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CRONULLA LEAGUES CLUB
EFFECTS OF ELECTROMAGNETIC RADIATION (EMR) FROM 132KV TRANSMISSION LINES ON THE HEALTH OF FUTURE OCCUPANTS OF PROPOSED RESIDENTIAL, COMMERCIAL AND RETAIL DEVELOPMENT.

1. Introduction

Under the master plan proposal the under utilised portions of the Cronulla Shark site on both sides of Toyota Stadium (see the area outlined in red in Fig.1 below) would be developed in order to create a new centre which will include a significant residential community, and a neighbourhood retail centre combined with the current licensed club premises and club entertainment businesses.

Fig.1 The development site.

Along its northern boundary line the existing club and the site proposed for the development is adjacent to the electricity easement which contains one 132kV overhead power line.

As part of the proposed development project it is required to carry out the detailed health impact assessment for exposure of the residential, commercial and retail tenancies to the electromagnetic field (EMF) emitted by the 132kV power line.

This report summarises the results of EMR study conducted for the project and provides the environmental impact statement in respect to EMF emission from the power line into the proposed tenancies.

The EMR study for the power lines comprised of computer modelling and calculation of the electric and magnetic field emission from the existing 132kV overhead power line.

While the electric field emitted by the power line varies very little with time as it is a subject to the power line operating voltage, the magnetic field, on the other hand, can significantly fluctuate hourly, daily, seasonally and yearly as a result of electricity consumption within the supply area serviced by the power line. Therefore, the magnetic field will be calculated for the present average loading of the power line and also for the future ultimate condition when the power line will be loaded close to its maximum current carrying capacity.

The results of EMF calculations are compared to the acceptable safe limits of human exposure as given in the national and international standards and guidelines.

2. Evaluation of EMR from Power Line

As was mentioned in the introduction section, the site for the proposed mixed development is adjacent to the electricity easement containing one double circuit 132kV overhead power line. The power line is constructed on steel towers, although, some small section of it in the area adjacent to the Cronulla Sharks Club, is on concrete poles recently erected as replacement for the two steel towers.

The double circuit construction of the power line means that there are practically two separate power lines mounted along its length on one common support structures. One such power line is designated by AusGrid as line number 916 and the other one as number 917.

Each power line is constructed from three vertically spaced three twin wires where each pair of twin wires represent one phase of one power line. The two power lines are erected on either side of the support tower (see Fig.2 below).

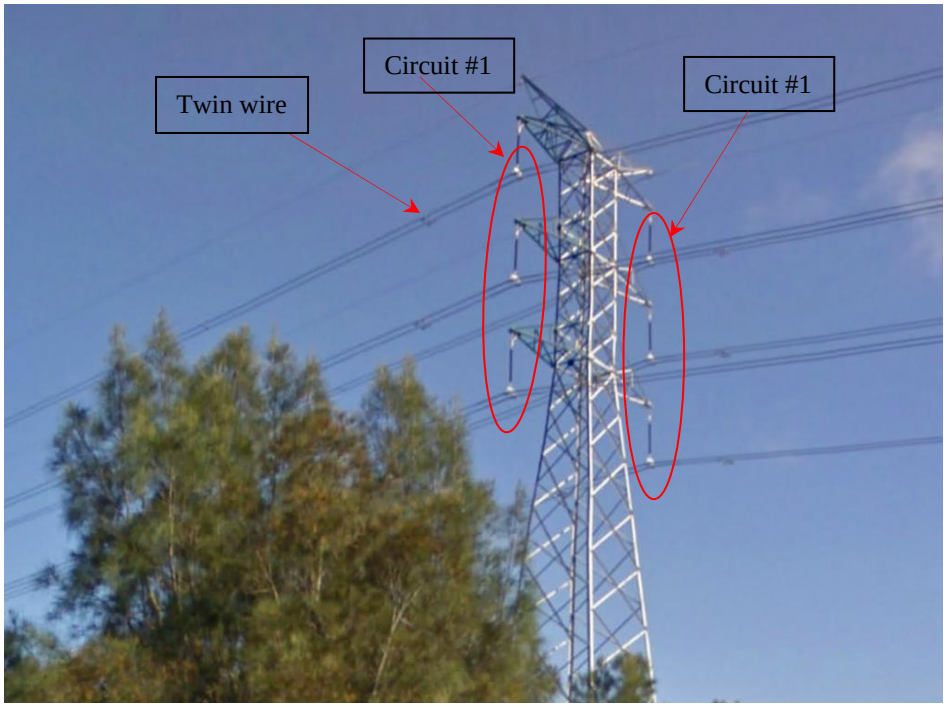


Fig.2 Steel support tower with two 132kV circuits

The twin wire phases of each circuit are installed one above the other on towers with 3.96m vertical distance between each phase.

The two circuits, each mounted on either side of the support tower, are 8.3m apart in the horizontal direction.

The twin wires in the bottom phase of each circuit have a minimum ground clearance of 9m and this point is roughly in the middle of a 150 – 220m long span between any two consecutive support towers.

The electric and magnetic field profiles were calculated in the direction across the power line easement and towards the proposed mixed development. The electric field profile was calculated only for the height of 1m above the ground, while the magnetic field profiles were calculated for several other heights in line with each floor level of the proposed buildings to be erected as part of the proposed development.

The reason for the single height electric field profile calculation and the multiple height magnetic field profile calculation is because the building materials such as bricks, concrete slabs and panels, plaster boards, wood, glass and any other building materials act as very efficient shielding mediums for the power frequency electric field. However, if the building material is not electrically conductive, such as various metals, then they possess no shielding property against the power frequency magnetic fields. It follows that inside a building, regardless of the floor height in respect to the position of wires of the power line the electric field would be almost immeasurable due to shielding effectiveness of building materials, while the strength of the magnetic field would depend on the shortest distance from the point of interest to the power line wires.

A computer model of the 132 kV cables was constructed for the EMF calculations.

The calculations were performed for the following two cases:

1. 445 A load current in each of the two 132kV circuits. This is the rated current for the existing 132kV overhead feeders.
2. 1000 A load current in each of the two 132kV circuits. This is the ultimate current carrying capacity if each circuit.

Based on the proposed plan of the development, the closest commercial building to the power line easement will be erected at a minimum of 9m distance, while the closest residential building will be erected at not less than 15 distance from the easement. The easement is approximately 35m wide and the power line is constricted right along its centreline.

2.1 Electric Field

The profile of electric field across the power line easement at 1m above the ground is presented in graphical form in Fig. 3 below.

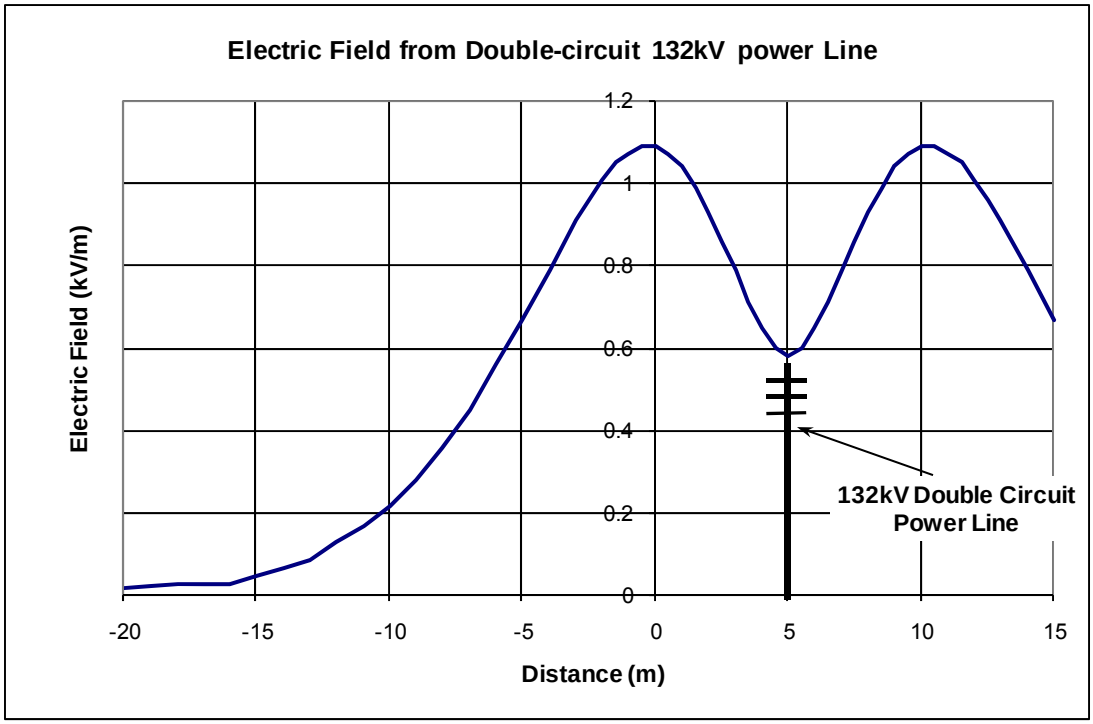


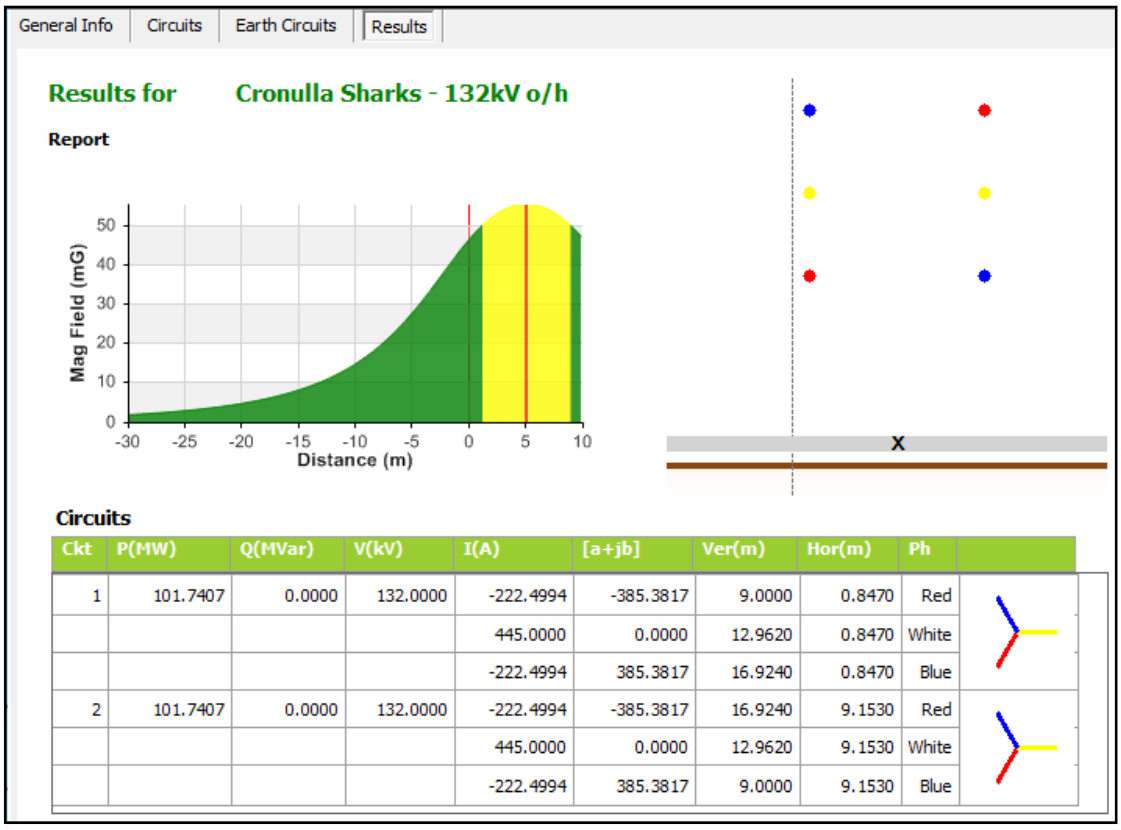
Fig.3 Electric field profile calculated across the power line easements at 1m height above ground.

From the electric field profile given in Fig.3 it can be concluded that the power frequency electric field at the front wall of the closest commercial building to the power line easement will be less than 0.02 kV/m or less than 20 V/m.

The same field at the front wall of the closest residential building would be less than 0.01 kV/m or less than 10 V/m.

2.2 Magnetic Field

The screen print from computer modelling software with geometrical representation of the two circuits of the power line and the resultant magnetic field profile calculated for 1m above ground is presented in Fig.4 below.



Circuits

Ckt	P(MW)	Q(MVar)	V(kV)	I(A)	[a+jb]	Ver(m)	Hor(m)	Ph
1	101.7407	0.0000	132.0000	-222.4994	-385.3817	9.0000	0.8470	Red
				445.0000	0.0000	12.9620	0.8470	White
				-222.4994	385.3817	16.9240	0.8470	Blue
2	101.7407	0.0000	132.0000	-222.4994	-385.3817	16.9240	9.1530	Red
				445.0000	0.0000	12.9620	9.1530	White
				-222.4994	385.3817	9.0000	9.1530	Blue

Fig.4 Screen print from computer modelling software with 132kV power line shown in the top right corner and the resultant magnetic field profile in the top left corner.

A family of magnetic field profiles calculated across the power line easement at different heights above the ground are presented in Fig.5 below. All these profiles were calculated for the existing electrical load of 445 A per circuit.

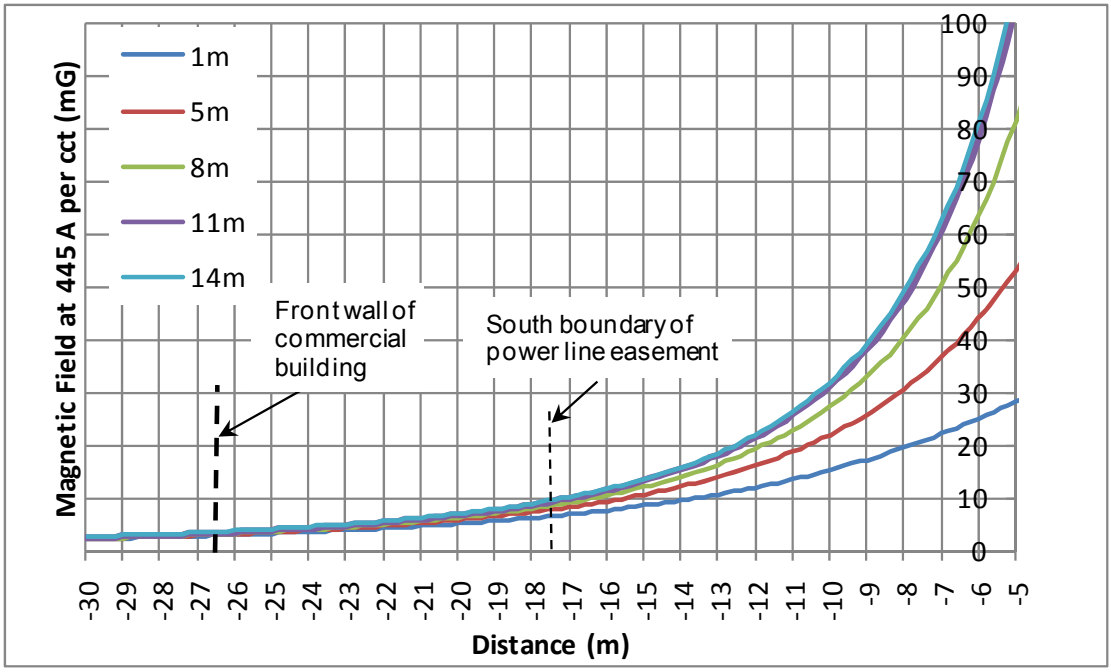


Fig.5 Magnetic field profiles across the power line easement for different heights above the natural ground and for the present electrical load of 445 A per circuit.

As can be seen from the graphs in Fig.5 the magnetic field emission on the southern edge of the power line easement is in the range from 7 mG to 10 mG for the heights from 1m to 14m above the ground.

The magnetic field level at the front wall of the closest building to the power line easements is ranging from 3 mG to 3.6 mG when the height of the observation point is ranging from 1m to 14m.

A family of magnetic field profiles calculated across the power line easement at different heights above the ground are presented in Fig.6 below. All these profiles were calculated for the ultimate electrical load of 1000 A per circuit.

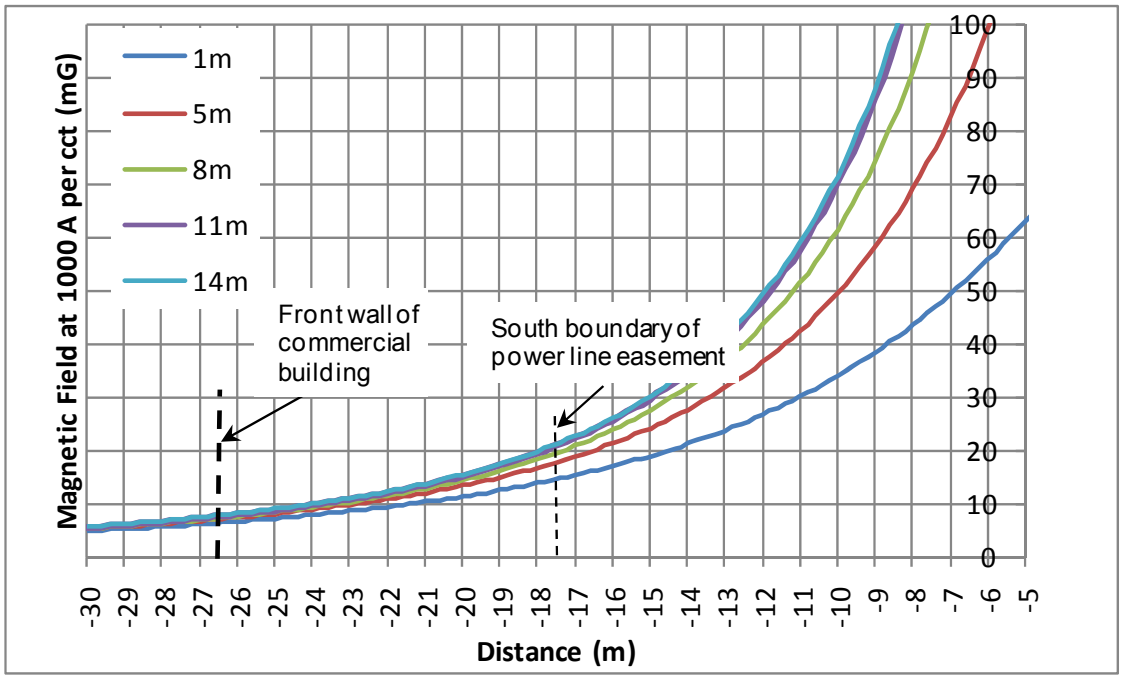


Fig.5 Magnetic field profiles across the power line easement for different heights above the natural ground and for the present electrical load of 445 A per circuit.

As can be seen from the graphs in Fig.6 the magnetic field emission on the southern edge of the power line easement when both circuits of the power line are loaded to their ultimate capacity is in the range from 15 mG to 23 mG for the heights from 1m to 14m above the ground.

For the same ultimate electrical load on the power line the magnetic field level at the front wall of the closest building to the power line easements is ranging from 6.5 mG to 8 mG when the height of the observation point is ranging from 1m to 14m.

3. EMF and Health

3.1 IRPA Guidelines

In 1989, the International Radiation Protection Association (IRPA) approved interim EMF human exposure guidelines prepared by its International Non-Ionising Radiation Committee. In the same year these guidelines were adopted as the interim guidelines by the National Health and Medical Research Council of Australia (NHMRC). The guidelines recommended the following limits:

Exposure	Magnetic Flux Density
Occupational	
Whole working day	**0.5 mT (=5,000 mG)**
Short term	**5.0 mT (= 50,000 mG)**
For limbs	**25.0 mT (=250,0000 mG)**
General public	
Up to 24 hours per day	**0.1 mT (=1,000 mG)**
Few hours per day	**1.0 mT (=10,000 mG)**

Notes:

a) IRPA guidelines were developed *"primarily on established or predicted health effects produced by currents induced in the body by external [EMFs]"*.

b) The guidelines were based on limiting current densities induced in the head and trunk by continuous exposure to 50/60 Hz electric and magnetic field to no more than about 10 mA/m^2.

c) Immediately observable minor biological effects have been reported in human studies in respect to induced current densities between 1 and 10 mA/m^2

d) The occupationally exposed population consists of adults exposed under controlled conditions in the course of their duties, who should be trained to be aware of potential risks and to take appropriate precautions.

The NHMRC guidelines state that: *"The occupationally exposed population consists of adults exposed under controlled conditions in the course of their duties, who should be trained to be aware of potential risks and to take appropriate precautions".* Based on this definition, the occupational exposure limits should only be applicable to skilled and trained workers who are directly involved with operation and maintenance of EMF emitting equipment and installations and who know how to limit the severity and duration of exposure to the power frequency electric and magnetic fields.

Concerns about inadequacies of IRPA guidelines were summarised in Gibbs Report in 1991:

> *Since the guidelines proceed on the basis that "adverse human health effects from exposure to ELF electric fields at strengths normally encountered in the environment or the workplace have not been established", it is apparent that they are not intended to provide protection against any adverse health effect that may be caused by such exposure, and they would not do so. The levels of exposure recommended are many times greater than the levels at which it has been suggested that the fields may create a risk.*

3.2 ICNIRP Guidelines

In 2010 the International Commission on Non-Ionising Radiation Protection (ICNERP) published the new "Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)". The new document replaced the last version of the guidelines previously published in 1998.

The principal limitation of the guidelines is stated in the "BASIS FOR LIMITING EXPOSURE" section as follows:

> *Induction of cancer from long-term EMF exposure was not considered to be established, and so these guidelines are based on short-term immediate health effects such as stimulation of peripheral nerves and muscles, shocks and burns caused by touching conducting objects, and elevated tissue temperatures resulting from absorption of energy during exposure to EMF.*

The guidelines state that:

> *Epidemiological studies have found that everyday chronic low intensity power frequency magnetic field exposure is associated with an increased risk of childhood leukaemia. However, laboratory studies have not supported this association and a causal relationship between magnetic fields and childhood leukaemia or any other long term effect has not been established. The absence of established causality is the reason why the epidemiological results have not been addressed in the basic restrictions. ICNIRP is well aware that these epidemiological results have triggered concern within the population in many countries. It is ICNIRP's view that this concern is best addressed within the national risk management framework.*

The table below contains the latest ICNIRP reference levels for the occupational and general public exposure to time-varying electric and magnetic fields.

Frequency range	E-field strength (kV/m)	Magnetic flux density (T)
Occupational exposure		
1 Hz - 8 Hz	20	0.2/f
8 Hz - 25 Hz	20	2.5×10^{-2}/f
25 Hz - 300 Hz	**5×10^{2}/f**	**1×10^{-3}**
300 Hz - 3 kHz	5×10^{2}/f	0.3/f
3 kHz – 100 MHz	1.7×10^{-1}	1×10^{-4}
General public exposure		
1 Hz - 8 Hz	5	$4\times10^{-2}/f^{2}$
8 Hz - 25 Hz	5	5×10^{-3}/f
25 Hz – 50 Hz	**5**	**2×10^{-4}**
50 Hz - 400 kHz	2.5×10^{2} /f	2×10^{-4}
400 Hz - 3 kHz	2.5×10^{2} /f	5×10^{-2}/f
3 kHz – 10 MHz	8.3×10^{2}	2.7×10^{-5}

Notes: a) 1μT = 10 mG
b) f - is the frequency of EMF in Hz.

From the ICNIRP table the maximum EMF exposure limit at the power frequency of 50Hz for the general public is 200μT or 2000 mG.

3.3 Other References

On the 18 December 1995 the Senate Economics References Committee released its report to the Senate on the proposed Eastlink transmission line project linking the electricity grids of New South Wales and Queensland. The committee's findings on the electromagnetic fields health effects are similar to those of the 1991 Gibbs Report. The Committee's Report states:

> *"In the light of... conflicting evidence, and because it is not possible scientifically to prove a negative, the Committee is unable to totally dismiss that there may be adverse (health) effect. Similarly the Committee is unable to conclude that a definite link between power lines and adverse effects on human health exists and thus that any new policy recommendations need to be made. However, the Committee is able to conclude that simply the fear of detrimental health effects, whether real or imaginary, is in itself having an impact on lives of some individuals. The Committee takes a similar*

stand to that of Gibbs Report. The Committee agrees that, as a minimum policy or until evidence suggests otherwise, the concept of 'prudent avoidance' should continue to be practised by government and power authorities..."

There have been a number of reported cases around the world where power transmission and distribution companies relocated or modified their existing electrical installations on the basis of perceived health risk associated with exposure to the power frequency magnetic fields, even though the levels were much smaller that the recommended by the NHMRC and ICNIRP safe exposure limits. Notwithstanding this the level at which such relocations or modifications are warranted is not established and consideration should be given to the net potential benefit that may be gained from such actions.

Over the last few years there have been many magnetic field surveys conducted within commercial and residential buildings in Australia and overseas. As a result of these surveys it can be concluded that the background level of magnetic field in a typical office or home environments is generally within the range of 0.5 – 3 mG. The EMF levels that can be measured along the streets in residential areas can typically range from 0.5 mG to 18 mG.

Some household electrical appliances can produce the EMF in the range of 5 mG to 70 mG. For example, an average electric hair dryer can typically emit the EMF of 25 mG, while an electric stove may emit the field in the range of 2 mG to 30 mG and the personal desk-top computer can emit the EMF in the range of 2 mG to 20 mG.

There is no irrefutable scientific evidence of the adverse health effect from the power frequency magnetic fields. Nor there is evidence to categorically dismiss its adverse health effect. It was not yet established, if a cumulative effect of relatively low field strengths may have some biological effect. It is also not known if even an intermittent exposure to the EMF may cause an adverse health effect and should be avoided.

In May 1999, the Director of the US National Institute of Environmental Health Sciences (NIEHS) tabled a report to the US Congress on “Health Effects from Exposure to Power-line Frequency Electric and Magnetic Fields".

A conclusion of the NIEHS report was:

“that ELF-EMF exposure cannot be recognised at this time as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In my opinion, the conclusion of this report is insufficient to warrant aggressive regulatory concerns. However, because everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted, such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposure.

“While the support from individual studies is weak, the epidemiological studies demonstrate, for some methods of measuring exposure, a fairly consistent pattern of a small, increased risk with increasing exposure that is somewhat weaker for chronic lymphocytic leukemia than for childhood leukemia”.

“mechanistic studies and the animal toxicology literature, failed to demonstrate any consistent pattern across studies although sporadic findings of biological effects have been recorded. No indication of increased leukemias in experimental animals has been observed.”

In February 1, 2000, the Swiss Bundesrat (Upper House) has enacted an "Ordinance Concerning Protection from Non-Ionising Radiation (NISV)" which sets a 10 mG exposure limit for power lines and other exposure sources affecting "sensitive use locations", including any room in a building which is "regularly occupied for significant period of time" and children's playgrounds.

An Explanatory Report issued by the Swiss Federal Office for the Environment, Forestry and Agriculture explains that these "precautionary" measures are needed because biological effects have been documented from EMF exposures below the ICNIRP limits, and because there is uncertainty about the possible harmful consequences of lower level exposures. The Report specifically points to the NIEHS Working Group recommendation that power frequency EMF be considered as "possible carcinogenic."

Early in 2001 the Advisory Group on Non-Ionising Radiation (AGNIR) to the UK National Radiological Protection Board has published a report on power frequency electromagnetic fields and the risk of cancer.

In assessing the results of all Residential Exposure studies conducted around the world the report states that:

> *"… relatively heavy average exposure of 0.4 μT* (4 mG) *or more are associated with doubling of the risk of leukaemia in children under 15 years of age. The evidence, however, is not conclusive."*

The main conclusion of the report is:

> *"Laboratory experiments have provided no good evidence that extremely low frequency electromagnetic fields are capable of producing cancer, nor do human epidemiological studies suggest that they cause cancer in general. There is, however, some epidemiological evidence that prolonged exposure to higher levels of power frequency magnetic fields is associated with a small risk of leukaemia in children. In practice, such levels of exposure are seldom encountered by the general public in the UK. In the absence of clear evidence of a carcinogenic effect in adults, or of a plausible explanation from experiments on animals or isolated cells, the epidemiological evidence is currently not strong enough to justify a firm conclusion that such fields cause leukaemia in children. Unless, however, further research indicates that the finding is due to chance or some currently unrecognised artefact, the possibility remains that intense and prolonged exposure to magnetic fields can increase the risk of leukaemia in children."*

In 2002 the International Agency for Research on Cancer (IARC) classified the power frequency magnetic fields as a *possible carcinogen*. [Ref.: (IARC), I.A.f.R.o.C. (2002). *Non-ionizing radiation, Part 1: static and extremely low-frequency (ELF) electric and magnetic fields.* Vol. 80. IARC Monogr Eval Carcinog Risks Hum.]

A recently conducted in the USA study of the effect of magnetic fields on the risk of miscarriage resulted in the following conclusion *"…prenatal maximum magnetic field exposure above a certain level (possibly around 16 mG) may be associated with miscarriage risk. The association was stronger for early miscarriages (<10 weeks of gestation) and among "susceptible" women with multiple prior foetal losses or subfertility."* [Re: Epidemiology 2002 January;13(1):9-20]

In 2003 The Italian President of the Council of Ministers adopted a law which sets the following EMF exposure limits for general population [Ref.: "DECREE OF THE PRESIDENT OF THE COUNCIL OF MINISTERS 8 JULY 2003 - Establishment of exposure limits, attention values, and quality goals to protect the population against power frequency (50 Hz) electric and magnetic fields generated by power lines"]:

> *Art. 3 Exposure limits and attention values*
>
> 1. *In case of exposure to electric and magnetic fields generated by power lines, the following exposure limits must not be exceeded: 100 μT* (1000 mG) *for the magnetic flux density and 5 kV/m for the electric field, both expressed as rms values.*
> 2. *As a cautionary measure to protect against any possible long-term effects that might be related to power frequency (50 Hz) magnetic fields, an attention value of 10 μT* (100 mG) *is adopted in children's playgrounds, residential dwellings, school*

premises, and in areas where people are staying for 4 hours or more per day. The attention value is the median of values recorded over 24 hours, under normal operational conditions.

Art. 4 Quality goals

1. *In designing new power lines in the neighbourhood of children's playgrounds, residential dwellings, school premises, and in areas where people are staying for 4 hours or more per day, as well as in planning developments in the proximity of existing electric power lines and installations, including the categories mentioned above, a quality goal of 3 μT* (30 mG) *is adopted for the purpose of the progressively minimising exposures to electric and magnetic fields generated by 50-Hz power lines. The quality goal is the median of values recorded over 24 hours, under normal operational conditions.*

In June 2005 a paper on one epidemiological study published in the British Medical Journal and entitled *"Childhood cancer in relation to distance from high voltage power lines in England and Wales: a case-control study"* (authors: Gerald Draper, Tim Vincent, Mary E Kroll, John Swanson) reported an elevated risk of leukaemia in children living in proximity to high voltage power lines. The main results of the study are: Compared with those who lived > 600 m from a line at birth, children who lived within 200 m had a relative risk of leukaemia of 1.69 (95% confidence interval 1.13 to 2.53); those born between 200 and 600 m had a relative risk of 1.23 (1.02 to 1.49). There was a significant ($P < 0.01$) trend in risk in relation to the reciprocal of distance from the line. No excess risk in relation to proximity to lines was found for other childhood cancers.

The results of another epidemiological study carried out in Japan and published in February 2006 in the International Journal of Cancer under the title *"Childhood leukemia and magnetic fields in Japan: A case-control study of childhood leukemia and residential power-frequency magnetic fields in Japan"*, provided additional evidence that the exposure to the time-weighted average power frequency magnetic field above 0.4μT (4 mG) was associated with a higher risk of childhood leukemia. The study included children whose mothers were exposed to high magnetic fields in residential settings while being pregnant. The outcome of this study is in agreement with conclusion of an earlier study carried out in Canada and reported in scientific literature in 2003 (Infante-Rivard C, Deadman JE. "Maternal occupational exposure to extremely low frequency magnetic fields during pregnancy and childhood leukemia.", *Epidemiology* 2003; 14: 437–441). This study concluded that:

Occupational exposure of mothers to high levels of magnetic fields during pregnancy has been associated with childhood leukaemia.

In February 2006 an Independent Advisory Group on Non-Ionising Radiation produced a report for the National Radiation Protection Board of UK under the title of: *"Power Frequency Electromagnetic Fields, Melatonin and the Risk of Breast Cancer".* The following was stated in the summary section of the report:

Investigations using cells, animals and humans have not given consistent or convincing evidence that EMF exposure affects melatonin production or action. However, there are deficiencies in the existing research, which leave open the possibility of an effect.

There is stronger evidence that melatonin can inhibit the growth of cancer cells in laboratory culture and in animals. Data on the possible relation of melatonin levels to risk of subsequent breast cancer in humans are limited and inconclusive. Studies investigating the effect of light exposure (which affects melatonin) on breast cancer risk in humans have given some evidence for an association, but left it unclear whether, if there is an association, it is causal in nature.

There is no consistent evidence, from research using cells, animals and humans, that EMF exposure is a cause of breast cancer, nor has any mechanism for such an association been demonstrated.

In 2002 the Planning and Environment Court of Queensland has imposed a magnetic field exposure limit of 0.4 μT (4 mG) on a new electricity substation development at Tanah Merah. This decision follows an appeal by the power company Energex Ltd, against an earlier decision of the court. The case was officially closed on the18th March 2002. The judgement was based on the findings of the NRPB AGNIR Report of April 2001 that exposure to magnetic fields above 0.4 μT is associated with a doubling of the risk of childhood leukaemia. The court accepted that while there was no absolute proof that exposure to magnetic fields caused an increased risk of childhood leukaemia, nevertheless the policy of "prudent avoidance" should apply.

Other possible adverse health effect of the EMF is that it may adversely affect medical devices such as metallic prosthesis, cardiac pacemakers and defibrillators, neurostimulators, cochlear implants and other bio-electronic devices and implants.

The magnetic field measurements conducted in the case where a person was fitted with a neurostimulator showed some effect at the EMF level above 0.05 μT (5 mG) and that it becomes painful above 0.5 μT (50 mG).

A common practice in the Australian construction industry is to limit the maximum EMF exposure to 10mG or less in all area that can be regularly occupied by people for a significant period of time. This practice was first emerged in late 1980s on the basis of our finding that such EMF is below the level of interference with 14" and 15" computer monitors fitted with Cathode Ray Tubes.

We've also been able to equate the previous practice of limiting the EMF to 10 mG in all commercial buildings to the new requirements of containing the EMF within the time-weighted average limit of 4 mG.

If a child in a childcare centre or an expecting mother at work are exposed to 10 mG during 8 hours a day, then their time weighted average exposure level (TWA) over the entire week is less than 4 mG. This is calculated on the basis that statistically the average EMF exposure level for the majority of urbane population is less than 2 mG.

$$EMF_{TWA} = \frac{(10mG \times 8hours + 2mG \times 16hours) \times 5days + 2mG \times 24hours \times 2days}{24hours \times 7days} = 3.9mG$$

4. EMF and Interference

4.1 Interference with Electronic Devices

Electromagnetic immunity levels for electronic devices used in residential, commercial and light industry are specified in the Australian Standard AS/NZS 4251.1 "Electromagnetic Compatibility-Generic Immunity Standard", Part 1: Residential, commercial and light industry. 1:1994. The standard is technically equivalent to the European standard EN 50082-1 published in August 1997.

The immunity limits specified in the standards for the low frequency EMF are summarised in the table below.

Device type	Residential / commercial environment
CRT displays	1.25 uT (12.5 mG)
Other equipment	3.75 uT (37.5 mG)

The cathode-ray-tube (CRT) based computer monitors which are commonly used in homes and offices are susceptible to EMF interference. The threshold level of sensitivity to the EMF for most 14" and 15" CRT based computer monitors is 10 mG. The monitors with 17" screens can be affected by the magnetic field less than 7 mG, while the monitors with 20"-21" screens can be affected by the magnetic fields less than 5mG.

The jittery screen of the EMF affected computer monitors could also be a source of adverse health effect through causing eye strain and headache for computer users.

4.2 Transmitted Voltages to Telecommunication Network

Voltages transmitted to a Telecommunications Network from external sources, either by induction or conduction, should not to exceed the limits for Telecommunications Network Voltages (TNV), as specified in AS/NZS 60950.1

4.3 Power Frequency Transients

Transient EMFs can be generated during a short circuit condition. Such EMFs can cause damage to sensitive electronic and bio-electronic devices, interfere with data communication lines and corrupt magnetic data storage media.

Currently there is no Australian standard that sets the electromagnetic field emission limits for interference with electronics and communication devices and equipment due to the transient voltage and current surges in the low voltage power supply and reticulation systems.

5 Conclusions and Recommendations

As a result of our analysis of EMF emission from the existing double circuit 132kV overhead power line power line into the proposed mixed development area adjacent to the electricity easement we can conclude that both the electric and magnetic field calculated for different heights above the ground are well within the recommended safe exposure limits for a short term occupancy in the proposed commercial and residential tenancies.

Based on our modelling and calculations we can also conclude that the derived magnetic field exposure levels in the proposed commercial and residential tenancies that would be located near the power line easement are below the time-weighted average level of 4 mG and, hence, pose no confirmed health risk for continuous occupancy of the premises by children.

Garry Melik
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