14.0 ELECTRIC AND MAGNETIC FIELDS

14.1 EXISTING ENVIRONMENT

14.1.1 Explanation & Sources of EMF

Electrical and Magnetic Fields (EMF) is the term used for electric fields and magnetic fields produced due to current movements with electrical conductors. Electric and magnetic fields occur in nature (e.g. static electricity, magnetic poles near north and south poles), in all living things (e.g. neuromuscular activity, functioning of cell membranes) and as a consequence of anthropogenic sources (e.g. generation, transmission, distribution and use of electrical equipment).

Electrical fields are caused by voltages (volts) and can be found near any electrical appliance that is switched on at the power outlet, even if it is not operating. High electrical fields are created by high voltages and are strongest close to their source; however, they reduce quickly with increasing distance from the source. Electric fields are measured in volts per meter (V/m).

Magnetic fields are caused by the flow of electricity (current) through a conductor (e.g. wire). Electrical appliances must be switched on and operating to create a magnetic field. Like electrical fields, magnetic fields are greatest close to the source and increase as the current increases. Magnetic field strength, which is measured in milligauss (mG), reduces quickly with increasing distance from the source.

Whereas electrical fields are easily shielded (weakened) by conducting objects such as trees and buildings, magnetic fields are not easily shielded by most materials. Magnetic fields can only be shielded by structures containing large amounts of ferrous metals of similar material. Typical magnetic fields generated from common household appliances and transmission lines are included in Table 14.1

TABLE 14.1 TYPICAL MAGNETIC FIELDS FROM COMMON ELECTRICAL APPLIANCES

EMF SOURCE	TYPICAL LEVEL (MG)	TYPICAL RANGE (MG)
Electric Stove	6	2-30
Computer	5	2-20
Television	1	0.2-2
Electric Blanket	20	5-30
Hairdryer	25	10-70
Fridge	2	2-5
Toaster	3	2-20
Electric Kettle	3	2-10
Electric Fan	1	0.2-2
Suburban Powerline	10	2-20
High Voltage Transmission Line	20	5-100

Source: Electricity Supply Association of Australia 2001

14.1.2 EMF & Health

The issue of possible adverse effects on human health from EMF has been investigated and studied for more than 40 years. Research to date has been extensively reviewed by bodies such as the World Health Organisation, the International Radiation Protection Association, and the National Radiological Protection Board (United Kingdom). Currently, no causal relationship has been established, however worldwide research is continuing.

Powerlink recognises there is community interest and concern regarding EMF from its facilities, and continues to monitor developments on this important issue. Powerlink endorses the approach taken by the electricity industry, basing its policy and actions on expert advice on this matter from competent health authorities in Australia and from around the world.

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is the Federal Government agency charged with responsibility for this issue and its Fact Sheet 'Electromagnetic Fields and Possible Adverse Health Effects' concluded:

"On balance, the scientific evidence does not indicate that exposure to 50Hz EMFs found around the home, the office or near power lines is a hazard to human health" (ARPANSA 2007a).

The full text of this document can be obtained on the ARPANSA website:
:http://www.arpansa.gov.au/radiationprotection/FactSheets/is_emf.cfm

ARPANSA also advise that where people are concerned about the risk of electric and magnetic fields, certain behavioural modifications with respect to use of household appliances could be undertaken to reduce exposure (ARPANSA, 2007b). That is, because the intensity of EMF drops off significantly with distance from the source, appliances could be moved away from close human contact (ARPANSA, 2007b).

Because of the existence of EMF in almost every part of our living environments and the lack of conclusive causal relationship data, the setting of recommended ambient 'acceptable' EMF levels has been difficult. The National Health and Medical Research Council (NHMRC) in 1989 issued interim guidelines for limitations of exposure to EMF. The NHMRC has rescinded this publication in accordance with its policy of reviewing documents published more than 10 years ago, but for completeness, references are included in this EIS where relevant. ARPANSA has since reviewed the NHMRC guidelines and in December 2006 released the 'Draft Radiation Protection Standard: Exposure Limits for Electric & Magnetic Fields – 0 Hz to 3 kHz' report (ARPANSA, 2006) for review. It is expected that the ARPANSA review, when finalised, will replace the NHMRC publication (i.e. the "Radiation Health Series No. 30, Interim guidelines of exposure to 50/60 Hz electric and magnetic fields").

The ARPANSA review (i.e. Draft Radiation Protection Standard) proposes a set of instantaneous reference levels for EMF exposure at 50Hz and these are outlined in Table 14.2 below whilst the NHMRC interim guideline for continuous public exposure is included in Table 14.3 below.

TABLE 14.2 ARPANSA DRAFT EMF STANDARD FOR LIMITS OF EXPOSURE – GENERAL PUBLIC

EXPOSURE CHARACTERISTICS	ELECTRICAL FIELD STRENGTH (V/M)	MAGNETIC FIELD STRENGTH (MG)
General Public	5,000	1,000
General Public 'Controlled Activity'*	10,000	3,000

* = an activity in which exposure to EMF may reasonably be expected to exceed public exposure reference levels. See ARPANSA for further details.

TABLE 14.3 NHMRC LIMITS OF EXPOSURE – GENERAL PUBLIC

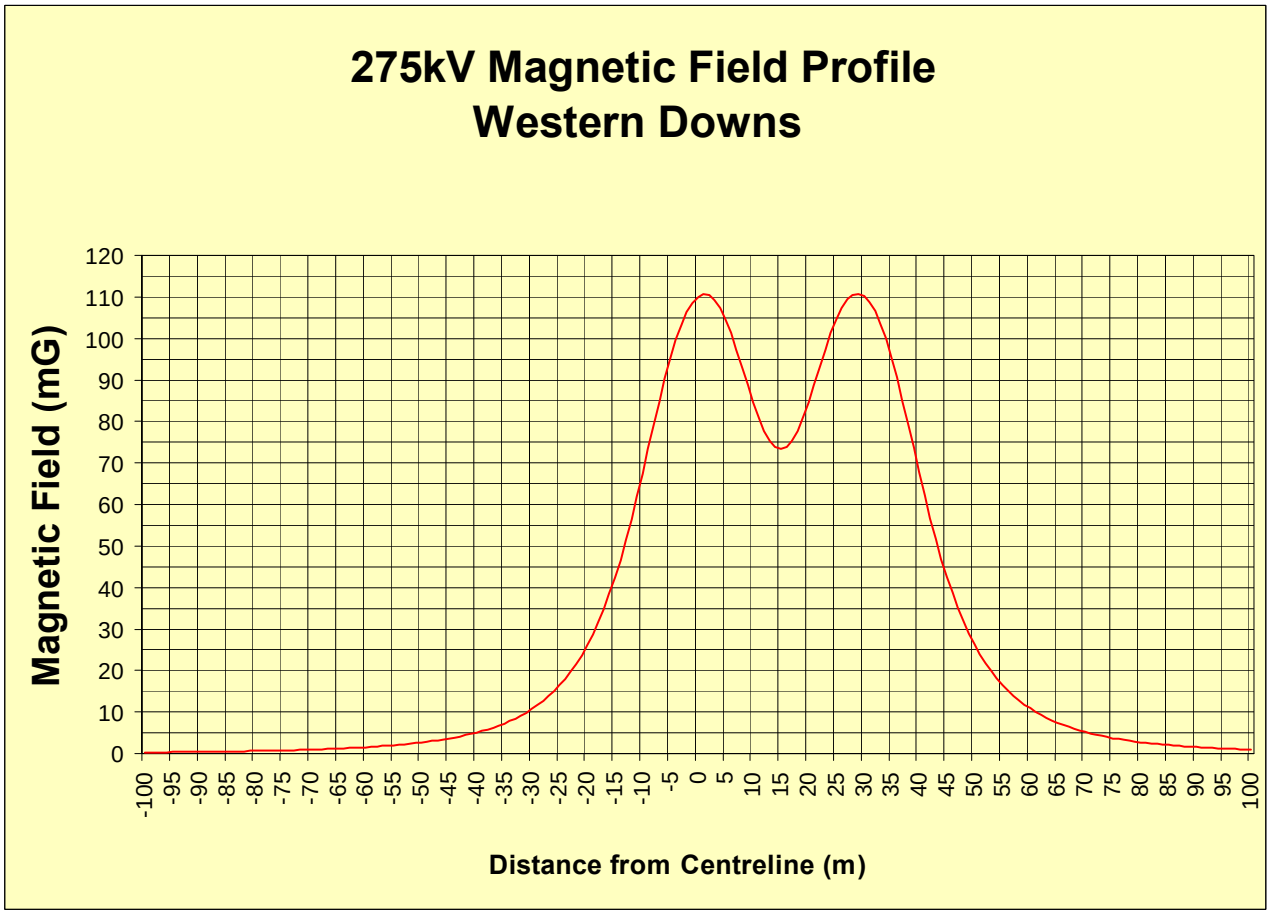
EXPOSURE CHARACTERISTICS	ELECTRICAL FIELD STRENGTH (V/M)	MAGNETIC FIELD STRENGTH (MG)
Up to 24hrs/d	5,000	1,000
Few hrs/d	10,000	10,000

14.1.3 Existing & Proposed EMF Levels

Currently, there are a number of high voltage transmission lines and distribution power lines traversing the area surrounding the project site which, together with domestic sources, contribute to the background levels of EMF. Current levels of EMF are well below the ARPANSA Draft Standard as well as the NHMRC limits of exposure and modeling indicates that even with the installation of the proposed transmission line, increases in field levels would be limited to areas immediately adjacent to the transmission line. Taking account of the impact of the proposed transmission line, field levels would remain well below the ARPANSA Draft Standard and the NHMRC limits of exposure, with field levels outside the proposed alignment corridor (to 30m either side of the centerline) would experience only minor increases above current background levels.

The EMF calculations for the proposed transmission line, as shown in the graph (Graph 14.1), are calculated by Powerlink from expected parameters for line loading, conductor configuration and height. The EMF profile and graph is representative of the section of dual line easement west of the Kogan Warra Road. For a single line easement, the EMF profile between the line and the easement boundary, and outside the boundary would be consistent with that situation for the dual line layout i.e. the EMF readings at a given distance "outside" the single and dual lines would be for all intents and purposes, the same level.

GRAPH 14.1 MAGNETIC FIELD PROFILE WESTERN DOWNS TRANSMISSION LINE



14.2 POTENTIAL IMPACTS

14.2.1 Health Concerns

The transmission of electricity via the proposed Project has the potential to generate electrical and magnetic fields which in turn raises public health concerns. Recommended (by ARPANSA and NHMRC) exposure levels have been outlined above along with the predicted EMF levels for the area immediately surrounding the proposed transmission line once constructed. The expected EMF levels from the proposed transmission line are well within the ARPANSA Draft Standard and the NHMRC limits of exposure.

It can also be seen that both EMF strength relationships are significantly reduced at the edge of the easement (i.e. approximately 30m either side of the centreline). Graph 14.1 shows even at the centreline of the proposed Project the EMF levels are consistent with the published typical ranges shown in Table 14.1 and Table 14.3.

14.2.2 Other Possible Impacts

The proposed Project has the potential to induce voltages on adjacent conducting objects. For example electric fields can induce charges on metal objects which may generate a slight spark and shock if touched. These slight sparks and shocks are harmless but can be perceived as a problem and to reduce the potential for such

occurrences, Powerlink Queensland's practice is to earth metal objects (such as fences), as required. Additional impacts that could be caused by EMF include:

- Corona effects - Energised surfaces, such as conductors, are surrounded by regions of high field strength that cause ionisation of the air. The corona effect is a minor electrical discharge as a consequence of ionised air and is strongest during wet weather. Other effects of corona may include gas emissions, audible noise and television and radio interference, as discussed below;
- Gas emissions – Extremely low concentrations of ozone, nitric oxide and nitrogen dioxide gases are generated by corona discharges. The concentrations produced are environmentally insignificant compared to the quantity produced by thunderstorms, solar radiation and wind;
- Audible noise - Corona noise is characterised by the 'crackling' sound that is normally heard during light rainfall. Noise generated by the conductor in normal dry weather is not noticeable; however, it rises during wet weather as a consequence of water droplets on the conductor itself. During such conditions, the noise from rainfall normally overrides the noise from the conductor. Therefore, audible noise from corona is dependent on weather and distance from the conductor; and
- Television and radio reception - Television and radio reception can potentially be affected by corona, however, this is considered unlikely, as corona effects are significantly reduced outside of the transmission line easement. Impacts on television and radio reception are unlikely to be experienced.

14.3 MITIGATION MEASURES

Powerlink follows the Electricity Networks Association's (ENA) EMF policy, which includes practising prudent avoidance when designing new electricity infrastructure. This involves actions including, where practicable, locating electricity assets away from houses, and configuring powerline conductors in a way which reduces EMFs. These strategies are based on the fact that the strengths of EMFs decrease rapidly with increasing distance from a powerline. For example, the EMFs become negligible at a distance of less than 100m from the type of line proposed for this Project.

Mitigation measures that may assist with EMF and associated impacts include:

- Appropriate design of conductors and line fittings can reduce corona discharge;
- Powerlink Queensland can install mitigation measures such as isolating fences into shorter sections, to reduce potential for induced voltage; and
- With regard to impact on essential services, Powerlink Queensland liaises regularly with the appropriate authorities (e.g. Telstra etc) to determine whether any mitigation measures will be required.

If a causal impact on television reception is observed due to the Transmission line operation, Powerlink Queensland will undertake necessary investigations and remedial measures (see Appendix G).