Electric and Magnetic Fields

HSEQ Operational Procedure

What this procedure describes

How to manage extra low frequency electric and magnetic fields (EMF).

Why it is required

- To ensure you understand TasNetworks commitment to monitor the latest scientific information on extra low frequency EMF.
- To provide timely and accurate information to the community, employees and contractors on the impact of EMF's from TasNetworks distribution and transmission systems.
- To ensure TasNetworks designs and operates its electrical equipment prudently within guidelines or standards as established by Australian authorities such as Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) and Energy Networks Australia (ENA 2016) and International authorities such as International Committee on Electromagnetic Safety, Institute of Electrical and Electronics Engineers (IEEE 2002).
- To ensure areas and apparatus which have EMF levels that may exceed relevant guidelines or standards are identified, and that all relevant employees, contractors and members of the public are made aware of the requirements for entering and/or working in such areas.

Who it applies to and when

This procedure applies to everyone working for or on behalf of TasNetworks in all TasNetworks facilities and equipment where extra low frequency EMF represents potential concern to employees, contractors and members of the public.

Authorisation	
Issue date	28/07/2016
Authorised by	HSETC Leader
Review Cycle	3 years

Revision History	
Date	**Revision Details**
4/12/14	Original Issue
11/2015	Zone references updated
25/09/2017	Reference to ENA changes
20/06/2018	General review – no significant changes

Contents

1. Scientific Information

1.1 Monitoring

The EMF Specialist ensures that TasNetworks obtains the latest information on EMF, via the ENA's Safety Committee. Employees and contractors are made aware of the EMF issue, including the current ARPANSA guidelines and their application, and these are updated periodically with current information. The EMF guidelines are summarised in Table 1 and 2.

The EMF Specialist, ensures that information on EMF is made available to employees, contractors and interested members of the public.

1.1.1 Measurement of EMF – Residential

TasNetworks measures EMF's associated with its electrical equipment at residential locations. It also conducts measurements for concerned members of the public, where this is regarded as an appropriate response by the EMF Specialist.

TasNetworks has a Residential Electric and Magnetic Field Measurement Protocol Guideline. The form – Measurement of 50Hz Magnetic Field is used to record these measurements. Copies of information obtained from these measurements are kept by the Customer Advocacy Group.

1.1.2 Measurement of EMF – Non-residential

As considered necessary, TasNetworks measures EMF associated with its electrical equipment within its own facilities and buildings and within the premises of other organisations. The measurements are documented in a report and a copy provided to the requestor.

1.2 New Electrical Facilities and the Operation of Existiing Electrical Equipment

TasNetworks designs, locates, and operates its electrical distribution and transmission systems prudently within current health guidelines as established by ARPANSA, ENA and other relevant regulatory body guidelines. Advice on current health guidelines is available from the EMF Specialist.

TasNetworks practices prudent avoidance. Design of new electrical facilities and associated environmental impact assessments will consider EMF's, particularly in regard to their capacity to produce magnetic fields and their proximity to public and private dwellings.

1.3 Determination of Field Strengths

The General Manager of Stategic Asset Management is responsible for the control of respective TasNetworks premises and ensures that all areas where EMF's exceed the limits,

as recommended by ARPANSA or other relevant regulatory groups, are identified and a register of these magnetic field readings is maintained by the Customer Advocacy Group.

1.4 Occupational Exposure Provisions

1.4.1 Controls for occupational exposure in areas of Elevated EMF

For occupational exposures, the controlled circumstances reference levels may only be applied where:

- Training and information (including field levels) are provided to employees and/or contractors for both magnetic and electric fields.
- A suitable assessment of employees and contractors for the presence of implanted medical devices is undertaken for both magnetic and electric fields.
- Steps have been taken to minimise secondary hazards arising from micro-shocks for electric fields; and
- Advisory signage warning of the possibility of micro-shock is placed in appropriate locations for electric fields.

1.4.2 Areas Having Fields Between 2,000 and 10,000 milliGuass

Employees and Contractors working in these areas should have completed EMF awareness training, know what the magnetic field values are (magnetic field readings required), and have been suitably assessed for implanted medical devices. Pregnant women and children should not enter these areas.

1.4.3 Areas Having Fields in Excess of 10,000 milliGuass

These areas should be signposted to indicate that entry or approach to these areas is not permitted while the relevant electrical equipment or conductors are energised. Where practical, personnel entry or approach should be prevented.

Areas having electric fields between 10 kV/m and 20 kV/m

People working in these areas should have completed EMF awareness training, know what the electric field values are (electric field readings required), and have been suitably assessed for implanted medical devices. Pregnant women and children should not enter these areas.

Areas having electric fields in excess of 20 kV/m

These areas should be signposted to indicate that entry or approach to these areas is not permitted while the relevant electrical equipment or conductors are energised. Where practical, personnel entry or approach should be prevented.

1.4.4 Medical Implants

An increasing number of people in the community and the workforce are being fitted with implanted medical devices such as cardiac pacemakers, defibrillators, neurostimulators,

insulin pumps, cochlear implants, and the like, as well as metallic screws, pins and plates inserted as the result of injury or trauma.

These devices may, under certain circumstances, be affected by internal electric fields generated as a result to external electric and magnetic fields.

Managers are responsible to ensure that their employees with implanted medical devices are informed about the potential for interference and where this interference may occur. Employees should be encouraged to discuss the matter with their physician and the implanted medical device's manufacturer.

Visitors and contractors visiting or working at a site shall be warned of possible interference to the operation of implanted medical devices. This should be accomplished by placement of signs at appropriate and prominent locations.

2. Handling Enquiries and Record Keeping

All EMF enquiries will be handled by the EMF Specialist. A record is to be maintained by the EMF Specialist of all enquiries received and measurement assessments.

All records including test results and enquiries need to be maintained in an authorised repository.

The EMF Database is maintained by TasNetworks Customer Advocacy Group.

3. Reference Levels for Occupational and Public Exposure for Magnetic and Electric Fields

Note: While ARPANSA directly references the ICNIRP 2010 ELF guidelines for exposure, the IEEE guideline provides an alternate set of guideline limits applicable to electric and magnetic field exposure.

Table 1: Summary of the magnetic field exposure Reference Levels for IEEE and ICNIRP.

	IEEE 2002	ICNIRP 2010
GENERAL PUBLIC		
Exposure general	Not specified	200 uT
Exposure to head and torso	904 uT	Not specified
Exposure to arms and legs	75,800 uT	Not specified
OCCUPATIONAL		
Exposure general	Not specified	1000 uT
Exposure to head and torso	2,710 uT	Not specified

Exposure to arms and legs	75,800 uT	Not specified

Note: 1 microtesla (μT) = 10 milligauss (mG).

Table 2: Summary of the electric field Reference Levels for relevant Australian and international exposure guidelines

	IEEE 2002	ICNIRP 2010
GENERAL PUBLIC		
Exposure	5 kV/m	5 kV/m
	10 kV/m	
	(Within right of way)	
OCCUPATIONAL		
Exposure	10 kV/m	10 kV/m
	20 kV/m	
	(Within right of way)	

Note: Electric Field Reference Levels at 50HZ for IEE and ICNIRP

4. Responsibilities

Implementation – All TasNetworks staff and contractors. The requirements set out in TasNetworks documents are minimum requirements that must be complied with by TasNetworks Staff and contractors, including designers and other consultants. The user is expected to implement any practices which may not be stated but which can reasonably be regarded as good practices relevant to the objective of this document. TasNetworks expects the users to improve upon these minimum requirements where possible and to integrate these improvements into their procedures and quality assurance plans.

Audit – Periodic audits to establish conformance with this document will be conducted by TasNetworks HSETC Group.

Compliance – All Group Managers.

Document Management – HSETC Group; TasNetworks HSETC Manager

5. Reference Documents

The following documents were reviewed as part of developing this procedure:

Legislation
•

Codes of Practice, Industry Codes, etc.
• ENA EMF Management Handbook : January 2016 • IEEE (Institute of Electrical and Electronics Engineers, Inc.) Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines. • ICNIRP (International Commission on Non-Ionising Radiation Protection) Guidelines for Limiting Exposure to Time Varying Electric and Magnetic Fields (1Hz – 100 kHz) 2010.
TasNetworks Documents
•
Forms
• Measurement of 50Hz Magnetic Fields
Other Documents/Resources
• ARPANSA (Australian Radiation Protection and Nuclear Safety Agency)

6. Records Arising from this Procedure

Record	Storage Location
Stored Documents and associated correspondence and approvals etc.	CAT (Customer Advocacy Tool).

7. Glossary

ARPANSA – Australian Radiation Protection and Nuclear Safety Agency. The Australian Commonwealth body with responsibility for developing exposure guidelines related to EMF's.

Electric and Magnetic Fields (EMF) – EMF is produced wherever electricity or electrical equipment is in use. Electric fields result from the voltage applied to a conductor or wire, while magnetic fields result from the current or flow of electricity in a conductor. The strength of the EMF increases with increasing voltage or current, and decreases with distance from the conductor or wire. Electric field strength is measured in kilovolts per metre (kV/m). Magnetic field strength is measured in microtesla (μT) or milligauss (mG).

Note: 1 microtesla (μT) = 10 milligauss (mG).

Energy Networks of Australia (ENA) – A national body representing most Australian Transmission and Distribution electricity supply businesses. ENA have developed the ENA EMF Management Handbook, which was released in January 2016.

HSETC – TasNetworks Health, Safety, Environment & Technical Competency Group.

ICNIRP – ICNIRP is the International Commission on Non-Ionizing Radiation Protection. It is a publicly funded body of independent scientific experts consisting of a main Commission of 14 members, its Scientific Expert Group and its Project Groups. The expertise is brought to bear on addressing the important issues of possible adverse effects on human health of exposure to non-ionising radiation.

IEEE – Institute of Electrical and Electronics Engineers.

Prudent Avoidance – Defined in a report to the New South Wales Minister for Minerals and Energy dated 28 February 1991 ("The Gibbs Report"). The Gibbs Report defines "prudent avoidance" as doing what can be done without undue inconvenience and at a modest expense to avert the possible risk to health by exposure to EMF from new high voltage transmission facilities.

Appendix A – TasNetworks Residential Electric and Magnetic Field Measurement Protocol

1. General

1.1 Purpose

To align TasNetworks with the residential electric and magnetic field (EMF) measurement protocol as used by members of the Energy Networks Association of Australia (ENA).

1.2 Objectives

The provision of a common residential electric and magnetic field measurement protocol to:

- Provide on-site magnetic and electric field readings, and supply data and information to residential customers.

1.3 Background

Different procedures for the measurement of residential EMF have been developed by various organisations according to their particular needs. Although these procedures have been similar, a common protocol is considered beneficial to allow:

- Data to be presented to customers in a consistent format.
- Data to be collected and stored in a consistent format to allow for meaningful comparisons between utilities.
- The protocol consists of an unstructured/educational component and a structured component that specifies certain indoor and outdoor measurements.
- The unstructured component is to demonstrate various magnetic field sources including household appliances. Customers are welcome to participate in and to request additional measurements which can be recorded in a special note section of the form.
- The structured component provides a uniform method for obtaining spot measurements of the magnetic fields in specified locations.
- The emphasis of the protocol is on magnetic field measurements. However electric field data may be recorded in the 'notes' section.

2. Protocol

TasNetworks form for the recording of measured data is the "Measurement of 50Hz Magnetic Fields" form. The form is produced in duplicate for distribution to customers and a central data base maintained by the Customer Advocacy Group.

Where residential premises are assessed for EMF, a recording of the outline of the house is made to include any electrical facilities (distribution power lines, transformers, transmission

lines, and substations etc.) within 50 metres and the meter box, distribution service (overhead or underground), and the position of the water main connection/water meter.

3. Residential Measurement Etiquette

Interior measurement procedures are intrusive by nature. Carefully trained field employees and a well-designed protocol can reduce the inconvenience to residents. Some work practices to consider include:

- Providing formal training on residential measurements for field employees.
- Provision of appropriate customer relations material for field employees.
- Provision of a statement of intent for residents (what they can expect in relation to the measurements).
- All measurements (unless otherwise noted) should be made at 1 metre above ground/floor level as per ANSI-IEEE standard #644-1994 (The Institute of Electrical and Electronics Engineers, Inc. Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines) Each measurement will consist of the recording of three orthogonal components of the magnetic field. (Three axis meter.)

3.1 Structured Component

- Measure set locations inside and outside of the house for both low/or no power and high power conditions. Mark the measurement locations on an outline diagram of the residence.
- The low (or no) power condition, simulating a time of low (or no) power use, is obtained by turning off most electrical items, except for clocks and refrigerators. Note: Some residents are happy to have the power turned off completely to see what the external magnetic field values are inside their residence. Discuss with the resident what they would like turned off. **Ensure the power is turned back on after this exercise.**
- The high power condition, simulating a time of high power use, is obtained by turning on most lights and other electrical appliances.
- The purpose of measuring under these two conditions is to compare the relative contribution of external and internal magnetic field sources within the home.

3.2 Unstructured Component

- Measure magnetic fields produced by typical appliances as listed on the form. Carry out other measurements as requested by the customer.

4. Equipment

4.1 Measurement equipment consists of

- Three axis magnetic field meter. (Calibrated annually.)
- Electric field meter. (Calibrated annually.)
- Distance measurement device.

- Measurement form, customer relation EMF brochures.

All meters should be periodically calibrated as per ANSI-IEEE standard #644-1994. Attention should be paid to calibrate at low field levels (<0.5 mG) due to influence of ambient magnetic field.

4.2 References

Legislation
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Codes of Practice, Industry Codes, etc.
• Energy Networks Australia EMF Management Handbook: January 2016
TasNetworks Documents
• TasNetworks Magnetic and Electric Fields Procedure • TasNetworks Residential Electric and Magnetic Fields Measurement Protocol
Forms
• Measurement of 50Hz Magnetic Field
Other Documents/Resources
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Appendix B – TasNetworks Magnetic Field Measurement Form

MEASUREMENTS OF 50Hz MAGNETIC FIELDS

RESIDENT

Name

Address

P/Code

Phone ( )

❒ Detached House ❒ Flat/Apartment

❒ House ❒ Other

Measurement Date

Measurement Time

Reference Number

MAGNETIC FIELD METER

Meter Model Serial No.

❒ Single - Axis Meter (maximum recorded)

❒ Three - Axis Meter (resultant recorded)

Manufacturer

Field Representative

Department

Address

P/Code

Phone: Fax: ( )

MAGNETIC FIELD MEASUREMENTS

Units are ❒ μT ❒ mG

Location	Low * Power Usage	High # Power Usage
Front Door		
Living/Family/Lounge room		
Kitchen		
Master Bedroom		
Bedroom 2		
Bedroom 3		
Other rooms		
Water Meter/Pipe (next to)		
Meterbox (At meter reading position)		
Street Distribution Line/Cable		
Centre front yard		
Centre back yard		

Appliance / Other	Magnetic Field on front surface of Appliance	At user position	
		Mag. Field	Distance (cm)
Television			
Electric Heater			
Electric Kettle			
Electric Range			
Microwave Oven			
Clock Radio			
Hair Dryer			
Other:			

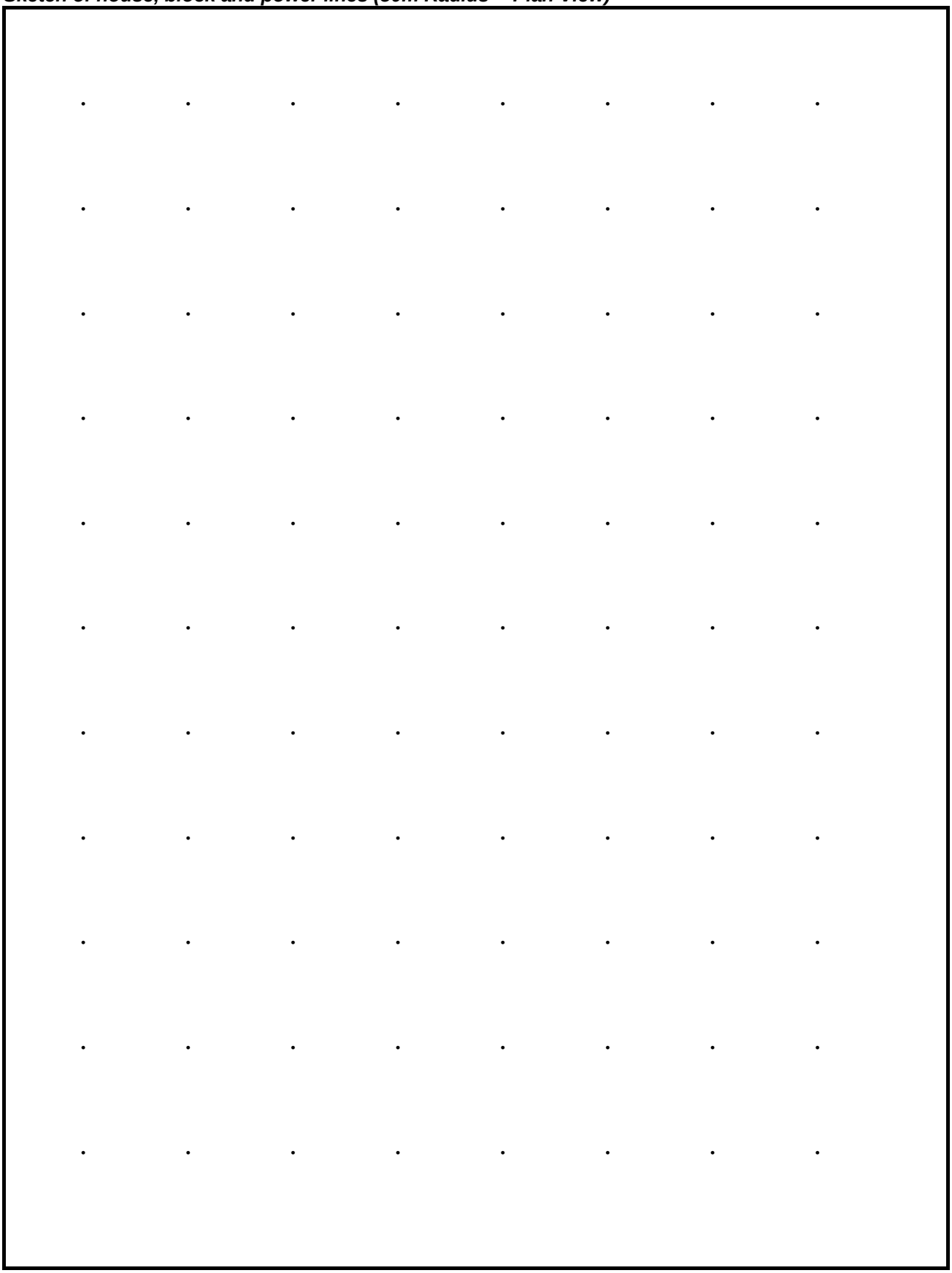
Notes: (e.g., additional measurements)

* Low Power Usage = Most items turned off (except clocks and refrigerators/Freezer).

High Power Usage = Lights and a number of kitchen/entertainment/heating items turned on.

All measurements are 1m above floor/ground level. Room measurements taken at near centre of room.
1 microtesla (μT) = 10 milligauss (mG).

Sketch of house, block and power lines (50m Radius -- Plan View)



Note: Indicate distances to electrical facilities.
Indicate locations of Meter Box, Overhead Service wire or Underground Service & Water Mains/Meter.