

Engineering Specification
Electrical Distribution Unit

SP D 79035

Sydney Trains Electricity Distribution Network Management Plan

Version 1.1

Date in Force: 30 November 2019

Specification

Approved by: Nadine Youssef
 Associate Director
 Electrical Distribution Unit
 Engineering System Integrity

Authorised by: Jonathon McKinnon
 Engineering Technical
 Publications Manager
 System Integrity

Disclaimer

This document was prepared for use by Sydney Trains or its contractors only. All Sydney Trains engineering documents are periodically reviewed, and new editions are published, between editions, amendments may also be issued. It is the document user's sole responsibility to ensure that the copy of the document it is viewing is the current version including any amendments that may have been issued. Errors or omissions in this document should be reported to Sydney Trains.

Sydney Trains makes no warranties, express or implied, that compliance with the contents of this document shall be sufficient to ensure safe systems or work or operation.

Document control

Version	Date	Author/ Prin. Eng.	Summary of change
1.0	5 June 2019	N/A	Previously assigned to Electrical discipline; moved to EDU discipline.
1.1	30 November 2019	N. Loveday	Updates to reflect minor changes per below and actions from 2019 ENSMS audit

Summary of changes from previous version

Summary of change
Section 3 table inserted listing relevant legislation, codes and standards
New section 1.5 legacy assets
References to "Electrical Safety Committee" removed.
Safety and risk policies replaced with references to the intranet versions
Network description (section 4) figure 2 removed
Sydney Trains organisation updated (figures 6, 7, 8)
Removed Electrical Risk Register, superseded by formal safety assessments
The following documents have been removed from the SMS, and replaced by explicit content in this plan <ul style="list-style-type: none"> a) SMS-02-RG-3058, RAA Matrix b) SMS-02-SP-3062, Safety Responsibilities, Authorities and Accountabilities c) SMS-02-TP-4057, Safety-responsibilities-incident and emergency response

Table of Contents

1	Introduction	6
1.1	Purpose	6
1.2	Objectives	7
1.3	Originating requirement.....	7
1.4	Implementation by TfNSW, AEOs and contractors.....	8
1.5	Legacy assets	9
1.6	Terms and definitions.....	10
2	Electricity Network Safety Management System (ENSMS).....	12
2.1	Sydney Trains' policies	12
2.2	Publication of the ENSMS.....	13
2.3	Management review and modifications to the ENSMS.....	13
3	Regulatory requirements.....	16
3.1	Overview	16
3.2	Rail Safety National Law (NSW) No. 82a	18
3.3	Electricity legislation.....	18
3.4	Exemptions	19
3.5	WHS Regulation 2017 (NSW).....	19
3.6	Electricity Supply (Safety and Network Management) Regulation 2014 & AS5577	19
3.7	Protection of the Environment Acts and Regulations	20
3.8	Contestable Network Services.....	20
3.9	Electricity Service Standards	21
3.10	Electricity Supply Industry and Related Codes and Guides	21
3.11	Code of Practice: Distribution Risk Management	22
3.12	Code of Practice: Managing Electrical Risks in the Workplace	22
3.13	Code of Practice: Work Near Overhead Power Lines	22
3.14	TfNSW Standards, Codes and Guidelines.....	22
3.15	Service and Installation Rules of NSW	23
3.16	Changes to Regulatory Requirements and Codes of Practice	23
4	Network Description	23
4.1	Overview	23
4.2	Supply Interfaces	24
4.3	Substations	25
4.4	High Voltage (HV) Aerial Lines & Underground Cables	26
4.5	Overhead Wiring (OHW) and Electric Rolling Stock.....	27
4.6	1500VDC Interfaces.....	27
4.7	Signalling Supplies.....	28
4.8	Low Voltage Supplies.....	29
4.9	Modified Direct Earthing System.....	29
4.10	Infrastructure Control (ICON).....	29
5	Safety Management	30
5.1	Safety Assurance	30
5.2	Safety Policy	30
5.3	Safety Management Lifecycle.....	31

5.4	Allocation of Risk Management Responsibilities	32
5.5	Sydney Trains' Electrical Safety Responsibilities	35
5.6	Working Safely Around Electrical Equipment	37
5.7	Exceptions, Non-compliance and Variations	37
5.8	Specific Hazards Nominated by AS5577	37
5.9	Risk Acceptance Criteria	41
5.10	Risk Treatment – ALARP or SFAIRP	41
5.11	Formal Safety Assessments	42
5.12	Periodic Review of Formal Safety Assessments	43
6	Incident Management	43
6.1	Safety Incident and Action Management	43
6.2	Electrical Safety Incident Reporting	44
6.3	Investigations	44
7	Audits and Reporting.....	45
7.1	Who Do We Report To.....	45
7.2	Regulatory Performance Reports	46
7.3	Internal Reporting.....	46
7.4	Internal Audits	46
7.5	External Audits	47
7.6	Audit Findings and Corrective Action	47
7.7	Incident Reporting	48
8	Organisation	48
8.1	Transport Cluster	48
8.2	Requirements Applicable to all AEO and Contractors	48
8.3	Sydney Trains as an AEO.....	51
8.4	Sydney Trains Organisation.....	51
8.5	Sydney Trains Responsibilities, Accountabilities and Authorisations.....	54
8.6	Key Persons.....	55
8.7	Resourcing	55
8.8	Training and Competency	56
8.9	Safety Awareness Training	57
8.10	Consultation and Communication	58
8.11	Safety in the Field	59
8.12	Emergency Preparedness and Response	60
9	Safety Performance Measurement and Evaluation	61
9.1	Key Performance Indicators.....	61
9.2	Monitoring and Measurement	61
9.3	Reporting and Incident Investigation.....	61
9.4	Safety (Corrective and Preventative) Action Management.....	61
9.5	Records	62
10	Asset Planning Management	62
10.1	Asset Management of the Electricity distribution network	62
10.2	System Integrity	63
10.3	System Capacity	63
10.4	Measures of Performance.....	64
10.5	Network Configuration Management	64

10.6	Design of New or Altered Assets	64
10.7	Acceptance of Designs	65
10.8	Cyclic Maintenance and Renewals	65
10.9	Operation and Maintenance.....	65
10.10	Safety, Security and Environmental Programs	66
10.11	Physical Security.....	66
11	Customer Connections.....	67
11.1	Customer Connections.....	67
11.2	Design & Construction	67
11.3	Maintenance.....	68
11.4	Criteria for Contractors.....	68
11.5	Risk Management Strategy.....	68
11.6	Code of Practice – Service and Installation Rules of NSW	68
11.7	Code of Practice – Installation Safety Management.....	68
11.8	Installation Inspections and Connections.....	69
11.9	Procedures for Notifying the Regulator of Defective Installation Work.....	69
12	Public Safety Awareness	69
12.1	Hazards.....	69
12.2	Risk Assessment in Relation to the Public.....	69
12.3	Advice to the Public.....	69
12.4	Risks within the Rail Corridor.....	70
12.5	External (3rd Party) Works by Neighbours and Councils	71
12.6	Neighbours of Easements and Public Assets	72
12.7	Safe Approach Distances for 3 rd Parties.....	72
13	Bush Fire Risk Management Plan	72
14	Referenced Documents	73
14.1	Versions	73
14.2	Public documents.....	73
14.3	Unpublished Documents.....	74
Appendix A	Traceability to the Regulation and AS5577	76

1 Introduction

1.1 Purpose

- 1.1.1 As defined in the Electricity Supply Act 1995[4] Sydney Trains is the operator of an electricity distribution network, operating under appropriate exemptions and in this capacity, Sydney Trains is obliged to take all reasonable steps to ensure that the design, construction, commissioning, operation and decommissioning of its network (or any part of its network) is safe¹.
- 1.1.2 Regulation 7 of the Electricity Supply (Safety and Network Management) Regulation 2014 [3]) – referred to as "the Regulation" requires Sydney Trains to establish and implement an Electricity Network Safety Management System which complies with AS5577 [14] .
- 1.1.3 This plan defines Sydney Trains electricity network safety management system and describes the controls which ensure system safety is assured through all lifecycle phases for all electricity network assets.
- 1.1.4 All organisations engaged in the design, construction, commissioning, operation and decommissioning of the RailCorp electricity distribution network are required to comply with this plan and the Sydney Trains electricity network safety management system. This includes but is not limited to Transport for NSW (TfNSW), the various divisions within Sydney Trains and TfNSW and Authorised Engineering Organisations (AEO) engaged by TfNSW and/or Sydney Trains.
- 1.1.5 Hence this plan:
- a) Identifies the statutory and other mandatory requirements that apply;
 - b) Provides guidance to employees and contractors engaged by Sydney Trains, TfNSW and AEO how to work safely on or near the electricity distribution network, through the application of Sydney Trains safety management system, the Electricity Network Safety Rules and related standards and procedures;
 - c) Informs non-electrical planners, project managers and engineers, maintenance managers, local councils, developers, neighbours and other external parties of the statutory requirements and procedures for working safely near RailCorp electrical assets. This includes activities such as construction work or vegetation clearance.
 - d) Demonstrates how Sydney Trains fulfils its obligations as the authorised operator of an electricity distribution network in accordance with the regulation and AS5577.
- 1.1.6 This plan addresses:
- a) The safety of the public, and persons near or working on the electricity distribution network;
 - b) The protection of property and of assets that are or could be affected by the electricity distribution network;
 - c) Safety aspects arising from the protection of the environment, including protection from ignition of fires by the electricity distribution network, and
 - d) Safety aspects arising from the loss of electricity supply to the overhead wire, signalling equipment, stations, facilities and electricity customers.

¹ Electricity Supply (Safety and Network Management) Regulation 2014, regulation 5.

1.2 Objectives

- 1.2.1 Sydney Trains operates and maintains an electricity distribution network to provide an adequate, safe, and reliable supply of electricity to fulfil the operational needs of the passenger railway. The railway infrastructure (including the electricity distribution network) is regulated by state and federal legislation, as well as a range of standards and codes of practice for which compliance is required of Sydney Trains and AEO engaged for the planning, design, construction, commissioning, operation or maintenance or disposal of electricity distribution network assets.
- 1.2.2 This Electricity Network Management Plan presents Sydney Trains approach to ensuring the design, construction, commissioning, operation and decommissioning of the electricity distribution network (or any part of its network) is safe. This plan:
- a) Presents Sydney Trains' approach to ensuring :
 - the safety of members of the public,
 - the safety of persons working on networks,
 - the protection of property (whether or not belonging to a network operator),
 - the management of safety risks arising from the protection of the environment (for example, preventing bush fires that may be ignited by network assets), and
 - the management of safety risks arising from loss of electricity supply.
 - b) Presents Sydney Trains' Electrical Network Safety Management System (ENSMS) as the means to accomplish the above.
- 1.2.3 References are included throughout to relevant documentation including publicly available documents as well as resources within Sydney Trains intranet. Links may change without notice after publication of this plan.
- 1.2.4 Compliance and implementation of the ENSMS (as required by regulation 8) is verified by audits as described in section 7. Audits and Reporting.

1.3 Originating requirement

- 1.3.1 The 4th paragraph of AS5577 section 1.1 states:
- "While this Standard has been developed for electricity supply networks, it is recognized that it may be used in relation to the safety of railway electricity networks. Before using this Standard for an electrified railway system, a rail system operator has to review the Standard to determine the Standard's suitability and applicability to the operator's rail system."*
- 1.3.2 Sydney Trains has reviewed AS5577 for suitability and applicability and attention is drawn to the following aspects.
- 1.3.3 Both the Rail Safety National Law (RSNL) [8] and AS5577 require consideration of alternative solutions and evaluation of the relative risks posed by the alternatives, and the adoption of a solution which minimises risk.

- 1.3.4 The electricity distribution network forms part of the infrastructure essential to the safe operation of the passenger rolling stock and the primary "customer" is the operation of the railway, i.e. passenger rolling stock and the passengers conveyed, not retail electricity consumers. Accordingly, the RSNL applies and the safety management system employed by Sydney Trains is in accordance with the requirements of the RSNL and guided by TfNSW[103].
- 1.3.5 The safety management system utilises the corporate SMS as implemented by Sydney Trains; it focusses on demonstrating that risk is or will be reduced "so far as is reasonably practicable" (SFAIRP) as required by the RSNL and the *Work Health and Safety Act 2011* (NSW). ALARP is not used.
- 1.3.6 Sydney Trains applies a safety change assessment process to determine the extent of the change, whether to demonstrate risk will be reduced SFAIRP, and the need to predict the safety performance through a risk analysis. The risk analysis may take the form of a Safety Assurance Report, Safety Assurance Statement, Hazard Assessment or a Project Hazard Log as determined by the initial analysis.
- 1.3.7 Section 99(1)(d) of the RSNL outlines that a safety management system must, amongst other things, provide for the comprehensive and systematic assessment of any identified risks. Risks are assessed according to a process outlined in section 100 of the RSNL. Risks are assessed at the level of the network and asset classes, as well as being assessed for individual assets when new or modified assets are constructed.
- 1.3.8 Appendix A3 of AS5577 outlines elements of a risk identification process that must form part of a Formal Safety Assessment. Sydney Trains' procedure involves consideration of the following:
- a) Risks related to the safe operation of the railway must be considered when determining which controls will be adopted for the design, construction, operation and maintenance of electricity network assets;
 - b) Some risks which arise in the context of the Electricity distribution network have consequences, causes and controls beyond the scope of the high voltage distribution network and which must be considered in the context of the enterprise as a whole.
 - c) The controls required to ensure the safe operation of trains may lead to decisions concerning design, operation and maintenance different to those that might be concluded by considering the Electricity distribution network alone.
- 1.3.9 Sydney Trains "Enterprise Risk Matrix v2.0" is used to assess risks and determine risk acceptance; this matrix has been benchmarked to provide meaningful results when risks are assessed in relation to all risks the level of the enterprise. In addition to safety risks, this integrates financial, environmental, customer experience and operational performance, and reputation. Sydney Trains also follows the guidance of the Office of the National Rail Safety Regulator "Guideline Major Works". This is the approach to implementing the requirements of AS5577 Appendix A, B1 and B2.
- 1.3.10 Risk management responsibilities, accountabilities and authorities are defined in the Sydney Trains SMS, this differs from the requirement of AS5577 para 4.4.4.

1.4 Implementation by TfNSW, AEOs and contractors

- 1.4.1 In accordance with Regulation 8(1) and AS5577 4.1 para 2, TfNSW, AEOs and contractors must comply with this plan and Sydney Trains ENSMS for the asset lifecycle phases for which they are engaged, their scope of work, responsibility and authority.
- 1.4.2 As described in the Service Installation Rules of NSW, the requirements of the electricity distributor (Sydney Trains) must be satisfied by all electrical installations which are either:

- a) on RailCorp land , or
 - b) to be supplied from the railway system, or
 - c) to be operated or maintained by Sydney Trains.
- 1.4.3 Installations on railway land which will not be supplied from the RailCorp network must be low-voltage connections and comply with the earthing and isolation requirements of Sydney Trains.
- 1.4.4 Installations on railway land must not be supplied as high-voltage connections from another electricity distributor (i.e. not supplied from the RailCorp network).
- 1.4.5 High voltage network-to-network connections to another electricity distributor are permitted (i.e. bulk supplies to the RailCorp network).
- 1.4.6 All installations to be operated or maintained by Sydney Trains must comply with TfNSW ASA requirements (ie use type-approved equipment) and comply with Sydney Trains requirements for operation, maintenance, spare parts, supportability and maintainability.
- 1.4.7 All work on the electricity distribution network must be in accordance with this plan and Sydney Trains electricity network safety rules. This applies in all lifecycle phases of the asset lifecycle (discussed further at 6.3).
- 1.4.8 Work near or in the vicinity (including non-electrical work and external parties) that is NOT undertaken by or on behalf of Sydney Trains as an Electrical Network Operator, must be performed in accordance with the SafeWork Codes of Practice and directions issued by Sydney Trains.
- 1.4.9 Guidance with respect to what is considered minimum evidence of compliance with AS5577 is provided in IPART's "Electricity Networks Audit Guideline".
- 1.4.10 TfNSW and AEOs must:
- a) Have a safety management system that complies with the requirements of AS5577;
 - b) Ensure the requirements detailed at section 8.2 are implemented;
 - c) When required (e.g. formal audit) produce evidence of their implementation of the requirements of AS5577;
 - d) Produce Formal Safety Assessments in accordance with section 5 of this plan;
 - e) Report incidents to Sydney Trains as described in this plan;
 - f) Provide statistics for inclusion in the data Sydney Trains reports to the regulator.

1.5 Legacy assets

- 1.5.1 AS5577 section 1.3 applies to existing legacy assets:
- 1) All proposed changes must be submitted to Sydney Trains for review.
 - 2) Where an asset is not modified (i.e. like-for-like replacements) the original safety assessment continues to apply.
 - 3) Where an asset is modified, or a new design is produced:
 - a) The AEO must provide evidence the safety hazards associated with the design, implementation, commissioning, operation and maintenance of the equipment have been identified, recorded, assessed and managed by eliminating safety risks so far as is reasonably practicable, and where not reasonably practicable,

by reducing those risks so far as is reasonably practicable. Further guidance is provided in section 5.

- b) New/modified assets should comply with the standards applicable at the date of the design. Where this is not reasonably practicable the AEO must obtain a concession from TfNSW with no objection from Sydney Trains EDU.
- 4) Where a standard is revised the change is reviewed to identify the equipment affected and the impact of the change, i.e. to determine whether a safety change can be initiated, and/or identify other benefits (financial, operational or maintenance).

1.6 Terms and definitions

For the purposes of this plan the definitions given in the *Electricity Supply Act 1995* (NSW) (ESA), *Electricity Supply (Safety and Network Management) Regulation 2014*, *Rail Safety National Law 2012* (NSW), and PR D 78100 Definitions and Conventions for Electrical Safety apply. In addition, the following definitions used:

Term	Definition
AEO	Authorised Engineering Organisation
AER	Australian Energy Regulator
ALARP	As Low As Reasonably Practicable (see SFAIRP)
ASA	Assets Standards Authority, a division of TfNSW
ATSB	Australian Transport Safety Bureau
Cause	An event or condition that may contribute to a risk.
Competent	A person who has been assessed to have the skills, knowledge and experience required to complete a task.
Consequence	The nature and magnitude of harm if a hazard is realised.
Control	Defence against a cause resulting in a safety hazard or consequence.
DC	Direct Current
DCCB	Direct-Current Circuit Breaker
EDU	Electricity Distribution Unit, a department within Engineering & System Integrity (ESI)
ENA NENS	Electricity Networks Association National Electricity Network Safety (code)
ENSMS	Electrical Network Safety Management System, comprises components of the Sydney Trains Safety Management System that are relevant and necessary to meet electrical regulatory requirements.
ENSR	Electrical Network Safety Rules, synonymous with ENSMS
EPA	Environmental Protection Authority
ERM	Enterprise Risk Management
ESA	Electricity Supply Act 1995 (NSW)
ESF	Electrical Safety Forum
ESI	Engineering & System Integrity, a business unit within Sydney Trains' Maintenance Directorate
Hazard	A situation, condition or thing that has the potential to harm a person. Hazards may be physical, biological, chemical, or psychological. Different types of hazards may originate from the same source. Hazard identification can be planned or unplanned.
HV	High Voltage
IAW	in accordance with
ICON	Infrastructure Control Centre, responsible for monitoring the status of the Electricity distribution network and carrying out de-energisation/re-energisation of the Electricity distribution network

Term	Definition
IFMS	Infrastructure Failure Management System
IMF	Incident Management Framework
IPART	Independent pricing and Regulatory Tribunal, a statutory authority and the electricity network regulator for NSW
ISSC	Industry Safety Steering Committee
LMS	Learning Management System
LV	Low Voltage
MEN	Multiple Earthed Neutral - A system of electrical earthing
MOM	Maintenance Operations Manager (located at Network Bases)
NMD	Network Maintenance Division, a business unit within Sydney Trains
NSW	New South Wales
OHW	Overhead Wire
ONRSR	Office of the National Rail Safety Regulator
OTSI	NSW Office of Transport Safety Inspectors
QMS	Quality Management System
REFS	Relevant Environmental Factors Study
RFS	Rural Fire Service of NSW
RMC	Rail Management Centre, responsible for monitoring the status of rail operations
RSNL	Rail Safety National Law 2012 (NSW)
SAU	Sydney Trains' Assets Assurance Unit
SCADA	Supervisory Control and Data Acquisition
SCARD	Safety Change Assessment and Reporting Determination
SCP	Staff Competency Profile
SENI	Significant Electricity Network Incident
SER	Safety, Environment, Quality and Risk, a directorate within Sydney Trains
SFAIRP	So Far As Is Reasonably Practicable
SIMP	Site Incident Management Plan
SJAMS	St James, a database for managing quality issues and corrective action
SME	Subject-Matter Expert
SMS	Safety Management System
TfNSW	Transport for NSW
TMP	Technical Maintenance Plan
UPS	Uninterruptible Power Supply
WHS	Workplace Health & Safety
Worker / person	Has the same meaning as provided by section 7(1) of the Work Health and Safety Act 2011 (Cth)

2 Electricity Network Safety Management System (ENSMS)

2.1 Sydney Trains' policies

2.1.1 Sydney Trains is committed to providing a safe environment for our staff, passengers, customers, contractors and the public. All Sydney Trains policies are published internally². Our safety policy is founded on the principles that:

- a) Good safety performance requires planning, training, consultation, supervision and accountability,
- b) Risks are identified and either eliminated or effectively managed,
- c) All requirements of relevant legislation are met,
- d) We are all responsible for safety, and
- e) All injuries are preventable.

2.1.2 To achieve these principles, Sydney Trains has established a comprehensive safety management system (SMS) available to all employees via the intranet. The Sydney Trains SMS is defined by SMS-01-SR-3000 Safety Management System Requirements³. It consists of 20 elements that comply with various legislative requirements and standards, including:

- a) *Rail Safety National Law 2012* (NSW) and Rail Safety National Law National Regulations 2012,
- b) *Work Health and Safety Act 2011* (Cth) and Work Health and Safety Regulations 2011,
- c) *Electricity Supply (Safety and Network Management) Regulation 2014*.

2.1.3 Sydney Trains SMS was established to enhance safety management performance throughout the organisation. The aim of the risk-based systematic approach to safety management in line with international best practice is to provide safe workplaces and to demonstrate conformance to the required regulatory, statutory and industry requirements.

2.1.4 The SMS is under constant review, refinement, improvement, and stringent change control as outlined in its inherent operational safety risk and change management procedures.

2.1.5 The SMS has been developed using a continual improvement cycle of monitoring and review, focussing on improved system efficiency and effectiveness leading to improved safety performance of all Sydney Trains operations, including the electricity distribution network.

2.1.6 The continual improvement cycle consists of:

- a) Commitment – the health and safety policy for the organisation and a demonstration of the commitment to the policy.
- b) Planning – the way in which Sydney Trains will plan to fulfil the health and safety policy, objectives and targets.
- c) Implementation – the way in which Sydney Trains will develop the capabilities and support mechanisms necessary to achieve the health and safety policy, objectives and targets.
- d) Measurement – the methods that Sydney Trains will use to measure, monitor and evaluate the health and safety performance.

² <http://intranet.sydneytrains.nsw.gov.au/my-hr/policies-and-procedures>

³ <http://sms.sydneytrains.nsw.gov.au/trim/sms-sydney-trains?RecordNumber=D2013%2F79068>

- e) Review – the way in which Sydney Trains will regularly review its safety management system by taking preventative and corrective action and continually improving its overall performance.

2.1.7 Each of the 20 elements of the SMS contains SMS documents (such as System and Operational Procedures, Forms, Guidelines, etc.) that together describe what Sydney Trains must do to manage safety, who is responsible and where appropriate, and how certain tasks must be done.

2.1.8 Sydney Trains' Electricity Network Rules and SMS form a subset of the SMS and are made available to all employees and external organisations via the RailSafe website. Sections are provided to contractors, suppliers and other third party stakeholders as may be required to assure safe outcomes.

2.2 Publication of the ENSMS

The EDU publishes Sydney Trains' Network Management Plan that includes in part 5 of Chapter 1 Sydney Trains' Safety Management System for public use via the RailSafe website, at <http://railsafe.sydneytrains.nsw.gov.au/electrical-safety-sms-documents>. This plan and the top-level Electrical Network Safety Rules are provided on this website.

2.3 Management review and modifications to the ENSMS

2.3.1 Overview

Sydney Trains' electrical network SMS, formal safety assessments and the Safety Assurance Statement continuously evolve in response to periodic reviews, corrective or preventive actions recorded in the quality management system. Changes may arise from:

- a) Changing operational and maintenance needs, changing statutory requirements and industry codes of practice,
- b) Changes in risk assessments, e.g. changes to safety controls,
- c) Recommendations from audits and incident investigations, organisational changes within Sydney Trains,
- d) Technological changes,
- e) Information received from the ESF and external industry forums, such as best practice,
- f) Process-improvement activities, as well as
- g) Feedback from stakeholders including TfNSW, AEO and authorised persons.

2.3.1.1 Sydney Trains' Electricity Distribution Unit controls:

- a) This Plan and Sydney Trains' Electricity Network Bushfire Risk Management Plan,
- b) The Electricity Network Safety Rules,
- c) The Electrical Risk Register, and
- d) Formal Safety Assessments for the electricity distribution network.

2.3.2 Periodic review

2.3.2.1 SMS-20-SP-3080 System Review is a procedure that describes Sydney Trains' commitment to continual improvement to effectively satisfy safety objectives and targets. The procedure is applicable to senior management and managers of the SMS, and details the following processes:

- a) Scheduling reviews of the SMS,

- b) Reviewing safety plans and performance indicators,
- c) Reporting on the SMS review and safety performance to senior management,
- d) Reporting on non-conformances identified in safety and system audits, and
- e) Implementing corrective actions to address non-conformance.

2.3.2.2 The ENSMS documents generally have a review date set in each document which acts as a trigger to cause the document to be reviewed by Sydney Trains' Electricity Distribution Unit (EDU), revised (if necessary) and re-published.

2.3.2.3 As a minimum this Plan, and the network safety rules are reviewed and re-published each calendar year.

2.3.2.4 Formal Safety Assessments are reviewed and updated every 5 years, and/or when a change has been identified which would affect the risk prioritisations.

2.3.3 **Initiating changes to the ENSMS**

2.3.3.1 Changes to the ENSMS typically arise:

- a) From incident investigations,
- b) From opportunities identified to improve safety,
- c) From opportunities identified to improve the capacity, operation and maintenance of the network, optimise the use of qualified resources or reduce administrative delays, or
- d) Introduction of new technology.

2.3.3.2 Changes to the ENSMS are initiated through the corporate safety change management processes. This includes:

- a) The rationale for initiating the change,
- b) The affected documents, showing the proposed change,
- c) The context of the change, indicating the assets and stakeholders affected,
- d) Demonstrates the impact of the change has been considered with respect to compliance, assets, documentation, maintenance, training and training materials,
- e) Where the change affects safety:
 - Identifies the alternative solutions considered,
 - The relative safety risks posed by the alternatives,
 - A logical argument showing the solution proposed reduces risk SFAIRP⁴, and
 - Supporting documentation including but not limited to SCARD, human factors analysis, functional analyses, risk register or hazard logs in accordance with the SMS procedures.

2.3.4 **Document management**

Changes to the ENSMS, are implemented in accordance with Sydney Trains' Procedure SMS-05-SP-3001 Document Control.

⁴ SMS-07-OP-3085 SFAIRP Determination and Demonstration

2.3.5 **Notification of changes**

- 2.3.5.1 Changes to ENSMS documents are announced internally via the issue of an "Engineering Instruction" which are sent to the Deputy Executive Directors of the business units within Sydney Trains' Engineering & Maintenance Directorate, and cascaded throughout the staff hierarchy to those affected, and the TfNSW Asset Standards Authority.
- 2.3.5.2 Revised ENSMS documents are published to a shared email address "Electrical Technical Contacts". All electrical authorised persons are automatically included as subscribers to this address.
- 2.3.5.3 Sydney Trains notifies the rail regulator⁵ of any changes to the ENSMS that may affect Sydney Trains accreditation/registration.
- 2.3.5.4 Sydney Trains is required to notify both the electricity regulator and ONRSR of changes to the ENSMS that may affect Sydney Trains accreditation, notably those affecting the high-voltage distribution network.
- 2.3.5.5 In addition, EDU assesses changes to the ENSMS as to whether the change affects the tasks performed by authorised persons e.g. changes to forms, procedures, equipment and records. If this is the case EDU will:
- a) Issue an engineering instruction informing the authorised persons of the change (including a copy of the revised documents),
 - b) Provide a written briefing explaining the aspects of the change as it affects each category of authorised persons,
 - c) Attend the workplaces affected and conduct briefing sessions for the authorised persons affected, ensuring not less than 90% have been briefed prior to the change being implemented; and
 - d) Retain records of the persons briefed.
- 2.3.5.6 All other persons (including members of the public, external parties, other government authorities etc.) can access the released versions of the ENSMS documents via the RAILS SAFE website. The front page of the website lists the documents that have recently changed.

2.3.6 **Effectiveness of changes**

In response to changes categorised as significant, Sydney Trains may initiate an analysis or audit to assess the effectiveness of the change and the effectiveness of any corrective or preventive action implemented. Analyses will be undertaken with support from SER; audits may be carried out by Sydney Trains Internal Audit or an external auditor may be engaged.

⁵ Rail Safety National Law National Regulations 2012 clauses 22, 23

3 Regulatory requirements

3.1 Overview

3.1.1 The primary legislation, standards and codes of practice applying to Sydney Trains are listed in legal requirements register on the intranet⁶. In addition to the *Electricity Supply (Safety and Network Management) Regulation 2014* and AS5577, other legislation applicable to the electricity distribution network includes but is not limited to the following acts, regulations and codes of practice.

3.1.2 Adherence to these standards, codes, and guidelines is required, to the extent practicable. Departures should be documented and justified including evidence the resulting level of safety is at least equal to or greater than the level of safety that would ensure from compliance with that standard. Where there are conflicting requirements the legislation, codes of practice and national standards take precedence over ASA standards.

3.1.3 The following table list of source documents indicating those used by Sydney Trains, or where alternative standards are used.

Document	Application	Comments
Rail Safety National Law (NSW) No. 82a	Applies	Refer 1.3 and 3.2
ENA DOC001 National Electricity Network Safety Code	Not used	Superseded by AS5577
NSW Code of Practice: Demand Management for Electricity Distributors	Not used	Sydney Trains does not have disconnectable loads, and does not implement load-shedding.
Crossings of navigable waters: Electricity Industry Code	Applies	Defines minimum clearances and aircraft warning markers on aerial lines
ISSC 33 Guideline for network configuration during high bushfire risk days	Applies	Refer Sydney Trains Bushfire Risk Management Plan; Auto-reclose is disabled on TOBAN days
NSW Code of Practice: Electricity Service Standards	Not used	Superseded by "Service and Installation Rules of New South Wales, 2018"
Service and Installation Rules of New South Wales, 2018	Applies	
ISSC 31 Guideline for the management of private overhead lines	Not used	ST does not have private overhead lines
ISSC 3 Guide for the management of vegetation in the vicinity of electricity assets	Applies	Refer Sydney Trains Bushfire Risk Management Plan
ISSC 14 Guide to electrical workers' safety equipment	Not used	Refer [61] [62]
ISSC 20 Guideline for the management of activities within electrical easements and close to electricity infrastructure	Applies	

⁶ SMS-01-RG-3148

Document	Application	Comments
ISSC 28 Guideline for enclosed spaces in NSW electricity networks	Not used	Superseded by SafeWork Code of Practice for Confined Spaces
SafeWork Code of Practice for Confined Spaces	Applies	
ISSC 29 Guideline for preclimbing and climbing assessment of poles	Not used	Refer PR D 78108 Pre-work Hazard Assessment and Controls for Work on Poles with Live Exposed Equipment
ISSC31	Applies	
ISSC 32 Guide for ISSC network operators to provide information to the construction industry for working near overhead power lines	Not used	Superseded by Safe Work Code of Practice "Working near Overhead Powerlines"
ISSC 34 Guide for ISSC height safety within the NSW electricity industry	Applies	
ISSC 35 Guideline to safe work area taping in outdoor switchyards	Applies	
Australian Standard 5804: High Voltage Live Working	Not used	Sydney Trains does not permit live work on HV equipment
AS 4741: Testing of Connections to Low Voltage Electricity Networks	Applies	
NSW Code of NSW Dept of Practice: Service Water and Energy and Installation Rules	Not used	Superseded by NSW Service and Installation Rules
NSW Code of Practice: Contestable Works	Not used	Refer 3.8
NSW Code of Practice: Installation Safety Management	Not used	Sydney Trains uses ISSC31
Transmission NSW Dept of Design Reliability Resources and Standard for NSW Energy December 2010	Not used	Sydney Trains does not operate a Transmission Network
NSW Electricity Transmission Reliability and Performance Standard 2017	Not used	Sydney Trains does not operate a Transmission Network
AS/NZS2067 Substations and high voltage installations exceeding 1kV a.c.	Applies	
AS/NZS 7000 Overhead Line Design	Applies	Sydney Trains applies its own design standards contain in its Design Manual, these meet or exceed the requirements of AS7000, notably in respect of clearances and blowout distances.

3.2 Rail Safety National Law (NSW) No. 82a

- 3.2.1 The safe operation of the rail infrastructure, of which the electricity distribution network is a part, is governed by the Rail Safety National Law (NSW) No 82a (RSNL). The RSNL defines "rail safety work" broadly and includes a variety of work on the rail infrastructure including the "*installation or maintenance of...the means of supplying electricity directly to Rail Infrastructure, (and) any rolling stock using Rail Infrastructure...*"⁷
- 3.2.2 The dependant legislation to the RSNL is the *Rail Safety National Law National Regulation 2012 (Rail Regulation)*. The Rail Regulation requires accredited rail infrastructure managers to maintain an appropriate safety management system, containing (but not limited to):
- a) Security management plans,
 - b) Emergency management plans,
 - c) Network rules,
 - d) Health and fitness management programmes,
 - e) Drug and alcohol management programmes,
 - f) Fatigue risk management programmes, and
 - g) Records of competence.

3.3 Electricity legislation

- 3.3.1 In NSW, the ESA is the overarching legislation covering the ownership and operation of an electricity network. This defines:
- a) a distribution system as "the electricity power lines and associated equipment and electricity structures that are used to convey and control the conveyance of electricity....to, from and along the rail network electricity system operated by, for or on behalf of Rail Corporation New South Wales or Transport for NSW...."
 - b) A network operator as "a transmission operator" or "distributor".
 - c) A distributor as "a person who owns, controls or operates a distribution system".
- 3.3.2 Therefore, as defined in the ESA (and associated regulations) Sydney Trains is a network operator. Under section 13 of the ESA, a person must not operate a distribution system for the purpose of conveying electricity without a distributor's licence. Sydney Trains is exempted from this requirement under regulation 14 of the *Electricity Supply (General) Regulation 2014*.
- 3.3.3 In addition to the provisions of the RSNL and supporting regulation, the ESA creates further and more specific rights and obligations relating to the operation and management of the electricity distribution network. This includes, but is not limited to:
- a) Certain powers afforded to network operators to acquire land (or easements) to extend or augment the electricity network,
 - b) Certain powers to prevent potential interference with the operation or placement of the electricity network,
 - c) Network access and usage charges, and
 - d) Vegetation management, including trees on private and public land that may or does pose a risk to the safe operation of the network.

⁷ Rail Safety National Law (NSW) No. 82a Part 1 section 8.1.g (ii)

- 3.3.4 The following regulations also apply to Sydney Trains as a network operator:
- a) *Electricity Supply (General) Regulation 2014 (NSW)*,
 - b) *Electricity Supply (Corrosion Protection) Regulation 2014 (NSW)*, and
 - c) *Electricity Supply (Safety and Network Management) Regulation 2014 (NSW)*.
- 3.3.5 The *Electricity Supply (General) Regulation 2014* covers the "customer facing" obligations of operating a distribution system, as well as obligations around greenhouse gas abatements and energy saving.
- 3.3.6 Sydney Trains has extensive corrosion protection systems in place in order to maintain the integrity of the rail traction and earthing systems. The *Electricity Supply (Corrosion Protection) Regulation 2014* requires Sydney Trains to maintain registration of all existing corrosion protection systems and to gain approval from the regulator for any new or proposed corrosion protection systems. These requirements are administered for Sydney Trains by the Electrolysis Group within the Network Maintenance directorate.

3.4 Exemptions

- 3.4.1 Generally, electricity distribution networks exist for the wholesale supply of electricity on behalf of retailers and the Australian Energy Regulator (AER) under the *National Electricity Law*. The *National Electricity Rules* is the legislative instrument.
- 3.4.2 Sydney Trains holds an exemption (AER – N02076/13) from the AER to register as a network service provider and from the operation of Chapter 5 of the National Electricity Rules. This exemption was granted to Sydney Trains in June 2013 and remains under the Australian Energy Regulator's Network Service Provider Registration Exemption Guideline. The exemption places certain conditions upon Sydney Trains applicable to exemption class NR05⁸ and relates to the way in which Sydney Trains may operate and maintain the network from which third party electricity customers are supplied.

3.5 WHS Regulation 2017 (NSW)

- 3.5.1 The Work Health and Safety Regulation 2017 (NSW) defines electrical safety requirements, notably regulations 144 to 166 inclusive. While regulation 144 suggests regulations 153 – 162 do not apply to Sydney Trains, regulations 153-162 are acknowledged as minimum requirements for the safe access to electrical equipment.
- 3.5.2 The sequences for de-energising, providing safe access and re-energising electrical equipment as described in the Electricity Network Safety Rules implement regulations 149-163.

3.6 Electricity Supply (Safety and Network Management) Regulation 2014 & AS5577

- 3.6.1 The Electricity Supply (Safety and Network Management) Regulation 2014 requires the operator of an electricity distribution network to have a safety management system which meets specific criteria, and requires compliance with AS5577 as described in section 2 of this plan.
- 3.6.2 AEOs are required to comply with AS5577, including producing Formal Safety Assessments and responding to the explicit risks identified in AS5577. Sydney Trains' implementation of this is described at section 5, Safety Management.

⁸ AER-N02076/13. Exemption class NR05 "Metered energy on selling to customers in networks with metering infrastructure enabling access to full retail competition in a jurisdiction".

3.7 Protection of the Environment Acts and Regulations

- 3.7.1 Several acts and regulations concern the protection of the environment; compliance with these is mandatory and Sydney Trains' Environmental Management System applies to all business activities that affect, or have the potential to affect the environment. This includes Sydney Trains own operations and activities undertaken by contracted service providers on behalf of Sydney Trains.
- 3.7.2 With respect to the electricity distribution network the obligations include but are not limited to:
- a) Ensuring trees are preserved,
 - b) Ensuring heritage assets are preserved,
 - c) Ensuring protected species are not harmed, and
 - d) Ensuring the environment is not polluted, i.e. containing and disposing of waste appropriately.
- 3.7.3 These issues may arise in all lifecycle phases from concept definition to disposal. Further guidance is provided in Sydney Trains Environment Management Manual EMS-01-MN-0001.

3.8 Contestable Network Services

- 3.8.1 The electricity distribution network exists primarily to provide a safe and reliable electricity supply for trains, stations and signalling. Much of the electricity distribution network is located on land owned or controlled by RailCorp or traverses public land.
- 3.8.2 Due to the relative inaccessibility of the electricity distribution network and the inherent complexities involved, connections of third parties to the system are only undertaken in distinct circumstances (e.g. commercial enterprise within the rail corridor in agreement with and ancillary to rail services). There are no likely connections envisaged where the electricity distribution network could be considered the only viable electricity service provider to an external customer outside the rail corridor.
- 3.8.3 TfNSW allows third party connections to the rail electricity network where these exist within premises either owned or formerly owned by RailCorp or predecessor organisations. Connections of this type are very few. Therefore, Sydney Trains does not consider obtaining accreditation under the Electricity Supply (Safety and Network Management) Regulation 2014 to provide contestable network services is warranted.
- 3.8.4 TfNSW authorises external organisations, under its Accredited Engineering Organisations (AEO) scheme, to work on rail infrastructure, including the electricity distribution network. Where required Sydney Trains will utilise the provisions of the AEO scheme to ensure third party connections are undertaken at market competitive rates.

3.9 Electricity Service Standards

- 3.9.1 Over 250 independent retail customers are connected to the electricity distribution network, primarily shops on station concourses. The customers are separately metered and billed by Sydney Trains as the distribution network operator.
- 3.9.2 Sydney Trains holds an exemption from the Australian Energy Regulator to register as a retailer and from the operation of certain parts of the *National Energy Retail Law*. This exemption (AER – R0042/13) was granted to Sydney Trains in July 2013 and remains under the AER's (Retail) *Exempt Selling Guideline* (March 2016). The exemption places certain conditions upon Sydney Trains applicable to exemption classes R1 and R5 and relates to the way in which Sydney Trains may supply third party electricity customers from the rail electricity distribution network.
- 3.9.3 Sydney Trains is also exempted from certain provisions of the ESA⁹, and Part 2 of the *National Electricity (NSW) Law*.

3.10 Electricity Supply Industry and Related Codes and Guides

- 3.10.1 Sydney Trains applies national and state (NSW) standards, codes and guidelines for the design, installation, operation and maintenance of the electricity distribution network. Their relevance is summarised below.
- 3.10.2 Sydney Trains also uses but does not necessarily fully comply with guidelines and documents nominated in relevant network standards and used in the electricity supply industry. Some are duplicated by, in conflict with or are superseded in part by other documents while other aspects arise as a result of operating a 1500VDC railway. These include:
- a) Energy Networks Association (ENA) standards published at www.ena.asn.au, and
 - b) Industry Safety Steering Committee (ISSC) guidelines.
- 3.10.3 The unique operational needs and risks arising from the railway result in technical requirements standards that differ from those adopted elsewhere in the electrical industry.
- 3.10.4 Sydney Trains reserves the right to deviate from industry standards in accordance with the engineering management framework, and where this occurs the rationale must be documented and supported by a safety assessment showing the risk is controlled SFAIRP.
- 3.10.5 Where conflicts arise – such as different standards or codes of practice prescribing conflicting requirements – Sydney Trains will make decisions ensuring regulatory requirements are satisfied and risk is considered.

⁹ Electricity Supply Act 1995 (NSW) s 43B

3.11 Code of Practice: Distribution Risk Management

- 3.11.1 In 2009 the NSW Government published a *Code of Practice for Electricity Transmission and Distribution Management* which provides a minimum standard for the management of the electricity network assets.
- 3.11.2 Some sections of this code are superseded by subsequent national standards, industry codes of practice (notably the ENA NENS documents) and the *Electricity Supply (Safety and Network Management) Regulation 2014 (NSW)*.

3.12 Code of Practice: Managing Electrical Risks in the Workplace

In February 2016 Safe Work Australia released a code of practice *Managing Electrical Risks in the Workplace*¹⁰ which is concerned with low-voltage installations, electrical machinery, tools and equipment, drawing largely on the requirements of the WH&S Act. It provides a useful introduction to electrical risks in the workplace. In particular:

- a) Appendix C provides a list of typical activities and the associated risks, these are included in the Sydney Trains ERR; and
- b) Appendix D provides a checklist for assessing electrical risks.

3.13 Code of Practice: Work Near Overhead Power Lines

The *Work Near Overhead Power Lines Code of Practice* applies with respect to all situations where there is a reasonable possibility of a person, either directly or through any conducting medium, coming closer than the approach distances specified in that code. The following guidance is provided:

- a) This Code must be applied by external parties performing work adjacent to overhead wires operated or maintained by Sydney Trains;
- b) Where the Code refers to the network operator, refer Sydney Trains SMS-06-GD-0268 "Working around Electrical Equipment";
- c) The term "accredited persons" in the Code means a person accredited by Sydney Trains in accordance with PR-D-78701 "Personal Certifications – Electrical";
- d) Safe Approach Distances described in SMS-06-GD-0268, either duplicate those in this Code or are more conservative (greater).

3.14 TfNSW Standards, Codes and Guidelines

- 3.14.1 Sydney Trains uses a comprehensive set of engineering standards to design, construct, commission, maintain, operate and decommission elements of the electricity distribution network. The engineering standards are developed, implemented, maintained and administered by the ASA within TfNSW and are integrated with technical maintenance plans and associated service schedules undertaken by Sydney Trains. Standards undergo periodic review to ensure they are effective and incorporate best practice.
- 3.14.2 The ASA is responsible for managing the content and integrity of the standards, making them available to AEOs and other interested parties. The ASA will set standards through the implementation of a process to promote collaboration between the ASA and other sectors of the rail industry.
- 3.14.3 The suite of network standards for which the ASA is responsible includes ASA published standards and RailCorp engineering standards which reference Australian and international standards deemed applicable to the NSW rail network.

¹⁰ https://www.safeworkaustralia.gov.au/system/files/documents/1705/mcop-managing-electrical-risks_in_the_workplace-v3.pdf

- 3.14.4 RailCorp engineering standards contain references to organisational processes and positions that are no longer valid in the current TfNSW organisational context. However, the technical requirements in those standards are still valid for the TfNSW rail environment. An overview of how the organisational processes and positions referenced in RailCorp engineering standards may be interpreted in the TfNSW "cluster" is available in the TfNSW's "Guide to interpretation of organisational role and process references in RailCorp standards"¹¹
- 3.14.5 ASA maintains a suite of specific electrical engineering standards comprising a total of available on the ASA website ¹².

3.15 Service and Installation Rules of NSW

- 3.15.1 Sydney Trains deviates from one of the objectives of the NSW Service and Installation Rules and the referenced Service and Installation Rules of NSW, owing to a departure from the requirements of AS/NZS 3000. The rail electricity distribution network utilises a modified direct earthing system, rather than a Multiple Earthed Neutral (MEN), on installations in the vicinity of the traction system. The modified direct earthing system minimises or eliminates the flow of DC traction current into the low voltage distribution system.
- 3.15.2 The rail electricity network's specific earthing requirements are set out in the RailCorp document EP 12 10 00 21 SP – "Low Voltage Installations Earthing". All installations near 1500V track are required to comply with this specification.

3.16 Changes to Regulatory Requirements and Codes of Practice

- 3.16.1 Sydney Trains participates in electrical industry forums, notably the electrical industry safety networks in Sydney / Illawarra / Hunter, the electrical Industry Safety Steering Committee (ISSC) and the Energy Networks Association (ENA) to maintain awareness of current trends and forthcoming changes in the electrical industry.
- 3.16.2 Sydney Trains also has a corporate subscription to SAIC Global and is automatically notified of changes to relevant standards.
- 3.16.3 The impact of changes is assessed by subject-matter-experts.

4 Network Description

4.1 Overview

- 4.1.1 This chapter presents a description of the electricity distribution network, including the parameters required by AS5577 Appendix C.
- 4.1.2 Sydney Trains operates the electricity distribution network (consisting of the distribution network and the traction system) supplying the railway operations of both Sydney Trains and NSW TrainLink as an integral part of the rail network.
- 4.1.3 As the operator of the electricity distribution network, Sydney Trains is defined in the ESA as a network operator. Ownership of the physical asset remains within Transport for New South Wales (TfNSW) and currently rests with RailCorp.

¹¹ <http://www.asa.transport.nsw.gov.au/sites/default/files/asa/asa-standards/ts-10760.pdf>

¹² <http://www.asa.transport.nsw.gov.au/ts/railcorp-engineering-standards/electrical/electrical-standards>

4.2 Supply Interfaces

- 4.2.1 The rail electricity distribution network takes high voltage AC supply via bulk supply points throughout the network area. These bulk supply points are provided by 2 adjacent network operators (AUSGrid and Endeavour Energy) and TransGrid at 132kV, 66kV, 33kV or 11kV.
- 4.2.2 Some railway stations and small installations within the rail corridor are supplied from the interfacing network operator (AUSGrid and Endeavour Energy) at low voltage (415V 3 phase and 240V single phase) via isolating transformers. The components of the electricity distribution network include:
- Substations,
 - High Voltage (HV) aerial lines and underground cables,
 - Low voltage distribution systems,
 - Earthing systems, and
 - ICON
- 4.2.3 The interface points are indicated in Figure 1, based on ASA standard T HR EL 17000 ST Demarcation of RailCorp Low Voltage Distribution System.
- 4.2.4 As a high-voltage distribution network operator all the substations operated or maintained by Sydney Trains must be supplied via the high-voltage distribution network, i.e. an asset or substation cannot be supplied from a high-voltage connection to another network operator in isolation from the distribution network.

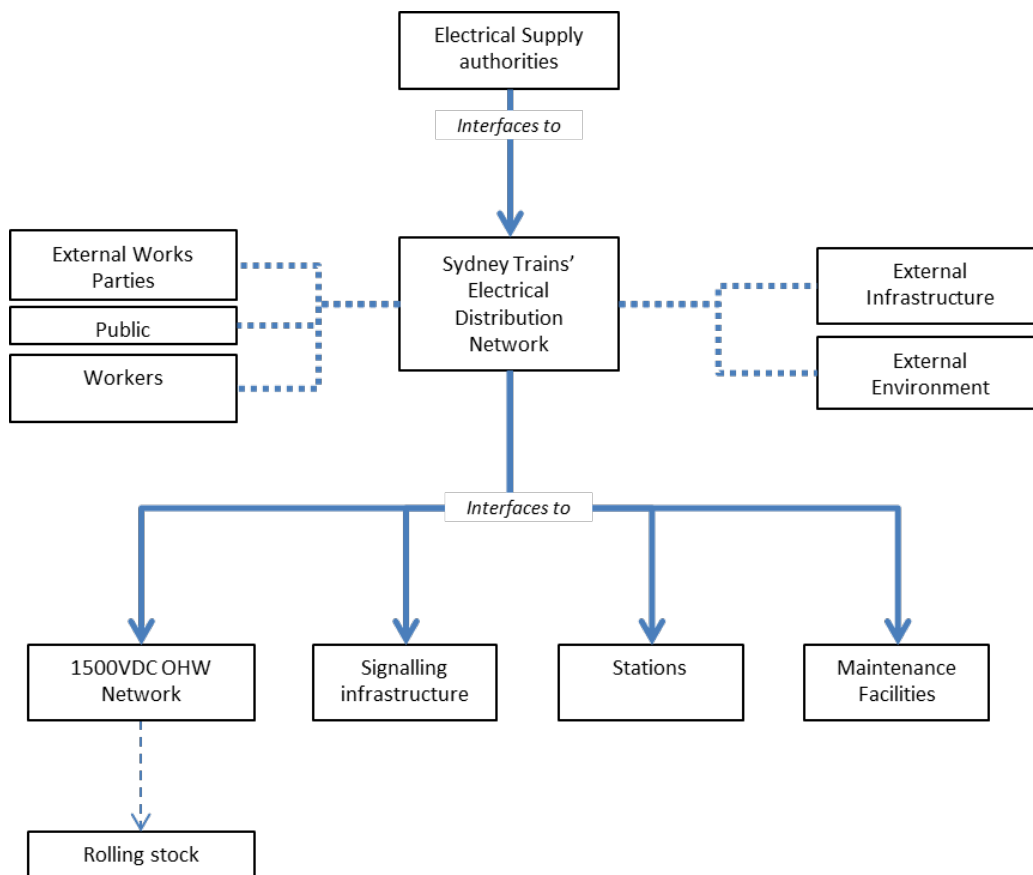


Figure 1 – Electricity distribution network context

- 4.2.5 The following **do not** form part of the electricity distribution network and are explicitly excluded:
- a) 1500VDC OHW, supplying power to rolling stock,
 - b) Signalling power,
 - c) Low-voltage supplies to stations, buildings, and workshop supply (general supply), and
 - d) Electrical assets of rail networks not managed by Sydney Trains, including but not limited to:
 - Sydney Metro and Sydney Light Rail;
 - Public-Private Partnerships (such as Reliance Rail); and
 - Other rolling stock operators.
- 4.2.6 The distribution network consists of HV aerial lines and underground cables that bring the AC supply to distribution and traction substations. The traction substations then convert the electricity supply to DC power, which in turn is fed into the overhead wiring (OHW) system, from which trains draw their supply and are able to run.
- 4.2.7 General power is supplied from the substations for the signalling system, lighting, workshops, offices, and stations; ensuring a continuous electrical supply to these assets. General power is provided at nominal voltages compliant with those outlined in AS60038. General power is, at numerous locations, supplied directly from a distribution substation or low voltage electricity network owned by an adjacent network operator.
- 4.2.8 Traction power is converted to 1500VDC (nominal) at traction substations, then delivered via the overhead wire network to trains, powering the electric train fleet and all the auxiliary services (e.g., lighting, air-conditioning) on the trains.
- 4.2.9 The whole of the electricity distribution network (apart from the overhead wiring and some general supplies) is designed so that the failure of any one item of equipment does not affect the running of trains. This is known as single contingency failure mode. At some locations, such as the City Underground, double contingency is provided to ensure a secure supply.
- 4.2.10 The traction system extends to Wickham (Newcastle) in the north, Lithgow in the west, Macarthur in the south-west, and Kiama in the south (Figure 2).

4.3 Substations

- 4.3.1 Traction substations provide control, distribution, protection, and transformation of AC power to 1500V DC power supply to the traction system. Traction sectioning huts maintain the overhead wiring voltage and eliminate unnecessary tripping of DC circuit breakers; they are not a source of power.
- 4.3.2 The rectification of AC to DC supply and the operation of the traction system can produce significant harmonics and other waveform distortions within the electricity distribution network. Therefore, general supply to other customers is largely limited to commercial enterprises operating within or immediately adjacent to the rail corridor.
- 4.3.3 Spacing of traction substations varies between one every 4 kilometres in high load areas, to one every 15 kilometres for outer suburban rail passenger transport. Substation spacing is a complex issue which must consider variables such as electrical loads, gradients, OHW types, energy losses, voltage drop, rail to earth voltage, and electrolysis.

- 4.3.4 High voltage feeders distribute the electricity supply to substations for rectification and further distribution to the OHW for traction supply and rail operations. For protection, operation and maintenance purposes, the overhead wiring is divided into separate sections by the switchable substations, sectioning huts, and field switches. Overall control and monitoring of Sydney Trains' substations is via a Supervisory Control and Data Acquisition (SCADA) system.
- 4.3.5 Electrical protection of the OHW system is provided by high-speed DC circuit breakers (DCCBs). Sectioning huts containing DCCBs are provided between substations for protection and sectioning of the OHW system and, on multiple tracks, to improve voltage regulation.
- 4.3.6 Substations and the selection of switchgear are based on AS3000, AS2067 and related ASA standards which require specific controls to mitigate the risks posed by this equipment.

4.4 High Voltage (HV) Aerial Lines & Underground Cables

- 4.4.1 The high-voltage network includes 882.6km of aerial lines of which 606.4 km is within the rail corridor, and 276.2km lies outside the rail corridor. The percentage on bushfire-prone land (in 2016) is depicted in Figure 2 below:

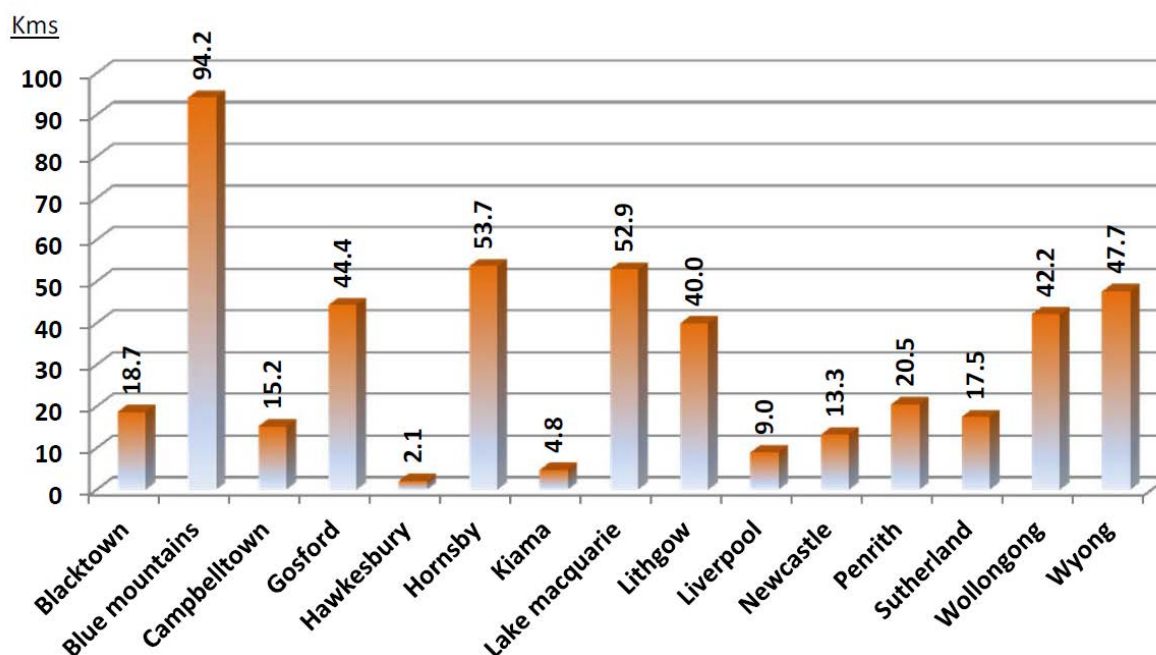


Figure 2 – Percentage of Feeders on Bushfire-prone Land

- 4.4.2 Except where general supply is taken directly from an adjacent network operator's distribution substation, the electricity supply between bulk supply points and substations is provided by HV AC aerial lines and underground cables.
- 4.4.3 High voltage electricity is distributed to and throughout the rail electricity distribution network at five nominal voltages:
 - a) 132kV – a short (<1km) aerial feeder (no. 285) from Heathcote Substation to an interconnection (at AUSGrid structure T231) with the 132kV feeder between AUSGrid's Port Hacking Switching Station and Endeavour Energy's Bellambi Transmission Substation.

- b) 66kV – network supplies from Endeavour Energy, AUSGrid, and TransGrid’s bulk supply points, and interconnections between traction substations and switching stations from Blacktown to Wallerawang and Hornsby to Sulphide Junction (Cardiff).
- c) 33kV - network supplies from Endeavour Energy and AUSGrid bulk supply points, and interconnections between traction substations in all other areas of the rail electricity distribution network.
- d) 11kV - Distribution and reticulation of electricity supplies to signalling and ancillary installations within or adjacent to the rail corridor, and railway stations.
- e) 2kVAC – feeder connecting PA to Erskineville and supplying four signalling locations around the City Circle.

4.4.4 The high voltage system consists of aerial conductors and underground cables, and is mostly located within the rail corridor. Underground cables generally require less routine maintenance than aerial lines. Cables can be subject to accidental damage during excavations, and faults are not always easy to find. Some sections of the system traverse public recreational and road reserves, National Parks, and government-administered properties.

4.4.5 Protection of HV feeders is from circuit breakers located within substations. Auto-reclosing is applied by the SCADA system at ICON.

4.5 Overhead Wiring (OHW) and Electric Rolling Stock

4.5.1 The 1500 Volt Overhead Wiring does not form part of the electricity distribution network and does not come under the scope of the Electricity Supply (Safety and Network Management) Regulation 2014. As such the methodology and practices of how Sydney Trains addresses the safety of persons in relation to the 1500 Volt OHW is not contained within this document; it is addressed in other Sydney Trains strategies, standards, documents, procedures and processes. However, many of the strategies deployed by Sydney Trains concerning the restrictions and safety of persons in the rail corridor also largely contribute to the strategies and procedures to limit public access to the potential hazards associated with the electricity distribution network.

4.5.2 The OHW system transfers traction power at 1500VDC from the traction substations to the train pantographs by way of catenary and contact wires. The train pantograph slides under the contact wire and collects power to operate the motors, with the current returning to the substations through the rails. The overhead is at positive voltage potential and the rails are at negative voltage potential. This system’s assets include the cables, wires, wire support structures, wire crossovers, regulators, insulators, and section switches.

4.6 1500VDC Interfaces

Where Sydney Trains supplies power to a 1500VDC section operated or maintained by another Rail Infrastructure Manager (RIM) an Interface Agreement shall be established requiring the RIM to liaise with Sydney Trains to ensure power is supplied when needed, and to ensure electrical work performed by one party do not adversely affect rail operations of the other party.

4.7 Signalling Supplies

- 4.7.1 The 120VAC signalling supplies do not form part of the electricity distribution network and do not come under the scope of the Electricity Supply (Safety and Network Management) Regulation 2014. The management of safety associated with the signalling supplies is covered by the RSNL. Reports are submitted to the Independent Transport Safety Regulator (ITSR) as part of Sydney Trains' rail safety accreditation.
- 4.7.2 Signalling power supplies are built with two independent sources of supply; one designated as normal, and the other as emergency. In most cases, the normal supply is assigned to the Sydney Trains 11kV / 2kV distribution system and the emergency supply is from the adjacent network operator at low voltage AC. The HV supply is transformed to LV (415VAC¹³, 240VAC, 120VAC) and then rectified where required to 24VDC for signalling.
- 4.7.3 These signalling power supplies are set up with an automatic changeover switch that is biased to draw supply from the normal source but will change over to the emergency source if the normal supply is lost. This provides a high level of independence and a low probability of simultaneous loss due to a common cause.
- 4.7.4 Some locations have two independent Sydney Trains supplies, with a small number of others relying on two supplies from the adjacent distribution network service provider. This not a normal or desired arrangement and a concession is required from ASA if contemplated.
- 4.7.5 New signalling power supply systems incorporate fewer power supply locations, with an uninterruptible power supply (UPS) downstream of the changeover contractor. The UPS provides a constant, smooth supply to the signalling equipment that is unaffected by surges, dips and other disturbances on the Sydney Trains or adjacent network operator networks. Adopting this technique has made the signalling system much more robust, particularly during extreme weather events.

¹³ Three phase earthed 415V supply.

4.8 Low Voltage Supplies

- 4.8.1 Stations, buildings and workshops are supplied from the HV distribution system. Substations transform the power to the required low voltage. The reticulation of low voltage supply is mostly insulated cables run in either ducts, buildings and structures or conduits. There is some pole mounted wiring, and this is generally between network operators substation or point of supply (connection point), and a building / structural point of attachment. A small amount of this is open wire. Protection of the general supply network is via high rupture capacity (HRC) fuses or low voltage circuit breakers.
- 4.8.2 Power failure at a station without a backup supply does not affect the traction or signalling systems. However, having no functioning lights, escalators or lifts on stations is a safety risk for the travelling public. In the event of power failure, station staff are trained to respond to ensure the safety of the travelling public. This may include running trains through blacked-out stations without stopping, and providing bus services between affected stations until power is restored.
- 4.8.3 The rail electricity network supplies electricity directly to independent (embedded) customers (e.g., retail tenants of Sydney Trains station concourses), and a small number of third party non-tenants. These consume approximately 1.8% of the energy supplied by the Sydney Trains network.
- 4.8.4 In the Blue Mountains it also serves as the backup supply for the Endeavour Energy feeder supplying public consumers with connections at the Lawson and Blackheath substations. In this respect the impact for retail consumers in these areas arising from isolations or failures on the feeders in the Blue Mountains must be considered.

4.9 Modified Direct Earthing System

- 4.9.1 The traction rail is insulated from the general mass of the earth by concrete or timber sleepers and ballast (crushed stone) that, in combination, present sufficient resistance to current flow to prevent almost all leakage to earth. The negative is NOT bonded to earth at the source so leakage current will only exist where a path of lower resistance bypasses part of the rail return system.
- 4.9.2 Some leakage is always possible and can often occur. If DC leakage currents are able to enter buried metallic objects such as metal water pipes or electric earthing systems, electrolysis can occur and, if left uncontrolled, this can completely corrode the affected metallic material.
- 4.9.3 As a control measure, Sydney Trains does not use a MEN system in situations near 1500V track. Installations near 1500V track must be electrically isolated from any MEN systems (usually by an isolating transformer installed between the point of supply and the main switchboard) and a dedicated, insulated earthing conductor is run from the substation throughout the local low voltage network.

4.10 Infrastructure Control (ICON)

- 4.10.1 Sydney Trains has a central facility (ICON) which monitors and controls the electricity distribution network and related infrastructure using a SCADA system which communicates with the substations throughout the network, and presents information to electrical system operators at the central control facility. The mission of ICON is to ensure the supply of electricity to the railway assets meets operational needs, primarily the rolling stock, signalling, maintenance centres, stations and other facilities, as well as:
- a) Monitor the status of the electricity distribution network including the high-voltage circuit breakers, feeders and substations;
 - b) Monitor the status of the 1500VDC overhead wire;

- c) Control the operation of most high-voltage circuit breakers;
 - d) Control the de-energisation and re-energisation of electrical assets
 - e) Control the auto-reclosing of high-voltage circuit breakers;
 - f) Monitor power usage at critical locations;
 - g) Manage the response to emergencies involving electricity, and
 - h) Record and respond to incidents, as/when reported.
- 4.10.2 The processes implemented by ICON are described in Operator Procedures and Trouble Instructions.
- 4.10.3 ICON has interfaces to the Rail Management Centre (rolling stock operations), WeatherZone (to monitor weather conditions) and emergency services.
- 4.10.4 To provide business continuity and disaster recovery in the event of certain types of incident, the ICON facility and its communications links are dual-redundant.

5 Safety Management

5.1 Safety Assurance

- 5.1.1 Sydney Trains provides assurance of system safety as described in the TfNSW "Guide to TfNSW Framework for Assuring the Safety of Rail Assets and Infrastructure". This describes:
- a) Safety duties,
 - b) The approach to transport safety regulation and assurance,
 - c) Ensuring safety and the meaning of SFAIRP,
 - d) Safety organisation and responsibilities,
 - e) Operation and maintenance of rail assets,
 - f) TfNSW's framework for assuring the safety of rail assets & infrastructure
 - g) The safety management lifecycle adopted,
 - h) Configuration management
 - i) Governance,
 - j) The Rail Services Contract and the organisational arrangements between TfNSW, RailCorp, Sydney Trains and AEOs.
- 5.1.2 Further guidance is provided in the ONRSR "Guideline Major Projects" concerning safety assurance, SFAIRP determination and the factors that should be considered.

5.2 Safety Policy

- 5.2.1 Sydney Trains' safety policy (refer Appendix 1) defines our commitment to risk management and guidance on risk management approaches. All staff are obliged to manage risk in accordance with this policy.
- 5.2.2 Risk management is integral to good corporate governance. It provides an integrated, systematic and mandatory approach to:
- a) Make decisions ensuring the change introduced is no less safe than previously, and identifying opportunities to reduce risks;
 - b) Minimise harm to persons (including the public, staff and contracts), the environment and other assets arising from the operation and maintenance of the railway;

- c) Ensure the organisation achieves its operational objective (i.e. operating the railway) while minimising the operational impact arising from incidents;
- d) Logically decompose these objectives to identify the safety controls that should be implemented at all levels of the organisation;
- e) Produce and retain records demonstrating compliance with these objectives and to satisfy legislative requirements for safety.

5.3 Safety Management Lifecycle

5.3.1 The safety life cycle is the series of phases from initiation and specifications of safety requirements, covering design and development of safety related features in a safety-critical system, and ending in decommissioning of that system. The lifecycle model is defined by the TfNSW ASA¹⁴, Figure 3:

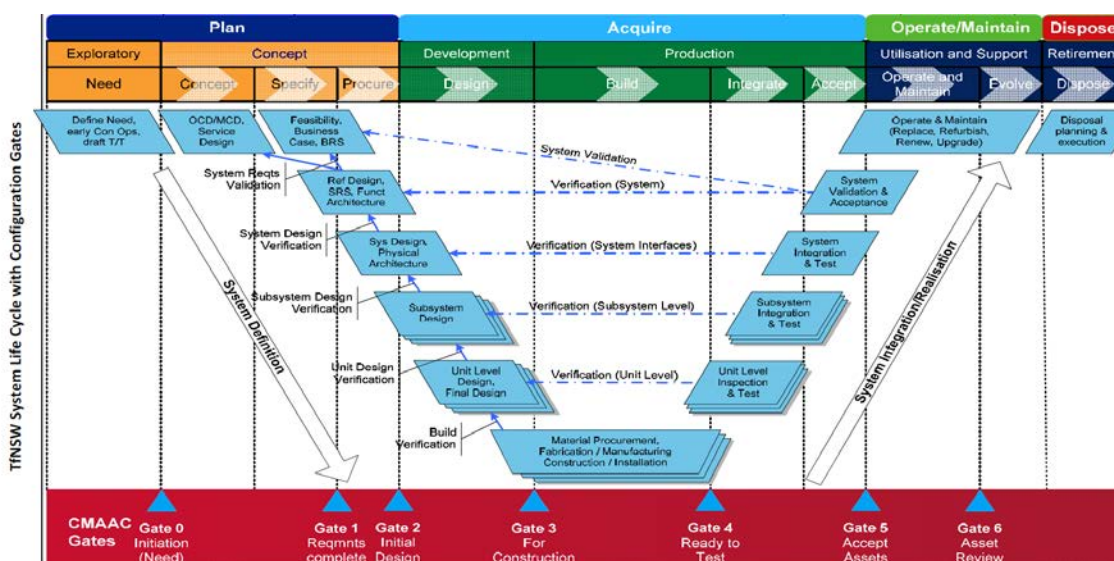


Figure 3 – ASA Asset Lifecycle Model (Based on AS15288)

5.3.2 All changes – including new or significantly altered assets, organisation changes and process changes – are assessed via a safety change and risk determination. This may result in safety assessments, refer sections 6.5.10 Formal Safety Assessments and 11 Asset Planning Management.

¹⁴ Figure 3 of TfNSW ASA standard T MU MD 20001 ST

5.4 Allocation of Risk Management Responsibilities

- 5.4.1 Stakeholders who are responsible or accountable, and those who should be consulted or informed are shown in Table 1.
- 5.4.2 Specific responsibilities are defined for each directorate in a . For example depending on the context of the risk assessment risk owners include Director, Executive Director, Associate Director, professional staff or workers. Directors are responsible for managing the foreseeable risk within their directorates and divisions and for providing assurance that risks are being managed appropriately.
- 5.4.3 All risk assessment activities must have a Risk Assessment Sponsor (RAS). The RAS is a Sydney Trains manager that has recognised the requirement to carry out a risk assessment and/or make decisions about divisional, project or operational functions, systems or resources, based on the results of the risk assessment. The RAS is often the risk owner for most of the risks identified within the risk assessment and frequently initiates the implementation of the safety controls identified.

Table 1 – Sydney Trains RACI Matrix for Risk Management Aspects of Electrical Assets in All Lifecycle Phases

Regulation & AS5577		Design				Construct	Commission	Operate		Dispose		
		Exploratory	Conceive			Develop	Produce		Utilise and Support		Retire	
Sydney Trains Asset Lifecycle		Need	Conceive	Specify	Procure	Design	Build	Integrate	Accept	Operate & Maintain	Evolve	Dispose
Stakeholder Organisations	ASA			R								
	TfNSW Strategic Planning	R	R		R		R*	R*	R*	I	I	I
	Sydney Trains as designer (incl. E&SI)	A	A	A	A	A						
	Sydney Trains as constructor (incl. MW)						A	A	A		A	A
	Sydney Trains Network Maintenance			C*, I			C*, I	C	C	A	C	C
	E&SI (incl. EDU)	C	I	C*, I	I	I	C*, I	I	I	C	C	I
	SER (Safety)									C	C	
	SER (Environmental)									C	C	
	AMD	C	C	C	C	I	R*/C	R*/C	R*/C	R	R	R
Key: R = Responsible A = Accountable C = Consult I = Inform												
R* depending on the project development: where TfNSW plans work = AMD C, where Sydney Trains lead project = AMD R, C* Proposed and Staged Operating Diagram Functions												

5.4.4 Risk management occurs primarily at six levels across the organisation:

Risk Owner	Responsibility
Chief Executive	Overall responsibility and accountability for the implementation of risk management within Sydney Trains. Delegates responsibility of monitoring risk assurance to Risk Owners who are at an appropriate level or perform a specific function within the business.
Director, Deputy Executive Directors	Responsible for managing risk within their Directorate. Formally defined as Safety Risk owners in the SMS. Ensure appropriate risk assurance activities undertaken for 'owned' risks.
Associate Directors & Professional Heads	Responsible for managing risk within their Division. Formally defined as Safety Risk Control owners in SMS. Make sure owned controls are in place and working as intended.
Project Managers	Responsible for managing risks associated with their projects, assets and contracts.
Maintenance Operations Managers, Team Managers, Area Electrical Engineers	Responsible for managing risks associated with maintenance activities and safety in the field, allocating resources and equipment.
Electrical Workers	Responsible for managing risks associated with maintenance activities and safety in the field, working safely in accordance with guidance and procedures provided in the Electrical Safety Management System, SWMS and SWI.

5.5 Sydney Trains' Electrical Safety Responsibilities

5.5.1 Planning

The safety planning process is detailed in the document SMS-03-SP-3063 Safety Planning, and is summarised in the following table:

Process	Responsibility	Tools & Forms
Define Organisation	Associate Director EDU	Corporate Plan Safety Strategic Plan
Establish Safety Objectives and Measureable Targets	EDU Principal Engineer Electrical Safety Systems supported by SMEs across Electrical division	KPIs - both positive and negative Positive Safety Performance Indicators (PSPIs)
Manage This Plan	EDU Principal Engineer Electrical Safety Systems	Directorate Business Plan and/or Divisional Business Plan Local Safety Plan
Measure Safety Performance	EDU Principal Engineer Electrical Safety Systems	Statistical reporting guide EDU Visual Management Centre
Manage Electrical Risk Register	EDU Principal Engineer Electrical Safety Systems SER Risk professional assigned to EDU Principal Engineers and SMEs within ESI Electrical	Electrical Risk Register SER Corporate risk register (FPE database) Safety Assurance Statement
Review This Plan	Associate Director EDU EDU Principal Engineer Electrical Safety Systems Manager Network Maintenance Manager Assets Assurance	Safety Strategic Plan Directorate Business Plan Divisional Business Plan Electrical Risk Register Safety Assurance Statement
Design Safety Management (where Sydney Trains is the AEO)	Design Manager, in accordance with Sydney Trains' Design Management Manual, MN A 00001.	SCARD Electrical Risk Register Hazard Log RATM Safety Assurance Statement Safety Assurance Report
Design Safety Management (external AEO)	Sydney Trains' Design Manager. The AEO presents hazard logs and risk assessments to Sydney Trains for review. Residual risks are presented to Sydney Trains for review and acceptance.	Risk Register* Hazard Log* RATM* Preliminary Design Review* Critical Design Review* Safety Assurance Statement* Safety Assurance Report* * note: by each AEO using their procedures
Implement Safety in Maintenance	Maintenance Operations Managers (MOMs) at Network Bases	Technical Maintenance Plans Electrical Risk Register Hazard Log Local Safety Plans Visual Management Centres
Work safely in accordance with SMS	Authorised persons, All staff and contractors	Sydney Trains SMS Electricity Network SMS (Electricity Network Safety Rules) Electrical Risk Register Hazard Log Hazardous Locations Register SWMS, SWI Site-Specific Hazard Logs Site-Specific Safety Plans Local Instructions Worksite briefings

5.5.2 **Establishing the Context**

5.5.2.1 The context of the risk assessment is first established – this entails:

- a) Defining the system boundary and what is (or isn't) part of the system of interest;
- b) Defining the lifecycle phases and the activities to be conducted within those phases.
- c) Identifying the stakeholders who will perform those activities, or provide resources or information or inputs to the activities;
- d) Identifying the stakeholders who depend on the work products and outcomes of the activities.

5.5.2.2 This applies to the electricity distribution network, 1500VDC overhead wire, as well low-voltage installations and electrolysis.

5.5.2.3 The context for the electricity distribution network is recorded in the Electrical Risk Register.

5.5.3 **Risk Identification**

5.5.3.1 Risk identification is an ongoing and continual process within the organisation. Risk identification can be achieved in a number ways including:

- a) Reviewing relevant legislation, standards and codes of practice to identify practices and controls that are mandatory or strongly recommended, as well as risks that must be controlled;
- b) The recommendations arising from coronial inquiries and incident investigations;
- c) Information from industry liaison (e.g. other electricity network operators and rolling stock operators);
- d) Internal or external subject matter expertise, often as part of a risk assessment workshop analysing the results of incident or near miss investigations developing specialist models such as fault trees or event trees;
- e) Changes to our operational environment, available technology, customer expectations, industry standards, legislation etc;
- f) From analyses of the failure modes of equipment (FMECA) or processes, as well as human factors assessments, safety hazard assessments and project hazard logs, and
- g) Incidents both within Sydney Trains and reported by other electrical organisations.

5.5.3.2 Risk identification shall be formally carried out at a frequency and level as appropriate to the general needs of the business or as relevant to the specific risk assessment being carried out.

The ERM approach ensures that these activities are applied to all facets of Sydney Trains operations including:

- a) Electricity distribution network planning,
- b) Site safety management,
- c) Electricity distribution network safety management,
- d) Substation operations and maintenance,
- e) Emergency response.

5.6 Working Safely Around Electrical Equipment

5.6.1 Sydney Trains has an established suite of rules and procedures for working safely on or near electrical equipment – refer PR D 78000 Electrical Network Safety Rules. Compliance with these rules is mandatory for all staff, AEO and contractors engaged to work on or near electrical equipment.

5.7 Exceptions, Non-compliance and Variations

5.7.1 Where an applicable relevant standard or procedure is not used, or compliance with specific requirements of an applicable standard will not be satisfied, the responsible organisation (Sydney Trains, TfNSW, AEO or contractor) shall document:

- The reason for the non-use or non-compliance with the requirement; and
- The alternative provisions for the design, construction, commissioning, installation, operation, maintenance and decommissioning of network assets that will ensure a level of safety in relation to those activities that is at least equal to or greater than the level of safety that would ensure from compliance with that requirement.

5.7.2 Where electrical work on or near electrical equipment differs from that defined in the ENSR a waiver may be sought from Sydney Trains; refer PR D 78101 “General Requirements for Electrical Work”.

5.7.3 Where a design, electrical installation, selection of equipment, equipment condition or maintenance procedure differs from the TfNSW ASA standards this must be resolved as either through obtaining a concession from TfNSW ASA, or accepted as a defect (and rectified).

5.8 Specific Hazards Nominated by AS5577

AS5577 Reference	Hazard	Response
1.1(a)	Permanent embedded generation facilities	Sydney Trains has photovoltaic generation at nominated locations with anti-islanding provisions. Hazards are recorded in the Electrical Risk Register.
1.1(b)	Temporary embedded generation facilities	Recently constructed substations are fitted with ports for connection of temporary generators. Older substations do not have this capacity. Hazards associated with emergency generators are recorded in the Electrical Risk Register.
1.1(c)	Emergency generators	Emergency generators are installed at key asset locations, including RMC and ICON, Prince Alfred substations and to back up key signalling supplies. One substation located in Royal National Park has an emergency generator. Hazards associated with emergency generators are recorded in the Electrical Risk Register.
1.2(a)(i)	Safety of the public	Refer section 12. Public Safety Awareness
1.2(a)(ii)	Safety of persons near or working on the network	Refer section 12. Public Safety Awareness

AS5577 Reference	Hazard	Response
1.2(a)(iii)	Protection of property and electricity network assets	Refer section 12. Public Safety Awareness
1.2(a)(iv)	Safety aspects arising from the protection of the environment, including protection from ignition of fires by the electricity distribution network;	Refer Sydney Trains Safety Risk Assessment Report - Electricity distribution network bushfire risk
1.2(a)(iv)	Safety aspects arising from the loss of electricity supply	Refer Electrical Risk Register
1.2(e)	Hazards associated with the design, construction, commissioning, operation maintenance and decommissioning of the electricity network are identified, assessed and managed...	Refer sections 5. Safety Management, and 8.2. Requirements Applicable to all AEO and Contractors
4.3.3(a)	a. Operating connected to emergency power sources	<p>Emergency generators are installed at key asset locations, including RMC and ICON, Prince Alfred substations and to back up key signalling supplies.</p> <p>One substation located in Royal National Park has an emergency generator.</p> <p>Hazards associated with emergency generators are recorded in the Electrical Risk Register.</p>
4.3.3(b)	b. Operating without normal supply assets such as powerlines or transformers	<p>The design of the electricity distribution network protects against this risk by redundancy, i.e. 2 or more duplicated (independent) supplies, with quality of service agreements from the external suppliers. Refer:</p> <ul style="list-style-type: none"> • Infrastructure Control Centre (ICON) Operator Procedures, • ICON Trouble Instructions (3 books) and • ICON Trouble Instructions "Book 8"
4.3.3(c)	c. Operating at other than normal voltage levels	<p>Sydney Trains operates at normal voltage levels in accordance with AS60038. The robust nature of the network implies that the network is not subject to operation at other than normal voltage levels.</p> <p>In the event of the supply being insufficient to sustain power to rolling stock, the traction substations are designed to shed loads automatically by dropping the supply to the largest loads (rolling stock) while maintaining supply to equipment (signalling, fire-life safety) required for the safe operation of trains as long as possible.</p>

AS5577 Reference	Hazard	Response
		<p>In this event the safe detrainment of passengers becomes the first priority and is handled according to the protocols of Sydney Trains' operations division. Refer:</p> <ul style="list-style-type: none"> • Infrastructure Control Centre (ICON) Operator Procedures, • ICON Trouble Instructions (3 books) and • ICON Trouble Instructions "Book 8"
4.3.3(d)	d. Operating under communication outages	<p>Sydney Trains operates private fixed networks for voice and data.</p> <p>Mobile phones over alternative carriers, landlines and internet (voice, messaging and email) are used as alternatives.</p> <p>In the event of a lengthy outage of all electrical power and communications, electrical staff can drive to substations to perform switching manually.</p> <p>ICON has a documented procedure for handling communication outages; refer Infrastructure Control Centre (ICON) Operator Procedures.</p> <p>There is a local instruction for each substation for operation in the event remote control from ICON (via SCADA) is not available.</p>
4.3.3(e)	e. Operating under changed conditions to avoid further damage to the network	<p>Sydney Trains operates at normal voltage levels in accordance with AS60038. The robust nature of the network implies that the network is not subject to operation at other than normal voltage levels.</p> <p>In the event of the supply being insufficient to sustain power to rolling stock, the traction substations are designed to shed loads automatically by dropping the supply to the largest loads (rolling stock) while maintaining supply to equipment (signalling, fire-life safety) required for the safe operation of trains as long as possible.</p> <p>In this event the safe detrainment of passengers becomes the first priority and is handled according to the protocols of Sydney Trains' operations division. Refer:</p> <ul style="list-style-type: none"> • Infrastructure Control Centre (ICON) Operator Procedures, • ICON Trouble Instructions (3 books) and • ICON Trouble Instructions "Book 8"
A3.1(a)	f. Safety related aspects of the loss of supply	<p>In the event of outages the network is designed to shed loads automatically by dropping the supply to the largest loads (rolling stock) while maintaining supply to equipment (signalling, fire-life safety) required for the safe operation of trains as long as possible.</p>

AS5577 Reference	Hazard	Response
		In this event the safe detrainment of passengers becomes the first priority and is handled according to the protocols of Sydney Trains' operations division.
A3.1(b)	g. Electrical work on or near electricity network assets	Refer PR D 78000 Electricity Network Safety Rules
A3.1(c)	h. Other activities that may involve electrical hazards, including work being carried out in the vicinity of electricity network hazards	Refer section 12. Public Safety Awareness
A3.1(d)	i. Single and multiple failure modes, including knock-on effects	Design aspects are included in the protection concepts by AEOs. Operational aspects - refer: <ul style="list-style-type: none"> • Infrastructure Control Centre (ICON) Operator Procedures, • ICON Trouble Instructions (3 books) and • ICON Trouble Instructions "Book 8"
A3.1(e)	j. The design of network assets and the condition and operating methodologies for electricity network assets	Refer sections 5. Safety Management, and 8.2. Requirements Applicable to all AEO
A3.1(f)	k. External hazards and natural disasters	Design aspects are included in the protection concepts by AEOs. Operational aspects - refer: <ul style="list-style-type: none"> • Infrastructure Control Centre (ICON) Operator Procedures, • ICON Trouble Instructions (3 books) and • ICON Trouble Instructions "Book 8"
A3.1(g)	l. Intentional and unintentional human activities	Refer sections 5. Safety Management, and 8.2. Requirements Applicable to all AEO. Operational aspects - refer: <ul style="list-style-type: none"> • Infrastructure Control Centre (ICON) Operator Procedures, • ICON Trouble Instructions (3 books), and • ICON Trouble Instructions "Book 8"

5.8.1 The FSA includes preventive and mitigating controls. As appropriate to each risk these include engineered controls and administrative (operational) controls. Implicit within each control is the need to ensure any response is performed in a safe manner.

5.8.2 Risks to the ability of the Electricity Distribution Unit to perform its tasks are not included in FSA; these are dealt with separately in Sydney Trains' Business Continuity Plans.

- 5.8.3 Sydney Trains' SMS Element 15 – Emergency Preparedness and Security contains plans, forms, lists, and guides and documents pertaining to emergency and security awareness and preparation.
- 5.8.4 Sydney Trains has business continuity plans, substation Local Instructions¹⁵ localised for specific sites, and "trouble instructions"¹⁶ as well as incident management plans in place to cover eventualities that could involve the electrical network such as:
- a) Power supply faults (loss of supply);
 - b) Infrastructure failures (civil or signalling),
 - c) Domestic animals and stock on line,
 - d) Fatality,
 - e) Fire,
 - f) Open gates or holes in fence,
 - g) Safeworking incidents,
 - h) Extreme weather,
 - i) Seasonal response,
 - j) Track geometry defects,
 - k) Train - Trips – Obstructions, and
 - l) Trespassing
- 5.8.5 The responses to these are addressed in the ICON Trouble Instructions.
- 5.8.6 Events leading to major disruptions to passenger rail services, regardless of cause are identified. The mitigating controls for these events generally include a combination of the use of alternate means of public transportation and re-routing trains, until normal services can be restored.

5.9 Risk Acceptance Criteria

Risks are assessed using a hazard log to record the causes, controls, consequence and likelihood. Risks are assessed using Sydney Trains' Enterprise Risk Matrix version 2.0, not the scale provided in AS5577 Appendix B1. Decisions concerning the implementation/rejection of controls follow the guidance of the ONRSR "Guideline Major Projects".

5.10 Risk Treatment – ALARP or SFAIRP

- 5.10.1 In all cases it remains necessary to demonstrate the risk is reduced SFAIRP by the application of appropriate controls that pass the test of "reasonably practicable".
- 5.10.2 Risk treatment is described in the Enterprise Risk Management System¹⁷. All safety risks must be managed to a level that is either broadly acceptable or tolerable and As Low As Reasonably Practicable (ALARP); the process for this is defined in SMS-06-PR-1382: ALARP Determination and Demonstration and further guidance is provided in the ONRSR "Guideline Major Projects".
- 5.10.3 A risk is assessed on the basis of both the existing controls, and possible additional controls that could be implemented.

¹⁵ <http://intranet.sydneytrains.nsw.gov.au/directorates/maintenance/engineering-and-system-integrity/engineering-information/electrical/substation-local-instructions>

¹⁶ <http://intranet.sydneytrains.nsw.gov.au/directorates/maintenance/network-maintenance/divisional-documents>

¹⁷ http://intranet.sydneytrains.nsw.gov.au/__data/assets/pdf_file/0007/57094/Enterprise-Risk-Management-System-Requirement.pdf

- 5.10.4 Even where a risk is classified as "broadly acceptable", if there are options for further risk reduction and the cost is proportionate to the benefits to be gained, then implementation of these options must be considered and either accepted or rejected together with the rationale for that decision.
- 5.10.5 Preventive and mitigating controls are identified in the Electrical Risk Register and hazard logs. The implementation and effectiveness of those controls is a matter for the specific project or asset teams and recorded in their specific safety documentation such as project hazard logs, safety assurance statements or safety assurance reports.

5.11 Formal Safety Assessments

- 5.11.1 AS5577 requires "formal safety assessments" in accordance with Appendix A of that standard. Sydney Trains applies its safety management system to implement this, as follows. "Formal safety assessments" are presented in the form of a "Safety Risk Assessment Report" (SRAR) which presents:
- The scope of the risk assessment, responding to the requirements of AS5577 in the context of the specific risk(s) considered;
 - Identification of the causes, the consequences and likelihood of the risk, and the existing and possible controls considered; the details are presented as a "Bow Tie" worksheet for importing data to the corporate risk register;
 - Identifies which controls are implemented or those rejected together with the rationale for their rejection;
 - References to the sources of information for the above, including evidence of the implementation of the controls;
 - An assessment of whether the risk is reduced SFAIRP; and
 - Recommendations for further action if the risk is not reduced SFAIRP.
- 5.11.2 The SRAR should contain a conclusion confirming whether the risk is considered to be managed SFAIRP, or recommendations of further work required to reach that conclusion which may include safety changes.
- 5.11.3 Safety changes are assessed using a "Safety Change Assessment and Reporting Determination" (SCARD)¹⁸. This is used to determine whether a Safety Change Plan¹⁹, Safety Assurance Report (SAR)²⁰ or Safety Assurance Statement (SAS)²¹ are to be produced.
- 5.11.4 Existing unmodified assets constructed prior to 2014 do not have formal safety assessments in the sense described by AS5577 for the specific asset. Where these assets are to be modified or replaced a Hazard Analysis²² is required presenting the risk considered, the causes (hazards) contributing to the risk, the alternatives considered, the controls, assumptions and exclusions, supported by a hazard log²³ (a spreadsheet with qualified data) and recommendations indicating which solution(s) are considered to reduce risk SFAIRP based on the hazard log data. The data required is described on the Risk Division's sharepoint site, together with templates and detailed guidance.

¹⁸ <http://sms.sydneytrains.nsw.gov.au/trim/sms-sydney-trains?RecordNumber=D2013%2F76308>

¹⁹ <http://sps.railcorp.nsw.gov.au/sites/Safety/RiskDivision/Templates/RD-TP-01%20Safety%20Change%20Plan.dot>

²⁰ <http://sps.railcorp.nsw.gov.au/sites/Safety/RiskDivision/Templates/RD-TP-06%20Safety%20Assurance%20Report.dot>

²¹ <http://sps.railcorp.nsw.gov.au/sites/Safety/RiskDivision/Templates/RD-TP-07%20Safety%20Assurance%20Statement.dot>

²² <http://sps.railcorp.nsw.gov.au/sites/Safety/RiskDivision/Templates/SSG-TP-001%20Hazard%20Analysis%20Template.docx>

²³ <http://sps.railcorp.nsw.gov.au/sites/Safety/RiskDivision/Templates/RD-TP-05%20Hazard%20Log.xls>

- 5.11.5 Sources of data for the consequences and likelihood are referenced in the hazard analysis with traceability of the risks and controls to the originating requirement statements (from standards, codes of practice, hazard logs, incident investigations, analyses, subject matter experts, risk workshops etc).

5.12 Periodic Review of Formal Safety Assessments

- 5.12.1 Risks and control measures should be reviewed on a regular basis. The frequency of their review should be determined by considering the significance of the risks associated with the hazard. A FSA should be reviewed in the following circumstances:
- The asset is to be significantly modified or replaced,
 - New information is made available about the risks associated with the hazard;
 - Changes have occurred that imply risks associated with operation or maintenance could be further reduced; examples include changes in the condition of the asset, requirements, available technology, work methods, external interfaces or the physical environment;
 - An incident occurs; and
 - Significant changes are proposed to the workplace or work system responsible for its maintenance.
- 5.12.2 In any other circumstances Formal Safety Assessments should be reviewed at intervals not greater than 5 years.

6 Incident Management

6.1 Safety Incident and Action Management

- 6.1.1 Incidents are managed in accordance with the Sydney Trains' incident management framework²⁴ and safety management system. The safety management system provides the following guides:
- SMS-17-OP-3102 Notify Safety Incidents,
 - SMS-17-GD-4702 L4 Investigation Plan,
 - SMS-17-OP-3101 Investigate Report On and Analyse Safety Incidents,
 - SMS-17-OP-3644 HPI Determination and Reporting,
 - SMS-17-OP-4701 Conduct of L4 Safety Investigations.
- 6.1.2 The Sydney Trains Incident Management Framework – 2 Plan²⁵ describes the response to a major incident.
- 6.1.3 The investigation an analysis following an incident may include recommendations for change. These are reviewed by SER and may lead to safety action items requiring corrective action; the process is documented in the SMS; see for example:
- SMS-18-OP-3115 Manage Corporate SEQR Recommendations/Findings
 - SMS-18-OP-3116 Manage Local SEQR Recommendations/Findings
 - SMS-18-OP-3139 Conduct SEQR Action Closure Review

²⁴ http://intranet.sydneystains.nsw.gov.au/__data/assets/pdf_file/0006/47544/IMF-Part-1_V-2.1-Final-.pdf

²⁵ http://intranet.sydneystains.nsw.gov.au/__data/assets/pdf_file/0007/47545/IMF-Part-2_V-2.1-Final.pdf

6.2 Electrical Safety Incident Reporting

- 6.2.1 Incidents should be reported to ICON in accordance with SMS-17-SP-3077 INCIDENT REPORTING AND INVESTIGATIONS.
- 6.2.2 ICON or the SER On-Call Officer will notify EDU of Significant or Major Incidents.
- 6.2.3 Notifying EDU of an incident:
 - a) Primary contact: Associate Director EDU,
 - b) Alternate contact Principal Electrical Safety Investigator.

6.3 Investigations

6.3.1 Major Safety Incident Investigation

- 6.3.1.1 The Business unit accountable for the process that involved the incident are responsible for undertaking the initial level 5 (or equivalent) investigation.
- 6.3.1.2 EDU on request will provide support to the business unit in completing the level 5 (or equivalent) investigation
- 6.3.1.3 The Principal Electrical Safety Investigator or another EDU Principal Engineer will attend site as soon as practical for the purposes of an initial assessment and oversight of evidence collection
- 6.3.1.4 A Flash Report is to be produced and provided to the Associate Director EDU within 24 hours.
- 6.3.1.5 Where Level 4 or 3 (or equivalent) investigations commence, the Principal Electrical Safety Investigator shall provide subject matter expertise for the investigation team. Where the PEI is not available the Associate Director EDU shall nominate a suitable person to be the SME.
- 6.3.1.6 Significant incidents may also result in an investigation by external authorities such as the Office of Transport Safety Investigations (OTSI) or SafeWork.

6.3.2 Reportable Safety & Asset Incident Investigation

- 6.3.2.1 The Business unit accountable for the process that involved the incident are responsible for undertaking the level 5 (or equivalent) investigation.
- 6.3.2.2 A Flash report is to be produced and provided to the Associate Director EDU within 48 hours.
- 6.3.2.3 EDU on request will provide support to the business unit in completing the level 5 (or equivalent) investigation
- 6.3.2.4 The relevant discipline Investigator shall attend site as soon as practical for the purposes of an initial assessment and oversight of evidence collection
- 6.3.2.5 Where investigations are required the Principal Electrical Safety Investigator will nominate a suitable subject matter expert for the investigation team.

7 Audits and Reporting

7.1 Who Do We Report To

7.1.1 EDU notify the Electrical Regulator of Reportable Safety Incidents, Major Reportable Safety Incidents, Reportable Asset Incidents and Major Reportable Asset Incidents.

7.1.2 Prior to verbally advising or reporting in writing to the regulators consult with Sydney Trains regulatory compliance:

Primary Contact Manager Regulatory Liaison,

Secondary Contact Manager Investigation & Action Management

7.1.3 IPART

Primary Contact Director, Independent Pricing and Regulatory Tribunal

Secondary Contact Principal Engineer, Energy Networks Regulation

Email: compliance@ipart.nsw.gov.au

7.1.4 From 1st July 2016 Sydney Trains is required to deliver reports to the regulator in accordance with the IPART "Electricity Network Reporting Manual" including:

Report topic	Reporting Period	When	Audit Report Required?
Compliance of ENSMS with regulatory requirements	N/A	None Required	As determined by IPART.
ENSMS performance	1 October to 30 September	31 October	No
Incident reporting	Report on individual incidents	Ongoing	No

7.1.5 Details of the required content and submission procedures are provided in the IPART reporting manual.

7.2 Regulatory Performance Reports

7.2.1 Although there is no regulatory requirement for non-licenced network operators to comply with the IPART Reporting Manual²⁶, Sydney Trains prepares:

- a) Annual ENSMS Performance Reports, and
- b) Annual Bushfire Risk Management Reports

7.2.2 Note the format and content of prescribed by the manual may change from year to year.

7.3 Internal Reporting

7.3.1 Sydney Trains' SAU publishes an "Electrical Asset Assurance Report" each quarter. This records statistics such as electrical asset condition rating, electricity demand and demand growth, network capacity, maintenance performance, defects, incidents and failures and summaries of significant incidents.

7.3.2 Sydney Trains also produces an annual "System Integrity" report encompassing the whole of the railway, including the electricity distribution network; for internal distribution only.

7.4 Internal Audits

7.4.1 From time to time Sydney Trains conducts internal audits of the safety management system, which may include the electrical network safety management system. Internal audits are initiated and carried out by Sydney Trains' SAU or the Internal Audit division. These may also initiate and conduct quality management audits.

7.4.2 Internal Audit provides an independent and objective review and advisory service to:

- a) Provide assurance to the Chief Executive, and the Audit and Risk Committee, that Sydney Trains' financial and operational controls, designed to manage the organisation's risks and achieve the entity's objectives, are operating in an efficient, effective and ethical manner; and
- b) Assist management in improving Sydney Trains business performance.

7.4.3 Audit objectives include:

- a) Evaluating the effectiveness of risk management processes and contributing to their improvement,
- b) Providing assurance that risk exposures relating to the organisation's governance, operations and information systems are correctly evaluated,
- c) Evaluating the design, implementation and effectiveness of the organisation's ethics-related objectives, programs and activities, and
- d) Assessing whether the information technology governance of the organisation sustains and supports the organisation's strategies and objectives.

7.4.4 Internal audits can be conducted to identify opportunities for improvement:

- a) Assisting in improving the efficiency, effectiveness and economy of Sydney Trains business systems and processes, and
- b) Assessing proposed changes to existing controls during changes to business processes.

²⁶ Refer 2nd para of page 5 of the IPART Electricity networks reporting manual.

7.4.5 The approach is described on the intranet²⁷:

- a) QMS-19-GD-3648 - Integrated Auditing Guide,
- b) QMS-19-SP-3647 - Auditing Procedure,
- c) QMS-19-WI-3649 - Risk Based Auditing,
- d) QMS-19-TP-6005 - Auditor Competency evaluation sheet, and
- e) QMS-19-GD-6006 - Auditor Competency Framework

7.5 External Audits

7.5.1 External audits may be initiated by the regulator (IPART) or Sydney Trains. These are to be conducted as described in the IPART Electricity Networks Audit Guideline. This provides guidance with respect to the selection of the auditor, the conduct of the audit and the criteria used.

7.5.2 When an external audit is required in response to an IPART:

- a) IPART must be given prior notice of the intention to conduct the audit, nominating the proposed auditor,
- b) The auditor must be selected as per section 12 of the Electricity Supply (Safety and Network Management) Regulation 2014 and the IPART Electricity Networks Audit Guideline, and
- c) A Deed must be prepared and signed between IPART, Sydney Trains, the Auditor describing the scope of the audit, the proposed auditor and a detailed audit proposal. The Deed and requirements are contained in the IPART Electricity Networks Audit Guideline.

7.5.3 Sydney Trains may also choose to engage external auditors. In this event IPART must be notified of the intention to conduct an audit, the proposed scope and proposed auditor. IPART may indicate that it has no interest in the audit in which case the Deed described above is not required.

7.6 Audit Findings and Corrective Action

Issue identified in audits are managed by the Investigation and Action Management business unit of Sydney Trains Safety & Accreditation Division. Issues arising from audits are:

- a) Reviewed to assess the relevant stakeholders,
- b) Allocated to managers who may accept each issue for action, transfer it to another manager or reject it;
- c) Appropriate action is negotiated and agreed with the stakeholders affected, and
- d) Tracked to closure within an agreed time frame.

²⁷ <http://intranet.sydneytrains.nsw.gov.au/directorates/seqr/quality-systems/integrated-audit>

7.7 Incident Reporting

- 7.7.1 Sydney Trains provides incident reports to the NSW Roads and Maritime Services department of TfNSW for incidents concerning crossings of the rail electricity networks over navigable waterways in NSW.
- 7.7.2 The various regulatory and investigative agencies such as ATSB, OTSI, ONRSR, IPART, SafeWork, EPA etc. mandate notification of a range of safety, electrical, WHS, Environmental etc. incidents within defined time frames.

8 Organisation

8.1 Transport Cluster

On July 01, 2013, Sydney Trains, TfNSW, and RailCorp entered into the Sydney Trains Rail Services Contract. Generally, asset ownership rests within RailCorp and the related strategy, policy and the high level governance functions are undertaken within TfNSW. This arrangement is described further in the TfNSW "Guide to TfNSW Framework for Assuring the Safety of Rail Assets and Infrastructure", refer Figure 4:

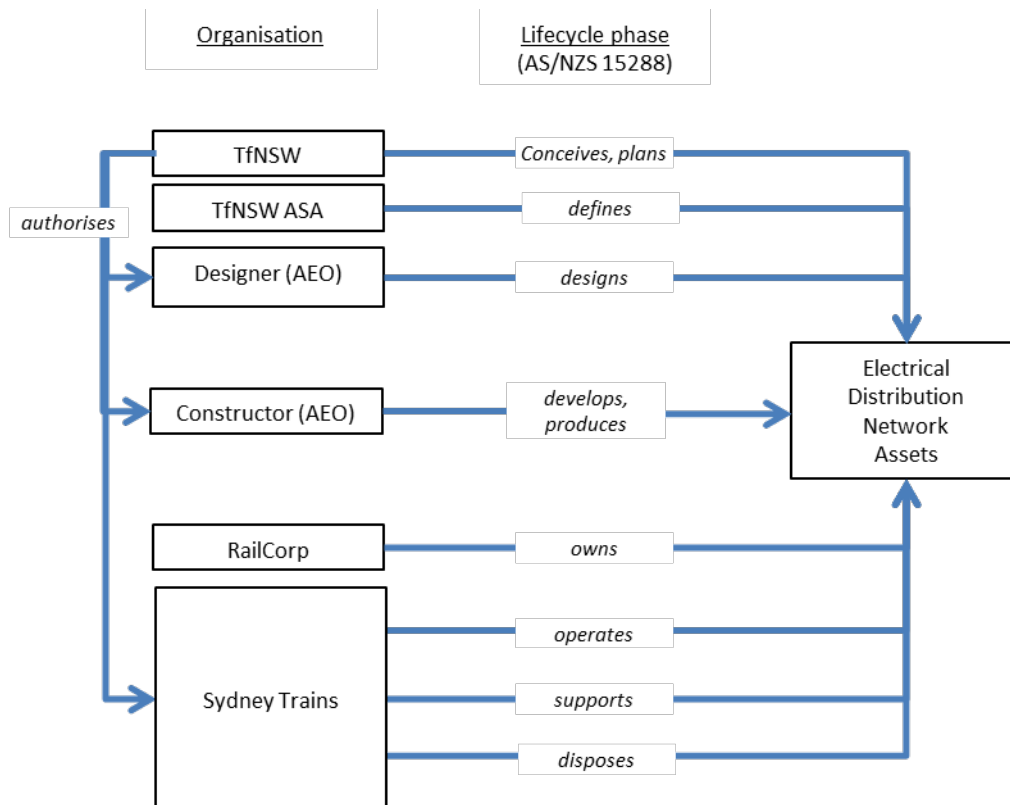


Figure 4 – Organisations and Their Roles in the Context of the Electricity distribution network

8.2 Requirements Applicable to all AEO and Contractors

The following are required of all AEO and contractors engaged for the planning, design, construction, commissioning, operation or maintenance or disposal of electricity distribution network assets:

Lifecycle phase	Requirement
All phases	<p>AEO shall implement the requirements of AS5577 tailored according to the lifecycle phases for which they are authorised.</p> <p>Each AEO is required to demonstrate its implementation of the requirements of AS5577 including but not limited to showing:</p> <ul style="list-style-type: none"> • It has a safety management system which complies with the requirements of AS5577; • Responsibilities and accountabilities are defined; • A risk register is maintained in which risks from all lifecycle phases have been identified and are assessed; • Conducts formal safety assessments as described in this plan; • Produces evidence that safety controls are implemented and are effective; and • Produces evidence that risks are controlled SFAIRP.
All	<p>Exceptions, non-conformances and variations shall be handled in accordance with section 5.7.</p>
Planning, Design, Implementation, Commissioning	<p>AEO shall comply with the requirements of AS5577 sections 4.4.4, 4.4.5, 4.4.6, and 4.5; attention is drawn to the minimum evidence required for compliance defined in the IPART Electricity Networks Audit Guideline.</p>
Design, Implementation	<p>The design of new or significantly modified electricity assets proposed at locations assessed as bushfire category 1 or 2 shall include a risk assessment showing the risk of bushfire is controlled SFAIRP. This analysis shall present:</p> <ul style="list-style-type: none"> • The threats considered, including events that lead to fire such as blown-in branches or bark from significant distances, trees or branches that may fall on overhead wires, ignitions caused by lightning and grassfires from neighbouring properties, as well as asset failure modes that may contribute to a fire ignition; • An analysis of the safety benefit obtained by preventing or mitigating the risk, • The alternative controls identified that could prevent or mitigate the risk, • Quantified assessment of the cost of implementing the alternatives, • The rationale for adopting a solution (RSNL section 46) which either (a) eliminates risks to safety so far as is reasonably practicable; or (b) if it is not reasonably practicable to eliminate risks to safety, minimises those risks so far as is reasonably practicable. <p>The meaning of "reasonably practicable" is that defined in the RSNL section 47.</p> <p>This data shall be supplied to and agreed with the network operator prior to commencing construction.</p>
Design, Implementation	<p>Maintenance task analysis and maintenance planning including repair or replacement of electrical assets shall be based on a failure modes, effects and criticality analysis (FMECA) that includes consideration of:</p> <ul style="list-style-type: none"> • the risks associated with bushfire at that location as represented by the bushfire category assigned to the asset or defect; • the past incidence and future risk of fire ignitions from all sources in the

Lifecycle phase	Requirement
	<p>vicinity of the asset;</p> <ul style="list-style-type: none"> • the time of year, expected weather conditions to be endured; • the age, prior maintenance history and failure rate of the asset. <p>This data shall be produced by the AEO responsible for design and agreed with the network operator and maintainer prior to commissioning the assets.</p>
Commissioning	<p>The Network Operator will not accept assets into service without completion of an agreed commissioning process. AEOs may utilise Sydney Trains GL D 79100 "Electrical Commissioning Requirements and Deliverables", or develop a plan agreed with Sydney Trains.</p>
Implementation, Operation and Maintenance	<p>All work on or near electrical equipment shall be performed in accordance with Sydney Trains Electrical Network Safety Rules, refer section 5.6.</p>
Maintenance	<p>Electricity network defects shall be assigned a bushfire risk category using the assessment defined by the network operator. This is a numeric value in the range 1 (highest risk) to 5 (lowest risk) based on the conditions at that location.</p> <p>This data shall be produced by the AEO responsible for maintenance and supplied to the network operator and maintainer prior to carrying out the maintenance.</p> <p>The AEO shall report the status of the defects found and the maintenance tasks (planned, completed, overdue) categorised by bushfire risk (1-5). This information shall be supplied each year by 30 August for inclusion in the network operators report to the regulator, and with updates when requested by the network operator. This is expected to occur 2-3 times during summer.</p>
Maintenance	<p>Maintenance or replacement of electricity assets in bushfire category 1 or 2 locations shall not be postponed beyond the original due date.</p>
Risk Management	<p>AEOs shall provide EDU with copies of risk assessments conducted for the scope of their work in the planning, design, implementation, commissioning and maintenance of electricity distribution network assets.</p>
Incident management	<p>Incidents shall be reported in accordance with:</p> <ul style="list-style-type: none"> - the Sydney Trains SMS (non-electrical incidents), and - section 6 of this plan (electrical incidents). <p>TfNSW and AEOs shall conduct their own initial investigation into incidents and provide Sydney Trains with copy of that investigation and any corrective action proposed.</p> <p>Sydney Trains reserves the right to investigate any/all electrical incidents and may issue recommendations arising.</p>
Audit	<p>Upon request from Sydney Trains, TfNSW and AEOs shall conduct regulatory compliance audits using an auditor agreed by Sydney Trains to assess the extent of compliance with the Electricity Supply (Safety and Network Management) Regulation 2014 (NSW), AS5577 and the Sydney Trains ENSMS.</p> <p>These audits shall be conducted in accordance with the IPART Electricity Networks Audit Guideline. The scope of the audits will be tailored according to the organisations responsibilities as an AEO.</p>

8.3 Sydney Trains as an AEO

- 8.3.1 Sydney Trains, in its role as the maintainer of the RailCorp infrastructure, is an AEO accredited by TfNSW to carry out engineering works on the infrastructure.
- 8.3.2 An AEO is accountable for ensuring it has the systems, tools, capability and capacity to deliver engineering services for any contracted scope of work. The capability of Sydney Trains to deliver relevant engineering services includes:
- a) Engineering management,
 - b) Competency management,
 - c) Configuration management,
 - d) Quality management,
 - e) Systems engineering, and
 - f) Safety management.
- 8.3.3 The TfNSW requirements for safety management are described in the TfNSW TS 20001: 2013 System Safety Standard for New or Altered Assets, and TS 10504: 2013 AEO Guide to Engineering Management sections 9.1-9.2.
- 8.3.4 Sydney Trains' Configuration Management Plan AMD-AMP-PL-001 details the safety assurance work products to be produced at various sections of the asset lifecycle; refer section 7.1 and Appendix A of that plan.
- 8.3.5 Sydney Trains:
- a) Provides the ASA with access to assets so that the ASA may carry out its review, surveillance and audit functions; and,
 - b) Provides the ASA with information relating to the Sydney Trains services reasonably requested by the ASA to enable ASA to perform its functions.
- 8.3.6 Within their scope of authorisation Sydney Trains is responsible for:
- a) Providing a safety and assurance argument for their engineering work
 - b) Coordinating the delivery of assets and services with the end user
 - c) Managing related stakeholder activities
 - d) Assuring their engineering work for safety and integrity
- 8.3.7 Sydney Trains uses its own systems and tools as evidence for authorisation, outlining how it undertakes, assure and manage engineering activities. The Sydney Trains' Design Management Manual MN A 00001²⁸ and Technical Reviews Manual MN A 00413²⁹ provide further details.

8.4 Sydney Trains Organisation

- 8.4.1 Sydney Trains operates via seven directorates, reporting to the Chief Executive as follows:
- a) Finance, IT & Procurement,
 - b) People & Corporate Services,
 - c) Communications,

²⁸ http://intranet.sydneytrains.nsw.gov.au/__data/assets/pdf_file/0005/94253/MN-A-00001_V1.3.pdf

²⁹ http://intranet.sydneytrains.nsw.gov.au/__data/assets/pdf_file/0009/93996/MN-A-00413_V1.1.pdf

- d) Safety, Environment & Risk (SER): The SER directorate plays a key and strategic role in the development, implementation and maintenance of the SMS and ERM. SER establishes and maintains Sydney Trains' safety and environment systems and the strategic policies which underpin these systems. SER operates within Sydney Trains' operational directorates to advise on and ensure that the SMS is effectively implemented on a day to day basis.
- e) Customer Service,
- f) Maintenance & Engineering: Maintenance is inclusive of the design, construction and commissioning of capital works and augmentation of the electricity distribution network, Within the Engineering and System Integrity division is the Electricity Distribution Unit (EDU). The functions of the EDU are specific to the development, implementation and administration of this plan.
- g) Operations: The operations directorate is responsible for the efficient, on time operations of the fleet and rolling stock of Sydney Trains.

8.4.2 The executive levels of Sydney Trains are depicted in Figures 5 and 6, showing the hierarchy down to the Associate Director EDU:

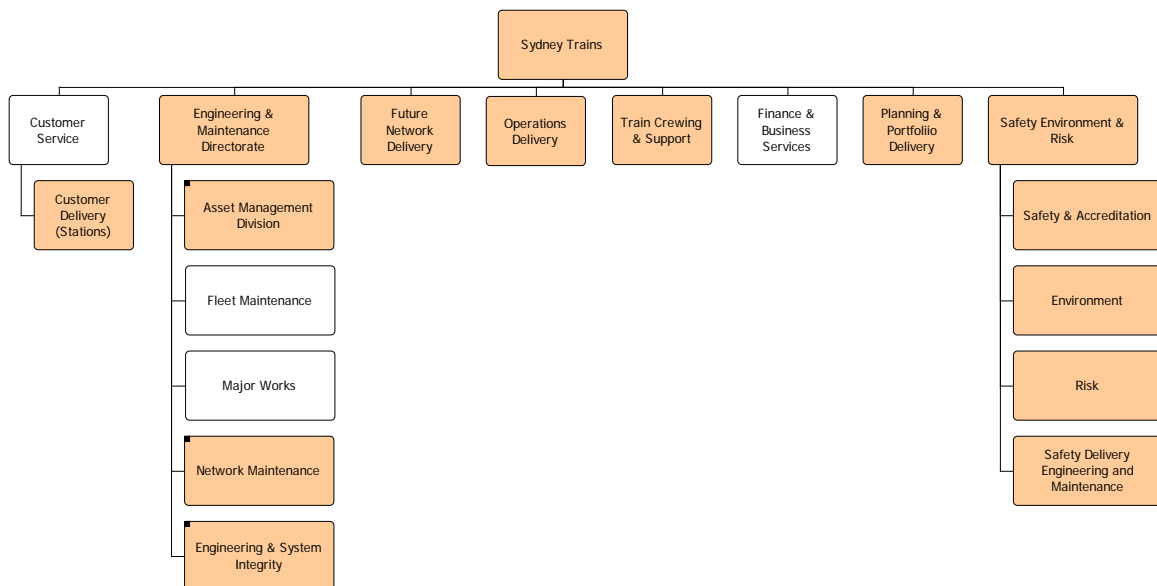


Figure 5 – Sydney Trains' Organisation

8.4.3 The organisation of Sydney Trains' Maintenance & Engineering Directorate is provided in Figure 6, showing the positions responsible for operation and maintenance of the electricity distribution network; these positions are also referenced throughout the ENSMS.

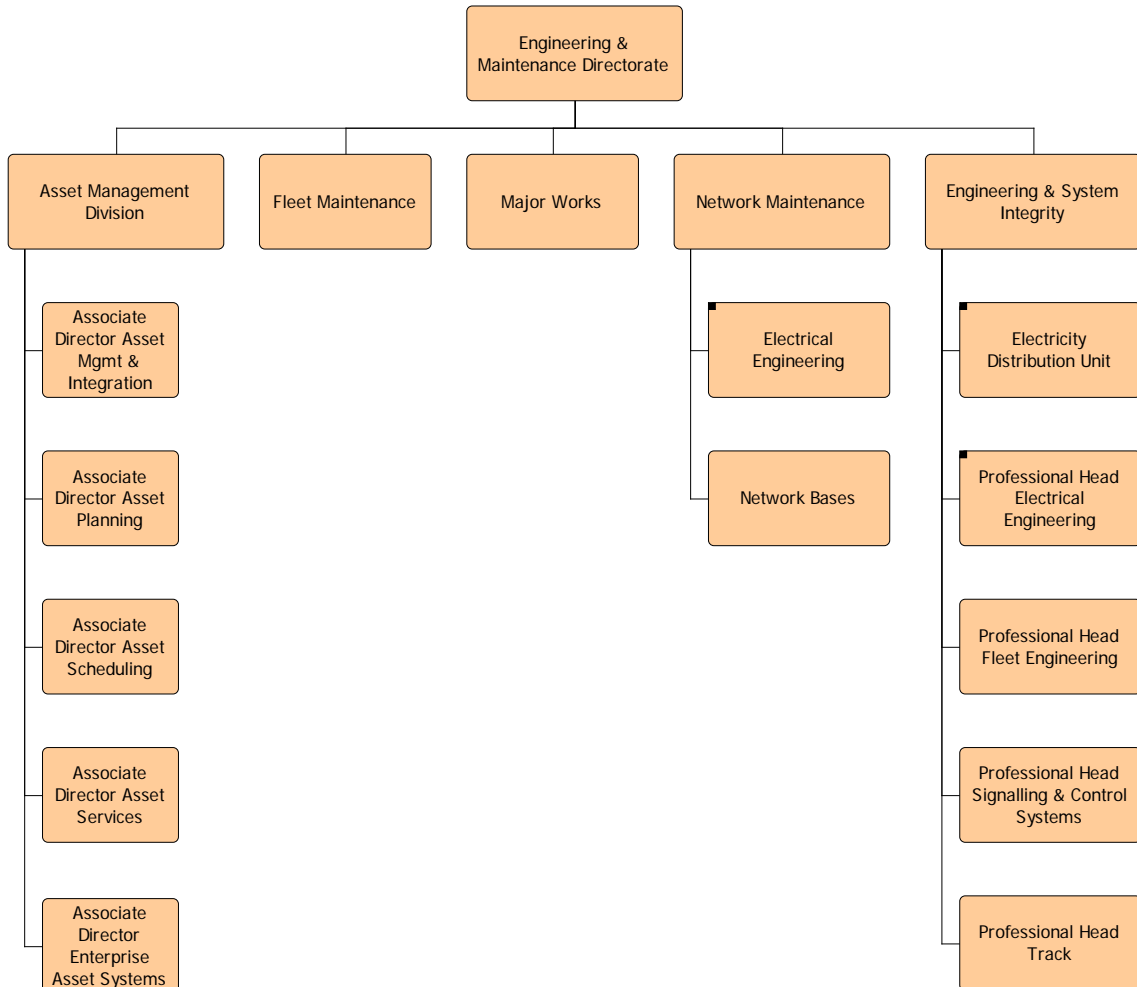


Figure 6 – Engineering Maintenance Directorate Organisation

8.4.4 Sydney Trains' Engineering & Maintenance Directorate (Figure 6) includes the Electricity Distribution Unit (Figure 7):

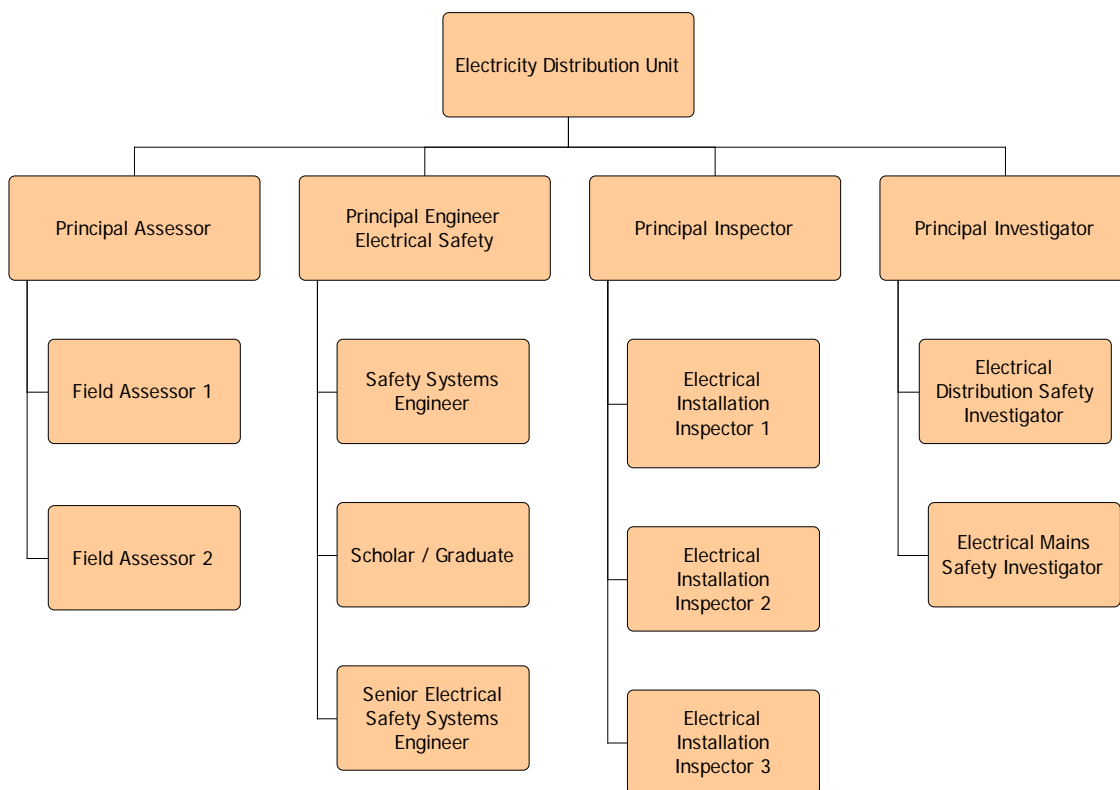


Figure 7 – Electricity Distribution Unit Organisation

8.5 Sydney Trains Responsibilities, Accountabilities and Authorisations

8.5.1 The obligations and authorisation of personnel, with respect to the design, construction, commissioning, operation, maintenance and decommissioning of the electricity distribution network are detailed within SMS-02-SP-3062 Safety Responsibilities, Authorities, and Accountabilities.

8.5.2 Sydney Trains SMS-02-RG-3058 Safety Responsibilities, Authorities and Accountabilities lists the responsibilities assigned to specific management roles.

8.6 Key Persons

The following persons are assigned responsibility for the implementation of this plan. All are within the Engineering & Maintenance Directorate:

Area of Responsibility	Directorate / Business Unit	Position
Management and control of the ENSMS as per section 5	EMD / Electricity Distribution Unit	Principal Engineer Electrical Safety Systems
Personal Certifications (Electrical)	EMD / Electricity Distribution Unit	Principal Assessor
Incident Investigations	EMD / Electricity Distribution Unit	Principal Investigator
Independent validation of assurance	EMD / Asset Assurance	Systems Assurance Manager
Audits (external)	Engineering & System Integrity	Deputy Executive Director Engineering & System Integrity
Audits (internal)	Finance & Corporate Services	Associate Director Asset Services & Governance
Design Risk Management	EMD / Electrical Engineering	Professional Head Electrical Engineering
External Party Works	EMD / Asset Management	Deputy Executive Director Asset Management
Maintenance planning	EMD / Asset Management	Asset Strategy Manager (Electrical) Asset Managers (Electrical)
Maintenance execution	EMD / Maintenance	Electrical Engineering Manager Maintenance Operations Managers (MOMs) at each Network Base

8.7 Resourcing

8.7.1 The numbers of electrical workers are managed by each network base within the Maintenance Directorate. Each base has a maintenance resource manager responsible for assigning resources to activities, and monitoring resource utilisation. When necessary the maintenance resource manager may seek additional resources from other network bases or externally (contractors, plant and machinery) as appropriate to the work.

8.7.2 Indicators are used to identify under-resourcing such as

- a) The maintenance tasks assigned/complete/outstanding,
- b) The number of outstanding defects or activities older than a defined threshold;
- c) Activities cancelled for lack of resources.

- 8.7.3 The Associate Director EDU manages the professional staff within the Electricity Distribution Unit based on the allocation of responsibilities, and resource utilisation. Resource utilisation is estimated by recording the tasks assigned/complete/outstanding.
- 8.7.4 The Maintenance Operations Managers (MOMs) at the network bases are responsible for allocating resources to network maintenance activities on a daily basis, including internal resources (staff and equipment) as well as engaging external contractors and hiring equipment as deemed necessary. The Maintenance Operations Managers and/or Maintenance Engineer may recommend changes to internal resource numbers as appropriate based on an ongoing need.

8.8 Training and Competency

- 8.8.1 All engineering activities performed on behalf of Sydney Trains, must be carried out by staff holding an appropriate level of engineering competency for the activities undertaken. This requirement addresses competency obligations of the Rail Safety National Law (RSNL) and its associated regulations, and as an AEO as required by Transport for NSW through the Asset Standards Authority (ASA).
- 8.8.2 Work in relation to the asset lifecycle of TfNSW assets, including engineering and design work, is required to be under the authorisation of an AEO. This requirement applies to engineering and design at all phases of the design development process, and applies to Sydney Trains projects whether delivered by in house resources or by contractors (including construction contractors).

Where projects are delivered by in-house resources, or by contractors who do not hold AEO status, staff competency is to be managed in accordance with:

- a) Sydney Trains' Competency Management Policy;
- b) Sydney Trains' Competency Framework; and
- c) Sydney Trains' Competency Management System supporting the 'Competency Framework'.

- 8.8.3 The processes contained in the Competency Management System cover both the requirements for initial competency assessment and processes to ensure the ongoing maintenance and currency of competencies.
- 8.8.4 Where projects, or engineering services, are to be delivered by contractors required to be an AEO under a Sydney Trains contract, such contractors must demonstrate compliance with their internal competency management system as assessed and approved by the ASA. Contractors must maintain a competence assessment system to provide evidence of appropriate competency management of their engineering or design personnel (i.e. designers, checkers and verifiers). This includes the need for the contractor to self-assess their personnel, and to have a robust and auditable process that identifies the qualifications, skills and experience of the identified personnel.

Training and competency for Sydney Trains engineers and managers are managed and assessed in accordance with the Engineering & System Integrity guidelines. Responsibilities are detailed in Sydney Trains' SMS-02-TP-4057.³⁰

- 8.8.5 The competencies and qualifications required for electrical workers are defined in PR D 78701 – Personal Certifications – Electrical.

³⁰ http://intranet.sydneytrains.nsw.gov.au/__data/assets/pdf_file/0012/109020/safety-responsibilities-sbo.pdf

8.8.6 SMS-11-SP-3011 Training and Competence describes Sydney Trains' systems of safety induction, identification of training needs, provision of training and assessment, and competence management of all workers and visitors applicable to Sydney Trains operations, including the electricity distribution network. This system procedure also explains the relationships between TfNSW Organisational Development, and General and Line Managers at Sydney Trains.

8.9 Safety Awareness Training

8.9.1 Safety training for electrical workers includes, but is not limited to:

- a) Initial training (e.g. initial safety compliance training programs and safety induction)
- b) Continuation training (e.g. Safety Management System training and safety refresher training)
- c) Certified specialist work safety training, including First Aid, Warden, Safety Committee, and Fork Lift
- d) Training of safety committee representatives and management relevant to their responsibilities
- e) Rail safety worker training including RIW and general construction induction training
- f) On-the-job training such as team training talks and e-learning
- g) Risk-based competency assessment.

The process for the management of safety training and competence at Sydney Trains is summarised in the table below:

Process	Responsibility	Tools & Forms
Identify competencies	Deputy Executive Directors TfNSW Organisational Development (OD) Line Managers	Staff Competency Profile (SCP) Safety curriculum
Develop training plans	Line Managers	SCP Safety Training Plans Learning Management System (LMS)
Induct workers	Line Managers	Safety Induction Guide Safety Induction Register Safety Induction Form
Provide training	Trainers Line Managers TfNSW OD	Quality Training Management System LMS
Assess competency and ongoing competence	Assessors Line Managers	Certificates, Licenses, Qualifications, Competency Assessments
Maintain and retain training and assessment records	Line Managers Trainers/Assessors TfNSW OD	LMS Records management system (TRIM – Total Records and Information Management)
Review and evaluate training programs	TfNSW OD Deputy Executive Directors Executive Director Safety	SCP LMS

8.10 Consultation and Communication

8.10.1 System Procedure SMS-10-SP-3070 Communication and Consultation aims to promote effective communication and consultation in regard to safe operations, and describes the processes and types of safety communications and consultation used across the organisation.

8.10.2 This system procedure outlines the following processes:

- a) Communicating safety information
- b) Health and safety consultation with workers or their representatives
- c) Exchanging safety information with external stakeholders
- d) Nomination process for worker representatives
- e) Resolution of safety issues
- f) Maintenance of communication and consultation records.

The process for the management of consultation and communication at Sydney Trains is summarised in the following table.

Process	Responsibility	Tools & Forms
Develop and maintain communication strategy	Systems Support and Assurance Specialist	<ul style="list-style-type: none"> • Safety Communication Schedule
Communicate safety information	Deputy Executive Directors Business Unit Managers Line Managers	Safety Inductions Guides: Providing Safety Briefings, Safety Noticeboards Requirements, Work Group Safety Communication Arrangements form
Exchange safety information with external stakeholders	Line Managers	Safety Induction
Manage consultation arrangements	Deputy Executive Directors Business Unit Managers Line Managers	Work Group Determination and Consultation Arrangements form Guide to Conducting Health and Safety Elections
Consult with workers	Business Unit Managers Line Managers	Guide to Managing WHS Safety Issues raised in consultation
Resolve safety issues Maintain communication and consultation records	Line Managers	Worksite Briefing Safety Committee agenda, minutes and other tools

8.11 Safety in the Field

- 8.11.1 Worksite safety in the field comprises two aspects. Where work is carried out in the rail corridor in a hazardous location where a Protection Officer is required, the site safety must be managed by the Protection Officer in accordance with the Rail Corridor Safety Program guidance³¹.
- 8.11.2 At worksites in other locations e.g. outside the rail corridor, the procedures defined at http://intranet.sydneytrains.nsw.gov.au/__data/assets/pdf_file/0013/121243/PCM-Work-Health-Safety.pdf apply.
- 8.11.3 Prior to commencing on-site activities a Pre-Work Briefing³² shall be conducted as per the SMS Operating Procedure 06.20 Pre-work Briefings³³. Briefings shall include hazards identified for the specific task(s) and the safety controls, including those identified in FSA.

³¹ For guidance refer <http://RailSafe.sydneytrains.nsw.gov.au/rail-corridor-safety-program>

³² See <http://sms.sydneytrains.nsw.gov.au/trim/sms-sydney-trains?RecordNumber=D2013%2F76345> (Sydney Trains) or <http://RailSafe.sydneytrains.nsw.gov.au/trim/contractors-protection-officers-workbook-forms2?RecordNumber=D2013&2F77773> (contractors)

³³ <http://sms.sydneytrains.nsw.gov.au/trim/sms-sydney-trains?RecordNumber=D2013%2F76346>, see also <http://RailSafe.sydneytrains.nsw.gov.au/trim/forms?RecordNumber=D2013%2F77774>

8.12 Emergency Preparedness and Response

8.12.1 The operational and system procedures within SMS Element 15 describe the processes for developing and implementing both strategic and local incident plans to ensure Sydney Trains responds effectively and safely to critical and other emergency situations.

8.12.2 SMS-15-OP-3132 Develop and Implement Site Incident Management Plan outlines the process to develop and implement strategic emergency preparedness plans which cascade down to the local site level. This includes:

- a) Establish strategic and local incident management plans
- b) Implement and communicate plans
- c) Training and practice incident response
- d) Evaluate and review incident management plans

8.12.3 The process for the management of emergency preparedness and response at Sydney Trains is summarised in the following table:

Process	Responsibility	Tools & Forms
Develop emergency strategic plans	<ul style="list-style-type: none"> • GM Operations • Incident and Emergency Response Manager 	Incident Management Framework (IMF)
Establish incident management plans	<ul style="list-style-type: none"> • GM Operations • Line Managers 	IMF Site Hazard Identification Template Site Incident Management Plan (SIMP) Workplace First Aid Assessment
Implement and communicate incident management plans and procedures	<ul style="list-style-type: none"> • Operational GMs • Incident and Emergency Response Manager • Line Managers 	Induction Guide Local Safety Induction Form
Provide emergency preparedness training	<ul style="list-style-type: none"> • Operational GMs • Line Managers 	Training Materials
Test and practice incident management plans and procedures	<ul style="list-style-type: none"> • Incident and Emergency Response Manager • Line Managers 	Schedule of Emergency Exercises SIMP IMF Evacuation Observation Form
Evaluate effectiveness of plans	<ul style="list-style-type: none"> • Incident and Emergency Response Manager • Line Managers 	External Emergency Services exercises SIMP
Review of plans		Document Review form Request to Publish form

9 Safety Performance Measurement and Evaluation

9.1 Key Performance Indicators

9.1.1 As required by regulation 10(1) of the Electricity Supply (Safety and Network Management) Regulation 2014, Sydney Trains measures performance against its safety management system at several levels. At the organisational level Sydney Trains uses three indicators:

- a) The impact on operations in the form of the total time delays to train running, incurred as a result of electrical incidents;
- b) Safety incidents (including near misses) as required to be reported by regulators including ONSRR, Safe Work Australia and IPART.

9.1.2 In addition to the above, other indicators are monitored and reported in order to provide a broad appreciation of safety-related performance. Details and commentary on the full range of safety performance indicators appears in Sydney Trains' Annual Safety Report and the Engineering & Maintenance Directorate Strategic Business Plan.

9.1.3 Safety performance is reported in the Annual Safety Report and provides a meaningful reflection of Sydney Trains' operational risk. Sydney Trains' external safety reporting remains aligned with the national rail occurrence standard Occurrence Notification – Standard 1 (ON-S1) of the Office of the National Rail Safety Regulator (ONRSR). ON-S1 data for the reporting period also appears in the Annual Safety Report.

9.1.4 The Electricity Distribution Unit reports safety performance for the Electricity distribution network to IPART, refer section 7.1. Electricity Networks Reporting Manual.

9.2 Monitoring and Measurement

9.2.1 The Electricity Distribution Unit utilises a "Visual Management Centre" to monitor incident rates involving electricity. These provide a rapid summary of performance (including safety) to senior management as well as providing a rapid indication of changes in performance. The statistics are categorised and analysed to quickly identify changing trends.

9.2.2 The procedures within SMS Element 16 describe Sydney Trains' systems for the inspection of workplaces and operational areas and inspection, testing and calibration programs for plant, equipment and engineering controls.

9.3 Reporting and Incident Investigation

System procedure SMS-17-SP-3077 and operational procedure SMS-17-OP-3102 detail Sydney Trains' processes for reporting rail and non-rail incidents and investigations. The operational procedure SMS-17-OP-3101 outlines the process required to investigate and report on safety incidents both internally and to external authorities / regulators when required.

9.4 Safety (Corrective and Preventative) Action Management

SMS-18-SP-3078 Safety Action Management advises managers of the process to manage corrective and preventative actions arising from the identification of non-conformances and recommendations.

9.5 Records

- 9.5.1 SMS-09-SP-3021 Records Management describes the systems for the creation, management, storage, retention and disposal of safety records. It applies to all workers responsible for managing safety records, and is relevant to the processes from identification of records to be retained, through to record retrieval and disposal.
- 9.5.2 Sydney Trains' Safety Records Register contains all records produced by the Safety Management System. The register is maintained by the Manager Enterprise Systems and reviewed by Information & Records Management Services in Transport Shared Services (TSS), in accordance with SMS-09-OP-3022 Identify and Monitor Safety Records. It details the types of safety records to be retained, confidentiality (where required), retention / custodial periods, and methods of disposal.

10 Asset Planning Management

10.1 Asset Management of the Electricity distribution network

- 10.1.1 Sydney Trains applies a comprehensive asset management plan (refer Electrical Asset Management Plan 2016/17-2025/26 PP-AMP-1617-PL-004). This plan documents the asset management model and processes pertaining to the electricity distribution network. The approach is based on the TfNSW Asset Management lifecycle (section 6.3. Safety Management Lifecycle).
- 10.1.2 The Engineering Management Manual MN-A-00001 provides further guidance on the lifecycle activities, configuration gates and work products. This, and Technical Reviews Manual MN-A-00413 provide the primary means by which Sydney Trains demonstrates its implementation of asset management.
- 10.1.3 Sydney Trains, through the application of its Total Asset Management Methodology:
- a) Requires assets to be planned, acquired, operated, maintained, upgraded, and disposed of in a systematic manner that meets the agreed needs of nominated stakeholders at minimum lifecycle cost
 - b) Applies risk management techniques across the asset's life cycle to ensure specified levels of service quality, safety, environmental risk, and economic outcomes are achieved in a timely manner.
 - c) Complies with the statutory and regulatory requirements including:
 - NSW Treasury's Total Asset Management (TAM) Manual;
 - the RSNL;
 - Office of the National Rail Safety Regulator (ONRSR);
 - the ESA; and,
 - National Rail Safety Accreditation Package (NAP) requirements.

Sydney Trains will continuously improve the Total Asset Management Methodology and associated capabilities to optimise the delivery and performance of the rail system assets that deliver safe, effective, and efficient rail services.

10.2 System Integrity

- 10.2.1 System integrity is the ability of the electricity distribution network to perform its intended functions without being degraded or impaired by changes or disruptions in its internal or external environments. This is the outcome of Sydney Trains' maintenance and asset management systems, processes and people.
- 10.2.2 Sydney Trains Engineering & System Integrity division compiles quarterly Asset Assurance Reports that include:
- a) Irregularities and incidents,
 - b) Levels of maintenance defects re vegetation clearance,
 - c) Defect age (rectification time),
 - d) Completion of routine maintenance activities,
 - e) Audit outputs,
 - f) Summaries of inspection findings, and
 - g) Technical investigations.
- 10.2.3 Asset Assurance Reports are compiled in consultation with subject matter experts (SMEs) from ESI and other divisions within the directorate. Consultation meetings provide an opportunity for SMEs to comment on report findings and their impacts upon system integrity. The Asset Assurance Reports focus on reliability measures and system safety.

10.3 System Capacity

- 10.3.1 The electricity distribution network is designed on the basis of providing traction and auxiliary power to electric trains, and power to operate the signalling systems, stations, workshops, and other facilities required to operate the railway.
- 10.3.2 If the total demand for power is at or exceeds system design capacity, the system becomes unreliable and failures become more frequent resulting in loss of power to trains, resulting in delays to the scheduled services. From a system perspective, the major issue is the capacity of the network to meet forecast peak demand which typically occurs in the Friday evening in hot weather.
- 10.3.3 This growth in demand stems from:
- a) Increasing numbers of rolling stock services to move the anticipated volume of passengers;
 - b) increasing the number of air-conditioned trains operating at any moment within a geographic region, and within the network as a whole;
 - c) timetable changes that may have the effect of increasing the number of trains in each section and their operational performance, and
 - d) extensions to the rail network itself that entail additional timetable services, stations etc.
- 10.3.4 Sydney Trains has tools to model and forecast power demand based on these parameters.
- 10.3.5 Capacity delivery is primarily managed through TfNSW's Power Supply Upgrade (PSU) program which comprises new and upgraded substations, and some enhancements to the 1500V DC overhead wiring system to address excessive wire temperatures. Parts of the high voltage AC electricity network also need to be augmented from time to time to ensure adequate capacity under contingency feeding conditions and provide connectivity to new substations.

10.4 Measures of Performance

10.4.1 Asset failures in the electricity distribution network may ultimately lead to resulting in loss of supply to trains or safety related systems required for the safe operation of trains (i.e. signalling, Train Radio or fire-life-safety systems such as tunnel emergency lighting & ventilation, sump pumps etc.). In this context the metrics used include:

- a) the delays (ie total time) to scheduled train services attributed to electrical assets, and
- b) the number of failures contributing to reduction of on-time-running of trains.

10.5 Network Configuration Management

10.5.1 As an AEO Sydney Trains has delegated authority to make decisions on the configuration of Transport for New South Wales (TfNSW) railway assets as described in "Guide to TfNSW Framework for Assuring the Safety of Rail Assets and Infrastructure". Sydney Trains' design configuration management responsibilities pertaining to the electricity network include:

- a) Matters arising from the interface of the rail infrastructure and rolling stock for which Sydney Trains is responsible.
- b) Matters arising from the interface of the rail infrastructure and rolling stock with the assets and operations of other entities.
- c) Hardware and software used in its configuration management systems, particularly in the production, collection and storage of product configuration information, and in change control procedures.

10.5.2 The Sydney Trains Configuration Control Board (CCB) provides senior management control over asset configuration matters at Sydney Trains. It comprises managers from appropriate business units (or their delegates) to adequately represent all Sydney Trains business units with railway asset configuration responsibilities. The Deputy Executive Director Network Maintenance and Deputy Executive Director Engineering & System Integrity (from the Maintenance directorate) represent the respective business units responsible for the electricity network infrastructure on the CCB. Subsidiary CCBs are established as directed and authorised by the Sydney Trains CCB to deliver effective configuration management of rail electricity network to provide management control over asset configuration matters within the appropriate electrical discipline and sub-disciplines.

10.5.3 CCB does not certify the technical integrity of proposed changes - consent from a CCB is contingent on persons with design authority confirming there is no objection to the technical content of the proposed change.

10.6 Design of New or Altered Assets

Designs produced internally (by Sydney Trains' Engineering & System Integrity) or externally (by TfNSW or external AEOs) are required to comply with

- a) Electrical infrastructure standards published by TfNSW³⁴ and
- b) Design requirements contained in Electrical Engineering Instructions, Technical Notes and Substation Location Instructions (protection settings).

³⁴ <http://www.asa.transport.nsw.gov.au/ts/asa-standards#electrical>

10.7 Acceptance of Designs

- 10.7.1 Designs produced internally (by Sydney Trains' Engineering & System Integrity) or externally (by TfNSW or external AEOs) are submitted for review by subject matter experts and may lead to the issue of actions requiring resolution prior to a statement of "No Objection to Construct". Sydney Trains does not "accept" designs by external AEOs.
- 10.7.2 Technical reviews and criteria are described in the Technical Reviews Manual (MN A 00413).

10.8 Cyclic Maintenance and Renewals

- 10.8.1 Electrical assets and their inherent components are naturally subject to fatigue throughout their operational lifespan. Within the rail network, such assets are planned to be replaced or refurbished prior to the end of their operational and / or economic life. This asset replacement and refurbishment routine is within the Major Periodic Maintenance (MPM) programme and is referred to as "Steady State Cyclic Maintenance and Renewals". The purpose of Steady State Cyclic Maintenance and Renewals is to ensure the condition and performance of electrical assets and, in turn, the overall electricity network remains sustainable over the long term.
- 10.8.2 For electricity infrastructure, cyclic maintenance and renewals comprise the following programs:

Contact wire renewal	AC Circuit breaker renewal	Bulk oil circuit breaker retrofit
Ring main unit renewal	Battery banks	Distribution line maintenance
Distribution line pole renewal	OHW maintenance	Substation maintenance
Switchgear	Transformers	

- 10.8.3 A key element of the maintenance strategy is to reduce the risk of infrastructure related failures by managing and upgrading the asset population to increase reliability and reduce risks arising from failure. These efforts are prioritised using risk assessment data.
- 10.8.4 These renewals may be carried out by Sydney Trains, TfNSW or external AEOs.

10.9 Operation and Maintenance

- 10.9.1 The standards, policies and procedures defining the operation and maintenance of electricity distribution network assets include:
- Electrical engineering instructions³⁵
 - Electrical standards (note ASA specifications take precedence)³⁶
 - Technical Maintenance Plans³⁷,
 - Technical Notes³⁸,
 - Trouble Instructions and Operator Procedures held at ICON, and
 - Substation Local Instructions³⁹.

³⁵ <http://intranet.sydneystains.nsw.gov.au/directorates/maintenance/engineering-and-system-integrity/engineering-information/electrical/engineering-instructions-and-advice>

³⁶ \\FSMET043\Engineering Standards\ELECTRICAL\standards\A_SPECS

³⁷ <http://intranet.sydneystains.nsw.gov.au/directorates/maintenance/engineering-and-system-integrity/engineering-information/electrical/technical-maintenance-plans>

³⁸ <http://www.asa.transport.nsw.gov.au/ts/railcorp-engineering-standards/electrical/electrical-technical-notes>

³⁹ <http://intranet.sydneystains.nsw.gov.au/directorates/maintenance/engineering-and-system-integrity/engineering-information/electrical/substation-local-instructions>

- 10.9.2 Electrical standards and TMPs specify:
- a) Maintenance to be carried out (inspection, testing, component change-out, etc.),
 - b) Frequency and methodology of maintenance practices,
 - c) Requirements for managing and reporting compliance with standards for nominated scheduled maintenance tasks.
- 10.9.3 The TMPs are a set of preventative and surveillance maintenance strategies and principles designed to achieve agreed operational and maintenance objectives and to ensure the supply of energy to Sydney Trains' operations is guaranteed.
- 10.9.4 Deviations from the TMPs may be proposed, in accordance with Sydney Trains' procedure PR E 72004 Electrical Engineering TMP Deviations.
- 10.9.5 On-site work is conducted in accordance with Sydney Trains' SMS. Prior to commencing on-site activities a pre-work briefing shall be conducted as per the SMS Operating Procedure 06.20 Pre-work Briefings. Briefings shall include hazards identified for the specific task(s) and the safety controls, as identified in FSA.
- 10.9.6 Records of the maintenance activities and inspections shall be maintained in Ellipse or as Asset Assurance Inspection Reports.

10.10 Safety, Security and Environmental Programs

- 10.10.1 Safety, security, and environmental programs are designed to improve asset performance and address statutory requirements where there is an obligation to carry out:
- a) Safety works to address WHS issues and provide a safe workplace for employees,
 - b) Security measures, and
 - c) Environmental compliance.
- 10.10.2 These programs are prioritised on the basis of the risk mitigated and improved compliance with standards. For electricity infrastructure these programs include:
- a) Vegetation control,
 - b) Asbestos removal (substations and huts),
 - c) Substation fencing,
 - d) Corridor boundary fencing,
 - e) DCCB Frame leakage at substations,
 - f) Spill protection, and
 - g) Tunnel Lighting.
- 10.10.3 The requirements for new or modified assets are defined in specifications published on the ASA website.

10.11 Physical Security

- 10.11.1 One of the primary preventive controls is physical security of the electricity network assets. The ASA has published standards defining the requirements for new or modified assets, including:
- a) EP 99 00 00 07 SP Substation Fencing,
 - b) ESC 510 Boundary Fences,
 - c) RSS-002 Stabling Locations and Maintenance Centres,

- d) RSS-003 Substations,
- e) RSS-004 Signalling and Control Room Facilities, and
- f) TMC 511 Boundary Fences Criteria for Electrical Assets

11 Customer Connections

11.1 Customer Connections

Sydney Trains ensures the safety of electrical installations connected to the Sydney Trains electricity distribution network⁴⁰, through:

- a) Design, construction and maintenance standards required of customers for their electrical installations,
- b) Testing, connection and notification criteria for contractors installing electrical installations,
- c) Inspection regime and procedures for directions to remedy faulty work and the disconnection of unsafe installations by the network operator, and
- d) Procedures for notifying the regulator of defective installation work.

11.2 Design & Construction

11.2.1 The design and construction of customers' electrical installations is required to comply with the following:

- a) AS/NZS 3000 Electrical Installations,
- b) Service and Installation Rules of NSW (refer section 3 of this document), and
- c) RailCorp Electrical Standards:
 - EP 12 00 00 02 SP Low Voltage Distribution and Installations Earthing References and Definitions,
 - EP 12 10 00 20 SP Low Voltage Distribution Earthing,
 - EP 12 10 00 21 SP Low Voltage Installations Earthing, and
 - EP 12 10 00 22 SP Buildings and Structures Under Overhead Lines

11.2.2 EDU has a group of installation inspectors who inspect low-voltage installations to confirm these are in accordance with the NSW Service Installation Rules. Metrics are collected concerning connection requests, and defects identified.

⁴⁰ Electricity Supply (Safety and Network Management) Regulation 2014, regulation 5.

11.3 Maintenance

- 11.3.1 In the case where Sydney Trains is the customer, Sydney Trains will maintain electrical installations in accordance with section 35 of the *Gas and Electricity (Consumer Safety) Act 2017* through the implementation of the relevant Sydney Trains Technical Maintenance Plans.
- 11.3.2 In the case where the Customer is an external entity to Sydney Trains, the customer will maintain their electrical installations in accordance with section 35 of the *Gas and Electricity (Consumer Safety) Act 2017*.

11.4 Criteria for Contractors

The testing, connection and notification criterion for contractors installing electrical installations is to comply with the *Electricity (Consumer Safety) Regulation 2015* and ASA document EP 17 00 00 06 SP Installation Inspections.

11.5 Risk Management Strategy

Risks in the area of customers' electrical installations are managed by applying the Codes of Practice for Installation Safety Management and the *Service and Installation Rules of NSW* (November 2016).

11.6 Code of Practice – Service and Installation Rules of NSW

Sydney Trains recognises the *Code of Practice (Electricity)* and the *Service and Installation Rules of New South Wales*. However, Sydney Trains stipulates the use of a Direct Earthing system, not the Multiple Earthed Neutral (MEN) system as specified in those Rules. This is to avoid the flow of DC traction current into the low voltage distribution system.

- 11.6.1 The specific requirements are set out in ASA document EP 12 10 00 21 SP Low Voltage Installations Earthing. Sydney Trains requires installations supplied from its distribution system comply with this specification.

11.7 Code of Practice – Installation Safety Management

Sydney Trains' system for the management of the following aspects of customers' installation safety, are covered in ASA document EP 17 00 00 06 SP Installation Inspections:

- a) Standard of Installation Work,
- b) Testing Requirements,
- c) Notification,
- d) Inspections,
- e) Remedy of Work Containing Safety Breaches,
- f) Connection to Supply,
- g) Audit Inspections,
- h) Corrective Action, and
- i) Qualifications of Inspectors.

11.8 Installation Inspections and Connections

Sydney Trains Electricity Distribution Unit collects records of installation inspections, Certificates of Connection and installation defects for low voltage electrical assets. Installation inspectors record this data in a database controlled by EDU. The database was designed and constructed to be intuitive and does not require formal training. Access is available to inspectors via desktop computers within EDU.

11.9 Procedures for Notifying the Regulator of Defective Installation Work

Installation inspection reports determine if the installation can be accepted for connection to supply or not. Any defect must be rectified by the contractor before supply connection. All defects are recorded. Defects which compromise safety are notified to the regulator in accordance with ASA document EP 17 00 00 06.

12 Public Safety Awareness

12.1 Hazards

Sydney Trains has established strategies and procedures to warn the public of the hazards associated with the electricity distribution network⁴¹. This includes Public Electrical Safety Awareness activities to identify the target groups, communication programs and media to warn the public of potential hazards associated with the electricity distribution network.

12.2 Risk Assessment in Relation to the Public

12.2.1 An important component of Sydney Trains' public electrical safety strategy is the identification of "at risk" groups.

12.2.2 The risk assessment of the electricity distribution network in relation to the public has been classified into two distinct categories:

- a) Risks external to the rail corridor, and
- b) Risks internal to the rail corridor.

12.2.3 These two categories have been derived due to approximately 66% of the electricity distribution network being situated within the dedicated rail corridor that is generally enclosed and restricted from public access.

12.2.4 There is some commonality of risks in relation to the public which apply to both external and internal areas of the rail corridor. Where this commonality exists, the associated risks and strategies are covered under the heading where most prominent.

12.3 Advice to the Public

12.3.1 Sydney Trains' distribution network is geographically located within the franchise areas of Ausgrid and Endeavour Energy, and comprises similar design configurations corresponding to the nominal voltages. Due to this geographical overlay and design similarity, Sydney Trains does not conduct its own public electrical awareness campaigns and relies on those conducted by Ausgrid, Endeavour Energy and Essential Energy to reach the target audiences who may attempt to access Sydney Trains' Electricity distribution network.

⁴¹ Electricity Supply (Safety and Network Management) Regulation 2014 Regulation 7(1)(b)(iii)

12.3.2 Sydney Trains has reviewed Endeavour Energy's and Ausgrid's Public Electrical Safety Awareness Plans and concluded that they cover the same "at risk" groups as Sydney Trains.

Endeavour Energy's 2016 Public Electrical Safety Awareness Plan (PESAP) outlines seven strategic programs for 2015/16, targeting key public audiences to help raise awareness of hazards faced through the interaction with the public electricity network. Of these, the following are also common to the "at risk" groups also shared by Sydney Trains:

- a) Tradespersons / outdoor workers
- b) General community and would-be copper thieves
- c) Primary school students
- d) Public and private easements – bushfire management

12.3.3 Ausgrid's 2016 Public Electrical Safety Awareness Plan identifies nine "at risk" groups, six of which directly apply to Sydney Trains' electricity distribution system namely:

- a) Tradespersons / outdoor workers
- b) Children
- c) General community
- d) Maritime operators (in the vicinity of waterway crossings)
- e) Emergency services personnel
- f) Young males – 16 to 25.

12.3.4 Targeted programs carried out by the respective Network Operators for the above identified groups align to the public target groups applicable to the electricity distribution system utilised by Sydney Trains. All of these programs are equally appropriate to the public external to the rail corridor.

12.3.5 Sydney Trains, like Ausgrid and Endeavour Energy, also has a small number of electricity cables and aerials which cross navigable waters. The public awareness programs conducted by Endeavour Energy and Ausgrid reach the same target groups (e.g., boat owners and operators, organisations active on navigable waterways) applicable to Sydney Trains.

12.3.6 For external parties working near underground services Sydney Trains is a contributing member of Dial Before You Dig, a referral service for information on locating underground utilities anywhere in Australia.

12.3.7 Sydney Trains maintains its focus on continuously improving the effectiveness of our strategies to address incidents of trespass and acts of suicide or self-harm across the rail network, i.e., risks in relation to the public internal to the rail corridor. The corridor fencing project is a 'hotspot' targeted program to reduce trespass and vandalism incidents.

12.4 Risks within the Rail Corridor

12.4.1 Since the majority of Sydney Trains' electricity distribution networks aerial lines and cables are situated within the dedicated rail corridor this means it is generally restricted from public access. Therefore, the risk associated with the public in relation to the electricity distribution network utilised by Sydney Trains is dramatically decreased due to this limited interface exposure.

- 12.4.2 Sydney Trains also engages a range of communication mediums to reach the target audience for each program implemented. The selected media varies in accordance with the requirements of each program but may include advertisements, education kits, personal presentations, press releases and the web. Examples are:
- a) Trespassing Safety Awareness included as part of Rail Safety Week each year - highlights the dangers of trespassing on the rail corridor,
 - b) The annual National Rail Safety Awareness Week - reminds passengers, pedestrians and road users to stay safe around railway lines, and
 - c) Sydney Trains' website www.sydneytrains.info - contains all of Sydney Trains' public safety messages including the issue of trespassing onto the rail corridor.
- 12.4.3 All safety aspects of work within the rail corridor is managed by the Rail Corridor Safety Division, whose purpose is to address risks faced by workers and contractors in the rail corridor, including safety controls and managing incidents where injury could occur.
- 12.4.4 The Incident and Emergency Response Unit co-ordinates joint exercises involving Bushfire Brigades, Councils, Emergency Services, and other relevant organisations to assist in the co-ordination of the various parties in the event of major incidents.
- 12.4.5 The Incident and Emergency Response Unit has published a "Guide for Emergency Services access to the Rail Corridor."⁴² It details the major hazards that could be encountered in the rail corridor including the electrical hazards and advises the procedures to be used before and whilst in the rail corridor.

12.5 External (3rd Party) Works by Neighbours and Councils

- 12.5.1 External works carried out by neighbours and councils in close proximity to electrical network assets pose risks to the external parties, and to the electrical network. Managing these risks includes the following:
- a) Responding to requests for information from external parties; Sydney Trains has a dedicated External Party Works Manager, within the Asset Management group to handle all liaison with those responsible for external works including councils and neighbours;
 - b) Identification of third-party works, which includes both advice from local councils, neighbours and developers concerning proposed developments or maintenance work as well as periodic inspections of the electrical network assets to identify activities to be conducted, or being conducted, in close proximity to the electrical network;
 - c) Responding to Development Applications received concerning proposed construction near electricity network assets and advising Councils of constraints or requirements that should be included;
 - d) Informing developers (via a form letter) of the risks associated with construction near electricity network assets, and advising them of the WorkCover Code of Practice "Work Near Overhead Power Lines" and how to request further advice from Sydney Trains or arrange an Electrical Permit;
 - e) Ensuring Sydney Trains Electricity distribution network assets are labelled with a contact telephone number and a unique identifier, to assist external parties wishing to Sydney Trains in respect of these assets; this primarily concerns poles supporting aerial lines;
 - f) Participating in "Dial Before You Dig" to provide detailed survey drawings showing the location of buried electrical assets to those seeking this information;

⁴² http://intranet.sydneytrains.nsw.gov.au/__data/assets/pdf_file/0007/56950/Guide-for-Emergency-Services-access-to-the-Rail-Corridor.pdf

- g) Providing information concerning safe working when working in close proximity to electrical assets via the RailSafe website;
- h) Assessment of the risks posed by the third-party works to assess the risks and possible controls; this is by EDU inspectors and SMEs within the Electrical department;
- i) Providing information to the third party in respect of the electrical network, including access to the Virtual Plan Room, access to the ENSMS, and specialist advice when requested;
- j) (optional) Ongoing surveillance of the work, when deemed necessary;
- k) Action that may arise in response to external works.

12.5.2 Periodic inspection of cable routes outside the rail corridor (both aerial and underground) are used to identify activities or structures that may pose risks (e.g. infringing the Safe Approach Distance). This is conducted periodically by the Sydney Trains Maintenance Directorate.

12.6 Neighbours of Easements and Public Assets

Where Sydney Trains carries out work on electrical network assets within easements and public land the Sydney Trains' External Party Works Manager is responsible for liaison with those affected, including councils and neighbours. This includes liaison with councils in respect of development applications and periodically reminding owners and residents on lands affected by or neighbouring easements of the constraints and obligations.

12.7 Safe Approach Distances for 3rd Parties

12.7.1 There are several documents describing the safe approach distances, notably SafeWork's *Work Near Overhead Power Lines Code of Practice*⁴³, ENA NENS 04-2006 and the NSW Government *Code of Practice - Electricity transmission and distribution asset management*.

12.7.2 Sydney Trains' defines safe approach distances which are the same as the SafeWork limits and provides extensive guidance for use by 3rd parties. These are published on the RAILS SAFE website, and describe the safe approach distance, hazards when using tools or materials in the vicinity, as well as mobile plant and temporary structures.

13 Bush Fire Risk Management Plan

Sydney Trains approach to managing the risks of bushfire associated with the Electricity distribution network is presented in SP D 79036 Electricity Network Bushfire Management Plan, version 1.0.

⁴³ http://www.safework.nsw.gov.au/__data/assets/pdf_file/0020/52832/Work-near-overhead-power-lines-code-of-practice.pdf

14 Referenced Documents

14.1 Versions

The following sections lists the documents referenced in this plan at the date of issue. All users of this plan are reminded to obtain current copies of referenced documents from the publisher of the document (e.g. SAI Global, TfNSW or Sydney Trains); it is not acceptable to rely on uncontrolled local or printed copies.

14.2 Public documents

Legislation

- [1] Electricity Supply (Corrosion Protection) Regulation 2014 (NSW)
- [2] Electricity Supply (General) Regulation 2014 (NSW)
- [3] Electricity Supply (Safety and Network Management) Regulation 2014 (NSW)
- [4] Electricity Supply Act 1995 (NSW)
- [5] National Electricity Rules version 92
- [6] Rail Safety (Adoption of National Law) Act 2012 (NSW)
- [7] Rail Safety (Adoption of National Law) Regulation 2012 (NSW)
- [8] Rail Safety National Law (NSW) no. 82a
- [9] Rail Safety National Law National Regulation 2012 (NSW)
- [10] Work Health and Safety Act 2011 (NSW)
- [11] Work Health and Safety Regulation 2011(NSW)

Australian Standards

- [12] AS/NZS 2067-2016, Substations and high voltage installations exceeding 1 kV AC.
- [13] AS/NZS 3000 – 2007, Electrical installations (known as the Australian / New Zealand Wiring Rules).
- [14] AS/NZS 5577 – 2013, Electricity network safety management systems
- [15] AS/NZS ISO/IEC 15288:2013, Systems and Software Engineering – System Life Cycle Processes
- [16] AS/NZS ISO 31000:2009, Risk management - Principles and guidelines
- [17] AS/NZS ISO 60038-2000, Standard Voltages

14.2.1 Industry Codes and Guides

- [18] Australian Energy Regulator Electricity Network Service Provider Registration Exemption Guideline 1 December 2016
- [19] Code of Practice - Electricity transmission and distribution asset management
- [20] Service and Installation Rules of NSW, 2015
- [21] ENA NENS 023-2009 Guidelines for Safe Vegetation Management Near Overhead Lines
- [22] ENA NENS 04-2006 National guidelines for safe approach distances to electrical and mechanical apparatus
- [23] A415539, Guideline – Major Projects, Office of the National Rail Safety Regulator

14.2.2 Sydney Trains

- [24] PR D 78000, Electricity Network Safety Rules
- [25] PR D 78100, Definitions and Conventions for Electrical Safety
- [26] PR D 78101, General Requirements for Electrical Work

- [27] PR D 78701, Personal Certifications
- [28] Safety Management System Elements - published at <http://RailSafe.sydneytrains.nsw.gov.au/sms-documents>
- [29] SMS-GD-06-0268, Working Around Electrical Equipment
- [30] SP D 79056 Electricity Network Bushfire Management Plan

14.2.3 **TfNSW**

- [31] EP 00 00 00 01 TI, RailCorp Electrical System General Description
- [32] EP 10 00 00 00 MP, Technical Maintenance Plan – Aerial Transmission Lines
- [33] EP 10 00 00 04 SP, Transmission Line Easement Conditions
- [34] EP 10 01 00 02 SP, Aerial Line Maintenance Standards
- [35] EP 10 01 00 03 SP, Aerial Line Base Safety and Operating Standards
- [36] EP 10 01 00 E, Transmission Line Equipment Manual
- [37] EP 12 00 00 02 SP, Low Voltage Distribution and Installations Earthing
- [38] EP 12 10 00 20 SP, Low Voltage Distribution Earthing
- [39] EP 12 10 00 21 SP, Low Voltage Installations Earthing
- [40] EP 12 10 00 22 SP, Buildings and Structures Under Overhead Lines
- [41] EP 17 00 00 06 SP, Installation Inspections
- [42] EP 99 00 00 07 SP, Substation Fencing
- [43] ESC 510, Boundary Fences
- [44] RSS-002, Stabling Locations and Maintenance Centres
- [45] RSS-003, Substations
- [46] RSS-004, Signalling and Control Room Facilities
- [47] T HR CI 12105 ST, Vegetation Hazard Management in the Rail Corridor
- [48] T HR EL 08011 ST, Overhead Wiring Maintenance Standards
- [49] T HR EL 10001 ST, HV Aerial Line Standard for Design and Construction
- [50] T MU AM 04001 PL, TfNSW Configuration Management Plan
- [51] TMC 511, Boundary Fences
- [52] TS 10504: 2013, AEO Guide to Engineering Management
- [53] TS 20001: 2013, System Safety Standard for New or Altered Assets

14.2.4 **Other**

- [54] IPART Electricity Network Reporting Manual, August 2018
- [55] IPART Electricity Networks Audit Guideline
- [56] National Rail Safety Accreditation Package (NAP)
- [57] NSW Treasury's Total Asset Management (TAM) Manual

14.3 Unpublished Documents

14.3.1 **Sydney Trains**

- [58] 50707-JB1162, Vegetation Manual
- [59] AMD-AMP-PL-001, Configuration Management Plan
- [60] APP-AMP-1617-PL-004, Electrical Asset Management Plan 2016/17 to 2025/26
- [61] D2013/80874 PPE for Electrical Work
- [62] EI A 19-04 New PPE for Electrical Work
- [63] Sydney Trains Electricity Network Performance Annual Report
- [64] EMS-09-GD-0067, Vegetation Management in the Rail Corridor
- [65] EMS-09-TP-0152, Vegetation Management Scope of Work
- [66] EMS-09-WI-0071, Bush Fire Hazard Reduction
- [67] EMS-09-WI-0178, Fauna Impact Mitigation when Clearing Vegetation

- [68] GL D 79100 Electrical Commissioning Requirements and Deliverables
- [69] Guide for Emergency Services access to the Rail Corridor
- [70] Infrastructure Control Centre (ICON) Operator Procedures and Trouble Instructions
- [71] MN A 00001, Design Management Manual
- [72] MN A 00413, Technical Reviews Manual
- [73] MN C 10501, Bush Fire Hazard Management
- [74] NMD-GD-182, Electrical Routine Maintenance
- [75] PR E 72004 - Electrical Engineering TMP Deviations
- [76] QMS-19-GD-3648, Integrated Auditing Guide
- [77] QMS-19-GD-6006, Auditor Competency Framework
- [78] QMS-19-SP-3647, Auditing Procedure
- [79] QMS-19-TP-6005, Auditor Competency evaluation sheet
- [80] QMS-19-WI-3649, Risk Based Auditing
- [81] Safety Risk Assessment Report - Electricity distribution network Bushfire Risk TRIM : DSYD2017/148710 30 June 2017
- [82] SMS-01-RG-3148, Legal Requirements Register
- [83] SMS-01-SR-3000, Safety Management System Requirements
- [84] SMS-03-SP-3063, Safety Planning
- [85] SMS-04-SP-3064, Asset Life Cycle Management
- [86] SMS-07-SP-3067, Manage Safety Change
- [87] SMS-09-OP-3022, Identify and Monitor Safety Records
- [88] SMS-09-SP-3021, Records Management
- [89] SMS-10-SP-3070, Communication and Consultation
- [90] SMS-11-SP-3011, Training and Competence
- [91] SMS-15-OP-3132, Develop and Implement Site Incident Management Plan
- [92] SMS-17-GD-4702, L4 Investigation Plan
- [93] SMS-17-OP-3101, Investigate Report On and Analyse Safety Incidents
- [94] SMS-17-OP-3102, Notify Safety Incidents
- [95] SMS-17-OP-3644, HPI Determination and Reporting
- [96] SMS-17-OP-4701, Conduct of L4 Safety Investigations
- [97] SMS-17-SP-3077, Incident Reporting and Investigations
- [98] SMS-18-OP-3115, Manage Corporate SEQR Recommendations/Findings
- [99] SMS-18-OP-3116, Manage Local SEQR Recommendations/Findings
- [100] SMS-18-OP-3139, Conduct SEQR Action Closure Review
- [101] SMS-18-SP-3078, Safety Action Management
- [102] SMS-20-SP-3080, System Review

14.3.2 **TfNSW**

- [103] Guide to TfNSW Framework for Assuring the Safety of Rail Assets and Infrastructure

14.3.3 **Other**

- [104] Sydney Trains - Audit of the Electrical Network Safety Management System 2015, Scott Lister; TRIM: DSYD2015/41864
- [105] Bushfire Risk Mitigation Audits of NSW Electricity Operators: Sydney Trains. Prepared for the Independent Pricing and Regulatory Tribunal; Eco Logical Australia 2016.
- [106] Northern Sydney Electricity feeder REFS – Bushfire Risk Assessment, Ecological Australia, 24th January 2013
- [107] Bushfire Risk Assessment - City West Feeder Lines, Aurecon, 5 January 2016
- [108] Bushfire Risk Assessment - West and Illawarra Region Electrical Feeders, Ecological Australia, July 2015.

Appendix A Traceability to the Regulation and AS5577

Source	Para	Originating Requirement	Response
Regulation	7(1)(a)	A network operator must have a safety management system in place that is in accordance with AS 5577	This Appendix
Regulation	8(1)	A network operator must implement its safety management system.	1.4. Implementation by TfNSW, AEOs
Regulation	9 and 12	Nomination of person as auditor	7.4. External Audits
Regulation	10(1)	A network operator must measure its performance against its safety management system.	7.1. Regulatory Reporting – IPART
AS5577	1.1 para 4	While this Standard has been developed for electricity supply networks, it is recognized that it may be used in relation to the safety of railway electricity networks. Before using this Standard for an electrified railway system, a rail system operator has to review the Standard to determine the Standard's suitability and applicability to the operator's rail system.	1.3. Originating Requirement
AS5577	1.3 para 3	Operation and maintenance procedures and practices for networks should comply with the most recent edition of a relevant Standard to the extent that is reasonably practicable.	3. Regulatory Requirements
AS5577	3.8	Risk Acceptance Criteria - to be defined in the Network Operator's risk methodologies	5.10. Risk Acceptance Criteria, 5.11. Risk Treatment – ALARP or SFAIRP
AS5577	3.9	Risk At an Acceptable Level - Level to be defined in the Network Operator's risk methodologies	5.10. Risk Acceptance Criteria, 5.11. Risk Treatment – ALARP or SFAIRP
AS5577	4.1 para 2	The ENSMS shall contain the Network Operator's safety arrangements for the following: <ul style="list-style-type: none"> - ENSMS policy - Planning - Implementation - Measurement and evaluation - Management review and change management 	Whole document
AS5577	4.1 para 3	The ENSMS shall include or refer to a description of the network(s), including or referencing suitable maps showing all network assets and the location of associated facilities such as substations and switching stations.	4. Network Description, Appendix 3
AS5577	4.1 para 4	... the Network Operator shall address the requirements of this standard.	This appendix
AS5577	4.1 para 5	The elements of an ENSMS, described in clauses 4.2 to 4.6 below, are interdependent and are of equal importance. An ENSMS shall address these requirements.	Does not comply. Refer 1.3
AS5577	4.2 para 1	The Network Operator shall define its policy and commitment towards the various aspects of operating the network safely.	5.2. Safety Policy Appendix 1 Safety Policy Appendix 2 Risk Management Policy
AS5577	4.2 para 2	A clear commitment by the Network Operator towards specific outcomes shall form the basis of the ENSMS	5.2. Safety Policy Appendix 1 Safety Policy Appendix 2 Risk Management Policy
AS5577	4.3.1 para 1	The Network Operator shall have appropriate planning processes and procedures for ensuring network safety in any situations that may result from normal and foreseeable abnormal operations including emergencies.	5.9. Specific Hazards Nominated by AS5577 5.12. Formal Safety Assessments
AS5577	4.3.2 para 1	When developing the ENSMS the Network Operator shall utilise a Formal Safety Assessment	5.12. Formal Safety Assessments

Source	Para	Originating Requirement	Response
		undertaken in compliance with this Standard (see Appendix A).	
AS5577	4.3.2 para 2	The ENSMS shall have appropriate processes and procedures for the production of Formal Safety Assessments. The Formal Safety Assessment shall comply with the principles of AS/NZS ISO 31000 and shall include methodologies appropriate to the network under consideration for the following:	5.12. Formal Safety Assessments
AS5577	4.3.2 para 2	a) Establishing the context of the specific assessment being undertaken and including the setting of risk acceptance criteria	5.12. Formal Safety Assessments
AS5577	4.3.2 para 2	b) Risk identification – recognising sources of risk external to the electricity network as well as those arising from the electricity network itself.	5.8. Electrical Risk Register 5.12. Formal Safety Assessments
AS5577	4.3.2 para 2	c) Risk analysis, including consideration of the consequences of the risks and the likelihood of the consequences occurring	5.8 Electrical Risk Register 5.10. Risk Acceptance Criteria
AS5577	4.3.2 para 2	d) Risk evaluation by comparison of the level of risk with risk acceptance criteria	5.10. Risk Acceptance Criteria
AS5577	4.3.2 para 2	Risk treatment, including where reasonably practicable the elimination of the source of risk and where elimination is not reasonably practicable, the identification of treatments or controls so that residual risks are reduced to as low as reasonably practicable (ALARP)	5.10. Risk Acceptance Criteria, 5.11. Risk Treatment – ALARP or SFAIRP
AS5577	4.3.2 para 3	Control measures required to reduce safety risks to the public, property, the environment and network personnel shall be incorporated into the appropriate procedures	5.7 Electrical Risk Register 5.10. Risk Acceptance Criteria, 5.11. Risk Treatment – ALARP or SFAIRP
AS5577	4.3.2 para 4	The Network Operator shall ensure that any Formal Safety Assessment carried out considers activities related to the following: Network planning Site safety management Network safety management incorporating Network structural integrity External interference management Fault condition monitoring and response, and Change of operating conditions and remaining asset life review (not used) Substation's operations and maintenance Emergency response	5.9. Specific Hazards Nominated by AS5577
AS5577	4.3.3 para 1	The network Operator shall plan and prepare for operation of the network in foreseeable abnormal circumstances or during significant disruption to normal operations. These circumstances may include the following: Operating connected to emergency power sources Operating without normal supply assets such as powerlines or transformers Operating at other than normal voltage levels Operation under communication outages Operating under changed conditions to avoid further damage to the network (Note: AS3745 Planning for emergencies in facilities, provides guidance. See also clause 4.4.7)	5.9. Specific Hazards Nominated by AS5577
AS5577	4.3.4.1 para 1	A Network Operator shall identify the published national or international technical standards used by it in:	14. Referenced Documents
AS5577	4.3.4.1 para 1	The design and construction of existing network assets;	Section 4 and 10.6. Design of New or Altered

Source	Para	Originating Requirement	Response
			Assets
AS5577	4.3.4.1 para 1	Design and construction of new network assets; and	Section 4 and 10.6. Design of New or Altered Assets
AS5577	4.3.4.1 para 1	The commissioning, installation, operation, maintenance and decommissioning of network assets	Section 4 and 10.6. Design of New or Altered Assets 10.7. Acceptance of Designs 10.9. Operation and Maintenance
AS5577	4.3.4.1 para 2	If the Network Operator chooses not to use an applicable relevant standard or chooses not to comply with particular provisions of that standard, the Network Operator shall document- <ul style="list-style-type: none"> The reason for the non-use or non-compliance with the standard; and The alternative provisions for the design, construction, commissioning, installation, operation, maintenance and decommissioning of network assets that will ensure a level of safety in relation to those activities that is at least equal to or greater than the level of safety that would ensure from compliance with that standard. 	3. Regulatory Requirements 5.7. Exceptions, Non-compliance and Variations
AS5577	4.3.4.2 para 1	A Network Operator shall identify the industry or company codes used by it in-	-
AS5577	4.3.4.2 para 1	The design and construction of existing network assets;	Section 4 and 10.6. Design of New or Altered Assets
AS5577	4.3.4.2 para 1	The design and construction of new network assets, and	Section 4 and 10.6. Design of New or Altered Assets
AS5577	4.3.4.2 para 1	The commissioning, installation, operation, maintenance and decommissioning of network assets.	Section 4 and 10.7. Acceptance of Designs 10.9. Operation and Maintenance
AS5577	4.3.4.2 para 2	If the Network Operator chooses not to comply with particular provisions of an industry or company code the Network operator shall document- <ul style="list-style-type: none"> The reason for the non-compliance with the code, and The alternative provisions for the design, construction, commissioning, operating, maintenance and decommissioning of network assets that will ensure a level of safety that is at least equal to or greater than the level of safety that would ensure from compliance with that code. 	3. Regulatory Requirements 5.7. Exceptions, Non-compliance and Variations
AS5577	4.4.1	The Network Operator shall define how it will implement the ENSMS	Whole document
AS5577	4.4.2 para 1	The Network Operator shall identify how the resourcing, equipment and material requirements for the network's safe operation and maintenance, including carrying out of hazard controls and mitigation identified in the Formal Safety Assessment. Appropriate resources shall also be identified to ensure the appropriate development, implementation, monitoring and review of the ENSMS.	5.8. Electrical Risk Register 8.7. Resourcing
AS5577	4.4.2 para 2	Sufficient personnel should be available for undertaking planned and unplanned operations and maintenance, taking into account the requirements	8.7. Resourcing

Source	Para	Originating Requirement	Response
		for leave and training.	
AS5577	4.4.3	A defined management structure for the Network Operator shall be established to identify key positions and/or personnel. The management structure shall be appropriate to the size and complexity of the network.	8. Organisation
AS5577	4.4.4	The responsibilities, accountabilities and authority levels of personnel and/or contractors with respect to the various aspects of the design, construction, commissioning, operation, maintenance and decommissioning of the network shall be detailed in the ENSMS. In particular personnel shall be identified and documented with the responsibility and authority to-	8.5. Sydney Trains Responsibilities, Accountabilities and Authorisations
AS5577	4.4.4	Approve policies and procedures;	8.5. Sydney Trains Responsibilities, Accountabilities and Authorisations
AS5577	4.4.4	Initiate action to, so far as reasonably practicable-	
AS5577	4.4.4	<ul style="list-style-type: none"> Prevent safety issues arising from a loss of supply; 	5.5.5. Specific Hazards Nominated by AS5577
AS5577	4.4.4	<ul style="list-style-type: none"> Prevent environmental impact; 	5.5.5. Specific Hazards Nominated by AS5577
AS5577	4.4.4	<ul style="list-style-type: none"> Mitigate the impact of such events to the public 	12. Public Safety Awareness
AS5577	4.4.4	<ul style="list-style-type: none"> Correct electricity network safety issues; 	9.4. Safety (Corrective and Preventative) Action Management
AS5577	4.4.4	<ul style="list-style-type: none"> Identify, record and report on any existing or potential deficiencies within the ENSMS or the network's design, construction, commissioning, operation, maintenance and decommissioning; 	9.3. Reporting and Incident Investigation
AS5577	4.4.4	<ul style="list-style-type: none"> Initiate, recommend, approve and monitor corrective and preventive actions in relation to identified existing or potential deficiencies within the ENSMS or the network's design, construction, commissioning, operation, maintenance and decommissioning; 	9.4. Safety (Corrective and Preventative) Action Management
AS5577	4.4.4	<ul style="list-style-type: none"> Evaluate and verify the effectiveness of any corrective or preventive action implemented; 	2.5.6.3.
AS5577	4.4.4	<ul style="list-style-type: none"> Satisfy the mandatory approval requirements of this standard for specific items to be approved. 	2.5.6
AS5577	4.4.5 para 1	The Network Operator shall ensure all persons involved with the design, construction, commissioning, operation, maintenance and decommissioning of the network are suitably trained.	8.8. Training and Competency
AS5577	4.4.5 para 2	The Network Operator shall establish and maintain procedures for identifying, facilitating and/or providing the training needs of all personnel operating the network covered by the ENSMS.	8.8. Training and Competency
AS5577	4.4.5 para 3	As a minimum personnel responsible for the operation and maintenance of the network shall, as applicable to their position, be adequately trained in the obligations of the ENSMS and briefed in the requirements of the controls and actions identified during the Formal Safety Assessments (see Appendix A).	8.8. Training and Competency
AS5577	4.4.6.1	The Network Operator shall identify individuals, stakeholder groups and organisations that have a relevant interest in the safety aspects of the design, construction, commissioning, operation, maintenance and decommissioning of the network. These may include but are not limited to,	8. Organisation 8.5. Sydney Trains Responsibilities, Accountabilities and Authorisations

Source	Para	Originating Requirement	Response
		landowners, employees, employee representative organisations, contractors, utilities, accredited service providers, local and emergency authorities, regulatory authorities and government agencies.	
AS5577	4.4.6.2	The Network Operator shall establish procedures for regular consultation and communication with, and reporting to, these identified stakeholders during the development, implementation and review of the ENSMS. These procedures need to include statutory reporting obligations in line with jurisdictional regulatory requirements.	2.2.2. Electrical Safety Forum
AS5577	4.4.7 para 1	The Network operator shall plan and prepare for emergency events resulting from the network's operation and maintenance, and also from external events that may affect the safe operation of the network.	5.5.5. Specific Hazards Nominated by AS5577
AS5577	4.4.7 para 2	In the event of an emergency the Network Operator shall ensure any response is performed in a safe manner.	5.5.5. Specific Hazards Nominated by AS5577
AS5577	4.5.1.1	The ENSMS shall incorporate procedures for the appropriate measurement and evaluation of the performance of the ENSMS elements. The results of audit, review and monitoring processes shall be utilized for the purpose of management review of the ENSMS.	9. Safety Performance Measurement and Evaluation
AS5577	4.5.1.2	The Network Operator shall establish procedures for identifying, recording and analysing network operational, maintenance and reliability data to identify trends in the network's operation and performance that may affect the safe operation of the electricity network. Analysis of this data should support operation of the network to continue as planned. It should also identify any negative trend that may result in an event adversely impacting the safe operation of the network.	9. Safety Performance Measurement and Evaluation
AS5577	4.5.2.1	The Network Operator shall establish procedures for identifying, notifying, recording, investigating and reporting accidents and incidents. This shall cover any event associated with the network that either causes or has the potential to cause any one or combination of the following: a) Death or significant injury to network personnel or the public. b) Significant damage to property. c) Significant impact on the safe operation of the network.	6. Incident Management
AS5577	4.5.2.2	The Network Operator shall develop and implement procedures for determining, approving and implementing corrective and preventive actions. The agreed actions shall, as far as reasonably practicable, eliminate or mitigate the identified hazard and shall be appropriate and commensurate to the risk identified. The agreed actions shall be documented and their implementation monitored and confirmed. The basis for any action shall be documented. The outcomes of corrective or preventative actions taken, along with their effectiveness, shall be subjected to independent internal review.	2.4.3. Corrective or Preventive Actions
AS5577	4.5.3	The Network Operator shall implement relevant records management arrangements for the following: a) Control of documents, legislation, standards, codes, guidelines and procedures required for	2.4.7. Document Management

Source	Para	Originating Requirement	Response
		<p>the safe design, construction, commissioning, operation, maintenance and decommissioning of the network.</p> <p>b) Maintenance of asset records including, but not limited to, maps, databases, designs and as-built drawings.</p> <p>c) Maintenance of commissioning, operation, maintenance and audit records.</p> <p>d) Maintenance of records relating to the ENSMS and revisions to it.</p> <p>e) Systems for storage and retrieval of records.</p> <p>f) Accident/incident records.</p>	
AS5577	4.5.4	<p>The Network Operator shall establish procedures for planning and implementing audits to determine the Network Operator's compliance with, and the effectiveness of, the ENSMS's plans and procedures. System audits should also assess compliance with regulatory requirements and ensure the ENSMS adequately addresses these issues.</p> <p>The Network Operator shall consider the hazards identified and risks evaluated in the Formal Safety Assessment to ensure that audits evaluate-</p> <p>a) the effectiveness of the ENSMS in controlling the risks identified; and</p> <p>b) the effectiveness of the monitoring procedures in place to identify new or changed hazards and risks.</p>	<p>7.3. Internal Audits</p> <p>7.4. External Audit of Electricity Network SMS</p> <p>7.5. Audit Findings and Corrective Action</p>
AS5577	4.5.4	<p>Audits shall be performed by competent personnel who are independent of the section of the ENSMS being audited.</p>	<p>7.4. External Audit of Electricity Network SMS</p>
AS5577	4.5.4	<p>The audit procedures shall cover the timing of audits, including the conduct of external independent audits where chosen or where required by regulatory authorities.</p>	<p>7.4. External Audit of Electricity Network SMS</p>
AS5577	4.5.4	<p>Audit procedures shall cover arrangements for verifying the implementation and effectiveness of corrective and preventive actions designed to address any non-conformances identified during the audit.</p> <p>The outcomes of audits shall be subject to management review.</p>	<p>7.4. External Audit of Electricity Network SMS</p>
AS5577	4.6.1	<p>The Network Operator shall establish procedures for regular management review of the effectiveness and appropriateness of the ENSMS.</p> <p>N OTE: This should include review by the Network Operator of those elements of the ENSMS considered high risk, and take into account the outcomes from the various procedures covering the measurement and evaluation of elements of the ENSMS.</p> <p>The ENSMS shall be reviewed and, if necessary, updated at least every five years or in the event of any change to the ENSMS. This includes, for example, changes to legislative requirements, organizational structure and operational experience.</p>	<p>2.4.2. Periodic Review</p>
AS5577	4.6.2 para 1	<p>The Network Operator shall establish procedures for managing changes to the ENSMS, procedures, network design, construction, operation, maintenance and decommissioning so that they are made in a controlled manner, reviewed, recorded</p>	<p>2.4. Review and Modifications to the ENSMS</p>

Source	Para	Originating Requirement	Response
		and approved by the Network Operator.	
AS5577	4.6.2 para 2	Any change to the network or its operating context shall be reviewed and approved by the Network Operator. Change shall be considered to have taken place if the engineering design has been upgraded or modified. Change shall be considered to have taken place if any event or newly identified hazard initiates an operational, technical or procedural change in the measures to (as a minimum)- (a) protect the network and associated components; (b) promote public safety awareness of the network; (c) operate and maintain the network safely; (d) implement emergency response arrangements; (e) prevent or minimize loss of supply; (f) carry out required inspections; and (g) ensure that the plans and procedures continue to comply with the network 's engineering and design standards.	2.4. Review and Modifications to the ENSMS
AS5577	4.6.2 para 3	The change management procedures shall address implementation of any resulting ENSMS changes, including notification and training of staff impacted by the change and the allocation of responsibilities for any identified actions. The change management procedures shall also include communication of changes to relevant stakeholders.	3.6.8. Notification of changes
AS5577	A1	A Formal Safety Assessment shall- (a) consider hazards that might be associated with activities on or near the electricity network ; (b) comply with the principles of AS/NZS ISO 31000; (c) use specific, formal, structured and documented risk methodologies that are fit for purpose and appropriate to the electricity network/network elements under consideration ; and (d) ensure the involvement of relevant identified stakeholders in relevant stages of the Formal Safety Assessment.	1.3. Originating Requirement 5.5.10. Formal Safety Assessments
AS5577	A2	The context of the Formal Safety Assessment shall be established including preconditions, the external circumstances in which the assessment is being undertaken and the internal circumstances of the Network Operator's business and the electricity network, or part of the network, that is under consideration. The criteria for acceptance of residual risks shall be established.	1.3. Originating Requirement 5.5.2. Establishing the Context 5.5.3. Risk Identification
AS5577	A3.1	The Formal Safety Assessment shall identify electricity network hazards that could cause an electricity related incident and, as a minimum, consider- (a) safety related aspects of the loss of supply ; (b) electrical work on or near network assets; (c) other activities that may involve electrical hazards, including work being carried out in the vicinity of electrical assets; (d) single and multiple failure modes, including knock-on effects as appropriate; (e) the design of network assets and the condition and operating methodologies for electricity network assets;	1.3. Originating Requirement 5.5.4. Electrical Risk Register 5.5.5. Specific Hazards Nominated by AS5577

Source	Para	Originating Requirement	Response
		(t) external hazards and natural disasters; and (g) intentional and unintentional human activities.	
AS5577	A3.2	The Formal Safety Assessment shall analyse the risks associated with all identified hazards, shall regard relevant electricity industry data and evidence, and shall include the following: An analysis of the possible consequences of a hazard, including consequences to the network work force, the public, other stakeholders, and safety related environmental impacts. This shall include consideration of consequences that are reasonably foreseeable as well those that have actually occurred in previous known events. An analysis of the likelihood of these consequences occurring, having regard to the Network Operator's and electricity industry's relevant information on historical fault frequencies and the level of exposure of persons to the hazard . An estimation of the residual risks associated with a hazard.	1.3. Originating Requirement 5.5.4. Electrical Risk Register 5.5.5. Specific Hazards Nominated by AS5577
AS5577	A4	Risk control measures or treatments shall be applied in accordance with the standard hierarchy of controls, i.e. where reasonably practicable, hazards and their associated risks, including risks to the community, shall be eliminated as the first preference. Where it is not reasonably practicable to eliminate the risk, the Formal Safety Assessment shall specify the treatments or controls to be applied. Control is achieved by the application of multiple independent protective measures. Where treatments or controls are applied, physical/engineering controls should be used in preference to procedural/managerial controls. Controls are considered effective when the residual risks associated with that hazard have been reduced to as low as reasonably practicable (ALARP) at that location. The Formal Safety Assessment should identify opportunities for further safety improvement, even if risks have been assessed as being ALARP.	1.3. Originating Requirement 5. Safety Management (all)
AS5577	A5	The Formal Safety Assessment shall include the following: An evaluation of the risks against the risk acceptance criteria. Where the residual risk is not acceptable, treatment or controls, which may include redesign or relocation of network assets, shall be applied until an acceptable risk level is achieved.	1.3. Originating Requirement 5.5.7. Risk Acceptance Criteria 5.5.8. Risk Treatment – ALARP or SFAIRP 5.11. Formal Safety Assessments
AS5577	Appendix B	ALARP	1.3 Originating Requirement