



Sydney Trains Electricity Distribution Network

Safety Management System Performance Report

2020 – 2021

Version control

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1 Annual Performance Report

1.1 Introduction

This report presents the performance achieved by Sydney Trains' Electricity Network Safety Management System (ENSMS).

This report is produced in accordance with the Electricity Supply Safety and Network Management (ESSNM) Regulation 2014 and is based on the templates provided by the regulator (IPART) in their Electricity Networks Reporting Manual, September 2020.

- The reporting period for the ENSMS performance (Tables A.1... A.15) is 1 July 2020 to 30 June 2021, and
- The reporting period for bushfire preparedness (Tables B. ... B.4) is 1 October 2020 to 30 September 2021.

1.2 Context

Sydney Trains is the operator and maintainer of the electric passenger heavy-rail network throughout the greater metropolitan Sydney region as shown on Sydney Trains website at <https://www.transport.nsw.gov.au/sydneytrains>.

As an essential part of this enterprise, Sydney Trains operates a high-voltage electricity distribution network which provides reliable power to the railway assets including traction for the rolling stock, signalling and other infrastructure necessary for the safe operation of the railway.

In this context the "customer" is the railway network operation - Sydney Trains does not supply electricity to retail customers outside the rail corridor.

1.3 High-voltage distribution network scope

The high-voltage distribution network comprises electricity assets between "bulk supply points" (where electricity is received from the major network providers) and the equipment supplying traction power (1500VDC) and low-voltage.

Table A.2 includes electric shock and fatalities from low voltage (LV, 1500VDC as well as high-voltage (HV).

Table A.3-A.15 include data for the HV distribution network only; data is excluded for assets that do not form part of the HV distribution network, such as:

- 1500VDC traction assets,
- Rolling stock and all non-rail infrastructure, signalling, voice/data communications systems and facilities.

1.4 Data source

The performance statistics are extracted from Sydney Trains Enterprise Asset Management (EAM) system for the year ending 30th June 2021. Sydney Trains adopted EAM effective 1 July 2017 and consequently some legacy data is no longer available prior to that date. EAM is a single system developed to satisfy the needs of the whole railway enterprise and support long-term trend analysis; hence there are limitations on the data available for this report and in some tables the categorisations used do not entirely match those in the IPART manual.

2 Summary of Safety Performance Statistics

Incident statistics are reported in four groups as required by the IPART Reporting Manual, as depicted in figure 1 below.

Tier 1 and Tier 2 performance measures, which are lagging indicators, align with the network operator's incident reporting requirements and the objectives of the ESSNM Regulation. They are relevant to all network operators and reflect the outcomes achieved from the actions taken to manage risks associated with the regulatory objectives.

Tier 3 and Tier 4 performance measures, which are leading indicators, are also aligned with incident reporting requirements (where applicable) and are intended to monitor the risk controls that each network operator has put in place as articulated through its SMS Formal Safety Assessments. Tier 4 measures are leading indicators that monitor operational activities associated with maintaining the control environment. Tier 3 measures are leading indicators that signal the potential for a Tier 1 or 2 incident to occur.

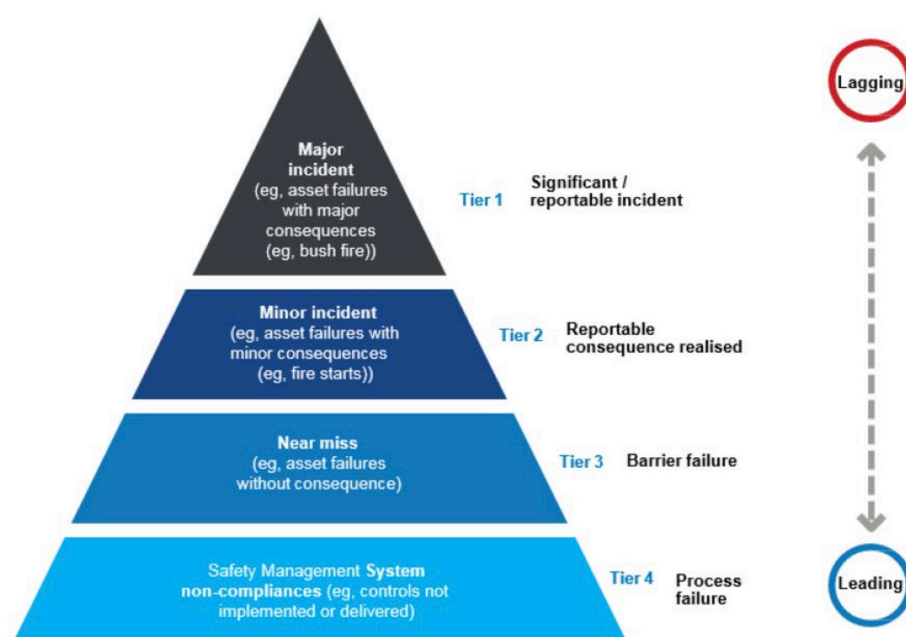


Figure 1 - Incident Tiers defined by IPART

Tier	Refer	Summary of Performance Statistics – 2021
1	Major incidents with consequences >\$500k	Table A.1 None
2	Minor incident - reportable consequence realised	Table A.2 1 - deliberate act by member of the public - unauthorised access in the rail corridor - resulted in fatality from contact with 1500VDC.
3	Barrier failure – asset failures without consequence and control failure near misses	Tables A.3 – A.5 as per tables below, nil items of note
4	Process failure – controls not implemented or delivered	Tables A.9-A.15 as per tables below, nil items of note

Table A.1 - Major Incidents

Tier 1 incidents are defined as a 'Major Incident' in accordance with the Electricity networks reporting manual – Incident reporting (Reporting Manual - Incident Reporting).

ESSNM Objective		Description of each major incident reported
Safety of members of the public		None
Safety of persons working on the network		None
Protection of property	Third-party property	None
	Network property ^A	None
Safety risks arising from loss of electricity supply ^B		None

Notes:

- A. For the purpose of this report, a “major incident” involves losses exceeding \$500,000 in relation to damage caused to electricity works as defined in the IPART Reporting Manual.
- B. As defined for major reliability incidents in IPART's Reporting Manual incident reporting requirements.

Table A.2 – Safety Incidents

Tier 2 incidents are defined as an 'Incident' in accordance with the IPART Reporting Manual - Incident Reporting.

ESSNM Objective		Description of each major incident reported
Safety of members of the public	1	Deliberate act by member of the public - unauthorised access in the rail corridor - resulted in fatality from contact with 1500VDC.
Safety of persons working on the network	0	None
Protection of third party property	0	None
Safety risks arising from loss of electricity supply	0	None

Table A.3 - Network asset failures

Performance Measure	Population	5-year average annual functional failures ^{A,F}	Annual functional failures for reporting period					
			Unassisted ^A			Assisted ^A		
			No fire	Fire		No fire	Fire	
				Contained	Escaped		Contained	Escaped
Towers	0	0	0	0	0	0	0	0
Poles (including street lighting columns/poles & stay poles)	12477	12	6	0	0	1	0	0
Pole-top structures	N/A	24	18	0	0	0	0	0
Conductor - HV OH (including sub-transmission) ^{A, B, C}	921km	41	15	0	0	5	0	0

Performance Measure	Population	5-year average annual functional failures ^{A, F}	Annual functional failures for reporting period					
			Unassisted ^A			Assisted ^A		
			No fire	Fire		No fire	Fire	
				Contained	Escaped		Contained	Escaped
Conductor - HV UG (including sub-transmission) ^{A, C}	403km	5	2	0	0	4	0	0
Conductor - LV OH ^{A, C}	N/A	2	1	0	0	0	0	0
Conductor - LV UG ^{A, C}	N/A	2	0	0	0	1	0	0
Power transformers ^D	286	28	6	0	0	0	0	0
Distribution transformers	284	11	4	0	0	1	0	0
Reactive plant ^E	89	3	0	0	0	0	0	0
Switchgear - distribution (Overhead)	0	28	5	0	0	1	0	0
Switchgear - distribution (Ground based)	1234	37	34	0	0	0	0	0
Protection relays or systems	2698	10	15	0	0	0	0	0
Substation SCADA system	260	11	15	0	0	2	0	0
Protection Batteries	1170	8	9	0	0	1	0	0

Notes:

- A. Refer Glossary for definitions and acronyms.
- B. Transmission and sub-transmission voltages are generally 33kV AC nominal and above. Transmission conductors form part of a transmission network. Sub-transmission conductors form part of a distribution network.
- C. Overhead service and underground service as defined in the NSW Service and Installation Rules.
- D. Power Transformers are transformers where the secondary/output voltage is 5kV nominal or above.
- E. Reactive plants are reactors and capacitors.
- F. Average based on actuals for the past 5 years.

Table A.4 - Vegetation contact with conductors

Performance measure	Event count - Current reporting period	Event count 2020-21	Event count 2019	Event count 2018	Event count 2017
Fire starts – grow-in	0	0	0	0	N/A
Fire start – fall-in and blow-in	0	0	0	0	N/A
Interruption – grow-in	1	1	8	7	N/A
Interruption – Fall-in and blow-in	1	1	2	4	N/A

Table A.5 - Unintended contact, unauthorised access and electric shocks

Detail	Event count - Current reporting period	Event count 2020	Event count 2019	Event count 2018	Event count 2017
Electric shock and arc flash incidents					
Public	1 ^a	0	4	N/A	N/A
Public worker	0	0	0	N/A	N/A
Network Employee / contractor	1 ^b	3	4	4	N/A
Accredited Service Provider	0	0	0	N/A	N/A
Livestock or domestic pet	0	0	0	1	N/A
Contact with energised overhead equipment					
Public road vehicle	0	2	2	1	N/A
Plant & equipment	1 ^c	3	2	3	N/A
Agricultural or other	0	1	0	0	N/A
Network vehicle	0	0	0	0	N/A
Contact with energised underground equipment					
Plant & equipment	0	1	2	1	N/A
Person with hand tool	1 ^d	0	3	0	N/A
Unauthorised access					
Distribution Substations	0	4	10	8	N/A
Towers/poles	3 ^e	2	4	0	N/A
Other (e.g. communications equipment)	0	0	0	0	N/A
Safe Approach Distance					
Structure/materials infringing SAD / Easement ^f	1 ^f	3	2	3	N/A
Network employee / contractor	0	4	3	3	N/A
Public	0	0	0	0	N/A
Public worker	0	0	2	0	N/A
TOTAL	8	23	32	28	

Notes:

- All electric shocks are reported except those resulting from static discharge or defibrillators, where the system is nominally extra low voltage or involving the DC rail traction system.
- Incidents that result in a burn or other injury requiring medical treatment resulting from exposure to an arc.
- Events caused by network assets, network asset defects or network activities, including shocks received, are reported. Installation events not associated with network assets are not reported.
- Includes all classes of authorised persons (network employee and network contractor).
- Does not normally include contact with a pole, pillar, distribution substation etc, unless the contact results in subsequent contact with an energised asset.
- Includes plant and equipment packed up for travel (ie, plant travelling on a public road to or from worksite).

In 2020-2021 the incidents include:

- 1 incident of unauthorised access to 1500VDC equipment by a member of the public, resulting in a fatality;
- 1 electric shock received by a worker from induced voltage on a high-voltage aerial line;
- 1 incident involving a crane making contact with a HV feeder;
- 1 incident involving a worker digging with hand tools exposing an underground cable;
- 3 incidents involving unauthorised drilling/excavation near underground cables and materials stockpiled under aerial lines; and
- 1 incident involving an undocumented feeder owned by another network operator crossing in close proximity to a Sydney Train HV feeder.

Table A.6 & A.7 – Reliability and Quality of Supply

Sydney Trains does not collect data in respect of quality of supply for the high-voltage distribution network as the system is inherently dedicated to supplying the railway (i.e. signalling and rolling stock) and the railway has its own standards for those which differ from consumer electricity standards.

Network reliability is measured in the form of "delay-minutes" to rolling stock for the 1500VDC supply to rolling stock; these events pose a business risk, not a safety risk. Short disruptions in the 1500VDC supplies to signalling and rolling stock are frequent events (daily) and the network includes redundancy to accommodate these with no operational impact.

Table A.8 - Network-initiated property damage events

Detail	Event count - Current reporting period	Event count 2020	Event count 2019	Event count 2018	Event count 2017
Third party property (assets including vehicles, buildings, crops, livestock)					
Damage (e.g. Fire, physical impact or electrical)	0	0	0	0	N/A
Network property (including non-electrical assets, vehicles, buildings)					
Damage (e.g. Fire, physical impact or electrical)	0	0	0	0	N/A

Note:

- This excludes assets destroyed in 2019-2020 bushfire season (refer ENSMS Performance Report 2019-2020 section Table A1 for details).

Table A.9 - Amendments and improvements to Formal Safety Assessments (FSA) or Associated Risk Treatments

FSA	Amendment / Improvements
Safety risks arising from Loss of Supply	Completed and audited in October 2020. FSA referred to Risk Division and Sydney Trains Executive for acceptance and inclusion in the corporate risk register in late 2021.
Safety risks to Workers and Public	Ongoing minor updates to the bow-tie tables to document causes & controls.
Safety risks arising from Bushfire	Completed and audited in October 2020. Added guidance concerning the assessment of asset conditions.

Table A.10 - Design, construction and commissioning

Performance Measure	Event count - Current reporting period	Event count 2020	Event count 2019	Event count 2018	Event count 2017
Project closeout reports completed	166	78	47	3	N/A
Project closeout reports audited	0	0	1	2	N/A

Sydney Trains uses the number of “approved installations connected” as a metric of the changes on the network – this is the nearest equivalent to “projects” in the sense described in the IPART manual. This includes LV, 1500VDC and HV installations by Sydney Trains, TfNSW and Authorised Engineering Organisations. The Electricity Distribution Unit inspects all electrical installations prior to energisation. In previous years, only project count was reported, in 2020-21 onwards, the report is accounting for approved installations.

Table A.11 - Asset inspections

Performance measure	Inspection tasks		Corrective action tasks Open = inspections planned and not overdue, Outstanding = inspections overdue.		
	Annual Target	Achieved	Tasks identified (all categories)	Open	Outstanding
Transmission substation	0	0	0	0	0
Zone substations	0	0	0	0	0
Distribution substation	10806	10197	1793	428	128
Transmission OH	0	0	0	0	0
Transmission UG	0	0	0	0	0
Distribution OH	4792	3018	3063	723	666
Distribution UG	179	149	23	8	9

All outstanding inspections are planned to be completed by 15 December 2021.

Table A.12 – Inspections (vegetation) aerial or ground based

Performance measure	Population (Feeders)	Target (poles)	Achieved	Outstanding	Comments
Inspections – North Region	33 Feeder	2302	2302	0	
Inspections – Blue Mountains	23 Feeders	2064	2064	0	
Inspections – South & Illawarra	13 Feeders	721	721	0	
Inspections - Metropolitan	0 Feeders	0	0	0	
Inspections - Total	69 Feeders	5087	5087	0	

Sydney Trains has completed its inspection (vegetation) program as at 30th September, with zero inspections outstanding. The “regions” above refer to the maintenance territories. Within the metropolitan region Sydney Trains has no aerial lines in bushfire-prone areas.

Table A.13 – Public electrical safety activities

Network operator public safety programs / campaigns	Details
Public Safety	Rail Safety Week 2021 included sessions for electrical safety awareness for the general public and ordinary persons (i.e. workers across the transport cluster without electrical accreditation).
Look-Up & Live	Sydney Trains is aware of the Look-up & Live website and is reviewing arrangements to contribute to this initiative

Table A.14 – Internal audits performed on any aspect of the ENSMS

Audit scope	Identified non-conformances	Actions
No internal audits in 2020-2021	N/A	N/A

Table A.15 – External audits performed on any aspect of the ENSMS

Audit scope	Identified non-conformance	Actions
The extent to which Sydney Trains has rectified all the outstanding non-compliances noted in GHD Advisory's (GHD) audit report titled <i>Electricity Network Safety Management System (ENSMS) Audit Sydney Trains</i> , dated 13 June 2019 (Audit Report)	None	None

3 Bushfire Preparedness Status

3.1 Bushfire risk profile across network operator's supply area

Sydney Trains has mapped its electricity distribution network (figure 2, below) and assessed the risk present at each pole location, based on the local conditions (local terrain, vegetation, soil type, wind) and the proximity of urban development potentially at risk. The risk is assigned a priority (1 = highest, 4 = lowest) at each pole and used to prioritise the planning of inspections, maintenance and the treatment of hazard trees. This includes both the **risk from** fires caused by network assets to external property and lives, as well as the **risk to** the network (with the potential to disrupt rail services and destroy assets) from external fires.

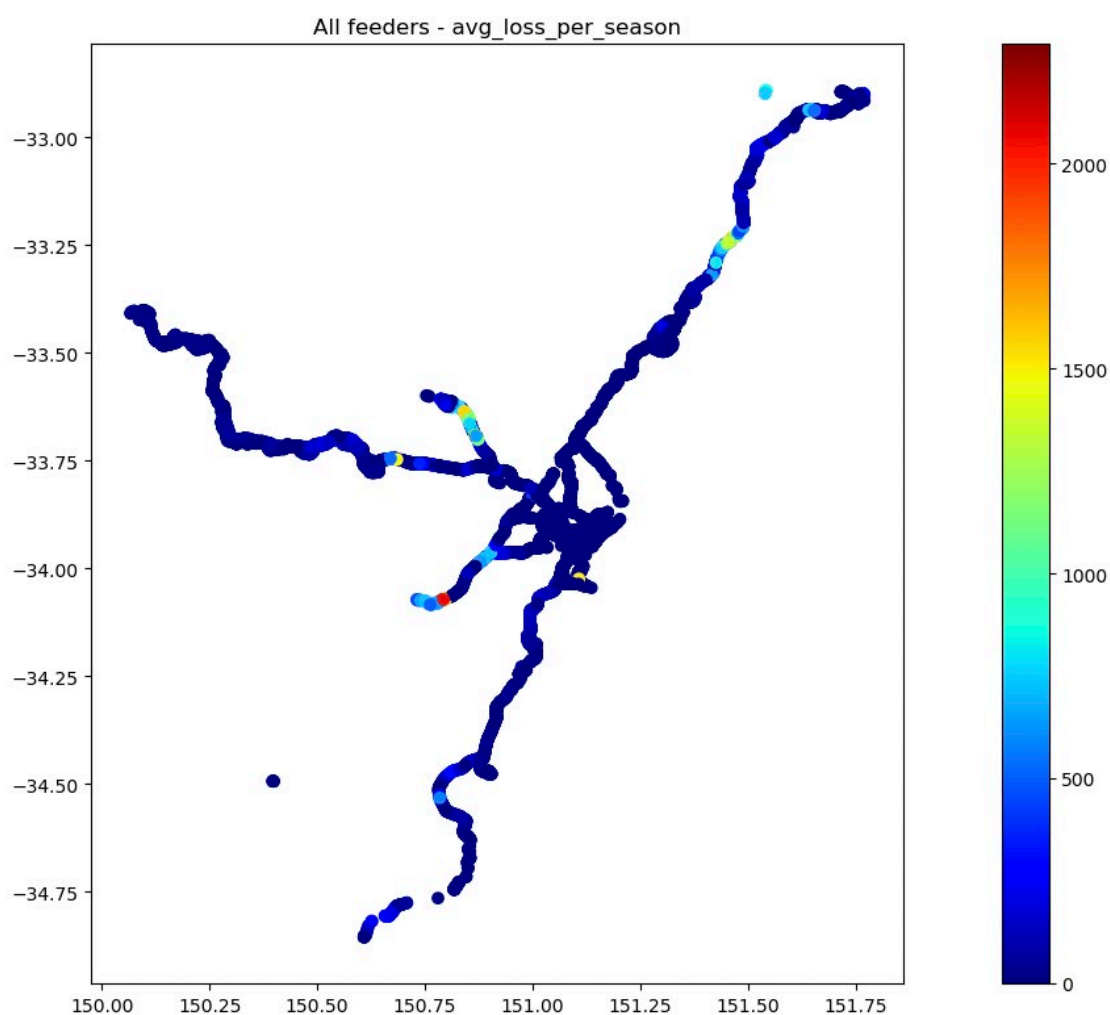


Figure 2. Map of the bushfire risk profile of the Sydney Trains network.

Figure 2 provides an overview of the average season bushfire risk profile for the network. In figure 1 the X-Y axes are longitude and latitude, respectively, while the colour coding represents risk (blue lowest, red highest). Key risk areas include:

- In the North, pockets of elevated risk where the feeder routes pass through or adjacent to the blue-gum forest at Cheltenham, Lane-Cove National Park, and national parks between Asquith and Woy-Woy;
- In the West, the risk extends from Emu Plains to the outskirts of Lithgow;

-
- In the South, where the feeder routes pass through Royal National Park and small pockets of dense vegetation near Stanwell Park.
 - Along the Illawarra route - is a mid-range risk in one small area, but generally the risk is not as high as it is further inland.

3.2 Bushfire risk management

Bushfire risk management activities are detailed in Sydney Trains Bushfire Risk Management Plan, published on RAILSAFE. There are three key aspects:

- Periodic inspections of the assets to identify potentially hazardous conditions or defects;
- Periodic inspection of the vegetation to identify:
 - trees near aerial lines,
 - ground-level vegetation around poles, and
 - hazard trees with the potential to fall or drop branches on aerial lines.
- Planned removal of the defects identified.

Sydney Trains defect targets are:

- Zero defects outstanding in priority 1 or 2 locations by 30 September,
- Zero defects (other categories) outstanding by 15 December.

As at 30 September 2021:

- Sydney Trains has completed its inspection program, with zero inspections outstanding;
- All activities in priority 1 and 2 locations have been completed, and
- There are 642 asset maintenance activities open (planned), with 120 outstanding in low-risk locations, these are expected to be completed by 30 November.

3.3 Permanent / temporary declaration of areas by Rural Fire Service and network operator's actions

Sydney Trains did not receive any directions from the Rural Fire Service in the reporting period.

Table B.1 – Aerial consumer mains on bush fire prone private land

Sydney Trains has no private LV lines on private land and no HV customers.

Table B.2 – Pre-summer bushfire inspections

Performance measure	Population (Feeders)	Target (poles)	Achieved	Outstanding
Inspections – North Region	33 Feeder	2302	2302	0
Inspections – Blue Mountains	23 Feeders	2064	2064	0
Inspections – South & Illawarra	13 Feeders	721	721	0
Inspections - Metropolitan	0 Feeders	0	0	0
Inspections - Total	69 Feeders	5087	5087	0

Table B.3 – Vegetation Tasks

Region	Vegetation Defects - by bushfire risk priority			
	1 (worst) Defects to be completed between 1-7 days	2 Defects that are to be completed between 8-31 days.	3-4 Defects to be completed after 31 days or more.	Hazard Trees
North - Central Coast				
Open	0	0	587	26
Outstanding	0	0	0	0
Blue Mountains				
Open	0	15	455	53
Outstanding	0	0	0	0
South & Illawarra				
Open	0	0	140	7
Outstanding	0	0	0	0
Metropolitan		0		
Open	0	0	0	0
Outstanding	0	0	0	0
Defects - Total	0	15	1182	86

All open hazard trees and category 2 vegetation defects are planned to be treated by 30 November 2021, all category 3 to 4 vegetation defects are planned to be completed by 15 December 2021 through a risk-based approach.

Table B.4 - Network asset tasks

Region	Asset tasks - by bushfire risk priority		
	1 (worst) Defects to be completed between 1-7 days	2 Defects that are to be completed between 8-31 days.	3-4 Defects to be completed after 31 days or more.
North - Central Coast			
Open	2	2	118
Outstanding	0	0	0
Blue Mountains			
Open	0	1	378
Outstanding	0	0	118
South & Illawarra			
Open	0	0	26
Outstanding	0	0	2
Metropolitan			
Open	0	0	0
Outstanding	0	0	0
Defects - Total	2	3	642

Note: The data in table B.4 is as at 30 September. The defects open in Cat 1 and 2 locations are now closed. Defects in Cat 3-4 locations are planned for completion as per the rules define.

4 Notes

4.1 Glossary

The following abbreviations, acronyms and definitions are used in this report.

AS	Australian Standard
assisted failure	a functional failure of a piece of equipment where the equipment was subject to an external force or energy source against which the standards for design and maintenance do not attempt to control (see also <i>unassisted</i>)
EAM	Enterprise Asset Management (system), a whole-of-business data system adopted by Sydney Trains
ENSMS	Electricity Network Safety Management System
ESSNM	Electricity Supply (Safety and Network Management) Regulation 2014
FSA	Formal Safety Assessment
HV	high voltage, nominal voltage 1kV AC and above
IPART	Independent Pricing and Regulatory Tribunal of NSW, a state government authority
LV	low voltage, nominal voltage below 1kV AC, nominal
N/A	Not Available / Not Applicable
OH	overhead
overhead service	as defined in the NSW Service and Installation Rules
power transformers	transformers where the secondary/output voltage is 5kV nominal or above
reactive plants	Includes reactors and capacitors
SAD	Safe Approach Distance
TfNSW	Transport for New South Wales, a state government authority
UG	underground
unassisted failure	a functional failure of a piece of equipment where the cause of the failure is neither an assisted failure nor a maintenance-induced failure.
underground service	as defined in the NSW Service and Installation Rules
WHS	Workplace Health & Safety

4.2 Referenced Documents

	Electricity Supply (Safety and Network Management) Regulation 2014
	Electrical Networks Reporting Manual, IPART, August 2018
AS5577-2013	<i>Electricity network safety management systems</i>
ISSC20	<i>Guideline for the Management of Activities within Electricity Easements and Close to Electricity Infrastructure</i>

5 Appendix A – Endorsement

Annual ENSMS Performance Report for 2020-2021

Submitted by Sydney Trains ABN 38 284 779 682

To: The Chief Executive Officer
Independent Pricing and Regulatory Tribunal
PO Box K35
Haymarket Post Shop
NSW 1240

Sydney Trains reports as follows:

1. This report documents the performance of Sydney Trains Electricity Network Safety Management System during the year 2020-2021 with all obligations to which Sydney Trains is subject to under the Electricity Supply (Safety and Network Management) Regulation 2014.
2. This report documents compliance with bushfire preparedness requirements for the period 1 October 2020 through to 30 September 2021.
3. This report has been prepared by Sydney Trains with all due care and skill in full knowledge of conditions to which it is subject and in compliance with IPART's Electricity Network Reporting Manual.
4. This report provides information on all obligations with which Sydney Trains did not fully comply during the financial year 2020-2021.
5. This compliance report is approved by the Chief Executive:

Date: 26 October 2021
.....

Signed: 
.....

Name: Matt Longland

Designation: CE Sydney Trains