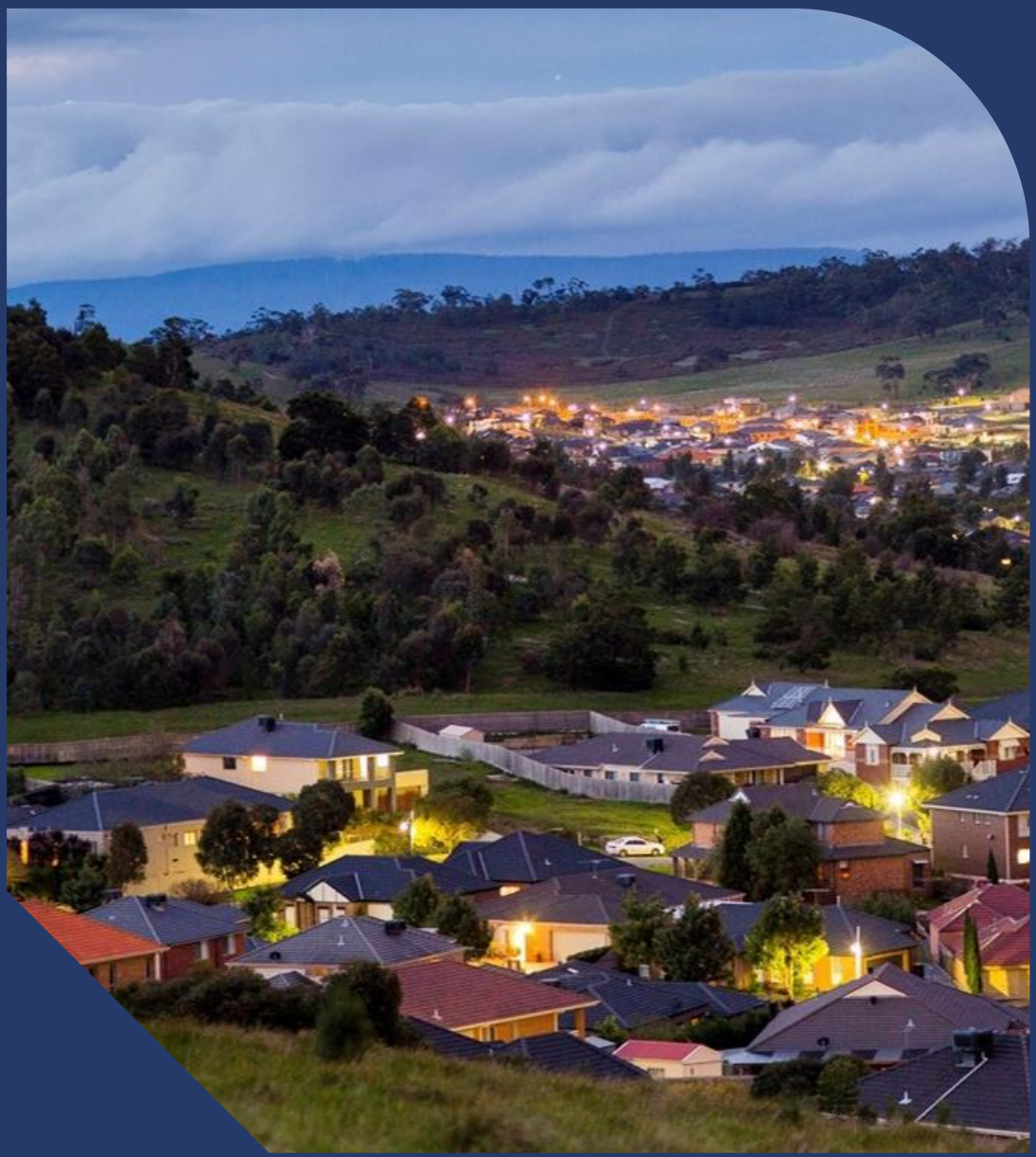
AusNet

Enhanced Network Safety Strategy

AMS Electricity Distribution Network



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Document number:	AMS 20-13
Issue number:	12
Status:	Draft
Approver:	R Jones
Date of approval:	31 January 2025

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1. Executive Summary

The purpose of the Enhanced Network Safety Strategy is to provide a consolidated view of the outputs of the Electricity Safety Management Scheme (ESMS), the Asset Management Strategy (AMS), the Bushfire Mitigation Management program and the Health, Safety, Environment and Quality (HSEQ) Management System view with regards to network safety for AusNet's electricity distribution network.

The programs described in this document are designed to provide incremental improvements to network safety. These programs complement business as usual work programs that identify asset replacements through condition based cyclic inspection of overhead line assets and condition assessments for zone substation primary and secondary assets which are designed to maintain network safety.

Analysis of network performance and incident data has identified a number of proactive replacement programs as the most effective and cost-efficient means of enhancing community and business health and safety outcomes against key operating environment risk drivers of climate change and increasing age of assets.

Table 1 provides a summary of the enhanced network safety programs for the upcoming 2026-2031 regulatory period.

Table 1: Enhanced Network Safety Programs

Enhanced Network Safety Program	Description
Service Cables	• Condition driven program - based on advanced metering infrastructure (AMI) data) • Volumes estimated on historical replacement rates
EDO fuse targeted replacement	• Targeted risk-based replacement program • Approximately 1,750 fuses per year
Overhead Conductor	• Targeted risk-based replacement program • Approximately 290km per year
Codified Areas SWER	• Insulating and undergrounding approximately 200km of SWER line in Codified Areas. Project contingent on funding approval in 2026-31 EDPR.
Conductor Spacers and Circuit Clearances	• Program has been completed
Government Funded Conductor Replacement	• Refer to BFM 10-01 Bushfire Mitigation Plan
Crossarms	• Condition based replacement program • Approximately 2,000 crossarms per year
Bird and Animal Proofing	• Reactive program • Volumes estimated on historical replacement rates
Rapid Earth Fault Current Limiter program	• As per REFCL program

Enhanced Network Safety Program	Description
Vegetation Management – Hazard Trees	• Based on inspections • Seeking $3m per annum uplift through opex step change targeting further hazard tree reduction for the 2026-31 regulatory period.
No Go Zones	• Continued support of public awareness programs
Overhead Conductor Ground Clearance	• Reactive program • Forecast based on historical expenditure
Asbestos	• Addressed as part of planned zone substation refurbishment projects
Lattice Towers – Fall arrest systems	• OH&S program
Explosive Failure	• Asset replacement programs informed by risk models
SWER Earths	• Earthing replaced due to fault or failure at inspection.
SWER Conductors	• Proactive Insulation/undergrounding of SWER conductor (Codified Areas) • SWER Condition/risk based replacement (Fire Loss Consequence).
Polyphase Conductors	• Polyphase Condition/risk-based replacement (Fire Loss Consequence).
Early Fault Detection	• Target non-visual defects. • 1800 devices across high consequence areas.

2. Introduction

2.1. Purpose

The purpose of this document is to provide a consolidated overview of the programs that deliver enhanced network safety to the public and employees.

2.2. Scope

This document describes the key programs designed to improve network safety outcomes and to mitigate key safety risks as far as practicable.

Network safety results from many elements of asset management including standards, design, operation, construction and maintenance. This document is not intended to describe how safety is incorporated into each asset management element in business as usual maintenance of safety outcomes.

2.3. Asset Management Objectives

As stated in AMS 01-01 Asset Management System Overview, the high-level asset management objectives re:

- Comply with legal and contractual obligations;
- Maintain safety;
- Be future ready;
- Maintain network performance at the lowest sustainable cost; and
- Meet customer needs.

As stated in AMS 20-01 Electricity Distribution Network Asset Management Strategy, the electricity distribution network objectives are to:

- Improve efficiency of network investments
- Maintain long-term network reliability
- Implement REFCLs within prescribed timeframes
- Reduce risks in highest bushfire risk areas
- Achieve top quartile operational efficiency
- Prepare for changing network usage.

2.4. Asset Management Strategy

As a consequence of the high exposure of the public to the electricity distribution network assets, implementation of a continuous improvement methodology to maintain or enhance network safety is a key asset management strategic objective and a requirement of the Electricity Safety Act's Electricity Safety Management Scheme (ESMS).

AusNet's score program for asset replacement and refurbishment involving assets with greatest exposure to the public is based primarily upon asset condition, which is determined through cyclic line inspection and testing programs.

The Enhanced Network Safety Plan assumes this core asset management activity continues and recommends a range of additional asset replacement and refurbishment programs that would not otherwise be identified through condition based asset inspection cycles or zone substation plant condition assessments.

An aspirational objective of the asset management strategy is to reduce the annual number of network related incidents reported to Energy Safe Victoria (ESV) by 20% per regulatory period following the guiding regulatory principle of the ESMS of reducing risk as far as practicable.

Review of network asset performance data provides the ability to perform root cause analysis of incidents in order to understand the failure mechanisms and drivers behind asset failures and is fundamental to achieving AusNets' asset management objectives.

2.5. Electrical Safety Management Scheme (ESMS)

Management of risks associated with network related incidents is achieved through AusNet's Electricity Safety Management Scheme (ESMS), which has been a legislative requirement since 2010.

AusNet's ESMS seeks to enhance network safety outcomes and comply with the *Electricity Safety (Management) Regulations* through identification of network asset performance risks and implementation of asset management strategies that manage risk *as far as practicable*.

Cost-effective utilisation of resources to obtain optimum reduction of risk is achieved through a prioritisation process using AusNet's corporate risk management framework, which is consistent with AS/NZS ISO 31000:2018 *Risk management –Guidelines*.

For each asset class identified as contributing significantly to the frequency of network related incidents, a strategy has been developed that identifies a range of maintenance and replacement strategies to manage the risks.

Analysis has revealed that accelerated replacement of selected assets can efficiently and effectively lead to a reduction in safety incidents. This involves replacing assets in high-risk areas with new assets. These new assets either have a lower probability of failure or are technically superior.

2.6. Bushfire Mitigation

AusNet's Bushfire Mitigation Management program is a mature and integral part of the ESMS and facilitates the identification and quantification of the causes of fire ignition incidents on the network.

The Bushfire Mitigation Management program provides a focused and continuous improvement program directed at those assets in hazardous bushfire risk areas (HBRA) and meets the objectives of the *Electricity Safety (Bushfire Mitigation) Regulations*.

2.7. Health and Safety

Our missionZero journey began in April 2011 when our leadership team committed to the missionZero program to ensure that everyone gets home from work safely. Since 2011 we have seen a continuous improvement in our Safety Culture as well as our Injury Rates, however feedback across the business was that missionZero need to be updated and take into account wellbeing of our people as well as other aspects. In 2022, with the help from representatives from across AusNet, the missionZero program was evolved to its next stage to become a more holistic program taking in Safety, Wellbeing and the Environment. MissionZero will continue to evolve over time to meet our business, employee, community, and environmental needs as we progress on our journey towards achieving our missionZero Strategy.

At AusNet we care for our people, customers & the environment and believe that they should be in a better state at the end of the day than when they started it. We have a relentless pursuit for keeping our people safe and achieving our missionZero strategy.

Why missionZero?

- We never compromise on safety and we genuinely care for the wellbeing of people, our customers and the environment.
- It is this mindset that drives us to ensure there are no negative impacts on our families and communities as a result of our business operations.
- To achieve our safety vision, our mission must be to work together to implement a common strategy with unified purpose and consistency of attitude.

3. Risk Assessment

3.1. Introduction

Identification of business health and safety risks requires the identification of the likelihood and consequence of events through quantitative, semi-quantitative or qualitative processes in accordance with AusNets' corporate Risk Management Policy and Framework and AS/NZS ISO 31000:2018.

Groups and/or individuals exposed to health and safety risks through AusNets' business operations are the public and employees.

Risk to the public is primarily managed and controlled through AusNets' ESMS and Bushfire Mitigation processes, whilst risk to employees is monitored and controlled through AusNets' HSEQ Management System.

A comprehensive process of risk identification and assessment is conducted to inform the five yearly revision of the ESMS, which is submitted to ESV for acceptance.

The resultant risks are recorded in a register and reviewed on a regular basis. New risks subsequently identified are also included in this register.

Risks assessed as Level A or Level B are recorded and managed through AusNets' corporate risk management information system (Enablon).

3.2. Serious Electrical Incidents

Serious electrical incidents, including electric shocks, are recorded through AusNets' Incident Management System (Enablon).

The Network Safety Management Committee is responsible for monitoring network performance trends together with identification and implementation of asset management strategies designed to manage risk *as far as practicable*.

The Electricity Safety Act 1998 defines "serious electrical incident" to mean:

> *An incident involving electricity which causes or has the potential to cause –*
>
> *(a) the death of or injury to a person; or*
> *(b) significant damage to property; or*
> *(c) a serious risk to public safety;*

The Electricity Safety (Management) Regulations 2009 require the reporting of electrical incidents:

> *…if the incident –*
>
> *(a) causes the death of or injury to a person; or*
> *(b) causes significant property damage; or*
> *(c) causes significant disruption to the community; or*
> *(d) involves a transmission line; or*
> *(e) involves an imminent risk of electrocution.*

Serious electrical incidents are categorised in accordance with established criteria and reported to Energy Safe Victoria (ESV).

In current year 2024 AusNet reports approximately 235 serious electrical incidents. Of this total, approximately 225 can be attributed to network related incidents.

Figure 2 shows the causes of network related serious incidents, excluding electric shock, by cause.

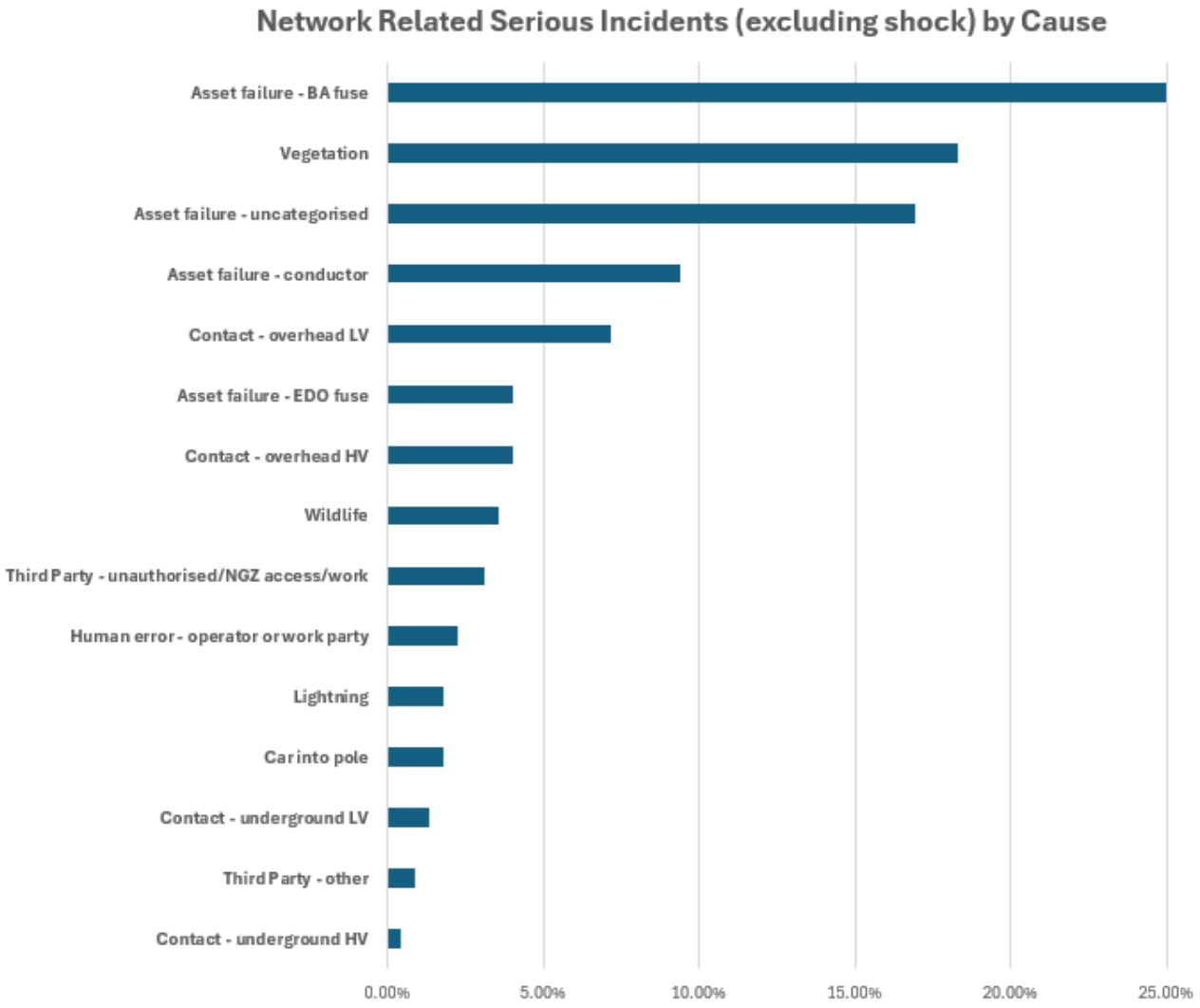


Figure 2: December 2023 – December 2024[1]

Figure 3 shows the number of network related electrical shock incidents. Currently AusNet Services reports approximately 25 network related electric shock incidents per annum (four year average).

[1] Osiris DataExtract – 2023-12-11-2024-12-11

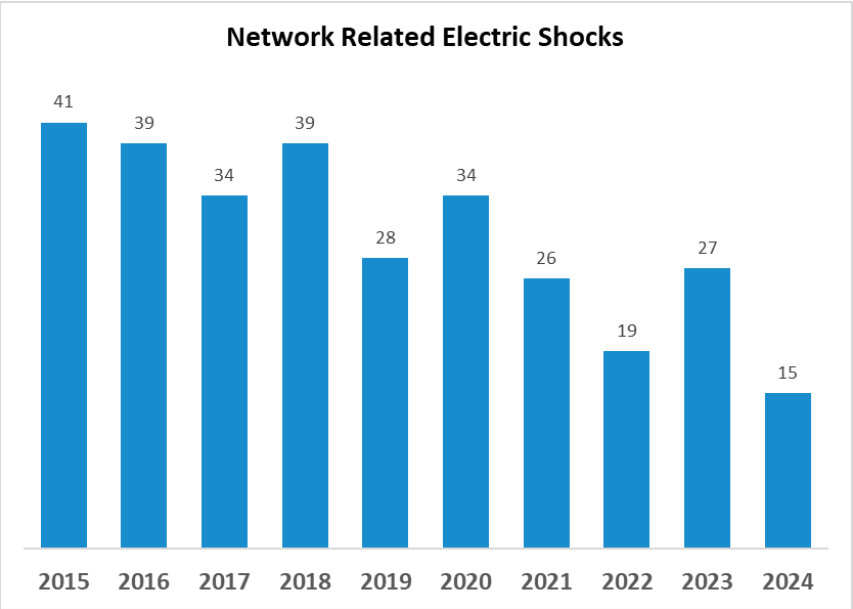


Figure 3: 2015 - 2024

Figure 4 identifies the mix of causes contributing to electrical shocks.

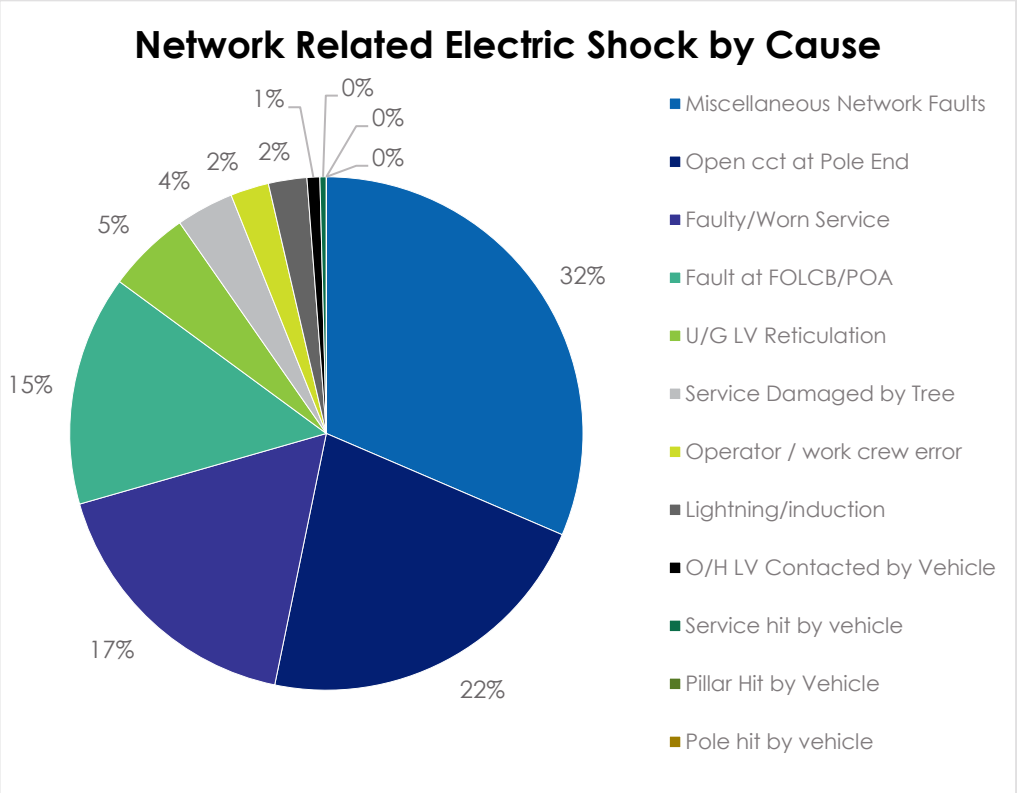


Figure 4: 2015 - 2024

Electric shock incidents are typically caused by defective neutral connections to customer premises. This KPI is reported one month in lag and profiled against a moving 12-month average of confirmed loss of neutral related to the network.

Service cable failures are the primary cause for network related electric shock incidents reported to ESV and are discussed in more detail in Section 4.1.

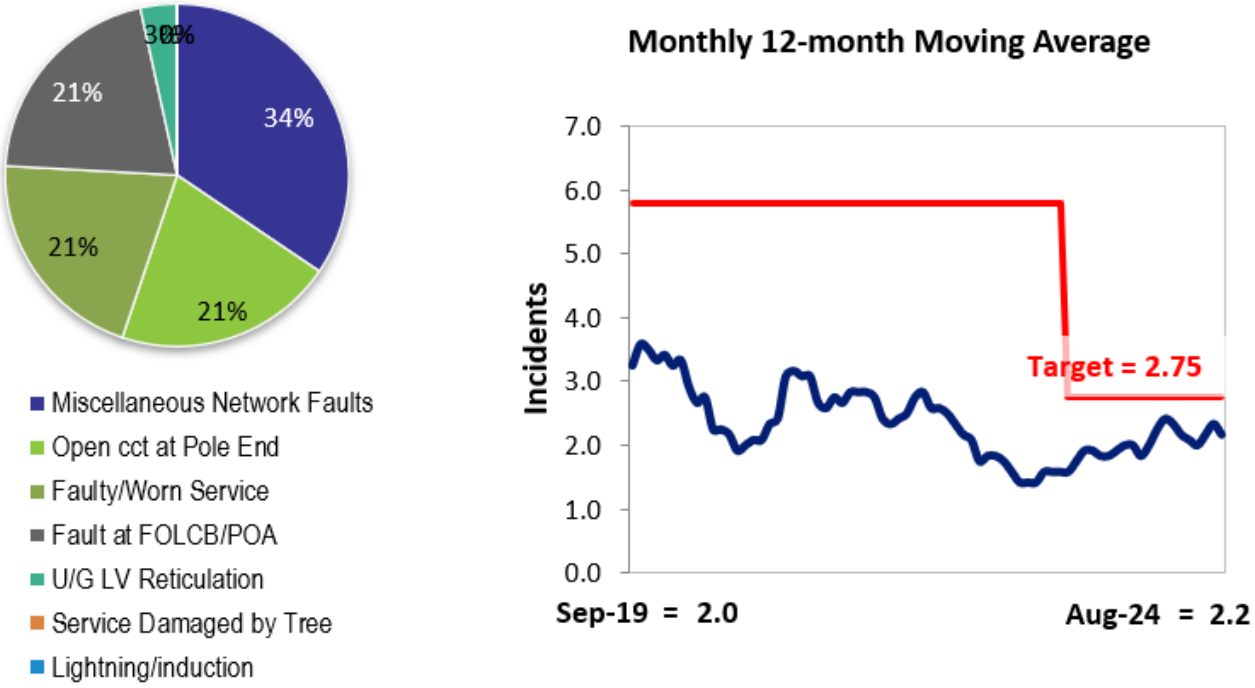


Figure 5: Electric Shock Incidents, Monthly 12 Month Moving Average & Causes[2]

HV fuses (Boric Acid and Expulsion Drop Out) are the primary cause for other serious incidents reported to ESV and are discussed in more detail in Section 4.2.

AusNet Services also has a focus on reducing the number of asset and ground fires. Figure 6 shows the number of fire start serious incidents reported to ESV. The four year average for asset fires is 77 and for ground fires the four year average is 60.

[2] Network Safety Report September 2024

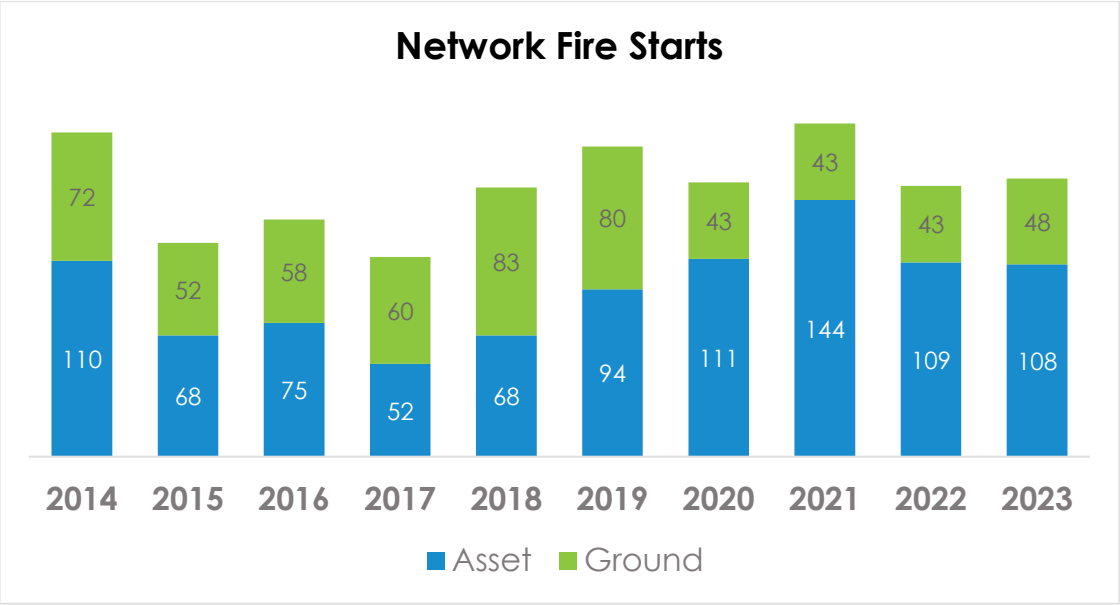


Figure 6: December 2024[3]

Fires can occur on the assets themselves (such as a timber pole fire) or can be ignited on the ground adjacent to the network. Both asset and ground fires are monitored by the Network Safety Management Committee.

The causes of asset fires and ground fires are shown in 7 and Figure 8 respectively.

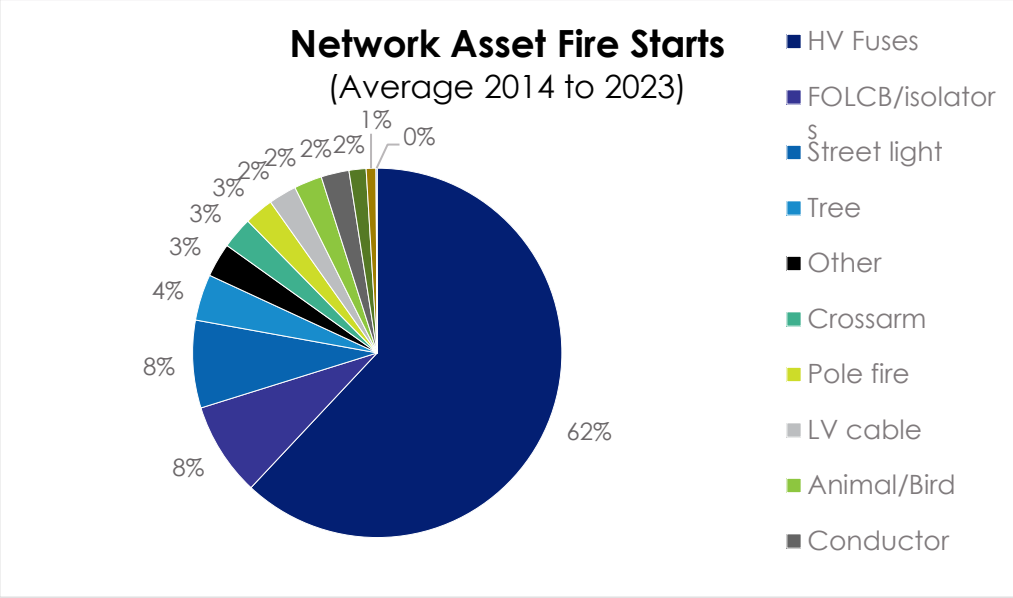


Figure 7: December 2024

[3] 2024 Update References

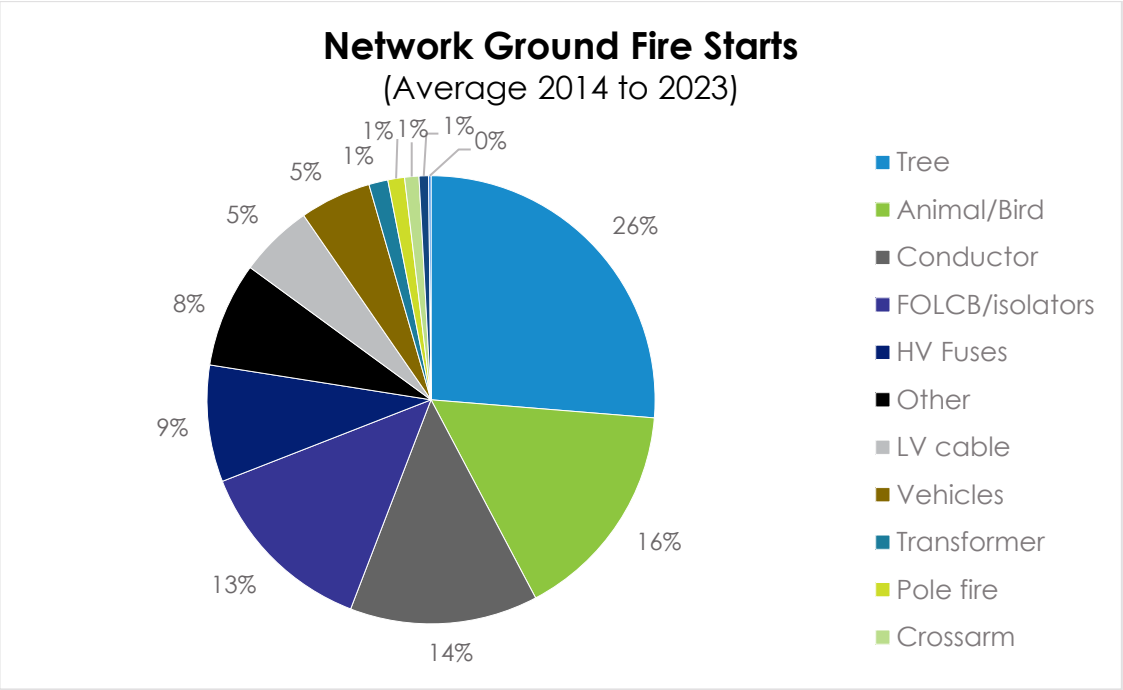


Figure 8: December 2024

Many asset failures do not lead to ground fires and therefore the consequence of these asset fires is generally less than the consequence of ground fires.

Ground fires can have severe consequences, particularly when the fire occurs in a densely populated, heavily vegetated area in extreme weather conditions.

Analysis of network performance and incident data also reveals that contact with overhead assets poses a significant public safety risk.

In response to electricity-related deaths and accidents on work sites and farms, the No Go Zone rules were developed. These rules describe the minimum safety requirements when working near overhead power lines.

The most prevalent cause of contact is breach of the No Go Zone rules. However, some overhead conductor and service cables installed by the former State Electricity Commission were installed at heights, and whilst compliant at the time of installation, do not comply with current design standard clearances and may pose a slightly increased risk to the public.

3.3. Occupational Health and Safety Risks

Occupational health and safety (OH&S) risks arise through operation, maintenance and construction activities.

These risks include the risk of injury from:

- Electric shock;
- Explosive or mechanical failure;
- Falls; and
- Exposure to electro-magnetic fields (EMF).

The AusNet Services Health, Safety, Environment and Quality (HSEQ) Management System has a range of strategies that continue to maintain a safe work environment, such as adherence to industry work practice standards and procedures.

Many of these OH&S risks, such as the risk of exposure to EMF, are managed through the application of design and work standards.

Other risks, such as the risk of falling from a structure, are managed by a combination of work standards and physical measures.

Maintenance of safe work environments requires constant review and challenge of existing practices and standards to ensure risk is being managed *as far as practicable*.

Historically, the asset replacement and operational initiatives implemented by AusNet Services following actual incidents of asset failure that have presented risk to personnel have included, but are not limited to:

- Continuous improvement of line inspection and condition monitoring;
- Replacement of lightning arrestors prone to explosive failure;
- Live line work restrictions on copper conductor;
- On-going replacement of powder filled fuses with alternative devices;
- Implementation of EDO replacement strategy including units prone to mechanical failure
- Replacement of HV air-break switches with gas or vacuum insulated switches; and
- Replacement of inoperable Iljin manual overhead gas switches with a failure mode, that allows components to break off and fall to ground, endangering operators.

The above programs form part of on-going asset management practices that have been primarily influenced by asset performance data.

The key strategy associated with OH&S is to continue to maintain a comprehensive HSEQ management system. This system comprises a policy, manual and processes and is certified to relevant standards such as AS/NZS 4801:2001 Safety Management System.

Unlike risks to the public, which have been identified and assessed through quantitative analysis of network incident data, the employee risks rely more upon semi-quantitative and qualitative reviews as there is little empirical incident data upon which to perform analysis.

The likelihood of an incident occurring is low, but the consequences of such incidents can be severe.

Key areas identified for safety improvement programs include:

- Asbestos containing materials within AusNets' zone substations and buildings;

- Lattice tower fall restraints; and

Potential risk to employees from explosive failure of ageing plant

3.4. Fire Loss Consequence Model (FLCM)

An outcome of the Powerline Bushfire Safety Taskforce (PBST) was the development of a fire loss consequence model (FLCM) by Dr K Tolhurst of Melbourne University, referenced in the PBST Final Report dated 30 September 2011.

The FLCM provides a methodology for identifying areas of highest fire loss consequence within areas previously treated homogenously as HBRA.

The model was subsequently used by ESV to support their Directive[4] for the suppression of high voltage feeder protection on Total Fire Ban days in those areas designated of highest fire loss consequence.

Since 2011, AusNet Services have used a model, based on the FLCM, to determine a value of risk that can be attributed to asset failures and is a key factor in planning asset replacement programs and developing asset management strategies.

Figure 8 shows the Fire Loss Consequence Model map.

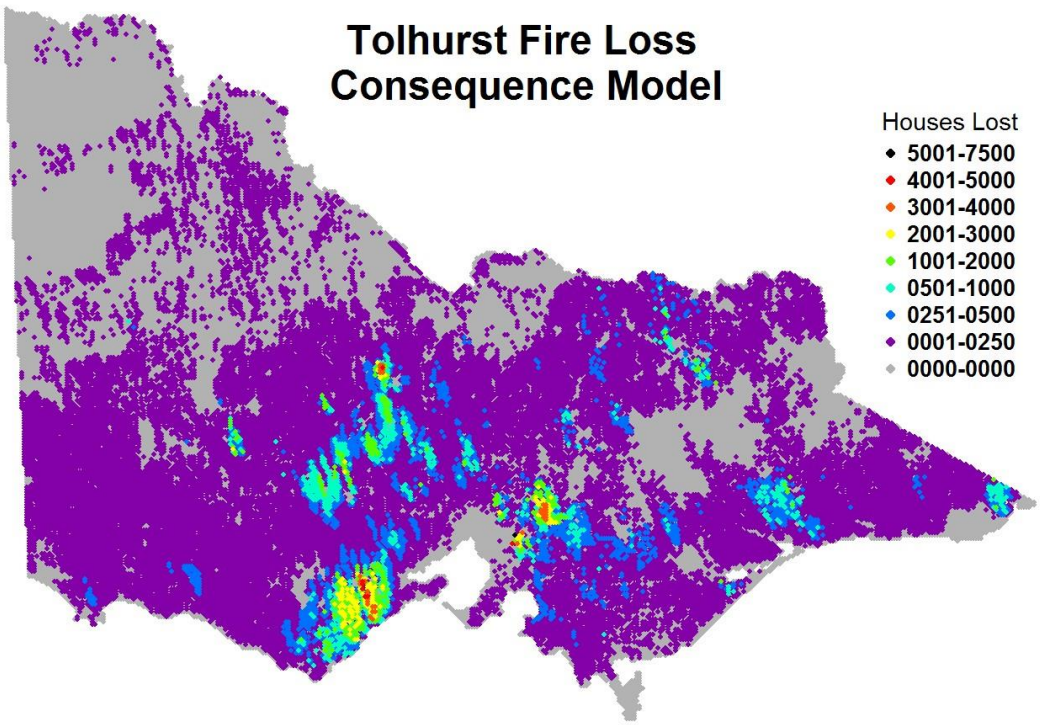


Figure 8: Fire Loss Consequence Model (FLCM) map

[4] ESV Directive issued under cover letter dated 23 December 2011.

3.5. F-Factor and Ignition Risk Units

In 2011, "F-Factor" was introduced as a scheme to incentivise Distribution Businesses to reduce the number of asset failures causing fire ignitions. AusNet Services has successfully implemented programs targeting at reducing fire ignitions, the resulting decline in asset fires is shown in Figure 5.

In December 2016, following a review of the F-factor target setting process, a new target setting process was put in place.

In the new risk based scheme, difference weights are applied to fires based on:

- the location of ignition (geography multiplier); and
- the prevailing fire danger rating in the relevant fire district in which the ignition occurred at the time. ignition occurred (time multiplier).

This combination of geography and time are used to calculate the ignition risk unit (IRU), as shown in Figure 9, with $15,000 allocated to each IRU under/over the benchmark.

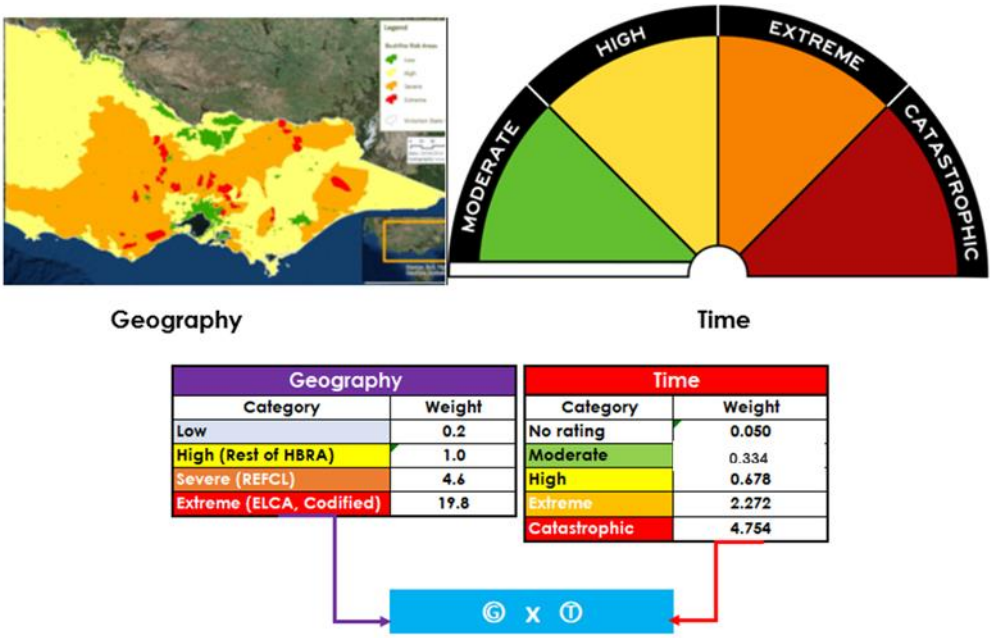
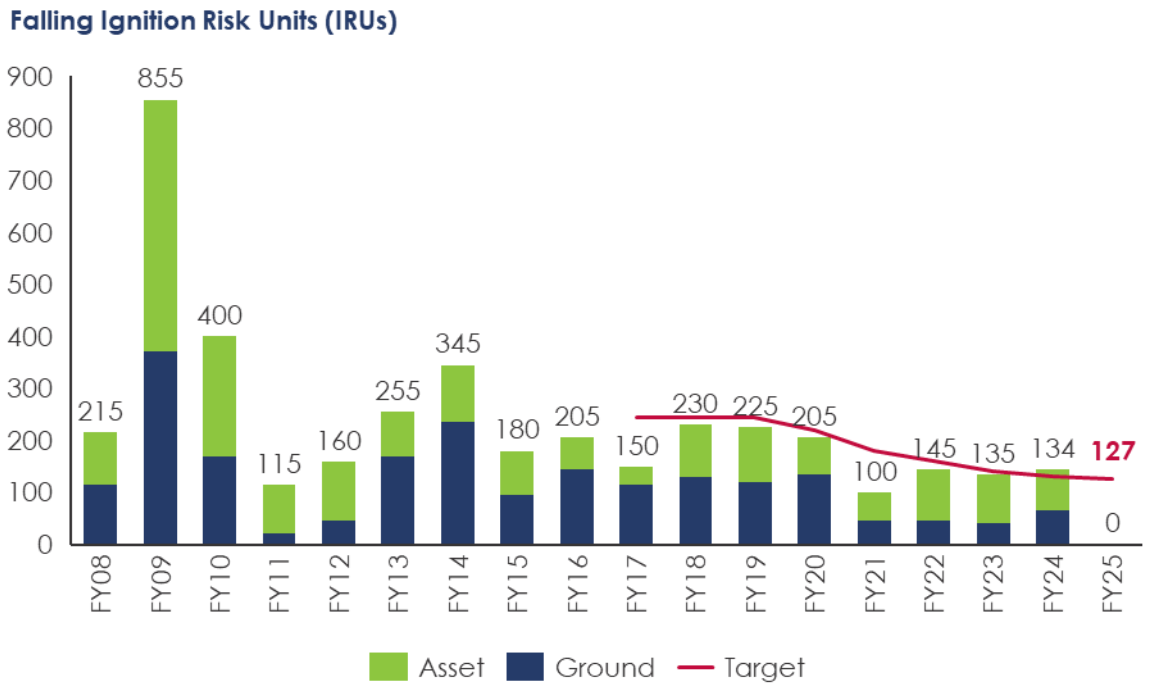


Figure 9: Ignition Risk Unit Input Multipliers

Table 2 gives the IRU targets as published in the Victoria Government Gazette 22 December 2016.

Table 2: IRU Performance



4. Management Strategies

4.1. Service Cables

4.1.1. Analysis

Since the introduction of a program utilising advanced metering infrastructure (AMI) data to detect safety issues associated with service cables, there has been a significant reduction in the number of electric shocks from service cables.

Figure 10 shows the electric shock incidents reported to Energy Safe Victoria since the introduction of the AMI data triggered replacement program.

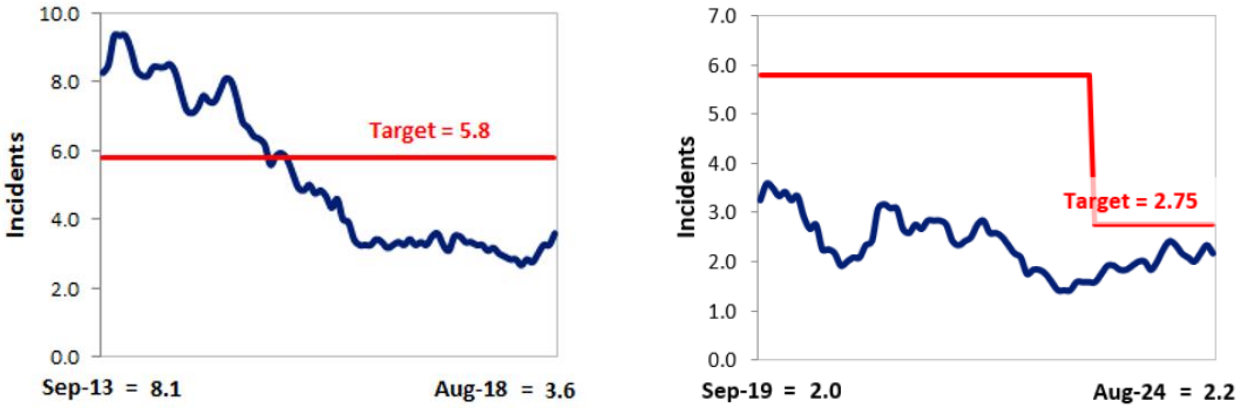


Figure 10: Electric Shock Incidents[5] (12 month rolling average) 2013 - 2024

4.1.2. Strategy

The success of the AMI data program in detecting issues with services cables has resulted in service cable replacements now primarily driven by AMI data, with the dispatch of fault crews to emerging service cable failures to mitigate risk of electrical shock in customers' premises.

In addition to replacements triggered by AMI data, when work is to be undertaken on assets adjacent to any neutral screened service cable, the service cable is also replaced.

Table 3 shows the recent history of service cable replacement volumes (number of services).

Table 3: Program Delivery History – Service Cables[6]

Program	CY2020	CY2021	CY2022	CY2023	CY2024	Total
Service Cable Replacement	3,626	4,986	2,842	2,350	4,015	**17,819**

[5] Network Performance Dashboard 201809 (Final)
[6] From Category Analysis RIN Data, Table 2.2 Repex

4.2. Medium Voltage Fuses

4.2.1. Analysis

Expulsion Drop Out (EDO) & Boric Acid (BA) fuses are designed for use in low fault energy locations, which are often areas of greatest bushfire risk. Expulsion Drop Out (EDO) fuse element and carrier combinations and fire-chokes are specified to minimise the risk of fire ignition. Boric Acid fuses utilise Boric Acid as interrupting medium in a sealed carrier

Despite this, BA & EDO fuse failures contribute the greatest proportion of asset fires and one of the largest causes of ground fires.

High salt pollution areas result in corrosion of the metal fittings and subsequent cracking of the porcelain insulators of EDO fuses. This presents an operating risk to personnel undertaking high voltage operations of these assets.

Monitoring of fire incident data has indicated bird and animal flashovers to earthed EDO brackets on concrete poles together with 'candling' or 'hang-ups' of EDO fuse tubes as key sources of fire ignition requiring targeted replacement.

AusNet Services utilises the fire loss consequence model (FLCM) (refer to Section 3.4) to undertake an economic analysis of the fuse population.

The program is to replace BA & EDO units with Fault Tamer or equivalent technology that has the same or improved performance.

4.2.2. Program Delivery History

Table 5: Program Delivery History – EDO Fuses[7]

Program	2026	2027	2028	2029	2030
BA & EDO fuse unit replacements	3,510	1,596	1,395	1,661	1,506

4.2.3. Strategy

The focus of the EDO strategy is to continue replacing the EDO fuses which represent the highest risk with Fault Tamer fuses, or equivalent.

[7] From the April Network Safety Report for the relevant year, except FY2019, which it the forecast volumes from February 2019 report.

4.3. Overhead Conductor

4.3.1. Analysis

Conductor failure presents both electric shock and bushfire ignition risks, with conductors being the third highest cause of ground fires.

Routine condition-based replacements are found through the cyclic inspection program and assigned a priority as prescribed in the 30-4111 Asset Inspection manual.

A proactive program of conductor replacement targeted at steel & copper conductor has been undertaken in the 2021-2026 regulatory period.

A cost benefit analysis of the risks posed by conductor has been conducted. The analysis considered the age, type, location and condition of the spans to determine the likelihood of failure and combines this with safety, bushfire and unserved energy consequences to determine the overall risk associated with each conductor span.

This identifies conductor spans where the benefit gained by replacing the span is greater than the cost of the span, so justifies the replacement of the span.

This analysis identifies the volume of conductor that should be replaced to reduce the risks associated with conductor *as far as practicable*.

4.3.2. Codified Areas

The 2009 Victorian Bushfires Royal Commission (VBRC) and the Powerline Bushfire Safety Taskforce (PBST) both recommended the replacement of SWER powerlines with underground or insulated overhead cables within 10 years.

These recommendations were implemented through changes to the Electricity Safety (Bushfire Mitigation) Regulations 2013 which requires that conductors within Codified Areas which have reached the end of life to be put underground or insulated.

AusNets' current condition based replacement forecast is for 7 km of SWER conductor in Codified Areas to reach end of life over the 2021-25 regulatory period.

This represents 1% of the SWER conductor in Codified Areas replaced over a 5-year period.

AusNet Services does not believe that this rate of replacement meets the expectations of our customers and stakeholders, so is proposing an additional program to accelerate the replacement of bare SWER conductor installed within the distribution network. This program will proceed if the expenditure is approved as part of the 2021-25 EDPR.

4.3.3. Strategy

The strategy is to continue the program of conductor replacement targeting deteriorated conductor in HBRA to reduce risk *as far as practicable*, based on the risk modelling outcomes.

4.4. Vibration Dampers and Armour Rods

Subsequent to the 2009 Victorian Bushfires Royal Commission recommendations, ESV issued a Directive, dated 4 January, 2011 for AusNet Services to prepare a plan requiring the fitting of vibration dampers and armour rods to its network in accordance with the Victorian Electricity Supply Industry (VESI) standards VX9/7037 and VX9/7037/1.

The Directive requires the plan to address the program in two broad stages as follows:

- Stage 1 – hazardous bushfire fire risk areas (HBRAs) before 1 November 2015, and
- Stage 2 – all other areas by 1 November 2020.

Accordingly, a number of plans were submitted before ESV accepted AusNet Services'

'Program for Fitting of Distribution Armour Rods and Vibration Dampers (AMS 20-52-1).

The agreed program has ensured the highest fire risk consequence areas within HBRAs, as modelled by Dr Tolhurst of Melbourne University, are addressed in Stage 1 of the program (by 2015) in accordance with the Directive.

Assets in HBRAs outside the highest fire risk consequence areas will be addressed together with assets in 'all other areas' in Stage 2.

Stage 2 is being undertaken in the 2016-2020 regulatory period. The initial plan was for the installation of dampers and armour rods at 110,000 structures at a rate of 22,000 per year.

In February 2017, a revised plan AMS 20-52-1 Issue 4 was accepted by ESV following an engineering assessment based on AS/NZS 7000 to clarify where vibration control should be applied.

This resulted in a revision of the total number of structures to be addressed in Stage 2 to 80,980.

Table 9: Program Delivery History – Armour Rod and Vibration Dampers[8]

Program	FY2016	FY2017	FY2018	FY2019	Total
Armour Rods and Vibration Dampers	19,890	18,500	17,200	13,054	**68,644**

The volumes remaining are given in Table 10.

Table 10: Armour Rods and Vibration Dampers

Program	FY20
Install Armour Rods and Vibration Dampers (HBRA and LBRA)	11,022

[8] From the April Network Safety Report for the relevant year, except FY2019, which was from an email from A Attar-Bashi 18 April 2019

4.5. Conductor Compliance Clearances

AusNet has embarked on a program to survey its network using LiDAR which is a remote sensing technique that measures distances and creates precise three-dimensional maps of the environment using laser light. LiDAR sensors emit many laser pulses per second and record the distances to multiple points on objects or surfaces within the field of view. This results in a dense collection of data points that generate accurate and precise three-dimensional representations (point cloud) of the target and surroundings by estimating the distance travelled by each laser beam. The attributes of the point cloud can be classified to identify structures, vegetation, buildings, roads, conductors and so on. This data is then processed using algorithms which identify clusters, or groups of points that form an object or feature. Once classified, additional algorithms are developed to automate measuring determined distances between point cloud objects such as conductors and structures or vegetation. Rectification works are prioritised based on severity of compliance breach.

Survey grade measurement example LiDAR output is shown in Figure 1.

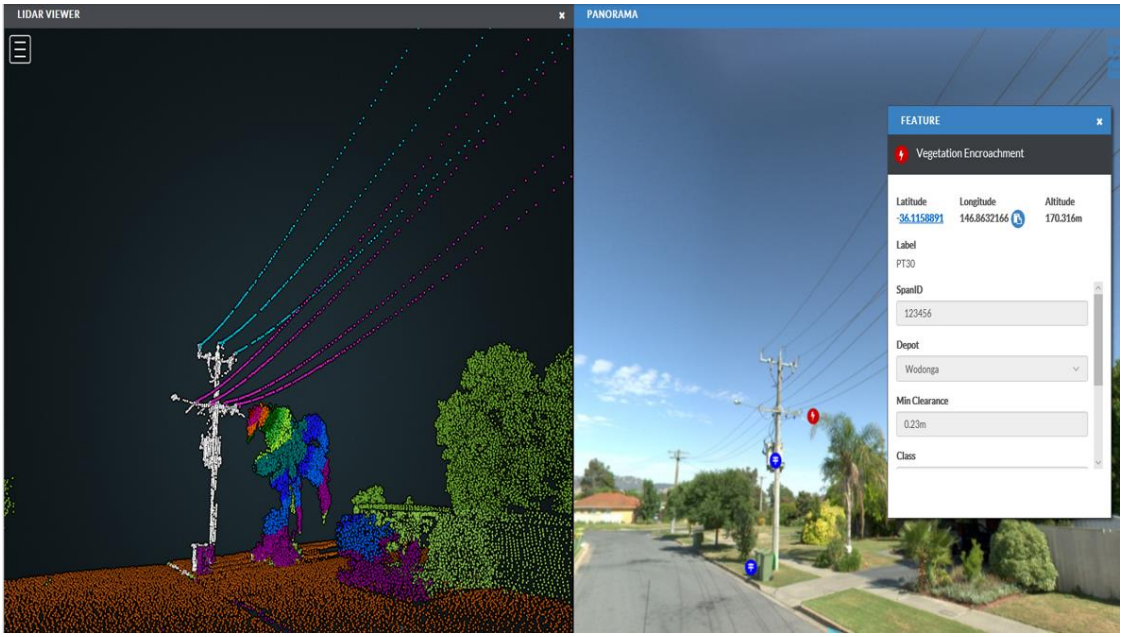


Figure 1: Example LiDAR representation of distribution network assets and surrounds

4.6. Overhead Conductor Ground Clearances

AusNet Services maintain a risk management approach for the management of overhead conductors and services cables below current design standard clearances (refer Section 7 of the Asset Inspection Manual 30-4111).

Overhead conductor and services cables identified as being below minimum clearance thresholds or scheduled for replacement are re-established to current design standards.

Cyclic inspections, together with asset maintenance and replacement are the network activities that initiate the low conductor clearance replacement program.

Table 18 gives the historic volumes of re-engineering work to address clearance issues.

Table 18: Program Delivery History – Clearance[9]

Program	FY2015	FY2016	FY2017	FY2018	Total
Clearance Re-engineering	187	94	196	238	**715**

This is an inspection-driven program.

4.7. Government Funded Conductor Replacement

In 2011 the Victorian Government announced a $750 million Powerline Bushfire Safety Program (PBSP). The 10-year program will deliver on recommendations (27 and 32) of the 2009 Victorian Bushfires Royal Commission and aims to reduce the risk of bushfires caused by electrical assets without causing significant impact on electricity supply reliability.

The program includes a Government contribution of up to $200 million over 10 years towards the replacement of the most dangerous power lines in the state that would otherwise not have been replaced.

Areas of high risk in both the Powercor and AusNets' network areas have been identified and replacement work involving the undergrounding of conductor or installation of covered conductor to replace bare conductor has commenced.

The size of the program and the allocation of the funds to Distribution Network Businesses, or other overhead line owners, are determined by the Government.

Further information pertaining to the details can be found in the *Bushfire Mitigation Plan*[10].

[9] Electricity Networks FY19 to FY23 Works Program, FY19 Edition

[10] BFM 10-01 Bushfire Mitigation Plan

4.8. Crossarms

4.8.1. Analysis

Crossarm failure can result in live conductors being dislodged and breaching regulatory safety clearances and/or serious incidents such as high voltage injections into customer installations that have resulted in fire.

A proactive program to replace deteriorated timber crossarms in HBRA with steel arms was introduced in 2009 and by the end of 2014 had replaced a significant proportion of deteriorated high voltage timber crossarms in HBRA.

Crossarm replacements have continued in the 2016-2020 regulatory period and it is forecast to replace approximately 17,000 high voltage and 29,000 low voltage timber crossarms due to condition.

This forecast is based on current inspection driven replacements and analysis of the risk of crossarm related bushfire ignition using the Fire Loss Consequence Model has been completed to determine the volume of crossarms that should be replaced to meet safety obligations *as far as practicable*.

4.8.2. Program Delivery History

Table 12: Program Delivery History – Crossarms[11]

Program	FY2021	FY2022	FY2023	FY2024	Total
Sub-transmission	11	14	9	9	**43**
High Voltage	690	518	509	470	**2187**
Low Voltage	2764	2073	2062	1695	**8594**
Total Crossarm Replacements	**3465**	**2605**	**2580**	**2174**	

[11] Electricity Networks FY19 to FY23 Works Program, FY19 Edition

4.9. Complex High Voltage Structures – Bird and Animal Proofing

AusNets' current initiatives and standards for reducing the risk of bushfire caused by Bird and Animal flashovers include:

- Standard design for complex structures includes insulated leads and covers;
- Standard applied for all new, replacement and augmentation works;
- Concrete poles with steel HV crossarms and standard post insulators fitted with bird covers;
- Standard application of stretch post insulators on conductive structures;
- Neutral earth resistors in zone substations;
- Animal guards to prevent access to assets.

Section 3.2 indicates bird and animal flashover incidents remain a significant contributor to ground fire ignitions.

AusNet services will continue to Bird and Animal Proof existing pole top assets in HBRA as a part of the Bushfire Mitigation Program.

This is a reactive program, so does not have target volumes, and instead is based on historical expenditure.

Program	FY22	FY23	FY24
Bird and Animal Proofing	$ 318,393	$ 322,317	$ 397,383

4.10. Rapid Earth Fault Current Limiters

A Rapid Earth Fault Current Limiter (REFCL) is a type of electricity network protection device that reduces the amount of energy dissipated during an earth fault. Implementation of the technology involves changing the way the 22kV network is earthed, from resistance earthing to resonant earthing. It was originally developed for its reliability benefits in Europe. In Victoria, however, it will be used to help reduce the risk of bushfires. Trials of the technology were conducted in 2014 and 2015.

An earth fault occurs when a connection is made between a powerline and the ground. This could occur as a result of a fallen powerline, a tree falling against a powerline or wildlife touching the pole and powerline at the same time.

The change to resonant earthing technology significantly reduces the fault current and the small residual current is compensated by injecting an equal and opposite current into the transformer neutral using an inverter.

When a fault occurs, a REFCL detects and significantly limits the energy flow within a tenth of a second. This reduces the possibility of a fire being started, or of a person or animal nearby receiving an electric shock.

If the fault is able to fix itself quickly (for example a tree branch that had touched the powerline then falls away), the REFCL allows the powerline to continue operating so that customers will not be affected.

Currently, without a REFCL, these faults can cause power to turn off for several minutes, lead to fires or even property damage. If the fault remains (for example a tree has fallen on a line or a car has hit a powerpole) then all power will be cut around the fault area.

Changes to the Electricity Safety Act together with Bushfire Mitigation Regulations require AusNet Services to install REFCL technology at 22 sites by April 2023 through three tranches. Each tranche is made up of a number of zone substations and the installation of the REFCL technology within each zone substation will be managed as a separate project. The location and timing for implementation of the REFCL technology through three tranches prescribed in Schedule 2 of the Regulations is illustrated in Figure 11.

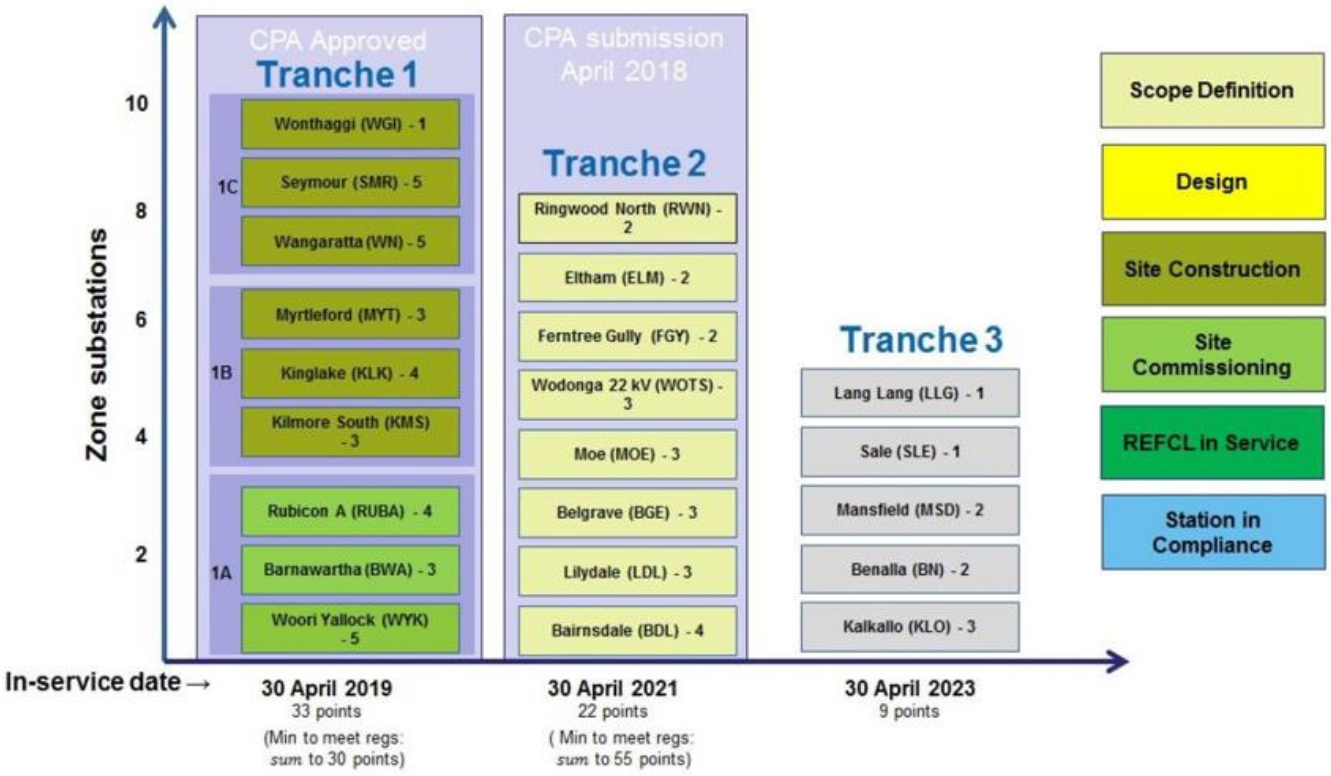


Figure 11: REFCL Tranches

4.11. Vegetation Management – Hazard Trees

4.11.1. Analysis

Hazardous trees represent a significant risk to the security of electricity supply and consequently the safety of customers and the community.Vegetation related faults are a material cause of asset and ground fires. Review of these incidents consistently indicates that trees and limbs falling from outside the clearance space are the cause of asset related failures that result in fire ignition. Primary causes for tree failure are strong wind events, tree/limb defects or a combination of both. However, it is widely recognised within the utility arboricultural industry that trees without any obvious structural defects can fail during significant weather events and even during benign conditions.

Vegetation outside the clearance space is managed to mitigate the risk of falling trees or parts of trees entering the clearance space. Vegetation outside the clearance space is assessed to identify obvious hazard trees that have the potential to impact overhead electrical infrastructure. These trees may be identified as being a hazard due to their physical condition and where their proximity to electrical infrastructure means they have the potential to fall into the clearance space.

Annual hazard tree volumes are difficult to forecast due to considerable variation in costs of each hazard tree. The identification and arboricultural assessment process also has bearing on overall annual volumes. AusNets'

4.11.2. Program Delivery History

Table 15: Program Delivery History – Hazard Trees[12]

Program	FY2021	FY2022	FY2023	FY2024	Total
Hazard Tree Removal	3,485	5,665	921	2,273	**12,344**

Note: FY2023 was a period of significant mobilisation effort following the implementation of a fully revised operating model and competitive tender process to engage two new principal delivery partners.

4.12. No Go Zone

4.12.1. Analysis

[12] From annual RIN reporting data.

Contact with overhead or underground distribution assets are usually attributable to plant and equipment being operated in breach of the Electricity Safety (Network Asset) Regulations.

Analysis of third party contacts with AusNets' assets indicates contact with overhead high voltage conductors as the most prevalent No Go Zone breach.

Encroachment on No Go Zone clearances can result in fatalities. All incidents are investigated and recorded by ESV.

Recent known occurrences of fatal incidents involve contact with overhead high voltage distribution assets, most occurred in rural areas and predominantly involved persons undertaking work activities in relation to agriculture.

A common cause of death was persons operating mobile cranes and tippers on trucks, being in contact with the vehicle and ground simultaneously as the mobile plant made contact with overhead high voltage conductors.

Contact with overhead high voltage conductors was also frequent for mobile excavators, particularly in conjunction with land development works. Fortunately, these works activities are generally confined to a single operator working on or in the plant which has meant the operators have not formed part of the electrical path to earth subsequent to inadvertent contact. However, there still remains significant risk for any individual/s working on the ground in close vicinity to the operating plant.

Advertising programs such as the 'look up and live' campaigns are targeted at reducing the number of contact with overhead high voltage conductor incidents. These programs are initiated by ESV and financially sponsored by the distribution businesses.

In addition, AusNet Services has consolidated its No Go zone information on one page on its website with links to relevant sites:

https://www.ausnetservices.com.au/safety/working-near-lines

Whilst not represented in the above data, instances of electrical fatalities outside of Victoria have been experienced with unauthorised access to distribution assets, particularly children entering high voltage zone substation and substation enclosures.

AusNet Services has an ongoing program of enhanced standards and security arrangements for new installations together with implementation of a prioritised retro-fit of existing installations. To mitigate potential safety risk to AusNets' personnel, public and un-authorised access, AusNets' *Asset Management Strategy – Infrastructure Security*[13] program has been developed to address this risk.

4.12.2. Strategy

AusNet Services will continue to support the maintenance of an industry advertising, education and awareness campaign through ESV. This should be supported through the maintenance of personnel within AusNet Services engaged in the administration of No Go Zone inquiries. Whilst a broad application of augmentation and line marking policies for overhead lines is not considered economical, targeted programs for assets considered high risk over public land provides an opportunity for mitigating risk to the public.

This has included:

- Identification of electrical hazards in the vicinity of boat ramps and has resulted in augmentation of network assets and/or the implementation of barriers and warning signs; *and*
- Relocation of network assets identified as being high risk of vehicle impact.

[13] AMS 20-14 Infrastructure Security

4.13. Asbestos

4.13.1. Analysis

According to WorkSafe Victoria's *Compliance Code: Managing asbestos in workplaces*, if asbestos containing material (ACM) is in good condition and left undisturbed, it is unlikely that asbestos fibres will be released into the air and the risk to health is extremely low. It is usually safer to leave it fixed or installed and review its condition over time.

However if ACM is deteriorated, has been disturbed or is asbestos-contaminated dust is present, the likelihood that asbestos fibres will be released into the air is increased.

Asbestos risk has been divided into four residual risk categories using the AusNet Services corporate risk management framework, with Level I representing the highest risk and Level IV representing the lowest risk.

Levels I and II generally contain risks that either need immediate attendance or can be cost effectively addressed independent of broader asset replacement projects.

Levels III and IV are generally considered risks that can be managed with on-going asset management controls and removed under an opportunistic basis with works such as:

- Station rebuild or augmentation projects
- Secondary system upgrade projects
- Building renewal or refurbishment projects

As of October 2018, there are no asbestos containing materials assessed as Level I or II.

4.13.2. Strategy

Level III and IV risks will be addressed through on-going asset management procedures and processes with asbestos removal being cost effectively integrated with broader asset replacement and augmentation projects on an opportunistic basis.

4.14. Lattice Towers – Fall Arrest Systems

4.14.1. Analysis

The distribution network is primarily constructed using poles. However, there are 465 steel lattice towers in the 66kV sub-transmission network.

The original design of the sub-transmission towers did not consider the provision of adequate electrical clearance for tower access. This lack of electrical clearance exposes line workers to the risk of a flashover event when climbing along the tower leg at the conductor level.

Additionally, at the time the majority of these towers were designed and constructed, there were no requirements to provide fall arrest systems. In the intervening years a range of Occupational Health and Safety laws have been introduced that require employers to provide a safe working environment for workers.

All infrastructure owners which require workers climbing up to a level greater than two metres above ground are now retrofitting a permanent fall arrest system on their assets.

A program to install fall arrest systems to sub-transmission line towers is ongoing.

4.14.2. Strategy

The program to install fall arrest systems on sub-transmission lattice towers has commenced. This program will result in the installation of a fall arrest system on 50 towers in each year of the 2026-2031 regulatory period. **Table 20: Fall Arrest System Volumes (Source: AMS 20-64 Issue 3, 2026-2031 – EDPR Forecast)**

Program	FY27	FY28	FY29	FY30	FY31	Total
Fall Arrest Systems	50	50	50	50	58	258

4.15. Explosive Failure

4.15.1. Analysis

This risk relates to the possible explosive failure mode of some current transformers (CTs) and voltage transformers (VTs) and also of the bushings of power transformer and circuit breakers. This can result in injury to people and collateral damage to adjacent plant and equipment within zone substation stations.

AusNet Services has not had any explosive failures of equipment in the distribution network; however there have been a number of explosive failures within terminal stations, with equipment similar to that located within zone substations. The equipment within zone substations operates at a lower voltage, so it is thought that the risk is lower than in terminal stations; however there is still a risk.

4.15.2. Strategy

Explosive failure is one of several consequences included in the risk models for zone substation equipment.

These risk models inform the replacement programs for high risk equipment.

5. Enhanced Network Safety Program Summary

Table 21: Enhanced Network Safety Programs

Enhanced Network Safety Program	Description
Service Cables	• Condition driven program (based on AMI data) • Volumes estimated on historical replacement rates
EDO fuse targeted replacement	• Targeted risk-based replacement program • Approximately 1,750 fuses per year
Overhead Conductor	• Targeted risk-based replacement program • Approximately 290km per year
Vibration Dampers and Armour Rods	• Approximately 11,022 sites remaining due for completion in FY2020
Conductor Spacers and Circuit Clearances	• Program has been completed
Government Funded Conductor Replacement	• Refer to BFM 10-01 Bushfire Mitigation Plan
Crossarms	• Targeted risk-based replacement program • Approximately 4,135 crossarms per year
Bird and Animal Proofing	• Reactive program • Volumes estimated on historical replacement rates
Installation of REFCLs	• As per REFCL program
Vegetation Management – Hazard Trees	• Based on inspections • 5,000 trees per year
No Go Zones	• Continued support of public awareness programs
Overhead Conductor Ground Clearance	• Reactive program • Forecast based on historical expenditure
Asbestos	• Addressed as part of planned zone substation refurbishment projects
Lattice Towers – Fall arrest systems	• Ongoing program • 18 towers per year
Explosive Failure	• Asset replacement programs informed by risk models

6. Abbreviations and definitions

TERM	DEFINITION
AMS	Asset Management Strategy

7. Legislative references

STATE	REGULATOR	REFERENCE
VIC (example only)	WorkSafe Victoria	Occupational Health and Safety Act 2004
	EPA Vic	Environment Protection Act 1970

8. Resource references

DOCUMENT ID	DOCUMENT TITLE
AMS 01-01	Asset Management System Overview
AMS 20-01	Electricity Distribution Network Asset Management Strategy
ACT 114/2019	Electricity Safety (Management) Regulations 2019
AS/NZS ISO 31000:2018	Risk management – Guidelines
ACT 40/2023	Electricity Safety (Bushfire Mitigation) Regulations.
AS/NZS 4801:2001	Occupational health and safety management systems
ACT 25/1998	Electricity Safety Act 1998

9. Appendices

None

10. Schedule of revisions

ISSUE	DATE	AUTHOR	DETAILS OF CHANGE
1	08/08/2008	P Bryant	First Edition.
2	28/10/2009	P Bryant	Update incident data Section 3.2.1.
3	17/11/2009	P Bryant	Included EDO section.
4	26/11/2009	P Bryant	Update reference to AMS 20-01.
5	14/07/2010	P Bryant	Update crossarm & EDOs. Add bird /animal, protection control programs, asset inspection & conductor ties.
6	23/01/2012	P Bryant	Inclusion of ESV Directives (a) armour rods & dampers, (b) Spacers & clearances in Sec 4.3 Conductor and (c) Protection settings in Sec 4.7 Enhanced Control & Prot. New regulatory obligation sec 4.8 – asset inspection cycle HBRA.
7	24/04/2012	P Bryant	Revise section 4.7 to include Woori Yallock REFCL trial & change of scope for protection of 3ph network – ZSS relays & ACRs
8	24/05/2012	P Bryant	EDO revised strategy. Based upon FLC Model. New sec 4.5.1.1 & revised sec 4.5.2. Sec 7.7.3 REFCL completion dates revised.
9	29/06/2012	P Bryant	Revised section 4.7.3 REFCL following consultation with ESV.
10	21/04/2015	J Dwyer T Gowland	Substantial revision to extend to 2020
11	26/06/2019	A Dickinson	Revised to include progress of programs and forecasts extended to 2025 in line with EDPR submission.
12	31/01/2024	T Baumgarten D McCrohan G Hannan	Updated for 2026 to 2031 regulatory proposal and to reflect latest information and updates

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