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SAFETY PERFORMANCE REPORT ON VICTORIAN ELECTRICITY NETWORKS 2014

JULY 2015

PREFACE

Energy Safe Victoria (ESV) is the independent technical regulator responsible for electricity, gas and pipeline safety in Victoria.

As part of this role, ESV annually reviews the safety performance of Victoria's major electricity companies. This report presents those findings for the 2014 calendar year so the community, Parliament and industry can assess how well Victoria's electricity distribution and transmission businesses are meeting their safety objectives.

This is the fifth year that ESV has publicly reported on the safety performance of Victoria's major electricity companies: AusNet Services, CitiPower, Powercor, Jemena and United Energy (distribution companies) and AusNet Services, Basslink and Transmission Operations Australia (transmission companies).

This report focuses on key safety indicators, as well as the operation of the Electricity Safety Management Schemes that became a mandatory requirement on the electricity distribution businesses following the 2009 Victorian Bushfires Royal Commission.

Victoria's regulatory regime requires the major electricity companies to provide ESV with documentation for review that details the safety systems they have in place to reduce the risk of their infrastructure starting fires. Electricity Safety Management Schemes and Bushfire Mitigation Plans are submitted to ESV every five years, while Electric Line Clearance Management Plans are submitted annually.

The primary responsibility for ensuring network safety rests with the major electricity companies, but ESV holds them accountable by requiring them to actively participate in targeted audits to confirm compliance with these safety systems.

ESV's audits are informed by trends and other risk-based assessments that enable us to analyse performance. This report also includes comments on a number of strategic and regulatory issues facing the industry.

ESV provides comment and input on the safety programs of the major electricity companies that are included in their periodic price and revenue proposals as submitted to the Australian Energy Regulator.

The reliability and safety performance of electricity networks, including their propensity to start fires, is ultimately a function of environmental factors as well as how well the networks are planned, designed, constructed, maintained and operated. This is in turn a reflection on the design and effectiveness of both economic and safety regulatory regimes.

While network assets are by their nature long-lived, some being more than 70 years old, they are subject to ongoing refurbishment based on asset management decisions made by the utilities to determine the replacement and maintenance requirement for individual asset classes. The impact of changes to network design, maintenance and operation on the safety performance of electricity networks may not become evident for many years.

This report provides objective evidence of the efficacy of initiatives adopted by the Victorian Government to meet Recommendation 34 from the 2009 Victorian Bushfires Royal Commission, namely to "... amend the regulatory framework for electricity safety to strengthen Energy Safe Victoria's mandate in relation to the prevention and mitigation of electricity-caused bushfires ...".

Paul Fearon
Director of Energy Safety
July 2015

SUMMARY

This report differs from that of previous safety performance reports issued by ESV. It reviews the performance of the major electricity companies as before, but this time undertakes a more thorough analysis of performance; it discusses both trends over time and looks for common themes and issues the industry faces.

The safety indicators and reporting from the major electricity companies show that the initiatives introduced following the 2009 Victorian Bushfires Royal Commission are delivering results: fire starts resulting from contact between HV assets and vegetation are falling (down by 33 per cent since 2012), and all but one of the major electricity companies is experiencing fewer conductor failures than in 2012.

This progress can be seen as a double-edged sword; the successful bushfire mitigation activity has to date focused primarily on high voltage (HV) assets. That success now makes the threats posed by low voltage (LV) assets more visible and it is appropriate for the industry to now focus on that arena.

The incidence of ground fires caused by LV asset failures is increasing year on year, to a greater extent than the rate of increase in LV asset failures. Although data is limited in this area, the inference is that LV fires are increasingly setting fire to surrounding vegetation.

This report suggests that the distribution companies manage vegetation encroachment more effectively than municipal councils.[1] The interface between councils and distribution companies is extensive and, if not managed well, council vegetation clearance activity (or lack thereof) can pose a threat to distribution company assets and the wider population.

The number of No Go Zone infringements (which threaten reliability, property and people) are steadily increasing but the reasons are unclear. It may be that increased awareness results in increased reporting or that increased construction activity adjacent to powerlines is causing more incidents. Further work is required to better understand and correct the trend.

The report shows an increasing number of pole and crossarm failures (not necessarily leading to fire), but potentially causing the injection of high voltage onto lower voltage assets. This poses a risk to the public in terms of damage to assets and risk to persons. Crossarm failure also risks putting conductors within reach of the public on foot or on the roads and presents a risk of fire start.

ESV also discusses its concern that aspects of current asset management practice may be placing network reliability at risk in the longer term as assets age and require replacement in substantial numbers in the future. ESV currently has almost no visibility of the potential impact of asset management practice on the network of the future, predominantly because of a lack of asset condition and age data provided to ESV. This is a situation ESV will address in the coming years.

[1] Councils, as opposed to distribution companies, are responsible for clearing vegetation around overhead lines in designated areas.

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1 INTRODUCTION

On 10 August 2005, Energy Safe Victoria (ESV) was established by the *Energy Safe Victoria Act 2005*. ESV is responsible for the safety and technical regulation of electricity, gas and pipelines in Victoria. ESV reports to the Victorian Parliament annually on the functions and programs that it administers.

ESV is committed to the safe, efficient supply and use of electricity and gas. This is the fifth year that ESV has reported on the safety performance of the Victorian electricity distribution businesses and the fourth year it has reported on safety performance of the Victorian electricity transmission businesses. This report informs stakeholders, the community, government and industry on how well these businesses are meeting their safety obligations.

This report also provides transparency on ESV's role in regulating the safety of electricity supply in Victoria and focuses on the key safety indicators reported by each major electricity company:

- incidents on the electricity network
- progress of critical safety programs
- progress of directions placed on each distribution company to meet the recommendations of the 2009 Victorian Bushfires Royal Commission
- operation of each company's Electricity Safety Management Scheme
- results of audits of the major electricity companies, including those to assess the readiness of these companies for the bushfire season.

1.1 AIM

The aim of the report is to inform the community, parliament and industry of how the major electricity companies and municipal councils have performed when delivering their electricity network safety obligations in 2014.

1.2 OBJECTIVE

The objective is to analyse the broad range of safety-related information that ESV acquired during 2014 to identify common themes and trends, draw conclusions and make appropriate recommendations.

1.3 SCOPE

The report assesses data supplied by each major electricity company and examines the safety performance of each major electricity company for 2014 and across previous years.

The performance of municipal councils is also assessed in relation to their obligations to maintain clearance of vegetation around electric lines.

Consideration of other inputs such as expenditure, cost benefit and suchlike is not the remit of ESV.

2 REGULATED PARTIES

This section describes the different groups that ESV is responsible for regulating in relation to maintaining the safety of Victoria's electricity transmission and distribution networks.

2.1 MAJOR ELECTRICITY COMPANIES

The *Electricity Safety Act 1998* (the Act) defines major electricity companies as comprising both licenced electricity transmission companies and licenced electricity distribution companies. These companies have specific requirements to maintain the safety of Victoria's electricity networks as detailed below.

The major electricity companies were formed following the disaggregation of the State Electricity Commission of Victoria (SECV). Details of the major electricity companies are provided in Table 1 (transmission) and Table 2 (distribution).

While generally similar in engineering terms, the major electricity companies have evolved differently as various engineering solutions have been adopted in line with the different environments affecting their operations. These differences include geography, topography, customer base and operating environment; all of which have the potential to influence safety performance. As such, care must be taken when comparing the performance of the individual major electricity companies; direct comparisons may not always be possible.

The main differences between the major electricity companies are:

- Powercor Australia and AusNet Services have extensive overhead rural electricity distribution networks, with Powercor having considerably more electric line length than any of the other distribution networks
- Jemena and United Energy have predominantly overhead urban electricity distribution networks
- CitiPower services the central business district and the inner-urban areas. Approximately 97 per cent of CitiPower's central business district network is underground while the inner urban network is mainly overhead
- AusNet Services is the only company operating transmission and distribution assets, with its transmission network covering the whole state of Victoria (including the interconnecting electric lines to New South Wales and South Australia)
- Basslink operates a HV interconnector between Victoria and Tasmania, which is operational almost continually to ensure electricity flows between the two states
- Transmission Operations Australia operates a HV powerline connecting Mt Mercer wind farm into the AusNet Services grid and, while important for the wind farm commercially, the availability of the powerline only affects the wind farm and not the integrity of the broader network.

The performance of the major electricity companies is measured in the context of compliance with the Act as underpinned by subordinate regulations that include:

- **Electricity Safety (Management) Regulations**
  These establish the requirement for each major electricity company to submit an Electricity Safety Management Scheme (ESMS) to ESV every five years for acceptance. ESV regularly audits each major electricity company for compliance with its ESMS.

- **Electricity Safety (Bushfire Mitigation) Regulations**
  These establish the requirement for each major electricity company to submit a Bushfire Mitigation Plan (BMP) to ESV every five years for acceptance. ESV regularly audits each major electricity company for compliance with its BMP.

- **Electricity Safety (Electric Lines Clearance) Regulations**
  These establish the requirement for each major electricity company to submit an Electric Line Clearance Management Plan (ELCMP) to ESV each year for acceptance. ESV regularly audits each major electricity company for compliance with its ELCMP.

As the primary operators of Victoria's electricity networks, this report predominantly focuses on the safety performance of the major electricity companies.

2.2 RESPONSIBLE PERSONS

The Act identifies responsible persons (in addition to the major electricity companies) required to maintain clearance of vegetation around electrical powerlines.

These responsible persons (excluding the major electricity companies) are required to produce an ELCMP annually, but are not obliged to submit it to ESV for acceptance. ESV can, and does, require such responsible persons to provide their ELCMP for audit.

Responsible persons include municipal councils in declared areas[2] and owners or operators of electric lines that meet the responsible person criteria.[3]

Table 1: Transmission companies

Transmission business	Transmission voltages	Approximate powerline length (km)	Approximate number of towers
AusNet Services	500kV AC and 220kV AC from Victorian power station switchyards.[4] 330kV AC and 275kV AC interconnections with New South Wales and South Australia respectively. 66kV AC sub-transmission across Victoria.	6574	13,000
Transmission Operations Australia	132kV between Mt Mercer wind farm and Elaine Terminal Station.	22	162
Basslink	500kV AC and 400kV DC link connecting Loy Yang power station in south east Victoria to George Town terminal station in north Tasmania. The Basslink Interconnector comprises 3.2km of 500kV AC overhead line, 57.4km of 400kV DC overhead line and 6.6km of 400kV DC underground cable in Victoria. It also includes assets not subject to ESV oversight, including 290km of 400kV DC submarine cable and overhead lines and substations in Tasmania.	67	142
TOTAL		**6661**	**13,304**

[2] A declared area is an area declared by Order in accordance with Section 81 of the Act.

[3] Sections 84A, 84B and 84D of the Act.

[4] AC = alternating current. DC = direct current, kV = kilo Volt (or 1000 Volt).

Table 2: Distribution companies

Distribution business	Approximate number of customers	Approximate area	Approximate powerline length (km)	Approximate number of poles
AusNet Services	680,000 90% residential	80,000 sq.km Outer-eastern suburbs, north to the New South Wales border, south and east to the coast.	48,900 85% rural 10% underground	380,000
CitiPower	320,995 85% residential	157 sq.km Melbourne CBD and inner suburbs.	7400 25% CBD 40% underground	60,000
Jemena	320,600 89% residential	950 sq.km City, north-west suburbs and Melbourne International Airport.	6136 86% urban 27% underground	100,200
Powercor	748,000 85% residential	150,000 sq.km Melbourne's Docklands precinct, west from Williamstown to the South Australian border, north to the Murray and south to the coast.	84,000 92% rural 11% underground	540,000
United Energy	660,000 90% residential	1500 sq.km South-eastern suburbs and south to the coast.	12,800 25% rural 20% underground	215,000
TOTAL	**2,714,595**		**159,236**	**1,295,200**

2.2.1 Municipal councils

There are 79 municipal councils across Victoria. Not all have a responsibility for managing clearance around electricity assets in declared areas. Those that have a responsibility within declared areas include all 31 metropolitan councils and 36 of the 48 rural councils.

2.2.2 Other responsible persons

This report addresses the electrical safety performance of the major electricity companies; it contains commentary on municipal councils due to their extensive and close interface with powerlines and the clearance space around them. The other responsible persons (that is, those that are not a major electricity company or a council) are outside the scope of this report.

3 ESV REGULATORY PROGRAM

3.1 SERIOUS ELECTRICAL INCIDENTS

The Act defines a serious electrical incident as an incident involving electricity that causes or has the potential to cause the death of or injury to a person, significant damage to property, or a serious risk to public safety.

The Act also defines one of ESV's key functions as the requirement to investigate events or incidents that have implications for electricity safety.

The Act states that major electricity companies must report to ESV any serious electrical incident that occurs in relation to its supply network or in relation to an electrical installation to which it supplies electricity. The Act similarly requires that a fire control authority must report to ESV any serious electrical incident that it attends.

The Electricity Safety (Installations) Regulations require that people involved in installation work report serious electrical incidents to ESV.

Electrical safety of the public and the workforce is the highest priority for ESV. Electric shock incidents, including those resulting in serious injury or fatality, are key performance indicators for electrical safety.

3.2 ELECTRICITY SAFETY MANAGEMENT SCHEMES

The Electrical Safety (Management) Regulations were amended in 2009 to require all major electricity companies within Victoria to operate within the scope of an accepted ESMS. Each company is required to submit an ESMS to ESV for review and acceptance every five years. The ESMS may be revised at any time and be subject to ESV acceptance.

The regulation underpinning the ESMS is wide-ranging and applies to all electricity network operations. Through oversight of these schemes, ESV is well placed to test, challenge and expose the safety performance of each major electricity company. Each company's principal safety objective is to manage the risks associated with the planning, design, construction, maintenance and operation of the electricity network, with special attention to the prevention of bushfires.

The ESMS is required to:

- identify network risks through a formal safety assessment framework
- manage network risks to be as low as reasonably practical
- list the technical standards adopted by the major electricity company.

It should also include mechanisms to:

- develop and implement new technology expeditiously to reduce network risk
- change and adapt quickly to changing community expectations
- report to the safety regulator
- allow the safety regulator to influence the safety-related decision-making of the industry
- penalise noncompliance.

ESV periodically audits each major electricity company's compliance with its ESMS, focussing on different elements of the accepted ESMS each time. ESV's initial plan was to audit the fundamental elements of the accepted ESMS at least once during its five-year life. This plan commenced in 2011 and was completed in 2014.

ESV developed the audit program using the information provided in each accepted ESMS, BMP and ELCMP. ESV adopted a risk-based approach to these audits, assessing the various network characteristics, asset age, operating environment and prior audit outcomes. ESV was also informed by data collected during previous audits and each company's initiatives in the management of electrical assets.

ESV performed two rounds of audits during 2014: the first on regulations 24, 27 and 28 of the ESMS and the second on the accuracy of data reported to ESV on the safety programs agreed with the Australian Energy Regulator (AER).

3.3 SAFETY PROGRAMS

The distribution businesses' safety programs were agreed with the AER in the 2011 to 2015 Electricity Distribution Price Review (EDPR) period. Part of this agreement included a requirement that ESV monitor the progress of the programs.

The AER allocated expenditure for each distribution businesses' safety programs. Some safety programs are unique to each distribution business, while there are also common programs across all of the businesses. Common programs include crossarm replacement, conductor replacement, services replacement and pole replacements. Other programs that are more specific to each distribution business include the installation of rapid earth fault current limiters (REFCL), the installation of backup protection schemes and fuse replacement programs.

ESV has captured data regarding the progress of the safety programs of each major electricity company. ESV reports on the progress of each safety program and any implications of such progress.

3.4 BUSHFIRE MITIGATION

The Electricity Safety (Bushfire Mitigation) Regulations require each major electricity company to develop a BMP every five years and submit it to ESV for acceptance.

During the year ESV audited almost every major electricity company to verify each company was operating in accordance with its BMP.[5] Each audited business was assessed for compliance with legislation and internal business process, and the preparedness of its network assets for the bushfire season was determined.

As part of the BMP audits, ESV undertook a limited desktop audit followed by a comprehensive field-based audit. The audits reviewed the state of the network from a field perspective and, in part, compared the physical assets to the company's records.

Audits of Basslink and Transmission Operations Australia were not conducted as the asset bases of both companies are relatively small, relatively new and vegetation was known to be well-managed.

3.5 ELECTRIC LINE CLEARANCE

The Act defines the responsibility of responsible persons to maintain vegetation clear of overhead electric lines. Responsible persons bound by the Act include major electricity companies, municipal councils and private property owners and occupiers.

[5] The exceptions were Basslink and Transmission Operations Australia due to the short length of their transmission lines and the newness and prior good condition of their assets.

The Electricity Safety (Electric Lines Clearance) Regulations require each major electricity company to develop an ELCMP each year and submit it to ESV for acceptance. The ELCMP is required to be prepared by the company by 31 March each year for the forthcoming financial year.

Specific clearance distances are outlined within the Code of Practice for Electric Line Clearance, which is a schedule to the regulations. Vegetation that does not comply with the requirements of the Code has the potential to compromise electrical safety, affect the reliability of supply and increase the likelihood of fire ignition.

ESV ensures compliance with the regulations through review and approval of the ELCMP and then auditing the implementation of the ELCMP. The audit process comprises a desktop audit of the organisation's vegetation database and other records followed by field audits to confirm appropriate clearance standards are achieved and well maintained.

During 2014, the Electric Line Clearance Consultative Committee invited ESV to draft new regulations to come into force in 2015. A Regulatory Impact Statement was released for public comment on the draft regulations in September 2014. The consultation period closed 13 January 2015 with various stakeholders providing submissions. The stakeholder submissions informed ESV of how the new draft regulations delivered both positive and negative outcomes for them.

Following consideration of the stakeholder submissions, ESV presented its findings to the Committee for consideration in its continued review of the draft regulations.

The Parliamentary Counsel Victoria advised ESV on 2 April 2015 that the development of the draft regulations was settled. In June 2015, the 2010 regulations expired and were replaced with the new 2015 regulations.

3.6 WORK PRACTICES

In accordance with section 6 of the Act, ESV's statutory objectives include the control of electrical safety standards for electrical work carried out by electrical workers and the maintenance of public and industry awareness of electrical safety requirements.

ESV meets these objectives by undertaking work practice observation audits of each distribution company to ensure works are undertaken safely and in accordance with its accepted ESMS. Compliance is assessed against the Electricity Safety (Management) Regulations 2009, with a specific focus on:

- Regulation 15 "Standards for works on applicable assets — where there are published technical standards", where the relevant technical standards include:
  - The Blue Book
  - The Green Book
  - Victorian Electricity Supply Industry (VESI) Field Workers Handbook
  - VESI HV Live Work Rules
  - VESI Installation Supply Connection Tests and Procedures.

- Regulation 16 "Standards for works on applicable assets — where there are no published technical standards", where ESV seeks evidence of company-developed standards.

Work practice observation audits were carried out on various types of work including:
- electrical access permit work for overhead and underground works
- live HV work, including glove and barrier techniques

- live LV work
- metering and servicing work
- public lighting and faults
- asset inspection.

Two forms of audit were used:

- Opportunistic audits
  These are random spot audits on work being undertaken on electrical distribution assets by distribution workers and contractors as ESV auditors observe crews in the field while undertaking other audit duties.

- Planned audits
  These are audits scheduled with a distribution business. The activities to be audited are selected by the auditor from lists of work being undertaken on the day.

ESV identifies areas of concern by reviewing the details of the audits and allocating the findings to the following categories in order to analyse trends:
- pre-site job planning
- risk assessment
- work crew communication
- general equipment and personal protective equipment
- LV resting
- HV live work
- LV work
- operating.

3.7 DIRECTIONS AND EXEMPTIONS

3.7.1 Directions

As an outcome of the 2009 Victorian Bushfires Royal Commission, ESV issued directions to the distribution companies to prepare plans for the upgrade of assets that had been identified by the Commission as having the potential to cause future bushfires. The two directions issued by ESV were:

- Installation of armour rods and vibration dampers

  ESV issued a direction to all the distribution businesses to prepare plans for the installation of armour rods and vibration dampers in accordance with VESI standards. This complies with recommendation 33 of the 2009 Victorian Bushfires Royal Commission. One of the fires was attributed to conductor failure as a result of Aeolian vibration.[6] The Commission determined that over a long period of time this vibration caused fatigue in a conductor tie that failed on Black Saturday resulting in a bushfire.

  The SECV had a set of criteria for the installation of both armour rods and vibration dampers. The SECV, and subsequently the distribution companies that followed the disaggregation of the SECV, had not always installed these items when constructing or maintaining overhead lines.

[6] Aeolian vibration is caused by the shedding of vortices off the overhead powerline setting up a vertical vibration in the powerline. The vibrations can stress the powerline, but more commonly affect the fittings where the powerline is clamped to poles or towers.

- Installation of LV spreaders

  In 2011 ESV directed all distribution companies to prepare plans to:
  - install LV spreaders in all spans of bare LV conductor in HBRA[7]
  - fit additional LV spreaders to all spans to achieve the requirements of VESI drawing VX9/7020/150
  - conduct an annual audit of the LV spreaders to confirm they are in place and functional
  - ensure the spacing between conductors meets the minimum separation as specified in Section 10.3 of the Energy Networks Association document "Guidelines for Design and Maintenance of Overhead Distribution and Transmission Lines" ENA C(b)1 - 2006
  - develop a program to identify all spans that do not meet the requirements of ENA C(b)1
  - develop a plan to ensure compliance with ENA C(b)1 in HBRA by November 2015 and in LBRA by November 2020
  - conduct an audit of the status and condition of the spacers installed to meet the requirements of ENA C(b)1.

  The direction did not require the companies to regularly report on the progress of these programs; however, where possible, ESV has collected this information for inclusion in this report.

ESV issued a direction regarding the Government Powerline Replacement Fund to Powercor on 11 July 2014 and to AusNet Services on 27 June 2014. The direction required them to complete certain powerline replacement projects by specified dates and to report progress monthly. Neither distribution company invoked its right of review of the ESV direction under section 69(3) of the Act. So, as required by the direction, they included the direction requirements into their Bushfire Mitigation Plans. ESV formally accepted their revised plans.

3.7.2 Exemptions

In 2010, the Electricity Safety (Electric Lines Clearance) Regulations were revised and the clearance distance required between overhead electric powerlines and trees was increased. Distribution companies and other responsible persons were required to manage trees to maintain compliance with the new regulations.

Due to the change in clearances from the previous regulations, none of the distribution companies was immediately compliant with the new regulatory requirements. All the distribution businesses, therefore, applied for an exemption to the regulations to allow time to transition to compliance with the new regulations. ESV granted these exemptions and has, since 2010, monitored their progress towards achieving compliance.

3.8 SAFETY INDICATORS

ESV reports on a range of measures used as indicators of safety performance. These are classified under:

- Incidents involving the public

  The electrical safety of the public, workers and contractors working for the major electricity companies is the highest priority for ESV. Electric shock incidents, including those resulting in serious injury or fatality, are key performance indicators for electrical safety.

[7] The likelihood of a fire spreading is predicted by the Country Fire Authority and categorised geographically as High Bushfire Risk Area (HBRA) or Low Bushfire Risk Area (LBRA).

- Asset failures

  Network assets can fail in a number of ways:
  - through environmental causes, such as weather or fauna
  - through third parties, such as a vehicle strike
  - through deterioration or overload.

  The asset failure may cause a fire to start on the ground or a fire on the asset. It may also expose the public to live equipment. Assets failures may injure the public, compromise the reliability of supply or potentially result in bushfires.

- Vegetation fires due to asset failure or contact

  Asset failures can cause ground fires from hot particles falling to the ground. Alternatively, the assets themselves can burn or melt without causing a ground fire. Contacts with assets can result in hot or burning material falling to the ground. Such materials may include tree branches, an animal or bird, or hot metallic particles or sparks from vehicle contact or conductors.

- Fires on or in assets

  An asset is considered to have experienced a fire if it gives out heat, smoke, undergoes combustion or a destructive burning. For reporting purposes any evidence of charring, smouldering or melting is categorised as a fire.

  An asset fire has the potential to start a ground fire. Assets that are poorly maintained or kept in service past their engineering life can fail and result in a fire.

  Assets failures may injure the public, compromise the reliability of supply or potentially result in bushfires.

Victoria has had a number of significant bushfires that have been shown to have started at an electrical network asset. The information that ESV collects and analyses provides an insight into the performance of the major electricity companies in mitigating bushfire risk, general safety and supply reliability issues associated with asset fires.

4 SERIOUS ELECTRICAL INCIDENTS

ESV investigates all serious electrical injuries to understand the root cause of the incident. The outcomes of ESV analyses of incidents are promulgated for action by the industry to ensure it has implemented appropriate measures to prevent reoccurrence.

4.1 INCIDENTS INVOLVING THE PUBLIC

In May 2014, there was one fatality involving a privately-engaged tree worker. The worker was pruning tree branches in the front yard of a residence in the vicinity of a 22kV overhead powerline located on the nature strip. The worker was electrocuted when he cut a branch that fell and contacted the overhead powerlines and the worker simultaneously. WorkSafe Victoria led the investigation and ESV provided technical assistance.

Subsequent to the fatality ESV initiated a new safety awareness campaign aimed at vegetation workers known as the “Don’t put your life on the line” campaign. The campaign warns vegetation workers of the electrical hazards when working near overhead powerlines, with a particular focus placed on private contractors and those new to the industry. Typically such groups do not have the same level of awareness or training as those employed by distribution companies or municipal councils.

To date the ongoing campaign has included ESV conducting a safety awareness presentation at an industry forum called Arborcamp in February 2015, and developing brochures, guidance and other promotional material (including full-page advertisements in industry publications such as Arbor Age and Landscape Contractor magazine) to raise awareness throughout the industry.

During 2014 ESV investigated the following electrical incidents in addition to the fatality above:

- In February 2014, a bakery worker was hospitalised for observation after receiving an electric shock when a truck contacted overhead lines. The incident caused HV to be injected into the nearby bakery.
- In April 2014, an open-circuited neutral conductor caused damage to the appliances at a single residence. The incident resulted from inadequate testing after the supply meter was changed the previous day.
- In October 2014, a residential customer was hospitalised for observation after receiving an electric shock. This came about because water from a high-pressure cleaner entered the live terminal with the connection to the house and electrified the gutters.

While any fatality is unacceptable, it is encouraging that there were no other electrical incidents from network infrastructure assets that resulted in serious injuries to the public or major electricity company workers in 2014.

4.2 MORWELL INCIDENT

On the morning of 4 April 2014 an incident occurred at the Morwell Terminal Station that resulted in the temporary loss of electrical supply to approximately 100,000 customers in the region.

ESV investigated the incident and issued an interim report on 2 May 2014. Several likely causes of the initial fault that led to the subsequent loss of supply were identified; however, ESV was unable to determine the exact cause due to the extensive damage in the vicinity of the original fault.

The investigation found that the network's primary protection system did not operate after the fault due to an incorrect relay setting, and a secondary (back-up) protection system failed to operate due to a faulty component.

ESV's final report[8] into the event made 13 recommendations for SP AusNet (now AusNet Services) to implement.

4.3 TRENDS

Trends in electric shock incidents, including those resulting in serious injury or fatality, are key performance indicators for electrical safety. Electric shock incidents have continually declined over the last five years as illustrated in Figure 1.

Table 3 details the electric shock incidents resulting from electricity distribution assets in 2014. It includes electric shock incidents resulting from No Go Zone breaches and accidents involving employees or contractors to the distribution businesses. ESV conducts an investigation into incidents involving serious electric shock, and assists other agencies such as WorkSafe in its investigations. ESV circulates Safety Alerts throughout the industry and the community to highlight dangerous situations.

Given the low levels of incidents reported, it is difficult to be conclusive about trends in the data. That said, electrical shocks without fatality have more than halved over the last five years, serious injuries to distribution company workers and contractors is at least stable, and fatal and serious injuries to members of the public are not increasing. While these trends are positive, efforts need to continue to reduce these further.

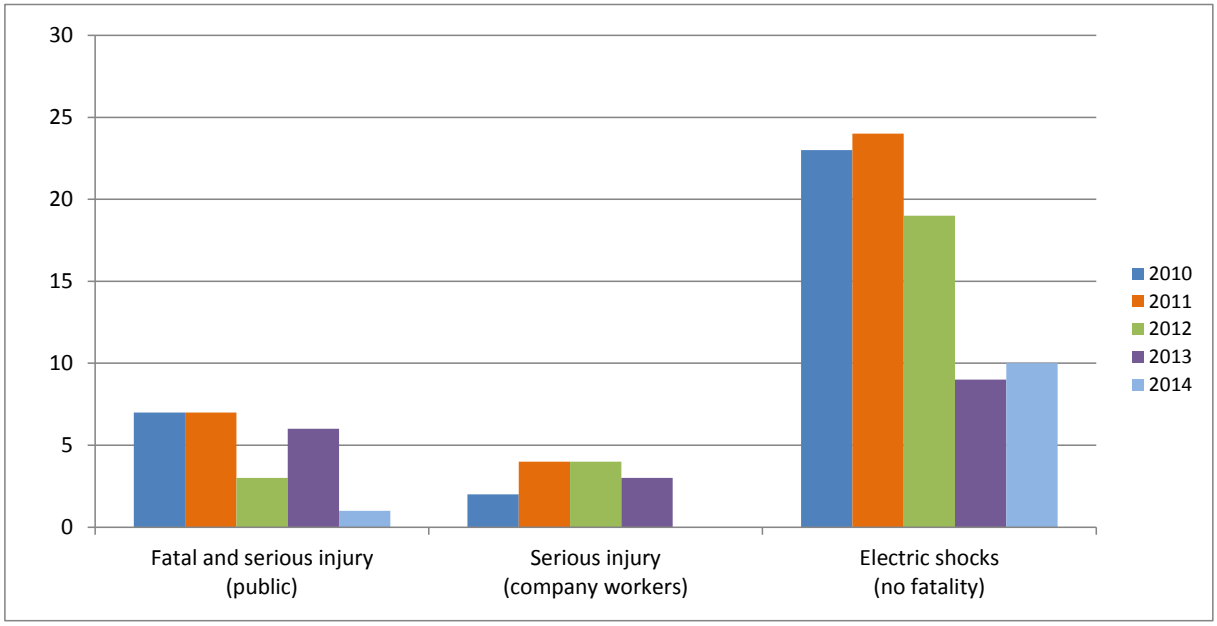

Figure 1: Electrical incidents involving distribution network assets

[8] *Morwell Terminal Station Incident Final Report*. Energy Safe Victoria, August 2014.

Table 3: Electric shocks by distribution company network

Item	2014 total	AusNet Services	CitiPower	Jemena	Powercor	United Energy
Electric shock – fatal	**1**	0	0	0	0	1
Electric shock – serious injury (public)	**0**	0	0	0	0	0
Electric shock – serious injury (company workers)	**0**	0	0	0	0	0
Electric shock – non-serious injury	**10**	5	2	0	2	1

5 SAFETY PERFORMANCE

The safety performance of the municipal councils in relation to their electric line clearance obligations is provided in Appendix A. Further comment is provided in Section 5.3.1.

The comparative performance of the major electricity companies is summarised in Section 5.1 and 5.2 for the transmission and distribution companies respectively.

Section 5.3 analyses and discusses the major themes arising from the safety benchmarking data and the implications for the future focus of ESV, the major electricity companies and municipal councils. The recommendations from this analysis and the appendices are summarised in Section 6.

5.1 TRANSMISSION COMPANY PERFORMANCE

Detailed information on the performance of the transmission companies is provided in Appendices B, C and G for AusNet Services (transmission), Basslink and Transmission Operations Australia (TOA) respectively.

All three transmission companies had approved safety management plans (ESMS and ELCMP). The audit of the AusNet Services ESMS was common to its transmission and distribution businesses, and the results are detailed in Table 4. The audits of the Basslink and TOA ESMS identified no noncompliances or areas requiring attention, and only a few opportunities for improvement.

Audits were not undertaken of Basslink's and TOA's ELCMP and work practices. The audit of the AusNet Services ELCMP identified no major variances, and the audit of its work practices was common with its distribution business (see Table 4 for results).

5.2 DISTRIBUTION COMPANY BENCHMARK

The distribution companies have the broadest responsibilities under the Act and the associated regulations. This report, therefore, pays specific attention to their safety performance as this is most pertinent to maintaining the safety of the public. Public safety can be compromised through interaction with electricity networks assets, through bushfires and other fires, and through undermining of the reliability of the electricity network.

Detailed information on the performance of the distribution companies is provided in Appendices B-H.

Table 4 summarises the performance of the transmission companies in preparing and delivering against the required safety management schemes, plans and programs. Successful completion of performance objectives is annotated with a green tick. Such objectives include the development of management plans (ESMS and ELCMP), overall audit compliance (ESMS and ELCMP) and the annual Bushfire Mitigation Index (BMI).[9] The audit information identifies the level of compliance of each company in delivering its safety programs in line with its safety management plans. This is measured in terms of a variance between documented procedures and ESV's observations of performance in the field.

[9] The BMI measures the performance of a range of inspection and maintenance activities against policy targets, with the objective being to reduce the index to zero by the start of the Fire Danger Period and to maintain a zero index rating throughout the period. It provides an index of a company's bushfire preparedness.

Table 4 also summarises each company's performance in delivering safety programs agreed with the Australian Energy Regulator and directions and exemptions issued by ESV. This performance is classified in Table 4 as follows:

0	Satisfactory outcome: all programs of work are expected to be completed by the end of 2015
1-2	Marginal outcome: only one program of work is not expected to be completed by the end of 2015
>2	Unsatisfactory outcome: multiple programs of work are not expected to be completed by the end of 2015

Each of the companies reports to ESV against a range of safety indicators reflecting incidents arising with regard to their network assets. This performance is summarised in Table 5 with the following annotations on trends:

↗	The number of incidents appears to be trending upward and, therefore, the risk of a safety incident occurring is increasing
↘	The number of incidents appears to be trending downward and, therefore, the risk of a safety incident occurring is decreasing
→	The number of incidents appears to be stable and, therefore, the risk of a safety incident occurring is neither increasing or decreasing
?	There is insufficient data to identify a trend

The major themes arising from the benchmarking of safety indicators are discussed in more detail in Section 5.3.

Table 4: Benchmarking of the distribution companies – plans and audits

Performance area	Measure	AusNet Services	CitiPower	Jemena	Powercor	United Energy
Electricity Safety Management Scheme						
ESMS review	Approval	✓	✓	✓	✓	✓
Audit	Noncompliance	0	0	0	0	0
	ARA	1	0	0	0	0
	OFI	14	4	3	4	6
	Overall compliance	✓	✓	✓	✓	✓
Safety programs						
Audit	Variance	5.4%	3.0%	1.3%	1.3%	1.9%
	Noncompliance	3	1	1	0	2
	ARA	1	0	4	3	3
	OFI	0	0	2	0	9
Program status	Ahead of schedule	5	2	6	5	12
	On schedule	4	0	2	0	6
	Behind schedule	1	6	6	3	16
	Unlikely to meet target	**0**	**6**	**5**	**1**	**13**
Bushfire mitigation						
Audit	Variance	1.0%	1.2%	3.0%	1.4%	3.4%
Bushfire preparedness	BMI	0.0	0.0	0.0	0.0	0.0
Electric line clearance						
ELCMP review	Approval	✓	✓	✓	✓	✓
Audit	Variance	5.7%	2.1%	3.6%	1.6%	6.3%
	Overall vegetation management	✓	✓	✓	✓	✓
Work practices						
Audit	Noncompliance	2	0	1	0	0
	ARA	3	2	9	2	10
	OFI	10	11	14	11	18
Directions and exemptions						
Directions	Ahead of schedule	0	-	0	2	6
	On schedule	2	-	2	0	3
	Behind schedule	0	-	0	1	0
	Unlikely to meet target	**0**	-	**0**	**1**	**0**
Exemptions	Complete	3	3	3	2	2
	Outstanding	0	0	0	**2**	0

Note: ARA = area for attention (minor or once-off noncompliance that requires action by the company but does not appear to pose a safety risk or represent a major deviation from process or procedure)

OFI = opportunity for improvement in process or procedure (provided for consideration by the company)

Table 5: Benchmarking of the distribution companies – safety indicators

Performance area	AusNet Services	CitiPower	Jemena	Powercor	United Energy
Incidents involving the public					
Overall performance	↘	↗	↗	↗	↘
No Go Zone infringements	↘	↗	↗	→	↘
Unauthorised access	↗	↘	↗	↗	→
Reverse polarity	→	?	?	?	→
HV injections	↘	→	↗	↗	→
Asset failures					
Overall performance	→	↘	↗	↗	↗
Conductor plus HV tie failure	↘	↘	↘	↘	↗
Pole failure	↘	→	↗	→	→
HV fuse failure	→	↘	→	→	↗
Crossarm failure (excluding failure due to fire)	↘	↗	→	↗	↗
LV asset failure	→	↗	↗	↗	→
Vegetation fires due to asset failure					
Overall performance	↗	↗	↗	↗	↗
Pole and/or crossarm failure	→	?	?	↘	?
Pole and/or crossarm fire	↗	?	?	↗	?
Oil-filled plant	→	?	?	?	?
HV fuse	↗	→	?	↘	→
LV asset failure	↗	↗	?	↗	↗
Other causes	→	→	↗	↗	↗
Vegetation fires due to contact					
Overall performance	↘	↘	→	↗	↗
Animal contact	↘	?	→	↗	→
Third-party impacts	→	?	→	→	→
Tree contact	↘	↘	↘	↗	→
Other causes	↘	↘	→	↘	?
Fires on or in assets					
Overall performance	→	↘	↗	↗	↗
Pole and crossarm fire	↗	↗	↗	↗	↗
Oil-filled plant	→	?	?	→	→
HV fuses	?	?	?	↘	→
LV equipment	↗	→	?	↘	↗
Other assets	→	↘	→	↘	↘

5.3 SAFETY THEMES AND FUTURE FOCUS

This section draws together data from the appendices to this report in order to explain the major themes arising from the safety indicator benchmarking (Table 5). In doing so, areas are identified for ESV, the distribution companies and other responsible parties (primarily municipal councils) to focus their future activities.

ESV has been progressively implementing data collection so some indicators do not have data going back to 2010.

5.3.1 Bushfire risk

A key focus for safety management over the last five years has been in reducing the risk of bushfires. Since the 2009 Victorian Bushfires Royal Commission, the AER has funded capital works targeted at fire reduction and ESV has issued directions and exemptions to improve safety performance in this area.

While the reporting of vegetation fires arising from tree contact is limited, it does indicate that these measures are gaining traction with the average number of such fires falling from 0.74 incidents/1000km of overhead line in 2012 to 0.49 in 2014 (Figure 2).

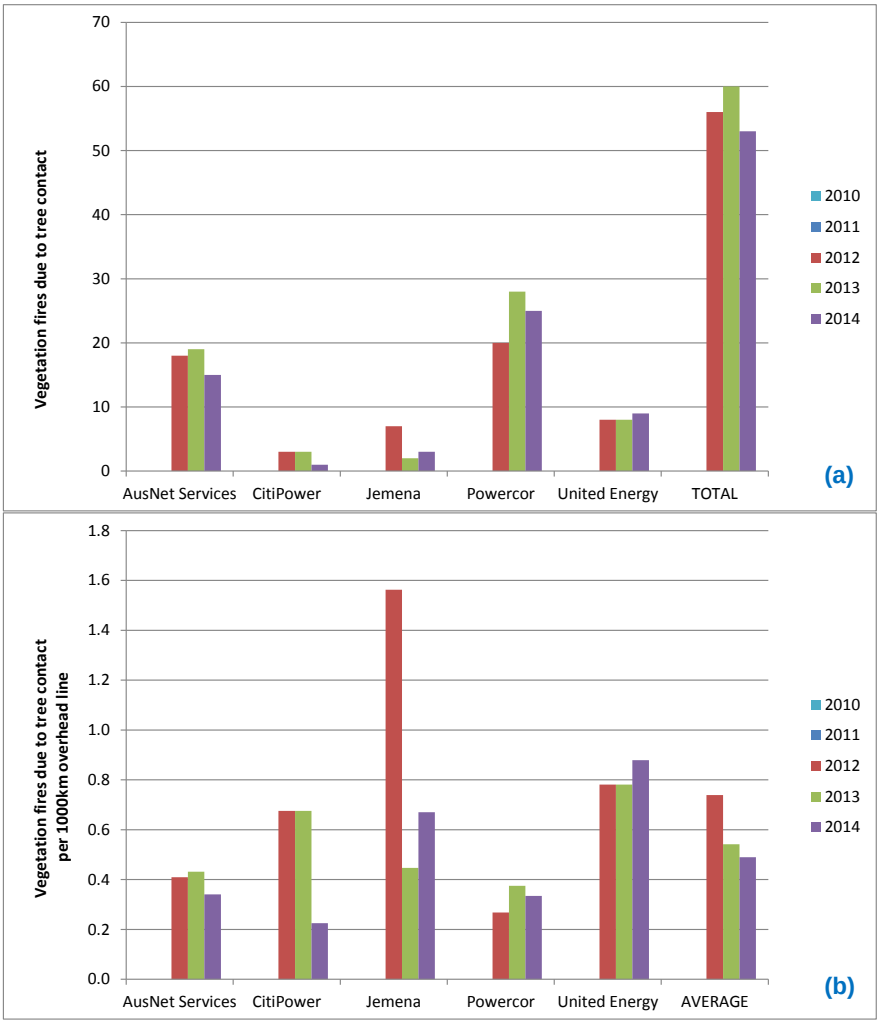

Figure 2: Vegetation fires from tree contact (a) total incidents and (b) incidents per 1000km

The reduction in fire starts from tree contact removes a major cause of bushfires and thereby improves the safety of communities across Victoria, particularly those in HBRA.

Further improvement in this area will require the ongoing effort of the distribution companies to maintain vegetation clearance around powerlines. Electric line clearance programs will, therefore, continue to be a major focus of these companies and of ESV's oversight of their activities.

However, responsibility for line clearance is not the sole responsibility of the distribution companies. Municipal councils also have a major role for ensuring vegetation is kept clear of overhead powerlines. While this responsibility lies primarily in areas where the risk of bushfire is minimal, there is potential for fire starts and overhead line failures due to vegetation contact. A failure by council to maintain line clearances may increase the risk of:

- bushfire events (lower risk in LBRA, but some councils do have small amounts in HBRA)
- localised fires and loss of houses, other amenities and human lives
- human contact with lines or enlivened foliage resulting in loss of life
- damage to overhead powerlines resulting in live lines coming down, with the potential to result in the loss of lives and impacts on the reliability of electricity supply.

The audit results for most distribution companies note that line clearances are better maintained when clearance is the responsibility of distribution companies. This also identified that councils need to increase their line clearance activities and improve their performance.

It is recommended that ESV undertakes further work to understand the magnitude of this issue with input from the distribution companies, and develop plans to improve performance in this area. This could include awareness campaigns to inform councils of the risk of such events when developing budgets and works plans.

Despite the improvement observed in fires due to contact with trees, vegetation fires due to faults and fires from distribution network assets have been increasing over the last four years (Figure 3). The distribution companies are generally on par as regards their performance, although Jemena and United Energy reported more vegetation fires per kilometre of overhead line despite the larger proportion of urban areas in their regions. The incidence of vegetation fires from AusNet Services' and Powercor's assets seems to be levelling off. This is positive given that they maintain the networks across most of rural Victoria where bushfires can be particularly devastating.

Figure 3 also shows the total numbers of vegetation and asset-related fires. Jemena and United Energy are experiencing significantly more fires per kilometre of overhead line than the other three distribution companies. Further work is required to understand the causes of this difference. It is also worth noting that total fires involving the assets of AusNet Services and Powercor appear stable, and those involving CitiPower assets are in decline.

Fires also represent a significant proportion of all incidents reportable to ESV by the distribution companies. One out of every three fire incidents reported to ESV involves a vegetation fire (Figure 4(a)). This proportion is increasing for AusNet Services, CitiPower and Powercor, and decreasing for Jemena and United Energy.

Vegetation fires also account for 11 per cent of all reportable incidents over the last four years. These have been increasing relative to other incidents for all distribution companies except Jemena, and have been oscillating for United Energy (Figure 4(b)). While the relative proportions of vegetation fires to other incidents may increase as absolute numbers of other incidents decrease, Figure 3 shows that vegetation fires are increasing in absolute terms.

Apart from management practices, climate is the major factor that could be influencing these observed behaviours. Elevated temperatures can physically stress distribution network assets. They also encourage people to use air-conditioning more frequently and put extra pressure on these assets. The hotter, drier conditions cause vegetation to dry out, thereby creating ground conditions more conducive to fire ignition. Increased failures or fires on the network combined with adverse ground conditions result in more frequent vegetation fires.

Overall vegetation fires are increasing, possibly influenced by climate. Ideally, Victoria's networks should be climate-proofed (and this may be a longer-term position); however, ESV first needs to collect more data to inform the validity of such a position and, if valid, identify suitable mitigations with the distribution companies.

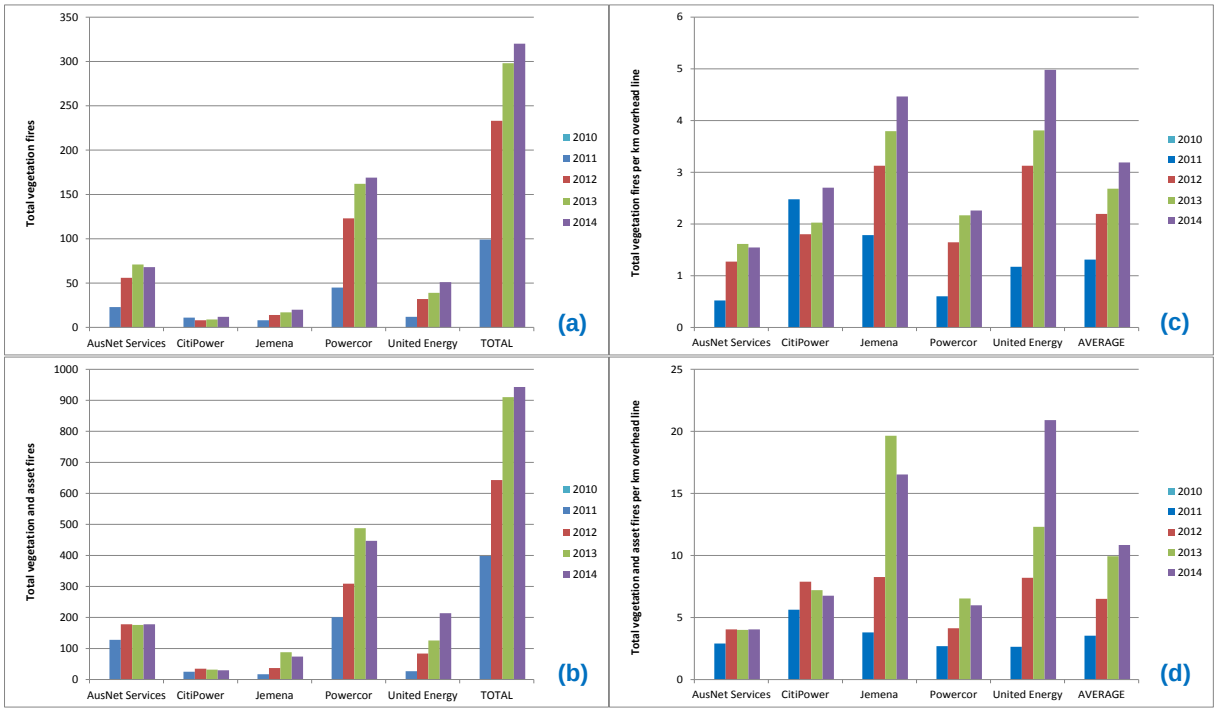

Figure 3: Fires from distribution assets (all causes)
(a) fires and faults resulting in vegetation fires
(b) vegetation fires and fires on or in assets
(c) and (d) are the same data as (a) and (b) normalised by the length of overhead line owned by each company

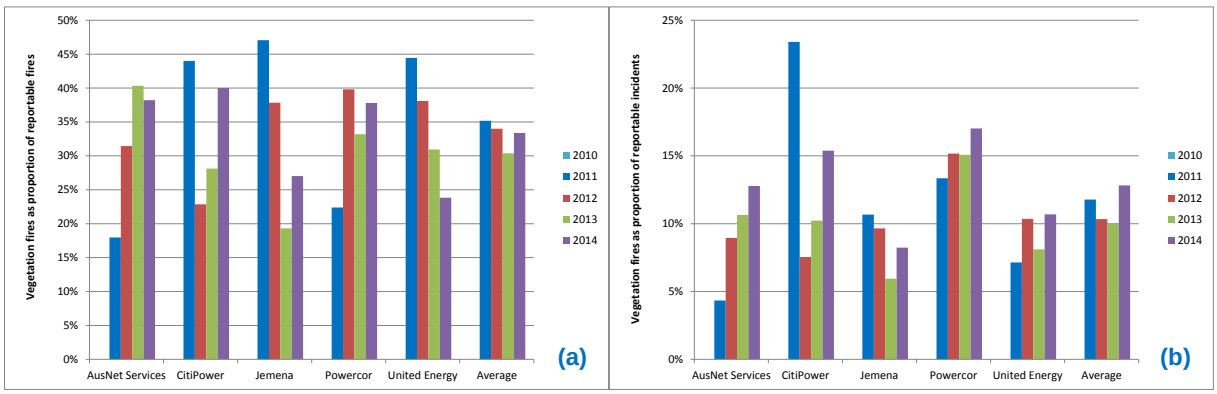

Figure 4: Vegetation fires as a proportion of (a) all fires and (b) all reportable incidents

5.3.2 Conductor failures

Figure 5 shows the performance of the distribution companies with regard to conductor failures on their networks. For four of the five companies, this has been trending downward since 2012. The exception is United Energy, where such failures have been increasing over the last five years.

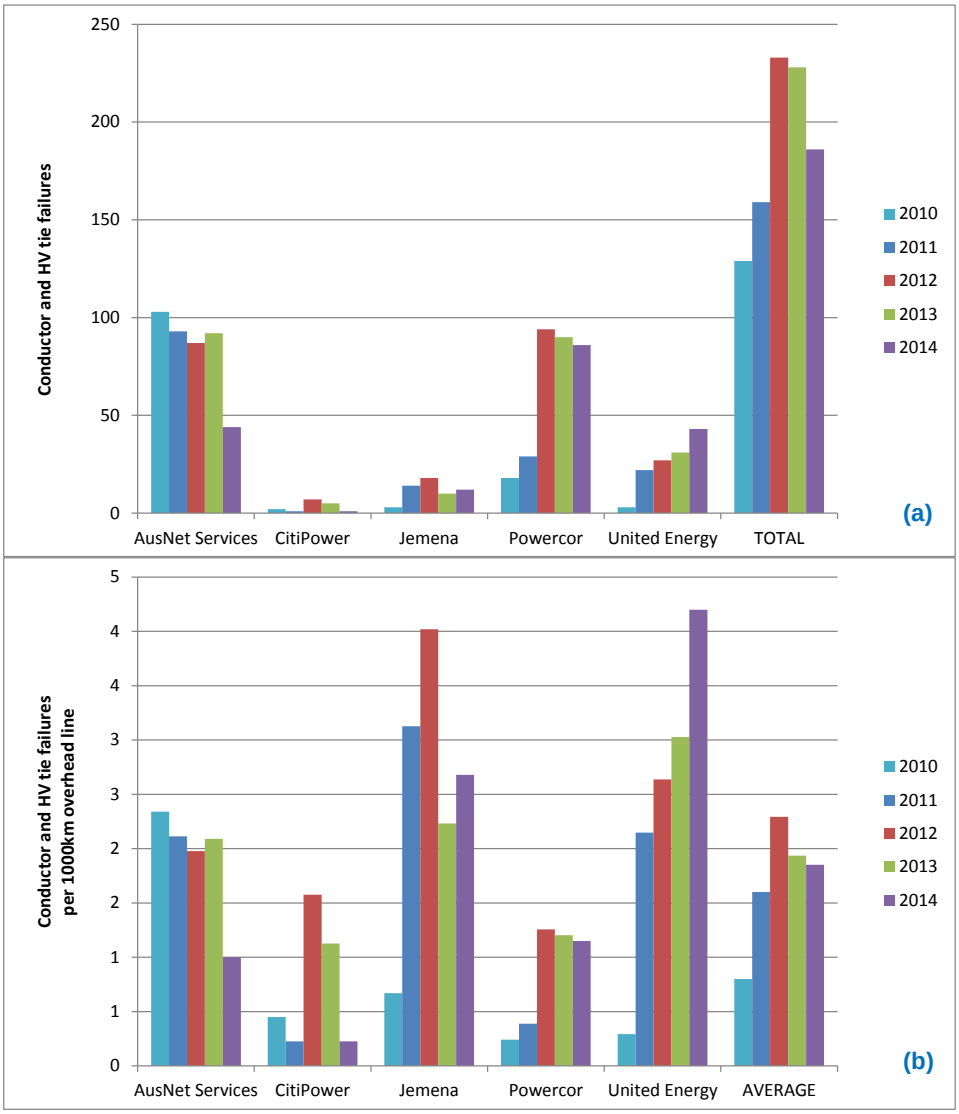

Figure 5: Conductor and HV tie failures (a) total incidents and (b) incidents per 1000km

It is probably too early for the effects of ESV's direction to install vibration dampers and armour rods to have manifested in this improved performance. This is evidenced by the improvement in CitiPower's network (where there is no requirement to install dampers and rods) and the decline in United Energy's network (where the directions program is reported as being ahead of schedule). Further consideration of the causes of conductor failures should be undertaken in order to ensure improved future performance.

The installation of dampers has the effect of reducing Aeolian vibration as winds blow across the powerlines (see page 18) and, subsequently, fatigue of the line or at the point to which

the line connects to a pole or tower. This, in turn, reduces the risk of a live powerline contacting the ground and starting a bushfire, hanging down where contact may result in loss of life, or contacting other lines thereby resulting in HV injections (with potential shock and injury consequences) and reduction in reliability of supply. ESV's direction to install dampers and armour rods should help reduce conductor failures in the future and improve safety performance.

5.3.3 Look up and live

The "Look up and live" media campaign was designed to raise awareness of the dangers associated with working near overhead lines, particularly within the farming and construction industries. WorkSafe Victoria is responsible for the No Go Zones rules around power poles and towers, and works with ESV to encourage businesses to comply with the rules.

For poles, the No Go Zone encompasses the space within 3m horizontally of a conductor and extending 3m below the conductor and all the space above the conductor.

Equipment is permitted to approach between 6.4m from the conductor and the No Go Zone (3m from the conductor) provided a safe system of work (possibly involving a spotter) is established to deliver the work.

No Go Zone infringements are those occurrences reported to ESV where the rules pertaining to either the 3m No Go Zone or the 6.4m approach have been breached.

Figure 6 shows an increasing number of No Go Zone infringements reported for CitiPower and Jemena. Powercor's performance is stable, and AusNet Services and United Energy have seen declining incidents since 2012.

The normalised data in Figure 6 reveals the CitiPower infringements are approximately eight times greater than the other distribution businesses (except Jemena).

The normalised data for Jemena indicates that its infringement rate is currently eight times greater than the other distribution businesses and, if extrapolated, suggests the 2015 rate could be 10 or 11 times greater. Figure 31 (page 97) shows that Jemena is experiencing an exponential rise in No Go Zone infringements, with a 99.9 per cent correlation between actual incidents and an exponential line of best fit.

The causes of these large differences are uncertain and more work is required to explain and contain them. There is no clear supporting evidence for these patterns, but possible contributory factors could be:

- the success of the "Look up and live" campaign raising awareness and so increased reporting
- increased construction works causing more infringements (that is, there is more activity near poles)
- unwillingness on the part of construction businesses to accept the costs associated with managing work close to powerlines and so taking chances.

It is recommended that ESV undertakes further investigation of infringements and serious incidents in order to better understand the logic underpinning the observed increase in No Go Zone infringements.

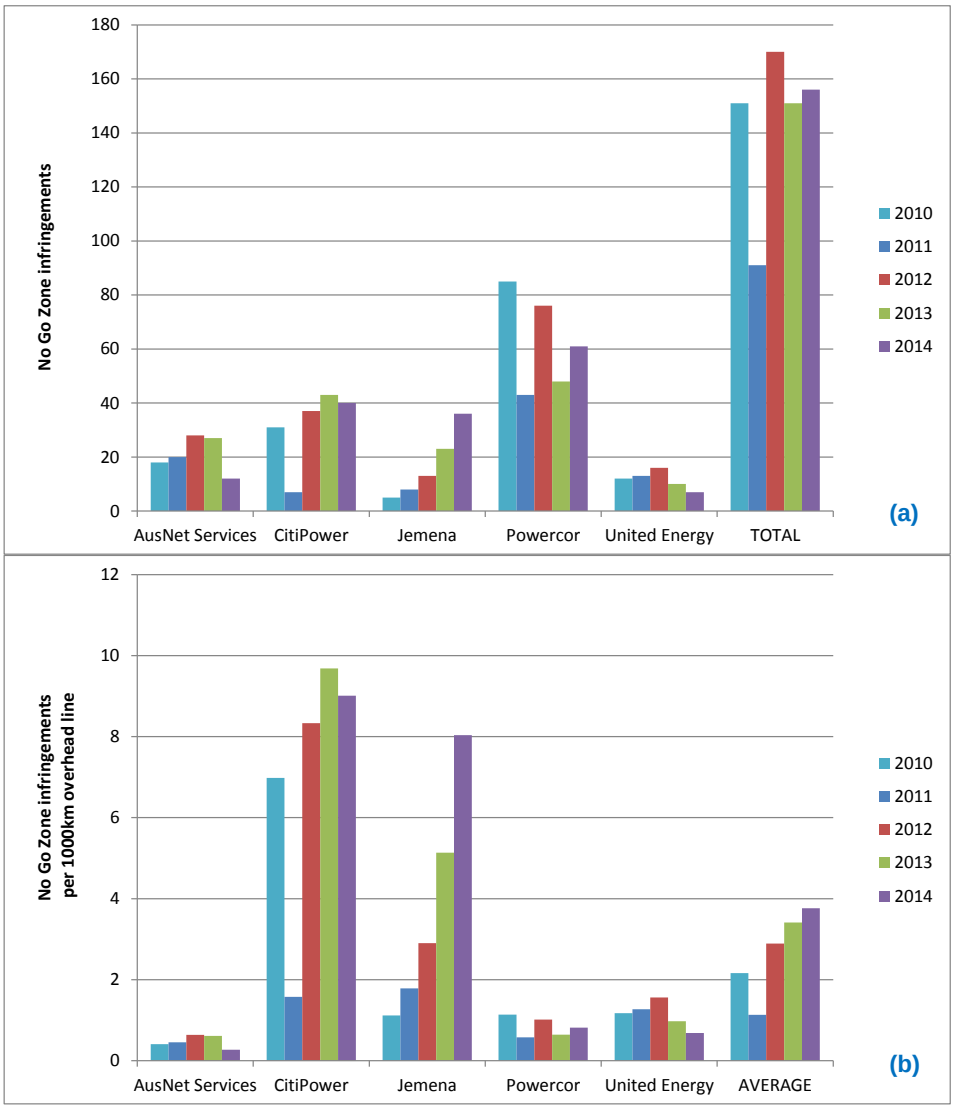

Figure 6: No Go Zone infringements (a) total incidents and (b) incidents per 1000km

There is an upward trend in the cases of unauthorised access to substations reported by all businesses (except AusNet Services and United Energy) to varying degrees (Figure 7). The most striking rate of increase is associated with Powercor. ESV cannot identify any cause for these trends. ESV has investigated a possible correlation between the copper price and the incidence of copper theft from substations, but there appears to be no direct relationship. In fact, unauthorised access increases as the long-term copper price comes down.

This does not preclude the possibility of people storing stolen copper and awaiting a shift in the market price for scrap copper. It is possible that the increase in unauthorised access to Powercor sites is associated with copper theft. This would indicate that Powercor needs to assess its security protocols and the accessibility of its assets.

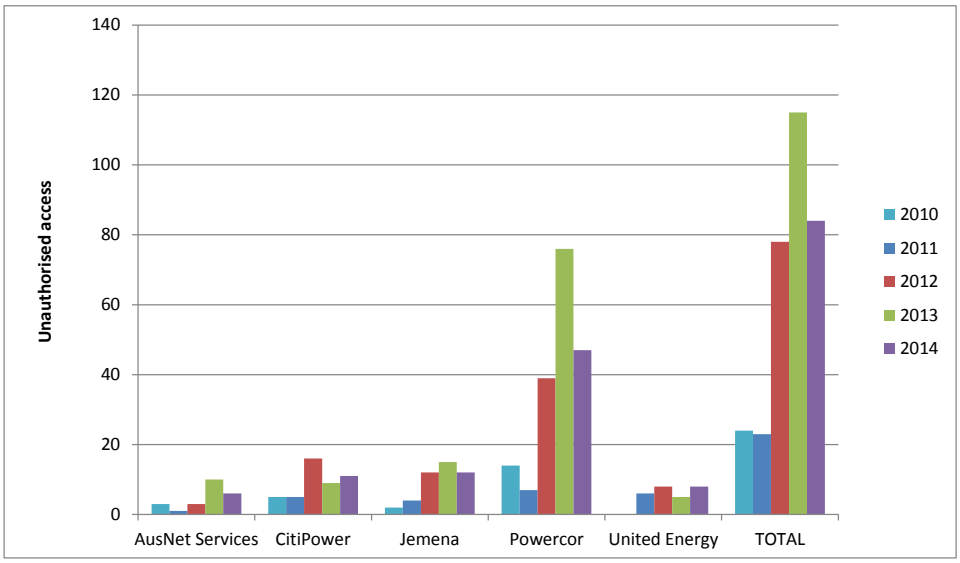

Figure 7: Unauthorised access

5.3.4 Emerging asset issues

The benchmarking data in Table 5 and the information contained in Appendices B-H indicate a range of asset issues that warrant specific discussion, in particular the incidence of pole and crossarm failures, HV injections and LV asset failures. Comment is also provided on the safety implications of ageing network infrastructure.

Pole and crossarm failures

The failure of poles and crossarms pose a number of risks, namely:

- Bushfires
  Pole and crossarm failures have the potential to cause bushfires through live lines coming into contact with vegetation and the ground and through burning material from pole-top infrastructure igniting vegetation at height or on the ground.

- HV injections
  Such failures can also cause HV and LV conductors to come into contact with each other. This can result in HV injections that can cause damage to local electrical equipment and shock members of the public close to such equipment. This is addressed separately below.

- Contact events
  The failure of crossarms can result in live conductors coming to the ground or hanging at a level where they can come into contact with people, vehicles or vegetation. These can result in:
  - electrocution and possible serious injuries or fatalities
  - an obstruction risk that can result in injury or damage and loss of control of vehicles (cars, trucks and bicycles)
  - fires.

Figure 8 shows the number of pole and crossarm failures (with and without fire) experienced across the distribution network in total and normalised by the number of poles managed by each distribution company.

Figure 8(c) indicates that the performance of each of the distribution businesses is similar with regard to pole and crossarm failures that do not result in a vegetation fire. After a peak in 2013, the number of failures without fire has decreased in 2014. ESV hopes further decreases in subsequent years will confirm a downward trend. Currently such failures are still 37 per cent higher than they were in 2011 so there is room for further improvement. Powercor appears to be performing slightly better than the other distribution companies in this regard.[10]

Failures and pole-top fires resulting in vegetation fires have been increasing since 2011 despite efforts to manage this. Contrary to the data on failures without fire, Figure 8(b) and Figure 8(d) indicate Powercor has a significant issue with regard to pole and crossarm failures and pole-top fires that result in vegetation fires. Predominantly this results from burning material from pole-top fires falling to the ground and igniting vegetation at the base of the pole.

This may not, however, be due to any failing on Powercor's behalf. Before discussing this, we first need to understand the mechanism behind pole-top fires.

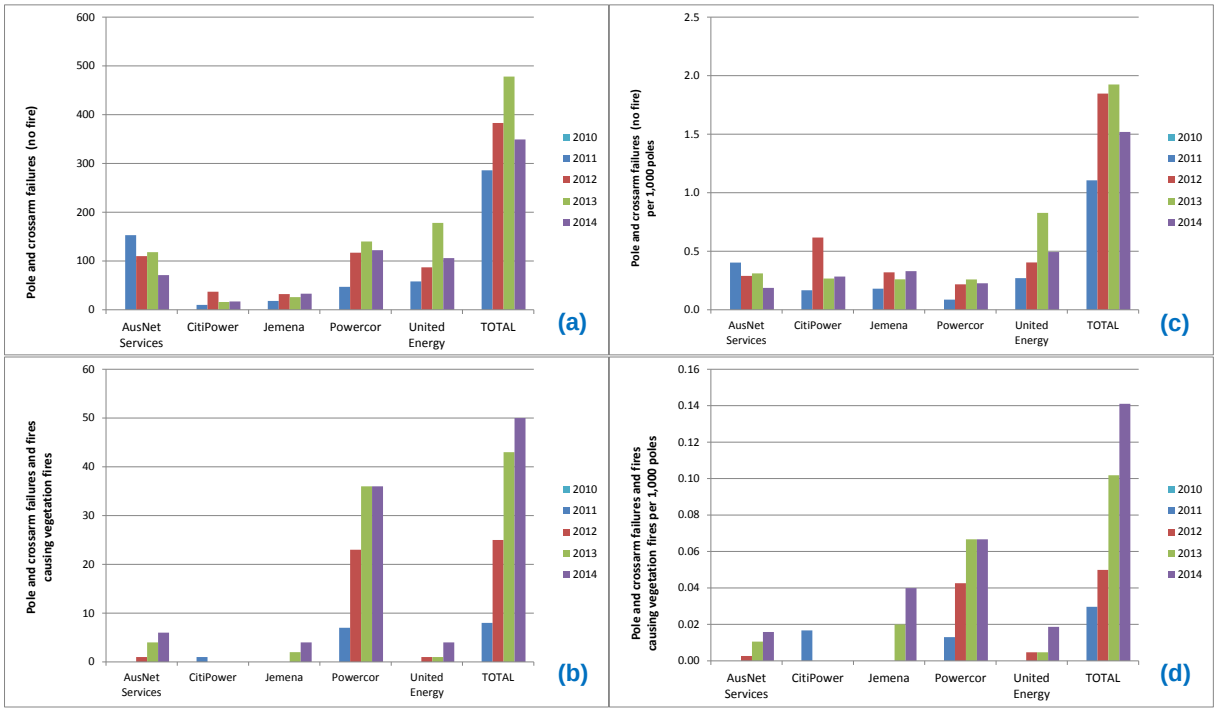

Figure 8: Poles and crossarm failures with and without resulting vegetation fires
(a) total pole and crossarm failures without vegetation fire
(b) pole and crossarm fires and failures resulting in vegetation fires
(c) and (d) are the same data as (a) and (b) normalised by the number of poles owned by each company

[10] It should be noted that the normalisation aggregates a number of different types of poles and pole infrastructure. More detailed information on the numbers of poles in each company's asset fleet and the age and types of poles failing and creating fires would enable a more detailed analysis.

Pole-top fires are caused by higher-than-normal leakage current flowing through or along the wooden crossarm or pole infrastructure. This then creates heat in the wood and, over a period of time, this heat causes the wooden structure to ignite. The conventional wisdom is that leakage currents become elevated when there is a small amount of drizzly rain after a long dry spell where dust has been deposited on the pole infrastructure, thereby creating a conductive medium.

Given the mechanism for initiating a pole-top fire requires drizzly rain, the risk of burning material from the pole-top resulting in a bushfire is thought to be low. That said, the Powercor data shows that vegetation can still be ignited; although the likelihood that this results in a bushfire is not known. It also does not preclude the other safety risks identified earlier.

When considering the issue with respect to Powercor's elevated vegetation fires, there may be local environmental factors that lead to this increased risk.

Firstly, Powercor operates assets in western Victoria where conditions are drier than the rest of the state, where there are higher levels of agricultural ploughing and where flat country can carry dust further afield. As a result, Powercor's assets may be more susceptible to dust build-up than those of the other distribution companies.

Secondly, north-west Victoria experiences lower levels of rainfall than other parts of the state. This may increase the likelihood of drizzly rain that combines with an increased likelihood of dust build-up to produce conditions more conducive to pole-top fires in Powercor's operating region. Inter-annual climate variability may also be a contributing factor here.[11]

Thirdly, the larger areas of grasslands around Powercor's assets may be more susceptible to ignition even if exposed to a slight drizzle.

At the moment, this is simply a hypothesis that may explain these elevated results and trends. Further data will need to be collected from Powercor and the other distribution companies to validate this hypothesis and better understand the propensity of assets to start vegetation fires. This may require information on:

- location of assets to match with local weather information
- nature and material type of assets to enable steel structures and other assets posing now fire risk to be removed from the analysis
- nature and material type of asset architecture to identify the propensity of this to fire risk
- age and condition of assets (particularly failed asset) to ascertain whether these factors and resulting deterioration increase the risk of fire.

Ascertaining the causal factors that result in elevated vegetation fires may allow the distribution businesses to move away from generic management of issues to a more environment-specific management regime. In order for ESV to be comfortable with such a move, we need to understand the environment within which these assets operate.

ESV also needs to investigate vegetation fires in greater detail to understand whether an increase in vegetation fires (and the conditions under which these fires are ignited) actually poses a greater risk of a bushfire or other high-consequence incident. This will, in turn, affect the prioritisation of management practices to address such incidents.

[11] Currently ESV does not have sufficient data to quantify a correlation between increased fire (or other) events and climate variability. This needs to be addressed in the future to better understand the implications of climate change (short and long-term) and to ensure that the distribution networks can be managed safely in this environment.

ESV's position is that climate variability should not be an excuse for poor performance, but rather a constraint within which assets needs to be managed safely.

HV injections

As noted above and as evident in Section 4.1, HV injections pose a serious safety risk to the general public. Figure 9 shows that such events have been increasing since 2010. While there has been a decrease in 2014, current levels are still elevated compared to 2010-11 and further decreases would need to be evident before confirming a downward trend.

CitiPower and Jemena have low levels of injections, mainly due to their smaller asset base compared to AusNet Services and Powercor. That said, Jemena has been experiencing an increase in such incidents over the last five years and this needs to be addressed.

The number of HV injections on the AusNet Services network has been declining since 2011 and this is a positive result. This will be due, in part, to reductions in pole and crossarm failures. Powercor has experienced an increase in HV injections, in part due to the increase in pole and crossarm failures in its network as discussed above (Figure 8).

The outlier is United Energy, which has the highest levels of HV injections of all the distribution companies despite its smaller asset base relative to AusNet Services and Powercor.

Figure 10 shows the relationship between HV injections and all pole and crossarm failure and fire events (excluding pole-top fires that do not cause vegetation fires). Excluding the United Energy data from the analysis yields a higher correlation of 0.924 between the variables. While this indicates a relationship between these variables, it does not imply a causal link. It does, however, indicate an area of further analysis to better understand the mechanisms leading to HV injections. This, in turn, would allow identification of improved management practices.

The high levels of correlation achieved when the United Energy data is excluded indicate that there is a different mechanism causing HV injections in the United Energy network (or at least a more dominant mechanism). This warrants further investigation with United Energy to better understand the causes of HV injections in its network in order to reduce the risks to the general public from its assets.

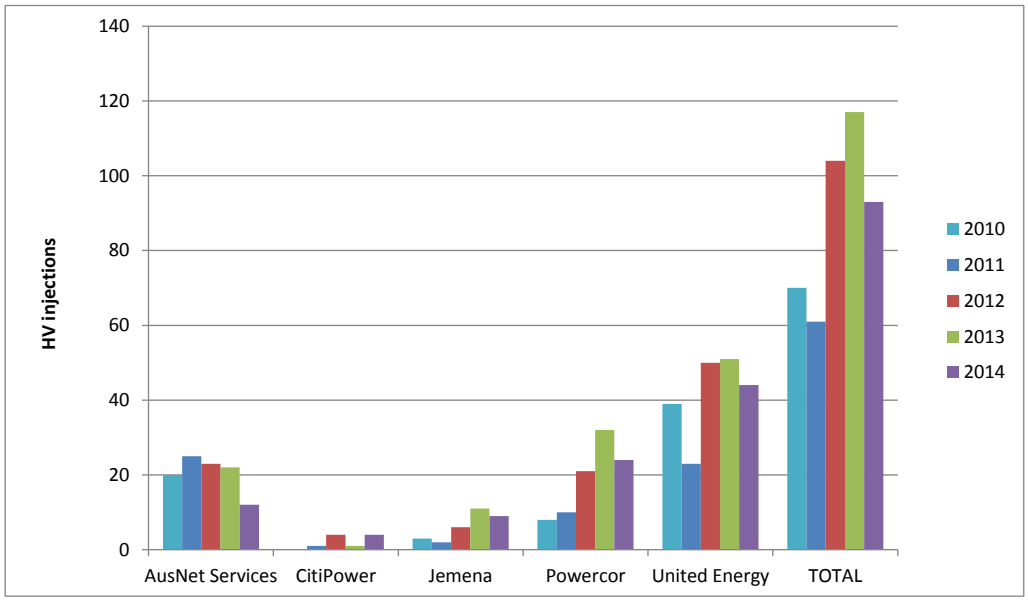

Figure 9: HV injections

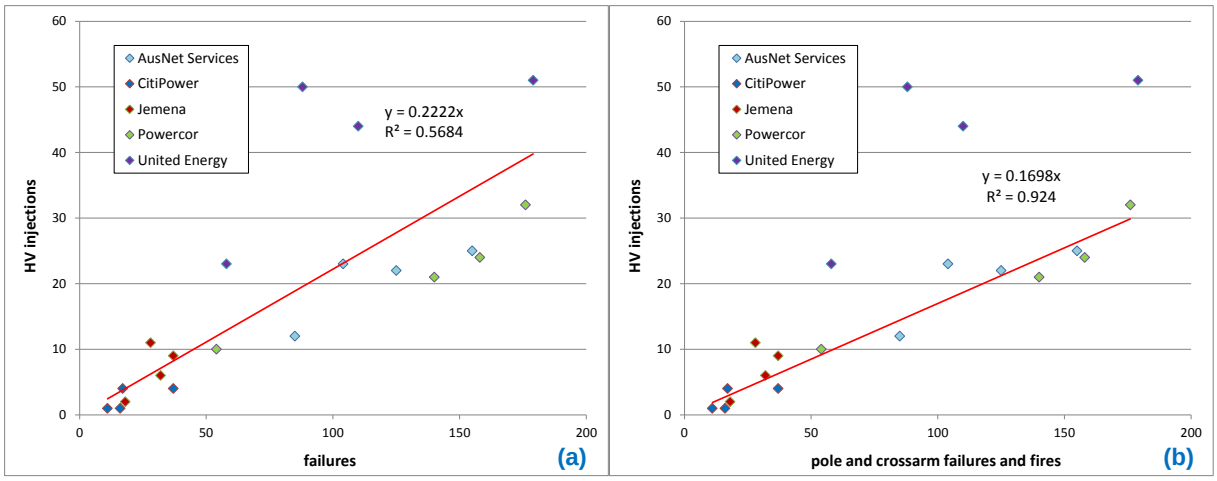

Figure 10: Relationship between HV injections and pole and crossarm failures
(a) all distribution companies, (b) all except United Energy

LV asset failures

Figure 11 shows LV asset failure incidents across the distribution companies separated into asset failures without fires, asset failures causing vegetation fires and fires on or in assets. These categories are mutually exclusive and do not overlap.

LV asset failures are increasing quite quickly for Jemena, while those for the remaining distribution companies are relatively steady.

Vegetation fires caused by LV assets are increasing for AusNet Services and United Energy.

Fires in LV assets are increasing for AusNet Services and United Energy, while they are falling steadily for Powercor. The absolute number of asset fires is also much higher for Powercor, but the numbers are falling steadily towards a similar order to the other distribution businesses.

These observations are based on limited data (in terms of volume and time), yet suggest the genesis of a possible problem with United Energy LV assets causing more fires.

When combined the data shows that, over three years, for all Victorian distribution companies:

- LV asset failures have increased by 12 per cent
- Vegetation fires attributed to LV assets have increased by 118 per cent and fires are now propagating beyond the asset
- Fires in or on assets have increased by 14 per cent.

This strongly suggests there is a case for understanding the causes of LV asset failures, fires and the mechanisms that could lead to vegetation fire.

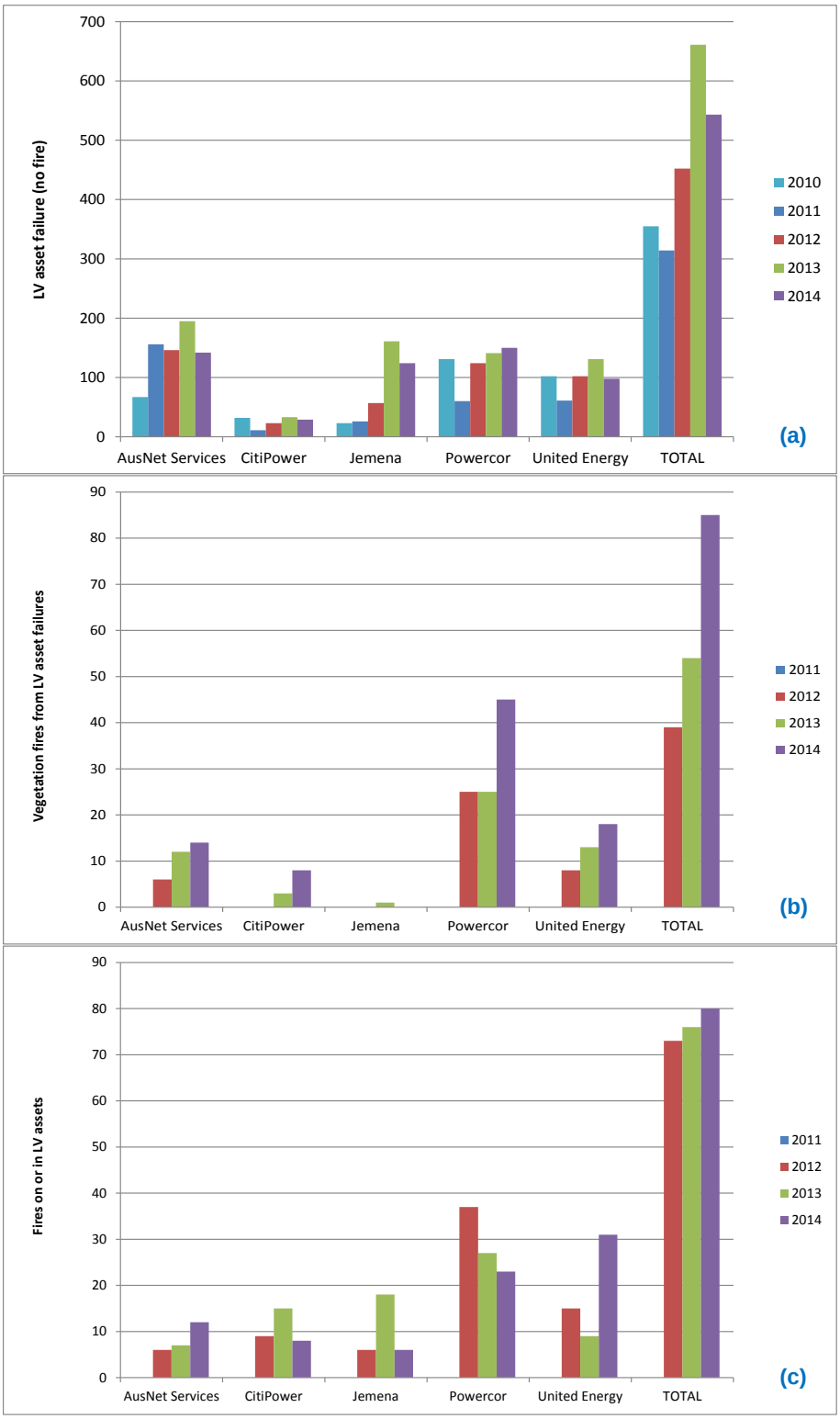

Figure 11: LV asset failures (a) no fires, (b) vegetation fires and (c) fires in or on assets

Ageing assets

ESV has no substantive data on the age of the assets of the major electricity companies. Without this information it is unable to gain a meaningful insight into the success, or otherwise, of their approach to asset management.

For example, the distribution businesses appear to be moving to a practice of replacing assets such as crossarms based on condition rather than age. The efficacy of this approach is dependent upon the quality, accuracy and currency of the condition assessment and its ability to predict the future state of crossarms based on some known rate of deterioration.

ESV does not assert this approach is wrong, but notes that the distribution networks were built within fairly short timeframes and will have a population of crossarms of similar age that are likely to deteriorate at similar rates, and so approach failure at the same time.

The move to condition-based replacement infers that, on balance, assets will be operated longer than would be the case if they were assigned a nominal engineering life after which they would be replaced. If true, this means assets will be operated closer to failure and that the number of assets approaching failure will be large. The approach therefore runs a risk that assets may be operated until they are well within the onset of significant unreliability. If this comes about, replacement could be constrained by shortages of materials, resources, access to assets, and capital to undertake the work.

ESV intends to ensure it improves its understanding of the major electricity companies' asset management engineering practices to secure a degree of confidence that the companies are managing their assets effectively and prudently to protect the State of Victoria. Where necessary, ESV should collect additional data from the major electricity companies to inform its understanding.

ESV also needs to secure confidence from the major electricity companies that future network performance is not being compromised by the deferral of expenditure.

6 RECOMMENDATIONS

This section collates the recommendations made in the appendices to this report and those arising from the discussion in the main body of this report are collated below. Further context for each recommendation is provided in the cross-references provided with the recommendation.

6.1 GENERAL

ESV recommends that it:

- facilitates engagement with municipal councils and distribution businesses to develop mechanisms for reporting and managing vegetation clearance infringements and expediting their resolution through appropriate escalation mechanisms — 5.3.1
- undertakes further work to understand the magnitude of the council vegetation clearance issue with input from the distribution companies, and develops plans to improve performance in this area — 5.3.1, A.1.2
- undertake further investigation to understand why Jemena and United Energy may be experiencing more fires per kilometre than the other distribution companies — 5.3.1
- undertake further investigation of infringements and serious incidents in order to better understand the logic underpinning the observed increase in No Go Zone infringements for CitiPower and Jemena — 5.3.3
- determines any requirements for extra data to ascertain causes of pole and crossarm fires and LV asset fires, including climate influences[12] — 5.3.1, 5.3.4
- investigates vegetation fires in greater detail to understand whether an increase in vegetation fires (and the conditions under which these fires are ignited) actually poses a greater risk of bushfire or other high-consequence incident — 5.3.4
- undertakes further analysis to better understand the mechanisms leading to HV injections in general and the mechanisms that may be affecting United Energy assets in a manner different to other distribution companies — 5.3.4
- improves its understanding of the major electricity companies' asset management engineering practices and, where necessary, collects additional data to inform its understanding. — 5.3.4

6.2 MUNICIPAL COUNCILS

ESV recommends that municipal councils:

- apply the line clearance management principles used for HV powerlines to LV powerlines — A.1.2
- actively pursue alternate means to establish and maintain a compliant clearance space where this cannot be achieved through standard management processes — A.1.2

[12] Additional data requirements may include information on asset locations, nature and material type of poles and pole architecture, age and condition of assets (particularly failed assets) and climate forecasts.

- employ more rigorous follow-up and escalation procedures to facilitate clearing in a more timely and effective manner in instances where vegetation is noncompliant due to an inability to obtain appropriate access, authorisation or resource. A.1.2

6.3 AUSNET SERVICES

ESV recommends that AusNet Services:

- retains all failed and fire-affected items in line with its current procedure B.2.1
- reviews its maintenance records system to ensure work is recorded as complete only when it is complete and not when it is scheduled B.4.1
- continues with the vegetation management methodologies as detailed in its ELCMP B.4.1
- conducts a systematic review of its ELCMP to ensure its future effectiveness B.4.1
- ensures the vegetation management principles utilised in HBRA are applied to LBRA B.4.1
- engages with, and provides greater assistance to, councils, private property owners and occupiers to facilitate the more effective clearing of the vegetation for which the councils and others are responsible B.4.1, B.6
- develops more rigorous follow-up and escalation procedures for councils and other responsible persons to expedite the clearing of noncompliant vegetation B.4.1
- continues to apply its ELCMP to its transmission assets B.4.2
- ensures its internal work practices program focuses on ensuring all workers: B.5
  - understand the importance of checking equipment and personal protective equipment before use
  - adhere to priority earthing requirements
  - comply thoroughly with electrical access procedures, particularly work permits
- undertakes a review to determine the root cause of failures, especially LV asset failures and HV fuse fires B.7.2, B.7.4

6.4 BASSLINK

ESV has made no recommendations for Basslink.

6.5 CITIPOWER

ESV recommends that CitiPower:

- conducts an internal audit of its safety programs to review consistency between the reported volumes of work completed and those actually completed and reports the outcomes to ESV D.2.1, D.3
- continues to use existing vegetation management methodologies in accordance with its ELCMP D.4

- reviews and upgrades its vegetation management database to improve the quality and accuracy of information — D.4
- engages with, and provides greater assistance to, councils and private property owners and occupiers to facilitate more effective clearing of the vegetation for which these groups are responsible — D.4, D.6
- ensures its internal work practices program focuses on ensuring all workers: — D.5
  - improve job planning and communications
  - ensure appropriate thorough onsite risk assessment including understanding of Job Safety Assessment, Safe Work Method Statement methodology and process
- actively monitors and reviews construction activities in its area and enforce rules to reduce the incidence of No Go Zone infringements — D.7.1
- investigates the root cause of its relatively high level of No Go Zone infringements and develops a strategy to address this — 5.3.3
- investigates the root cause of its LV asset failures and implement programs to reduce the number of failures and reverse the upward trend observed over the last four years — D.7.2, D.7.3
- investigates the root causes of pole and crossarm fires and implements measures to reduce the likelihood of such fires — D.7.4

6.6 JEMENA

ESV recommends that Jemena:

- conducts an internal audit to examine the consistency between the field condition of the network assets and the records in the works management system, takes corrective action and reports the outcomes to ESV — E.3
- continues to utilise existing vegetation management methodologies as detailed in its ELCMP — E.4
- conducts a systematic review of its ELCMP to ensure its effectiveness into the future and to identify and implement improvement opportunities should they be identified — E.4
- ensures management principles utilised in clearing vegetation in HBRA are applied to vegetation clearing in LBRA — E.4
- engages with, and provides greater assistance to, councils and private property owners and occupiers to facilitate more effective clearing of the vegetation for which these groups are responsible — E.4, E.6
- ensures more thorough compliance with its internal work practices program, specifically: — E.5
  - improving job planning, including communication with crew leaders
  - ensuring appropriate, thorough on-site risk assessment, including improving the understanding of Job Safety Assessment and Safe Work Method Statement methodology and process
  - ensuring all workers understand the importance of checking equipment and personal protective equipment prior to use
  - complying thoroughly with electrical access permit procedures, especially work permits

- reviews the adequacy of controls in place to prevent safety incidents involving the public, especially No Go Zone incidents — 5.3.3, E.7.1
- considers the causes of failure of steel public lighting poles to determine whether they arise from faults in the poles or from third-party damage — E.7.2
- undertakes further measures to reduce pole and crossarm fires to contain the upward trend. — E.7.4

6.7 POWERCOR

ESV recommends that Powercor:

- continues to use existing vegetation management methodologies in accordance with its ELCMP — F.4
- applies the management principles used in clearing vegetation on HBRA to that in LBRA — F.4
- engages with, and provides greater assistance to, councils and private property owners and occupiers to facilitate more effective clearing of the vegetation for which these groups are responsible — F.4, F.6
- ensures its internal work practices program focuses on ensuring all workers: — D.5
  - improve job planning and communications
  - ensure appropriately thorough onsite risk assessment including understanding of Job Safety Assessment, Safe Work Method Statement methodology and process
- reconsiders its management processes to ensure direction and exemption programs are adequately completed and recorded — F.6
- reviews the adequacy of controls in place to prevent safety incidents involving the public — F.7.1
- investigates the nature of its increasing number of unauthorised access to its assets and puts in place actions to contain the increase — 5.3.3
- determines the reasons for the increase in LV asset failures and implements a program to reduce the risk of ground fire — F.7.3
- determines the reasons for the increase in pole and crossarm fires and implements a maintenance or asset replacement program to reduce the risk of ground fire. In particular Powercor should consider introducing more steel crossarms into its network. — F.7.4

6.8 TRANSMISSION OPERATIONS AUSTRALIA

ESV has made no recommendations for Transmission Operations Australia.

6.9 UNITED ENERGY

ESV recommends that United Energy:

- ensures its quarterly reporting is accurate and that all works undertaken are included in the quarterly reports — H.2.1
- conducts an internal audit of its safety programs to review consistency between the reported volumes and works actually completed, take corrective action based on the findings and report the outcomes to ESV — H.2.1

- increases crossarm replacement rates to reverse the upward trend in pole-top fires — H.2.2
- reviews its strategy of replacing crossarms on the basis of condition alone to address this persistent problem — H.2.2, H.7.1, H.7.2
- reviews the processes and procedures that inform its asset database and, where required, takes action to ensure its material types are included for each pole and crossarm — H.2.2
- conducts an internal audit to assess the accuracy of its asset database and reports the outcomes to ESV — H.3
- continues to use existing vegetation management methodologies as detailed in its ELCMP — H.4
- engages with, and provides greater assistance to, councils and private property owners and occupiers to facilitate more effective clearing of the vegetation for which these groups are responsible — H.4, H.6
- ensures more thorough compliance with its internal work practices program, specifically: — H.5
  - ensuring the appropriate condition of, and earthing of, plant for HV live work
  - ensuring all workers understand the importance of checking equipment and personal protective equipment prior to use
  - complying with LV metering and testing requirements
- analyses the root cause of LV asset failures and implements a program to address the failure modes. — H.7.4

7 GLOSSARY

ABC	aerial bundled cable
AC	alternating current
ACR	auto circuit recloser
AER	Australian Energy Regulator
ARA	area requiring attention
BMI	Bushfire Mitigation Index
BMP	Bushfire Mitigation Plan
CAPEX	capital expenditure
CBD	central business district
DC	direct current
EDO	expulsion drop out
EDPR	Electricity Distribution Price Review
ELCMP	Electric Line Clearance Management Plan
ESMS	Electricity Safety Management Scheme
ESV	Energy Safe Victoria
HBRA	high bushfire risk area
HV	high voltage
km	kilometre
kV	kiloVolt
LBRA	low bushfire risk area
LiDAR	Light Detection And Ranging
LV	low voltage
OFI	opportunity for improvement
OPEX	operating expenditure
REFCL	rapid earth fault current limiters
SECV	State Electricity Commission of Victoria
SWER	single wire earth return
TOA	Transmission Operations Australia
variance	The difference between a recorded state and an observed state. Recorded states may include procedure as documented in a company's plans/manuals or data as recorded in a company's database. The observed state is ESV's observation of performance in the field, either through implementation of procedures or the actual state of assets when inspected.
VESI	Victorian Electricity Supply Industry

A MUNICIPAL COUNCILS

There are 79 municipal councils across Victoria, of which 31 are metropolitan and 48 are rural cities/shires. All metropolitan councils and 36 rural councils are required to conduct electric line clearance works within declared areas.

A.1 ELECTRIC LINE CLEARANCE

A.1.1 Electric Line Clearance Management Plans

During 2014, 26 municipal councils submitted an ELCMP to ESV for review and approval.

ESV initially assessed the plans to verify compliance with the requirements of the Electric Line Clearance Regulations. ESV referred the plans with the required elements of an ELCMP internally for detailed review. Any deficient plans were referred back to the municipal council for amendment. ESV consulted as necessary to aid any required plan amendments.

After the full assessment of the plans, those deemed acceptable were recommended for approval by the Director of Energy Safety.

ELCMP for 18 municipal councils were approved by the Director of Energy Safety in 2014, and five more were approved on 17 February 2015.

Figure 12 shows the results of the assessment process graphically and Table 6 provides the detailed data on each council's progress.

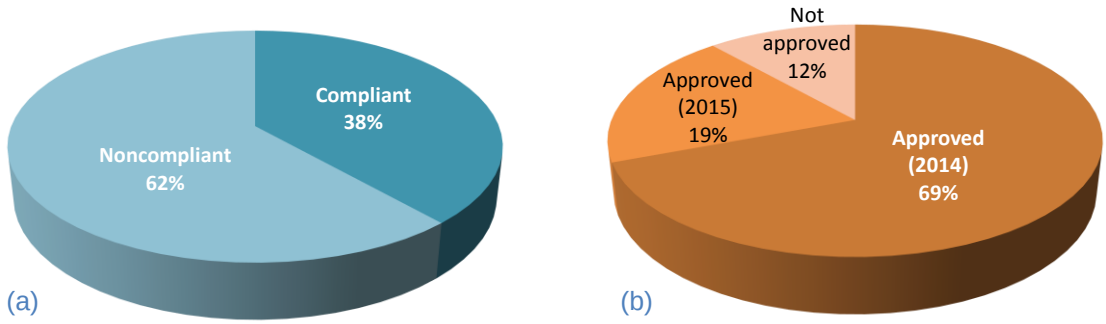

Figure 12: Council's 2014 ELCMP progress (a) initial assessment and (b) plan approval

Most of the initial ELCMP submitted did not meet the minimum approval criteria. This may indicate that many municipal councils lack an understanding of the regulations and how to apply them to an ELCMP.

After consultation on shortcomings and the submission of amended plans, most were approved by the Director of Energy Safety. ESV's consultations regarding the assessment criteria greatly assisted councils in achieving a positive outcome. ESV found that councils were generally responsive to requests for modification to ensure ELCMP met approval standards.

ESV continues to work with those councils where submitted ELCMP were deficient and could not be approved in 2014. ESV anticipates that approval of the remaining three ELCMP can be achieved in 2015. ESV continues to assist these councils in their endeavours.

Following the council ELCMP review and approval process ESV recommends that it:

- continues to engage with municipal councils to further develop their understanding of the regulations and their regulatory obligations
- standardises ELCMP approval process and communicates change of standards or expectation to affected stakeholders.

Table 6: 2014 ELCMP assessment and approval register – municipal councils

Municipal council	Date ELCMP received	Initial assessment completed	Compliant initial assessment	Date referred for approval	Approval status	Date of approval
Alpine Shire	8/05/2014	5/06/2014	YES	5/06/2014	YES	27/06/2014
Ballarat City	1/08/2014	15/08/2014	YES	15/08/2014	YES	8/09/2014
Baw Baw Shire	24/03/2014	15/04/2014	YES	15/04/2014	YES	7/05/2014
Benalla Shire	9/05/2014	13/04/2014	YES	13/05/2014	YES	20/05/2014
Boroondara City	5/11/2014	13/11/2014	YES	13/11/2014	YES	17/02/2015
Cardinia Shire	10/06/2014	11/06/2014	YES	11/06/2014	YES	27/06/2014
Darebin City	5/09/2014	22/10/2014	NO	30/10/2014	YES	17/02/2015
East Gippsland Shire	10/09/2014	6/10/2014	NO		NO	
Geelong City	10/09/2014	16/10/2014	NO	13/11/2014	YES	17/02/2015
Glenelg Shire	3/09/2014	30/09/2014	NO		NO	
Hobsons Bay City	20/05/2014	13/06/2014	NO	1/07/2014	YES	25/07/2014
Horsham Shire	21/07/2014	21/07/2014	NO	31/07/2014	YES	5/08/2014
Indigo Shire	1/09/2014	3/09/2014	NO	9/10/2014	YES	3/11/2014
Knox City	12/05/2014	13/04/2014	YES	13/05/2014	YES	20/05/2014
Latrobe City	5/03/2014	2/04/2014	NO	4/06/2014	YES	6/08/2014
Macedon Ranges Shire	30/07/2014	6/08/2014	NO	10/09/2014	YES	14/10/2014
Manningham City	11/09/2014	29/10/2014	NO	18/11/2014	YES	12/02/2015
Maribyrnong City	28/03/2014	14/04/2014	YES	14/04/2014	YES	28/04/2014
Melton City	11/09/2014	17/10/2014	NO	7/11/2014	YES	17/02/2015
Monash City	17/03/2014	19/05/2014	NO	3/06/2014	YES	11/06/2014
Moreland City	16/07/2014	21/07/2014	NO	5/09/2014	YES	14/10/2014
Mount Alexander Shire	5/05/2014	12/06/2014	NO	5/08/2014	YES	8/09/2014
Northern Grampians Shire	9/05/2014	20/06/2014	NO	14/08/2014	YES	8/09/2014
South Gippsland Shire	28/11/2014	27/01/2015	NO		NO	
Surf Coast Shire	14/03/2014	14/04/2014	YES	1/07/2014	YES	31/07/2014
Whittlesea City	21/05/2014	6/06/2014	YES	6/08/2014	YES	25/08/2014

A.1.2 Electric line clearance audits

During 2014 ESV conducted 22 electric line clearance field audits across Victoria's councils. A total of seven metropolitan and 15 rural cities/shires were audited, representing 23 per cent of metropolitan and 42 per cent of rural councils required to conduct electric line clearance works within declared areas.

Scheduled electric line clearance field audits were utilised to verify application of ELCMP and compliance with the code of practice.

ESV audited the following metropolitan and rural councils across Victoria:

- *Metropolitan*
  - Banyule City
  - Bayside City
  - Knox City
  - Maroondah City
  - Mornington Peninsula Shire
  - Port Phillip City
  - Whitehorse City
- *Rural*
  - Alpine Shire
  - Benalla Rural City
  - Campaspe Shire
  - Central Goldfields Shire
  - Colac Otway Shire
  - Gannawarra Shire
  - Greater Shepparton City
  - Horsham Rural City
  - Mildura Rural City
  - Mitchell Shire
  - Mount Alexander Shire
  - Northern Grampians Shire
  - Strathbogie Shire
  - Surf Coast Shire
  - Swan Hill Rural City

Before the field audits of each council, ESV undertook a desktop audit to review the documentation held by the council relevant to those specific areas of the ELCMP considered a priority for the 2014 audit period.

Information requested from the councils included:

- current ELCMP
- vegetation inspection results
- vegetation cutting records
- audit records to confirm clearances were achieved
- examples to demonstrate actions implemented to address noncompliant vegetation identified during an internal audit
- training matrix for personnel responsible for the undertaking of electric line clearing activities
- examples of notification provided to affected persons.

All municipal councils provided the requested documentation. The reviews indicated accurate and traceable links between vegetation inspection, notification and clearing; typically this was consistent with ELCMP specifications.

Training records confirmed the majority of personnel employed by municipal councils were adequately trained and deemed competent to perform assigned tasks. In instances where competency was found deficient or needed refreshing, resolution plans were in place.

A particular emphasis was placed on observing electric line clearance adjacent to HV powerlines. Although sometimes considered lower risk, LV powerlines were not excluded from the audit process. The audit sample size was proportional to the asset population in the declared area. In addition to the scheduled audits, ESV took the opportunity to record and report noncompliant vegetation when observed during regular operational activities.

Vegetation was determined to be noncompliant where it did not meet the clearance requirements of the code. In such instances a noncompliance notice was issued to the municipal council, which was given 60 days to resolve the clearance issue.

When noncompliant vegetation was identified through unscheduled audits, noncompliance notices were prepared and issued to the responsible municipal council.

Figure 13 shows the number of noncompliant spans observed in each council's area during the electric line clearance audits and regular ESV operational activities.

Figure 14 provides a breakdown of noncompliant spans by asset type. Most of the noncompliances (81 per cent) related to LV and mixed HV/LV powerlines. Vegetation adjacent to HV/LV assets assessed as noncompliant predominantly only entered the LV clearance space, thereby increasing the level of LV noncompliance.

While the audits focused on HV powerlines, such powerlines only accounted for 14 per cent of noncompliances. This suggests councils are placing a greater emphasis on maintaining the HV clearance space. This may be the result of an assumption that LV noncompliance presents less risk when compared to HV.

Figure 15 identifies the action status of the noncompliances issued to municipal councils within the 60-day period. Where noncompliance notices were issued, councils typically responded in an appropriate manner, although on occasions this required additional time to rectify issues. Most noncompliances have now been actioned and the relevant vegetation brought into compliance.

There were two scenarios where councils were unable to effectively or promptly resolve noncompliances. The scenarios were:

- where a council had been unable to gain appropriate access/authorisation/resource to clear vegetation from the HV clearance space
- where a council determined that achieving compliance would adversely impact vegetation amenity and its perception of community vegetation management expectation.

Overall, council documentation and processes relevant to electric line clearance activities were found to be sound, robust and traceable despite the poorer initial quality of ELCMP submitted for review (see Section A.1.1).

Councils were also found to pay more attention to maintaining electric line clearance around the HV networks. Noncompliances more commonly occurred around LV powerlines. This infers a presumed lesser risk of a vegetation fire arising from contact with LV powerlines.

Where the performance of councils' line clearance activities were lacking in relation to regulatory obligations, the councils generally showed a willingness to resolve shortcomings.

As an outcome of the electric line clearance audits of councils, it is recommended that municipal councils:

- apply the line clearance management principles used for HV powerlines to LV powerlines
- actively pursue alternate means to establish and maintain a compliant clearance space where this cannot be achieved through standard management processes
- employ more rigorous follow-up and escalation procedures to facilitate clearing in a more timely and effective manner in instances where vegetation is noncompliant due to an inability to obtain appropriate access, authorisation or resource.

ESV will work with the municipal councils and distribution companies to develop agreed plans to comply with the 2015 Electric Line Clearance Regulations.

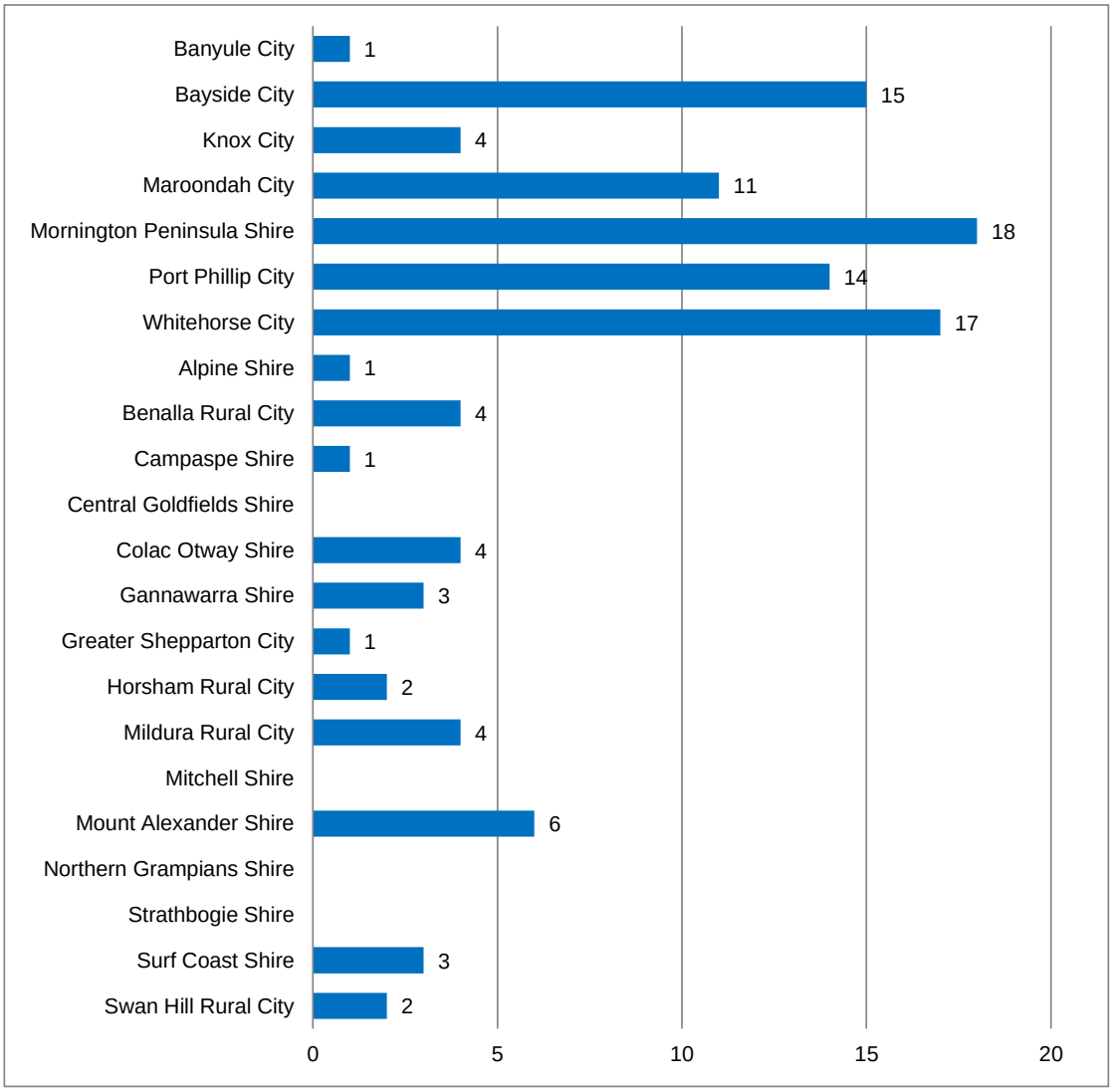

Figure 13: Noncompliant spans by municipal council

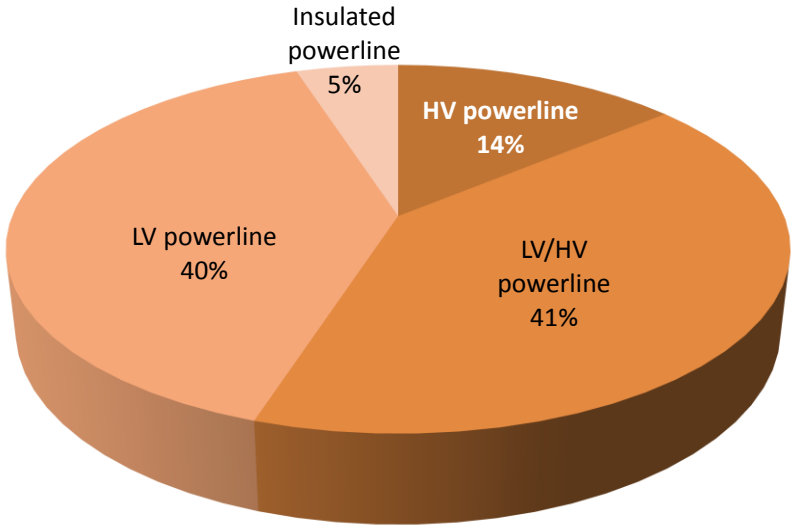

Figure 14: Noncompliant spans by asset type – municipal councils

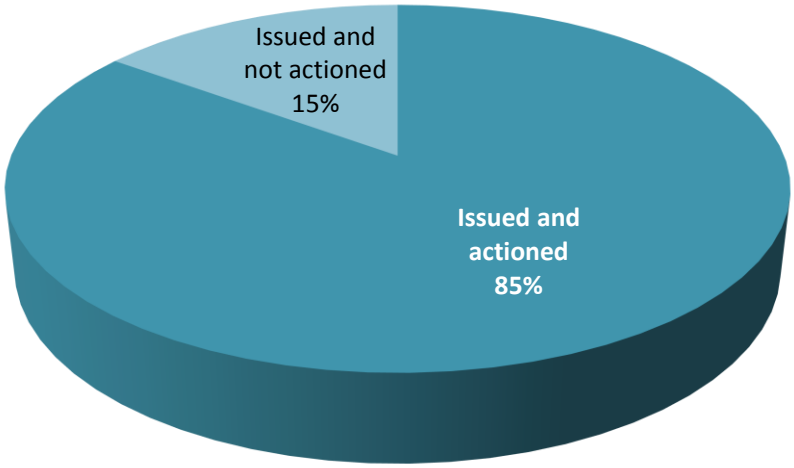

Figure 15: Action status of noncompliant spans within 60-day period – municipal councils

B AUSNET SERVICES

AusNet Services is majority-owned by Singapore Power. It has two operating subsidiaries: AusNet Services Transmission (owns and operates the electricity transmission business) and AusNet Services Distribution (owns and operates the electricity and gas distribution businesses). As the two subsidiaries are managed by the same CEO and Board and use similar procedures, ESV encompasses both subsidiaries into a single entity for reporting purposes. Where the discussion relates to a specific area of the business, this will be identified within the text.

B.1 ELECTRICAL SAFETY MANAGEMENT SCHEME

In April 2014, ESV conducted a desktop audit at AusNet Services' offices in order to assess its interpretation and implementation of the following sections of the Electricity Safety (Management) Regulations:

- r.24 incident recording, investigation and reviewing
- r.27 relevant asset operator requirements for reporting of serious electrical incidents
- r.28 relevant asset operator reporting of incidents other than serious electrical incidents.

The audit considered AusNet Services' distribution and transmission operations. It identified the following:

- Noncompliances

  No noncompliances were identified.

- Areas requiring attention

  One area requiring attention was identified that related to not complying with the AusNet Services Distribution Procedure Electrical Incident Investigation and Reporting, Document Number 30-2010. This procedure stated that "Any hardware involved in a fire or failure is to be retained to allow inspection by NSD Asset Engineering personnel and it must not be disposed of without the written agreement of Manager Electricity Networks".[13] Initially the NSD Asset Engineer stated that this was the case; however, evidence provided later in the audit demonstrated that this was only done when NSD Asset Engineering had requested specific items be quarantined and not as a general procedure. The NSD Asset Engineer also later stated field crew only quarantined failed items when the NSD Asset Engineer had requested they do so. This is in conflict with the written policy.

  The failure to retain such asset items (as required by the procedure) is probably due to a pragmatic approach rather than procedural. A large number of items fail and these are often physically large. Retention may require storage for a long period of time. Storage of all failed items may be difficult and the procedure as approved may not be practical to implement.

  By failing to retain items that fail, AusNet Services may be compromising the ability to undertake fault investigations. This, in turn, prevents the analysis of the causes of these failures and the mitigation of the risk of future failures.

  AusNet Services should retain all failed and fire-affected items in line with its current procedure. ESV would be concerned if it felt AusNet Services was not actively pursuing opportunities to inform continual improvement by undertaking proper fault investigations.

[13] Network Services Division, a division within AusNet Services.

- Opportunities for improvement

  Fourteen opportunities for improvement were identified. Six of these related to poor documentation or document control, two related to poor record keeping, two related to not precisely following procedures, and four were improvement suggestions. All were minor in nature and related to diverse causes, with the main cause being poor document control. There are no serious safety implications from these findings

Overall, AusNet Services compliance with the specific areas of audit within the Electricity Safety (Management) Regulations is satisfactory.

B.2 SAFETY PROGRAM

B.2.1 Audit findings

In November 2014, ESV carried out an audit on AusNet Services' distribution assets in order to verify the progress of work completed by AusNet Services as part of its safety programs. The audits comprised a limited desktop audit and a comprehensive field-based audit.

A total of 2293 assets were audited. The audit found that, for the majority of the safety programs, the AusNet Services reported volumes matched the actual completed work; however, issues were identified with 123 assets in relation to safety programs and the armour rods and vibration dampers direction. This is a variance of 5.4 per cent.

Table 7 provides further details on the specific safety programs and number of assets audited and the variance for each specific safety program. The directions audit data is not included.

As part of the armour rod and vibration dampers direction, 926 assets were audited and 76 issues were identified for a variance of 8.2 per cent.

The variance of 8.2 per cent for reporting the armour rods and vibration damper program is relatively high. Many of the issues identified related to AusNet Services' system records the installation of rods or dampers having occurred when a work order is actioned rather than when the task is physically completed.

Table 7: Summary of audit results for AusNet Services safety programs

Program	Number of assets audited	Number of issues identified	Variance (%)
Animal proofing	54	1	1.9%
EDO fuses and EDO fuse tubes[14]	200	4	2.0%
Reconductoring	56	0	0.0%
Crossarms	1057	42	4.0%
Armour rods and vibration dampers	926	76	8.2%
TOTAL	**2293**	**123**	**5.4%**

[14] Expulsion drop out (EDO) fuses

AusNet Services' method of recording work completed created several anomalies.

ESV found sites with LV-only poles being recorded as having had armour rods and vibration dampers installed, but where rods and dampers had not been installed.

ESV also found several sites where poles with HV ABC[15] were recorded as having rods and dampers installed but no installation was observed on site. In response, AusNet Services suggested that originally these sites were bare HV conductors with armour rods and vibration dampers and had subsequently been replaced with HV ABC that no longer required dampers. No records could be produced demonstrating this conversion had actually occurred.

While AusNet Services' position is that rod and dampers were not required in either instance, ESV's concern was that appropriate records confirming this and the actual state of works could not be provided.

A systemic problem was identified on the HV line heading east out of Healesville on Feeder WYK24 on the Maroondah Highway. It was reported that new crossarms, armour rods and vibration dampers had been installed on many poles. On inspection it was discovered armour rods had not been installed on any of the poles. AusNet Services advised that this error was caused by a contractor incorrectly closing incomplete work orders.

There are 42 occurrences (out of 1057) where AusNet Services has claimed it has replaced or removed a crossarm from a pole, but on inspection ESV was unable to verify this in the field and AusNet Services was unable to produce evidence to support these claims. This appears to be another failing in the system AusNet Services uses to record activity that is based on the intent rather than the action.

Overall, the majority of issues contributing to the high variance appeared to be due to the method of reporting used by AusNet Services. This can result in assets remaining in service when they should have been replaced or upgraded.

AusNet Services should review its records system to ensure works are listed as having occurred only when the works have actually been completed.

For the systemic problem on the east side of Healesville where armour rods have not been installed, ESV recommended that AusNet Services audit all work undertaken by the same work crews and address any identified shortcomings. AusNet Services advises that this work is complete and all items have been rectified by its contractor.

B.2.2 Safety program status

Asset failures are one of the major contributors to network-related fires. They were one of the causes of the 2009 Black Saturday fires. The safety programs involve the accelerated replacement of specific assets before they would normally be replaced as part of regular maintenance. This early replacement of assets reduces the chance of failure, thereby resulting in a more reliable and safer electrical distribution network.

AusNet Services reports on 10 safety programs to ESV. Performance against target is also shown graphically in Figure 16. Specific data on the status of these safety programs are provided in Table 8.

[15] Aerial Bundled Cables (ABC) are overhead powerlines where several insulated conductors are bundled tightly together. This contrasts with the standard practice of using uninsulated cables separated by air gaps.

Progress on four of the programs is in line with AusNet Services' forecast for 2014:

- replace all SWER OCRs[16]
- targeted replacement of EDO fuses[14]
- replace HV pin-type insulator sets (mitigation of pole-top fire risk)
- pre-emptive replacement of steel conductor.

Progress on five of the programs is ahead of AusNet Services' forecast for 2014:

- replace or upgrade three-phase ACR controllers[17]
- targeted bird and animal proofing in HBRA
- targeted replacement of EDO fuse tubes[14]
- pre-emptive replacement of copper conductor
- crossarm replacement.

Progress on one of the programs is behind AusNet Services' forecast for 2014:

- augment spans where there are overhanging trees in HBRA (undergrounding, relocation, replacement with ABC).

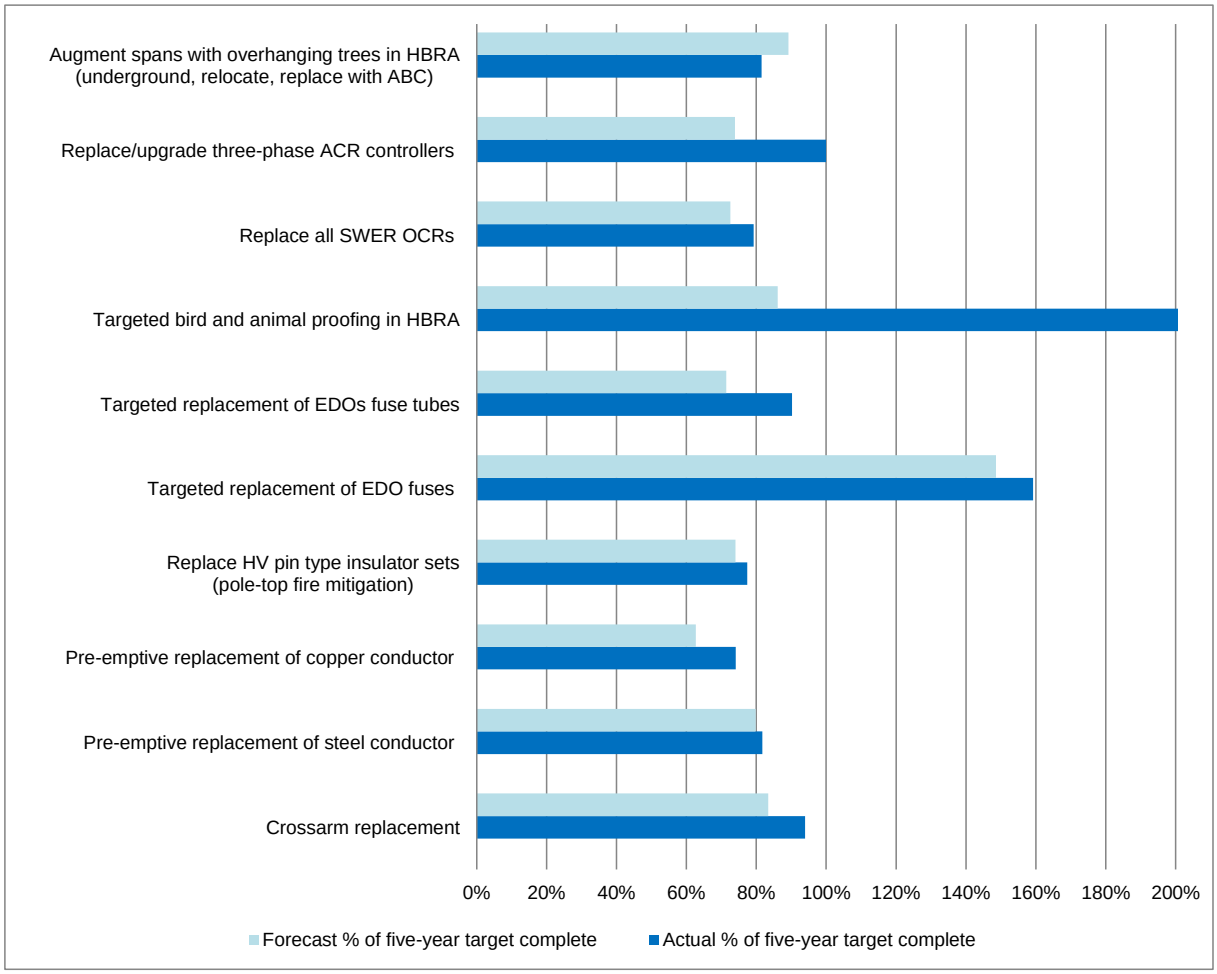

Figure 16: Status of AusNet Services' safety programs

[16] Single Wire Earth Return (SWER) Oil Circuit Recloser (OCR)

[17] Auto Circuit Recloser (ACR)

Table 8: Status of AusNet Services' safety programs

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
Augment spans with overhanging trees in HBRA (underground, relocate, ABC)	Number of spans	1445	1320	1620	Program is 9% behind forecast
Replace or upgrade three-phase ACR controllers	Number of units upgraded or replaced	173	234	234	Program is 35% ahead of forecast
Replace all SWER OCRs	Number of OCRs replaced	381	416	525	Program is 9% ahead of forecast
Targeted bird and animal proofing in HBRA	Number of assets fauna-proofed	5168	12,391	6000	Program is 140% ahead of forecast
Targeted replacement of EDO fuse tubes	Number of EDO fuse tubes replaced	8068	10,149	11,246	Program is 26% ahead forecast
Targeted replacement of EDO fuses	Number of EDO fuses replaced	16,074	17,221	20,339	Program is 7% ahead of forecast
Replace HV pin type insulator sets – pole-top fire mitigation	Number of insulator sets replaced	4184	4373	5650	Program is 5% ahead of forecast
Pre-emptive replacement of copper conductor	Kilometres of conductor	178	211	284	Program is 18% ahead of forecast
Pre-emptive replacement of steel conductor	Kilometres of conductor	1143	1171	1432	Program is 2% ahead of forecast
Crossarm replacement	Number of crossarms replaced	39,016	43,957	46,785	Program is 13% ahead of AS forecast
RED	Program total to date < 90 per cent of forecast to date				
GREEN	Program total to date 90-110 per cent of forecast to date				
BLUE	Program total to date > 110 per cent of forecast to date				

AusNet Services is well advanced with its safety programs and seems to have prioritised its programs to minimise asset failures and network-related fires. This is reflected in its performance, with all of the programs except one being on or ahead of forecast. It is particularly pleasing to see the crossarm and EDO fuse replacement programs ahead of forecast as these will significantly improve network reliability and reduce fire start risk. Rather than replace with like, AusNet Services is replacing the EDO fuses with boric acid fuses that are less prone to causing fires — a further benefit of the program.

While the program to augment spans is behind forecast, it is only 14 per cent behind and ESV expects AusNet Services to deliver all of its safety programs by the end of 2015.

B.3 BUSHFIRE MITIGATION

B.3.1 Distribution network

The bushfire mitigation audit focused on the high risk areas of the AusNet Services distribution network (based on the Tolhurst model).[18] ESV visited six distribution feeders from Doreen to Belgrave and viewed 1603 assets in total.

A desktop audit of the technical information provided by AusNet Services was carried out prior to the field audit to ensure that the information ESV had received was appropriate for this audit. The information contained in the documents showed that AusNet Services had in place detailed asset management strategies for different elements of its network. These included risk assessments, maintenance procedures and others as per expected industry standard practice.

The fire start information for the 2006-2013 period shows that the number of network-related fires varies from year to year. The top five causes of fire starts were due to fuses, crossarms, trees, conductors and fauna.

The variance can be shown to be:

- number of assets inspected (detailed review) 1603
- number of issues identified 29
- number matching notification by AusNet Services 12
- variance (detailed review) = (29-12)/1603 1%

The findings of the bushfire mitigation field audit were:

- the AusNet Services database accurately represented its assets in the field with an accuracy rate of approximately 99 per cent
- one low span of LV conductor was found crossing non-traversable land
- two spans of LV conductor were found without LV spreaders installed
- 13 LV crossarms were identified as requiring assessment by AusNet Services — five it was aware of and eight it was unaware of
- eight HV crossarms were identified as requiring assessment by AusNet Services, of which four were not recorded in its asset management system
- a number of trees were found to be almost touching HV or LV (although this was not the focus of the audit).

Of the 29 issues identified, AusNet Services were aware of 12 and not aware of the other 17 (mainly crossarm issues). None of the issues identified were believed to be of major concern.

For most items identified during this audit, ESV noted deterioration has occurred since the last inspection; however, the next inspection had not been undertaken and was due in the coming year. None of the items identified appear to present an immediate threat to the network.

There were also a number of locations identified where AusNet Services was in the process of replacing overhead bare conductor with HV ABC[15] or HV underground cables in heavily-treed high-risk areas. These projects are funded by the Victorian Government through the Powerline Bushfire Safety Program and form part of AusNet Services' Bushfire Mitigation Plan. These works should further reduce the risk of bushfire from AusNet Services' distribution network.

[18] A computer model developed by Kevin Tolhurst and Derek Chong at The University of Melbourne that predicts the spread of fire based on weather, wind, vegetation, topography and bush dryness,

B.3.2 Transmission network

ESV audited the 500kV powerlines running between the Hazelwood and Cranbourne terminal stations, the Hazelwood and Rowville terminal stations and the Cranbourne and Rowville terminal stations. A total of 56 transmission towers were inspected.

A number of good practices were noted during the audit, including:

- twice yearly patrol of the transmission assets by local linesmen
- yearly inspection of the transmission easement by the vegetation management group
- an easement report detailing current and past issues with a timeframe for resolution.

The visual inspection found the transmission assets to be generally in very good condition with a low risk of failure. The issues found were minor in nature and would be repaired as part of routine maintenance. ESV recommended that AusNet Services should follow up and ensure these issues are resolved.

Overall, AusNet Services was found to have a detailed knowledge of its assets, their condition and the proximity of vegetation to its assets. The easement report provided by AusNet Services included detailed information on the condition of the lines. AusNet Services' system of regular patrols of the system would ensure that its knowledge is regularly updated.

B.4 ELECTRIC LINE CLEARANCE

B.4.1 Distribution network

The AusNet Services ELCMP for the distribution network was received by ESV on 24 March 2014, and the assessment was finalised on 27 September 2014. The plan was observed to be mature and well supported by comprehensive processes and procedures. Subsequent to minor amendments throughout the assessment process, the plan was approved by the Director of Energy Safety on 14 October 2014.

An electric line clearance audit of the AusNet Services distribution network was conducted between 20-24 November 2014. This occurred at randomly selected locations throughout the network. Due to increased fire threats associated with the network, particular emphasis was placed on inspecting electricity spans located in HBRA. Spans in LBRA were inspected to a lesser extent.

A total of 472 electricity spans were inspected during the field component of the audit. Of these spans, 374 were located within HBRA and 98 in LBRA.

Table 9 summarises the audit findings.

Generally the noncompliant spans fell into two groups:

- Spans for which AusNet Services is responsible

  Isolated instances of noncompliant spans were observed in areas deemed to be the management responsibility of AusNet Services. Clearance standards in HBRA were viewed to be of a higher quality than those achieved in LBRA, reflecting a commitment to mitigate risk within fire-prone areas.
  The audit results indicate that, where AusNet Services is responsible for vegetation management, its processes and clearing activities are implemented effectively and provide for appropriate compliance standards. This is particularly the case for HBRA covered by the audit. Vegetation within LBRA is maintained to a lesser extent. Overall acceptable compliance was achieved.

- Spans for which AusNet Services is not responsible

  Where noncompliant vegetation identified was not the management responsibility of AusNet Services, it was the responsibility of municipal councils or private property owners and occupiers. This was significantly more evident within the LBRA audited.

  The higher frequency of noncompliant spans in areas managed by other responsible persons may adversely affect electrical safety, the reliability of supply and increase the potential for fire starts. These noncompliance issues could also impact the AusNet Services distribution network.

  AusNet Services has systems in place to notify such responsible persons of the requirement to maintain a clearance space. There is, however, evidence that these systems may fail to:
  - effectively notify the relevant persons of their responsibility
  - track or provide for follow up consultation on responsible person inaction
  - accommodate an effective escalation process when a responsible person has failed to act.

Table 9: Electric line clearance field audit results – AusNet Services

Field audit results	Total	Variance (%)
HBRA assets audited in the field	374 (79.2%)	
LBRA assets audited in the field	98 (20.8%)	
Total assets audited in the field	**472**	
HBRA noncompliant spans – AusNet Services responsibility	14	3.7
LBRA noncompliant spans – AusNet Services responsibility	13	13.3
Total noncompliant spans – AusNet Services responsibility	**27**	**5.7**

AusNet Services' vegetation management database was also reviewed during the audit to verify its accuracy. Information relevant to the clearing activities of spans in both HBRA and LBRA proved very accurate and was maintained to a high standard. It was also extremely easy to use.

Affected persons surveyed during the audit commented they had been advised of the intended clearing process. Typically they felt they had received appropriate notification of the proposed works and were made aware of the options available should they oppose scheduled works. Several property owners raised issue with trees being continually pruned where it would have been their preference for them to be removed. While additional resource allocation would be required to facilitate this outcome, long-term benefits may be gained.

The review of AusNet Services' ELCMP recommended that AusNet Services:
- continues to utilise existing vegetation management methodologies as detailed in its ELCMP
- conducts systematic review of the ELCMP to ensure its effectiveness into the future and to identify and implement improvement opportunities should they be identified.

The electric line clearance audit recommended that AusNet Services:

- ensures management principles utilised in clearing vegetation in HBRA are applied to vegetation clearing in LBRA
- continues to provide greater assistance to municipal councils and private property owners and occupiers to enable them to facilitate more effective and efficient clearing of vegetation that is their management responsibility
- develops more rigorous follow-up and escalation procedures for municipal councils and private property owners and occupiers to ensure clearing of noncompliant vegetation in a more timely and effective manner.

B.4.2 Transmission network

AusNet Services ELCMP for the transmission network was received by ESV on 24 March 2014 and assessment finalised on 30 July 2014. Following minor amendment throughout the assessment process the plan was found to meet the minimum approval criteria. It was subsequently approved by the Director of Energy Safety on 4 August 2014.

An electric line clearance audit of the AusNet Services transmission network was conducted between 20-21 November 2014. ESV audited the 500kV powerlines running between the Hazelwood and Cranbourne terminal stations, the Hazelwood and Rowville terminal stations and the Cranbourne and Rowville terminal stations. This occurred at randomly selected locations along these powerlines. Due to increased fire threats associated with the network, particular emphasis was placed on inspecting electricity spans located in HBRA. Spans in LBRA were inspected to a lesser extent.

A total of 472 electricity spans were inspected during the field component of the audit. Of these spans, 374 were located within HBRA and 98 in LBRA.

The audit found AusNet Services to have comprehensive vegetation management processes and procedures in line with its ELCMP. ESV found that AusNet Services had implemented these processes and procedures at the audited sites.

The audit also ascertained that AusNet Services had sound knowledge of the state of the transmission network and the surrounding vegetation. To ensure its understanding of line condition and vegetation clearance is kept current AusNet Services undertakes regular patrols and an annual inspection of transmission easements by its vegetation management group.

No noncompliant vegetation was identified at the sites audited indicating the successful application of AusNet Services ELCMP. This indicates the significance AusNet Services places on complying with the requirements of the regulations as they relate to transmission assets.

ESV recommends that AusNet Services continues to apply its ELCMP to its transmission assets. It also recommends that ongoing review of the ELCMP occurs to ensure associated processes and procedures remain relevant in achieving the outcome of continued compliance with the regulations.

B.5 WORK PRACTICES

In 2014, ESV undertook five audits of AusNet Services' work practices across five sites. The findings of these audits were as follows:

- two noncompliances relating to not checking fall prevention equipment prior to use

- three areas requiring attention relating to not checking the condition of personal protective equipment and glove and barrier equipment prior to use and appropriately earthing an elevated work platform
- 10 opportunities for improvement relating to:
  - appropriate earthing and adherence to priority earthing requirements
  - equipment checks prior to use
  - calculation and documentation of temporary loads/tensions
  - electrical access permit procedures, including permit issue processes.

These findings are consistent with those of the 2013 audits, where the key areas of concern also related to personal protective equipment and equipment checks, appropriate earthing, and electrical access permit issue processes.

ESV recommends AusNet Services ensures it has an internal work practices program with specific focus on ensuring all workers:
- understand the importance of checking equipment and personal protective equipment prior to use given its role as the last line of defence in the safety hierarchy
- adhere to priority earthing requirements
- comply thoroughly with electrical access permit procedures, particularly the issuance of work permits.

B.6 DIRECTIONS AND EXEMPTIONS

AusNet Services reported on the progress of the two directions and three exemptions in relation to the distribution network. Details are provided in Table 10.

Progress on the three exemptions is complete:
- cyclic clearing – ABC or insulated cable in all areas
- cyclic clearing – powerlines other than ABC or insulated cable in HBRA
- cyclic clearing – powerlines other than ABC or insulated cable in LBRA.

AusNet Services completed its cyclic clearing exemptions programs in 2013. The completion of these exemptions means that all trees in AusNet Services area for which it is responsible should now be at the minimum regulatory clearance distance away from any conductors. However not all trees within its area are the responsibility of AusNet Services. There are trees in its area that are managed by other responsible persons and these may not be maintained to be clear of the overhead lines.

ESV would recommend that AusNet Services engage more with other responsible persons (municipal councils and private property owners and occupiers) to ensure that trees that are the responsibility of those responsible persons are also compliant with the Electric Line Clearance Regulations. This will minimise the possibility of AusNet Services distribution network causing a bushfire and will increase the reliability of its network.

Progress on the two directions is on target:
- fitting of armour rods and dampers in HBRA
- fitting of HV and LV spacers in HBRA.

Early in 2015 AusNet Services advised of a plan that deviates from the original commitment to prioritise spans longer than 300m, and to compensate by increasing the volumes in the high consequence areas (as per the Tolhurst model). AusNet Services also suggested that a future arrangement could factor in likelihood to its risk calculations in addition to consequence based upon its latest information.

Table 10: Progress of direction and exemption programs – AusNet Services

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
Fitting of armour rods and vibration dampers in HBRA	Number of spans	40,836	36,411	59,645	Program is 10% behind of schedule.
Fitting of HV and LV spacers in HBRA	Number of spans inspected	8000	7333	10,242	Program is 8% behind schedule. Spacers are installed as required.
Cyclic clearing – ABC or insulated cable in all areas	Per cent of spans	100%	100%	100%	Program was completed in 2013.
Cyclic clearing – powerlines other than ABC or insulated cable in HBRA	Per cent of spans	100%	100%	100%	Program was completed in 2013.
Cyclic clearing – powerlines other than ABC or insulated cable in LBRA	Per cent of spans	97%	100%	100%	Program was completed in 2013.

RED	Program total to date < 90 per cent of forecast to date
GREEN	Program total to date 90-110 per cent of forecast to date
BLUE	Program total to date > 110 per cent of forecast to date

ESV understands the intent is to address risk in accordance with AusNet Services' loss consequence model. An outcome of this approach could be to lessen the cost to the business by arranging works so they can be delivered along contiguous spans, rather than isolated spans longer than 300m (that is, improved efficiency). ESV is still assessing this approach, and, in the interim, will monitor AusNet Services against the original targets.[19]

ESV expects that AusNet Services will achieve its agreed volumes of armour rods and vibration dampers in HBRA in 2015. Completion of these works will be a positive step for fire prevention.

The HV and LV spacers program was 8 per cent behind target at the end of 2014. AusNet Services is likely to meet the agreed plan put in place as an outcome of the ESV direction.

On 27 June 2014, ESV issued a direction to AusNet Services regarding the Government Powerline Replacement Fund. The direction required certain powerline replacement projects to be completed by specified dates, and for AusNet Services to report progress monthly. AusNet Services did not invoke its right of review of the ESV direction under section 69(3) of the Electricity Safety Act 1998. So, as required by the direction, AusNet Services incorporated the direction requirements into its bushfire mitigation plan. ESV formally accepted the revised plan.

Since then AusNet Services has reported its progress regularly and provided no indication that any powerline replacement project was at risk of not being delivered in accordance with the BMP. AusNet Services latest report (July 2015) now suggests it is unlikely to comply with

[19] ESV is requiring Safety Cases to be provided as supporting material for ESMS acceptance from 2015 onwards. The Safety Case will require formal hazard and risk assessments to provide greater visibility to decision-making within the major electricity companies.

the accepted BMP on three of its powerline replacement projects. ESV is concerned that these difficulties have been omitted from previous reports; ESV plans to engage with AusNet Services to understand why the reports were incomplete and to determine what corrective action is appropriate.

B.7 SAFETY INDICATORS

ESV assesses a range of key safety indicators on an ongoing basis and requires regular reporting by each distribution business. These indicators include:

- incidents involving the public
- asset failures
- vegetation fires due to asset failure or contact
- fires on or in assets.

Each of these is discussed in detail in this section.

B.7.1 Incidents involving the public

Table 11 details the incidents involving the public interacting with AusNet Services' assets and Figure 17 shows these graphically.

In 2014, AusNet Services reported a 49 per cent decrease in the number of incidents involving the public (from 59 in 2013 to 30) mainly due to a decrease in the number of reports of No Go Zone incidents, HV injections and unauthorised access events. Given that AusNet Services' total safety incidents involving the public were increasing from 2010 to 2013 in an uptrend, the reduction in 2014 is most welcome.

There were 12 No Go Zone incidents in 2014 (a reduction of 56 per cent from 2013). This is the lowest number of such incidents reported by AusNet Services since 2010. The reason for this decrease is unknown. Possible explanations could include a decrease in construction activity in the AusNet Services area.

HV injections reduced by 45 per cent compared to those in 2013 and were also at their lowest level since 2010. This continues a downward trend evident since 2011. HV injections may be caused by asset failure or severe weather conditions. AusNet Services reported a reduction in the number of asset failures in 2014 compared to 2013, which may explain the reduction in the number of HV injections.

While unauthorised access incidents dropped from 10 in 2013 to 6 in 2014, such incidents have been increasing over the 2010-2014 period.

Overall, the recent decrease in overall incidents involving AusNet Services' assets is a positive sign for community safety. AusNet Services should, as a minimum, maintain its current controls and also seek opportunities for improvement to prevent the upward trend reoccurring.

Table 11: Safety incidents involving the public – AusNet Services

Item	Total	2010	2011	2012	2013	2014
No Go Zone infringements	**105**	18	20	28	27	12
Unauthorised access	**23**	3	1	3	10	6
Reverse polarity	**7**	3	1	3	0	0
HV injections	**102**	20	25	23	22	12
Total incidents	**237**	**44**	**47**	**57**	**59**	**30**

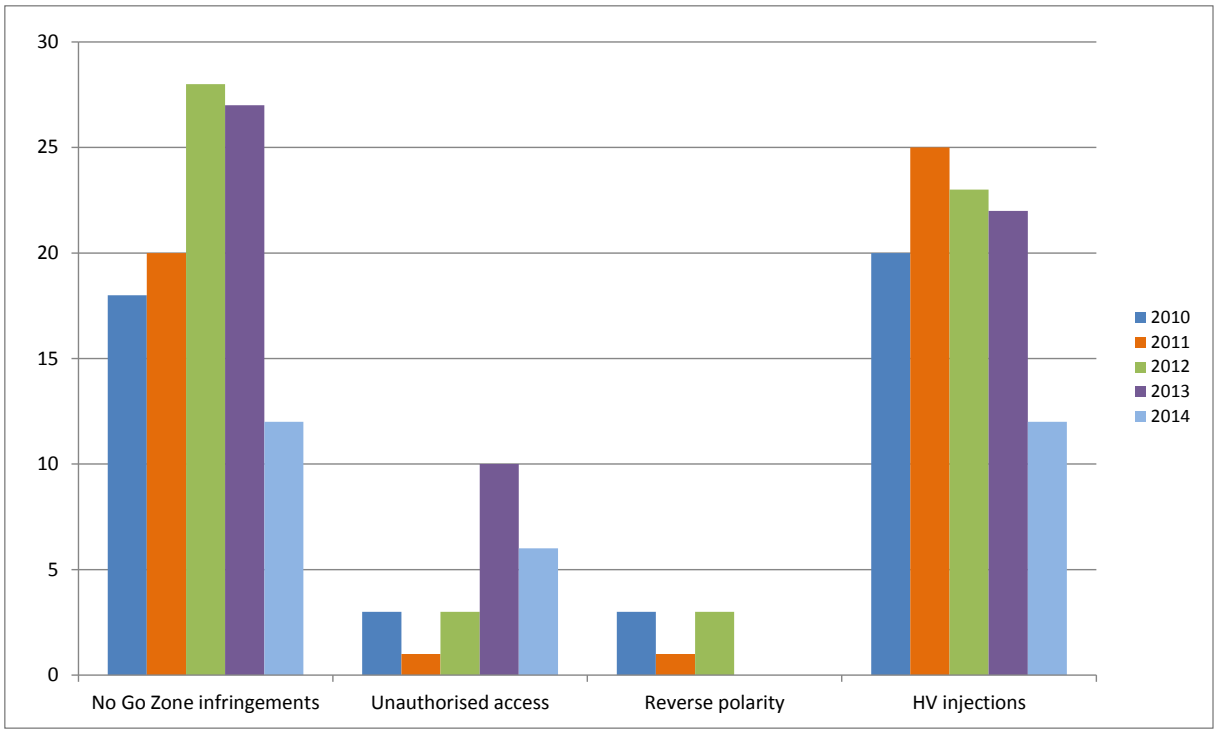

Figure 17: Safety incidents involving the public – AusNet Services

B.7.2 Asset failures

AusNet Services reported a 28 per cent reduction in asset failures in 2014 (Figure 18 and Table 12).

HV fuses were the only assets where failure rates increased between 2013 and 2014. There were 86 failures in 2013 and 97 failures in 2014 (an increase of 13 per cent). That said, failure levels are below those experienced in 2012 and are generally stable over this period.

There is a low level of pole failures each year accounting for less than 5 per cent of failures. Such failures are trending downward.

LV asset failures have the highest incidents of failure and are 40 per cent of AusNet Services' total asset failures in 2014. While they have increased significantly since 2010, the numbers of failures have been steady since 2011.

There have been downward trends in conductor and crossarm failures from 2010 to 2014, with the number of failures of each in 2014 being at the lowest level since reporting to the current guidelines began.
The reductions in asset failures may be due to the implementation of large volumes of asset changes undertaken as part of AusNet Services' safety programs. ESV regards the investment in these safety programs as worthwhile as the consequence of asset failures can be severe.

ESV recommends that AusNet Services review its asset programs and address the root cause of failures, especially LV asset failures.

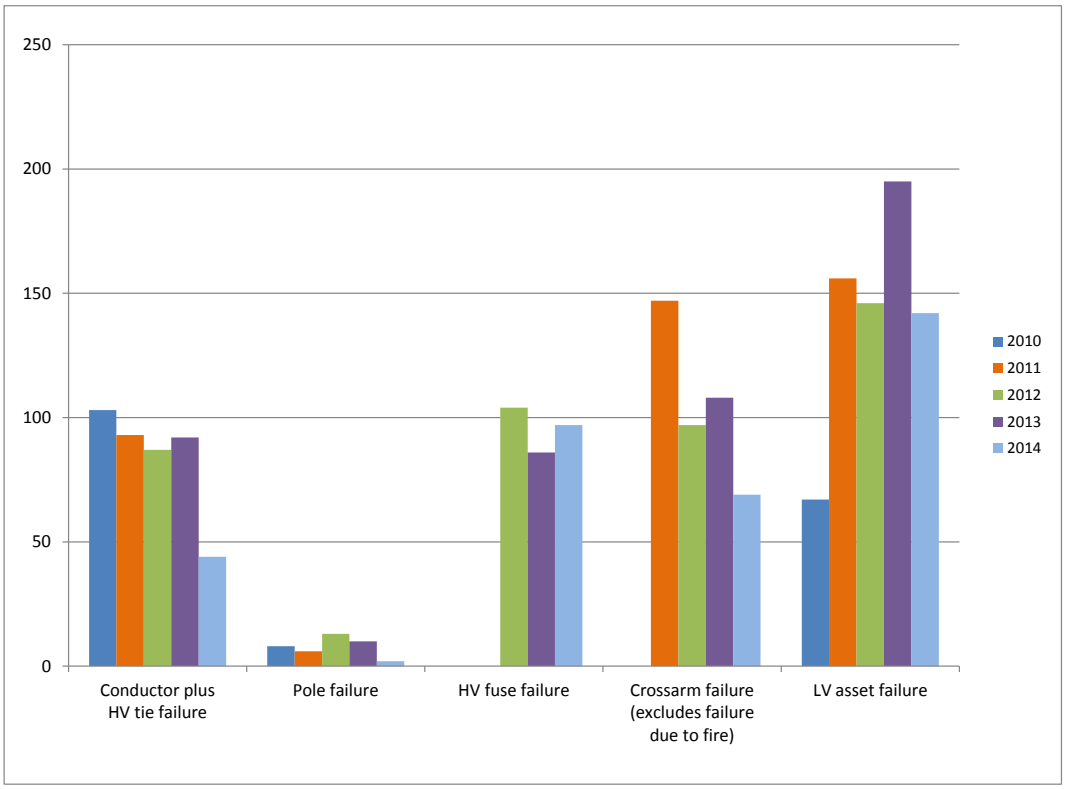

Figure 18: Asset failures by type – AusNet Services

Table 12: Asset failures by type – AusNet Services
n/a – not recorded

Item	Total	2010	2011	2012	2013	2014
Conductor plus HV tie failure	**419**	103	93	87	92	44
Pole failure	**39**	8	6	13	10	2
HV fuse failure	**287**	n/a	n/a	104	86	97
Crossarm failure (excludes failure due to fire)	**421**	n/a	147	97	108	69
LV asset failure	**706**	67	156	146	195	142
Total	**1872**	**178**	**402**	**447**	**491**	**354**

B.7.3 Vegetation fires due to asset failure or contact

Figure 19 shows the total numbers of vegetation fires due to asset failures and contact events. The detailed data are provided in Table 13 (asset failures) and Table 14 (contact events).

Overall, AusNet Services reported a small decrease in total vegetation fire starts between 2013 and 2014 (a drop of 4 per cent). There was, however, a 21 per cent increase in fires due to asset failures. The overall number stayed level only because of a 27 per cent decrease in fires due to contact events.

Figure 20 and Figure 21 provide comparisons of the failure causes for asset failure fires and contact event fires respectively. These show upward trends in fires resulting from pole and/or crossarm fires, HV fuses and LV asset failures. These are counterbalanced by downward trends in fires from animal impacts (a short-term reduction after a longer upward trend), tree contact and other contacts. There is also a general stability in fires from pole and/or crossarm failure, oil-filled plant and third-party impacts.

Since 2011, the highest ranking causes of vegetation fires associated with AusNet Services' assets were consistently tree contact, failure of other assets, LV asset failure and animal contact.

The upward trend in fires caused by asset failures is undesirable and increases the likelihood of a bushfire.

Fires due to tree contact and LV asset failures remain as the most urgent issues for AusNet Services to resolve. The root cause of LV asset failures should be investigated further so that a program to reduce the number of failures can be implemented.

Further assessment of other asset failures should also be undertaken to better understand the assets within this category and the root causes of these failures.

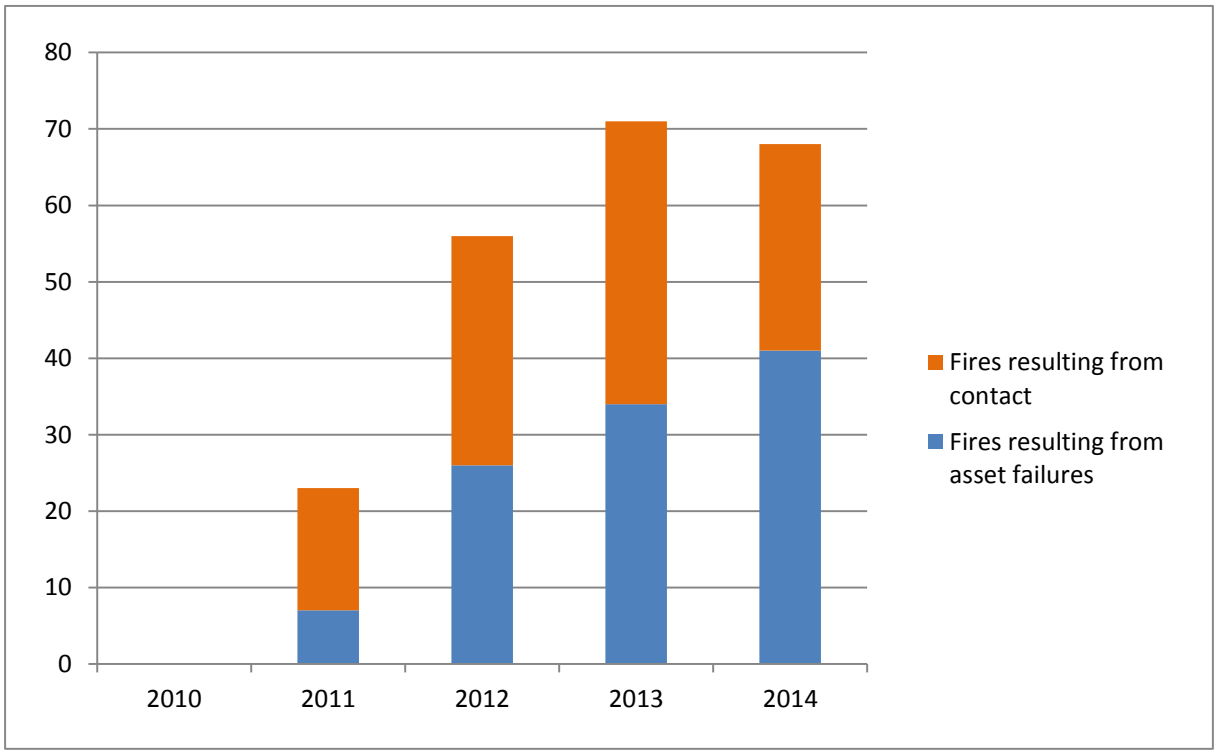

Figure 19: Vegetation fires due to asset failures and contact – AusNet Services
Note: There was no requirement to report on vegetation fires in 2010

Table 13: Asset failures resulting in vegetation fires – AusNet Services
n/a – not recorded

Cause of failure	Total	2011	2012	2013	2014
Pole and/or crossarm failure	**2**	0	0	1	1
Pole and/or crossarm fire	**9**	0	1	3	5
Oil-filled plant	**3**	0	1	0	2
HV fuse	**16**	2	3	5	6
LV asset failure	**32**	n/a	6	12	14
Other assets (e.g. street lights, surge arresters, etc.)	**46**	5	15	13	13
Total fires – asset failures	**108**	**7**	**26**	**34**	**41**

Table 14: Vegetation fires resulting from contact with assets – AusNet Services
n/a – not recorded

Cause of failure	Total	2011	2012	2013	2014
Animals	**34**	4	8	14	8
Third party (e.g. vehicle, vandalism)	**11**	n/a	4	3	4
Tree contact	**52**	n/a	18	19	15
Other causes	**13**	12	0	1	0
Total fires - contact	**110**	**16**	**30**	**37**	**27**

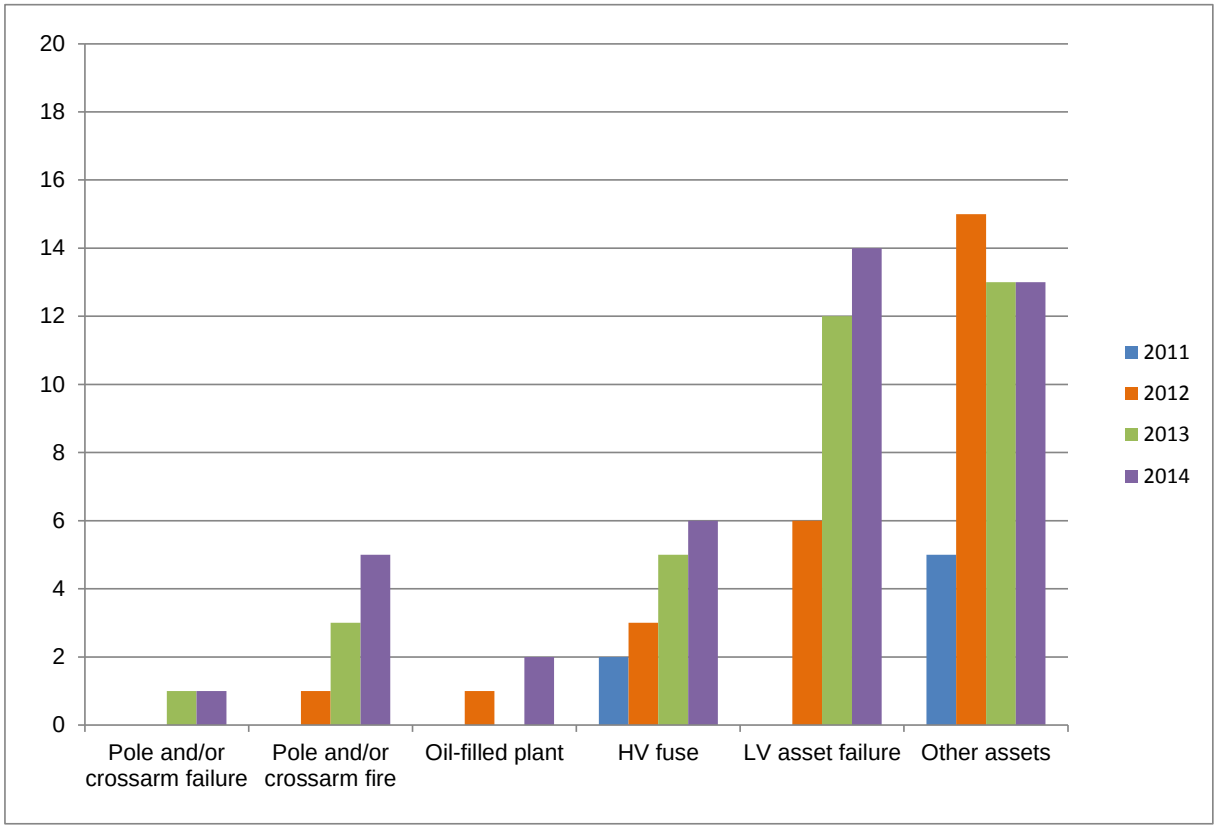

Figure 20: Vegetation fires resulting from asset failures – AusNet Services

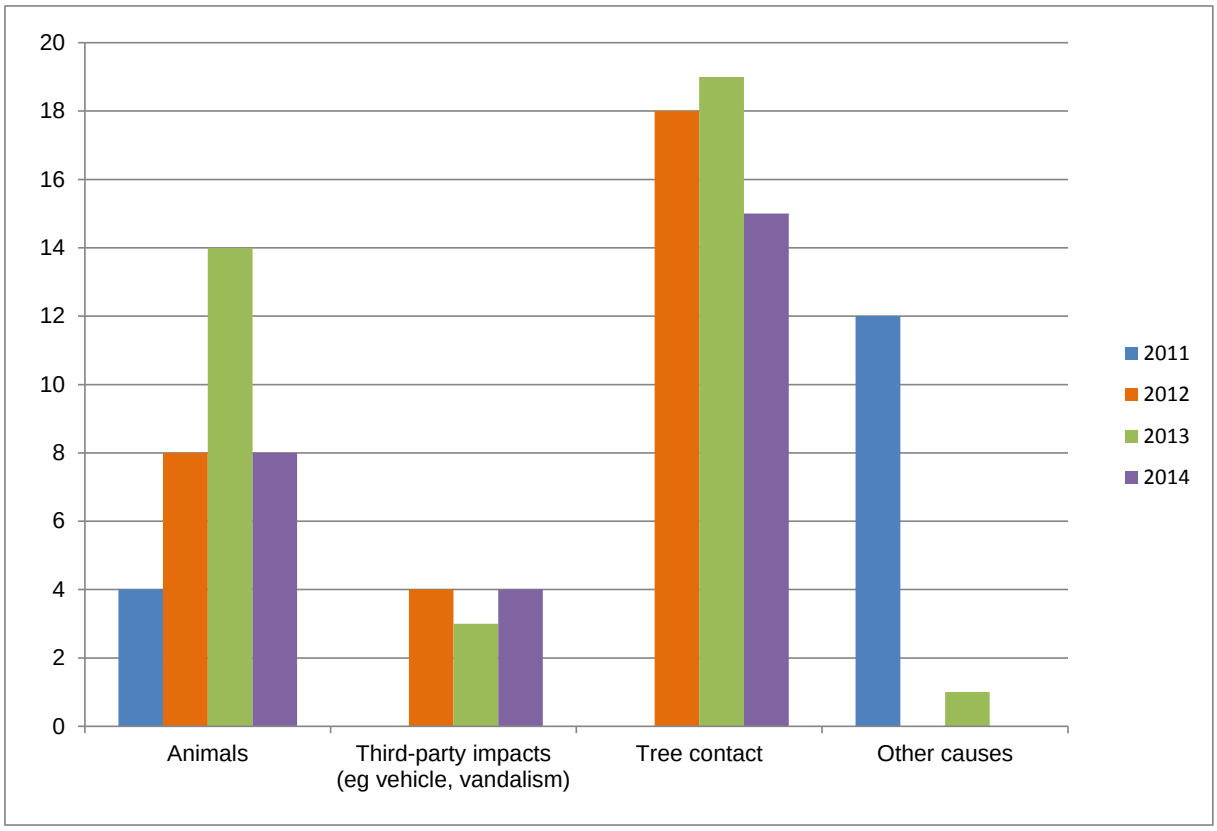

Figure 21: Vegetation fires resulting from contact with assets – AusNet Services

B.7.4 Fires on or in assets

Table 15 details the fires arising on or in the assets of AusNet Services. In 2014 AusNet Services reported 110 fire starts. This was a small (4.7 per cent) increase from 2013.

While the total number of fires remains stable, there are trends in the assets where these fires arise (Figure 22).

More than half the fires are due to HV fuse failures. The number of fuse fires declined from 2011 where they accounted for 90 per cent of asset fires. While 2014 saw numbers increase, such failures have been reducing over the last five years. Despite this, it is concerning that AusNet Services' fuse fires represent 75 per cent of the total HV fuse fires for all the distribution businesses. A reduction in its fuse fires would affect the overall industry performance significantly.

There have been efforts by AusNet Services to reduce the number of HV fuse fires through instituting a fuse replacement program, and this is shown by the overall downward trend. However, the 25 per cent increase in 2014 is worrying and AusNet Services clearly needs to continue its focus on what has been an ongoing issue for some years.

AusNet Services undertook an assessment of its high levels of fuse failure and reported to ESV prior to the 2011-2015 EDPR period. It subsequently undertook an accelerated program of fuse replacements to address these historic issues. Despite this, it still has high levels of fuse failures compared to other distribution companies (including Powercor, the other company with a similar mix of urban and rural networks).

ESV recommends that AusNet Services undertakes a further study to ascertain why it continues to have a disproportionately high number of HV fuse failures compared to the other distribution companies.

AusNet Services is also experiencing increases in the number of fires due to pole and crossarm fires and LV equipment failures. In comparison to HV fuse fires, the numbers here are low; however, any consistent upward trends need to be addressed. AusNet Services should monitor LV equipment failures and take action if this trend continues.

Table 15: Fires on or in assets – AusNet Services
n/a – not recorded

Item	Total	2011	2012	2013	2014
Pole and crossarm fire	**47**	7	9	14	17
Oil filled plant	**2**	0	0	1	1
HV fuse	**288**	94	79	51	64
LV equipment	**25**	n/a	6	7	12
Other assets	**80**	4	28	32	16
Total fires	**442**	**105**	**122**	**105**	**110**

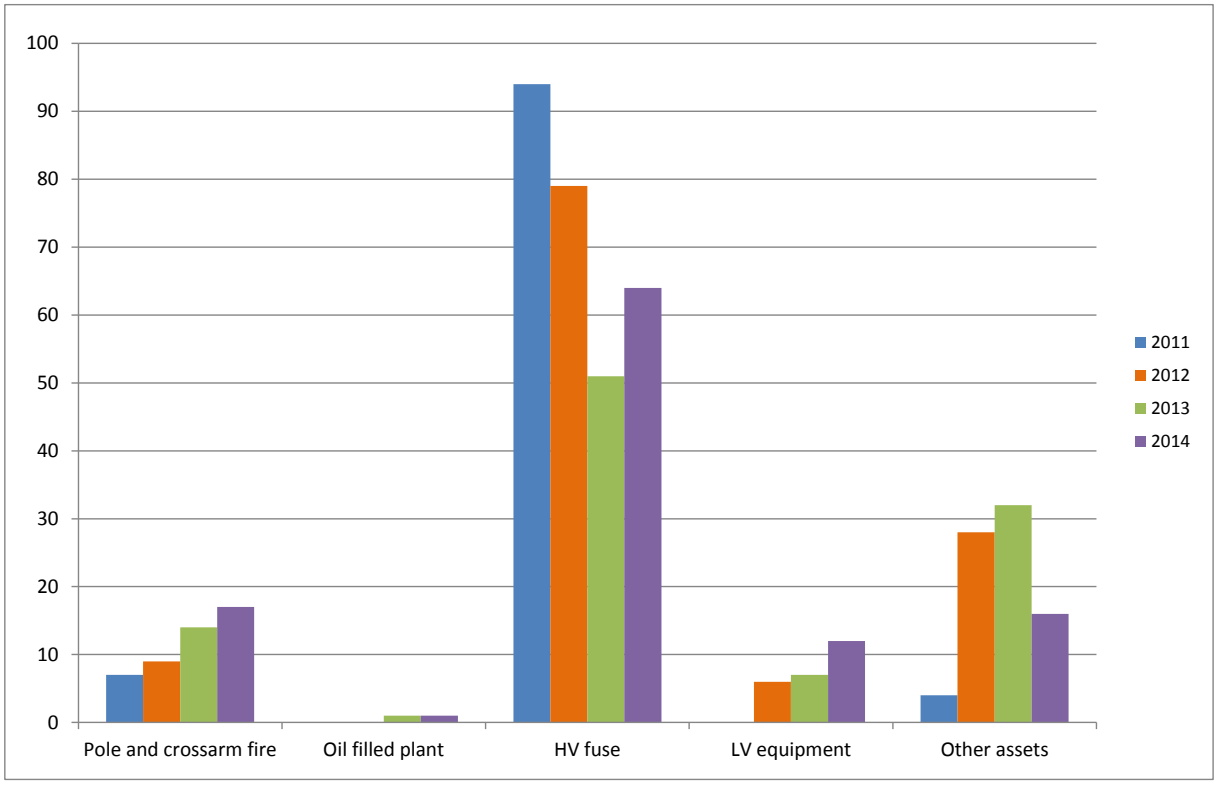

Figure 22: Fires on or in assets – AusNet Services

C BASSLINK

Basslink owns and operates the Basslink HVDC interconnector between Victoria and Tasmania. In Victoria its assets comprise the Loy Yang converter station connected to the 500kV transmission system via 3.2km of AC overhead line. From the converter station, 57km of DC overhead line and 6.4km of underground cable connect to the submarine cables that cross Bass Strait to Tasmania.

Basslink is registered as a Market Network Service Provider.

Basslink was owned by CitySpring Infrastructure Trust (now Keppel Infrastructure Trust), an entity listed on the Singapore stock exchange.

C.1 ELECTRICAL SAFETY MANAGEMENT SCHEME

In May 2014, ESV conducted a desktop audit at the Basslink office in order to assess its interpretation and implementation of the following sections of the Electricity Safety (Management) Regulations:

- r.24 incident recording, investigation and reviewing
- r.27 relevant asset operator requirements for reporting of serious electrical incidents
- r.28 relevant asset operator reporting of incidents other than serious electrical incidents.

The audit identified no noncompliances or areas requiring attention. Three opportunities for improvement were identified.

Two of the three opportunities for improvement related to incorrect documentation while the third opportunity for improvement related to failing to follow an internal procedure to regularly rehearse emergency management procedures. There are no serious safety-related issues with these findings.

Basslink was found to be compliant to the requirements of the regulations and its Electricity Safety Management Scheme. The three opportunities for improvement were minor issues that were probably due to lack of oversight in keeping documentation up-to-date. The opportunities for improvement are improvement suggestions for Basslink to consider and address if it deems necessary.

Overall, the audit found Basslink to be performing satisfactorily. ESV recommends that Basslink review ESV's audit findings and consider opportunities to improve the safety performance of the business.

C.2 SAFETY PROGRAM

Basslink is not regulated by the AER and, as such, AER-approved safety programs do not apply. Basslink has no identified safety issues that warrant monitoring by ESV.

C.3 BUSHFIRE MITIGATION

The Basslink Bushfire Mitigation Plan 2014-2019 was assessed and, after minor amendments, was accepted by the Director of Energy Safety on 15 September 2014.

ESV did not conduct a bushfire mitigation audit on Basslink in 2014. Basslink's assets are relatively new and its previous audit records showed these were in good condition.

C.4 ELECTRIC LINE CLEARANCE

The Basslink ELCMP was received by ESV 27 March 2014 and assessment finalised on 19 August 2014. The plan was observed to be mature and well supported by adequate processes and procedures. Subsequent to minor amendment throughout the assessment process the plan was approved by the Director of Energy Safety on 8 September 2014.

The electrical assets owned and operated by Basslink were considered to be recent installations. Audit records from 2013 found them to be of good condition. Vegetation clearance standards observed at this time did not indicate concern with compliance to the regulations.

For these reasons an electric line clearance audit was not conducted in 2014.

C.5 WORK PRACTICES

Basslink is rarely out of service for maintenance (approximately four days every two years) and undertakes no live work. No work practices audits were scheduled for 2014.

C.6 DIRECTIONS AND EXEMPTIONS

Basslink has sought no exemptions from regulations. ESV has not had cause to issue directions to Basslink.

C.7 SAFETY INDICATORS

Basslink is essentially one relatively short overhead line and one converter station. It is statistically insignificant and does not report safety indicators.

D CITIPOWER

CitiPower owns and operates electricity distribution assets in Victoria. CitiPower's network delivers electricity across 157 square kilometres of the Melbourne Central Business District and inner suburbs.

CitiPower/Powercor is jointly owned by Cheung Kong Infrastructure, Power Assets Holdings and Spark Infrastructure. Cheung Kong Infrastructure, Power Assets Holdings are both part of the Cheung Kong Group of companies. They jointly hold a 51 per cent stake in CitiPower/Powercor, with the remaining 49 per cent held by Spark Infrastructure.

CitiPower and Powercor are managed by a single executive management team using common procedures and systems across the two distribution businesses. As a result, the Electricity Safety Management System (Section D.1) and the work practices observations audits (Section D.5) have been undertaken jointly across the two businesses. The remaining sections within this appendix refer to the specific assets within the CitiPower network and have therefore been assessed independently on the Powercor assets.

D.1 ELECTRICAL SAFETY MANAGEMENT SCHEME

In May 2014, ESV conducted a desktop audit at CitiPower/Powercor offices in order to assess its interpretation and implementation of the following sections of the Electricity Safety (Management) Regulations:

- r.24 incident recording, investigation and reviewing
- r.27 relevant asset operator requirements for reporting of serious electrical incidents
- r.28 relevant asset operator reporting of incidents other than serious electrical incidents.

As the two companies are managed by the same CEO and Board and they use the same procedures, the ESV audit encompassed both companies in the same audit with the findings being applicable to both entities.

The audit found no areas of noncompliance or areas requiring attention. Four opportunities for improvement were identified relating to document control (failure to update documentation or follow procedures) and one relating to a distribution business-wide improvement to encourage a broader distribution of safety grams/alerts.[20] There were no serious safety implications in these findings. A formal response was required for each of these items.

D.2 SAFETY PROGRAM

D.2.1 Audit findings

In November 2014, ESV carried out a field audit on CitiPower's assets in order to verify the progress of work completed by CitiPower as part of its safety programs. The audit comprised a limited desktop audit and a comprehensive field-based audit.

A total of 502 assets were audited. The audit found that, for five of the six safety programs, the works recorded in CitiPower's asset management database matched the actual completed work. However, issues were identified with 15 assets in the sixth program (an overall variance of 3 per cent). More specifically, all the issues identified related to crossarm maintenance and, given that only 326 crossarms were inspected, this represents a variation of 4.6 per cent of crossarms. The reason the discrepancies in record-keeping for crossarm replacement was not explained by CitiPower.

[20] This was subsequently implemented across all major electricity companies.

CitiPower may have a high number of crossarms in a condition where they may fail; however, the inaccuracies in its records may have led CitiPower to assume works had already been undertaken and its network was safer than it really was.

ESV raised a noncompliance on the crossarm replacement programs due to the high variance associated with inaccuracies in CitiPower's crossarm replacement records. ESV therefore recommended that, as a priority, CitiPower conduct an internal audit of the safety programs to review consistency between the reported volumes and works actually completed, take corrective action based on the findings and report the outcomes to ESV.

D.2.2 Safety program status

Asset failures are one of the major contributors to network-related fires. They were one of the causes of the 2009 Black Saturday fires. The safety programs involve the accelerated replacement of specific assets before they would normally be replaced as part of regular maintenance. This early replacement of assets reduces the chance of failure, thereby resulting in a more reliable and safer electrical distribution network.

CitiPower reports on eight safety programs to ESV. Performance against target is shown graphically in Figure 23. Specific data on the status of these safety programs are provided in Table 16.

CitiPower does not consider these programs to be safety programs but rather regular maintenance. As a result, annual forecasts for these safety programs were not established by CitiPower. Instead the forecast volumes shown in Table 16 are based on the figures supplied to the AER for revenue determination purposes and annualised by ESV to monitor progress.

ESV does not agree with CitiPower's viewpoint. The rationale for the safety programs was to accelerate routine works in order to reduce public safety risks. While such works may be scheduled as part of routine maintenance and funded out of normal revenues, the AER approved additional funding explicitly to have such works undertaken earlier than otherwise may have been the case. It was a condition of the AER funding that ESV monitor performance against these programs. Therefore, ESV continues to monitor performance against the commitments made with the AER.

Progress on two of the programs is ahead of ESV's forecast for 2014:
- crossarm replacement
- pole replacement staked.

Progress on the other six programs is behind ESV's forecast for 2014:
- pole replacement poles and stays
- LV overhead conductor replacement
- HV conductor replacement
- pole replacement LV
- pole replacement HV
- pole replacement sub-transmission.

Power pole replacement programs (sub-transmission, LV and HV) are behind the ESV forecast. However, given the small numbers of poles within the CitiPower asset fleet, the progress of these programs is of less concern at this time. The planned power pole replacement program has also been offset to some degree by an increase in the number of staked power poles.

CitiPower reports that only 70m of LV conductor and no HV conductor had been replaced by the end of 2014. Discussions with CitiPower throughout the five-year EDPR period have identified that its reported volumes may not accurately align with works completed. CitiPower had advised that issues with its information technology and recording systems are the cause. Accordingly, ESV has recorded that these programs are behind ESV's forecast. In order to meet its targets, CitiPower needs to allocate significant resources to complete these programs by the end of 2015.

ESV would recommend that CitiPower resolve its information technology and reporting system issues. Without accurate reporting, CitiPower cannot know the true state of its network assets. This, in turn, poses a significant risk in relation to network reliability and health and safety.

While it is pleasing to see that crossarm replacement and power pole replacement programs are well ahead of forecast, ESV does not expect CitiPower to meet the safety program targets for the six programs behind schedule by the end of 2015. CitiPower's area lies in LBRA and does not pose a significant bushfire risk; however, there is still potential for safety risks to the public and fire risks to houses and other infrastructure.

While CitiPower considers these programs to be regular maintenance rather than safety programs, meeting the original commitment made with the AER for these programs would mitigate some of the risks associated with its network. CitiPower should plan to meet the targets. CitiPower would need to ramp up its safety programs if it wishes to meet its five-year safety program targets.

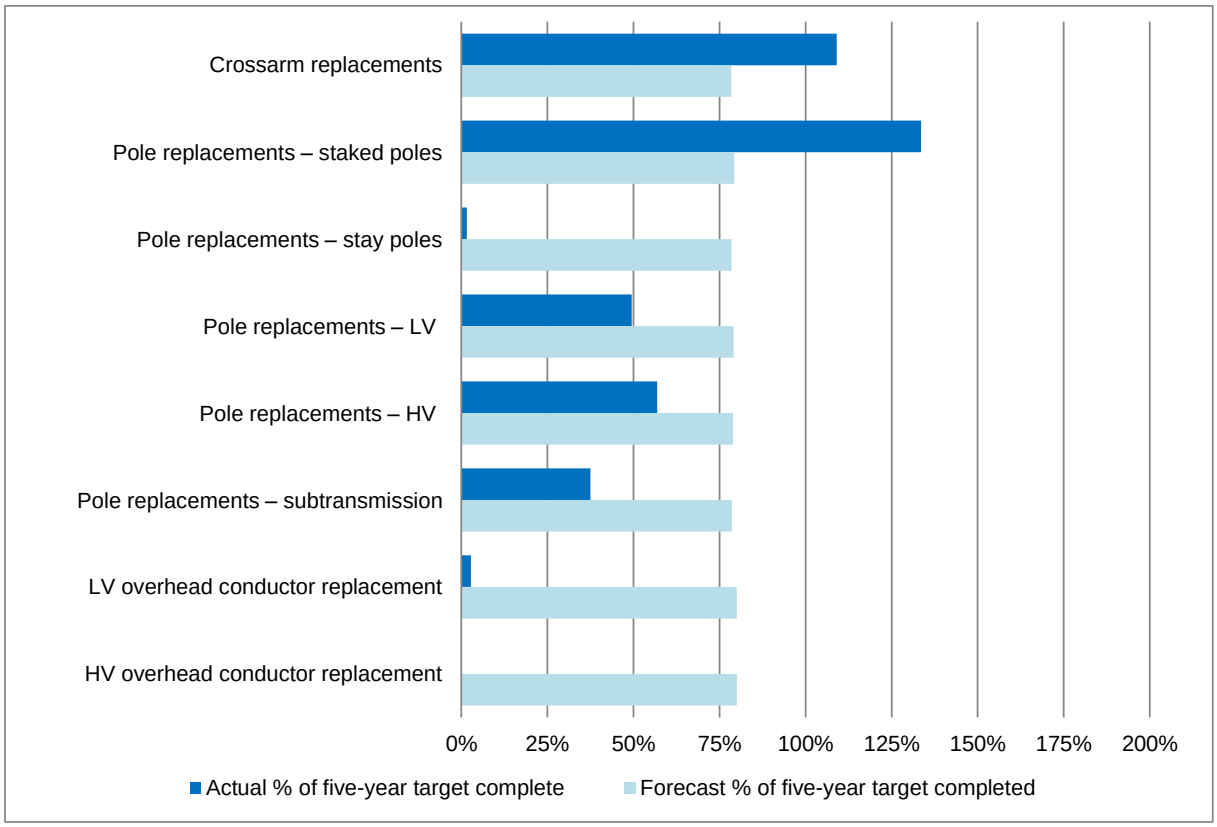

Figure 23: Status of CitiPower's safety programs

Table 16: Status of CitiPower's safety programs

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
Crossarm replacements	Number of crossarms replaced	2900	4035	3700	Program is 39% ahead of ESV forecast.
Pole replacements - Staked poles	Number of poles staked	1050	1769	1325	Program is 68% ahead of ESV forecast.
Pole replacements - Stay poles	Number of poles replaced	51	1	65	Program is 98% ahead of ESV forecast.
Pole replacements - LV	Number of poles replaced	454	184	574	Program is 37% behind ESV forecast.
Pole replacements - HV	Number of poles replaced	183	132	232	Program is 28% behind ESV forecast.
Pole replacements - Sub transmission	Number of poles replaced	44	21	56	Program is 52% behind ESV forecast.
LV overhead conductor replacement	Route kilometers of conductor replaced	2.5	0.07	2.5	Information technology upgrade required. CitiPower could not provide any figures on the progress of this program.
HV overhead conductor replacement	Route kilometers of conductor replaced	10	0	12.5	Information technology upgrade required. CitiPower could not provide any figures on the progress of this program.

RED	Program total to date < 90 per cent of forecast to date
GREEN	Program total to date 90-110 per cent of forecast to date
BLUE	Program total to date > 110 per cent of forecast to date

D.3 BUSHFIRE MITIGATION

A desktop audit of CitiPower's asset database was carried out prior to the field audit to ensure that the information ESV had received was appropriate for this audit.

ESV viewed more than 500 assets overall as part of the audit and inspected 25 assets in detail. These assets were on feeders from the Armadale and Albert Park zone substations.

The findings of the bushfire mitigation field audit were:

- five crossarms showed a level of wear that required closer inspection
- one LV spreader in Phillipson Street south of Ashworth Street was identified as broken
- a vine was observed growing on a pole and crossarm in Napier Street.

The variance can be shown to be:

- approximate number of assets viewed while travelling 500
- number of assets inspected in detail 25
- assets not matching the database notifications 7
- variance = (6/500) 1.4%

Discrepancies were also noted between conditions in the field and CitiPower's asset database. An example was the vine growing on the pole in Napier Street. CitiPower's records indicated that the crossarm had been replaced with steel in 2005 yet this pole had a wooden crossarm.

ESV recommended that CitiPower conduct a review of its record systems to determine the extent of the records not matching the actual field assets. ESV also required CitiPower to submit a detailed plan to address all issues found in the audit.

D.4 ELECTRIC LINE CLEARANCE

CitiPower's ELCMP was received by ESV on 31 March 2014 and the assessment was finalised on 28 August 2014. The plan was observed to be thorough, with embedded management systems defining the required outcomes. Subsequent to minor amendments throughout the assessment process, the plan was approved by the Director of Energy Safety on 15 October 2014.

An electric line clearance audit of the CitiPower network was conducted between 4-6 December 2014. This occurred at randomly selected locations throughout the network.

A total of 423 electricity spans were inspected during the field component of the audit. All of these spans were located in the LBRA as CitiPower has no assets in HBRA.

Table 17 summarises the audit findings.

Table 17: Electric line clearance field audit results – CitiPower

Field audit results	Total	Variance (%)
HBRA sites audited in the field	0 (0%)	
LBRA sites audited in the field	423 (100%)	
Total sites audited in the field	**423**	
LBRA noncompliant spans – CitiPower responsibility	9	2.1
LBRA noncompliant spans – ORP responsibility (council)	198	46.8
LBRA noncompliant spans – ORP responsibility (private owner)	83	19.6

Generally the noncompliant spans fell into two groups:

- Spans for which CitiPower is responsible

  Isolated instances were observed where vegetation was found encroaching on overhead assets in areas that were the management responsibility of CitiPower.

  The audit results indicate that where CitiPower is responsible for vegetation management its processes and clearing activities are effective and provide for appropriate compliance standards.

Despite the positive performance in the field, ESV found issues with the accuracy of CitiPower's vegetation management database. It was observed that asset information did not always match site conditions and the database appeared to be inaccurate and poorly maintained.

- Spans for which CitiPower is not responsible

  Extensive noncompliance was observed where vegetation was the management responsibility of a municipal council. This occurred with respect to uninsulated LV electrical assets and uninsulated HV electrical assets. It was also the case for LV insulated lines.

  Evidence existed that suggested recent clearing activities by municipal councils had occurred; however, in many instances the implemented actions did not achieve code compliance.

  Noncompliant vegetation in the clearance space of electrical powerlines that are the responsibility of private property owners and occupiers was also a substantial issue.

  The higher frequency of noncompliant spans in areas managed by other responsible persons may adversely affect electrical safety, the reliability of supply and increase the potential for fire starts. These noncompliance issues could also impact the CitiPower distribution network.

  CitiPower has systems in place to notify municipal councils and private property owners and occupiers of the requirement to maintain a clearance space. There is, however, evidence that these systems may fail to:
  - effectively notify the relevant persons of their responsibility
  - track or provide for follow up consultation on responsible person inaction
  - accommodate an effective escalation process when a responsible person has failed to act.

  There is no obligation on CitiPower to pursue a responsible person to ensure compliance with the regulations.

The review of CitiPower's ELCMP recommended that CitiPower:
- continues to utilise existing vegetation management methodologies as detailed in the ELCMP
- conducts systematic review of its ELCMP to ensure its effectiveness into the future and to identify and implement improvement opportunities should they be identified.

The electric line clearance audit recommended that CitiPower:
- continues to implement vegetation management principles utilised in clearing vegetation from electric lines
- reviews and upgrades its vegetation management database to improve the accuracy and quality of information
- provides greater assistance to municipal councils and private property owners and occupiers to enable them to facilitate more effective and efficient clearing of vegetation that is their management responsibility
- develops more rigorous follow-up and escalation procedures for municipal councils and private property owners and occupiers to ensure clearing of noncompliant vegetation in a more timely and effective manner.

D.5 WORK PRACTICES

ESV undertook nine audits of CitiPower/Powercor's work practices at nine sites in 2014. Of these three were conducted at CitiPower sites and six at Powercor sites. Given the two businesses operate the same processes, these findings have been aggregated. The findings of these audits were as follows:

- two areas requiring attention relating to:
  - lack of training and understanding of the Safe Work Method Statement and Job Safety Assessment processes
  - no Live Line manual for reference in field
- 11 opportunities for improvement of which the common issues related to:
  - Safe Work Method Statement understanding and communication
  - thoroughness of Job Safety Assessment processes.

No noncompliances were identified.

These findings are consistent with those of the 2013 audit, where the key areas of concern also related to a lack of understanding of the importance of planning and adequate on-site risk assessment, including understanding of the Job Safety Assessment and Safe Work Method Statement processes.

ESV recommends that CitiPower/Powercor ensures its internal work practices program focuses on ensuring all workers:

- improve job planning and communications
- ensure appropriate, thorough on-site risk assessment, including improving the understanding of Job Safety Assessment and Safe Work Method Statement methodology and process.

D.6 DIRECTIONS AND EXEMPTIONS

CitiPower has no HBRA in its region and, therefore, there were no directions placed on CitiPower regarding the installation of armour rods and vibration dampers in HBRA.

Two directions have been placed on CitiPower that it is yet to commence planning for:

- install armour rods and vibration dampers in LBRA by 2020
- install spreaders on the HV in LBRA by 2020.

CitiPower reported on the progress of three exemptions. The three exemptions programs are complete:

- overhanging trees (cut)
- cyclic clearing – ABC or insulated cable
- cyclic clearing – powerlines not insulated in LBRA.

The overhanging trees exemption was completed in 2011. One-year extensions were granted in September 2013 for the two cyclic clearing exemptions. These programs were completed in 2014 in line with the extended completion date.

In 2010 the Electric Line Clearance Regulations were amended and required a greater clearance between trees and overhead powerlines. CitiPower applied to ESV for an exemption under regulation 10 of the Electric Line Clearance Regulations to allow a transition period until full compliance can be achieved.

Its initial plan was to achieve compliance by the end of 2013. In 2013 CitiPower asked for an extension of one year to achieve compliance. This extension was granted and the transition

program was completed in 2014. By completing the transition program, ESV expects CitiPower to now be fully compliant with the 2010 Electric Line Clearance Regulations and able to maintain compliance to the current standards across its network. It should be noted that this cannot necessarily be said for all trees in the CitiPower area as local councils and other responsible persons are also required to clear certain trees around powerlines and this is outside CitiPower's direct control.

ESV recommends that CitiPower engage more with other responsible persons within its area to ensure compliance with the Electric Line Clearance Regulations and thereby ensure safety and network reliability risks are minimised.

ESV also recommends that CitiPower commence planning to ensure the two directions placed relating to armour rods, vibration dampers and LV spreaders can be delivered by 2020.

D.7 SAFETY INDICATORS

ESV assesses a range of key safety indicators on an ongoing basis and requires regular reporting by each distribution business. These indicators include:

- incidents involving the public
- asset failures
- vegetation fires due to asset failure or contact
- fires on or in assets.

Each of these is discussed in detail in this section.

D.7.1 Incidents involving the public

Table 18 details the incidents involving the public interacting with CitiPower's assets and Figure 24 shows these graphically.

In 2014, CitiPower reported a small increase in the number of incidents involving the public from 53 in 2013 to 55 in 2014 (4 per cent).

There is a general trend of increasing No Go Zone infringements over the last five years. Such incidents represent 73 per cent of CitiPower's total incidents in 2014. The reason for this upward trend is unclear, but it may be due to increased reporting of incidents related to better awareness or to increased construction activity in the CitiPower area. The concern in this trend is that it increases the likelihood of a fatality in the CitiPower area.

Table 18: Safety incidents involving the public – CitiPower

Item	Total	2010	2011	2012	2013	2014
No Go Zone infringements	**158**	31	7	37	43	40
Unauthorised access	**46**	5	5	16	9	11
Reverse polarity	**1**	0	1	0	0	0
HV injections	**10**	0	1	4	1	4
Total incidents	**215**	**36**	**14**	**57**	**53**	**55**

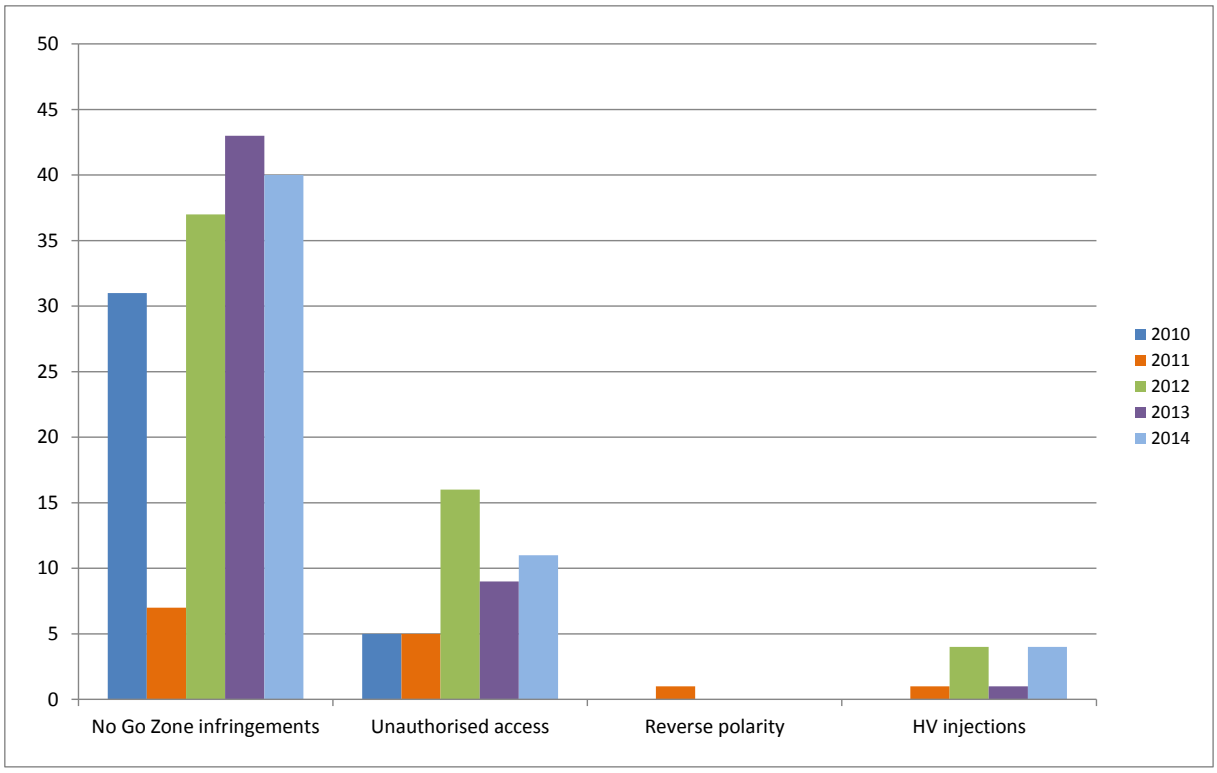

Figure 24: Safety incidents involving the public – CitiPower

The next largest source of incidents (unauthorised access) is trending downwards back towards the levels experienced at the start of the five-year period.

Overall, the total number of incidents across the five-year period remains relatively stable, with the exception of an unusually small number of incidents reported in 2011.

CitiPower approached ESV to further promote electrical safety to the building industry and councils around building developments near overhead lines. ESV did publish and promulgate a brochure and an advertising campaign in industry publications aimed at delivering this objective. ESV also continues to work with councils and the construction industry to raise awareness during the planning process.

To reinforce this initiative, ESV recommends that CitiPower actively monitor and review construction activities in its area and enforce the rules to reduce the incidence of No Go Zone infringements. CitiPower should also review the adequacy of controls it has in place to prevent safety incidents involving the public, especially No Go Zone incidents.

D.7.2 Asset failures

In 2014, CitiPower reported a 14 per cent reduction in the total number of asset failures between 2013 and 2014 (Figure 25 and Table 19).

Total asset failures peaked in 2012 and have been reducing since then. This is reflected in reductions in conductor failures and HV fuse failures. Pole failures also appear to be stable at a low level of incidents. This is positive.

There are, however, some areas of concern. Crossarm failures have been increasing over the last five years. This has included a major peak in 2012 that needs to be considered when looking at total asset failures as it tends to mask some negative trends post-2012. This includes the upward trend in LV asset failures, which have more than doubled since 2011 and represented 60 per cent of CitiPower's asset failures in 2014.

Overall, CitiPower has very few asset failures when compared to other distribution businesses. This is predominantly due to the small size of its service area and the small amount of overhead lines it operates.

The main area of concern is the increase in LV assets failures since 2011. Such failures can lead to power outages and broken neutrals, both of which pose serious safety risks. ESV recommends that CitiPower investigates the root cause of its LV asset failures and implements programs to reduce the number of failures and reverse the upward trend observed over the last four years.
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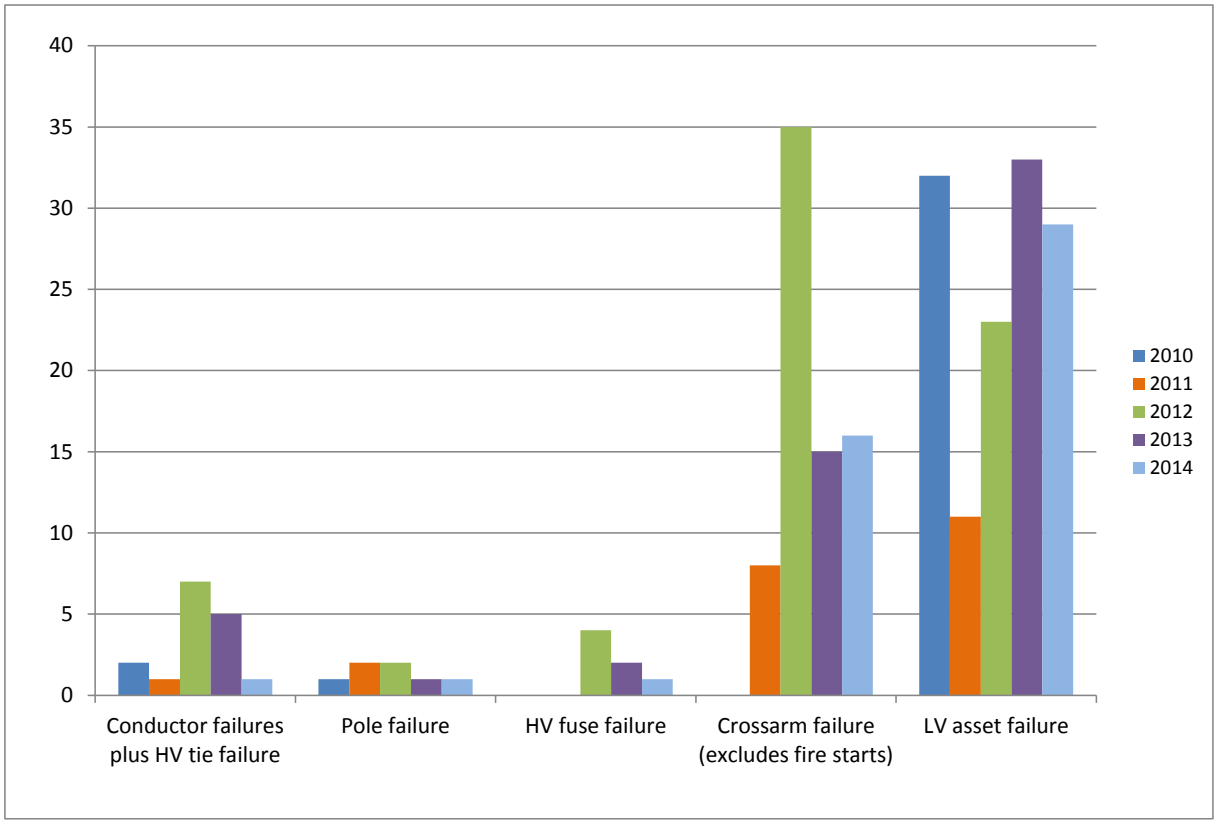

Figure 25: Asset failures by type – CitiPower

Table 19: Asset failures by type – CitiPower
n/a – nor recorded

Item	Total	2010	2011	2012	2013	2014
Conductor plus HV tie failure	**16**	2	1	7	5	1
Pole failure	**7**	1	2	2	1	1
HV fuse failure	**7**	n/a	n/a	4	2	1
Crossarm failure (excludes failure due to fire)	**74**	n/a	8	35	15	16
LV asset failure	**128**	32	11	23	33	29
Total	**232**	**35**	**22**	**71**	**56**	**48**

D.7.3 Vegetation fires due to asset failure or contact

Detailed data on the total numbers of vegetation fires due to asset failures and contact events are provided in Table 20 (asset failures) and Table 21 (contact events).

Overall, the total number of vegetation fires in CitiPower's area has been relatively stable over the last four years (Figure 26). There has also been an overall reduction in the number of fires resulting from contact with assets. In 2011 contact events accounted for 82 per cent of fires and by 2014 they only accounted for 8 per cent. The numbers of events also reduced from nine to one over the period. This is a positive trend and CitiPower should be commended for this.

Unfortunately efforts to reduce contact events have been offset by an increase in vegetation fires resulting from asset failures. This has predominantly been due to the increase in fires associated with LV assets (Figure 27). Failures of LV assets accounted for 67 per cent of all vegetation fires in 2014. CitiPower has not advised ESV of the cause of the increasing LV asset-related fires.

While vegetation fires in CitiPower's LBRA area do not represent a bushfire risk, fires from LV asset failures can cause localised safety and reliability issues. ESV recommends that CitiPower determine the root causes of the LV asset fires and implement risk mitigation measures.

Table 20: Asset failures resulting in vegetation fires – CitiPower
n/a – nor recorded

Item	Total	2011	2012	2013	2014
Pole and/or crossarm failure	**1**	1	0	0	0
Pole and/or crossarm fire	**0**	0	0	0	0
Oil-filled plant	**1**	0	0	1	0
HV fuse	**2**	0	0	1	1
LV asset failure	**11**	n/a	0	3	8
Other assets (e.g. street lights, surge arresters, etc.)	**7**	1	3	1	2
Total fires – asset failures	**22**	**2**	**3**	**6**	**11**

Table 21: Vegetation fires resulting from contact with assets – CitiPower
n/a – nor recorded

Item	Total	2011	2012	2013	2014
Animals	**1**	0	1	0	0
Third party (e.g. vehicle, vandalism)	**0**	n/a	0	0	0
Tree contact	**7**	n/a	3	3	1
Other causes	**10**	9	1	0	0
Total fires - contact	**18**	**9**	**5**	**3**	**1**

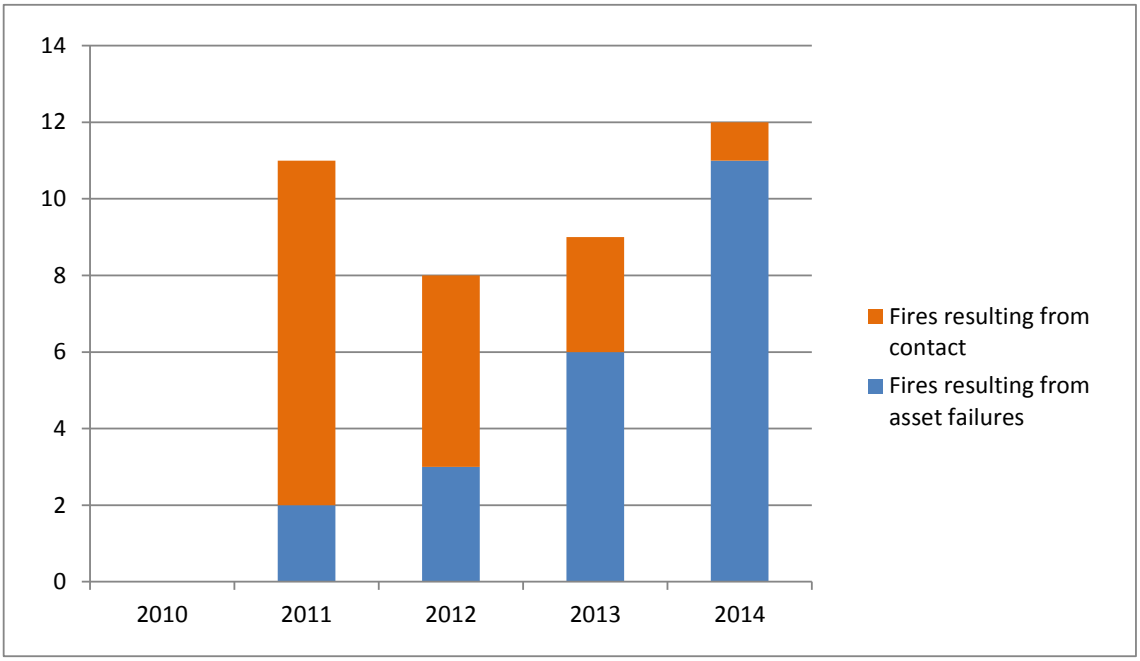

Figure 26: Vegetation fires due to asset failures and contact – CitiPower
Note: There was no requirement to report on vegetation fires in 2010

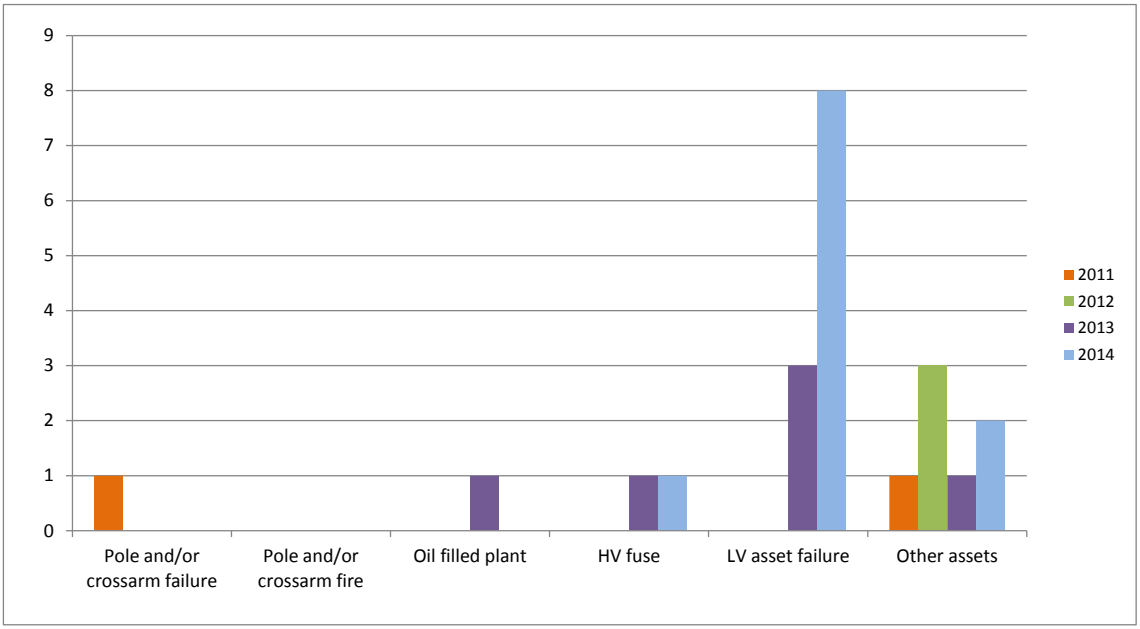

Figure 27: Vegetation fires resulting from asset failures – CitiPower

D.7.4 Fires on or in assets

Table 22 details the fires arising on or in CitiPower's assets. In 2014 CitiPower reported 18 fire starts — a 22 per cent reduction from 2013. This is part of a general reduction in asset fires that has been occurring since 2012.

There has been an increase in pole and crossarm fires over the last four years (Figure 28). There were no pole and crossarm fires in 2011 and now they account for 39 per cent of all fires — second only to LV equipment fires.

The increase in pole and crossarm fires has been offset by reductions in fires associated with other assets in 2013 and LV equipment in 2014. CitiPower has not explained the increase in pole and crossarm fires, which is emerging as a significant asset management issue.

ESV recommends that CitiPower investigates the root causes of pole and crossarm fires and implements measures to reduce the likelihood of such fires.

Table 22: Fires on or in assets – CitiPower
n/a – nor recorded

Item	Total	2011	2012	2013	2014
Pole and crossarm fire	**14**	0	2	5	7
Oil-filled plant	**1**	1	0	0	0
HV fuse	**1**	1	0	0	0
LV equipment	**32**	n/a	9	15	8
Other assets	**34**	12	16	3	3
Total fires	**82**	**14**	**27**	**23**	**18**

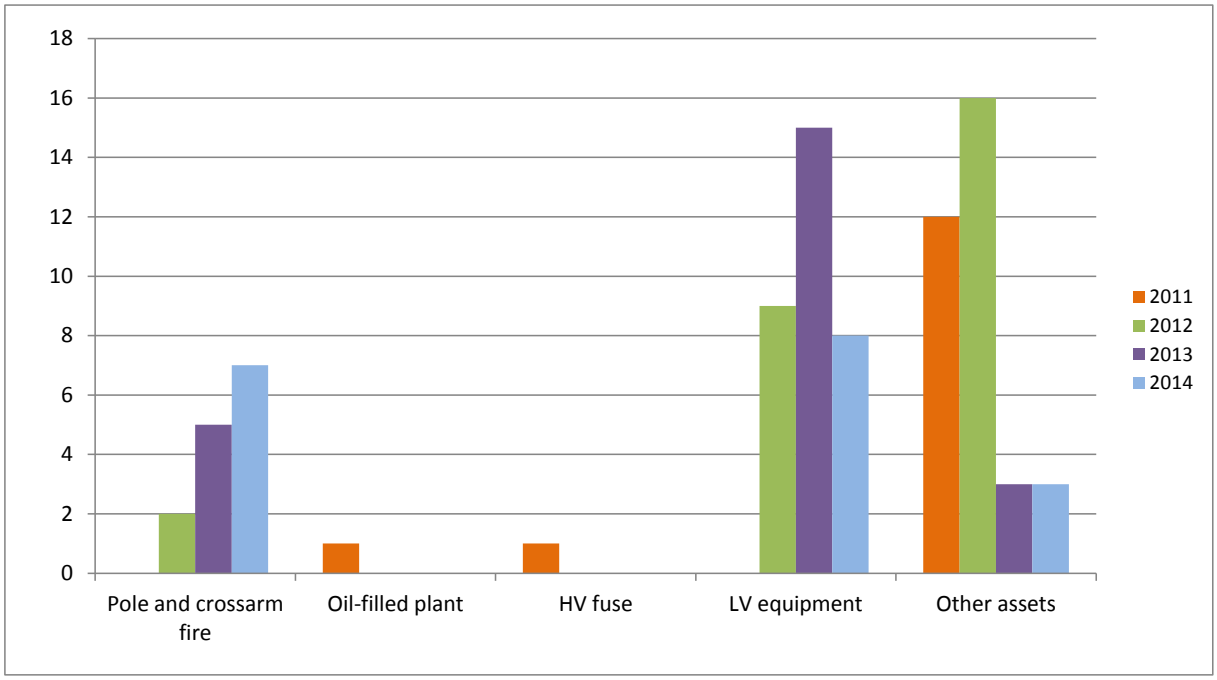

Figure 28: Fires on or in assets – CitiPower

E JEMENA

Jemena owns and operates a portfolio of electricity and gas assets across the east coast of Australia. Its electricity distribution network delivers electricity across 950 square kilometres of northern and western suburbs of greater Melbourne, including Melbourne airport.

Jemena is jointly owned by the State Grid Corporation of China (60 per cent) and Singapore Power (40 per cent).

E.1 ELECTRICAL SAFETY MANAGEMENT SCHEME

In February 2014, ESV conducted a desktop audit at Jemena's offices in order to assess its interpretation and implementation of the following sections of the Electricity Safety (Management) Regulations:

- r.24 incident recording, investigation and reviewing
- r.27 relevant asset operator requirements for reporting of serious electrical incidents
- r.28 relevant asset operator reporting of incidents other than serious electrical incidents.

The audit found no areas of noncompliance or areas requiring attention. Three opportunities for improvement were identified related to documentation that was not up-to-date. There were no serious safety implications in these findings. Jemena is required to review and provide a response to ESV for 'close-out'.

E.2 SAFETY PROGRAM

E.2.1 Audit findings

In October and November 2014, ESV carried out an audit on Jemena's electricity network assets to verify the progress of work completed by Jemena as part of its safety programs. The audits comprised a limited desktop audit and a comprehensive field-based audit.

A total of 2141 sites were audited. The audit of the Jemena safety programs found that, for the majority of the safety programs, the Jemena reported volumes matched the actual completed work; however, 28 issues were identified. This is a variance of 1.3 per cent.

The audit also identified the following:

- Noncompliances

  ESV raised a noncompliance on the safety program for the replacement of poles based on age and condition. Nine sites were identified where volumes were reported as replaced despite the works not having been done in the current regulatory period.[21] Based on a total of 58 pole-replacement sites inspected, this equates to an variance of 15 per cent. This represented the most significant finding of the safety program audit.

  It is not clear why the safety program that related to the replacement of poles based on age and condition had such a significant number of noncompliant items.

  Due to the significant discrepancy identified during the safety program audit in the pole replacement program ESV recommended that Jemena conduct a broad-based internal audit of the safety programs to review consistency between the reported volumes and works actually completed, take corrective action based on the findings, and report the outcomes to ESV.

[21] Jemena advised that the nine identified poles were replaced prior to the current EDPR period and there is no outstanding pole replacement work or safety issue.

- Areas requiring attention

  Four of the safety programs had a variation of one item reported as completed, yet not actually done:
  - planned replacement of non-preferred services due to height
  - replace crossarms/insulator sets – pole-top fire mitigation
  - stake poles – based on age and condition
  - stake undersized poles.

- Opportunities for improvement

  Two safety programs had not started by the end of 2014:
  - install REFCL and associated equipment at zone substations
  - service line clearance - overhead services requiring undergrounding.

  Jemena advised that it was waiting for the outcome of an ongoing investigation regarding the functionality and issues with the United Energy REFCL project, and the development of an industry and state-agreed performance specification, prior to initiating its works.

  Jemena has submitted reasons for the delay on installation of its REFCL. Jemena advised that it has been able to achieve the service line clearance requirements without needing to underground any services. This was achieved by relocating services to alternative poles or installing mid-span services.

Overall, Jemena is accurate in its reporting and is on track to complete its safety programs as scheduled. Jemena only had one safety program raised as a noncompliance. There were no discrepancies with the completion of the directions program. ESV has a reasonable expectation that the volumes will be corrected and the cause of the noncompliance addressed.

E.2.2 Safety program status

Asset failures are one of the major contributors to network-related fires. They were one of the causes of the 2009 Black Saturday fires. The safety programs involve the accelerated replacement of specific assets before they would normally be replaced as part of regular maintenance. This early replacement of assets reduces the chance of failure, thereby resulting in a more reliable and safer electrical distribution network.

Jemena reports on 14 safety programs to ESV. Performance against target is shown graphically in Figure 29. Specific data on the status of these safety programs are provided in Table 23.

Progress on two of the programs is in line with Jemena's forecast for 2014:
- replace crossarms or insulator sets – pole-top fire mitigation
- replace existing SWER lines.

Progress on six of the programs is ahead of Jemena's forecast:
- replace overhead conductor – mainly steel
- stake undersized poles
- stake poles – based on age and condition
- replace poles – based on age and condition
- removal of public lighting switch wire
- planned replacement of non-preferred services due to height.

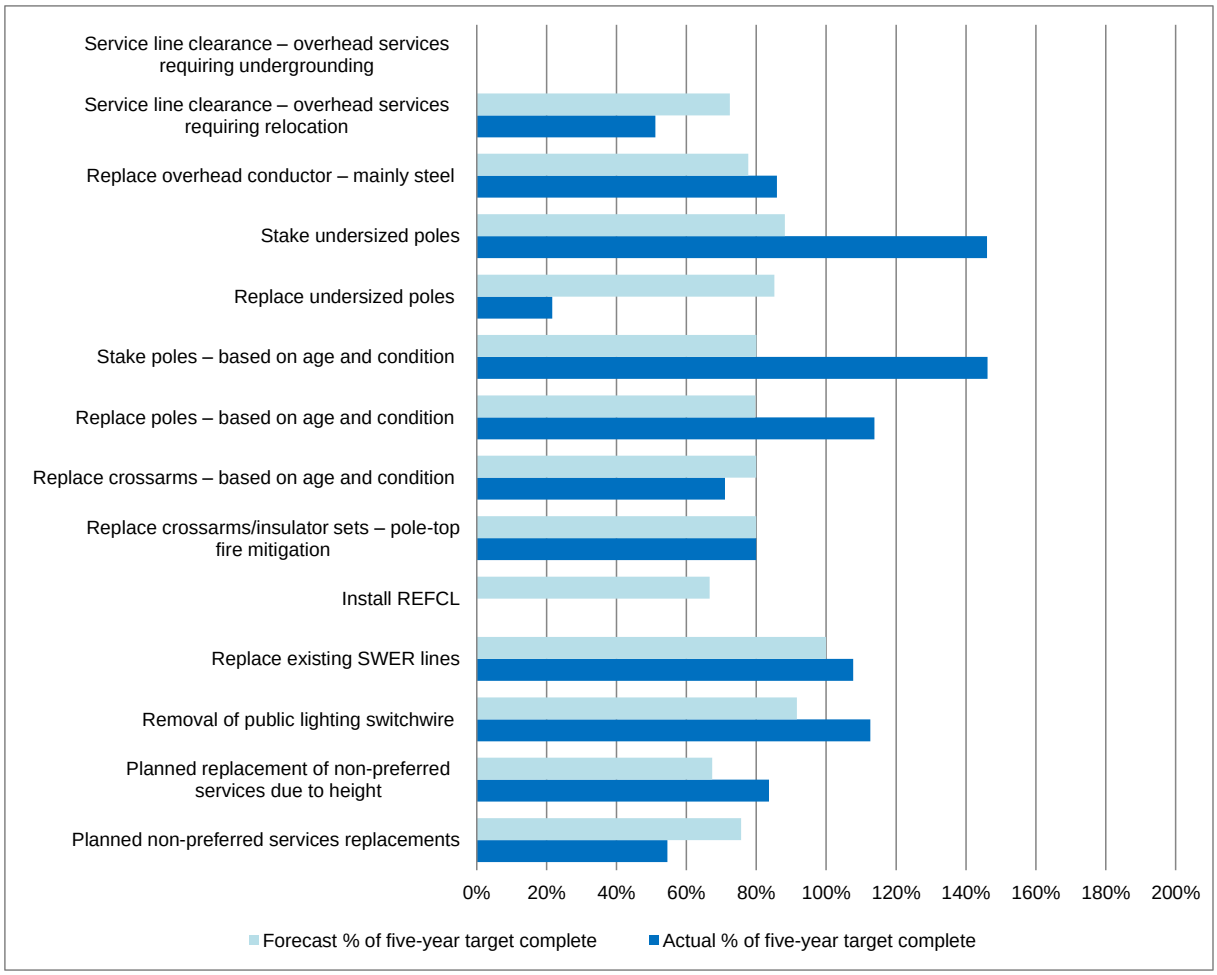

Figure 29: Status of Jemena's safety programs

Table 23: Status of Jemena's safety programs

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
Service line clearance – overhead services requiring undergrounding	Number of services replaced	0	0	672	Jemena has been able to achieve clearance requirements through other means. The target was changed to zero.
Service line clearance – overhead services requiring relocation	Number of services replaced	126	89	2691	Program was 29% behind Jemena forecast. Jemena has changed the target for this program from 2691 to 174; hence it does not expect to reach its original target.
Replace overhead conductor – mainly steel	Kilometres of overhead conductor replaced	87	96	112	Program was 10% ahead of Jemena forecast.

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
Stake undersized poles	Number of poles staked	970	1606	1,100	This program was 66% ahead of forecast. More poles than forecast were assessed as suitable for staking.
Replace undersized poles	Number of poles replaced	1180	300	1385	Program was 74% behind forecast.
Stake poles – based on age and condition	Number of poles staked	892	1628	1114	This program was 86% ahead of forecast.
Replace poles – based on age and condition	Number of poles replaced	1032	1473	1294	This program was 43% ahead of forecast. A larger number of poles than forecast were assessed and replaced.
Replace crossarms – based on age and condition	Number of crossarms replaced	11,292	10,034	14,117	Program was 11% behind forecast.
Replace crossarms or insulator sets – pole-top fire mitigation	Number of crossarms replaced	2268	2267	2835	Program was in line with Jemena forecast.
Install REFCL	Number of zone substations	2	0	3	Program was behind Jemena forecast. Due to technical reasons, it is unlikely that this program will be completed on time.
Replace existing SWER lines	Kilometres of existing SWER removed	13	14	13	Program was in line with Jemena forecast.
Removal of public lighting switch wire	Spans removed	4674	5746	5100	Program was 23% ahead of Jemena forecast. Jemena surveyed its network and identified all of the public lighting switch wire locations.
Planned replacement of non-preferred services due to height	Number of services	2687	3335	3987	This program was 24% ahead of Jemena forecast.
Planned non-preferred services replacements	Number of services	22,700	16,383	30,000	Program was 28% behind Jemena forecast due to priority being given to the “planned replacement of non-preferred services due to height” program.

RED	Program total to date < 90 per cent of forecast to date
GREEN	Program total to date 90-110 per cent of forecast to date
BLUE	Program total to date > 110 per cent of forecast to date

Progress on six of the programs is behind Jemena's forecast:

- service line clearance – overhead services requiring undergrounding
- service line clearance – overhead services requiring relocation
- replace undersized poles
- replace crossarms – based on age and condition
- install REFCL
- planned non-preferred services replacements.

In 2012 Jemena informed ESV that it was amending (reducing) the targets for two of its programs:

- service line clearance – overhead services requiring undergrounding
- service line clearance – overhead services requiring relocation.

At that time, Jemena also introduced a new program:

- overhead mains – spans requiring replacement with LV ABC.

For the two service line clearance programs, ESV is still reporting to the AER on Jemena's performance against its original targets despite Jemena's amendment of these targets. Given Jemena does not propose to continue with these programs as initially planned, these two programs will not achieve the originally agreed volumes. Jemena asserts that it is achieving the same outcomes without the need for undergrounding by relocating services to alternative poles or installing mid-span services.

The program to replace undersize poles had been commenced but was 74 per cent behind target. Jemena considers this program and the program to stake undersized poles (66 per cent ahead of schedule) as a single program. The combined forecast for both programs at the end of 2014 was 2150 of which Jemena had completed 1906 (or 89 per cent of its target). Jemena has stated it will complete the required volume (the combined targets across both programs is 2485) by the middle of 2015. Jemena has also stated it was able to reinforce a higher proportion of poles than was originally proposed and therefore was able to replace a lower number. This outcome may result in a lower cost for this program.

The program to replace crossarms based on age and condition was 11 per cent behind target. Jemena expects this program to be on target by the end of 2015.

For the REFCL program, Jemena was planning to install three units over the five-year period, with one in 2013, one in 2014 and one in 2015. REFCL are a new technology and have been challenging to implement. As a result of associated technical reasons, none of the units had been installed by the end of 2014. Jemena plans to commence the installation of one REFCL in 2015.

The program to replace planned non-preferred services was 28 per cent behind target. Jemena considers this program and the program to replace non-preferred services due to height as one program. The combined target for both programs at the end of 2014 was 25,387 and Jemena had replaced 19,718 services (78 per cent of the target). Jemena is forecasting that it will achieve the required volume for the combined projects. There are 14,269 services yet to be replaced in order to meet the target by the end of 2015. In 2014, Jemena replaced 6795 services across both these programs. Jemena will need to double its output in order to replace the remaining 13,004 services and complete the combined target.

In summary, Jemena is behind target on six of its 14 safety programs, on target for two programs and ahead of target on six programs. The programs Jemena are ahead of target on are mainly pole, conductor, services and crossarm items, which are some of the highest risk elements on its network.

E.3 BUSHFIRE MITIGATION

A desktop audit of Jemena's works management system was performed prior to the field audit to ensure that the information ESV had received was appropriate for this audit.

Jemena has a comprehensively documented system for bushfire mitigation management and has also developed individual and collective plans in order to mitigate the risks associated with specific assets.

ESV then visited three geographic areas within Jemena's region and in total viewed 491 poles. The audit findings are summarised in Table 24.

The findings of the bushfire mitigation field audit were:

- 16 LV wooden crossarms (most of them with services attached only) were observed as deteriorated — two required high priority maintenance, three required low priority maintenance and six required opportunistic maintenance
- four HV wooden crossarms were identified as defective
- 10 poles in Mickleham area were missing identification numbers due to recent fires
- two locations had missing or loose animal covers on the transformers
- one location had a damaged stay wire.

Most of the findings related to defects in LV crossarms used only for attaching services. A Jemena subject matter expert advised that issues with these crossarms typically disrupt only a small number of customers and are not a major cause for starting fires or a safety issue.

Ten findings from the field audit were randomly selected and were compared with the records in Jemena's works management system. Five of the 10 did not have matching notifications created in the system. Therefore, for this small sample size, 50 per cent of the defects were found to not be recorded for actioning.

Jemena advised that the items identified did not meet the minimum condition criteria specified in its Asset Inspection Manual and, therefore, were not required to be recorded in its works management system.

The sample size was insufficient to conclude there is a systemic issue with the accuracy of Jemena's works management system.

ESV recommended that Jemena conduct an internal audit to consider consistency between the field condition of the network assets and the records in the works management system take corrective action based on the findings and report the outcomes to ESV.

Table 24: Bushfire Mitigation Plan audit results – Jemena

Region	Assets viewed	Areas requiring attention	Variance
Mickleham	137 poles	8	6%
Clarkefield	111 poles	1	1%
Gisborne South	243 poles	6	2%
Total	**491 poles**	**15**	**3%**

E.4 ELECTRIC LINE CLEARANCE

Jemena's ELCMP was received by ESV on 31 March 2014 and the assessment was finalised on 5 August 2014. The plan was observed to be mature and well supported by comprehensive processes and procedures. Subsequent to minor amendment throughout the assessment process, the plan was approved by the Director of Energy Safety on 5 August 2014.

An electric line clearance audit of the Jemena network was conducted between 27 September 2014 and 1 October 2014. This occurred at randomly selected locations throughout the network. It took into consideration a closely balanced sample of electricity spans that existed in HBRA and LBRA.

A total of 422 electricity spans were inspected during the field component of the audit. Of these spans, 213 were located within HBRA and 209 in LBRA.

Table 25 summarises the audit findings.

Generally the noncompliant spans fell into two groups:

- Spans for which Jemena is responsible

  Few instances of noncompliant vegetation were observed that were Jemena's management responsibility. Clearance standards in HBRA were viewed to be of a higher quality than those achieved in LBRA, reflecting a commitment to mitigate risk within fire-prone areas.

  The audit results indicate that, where Jemena is responsible for vegetation management, its processes and clearing activities are implemented effectively and provide for appropriate compliance standards. This is particularly the case for HBRA covered by the audit. Vegetation within LBRA is maintained to a lesser extent. Overall acceptable compliance was achieved.

- Spans for which Jemena is not responsible

  Where noncompliant vegetation identified was not the management responsibility of Jemena, it was the responsibility of municipal councils or private property owners and occupiers. This was significantly more evident within the LBRA audited where frequency suggests a systemic issue.

Table 25: Electric line clearance field audit results – Jemena

Field audit results	Total	Variance (%)
HBRA sites audited in the field	213 (50.5%)	
LBRA sites audited in the field	209 (49.5%)	
Total sites audited in the field	**422**	
HBRA noncompliant spans – Jemena responsibility	4	1.9
LBRA noncompliant spans – Jemena responsibility	11	5.3
Total noncompliant spans – Jemena responsibility	**15**	**3.6**

The higher frequency of noncompliant spans in areas managed by other responsible persons may adversely affect electrical safety, the reliability of supply and increase the potential for fire starts. These noncompliance issues could also impact the Jemena distribution network.

Jemena has systems in place to notify municipal councils and private property owners and occupiers of the requirement to maintain a clearance space. There is, however, evidence that these systems may fail to:

- effectively notify the relevant persons of their responsibility
- track or provide for follow up consultation on responsible person inaction
- accommodate an effective escalation process when a responsible person has failed to act.

Jemena's vegetation management database was also reviewed during the audit to verify its accuracy. Information relevant to the clearing activities of spans in HBRA proved accurate and well maintained, with database descriptions accurately reflected in the field audit observations. For spans in LBRA, the audit found information was not maintained to the same standard. This particularly applied to the descriptions of the spans' physical attributes and the associated clearances.

Affected persons surveyed during the audit commented they had been advised of the intended clearing process. Typically they felt they had received appropriate notification of the proposed works and were made aware of the options available should they oppose scheduled works.

The review of Jemena's ELCMP recommended that Jemena:

- continues to utilise existing vegetation management methodologies as detailed in its ELCMP
- conducts a systematic review of the ELCMP to ensure its effectiveness into the future and to identify and implement improvement opportunities should they be identified.

The electric line clearance audit recommended that Jemena:

- ensures management principles utilised in clearing vegetation in HBRA are applied to vegetation clearing in LBRA
- provides greater assistance to municipal councils and private property owners and occupiers to enable them to facilitate more effective and efficient clearing of vegetation that is their management responsibility
- develops more rigorous follow-up and escalation procedures for municipal councils and private property owners and occupiers to ensure clearing of noncompliant vegetation in a more timely and effective manner.

E.5 WORK PRACTICES

ESV undertook four audits of Jemena's work practices at four sites in 2014. The findings of these audits were as follows:

- one noncompliance relating to a failure to carry out a check test during connection testing
- nine areas requiring attention of which the main issues related to:
  - electrical access permit issuing process
  - knowledge of Safe Work Method Statements and Job Safety Assessments
  - suitability and checking of personal protective equipment and glove and barrier equipment.
- 14 opportunities for improvement of which the main issues related to:
  - poor job planning and risk assessment (including lack of understanding of the Job Safety Assessment process and of Safe Work Method Statements)

- not checking of personal protective equipment and equipment (particularly G&B) prior to use
- electrical access permit procedures, including operating and permit issue processes.

These findings are consistent with those of the 2013 audits, where the key areas of concern also related to job planning, risk assessment process, personal protective equipment and equipment checks, and electrical access permit issue processes.

ESV recommends that Jemena ensures more thorough compliance with its internal work practices program, specifically:

- improving job planning, including communication with crew leaders
- ensuring appropriate, thorough on-site risk assessment, including improving the understanding of Job Safety Assessment and Safe Work Method Statement methodology and process
- ensuring all workers understand the importance of checking equipment and personal protective equipment prior to use
- complying thoroughly with electrical access permit procedures, particularly the issuance of work permits.

E.6 DIRECTIONS AND EXEMPTIONS

Jemena reported on the progress of two directions. It had previously completed its three exemption programs in 2013. Details are provided in Table 26.

In relation to the completed directions associated with electric line clearance, Jemena advised it has fully transitioned to the 2010 Electric Line Clearance Regulations and is now expected to be able to maintain compliance to the current standards across its network. It was noted that this cannot necessarily be said for all trees in the Jemena area as municipal councils and other responsible persons are also required to clear certain trees around powerlines and this is outside Jemena's direct control.

ESV recommends that Jemena engages with other responsible persons in its area to ensure compliance with the Electric Line Clearance Regulations to ensure bushfire and network reliability risks are minimised.

With the remaining directions, both are on target.

The program to fit armour rods was notified as being on target despite significantly fewer armour rods being fitted than originally forecast. Jemena advised that, since the direction was originally issued, its asset inspection process identified that significantly fewer armour rods were actually required than were originally forecast. Jemena's position was that it had over-estimated the number of spans requiring remediation in developing the original direction.

ESV continues to report against its original forecast, not the volumes determined through asset inspection.

Jemena is expected to complete its armour rods and vibration damper programs in 2015, although the number installed will be different to its initial estimate. Completion will reduce the risk of conductor or tie failures.

Jemena also had an annual program to confirm that all of the required spacers were in place and functional prior to 1 November 2014. Progress on this program was not reported to ESV.

Table 26: Progress of direction and exemption programs – Jemena

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
Fitting of armour rods (HBRA)	Number of spans	4900	1691	5100	Program is on schedule (see comments above).
Fitting of vibration dampers (HBRA)	Number of spans	4900	4496	5100	Program is 8% behind schedule.
Cyclic clearing – ABC or insulated cable (all areas)	Per cent of spans	100%	100%	100%	Program was completed in 2013.
Cyclic clearing – powerlines other than ABC or insulated cable (LBRA)	Per cent of spans	100%	100%	100%	Program was completed in 2013.
Cyclic clearing – powerlines other than ABC or insulated cable (HBRA)	Per cent of spans	100%	100%	100%	Program was completed in 2013.

RED	Program total to date < 90 per cent of forecast to date
GREEN	Program total to date 90-110 per cent of forecast to date
BLUE	Program total to date > 110 per cent of forecast to date

E.7 SAFETY INDICATORS

ESV assesses a range of key safety indicators on an ongoing basis and requires regular reporting by each distribution business. These indicators include:

- incidents involving the public
- asset failures
- vegetation fires due to asset failure or contact
- fires on or in assets.

Each of these is discussed in detail in this section.

E.7.1 Incidents involving the public

Figure 30 graphically shows the incidents involving the public interacting with Jemena's assets. The data underpinning this figure are provided in Table 27.

In 2014, Jemena reported a 16 per cent increase in the number of safety incidents involving the public from 49 in 2013 to 57 in 2014 mainly attributable to an increase in the number of No Go Zone infringements.

There is a clear trend of increasing No Go Zone incidents from 2010 through to 2014, with an average annual increase of 64 per cent over the period. No Go Zone infringements also represent 63 per cent of the total incidents in 2014. This exponentially upward trend is of concern.[22]

[22] Figure 31 shows a 99.9 per cent exponentially-correlated growth in No Go Zone infringements over the last five years.

The reason for the increase in No Go Zone incidents is unclear but may be due to increased reporting of incidents resulting from better awareness of No Go Zones or greater construction activity in the Jemena area. Further investigation is warranted to determine the cause of the increase as a fatality in the Jemena area becomes more likely as this trend escalates.

Jemena asserts it mitigates the No Go Zone risk through:

- Dial Before You Dig services
- maintaining specified clearance distances from overhead and underground assets
- publishing No Go Zone information on its website
- ESV safety awareness campaigns.

Jemena asserts that it mitigates the consequences of a breach of a No Go Zone by:

- network protection systems such as automatic circuit reclosers and circuit breakers
- emergency response procedures
- personal protective equipment
- No Go Zone investigations.

Jemena should review the adequacy of controls it has in place to prevent safety incidents involving the public, especially No Go Zone incidents. The exponential rise in incidents provides no comfort that Jemena's preventative mitigations are effective. Relying on post-incident responses will have no impact on the exponential increase in incident occurrence (Figure 31) and an increasing likelihood of a fatality occurring.

Unauthorised access and HV injections had also been increasing up to 2013, but had experienced declines in 2014. Jemena should maintain its current controls and seek opportunities for improvement to prevent the upward trend reoccurring.

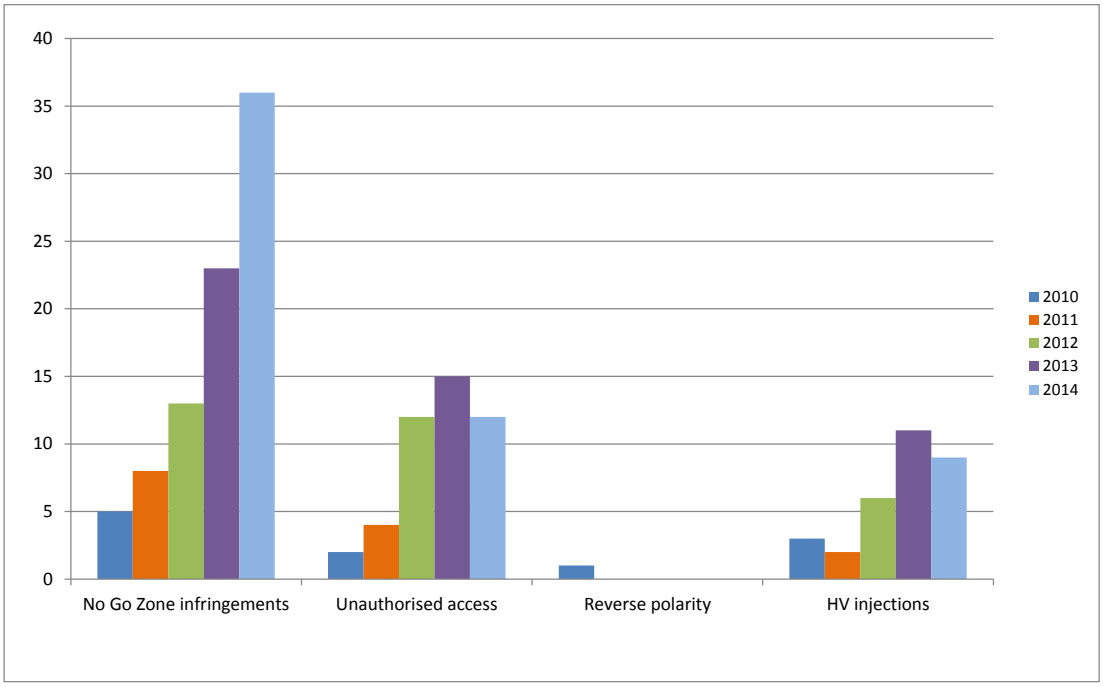

Figure 30: Safety incidents involving the public – Jemena

Table 27: Safety incidents involving the public – Jemena
n/a – not recorded

Item	Total	2010	2011	2012	2013	2014
No Go Zone infringements	**85**	5	8	13	23	36
Unauthorised access	**45**	2	4	12	15	12
Reverse polarity	**1**	1	0	0	0	0
HV injections	**31**	3	2	6	11	9
Total incidents	**162**	**11**	**14**	**31**	**49**	**57**

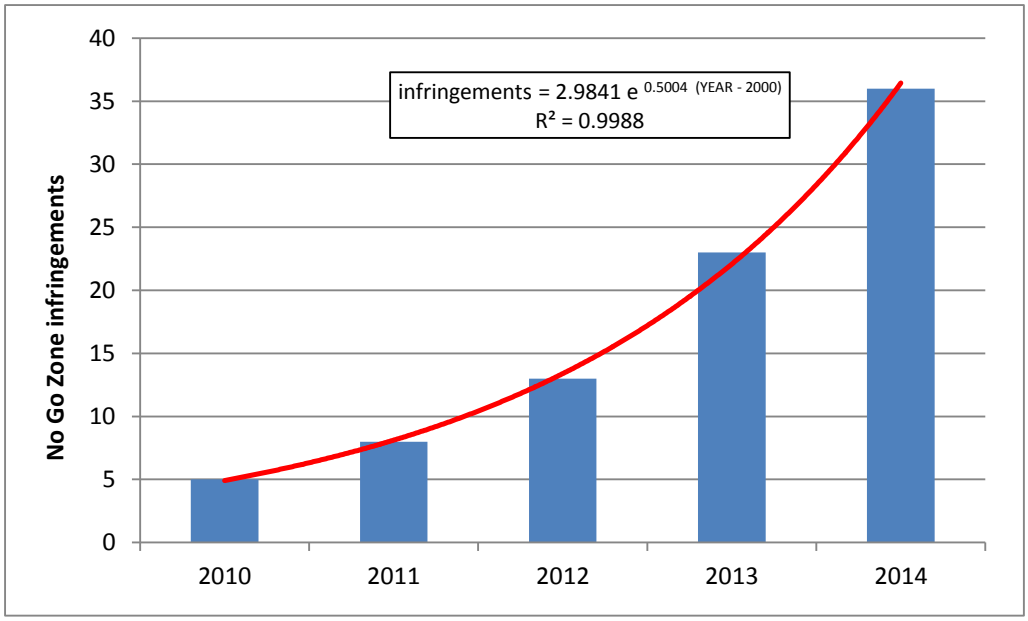

Figure 31: Increase in No Go Zone infringements – Jemena

E.7.2 Asset failures

In 2014, Jemena reported a reduction in the number of failures of LV assets compared to 2013 (Figure 32 and Table 28). While the total number of asset failures decreased in 2014, there has been an upward trend in total failures over the last five years.

LV assets represented 73 per cent of Jemena's total asset failures in 2014. While the number of LV asset failures reported in 2014 has reduced from 2013, they remain at a relatively high level (more than double the number in 2012).

Crossarm failures were the next highest contributor at 15 per cent of asset failures. These increased by four in 2014; however, 2013 represented a drop of nine from 2012. Overall, there is no discernible upward or downward trend in the number of crossarm failures.

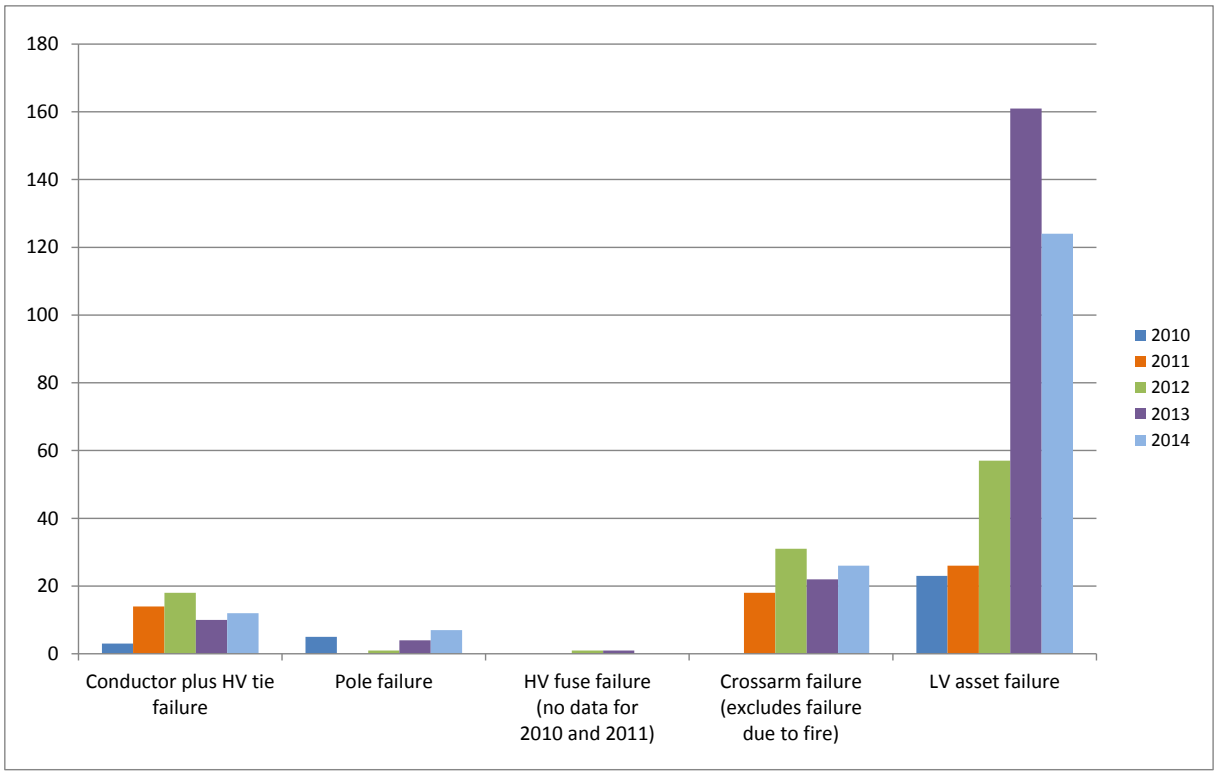

Figure 32: Asset failures by type – Jemena

Table 28: Asset failures by type – Jemena
n/a – not recorded

Item	Total	2010	2011	2012	2013	2014
Conductor plus HV tie failure	**57**	3	14	18	10	12
Pole failure	**17**	5	0	1	4	7
HV fuse failure	**2**	n/a	n/a	1	1	0
Crossarm failure (excludes failure due to fire)	**97**	n/a	18	31	22	26
LV asset failure	**391**	23	26	57	161	124
Total	**564**	**31**	**58**	**108**	**198**	**169**

Pole failures increased by 75 per cent in 2014 (up from four in 2013 to seven in 2014). While appearing low, Jemena accounts for 23 per cent of all pole failures across the Victorian electricity network in 2014 despite owning less than 10 per cent of all poles.

Advice from Jemena is that the failures are predominantly of steel public lighting poles. These poles are at an elevated risk of failure due to traffic accidents. Further consideration should be given by Jemena to the causes of such failures to determine whether they arise from faults in the poles or from higher levels of third-party damage.

Presently ESV does not have sufficient information on the specific assets failing to be able to separate such incidents from the general pole failure data and develop a position on this. It is recommended that ESV secures such asset data from the major electricity companies to be able to develop an informed position on future asset failures and trends.

Conductor, ties and HV fuses contribute a small proportion of Jemena's total asset failures and there is no discernible upward or downward trend in the occurrence of these incidents.

E.7.3 Vegetation fires due to asset failure or contact

Figure 33 shows the total numbers of vegetation fires due to asset failures and contact events. The detailed data are provided in Table 29 (asset failures) and Table 30 (contact events).

There has been an overall increase in vegetation fires between 2011 and 2014; however, the total number of fires is small and there does not appear to be to any one particular cause. Given that many of the incidents are isolated events and there are no discernible trends, such incidents can still have significant consequences with regard to bushfires and public safety.

Incidents listed under "other assets" are responsible for approximately half the vegetation fires annually in 2013 and 2014. Yet this category is simply presented as a catch-all for a mixture of asset failures such as street lights, surge arresters and lightning (among others). While it is purported that these are once-off events that generally do not have a common failure cause, ESV recommends that Jemena undertakes a further breakdown of "other assets" incidents and report on this to ESV.

Jemena had very few vegetation fires and there was no single cause that can be found that explains the small increase in the total number of vegetation fire starts.

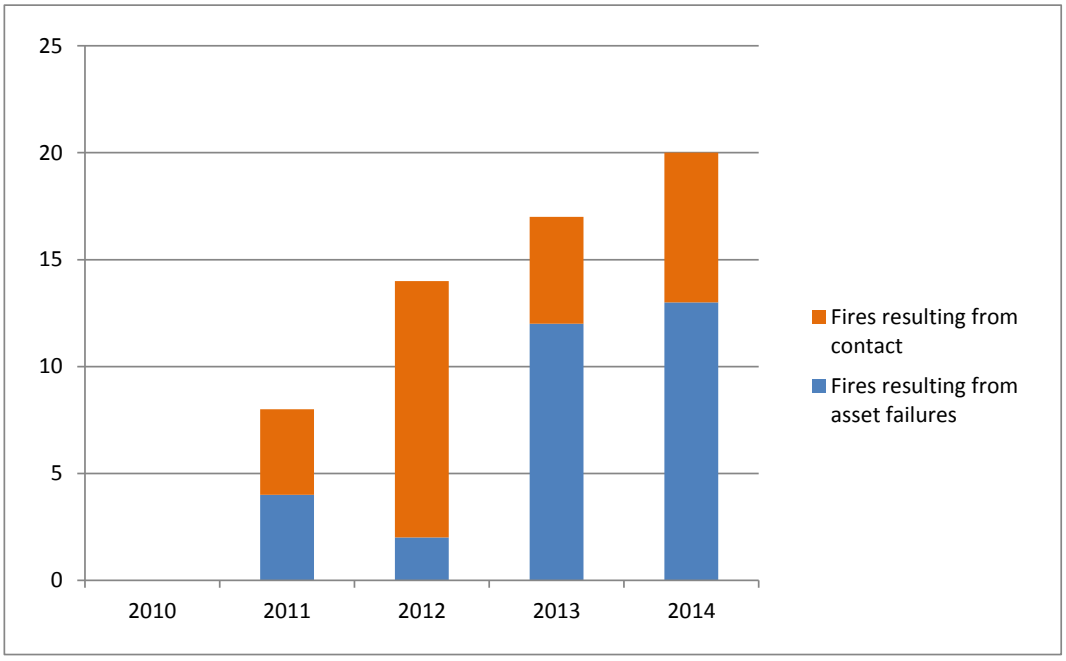

Figure 33: Vegetation fires due to asset failures and contact – Jemena
Note: There was no requirement to report on vegetation fires in 2010

Table 29: Asset failures resulting in vegetation fires – Jemena
n/a – not recorded

Item	Total	2011	2012	2013	2014
Pole and/or crossarm failure	**5**	0	0	2	3
Pole and/or crossarm fire	**1**	0	0	0	1
Oil filled plant	**0**	0	0	0	0
HV fuse	**1**	0	1	0	0
LV asset failure	**1**	n/a	0	1	0
Other assets (e.g. street lights, surge arresters, etc.)	**23**	4	1	9	9
Total fires – asset failures	**31**	**4**	**2**	**12**	**13**

Table 30: Vegetation fires resulting from contact with assets – Jemena
n/a – not recorded

Item	Total	2011	2012	2013	2014
Animals	**7**	2	3	2	0
Third party (e.g. vehicle, vandalism)	**4**	n/a	1	1	2
Tree contact	**12**	n/a	7	2	3
Other causes	**5**	2	1	0	2
Total fires - contact	**28**	**4**	**12**	**5**	**7**

E.7.4 Fires on or in assets

Table 31 details the fires arising on or in Jemena's assets. In 2014 Jemena reported 54 fire starts — a 24 per cent reduction from 2013. The decrease was mainly due to fewer pole-top fires and fires reported in "other assets".

While a positive result, there are trends that should be considered further (Figure 34).

Pole and crossarm fires accounted for 83 per cent of all of Jemena's fires in 2014 and the numbers of such fires have been increasing over the last four years despite the once-off reduction in 2014.

Pole and crossarm fires have the potential to become vegetation fires. While ESV is pleased to see the 2014 performance results indicating a possible reversal of the trend, the number occurring in 2014 was still two to three times the number in 2012. Jemena should undertake further measures to reduce pole and crossarm fires in order to prevent the upward trend reoccurring. One such measure could be to increase the rate at which wooden HV crossarms are replaced with steel crossarms, as this is known to greatly reduce the number of pole-top fires.

Table 31: Fires on or in assets – Jemena
n/a – not recorded

Item	Total	2011	2012	2013	2014
Pole and crossarm fire	**119**	5	17	52	45
Oil filled plant	**2**	0	0	0	2
HV fuse	**2**	1	0	1	0
LV equipment	**1**	n/a	0	0	1
Other assets	**33**	3	6	18	6
Total fires	**157**	**9**	**23**	**71**	**54**

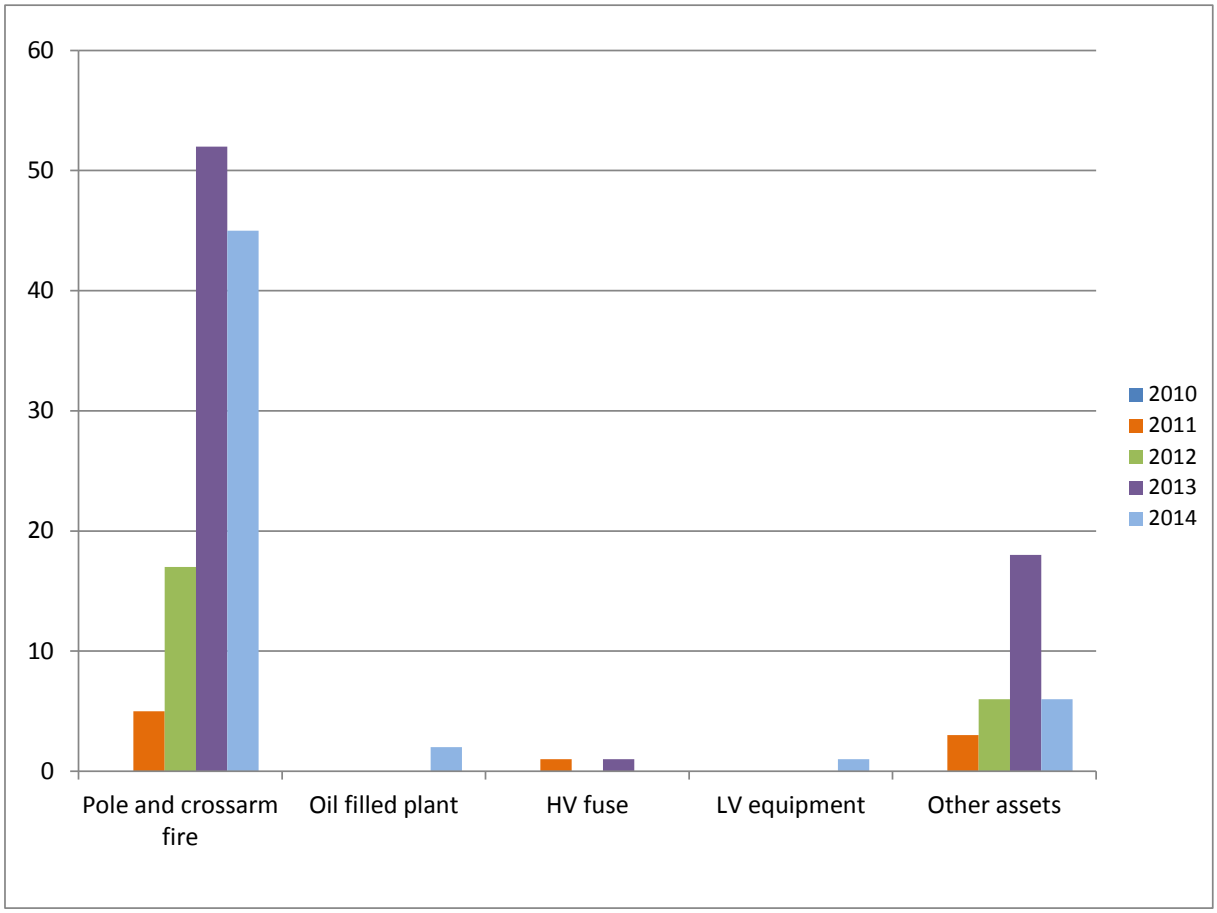

Figure 34: Fires on or in assets – Jemena

F POWERCOR

Powercor owns and operates electricity distribution assets in Victoria. Powercor's network delivers electricity across 150,000 square kilometres covering Melbourne's Docklands Precinct, west from Williamstown to the South Australian border, north to the Murray and south to the coast.

CitiPower/Powercor is jointly owned by Cheung Kong Infrastructure, Power Assets Holdings and Spark Infrastructure. Cheung Kong Infrastructure and Power Assets Holdings are both part of the Cheung Kong Group of companies. They jointly hold a 51 per cent stake in CitiPower/Powercor, with the remaining 49 per cent held by Spark Infrastructure.

CitiPower and Powercor are managed by a single executive management team using common procedures and systems across the two distribution businesses. As a result, the Electricity Safety Management System (Section F.1) and the work practices observations audits (Section F.5) have been undertaken jointly across the two businesses. The remaining sections within this appendix refer to the specific assets within the Powercor network and have therefore been assessed independently of the CitiPower assets.

F.1 ELECTRICAL SAFETY MANAGEMENT SCHEME

Refer to the discussion of the CitiPower/Powercor Electrical Safety Management Scheme in Section D.1 (page 73).

F.2 SAFETY PROGRAM

F.2.1 Audit findings

In October 2014, ESV carried out a field audit on Powercor's electricity network assets in order to verify the progress of work completed by Powercor as part of its safety programs. The audit comprised a limited desktop audit and a comprehensive field-based audit.

A total of 1430 sites were audited. The audit found that, for the majority of the safety programs, the Powercor reported volumes matched the actual completed work; however, issues were identified at 19 sites. This is a variance of 1.3 per cent.

The audit identified the following:

- 11 of the issues related to incorrect allocation of pole replacements to the wrong program, including the HV pole, LV and stay pole replacement programs
- six items related to works that had not been done
- one item each related to a retired asset and to a duplicate item.

The main error was simple record-keeping and has no serious safety implications. The cause was probably human error in reporting, recording and input of data into Powercor's information systems. Given the low level of variance, ESV classed these as areas requiring attention.

ESV recommended that Powercor conduct a review of its record systems to determine the extent of the records not matching the actual field assets and report back to ESV on the items identified.

F.2.2 Safety program status

Asset failures are one of the major contributors to network-related fires. They were one of the causes of the 2009 Black Saturday fires. The safety programs involve the accelerated replacement of specific assets before they would normally be replaced as part of regular maintenance. This early replacement of assets reduces the chance of failure, thereby resulting in a more reliable and safer electrical distribution network.

Powercor reports on eight safety programs to ESV. Specific data on the status of these safety programs are provided in Table 32. Performance against target is also shown graphically in Figure 35.

Powercor does not consider these programs to be safety programs but rather regular maintenance. As a result, annual forecasts for these safety programs were not established by Powercor. Instead the forecasts volumes shown in Table 32 are based on the figures supplied to the AER for revenue determination purposes and annualised by ESV to monitor progress.

ESV does not agree with Powercor's viewpoint. The rationale for the safety programs was to accelerate routine works in order to reduce public safety risks. While such works may be scheduled as part of routine maintenance and funded out of normal revenues, the AER approved additional funding explicitly to have such works undertaken earlier than otherwise may have been the case. It was a condition of the AER funding that ESV monitor performance against these programs. Therefore, ESV continues to monitor performance against the commitments made with the AER.

Progress on five of the programs was ahead of the ESV's forecast for 2014:

- crossarm replacement
- pole replacement – staked poles
- pole replacement – stay poles
- pole replacement – HV
- pole replacement – LV.

Progress on three of the programs was behind ESV's forecast for 2014:

- LV overhead conductor replacement
- HV conductor replacement
- pole replacements – sub-transmission.

Powercor reports that it has replaced less overhead conductor than ESV's 2014 forecast, putting at risk the program target to replace 20km of LV overhead conductor and 2380km of HV overhead conductor. Feasibly Powercor could still meet its LV conductor replacement target despite being significantly behind as of 2014 as it only needs to replace 7km of LV conductor in 2015. It is unlikely Powercor will meet its HV conductor replacement target as it has only completed 14 per cent of its expected target at the end of 2014 and the quantity it has to replace to meet the total volume is high.

Powercor's transmission pole replacement program is 14 per cent behind target. It is feasible that Powercor could still meet the target for this program by the end of 2015.

While it is pleasing to see that the crossarm and power pole replacement programs (HV and stay power poles) are well ahead of ESV's forecast, Powercor are well behind target on the HV conductor replacement program and is unlikely to complete it by the end of 2015. Powercor is also slightly behind on one of the sub-transmission pole replacement and the LV conductor replacement programs, although it is feasible that these can be completed by the end of 2015.

As there is significant HBRA in Powercor's area, failure to complete the conductor replacement programs may increase the risk of bushfires and reduce the reliability of the Powercor distribution network.

While Powercor considers these programs to be regular maintenance rather than safety programs, failure to meet the original commitment made to the AER for these programs could increase the bushfire risks associated with its network. Powercor should plan to meet the targets. Powercor would need to significantly ramp up its safety programs if it wishes to meet its five-year safety program targets.

Table 32: Status of Powercor's safety programs

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
LV overhead conductor replacement	Route kilometres of conductor replaced	16	13	20	Program is 19% behind ESV forecast.
HV overhead conductor replacement	Route kilometres of conductor replaced	1900	265	2380	Program is 86% behind ESV forecast.
Pole replacements – sub-transmission	Number of poles replaced	265	224	336	Program is 15% behind ESV forecast.
Crossarm replacements	Number of crossarms replaced	12,800	28,066	16,000	Program is 119% ahead of ESV forecast.
Pole replacements – staked poles	Number of poles staked	3758	4385	4760	Program is 17% ahead of ESV forecast.
Pole replacements – stay poles	Number of poles replaced	76	179	96	Program is 135% ahead of ESV forecast.
Pole replacements – LV	Number of poles replaced	834	976	1,056	Program is 17% ahead of ESV forecast.
Pole replacements – HV	Number of poles replaced	2615	4016	3312	Program is 54% ahead of ESV forecast.

RED	Program total to date < 90 per cent of forecast to date
GREEN	Program total to date 90-110 per cent of forecast to date
BLUE	Program total to date > 110 per cent of forecast to date

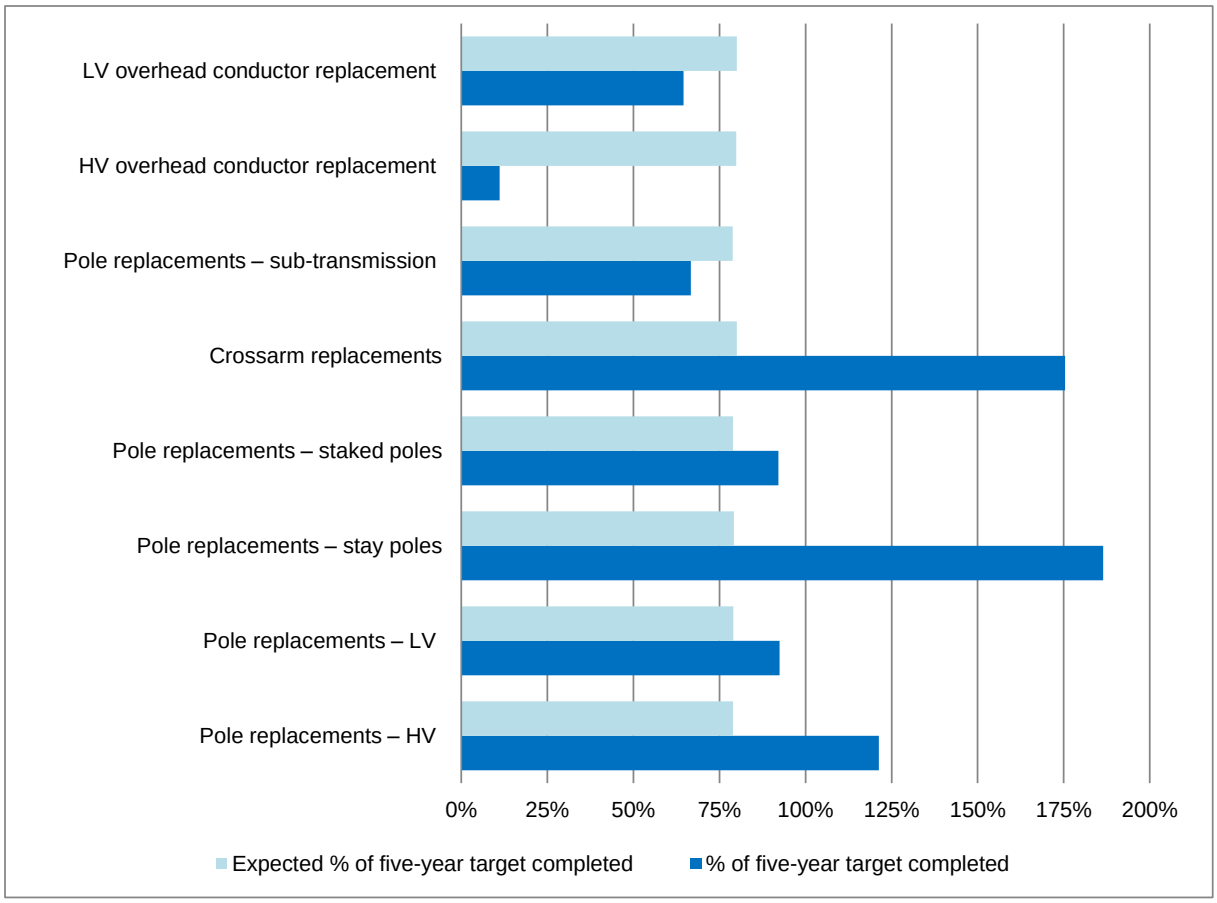

Figure 35: Status of Powercor's safety programs

F.3 BUSHFIRE MITIGATION

A desktop audit of Powercor's asset database was carried out prior to the field audit to ensure that the information ESV had received was appropriate for this audit.

The desktop audit identified that Powercor's fire start trend showed an increase in the number of vegetation fire starts due to its assets (see Figure 38). Powercor stated that the increasing trend was due to more accurate reporting of fire starts. ESV is concerned with this statement for two reasons:

- if Powercor's position is that fire starts have not been worsening, it implies that Powercor under-reported historic fire levels by a factor of three (or more)
- if Powercor's position is that it is not performing any worse that the other distribution companies (accounting for different sizes of asset base), it implies that the other businesses continue to significantly under-report fire levels (see Figure 8(d) on page 35).

ESV has trouble accepting either of these assertions.

ESV viewed more than 1000 sites overall as part of the field audit and inspected 113 sites in detail. The sites selected for the audit were on feeders in the Ballarat, Kyneton, Otways and Pyalong areas. ESV found evidence of a significant amount of work that has been undertaken during the last five years.

The findings of the bushfire mitigation field audit were:

- three sites with bird covers missing or dislodged
- seven crossarms showed a concerning level of wear[23]
- a fungal fruiting body was found on a wooden crossarm (vegetation in clearance zone)
- an LV spreader was found detached in the HBRA
- a pole-top had a significant split
- a stay eyebolt had moved down by approximately 200mm.

The variance can be shown to be:

• approximate number of assets viewed while travelling	1000
• number of sites visited (detailed review)	113
• number of sites of not matching database (notifications)	14
• variance (detailed sites reviewed) = 14/1000	1.4%

The major differences between the Powercor asset database and the field results were mostly associated with crossarms that had not been inspected recently. The majority of these crossarms were last inspected in 2012, indicating that the amount of degradation had probably reached the minimum criteria for notification and should be noted at the next inspection.

While the majority of items inspected in detail showed signs of wear, it was deemed that they were unlikely to be at risk of failure during the fire season.[23] There were, however, some individual assets requiring immediate maintenance. Any of these assets had the potential to fail or cause a fire and result in a serious safety issue.

ESV recommended that Powercor conduct a review of its record systems to determine the extent of the records not matching the actual field assets. ESV also required Powercor to submit a detailed plan to address all issues found in the audit.

F.4 ELECTRIC LINE CLEARANCE

Powercor's ELCMP was received by ESV on 31 March 2014 and the assessment was finalised on 19 August 2014. The plan was found to be well supported by relevant processes and procedures. Subsequent to minor amendment throughout the assessment process, the plan was approved by the Director of Energy Safety on 15 October 2014.

An electric line clearance audit of Powercor's network was conducted between 18-22 September 2014. This occurred at randomly selected locations throughout the network. Due to increased fire threats associated with the network, particular emphasis was placed on inspecting electricity spans located in HBRA. Spans in LBRA were inspected to a lesser extent.

A total of 438 electricity spans were inspected during the field component of the audit. Of these spans, 384 were located within HBRA and 54 in LBRA.

Few instances of noncompliant vegetation were observed that were the management responsibility of Powercor. Clearance standards of HBRA were viewed to be far better than those achieved in LBRA.

Table 33 summarises the audit findings.

[23] Powercor contends that the level of wear observed did not warrant action before the next scheduled inspection.

Table 33: Electric line clearance field audit results – Powercor

Field audit results	Total	Variance (%)
HBRA sites audited in the field	384 (87.7%)	
LBRA sites audited in the field	54 (12.3%)	
Total sites audited in the field	**438**	
HBRA noncompliant spans – Powercor responsibility	4	1.0
LBRA noncompliant spans – Powercor responsibility	3	5.6
Total noncompliant spans – Powercor responsibility	**7**	**1.6**

Generally the noncompliant spans fell into two groups:

- Spans for which Powercor is responsible

  Few instances of noncompliant vegetation were observed that were the management responsibility of Powercor. This did not correlate as a systemic issue of the audit sample.

  The audit results indicate that, where Powercor is responsible for vegetation management, its processes and clearing activities are effective and provide for appropriate compliance standards. This is particularly the case for HBRA. Vegetation and associated data for LBRA is maintained to a lower standard, although compliance was still achieved. This may indicate greater importance being placed on resource allocation to mitigate the higher risks associated with HBRA.

- Spans for which Powercor is not responsible

  Extensive noncompliance was observed where vegetation was the management responsibility of municipal councils or private property owners and occupiers.

  The higher frequency of noncompliant spans in areas managed by other responsible persons may adversely affect electrical safety, the reliability of supply and increase the potential for fire starts. These noncompliance issues could also impact the Powercor distribution network.

  Powercor has systems in place to notify municipal councils and private property owners and occupiers of the requirement to maintain a clearance space. There is, however, evidence that these systems may fail to:
  - effectively notify the relevant persons of their responsibility
  - track or provide for follow up consultation on responsible person inaction
  - accommodate an effective escalation process when a responsible person has failed to act.

Powercor's vegetation management database was also reviewed during the audit to confirm its accuracy. It was observed that, in HBRA, asset information well maintained and clearly described the network assets that existed, clearance distances, inspection dates and outstanding works. The information relevant to spans in LBRA was not of the same standard or precision.

The review of Powercor's ELCMP recommended that Powercor:

- continues to utilise existing vegetation management methodologies as detailed in its ELCMP
- conducts a systematic review of its ELCMP to ensure its effectiveness into the future and to identify and implement improvement opportunities should they be identified.

The electric line clearance audit recommended that Powercor:

- applies management principles used in clearing vegetation in HBRA to vegetation clearing in LBRA
- provides greater assistance to municipal councils and private property owners and occupiers to enable them to facilitate more effective and efficient clearing of vegetation that is their management responsibility
- develops more rigorous follow-up and escalation procedures for municipal councils and private property owners and occupiers to ensure clearing of noncompliant vegetation in a more timely and effective manner.

F.5 WORK PRACTICES

Refer to the discussion of the CitiPower/Powercor work practices in Section D.5 (page 79).

F.6 DIRECTIONS AND EXEMPTIONS

Powercor reported on the progress of three directions and four exemptions in relation to its distribution network. Details are provided in Table 34.

Powercor reported on the progress of three directions:

- survey of HV spans (clearances) in HBRA
- fitting of armour rods and vibration dampers in HBRA
- fitting of HV and LV spacers in HBRA.

Two of the directions have been completed — survey of HV spans in HBRA and fitting of HV and LV spacers in HBRA.

In 2011, ESV issued a direction to Powercor to develop a plan to install armour rods and vibration dampers across its HBRA by the end of 2015.

Powercor initially reported (for this report) the number of armour rods and vibration dampers it had installed as 128,094 of each. Powercor has recently amended these figures to those reflected in Table 34, namely 16,545 armour rods and 100,522 vibration dampers.

Changes of this magnitude engender doubt in Powercor's ability to provide authoritative figures on its performance.

As at the end of 2014, using the latest figures, Powercor reported that it had installed approximately 59 per cent of the target number of vibration dampers. Its installation of armour rods is 5 per cent behind the program target.

ESV is concerned that the changes to the reported data could be indicative of issues surrounding the recording of work completed and potentially the recording of condition assessment data.[24] Condition assessment data is essential to informing asset replacement decisions.

[24] This concern is not limited to Powercor alone.

To better inform itself, ESV will be seeking additional information from Powercor and the other major electricity companies regarding the condition, age and predicted degradation trajectories of their assets.

Table 34: Progress of direction and exemption programs – Powercor

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
Survey of HV spans (clearances) – HBRA	Spans surveyed	10,369	10,364	10,397	Program is complete.
Fitting of armour rods and vibration dampers – HBRA	Number of spans	17,400 (rods) 168,600 (dampers)	16,545 (rods) 100,522 (dampers)	20,300 (rods) 196,700 (dampers)	Armour rods installation is 5% behind schedule. Dampers installation is 41% behind schedule.
Fitting of HV and LV spacers in HBRA[25]	Number of spans inspected	-	-	-	Program is complete.
Cyclic clearing – ABC or insulated cable (all areas)	Per cent of spans	100%	99.8%	100%	Program is 0.2% behind schedule.
Cyclic clearing – powerlines other than ABC or insulated cable (LBRA)	Per cent of spans	100%	99.8%	100%	Program is 0.2% behind schedule.
Cyclic clearing – powerlines other than ABC or insulated cable (HBRA)	Per cent of spans	100%	100%	100%	Program was completed in 2013.
Overhanging trees (cut)	Per cent of spans	100%	100%	100%	Program was completed in 2011.

RED	Program total to date < 90 per cent of forecast to date
GREEN	Program total to date 90-110 per cent of forecast to date
BLUE	Program total to date > 110 per cent of forecast to date

Powercor has advised that it is unlikely to complete the installation of armour rods and vibration dampers programs by the end of 2015. In 2014 Powercor approached ESV to amend its directions program. ESV is currently reviewing this request.

Powercor also reported on the progress of four exemptions:

- cyclic clearing – ABC or insulated cable in all areas
- cyclic clearing – powerlines other than ABC or insulated cable in HBRA
- cyclic clearing – powerlines other than ABC or insulated cable in LBRA
- overhanging trees (cut)

[25] The direction on fitting spacers did not include a reporting requirement. Powercor subsequently did not set targets or report performance to ESV beyond advising that spacers had been fitted to all powerlines where a requirement for them had been identified.

The overhanging trees exemption was completed in 2011 and the cyclic clearing of powerlines other than ABC or insulated cable in HBRA was completed in 2013.
In 2010 the Electric Line Clearance Regulations were amended and required a greater clearance between trees and overhead powerlines. Powercor applied to ESV for an exemption under regulation 10 of the Electric Line Clearance Regulations to allow a transition period until full compliance can be achieved.

The initial plan was to achieve compliance by the end of 2013. In 2013 Powercor asked for an extension of one year to achieve compliance. This extension was granted; however, two of the exemptions were not completed by the end of 2014 — cyclic clearing (ABC or insulated cable) and cyclic clearing – powerlines other than ABC or insulated cable (LBRA). Powercor still had 700 spans across the network that had not been transitioned (and were therefore noncompliant) at the end of 2014. All works in HBRA were subsequently completed in February 2015, and those in LBRA were completed in March 2015.

By completing the transition program, Powercor should now be fully compliant with the 2010 Electric Line Clearance Regulations and should be able to maintain compliance to the current standards across its network. It should be noted that this cannot necessarily be said for all trees in the Powercor area as local councils and other responsible persons are also required to clear certain trees around powerlines and this is outside Powercor's direct control.

ESV recommends that Powercor engages more with other responsible persons within its area to ensure compliance with the Electric Line Clearance Regulations and thereby ensure safety and network reliability risks are minimised.

On 11 July 2014, ESV issued a direction to Powercor regarding the Government Powerline Replacement Fund. The direction required certain powerline replacement projects to be completed by December 2015, and for Powercor to report progress monthly. Powercor did not invoke its right of review of the ESV direction under section 69(3) of the Electricity Safety Act 1998. So, as required by the direction, Powercor incorporated the direction requirements into its bushfire mitigation plan. ESV formally accepted the revised plan.

Powercor stated in an April 2015 progress report that six of the 19 projects it reported against would not be completed until after the December 2015 deadline. Powercor estimated completion dates between February and April 2016. ESV immediately sought an explanation from Powercor. Its response advised that the projects had only recently been accepted for funding by the Department of Economic Development Jobs Transport and Resources and timeframes established. Powercor offered no change to the program timing.

In June 2015 Powercor reported that it had revised the completion dates to show that now only two projects would miss the December deadline and be completed in January 2016.

Powercor should ensure it completes all its direction and exemption programs as required. ESV does not accept that Powercor should delay compliance with a direction while awaiting funding.

F.7 SAFETY INDICATORS

ESV assesses a range of key safety indicators on an ongoing basis and requires regular reporting by each distribution business. These indicators include:

- incidents involving the public
- asset failures
- vegetation fires due to asset failure or contact
- fires on or in assets.

Each of these is discussed in detail in this section.

F.7.1 Incidents involving the public

Figure 36 shows the incidents involving the public interacting with Powercor's assets graphically and Table 35 provides the underlying data.

In 2014, Powercor reported a 15 per cent decrease in the number of incidents involving the public from 156 in 2013 to 132, mainly due to a decrease in the number of reports of unauthorised access. Given that Powercor's total safety incidents involving the public were increasing from 2011 to 2013 in an upward trend, the reduction in 2014 is most welcome.

The number of No Go Zone infringements increased from 48 in 2013 to 61 in 2014 (a 27 per cent increase). Figure 36 shows that there is no particular trend for No Go Zone infringements from 2010 to 2014. Reasons for variations from year to year could be due to the general amount of construction activity, the willingness for construction workers to report infringements and the opportunistic nature of finding an infringement.

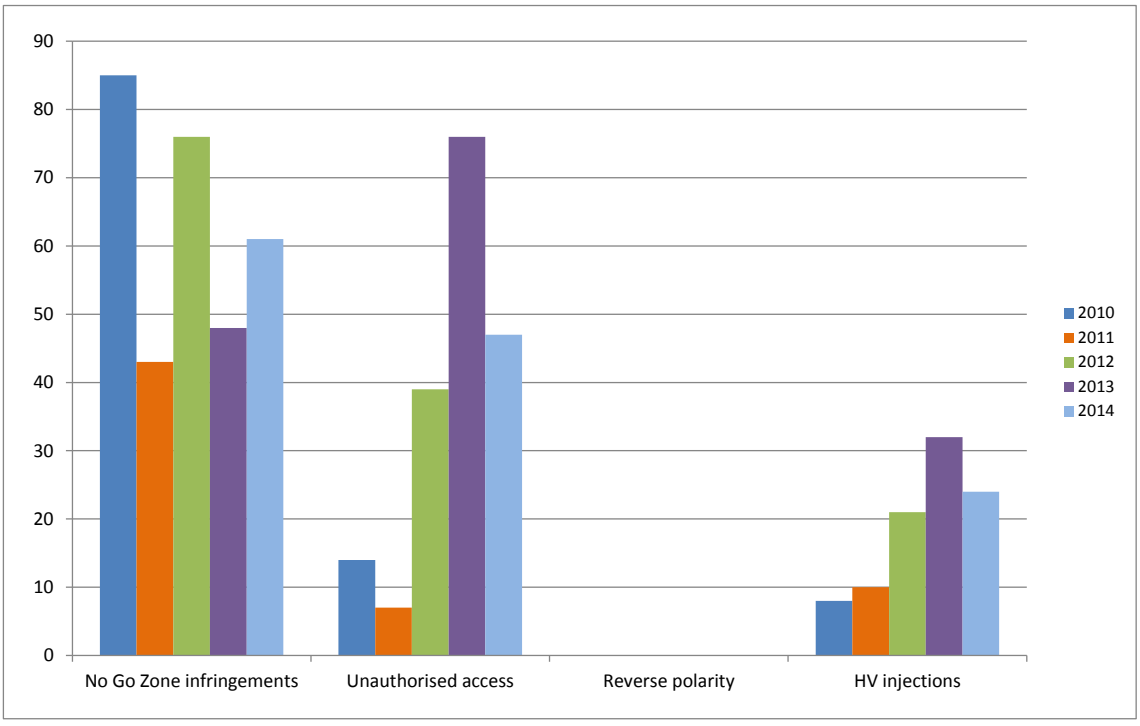

Figure 36: Safety incidents involving the public – Powercor

Table 35: Safety incidents involving the public - Powercor

Item	Total	2010	2011	2012	2013	2014
No Go Zone infringements	**313**	85	43	76	48	61
Unauthorised access	**183**	14	7	39	76	47
Reverse polarity	**0**	0	0	0	0	0
HV injections	**95**	8	10	21	32	24
Total incidents	**591**	**107**	**60**	**136**	**156**	**132**

Unauthorised access incidents decreased 38 per cent in 2014 compared to those reported in 2013. Figure 36 shows an increasing trend in the number of reported unauthorised access incidents despite the reduction in 2014.

In 2014 there was a reduction of 25 per cent in the number of HV injections compared to 2013. As with unauthorised access incidents, HV injections are showing an upward trend despite the reduction observed in 2014. HV injections can be caused by lightning or asset failure. Powercor reported a reduction in the number of asset failures in 2014 and this may explain the reduction in the number of HV injections.

ESV recommends that Powercor review the adequacy of controls in place to address increasing unauthorised access issues and HV injections.

F.7.2 Asset failures

In 2014 Powercor reported a 7 per cent overall performance improvement in asset failures from 2013 (Table 36 and Figure 37).

LV assets were the only assets where failure rates increased between 2013 and 2104. There were 141 failures in 2013 and 150 failures in 2014 (an increase of 6 per cent). This is part of an upward trend observed since 2011.

HV fuse failures were the assets with the highest failure level reported, accounting for 34 per cent of asset failures in 2014. There is no upward or downward trend in HV fuse failures. The levels of fuse failures are of concern as they are known to cause fire starts.

A further 27 per cent and 19 per cent of failures were due to LV assets and crossarms respectively. Both are exhibiting upward trends since 2011, despite the 13 per cent decrease in crossarm failures in in 2014.

Conductor failures were responsible for 16 per cent of all failures; however unlike the larger contributors, there has been a downward trend in conductor failures evident since 2012.

Pole failures account for a low level of failures at three per cent. The numbers of such failure increased from 2011 to 2013, but numbers in 2014 dropped to a level marginally lower than in 2012. Hopefully this is the start of a downward trend.

ESV recommends that Powercor reviews its asset programs and address the root cause of its asset failures.

Table 36: Asset failures by type – Powercor
n/a – nor recorded

Item	Total	2010	2011	2012	2013	2014
Conductor plus HV tie failure	**317**	18	29	94	90	86
Pole failure	**67**	4	8	18	20	17
HV fuse failure	**570**	n/a	n/a	167	215	188
Crossarm failure (excludes failure due to fire)	**363**	n/a	39	99	120	105
LV asset failure	**606**	131	60	124	141	150
Total	**1923**	**153**	**136**	**502**	**586**	**546**

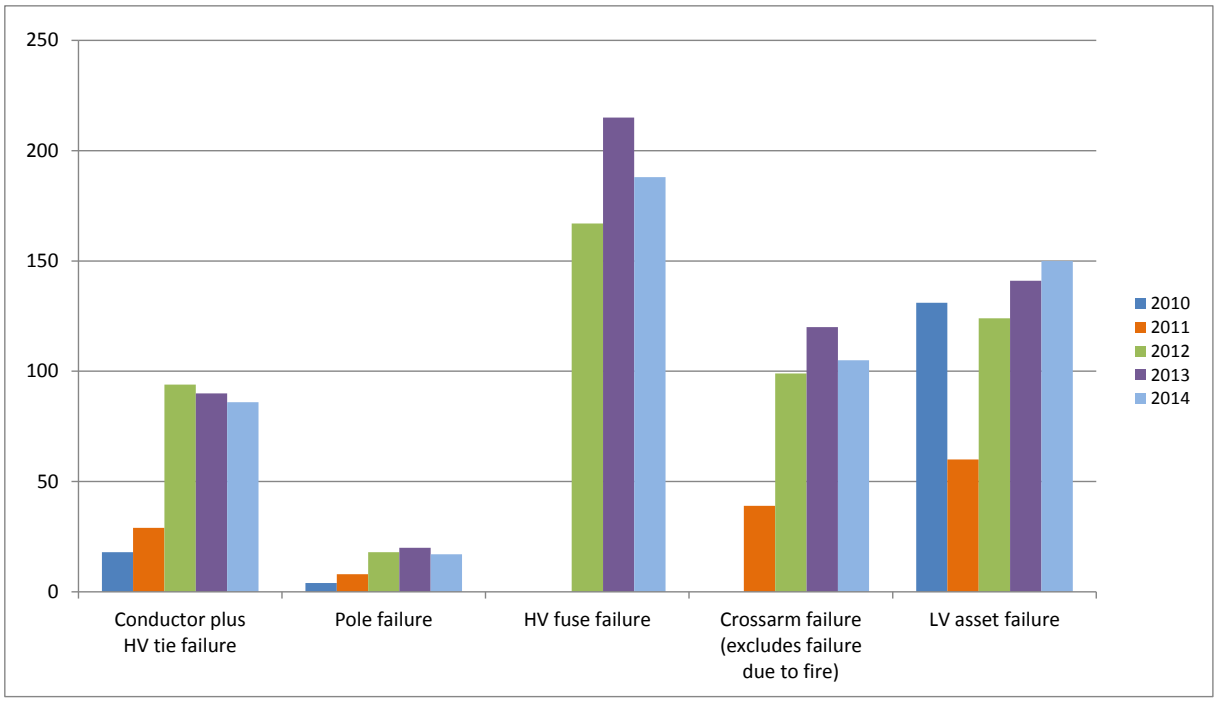

Figure 37: Asset failures by asset – Powercor

F.7.3 Vegetation fires due to asset failure or contact

Detailed data on the total numbers of vegetation fires due to asset failures and contact events are provided in Table 20 (asset failures) and Table 21 (contact events).

In 2014, Powercor reported a 4 per cent increase in the total number of vegetation fire starts, the number of fires increasing from 162 to 169 between 2013 and 2014 (Figure 38). Fires caused by asset failures increased by 16 per cent, with this partially offset by a 12 per cent decrease in fires due to contact with assets. The increase in asset fires is due to a large increase in LV asset failures (Figure 39 and Figure 40). In 2014, fires due to LV asset failures increased by 80 per cent and represented the highest cause of Powercor's asset fires.

The increasing trend of fire starts increases the likelihood of a bushfire in Powercor's area.

Powercor LV asset fires represent 53 per cent of all LV asset fires across all distribution businesses (45 out of 85) and 22 per cent of all fires due to asset failure across all distribution businesses. The reasons for the increase in LV asset fires and the high level of LV asset fires in Powercor's asset fleet have not been investigated and are unknown.

ESV recommends that Powercor should determine the reasons for the increase in LV asset failures and implement a maintenance program to reduce the risk of ground fire.

Along with LV assets fires, Powercor is also experiencing increases in pole and crossarm fires, fires due to other assets and animal contact fires. Decreases have occurred in relation to fires due to pole and crossarm failures, HV fuses and other causes.

Table 37: Asset failures resulting in vegetation fires – Powercor
n/a – nor recorded

Item	Total	2011	2012	2013	2014
Pole and/or crossarm failure	**19**	6	7	3	3
Pole and/or crossarm fire	**83**	1	16	33	33
Oil-filled plant	**0**	0	0	0	0
HV fuse	**48**	9	14	13	12
LV asset failure	**95**	n/a	25	25	45
Other assets (e.g. street lights, surge arresters, etc.)	**54**	9	11	19	15
Total fires – asset failures	**299**	**25**	**73**	**93**	**108**

Table 38: Vegetation fires resulting from contact with assets – Powercor
n/a – nor recorded

Item	Total	2011	2012	2013	2014
Animals	**67**	3	15	23	26
Third party (e.g. vehicle, vandalism)	**29**	n/a	9	13	7
Tree contact	**73**	n/a	20	28	25
Other causes	**31**	17	6	5	3
Total fires - contact	**200**	**20**	**50**	**69**	**61**

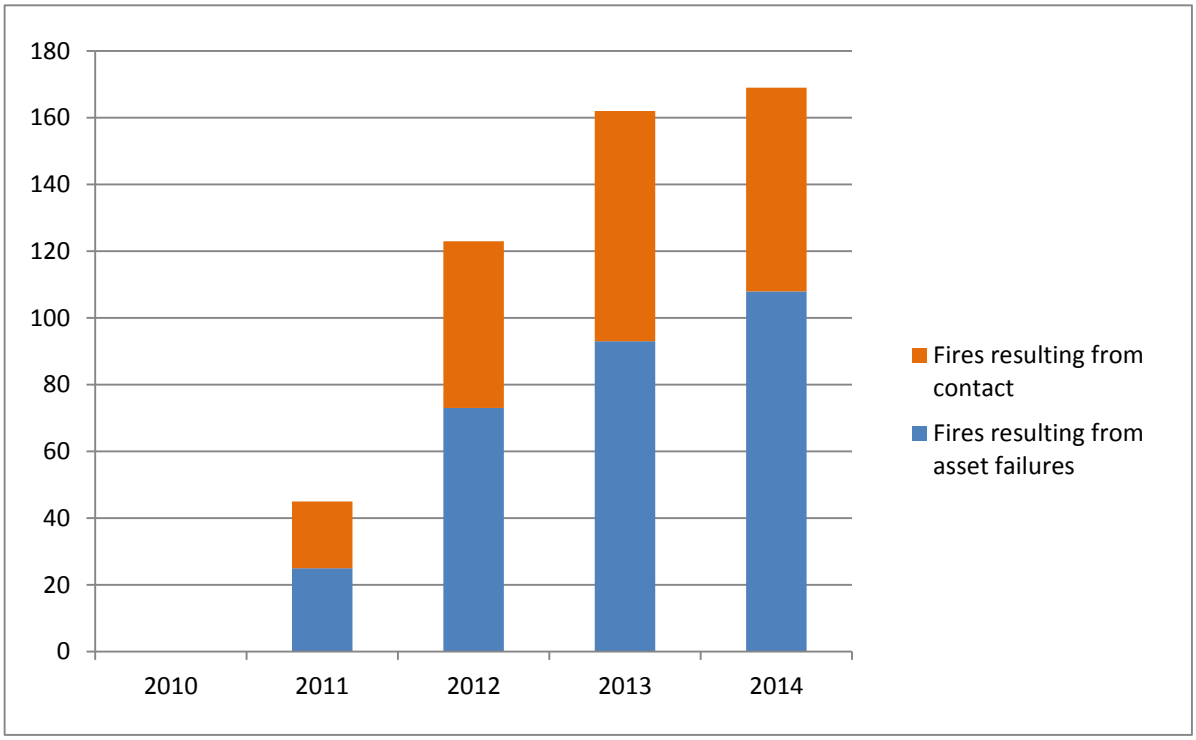

Figure 38: Vegetation fires due to asset failures and contact – Powercor
Note: There was no requirement to report on vegetation fires in 2010

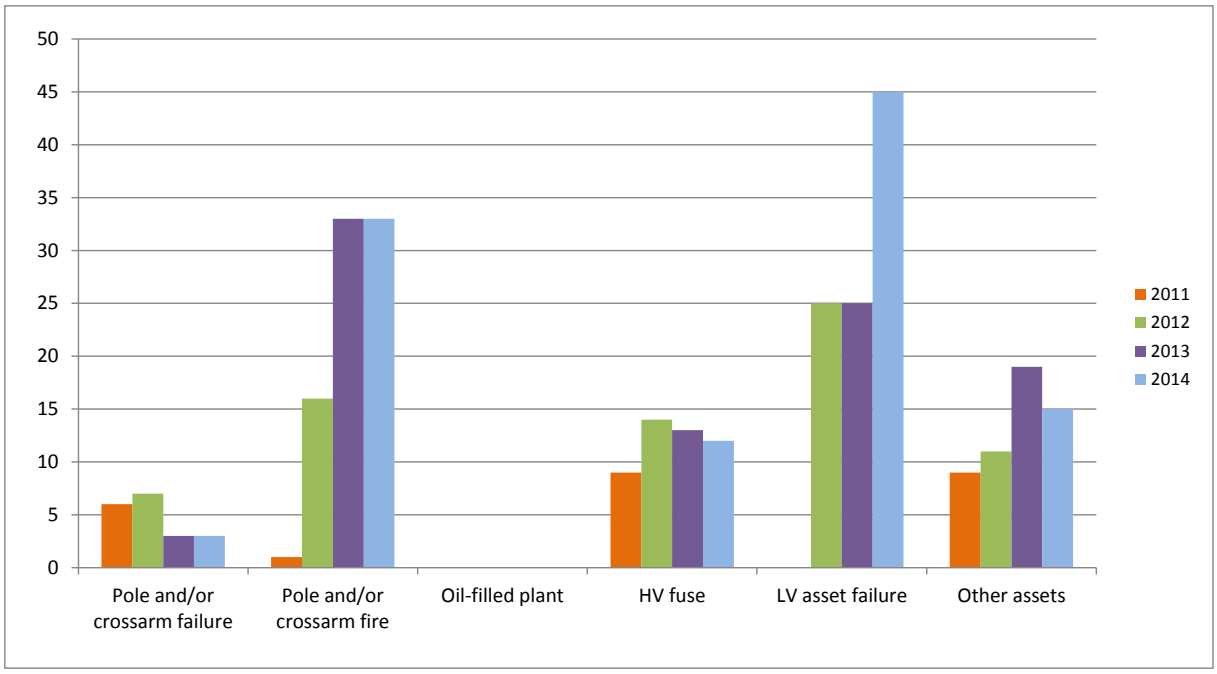

Figure 39: Vegetation fires resulting from asset failures – Powercor

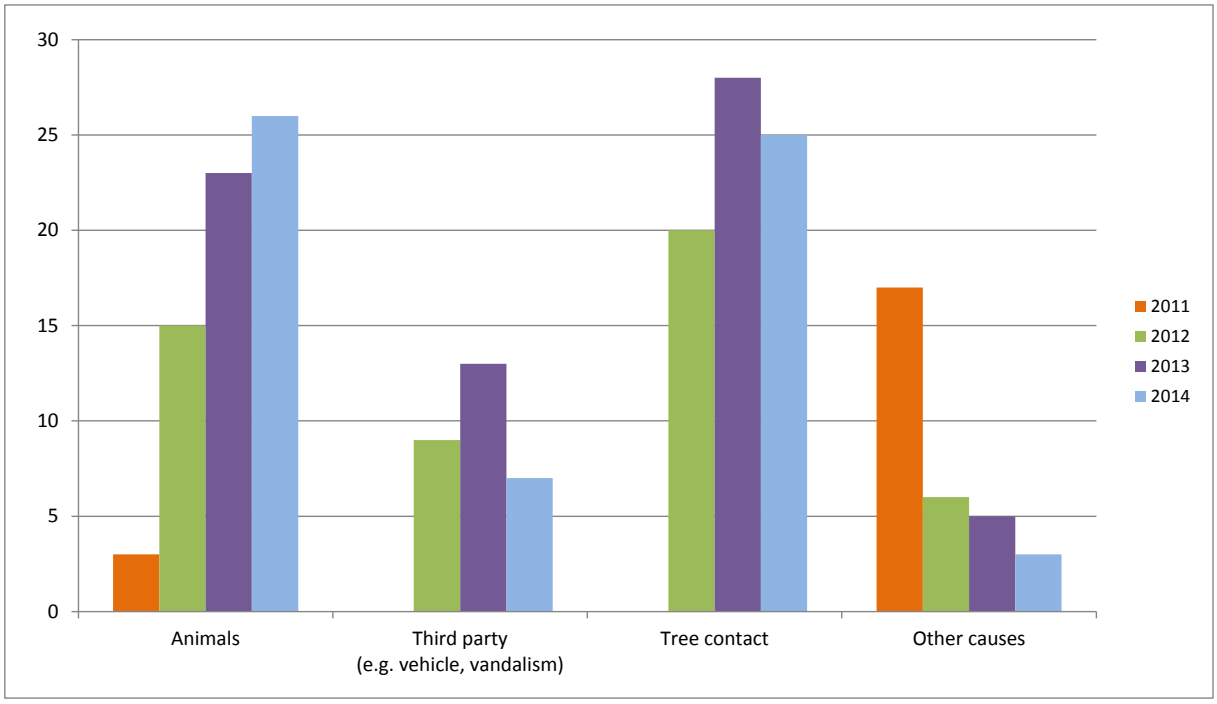

Figure 40: Vegetation fires from contact with assets – Powercor

F.7.4 Fires on or in assets

Table 39 details the fires arising on or in Powercor's assets. In 2014 Powercor reported 278 fire starts — a 15 per cent reduction from 2013. This is a decrease from 2013; however, it is still significantly higher than levels in 2011 and 2012.

Over the last four years there has been a downward trend in HV fuse fires, LV equipment fires and fires in other assets. Oil-filled plant fires are low and stable. These positive results are, however, overshadowed by the increase in pole and crossarm fires. These have increased from 33 fires in 2011 to 226 in 2014 — an almost seven-fold increase in three years. Such fires represent 81 per cent of Powercor's total number of fires on or in assets in 2014.

Pole-top fires are of particular concern as they can cause bushfires and Powercor has significant areas of HBRA in the drier parts of Victoria.

ESV recommends that Powercor should determine the reasons for the increase in pole and crossarm fires and implement a maintenance and/or asset replacement program to reduce the risk of ground fire. In particular, Powercor should consider introducing more steel crossarms into its network.

Table 39: Fires on or in assets – Powercor
n/a – nor recorded

Item	Total	2011	2012	2013	2014
Pole and crossarm fire	**633**	33	110	264	226
Oil-filled plant	**8**	3	0	2	3
HV fuse	**138**	64	24	30	20
LV equipment	**87**	n/a	37	27	23
Other assets	**80**	56	15	3	6
Total fires	**946**	**156**	**186**	**326**	**278**

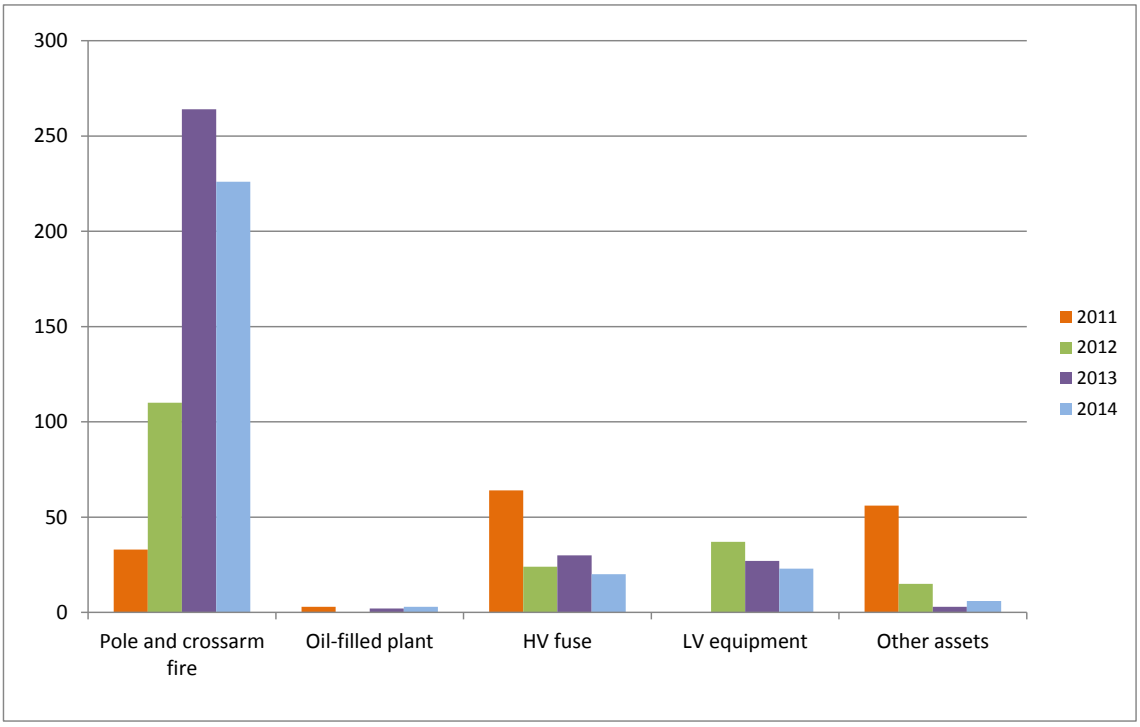

Figure 41: Fires on or in assets – Powercor

G TRANSMISSION OPERATIONS AUSTRALIA

Transmission Operations Australia (TOA) specialises in constructing, owning, and operating electricity transmission assets that connect generation assets and load requiring assets to the existing electricity network. It is licensed transmission company in Victoria.

In Victoria, TOA owns and operates the connection for the Mt Mercer Wind Farm to the existing electrical transmission network. This includes a 21km 132kV powerline and the Elaine Terminal Station, which steps the voltage up from 132kV to 220kV for injection into the AusNet Services transmission network. Practical completion of the transmission link was completed in November 2013.

TOA is jointly owned by Cheung Kong Infrastructure Holdings Ltd (50 per cent) and Power Assets Holdings Ltd (50 per cent), who also hold majority ownership interests in the CitiPower and Powercor Group of companies.

G.1 ELECTRICAL SAFETY MANAGEMENT SCHEME

In May 2014, ESV conducted a desktop audit at TOA's offices (together with CitiPower and Powercor). The audit was undertaken in order its interpretation and implementation of the following sections of the Electricity Safety (Management) Regulations:

- r.24 incident recording, investigation and reviewing
- r.27 relevant asset operator requirements for reporting of serious electrical incidents
- r.28 relevant asset operator reporting of incidents other than serious electrical incidents.

As the members of TOA's Board also sit on the Powercor/CitiPower Board and the companies use similar procedures, the ESV ESMS audit encompassed all three companies in the same audit with the findings being applicable to all three entities.

The audit identified no noncompliances or areas requiring attention. Four opportunities for improvement were raised, of which three were related to document control and one related to a distribution business-wide improvement to encourage a broader distribution of safety grams/alerts.[26] There were no serious safety implications in these opportunities for improvement; however, ESV requires a formal corrective action or response is required for each of these items.

G.2 SAFETY PROGRAM

TOA is not regulated by the AER and, as such, AER-approved safety programs do not apply. TOA has no identified safety issues that warrant monitoring by ESV.

G.3 BUSHFIRE MITIGATION

TOA's BMP 2014-2019 was assessed and after minor amendments through the process the plan was accepted by the Director of Energy Safety on 24 October 2014.

ESV did not conduct a bushfire mitigation audit on TOA in 2014. Its assets were commissioned in the year prior (that is, 2013) and, being new, are considered have low risk of failure.

[26] This was subsequently implemented across all major electricity companies.

G.4 ELECTRIC LINE CLEARANCE

The TOA ELCMP was received by ESV on 31 March 2014 and the assessment finalised on 13 October 2014. The plan was observed to be mature and well supported by adequate processes and procedures. Subsequent to minor amendment throughout the assessment process the plan was approved by the Director of Energy Safety on 3 November 2014.

Given that TOA had only commissioned its Victorian transmission assets in November 2013, the assets were considered to be of good condition and unlikely to be affected by new growth vegetation. As such, it was deemed that TOA would not require an electric line clearance audit in 2014.

G.5 WORK PRACTICES

Given that TOA had only just commissioned the Mt Mercer powerline at the end of 2013, there was no need for significant maintenance work. As such, no work practices audits were scheduled in 2014. ESV plans to undertake work practices audits of TOA in future years.

G.6 DIRECTIONS AND EXEMPTIONS

There are currently no directions or exemptions pertinent to TOA.

G.7 SAFETY INDICATORS

TOA operates only one relatively short overhead line and one substation in Victoria. It is statistically insignificant and does not report safety indicators.

H UNITED ENERGY

United Energy distributes electricity to more than 640,000 customers (primarily residential customers) across east and south east Melbourne and the Mornington Peninsula.

United Energy is jointly owned by DUET Group (66 per cent) and Singapore Power (34 per cent). Singapore Power also owns 40 per cent of Jemena.

United Energy engaged Tenix and ZNX (Zinfra) as subcontractors to manage aspects of its operations and maintenance services; Tenix was responsible for the southern region and ZNX for the northern region.[27] Any reference to United Energy within this section also encompasses Tenix and ZNX operations on United Energy's assets.

H.1 ELECTRICAL SAFETY MANAGEMENT SCHEME

In April 2014 ESV conducted a desktop audit at United Energy's office to assess its interpretation and implementation of the following sections of the Electricity Safety (Management) Regulations:

- r.24 incident recording, investigation and reviewing
- r.27 relevant asset operator requirements for reporting of serious electrical incidents
- r.28 relevant asset operator reporting of incidents other than serious electrical incidents.

The audit identified zero noncompliances or areas requiring attention. Six opportunities for improvement were identified, of which two were related to not following procedures (no signature and not reviewing a document as per procedure), two were document control issues and two were improvement suggestions made by ESV. One improvement, in particular, related to a distribution business-wide improvement to encourage a broader distribution of safety grams/alerts.[28]

H.2 SAFETY PROGRAM

H.2.1 Audit findings

In October and November 2014, ESV audited United Energy's electricity network assets to verify the progress of its safety programs. The audits comprised a limited desktop audit and a comprehensive field-based audit.

United Energy reports to ESV on a range of safety programs, namely:

- 22 programs arising from the AER 2010 determination[29]
- 13 additional safety programs created as an outcome of an internal 2012/13 review, including one program resulting from an ESV direction.

Of the original 22 programs, four did not start by the end 2014 based on data provided by United Energy in its quarterly reporting to ESV:

- install REFCL and associated equipment at zone substations
- replace existing SWER lines with 22kV overhead bare conductor
- inspect, clean, tighten, life extension – pole-top fire mitigation
- install HV ABC in HBRA.

[27] These operations and maintenance services are now provided by Downer EDI and ZNX.

[28] This was subsequently implemented across all major electricity companies.

[29] *Victorian electricity distribution network service providers: Distribution determination 2011–2015. Final decision*. Australian Energy Regulator. October 2010.

In its Safety Programs, Directions and Exemptions 2014 report, United Energy contend that 196,640 pole-tops have been inspected and 3340 HV fuses, surge diverters or sets of insulators have been replaced and pole-tops tightened. This information has not been reported to ESV as part of United Energy's quarterly reporting. Considering the volume of works purported to have been completed, it is surprising that this has not been reported previously. ESV has not had the opportunity to verify such works have been undertaken. ESV recommends that United Energy ensure that any works undertaken be included in its quarterly reporting so that ESV can check the veracity of the data.

Of the additional 13 programs, five had not yet started by the end of 2014 and the rest of the programs were underway. The program to install vibration dampers and armour rods, the program resulting from ESV's direction, had started.

As part of the audit of all 35 programs 2383 assets were audited and 46 issues were identified. This is a variance of 1.9 per cent.

The audit of the United Energy safety programs found that the reporting of works generally matched with the actual completed work. The audit identified the following:

- Noncompliances

  ESV raised noncompliances on two of the original safety programs and one of the additional programs:
  - replace poles – based on age and condition (original program)
  - pole-top structure – surge diverter replacement (original program)
  - installation of vibration dampers (additional program and ESV direction).

  For the pole replacement program, six of the 388 sites reported finished had not been completed (a variance of 1.5 per cent). For the surge diverter replacement, works at 12 of the 70 sites reported as finished had not been completed (a variance of 17.1 per cent)

  In relation to the ESV direction, ESV found 16 out of 140 locations where the vibration dampers had not been installed as recorded, but United Energy reported the works as complete.[30] This equates to a variance of 11 per cent.[31]

  The noncompliances were raised due to a high number of discrepancies between volumes of works reported as complete and those actually undertaken.

  ESV recommended that United Energy conduct an internal audit of the safety programs to review consistency between the reported volumes and works actually completed, take corrective action based on the findings and report the outcomes to ESV.

- Areas requiring attention

  ESV considers that three of the safety programs are an area requiring attention as there is a discrepancy between reported and completed jobs. The programs are:
  - planned non-preferred services replacements
  - pole-top structure – HV fuse replacement
  - replace poles – based on age and condition.

  ESV's recommendation regarding the noncompliance raised due to records discrepancies should also consider the items raised in this area requiring attention.

[30] In some instances United Energy reported that the HV dampers were installed on the other end of the span. This is still a discrepancy against records and remains a variance.

[31] As regards the other element of the ESV direction (namely the installation of armour rods), ESV found minimal variation between the number jobs reported as complete and those actually completed.

- Opportunities for improvement

  Nine opportunities for improvement were identified; all related to safety programs that had not commenced by the end of 2013.

While three of the safety programs were noncompliant and three are an area requiring attention due to overstating progress of works, the reporting of most of United Energy's safety programs is generally accurate.

H.2.2 Safety program status

Asset failures are one of the major contributors to network-related fires. They were one of the causes of the 2009 Black Saturday fires. The safety programs are the targeted replacement of specific assets before they would normally be replaced as part of regular maintenance. This early replacement of assets is intended to reduce the chance of failure, thereby resulting in a more reliable and safer electrical distribution network.

As noted in Section H.2.1, United Energy reports to ESV on a range of safety programs:

- Original suite of AER programs

  As part of the 2010 AER determination,[32] United Energy developed, evaluated and prioritised 22 safety programs.These programs were based on the best information available at the time and have been regularly reviewed and prioritised by United Energy to optimise results.

  Performance against target for the original safety program is shown graphically in Figure 42. Specific data on the status of these safety programs are provided in Table 40.

- Additional safety programs

  In 2012–13 United Energy undertook an internal review to ascertain whether the safety programs warranted amendment. United Energy then informed ESV that it had revised the volumes down for some of its existing safety programs to bring them in line with its asset management practices and in response to new technologies, more recent forecasts, new information and consideration of emerging issues. Twelve alternative programs were then initiated, with United Energy advising the introduction was done to meet condition assessment criteria, minimise risk and reduce the hazards associated with network operations.

  A further program was included to address an ESV direction in relation to installation of vibration dampers and armour rods.

  It appears that the review offered an opportunity to promote works onto the safety program roster that were originally to be funded internally. One such program was the earthing program. This program had no annual targets as it was completed prior to 2014. Discussions with United Energy indicated that this program was actually completed before the additional safety programs were created. United Energy states that other substations will be completed on an opportunistic basis. ESV infers from this that United Energy has no plan to complete any specific work within any clear timeframe.

[32] *Victorian electricity distribution network service providers: Distribution determination 2011–2015. Final decision*. Australian Energy Regulator. October 2010.

United Energy's 2012–13 review, while achieving comparable expenditure on safety, appears to be departing from the original recommended course of action.

Performance against target for the additional safety programs is shown graphically in Figure 43. Specific data on the status of these safety programs are provided in Table 41.

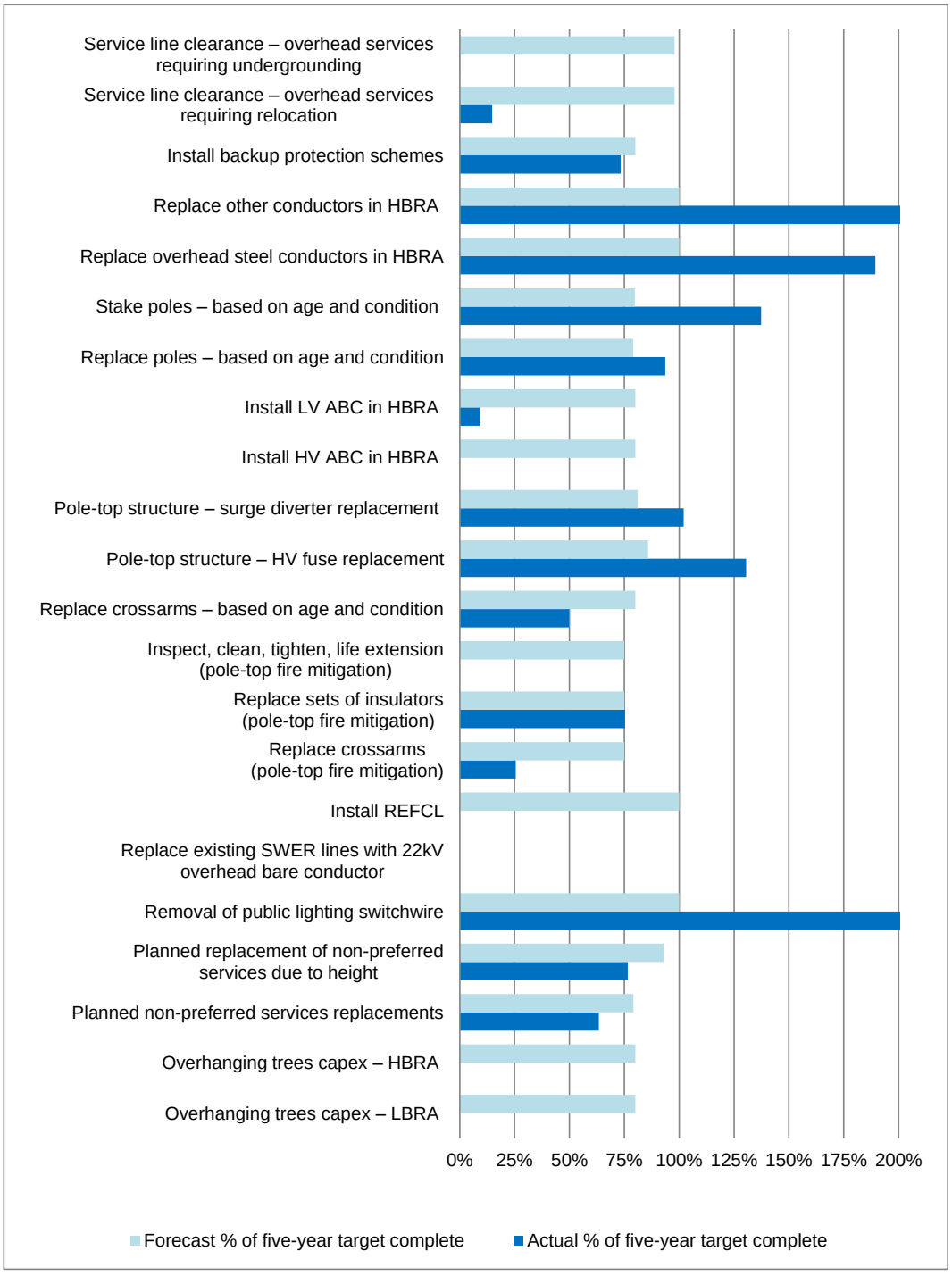

Figure 42: Status of United Energy's safety programs (original programs)

Table 40: Status of United Energy's safety programs (original programs)

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
Service line clearance – overhead services requiring undergrounding	Number of services	1734	1	1771	Program is 99.94% behind forecast. Unlikely to meet original target.
Service line clearance – overhead services requiring relocation	Number of services	6934	1047	7083	Program is 85% behind forecast. Unlikely to meet original target.
Install backup protection schemes	Zone substations completed	12	11	15	Program is 8% behind forecast. Program will be completed by the end of the current regulatory period.
Replace other conductors in HBRA	Kilometres of conductor replaced	2	5	126	Program is 150% ahead of forecast.
Replace overhead steel conductors in HBRA	Kilometres of conductor replaced	23	44	80	Program is 91% ahead of forecast. United Energy has revised its final target down from 80 to 23 and has no interim yearly targets.
Stake poles – based on age and condition	Number replaced	1584	2725	2098	The program is 72% ahead of forecast. All poles suitable for staking have been staked.
Replace poles – based on age and condition	Number replaced	2161	2564	2805	Program is 19% ahead of forecast. All end-of-service life poles have been replaced.
Install LV ABC in HBRA	Metres of LV ABC	11,800	1338	14,750	Program is 89% behind forecast.
Install HV ABC in HBRA	Metres of HV ABC	19,200	0	24,000	Program is 100% behind forecast.
Pole-top structure – surge diverter replacement	Number replaced	854	1076	1054	Program is 26% ahead forecast. All diverters needing replacement have been replaced.
Pole-top structure – HV fuse replacement	Number replaced	694	1055	808	Program is 52% ahead of forecast. All fuses needing replacement have been replaced.
Replace crossarms – based on age and condition	Number of crossarms replaced	40,070	24,898	50,088	Program is 38% behind forecast. All end-of-life crossarms identified to date are said to have been replaced.

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
Inspect, clean, tighten – pole-top fire mitigation	Poles completed	1500	0	3300	Program is 100% behind forecast. All end-of-life components identified to date are said to have been replaced.
Replace sets of insulators – pole-top fire mitigation	Number of insulator sets replaced	1200	1206	3400	Program is in line with forecast. All end-of-life components identified to date are said to have been replaced.
Replace crossarms – pole-top fire mitigation	Number of crossarms replaced	1200	408	3000	Program is 66% behind forecast. All end-of-life components identified to date are said to have been replaced.
Install REFCL	Number of zone substations	2	0	7	Program is 100% behind the forecast. Work will not proceed until technical matters have been resolved.
Replace existing SWER lines	Kilometres of existing SWER removed	0	0	44	Program is in line with forecast.
Removal of public lighting switch wire	Spans removed	7236	27,353	7236	Program is 278% ahead of forecast. Switch wire is removed when the adjacent LV crossarms are replaced.
Planned replacement of non-preferred services due to height	Number of services	11,734	9662	12,618	Program is 18% behind forecast. All “low” services identified have been rectified
Planned non-preferred services replacements	Number of services	114,000	91,258	144,000	Program is 20% behind forecast. All services identified as requiring replacement have been replaced.
Overhanging trees CAPEX – HBRA (undergrounding, line relocation, ABC, etc.)	Spans removed	560	0	700	Program is 100% behind forecast. Program has been revised and is unlikely to meet original target.
Overhanging trees CAPEX – LBRA (undergrounding, line relocation, ABC, etc.)	Spans removed	22	0	28	Program is 100% behind forecast Program has been revised and is unlikely to meet original target.

RED	Program total to date < 90 per cent of forecast to date
GREEN	Program total to date 90-110 per cent of forecast to date
BLUE	Program total to date > 110 per cent of forecast to date

Table 41: Status of United Energy's safety programs (additional programs)

Program	Measure	2014 cumulative forecast	2014 completed to Date	Program Target	Comments
Doncaster pillars	Number removed	510	593	790	This program is 16% ahead the United Energy forecast.
Air break switch replacement with gas switches	Number replaced	565	183	915	This program is 68% behind United Energy forecast.
P brackets with pole caps replacement	Number replaced	800	1949	1200	This program is 143% ahead of forecast.
Kaon fuse replacement	Number installed	30	1	50	This program has not started. A trial unit has been installed.
LiDAR	Trialed	1	0	1	This program is 100% behind United Energy forecast and has not started.
Conductor clashing prevention	Number of sites	20	594	30	This program is 2,870% ahead of United Energy forecast.
Fitting armour rods and vibration dampers	Number Installed	1200	1861	1900	This program is 55% ahead of United Energy forecast.
Low transformer mounting height	Number resolved	12	11	17	This program is in line with United Energy forecast.
Low tramways projects	Number of locations	4	4	4	This program is in line with United Energy forecast.
Zone substation security	Number of zone substations	3	7	6	This program is complete.
Earthing	Number of locations	0	153	153	This program was completed prior to 2014.
DC systems management	Number of zone substations	33	27	43	This program is 18% behind United Energy forecast.
Bird and animal proofing	Number of structures	587	924	793	This program is 57% ahead of United Energy forecast.

RED	Program total to date < 90 per cent of forecast to date
GREEN	Program total to date 90-110 per cent of forecast to date
BLUE	Program total to date > 110 per cent of forecast to date

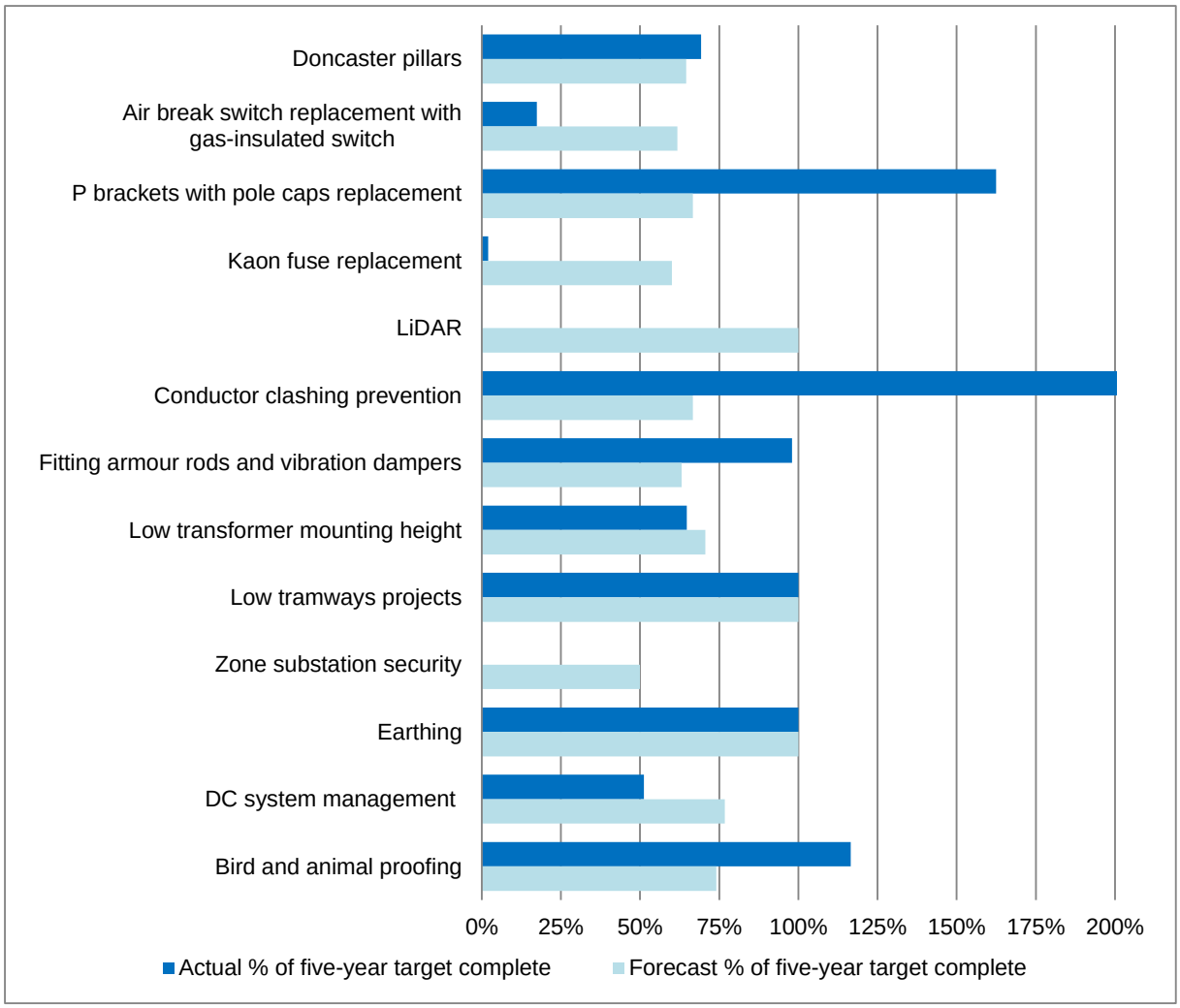

Figure 43: Status of United Energy's safety programs (additional programs)[33]

Original suite of AER programs

The status of United Energy's safety programs can be summarised as follows:

- Programs ahead of the United Energy forecast
  - replace other conductors in HBRA
  - replace overhead steel conductors in HBRA
  - stake poles – based on condition
  - replace poles – based on condition
  - pole-top structure – surge diverter replacement
  - pole-top structure – HV fuse replacement
  - removal of public lighting switch wire.

- Programs in line with the United Energy forecast
  - install backup protection schemes
  - replace sets of insulators – pole-top fire mitigation.

[33] The Conductor Clashing Prevention Program is at 1980 per cent of its 2014 forecast as shown in Table 41, but for clarity sake it is capped at 200 per cent in Figure 43.

- Programs behind the United Energy forecast
  - service line clearance – overhead line requiring undergrounding
  - service line clearance – overhead line services requiring relocation
  - install LV ABC in HBRA
  - install HV ABC in HBRA
  - replace crossarms – based on age condition
  - inspect, clean and tighten – pole-top fire mitigation
  - replace crossarms – pole-top fire mitigation
  - install REFCL
  - planned replacement of non-preferred services due to height
  - planned replacement of non-preferred services
  - overhanging trees CAPEX – HBRA
  - overhanging trees CAPEX – LBRA.

- Programs due to commence in 2015
  - replace existing SWER lines.

United Energy is behind its forecast progress in delivering 12 of the 22 programs originally agreed with the AER. The following comments can be provided on some of the programs that are behind forecast and the one program yet to start:

- Service line replacement programs

  United Energy has four service line replacement programs:
  - service line clearance – overhead services requiring undergrounding
  - service line clearance – overhead services requiring relocation
  - planned replacement of non-preferred services due to height
  - planned non-preferred services replacements.

  These four programs are all behind schedule. At the end of 2014 the required volume for overhead services to have been replaced or relocated is 134,402; however, only 101,968 were completed (75 per cent of the 2014 target).

  United Energy states in its Safety Programs, Directions and Exemptions report that it is only going to look at 20,292 overhead services in 2015. Therefore, this would only equate to a total of 122,260 services. The program target for completion in 2015 is 165,472. This means that at most United Energy will only achieve 74 per cent of its overall target. We can conclude that United Energy does not plan to meet this target in the 2011-2015 EDPR period.

  The AER provided once-off CAPEX[34] funding to United Energy for a permanent solution to the services issue, yet United Energy decided not to progress with this solution and to implement an ongoing OPEX[34] solution (tree management). This decision will increase the operational costs to the business and is less likely to result in a substantive long-term risk reduction. ESV considers this may be a sub-optimal decision.

- Install HV or LV Aerial Bundled Conductor in HBRA

  The programs to replace bare conductor in HBRA with HV or LV ABC are well behind their expected targets. United Energy only installed 1.3km of LV ABC (11 per cent of target) and has not installed any HV ABC against targets of 11.8km and 19.2km respectively.

[34] CAPEX = capital expenditure, OPEX = operating expenditure

United Energy has stated that its condition assessment, risk analysis and cost-benefit analysis identified fewer than expected overhead powerlines suitable for replacement with HV or LV ABC. It also states that it is still searching for a suitable replacement product for HV ABC.

The original estimates for these programs were not based on engineering considerations such as condition assessment. United Energy appears to have changed the criteria since agreeing to the programs with the AER, perhaps to be more in line with its routine maintenance practices.

United Energy's reduction to its conductor replacement programs in HBRA means that in the future this conductor will still need to be replaced. The failure to bring forward these works (as part of the AER-approved safety programs) may also adversely impact bushfire mitigation initiatives recommended by the bushfire taskforce and impact program safety objectives.

- Replace crossarms due to age and condition and to mitigate pole-top fires

  United Energy advised ESV that it expects to replace 30,170 crossarms based on its condition assessment approach and not the originally 53,088. The replacement of 24,898 crossarms up until the end of 2014 was in line with this new target, but significantly behind the original target.

  Figure 45 (page 139) shows the number of reported crossarm failures without fires in 2014, while less than in 2013, is still part of an ongoing upward trend in such failures over the last five years.[35,36] Figure 49 (page 143) also shows an ongoing upward trend in the number of reported pole and crossarm fires over the 2010-2014 period.

  The original AER-approved program called for replacement of crossarms based on age and condition; however, United Energy replaces crossarms based only on their condition. If condition assessment was effective by itself, United Energy would be reversing the trend of crossarm failures and fires. The evidence is that United Energy's crossarm replacement program is not keeping pace with the rate of incidents, and this is likely to seriously impact safety. Replacement rates need to be increased to reverse the upward trend as failure to do so will increase the safety risk; both age and condition should be used as criteria for replacement.

- Install REFCL

  REFCL are a new technology and United Energy had a number of issues to resolve associated with their implementation. The unit installed at Frankston South Zone substation has not performed as expected. United Energy has made the equipment and facilities available for testing in support of the Powerline Bushfire Safety Program. United Energy states that the technology is capable of reducing the fire risk associated with falling conductors, but awaits the availability of a robust reliable unit on the market.

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[35] United Energy contends that it was incorrectly reporting crossarms as failed when they had been noted as requiring urgent replacement. This would mean the failure rates reported may be overstated. United Energy will not attempt to correct the historical quantities reported, but will in future only report crossarm failures when they actually fail.

The outcome of not correcting the historical data is that a perception is created that United Energy's performance has improved in 2014 (and onwards) when compared to the 2010-2013 period.

[36] The decrease in 2014 could be due to United Energy's reclassification of failure events for 2014. Alternatively it may have been due to the milder weather conditions placing less stress on crossarms. Even if it were due to condition assessments, these assessments alone are still not sufficient to reduce the five-year upward trend in failures.

Consequently it has deferred the program to install seven more on its network. ESV notes that United Energy has communicated its intention to install another REFCL at one of its Zone Substations in 2015-16 once certain technical issues are resolved and an industry- and state-agreed performance specification is developed.

- Replace existing SWER lines

  As of 2014 United Energy was on target with its SWER replacement program; however, this finding is artificial as United Energy proposed to undertake all work on this program in 2015. In order to understand whether the 2015 target is likely to be met requires consideration of measures other than performance to date.

  United Energy agreed to replace six separate SWER lines with 22kV overhead conductors by the end of 2015. A total of 44km of lines is scheduled for replacement.

  Only the 4.5km Green Bush SWER line on the Mornington Peninsula is in a treed area, and the associated land is managed by Parks Victoria. It was proposed to replace this line with a 1km underground cable. Negotiations with Parks Victoria have been unable to progress installation and the SWER line has not been replaced. It is unlikely it will be completed in 2015.

  The replacement of the other SWER lines requires installation of new poles on private property. United Energy has advised that these lines have also been delayed due to difficulties in negotiating with land owners. It is also unlikely these lines will be replaced in 2015.

- Other discontinued programs

  Three of the original safety programs have not started. These are Inspect, clean and tighten (pole-top hardware), Overhanging trees CAPEX (HBRA) and Overhanging trees CAPEX (LBRA).

  United Energy claims that all end-of-life components subject to Inspect, clean and tighten (pole-top hardware) have been identified and replaced despite no recorded activity for 2014. No further activity toward meeting this target will be undertaken in 2015.

  The two programs relating to overhead trees were discontinued as part of United Energy's 2012-13 review. As such, this target will not be achieved.

Overall nine of the original safety programs are on track for completion by the end of 2015. The other 13 programs are not expected to meet target.

Additional safety programs

United Energy also reported on the progress of 13 additional safety programs.

Progress on five of the programs is ahead of United Energy's forecast:
- Doncaster pillars
- P brackets with pole caps replacement
- conductor clashing prevention
- fitting armour rods and vibration dampers
- bird and animal proofing.

Progress on four of the programs is in line with United Energy's forecast:
- low transformer mounting height
- low tramways projects
- zone substation security
- earthing.

Progress on four programs is behind United Energy's forecast:
- air break switch replacement with gas switches
- Kaon fuse replacement
- LiDAR
- DC systems management.

The following comments can be provided on the programs that are behind forecast:

- Air break switch replacement with gas switches
  United Energy originally forecast that 565 air break switches would have been replaced by the end of 2014, with a further 350 to be replaced in 2015. At the end of 2014 only 183 had been replaced. Given United Energy plans to only replace 300 in 2015, at most 483 will be replaced in total; this is well below the original forecast of 915.

- Kaon fuse replacement
  When United Energy introduced the additional safety programs it forecast that it would install 50 sets of the Kaon FuseSavers — 10 in 2013, 20 in 2014, and 20 in 2015. At the end of 2014 United Energy had installed one set of FuseSavers as a trial. United Energy claim that a further 20 sets of FuseSavers will be installed after successful completion of the trial. It has provided no timeframe for the works. Even if it completes them in 2015, United Energy will be well short of the target.

- LiDAR[37]
  United Energy planned to implement one LiDAR program in 2014; however, it are still at the evaluation stage. This program is not expected to be completed by the end of 2015.

- DC systems management
  United Energy had a target of reviewing 33 DC systems by the end of 2014, with a further 10 systems to be reviewed in 2015. In 2014, United Energy completed 27 systems and advises that the remainder will be completed on an opportunistic basis. This infers there is no longer a specific target date to install the outstanding 16 systems.

Conclusion

United Energy reported on the progress of 22 safety programs as agreed with the AER. In 2012-13 it amended the targets for eight programs, reducing seven and increasing one. It introduced an additional 13 programs and subsequently initiated progress reporting for these to ESV. This reporting does not imply acceptance by ESV of the changes to the programs, and ESV continues to report United Energy's progress against the original targets.

Summary of the situation against United Energy's forecast:
- seven of the original programs are ahead of forecast
- three of the original programs are in-line with forecast
- 12 of the original programs are behind forecast

[37] Light Detection And Ranging (LiDAR) is a remote sensing technology that measures distance by illuminating a target with a laser and analysing the reflected light.

- five of the additional safety programs are ahead of forecast
- three of the additional safety programs are in-line with forecast
- five of the additional safety programs are behind forecast.

While the additional safety programs being implemented by United Energy have some safety merit, there is no evidence to support the assertion that Victoria is less at risk from United Energy's network with the reduction in the AER-agreed safety programs and the implementation of United Energy's additional programs.

ESV will continue to monitor United Energy against its original AER-agreed safety programs, and will continue to recommend to United Energy that it meets the commitment by the end of 2015. These programs were originally assessed as having significant safety value.

Based on the information provided and performance to date, United Energy would need to significantly increase its activity levels in order to complete all of the safety programs by the end of 2015.

United Energy's current condition assessment practice does not appear to be stemming the upward trend of failures of these assets. ESV recommends that United Energy reviews its condition assessment practice (specifically its strategy for crossarm replacement) and demonstrates to ESV the engineering that informs the practice.

ESV also expects United Energy to address the lack of data on the material of its crossarm population (that is, whether crossarms are wood or steel). This also raises broader concerns about the state of United Energy's detailed asset database, a key input to its condition assessment practice. ESV also recommends that United Energy reviews the information in its asset database and, where required, takes corrective action to ensure material types are included for each pole and crossarm asset.

H.3 BUSHFIRE MITIGATION

ESV visited three geographic regions and in total viewed 380 assets that were all in HBRA.

A desktop audit of the technical information provided by United Energy was carried out before the field audit to ensure that the information ESV had received was appropriate for this audit. The information contained in the documents showed that United Energy had a comprehensively documented system for bushfire mitigation management, including individual and collective plans to mitigate the risks associated with specific assets.

During the audit a limited comparison was made between ESV's findings in the field and United Energy's asset database. This was based on a small sample of randomly selected records.

The findings of the bushfire mitigation field audit were:
- seven LV wooden crossarms observed as visibly deteriorated
- one HV wooden crossarm identified as visibly deteriorated
- three stay wires rubbing against LV ABC
- one cable/guard required and not present
- one instance of damage to an underground cable guard.

Crossarm deterioration was a significant issue in the audit. ESV is not satisfied that United Energy's condition monitoring practice is effective in determining when to replace crossarms (see Section H.2.2).

In total the variance can be shown to be:

- total of inspected poles 380
- number of areas requiring attention 13
- variance 3.4%

A disconnect was also found between asset conditions in the field and those recorded in United Energy's asset database. A number of items were identified that were not recorded in the asset database. This is of concern. It is not clear if this issue occurred because the infrastructure defects were only recently found and yet to be noted in the database, or if the defects were not detected during the last inspection, or if it was a failure in process.

From the audit results the overall condition of the assets inspected in HBRA is adequate for the fire season and, considering the number of assets visited, a fair representation of United Energy's entire network. ESV considered the company to be ready for the bushfire season.

ESV recommends that United Energy conduct an internal audit to consider the accuracy of the database in relation to infrastructure assets, take corrective action based on the findings, and report the outcomes to ESV.

H.4 ELECTRIC LINE CLEARANCE

The United Energy ELCMP was received by ESV on 31 March 2014 and the assessment was finalised on 22 September 2014. The plan was observed to be well-developed and supported by thorough processes and procedures. Subsequent to minor amendments throughout the assessment process, the plan was approved by the Director of Energy Safety on 6 November 2014.

An electric line clearance audit of United Energy's network was conducted between 16-19 October 2014. This occurred at randomly selected locations throughout the network. Due to increased fire threats associated with the network particular emphasis was placed on inspecting electricity spans that existed in HBRA. Spans in LBRA were inspected to a lesser extent.

A total of 891 electricity spans were inspected during the field component of the audit. Of these spans 754 were within HBRA and 137 in LBRA.

Table 42 summarises the audit findings

Table 42: Electric line clearance field audit results – United Energy

Field Audit Results	Total	Variance (%)
HBRA assets audited in the field	754 (84.6%)	
LBRA assets audited in the field	137 (15.4%)	
Total assets audited in the field	**891**	
HBRA noncompliant spans – United Energy responsibility	35	4.6
LBRA noncompliant spans – United Energy responsibility	21	15.3
Total noncompliant spans – United Energy responsibility	**56**	**6.3**

Generally the noncompliant spans fell into two groups:

- Spans for which United Energy is responsible

  Isolated instances of noncompliant spans were observed in areas deemed to be the management responsibility of United Energy. Clearance standards in HBRA were viewed to be of a higher quality than those achieved in LBRA, reflecting a commitment to mitigate risk within higher-risk areas.

  Audit results indicate that where United Energy is responsible for vegetation management its processes and clearing activities are implemented effectively. This is particularly the case for HBRA covered by the audit. Vegetation within LBRA is maintained to a lesser extent. Overall acceptable compliance was achieved, although this was marginal in some instances.

- Spans for which United Energy is not responsible

  Where noncompliant vegetation identified was not the management responsibility of United Energy, it was the responsibility of municipal councils or private property owners and occupiers. There was significantly more noncompliant vegetation evident within the LBRA audited.

  The higher frequency of noncompliant spans in areas managed by other responsible persons may adversely affect electrical safety, the reliability of supply and increase the potential for fire starts. These noncompliance issues could also impact the United Energy network.

  United Energy has systems in place to notify such responsible persons of the requirement to maintain a clearance space. There is, however, evidence that these systems may fail to:
  - effectively notify the relevant persons of their responsibility
  - track or provide for follow up consultation on responsible person inaction
  - accommodate an effective escalation process when a responsible person has failed to act.

  There is no obligation on United Energy to pursue a responsible person to ensure compliance with the regulations.

United Energy's vegetation management database was reviewed during the audit to verify its accuracy. Information relevant to the clearing activities of spans in both HBRA and LBRA proved very accurate and was maintained to a high standard. Descriptions detailed in the database reflected field audit observations. It was also extremely easy to use.

Affected persons surveyed during the audit commented they had been advised of the intended clearing process. Typically they felt they had received appropriate notification of the proposed works and were made aware of the options available should they oppose scheduled works.

The audit of United Energy's ELCMP recommended that United Energy:
- continues to utilise existing vegetation management methodologies as detailed in its ELCMP
- conducts a systematic review of the ELCMP to ensure its effectiveness into the future and to identify and implement improvement opportunities should they be identified.

The electric line clearance audit recommended that United Energy:

- ensures management principles utilised in clearing vegetation in HBRA are applied to vegetation clearing in LBRA
- provides greater assistance to municipal councils and private property owners and occupiers to enable them to facilitate more effective and efficient clearing of vegetation that is their management responsibility
- develops more rigorous follow-up and escalation procedures for municipal councils and private property owners and occupiers to ensure clearing of noncompliant vegetation in a more timely and effective manner.

H.5 WORK PRACTICES

In 2014, ESV undertook six audits of United Energy's work practices across six sites. The findings of these work practice audits were as follows:

- 10 areas requiring attention, of which the main issues related to:
  - checking the condition of personal protective equipment and glove and barrier equipment before use
  - lack of risk assessments (including Job Safety Assessment process) and lack of knowledge of Safe Work Method Statements.
- 18 opportunities for improvement, of which the prevalent issues related to:
  - general inspection and checking of all personal protective equipment and other equipment (particularly glove and barrier) before use
  - HV live work, particularly in relation to checking and cleaning mobile plant prior to use and the earthing and bonding of mobile plant when less two metres apart
  - LV testing, particularly in relation to metering and servicing activities.

These findings, when compared with those of 2013, reveal the key areas of concern to be general inspection of personal protective equipment and equipment checks, risk assessment processes, LV (metering and servicing) testing and HV live work (condition of, and earthing of, plant).

ESV recommends United Energy ensures its internal works practices program focuses attention on ensuring all workers:

- understand the importance of checking equipment and personal protective equipment before use given its role as the last line of defence in the safety hierarchy
- ensure appropriate condition of, and earthing of, plant for HV live work
- comply with LV (metering and servicing) testing requirements.

H.6 DIRECTIONS AND EXEMPTIONS

United Energy reported on the progress of three direction programs and five exemptions. Details are provided in Table 43.

Progress on three exemptions has been completed:

- cyclic clearing – ABC or insulated cable (all areas)
- cyclic clearing – powerlines other than ABC or insulated cable (LBRA)
- cyclic clearing – powerlines other than ABC or insulated cable (HBRA).

United Energy completed its cyclic clearing exemptions programs in 2013. The completion of these exemptions means that all trees in United Energy's area for which it is responsible should now be at the minimum regulatory clearance distance away from any conductors. This will make the United Energy region less fire-prone.

Table 43: Progress of direction and exemption programs – United Energy

Program	Measure	2014 cumulative forecast	2014 completed to date	Program target	Comments
Fitting of vibration dampers (HBRA)	Number of spans surveyed	16,296	19,613	as required	Program is 20% ahead of schedule. Not included in graph.
Fitting of armour rods (HBRA)	Number of spans surveyed	16,296	19,613	as required	Program is 20% ahead of schedule. Not included in graph.
Survey of HV spans (clearances)	Number of spans surveyed	16,296	19,613	19,602	Program 20% ahead of schedule.
Cyclic clearing – ABC or insulated cable (all areas)	Per cent of spans	100%	100%	100%	Program was completed in 2013.
Cyclic clearing – powerlines other than ABC or insulated cable (LBRA)	Per cent of spans	100%	100%	100%	Program was completed in 2013.
Cyclic clearing – powerlines other than ABC or insulated cable (HBRA)	Per cent of spans	54%	100%	100%	Program was completed in 2013.
Overhanging trees (cut) – powerlines other than ABC and insulated cables (LBRA)	Number of spans	100%	100%	100%	Program is on schedule.
Overhanging trees (cut) – powerlines other than ABC and insulated cables (HBRA)	Number of spans	100%	100%	100%	Program is on schedule.

RED	Program total to date < 90 per cent of forecast to date
GREEN	Program total to date 90-110 per cent of forecast to date
BLUE	Program total to date > 110 per cent of forecast to date

Progress on two exemptions is on target:

- overhanging trees (cut) – powerlines other than ABC and insulated cables (LBRA)
- overhanging trees (cut) – powerlines other than ABC and insulated cables (HBRA).

United Energy completed its overhanging tree programs in both LBRA and HBRA and has addressed all issues identified (303 spans in the LBRA in and 2390 spans in HBRA). As overhanging trees present an ongoing issue United Energy plans to continue assessing spans in both the HBRA and LBRA and will address any issues in a prioritised manner.

Not all trees within its area are the responsibility of United Energy. There are trees in its area that are managed by other responsible persons and these may not be maintained to be clear of the overhead lines.

ESV recommends that United Energy increase its engagement with other responsible persons (municipal councils and private property owners and occupiers) to ensure that trees that are the responsibility of those responsible persons are also compliant with the Electric Line Clearance Regulations. This will minimise the risk of United Energy's network causing a bushfire and will increase the reliability of its network.

Progress on three directions is on target:
- fitting of vibration dampers (HBRA)
- fitting of armour rods (HBRA)
- survey of HV spans.

United Energy's program is to inspect all HV spans in its HBRA and install armour rods and vibration dampers as required. Reporting is based on the number of spans that have been assessed, not the number of armour rods and/or vibration dampers installed. Armour rods and vibration dampers are only installed as required. This inspection and installation process is ahead of target. Armour rods and vibration dampers have been reported as being installed at all required locations.

United Energy is well ahead of its targets for the inspection of HV overhead lines in HBRA to determine if HV spacers are required. Eighty per cent of the network has been inspected and 1811 HV spacers have been installed.

In summary, United Energy appears to be on target to complete its direction programs in HBRA by November 2015.

H.7 SAFETY INDICATORS

ESV assesses a range of key safety indicators on an ongoing basis and requires regular reporting by each distribution business. These indicators include:
- incidents involving the public
- asset failures
- vegetation fires due to asset failure or contact
- fires on or in assets.

Each of these is discussed in detail in this section.

H.7.1 Incidents involving the public

Figure 44 shows the incidents involving the public interacting with United Energy's assets graphically and Table 44 provides the underlying data.

In 2014, United Energy reported a 10 per cent decrease in the number of incidents involving the public (from 66 in 2013 to 60 in 2014) mainly due to fewer high voltage injections.

United Energy's total incidents involving the public are primarily driven by high voltage injections, which made up 73 per cent of the total incidents involving the public in 2014. Although United Energy's high voltage injections have decreased compared to 2013, they remain relatively high at 47 per cent of all high voltage injections reported across the distribution businesses in 2014.

Pole-top fires, crossarm failures, lightning strikes and other asset failures are the main cause of high voltage injections. High voltage injections reported to ESV by United Energy during 2014 are mostly due to crossarm fires causing failure of the crossarm and subsequent contact with the lower voltage conductors. This further reinforces the recommendation in

Section H.2.2 that crossarms should be replaced based on both age and condition, and that United Energy needs to increase the rate at which it replaces crossarms.

There were seven No Go Zone incidents in 2014 (a reduction of 30 per cent from 2013). This is the lowest number of such incidents reported by United Energy since 2010. This continues the downward trend that started in 2012, and United Energy is commended for this positive result.

Unauthorised access incidents increased from five in 2013 to eight in 2014 (a 60 per cent increase). That said, the numbers of these incidents oscillate over the last four years and generally appear stable.

The numbers of reverse polarity events is low and United Energy is also commended for this result and is encouraged to continue its efforts in preventing such incidents.

High voltage injections can cause significant appliance damage, house fires and fatalities. The issues noted in Section H.2.2 regarding United Energy's management of its crossarm assets need to be addressed as a priority to ensure failures of these assets do not lead to serious safety incidents in the future.

Overall, the recent decrease in total incidents involving United Energy's assets seems to be a positive sign for community safety. There are, however, areas where additional work is required.

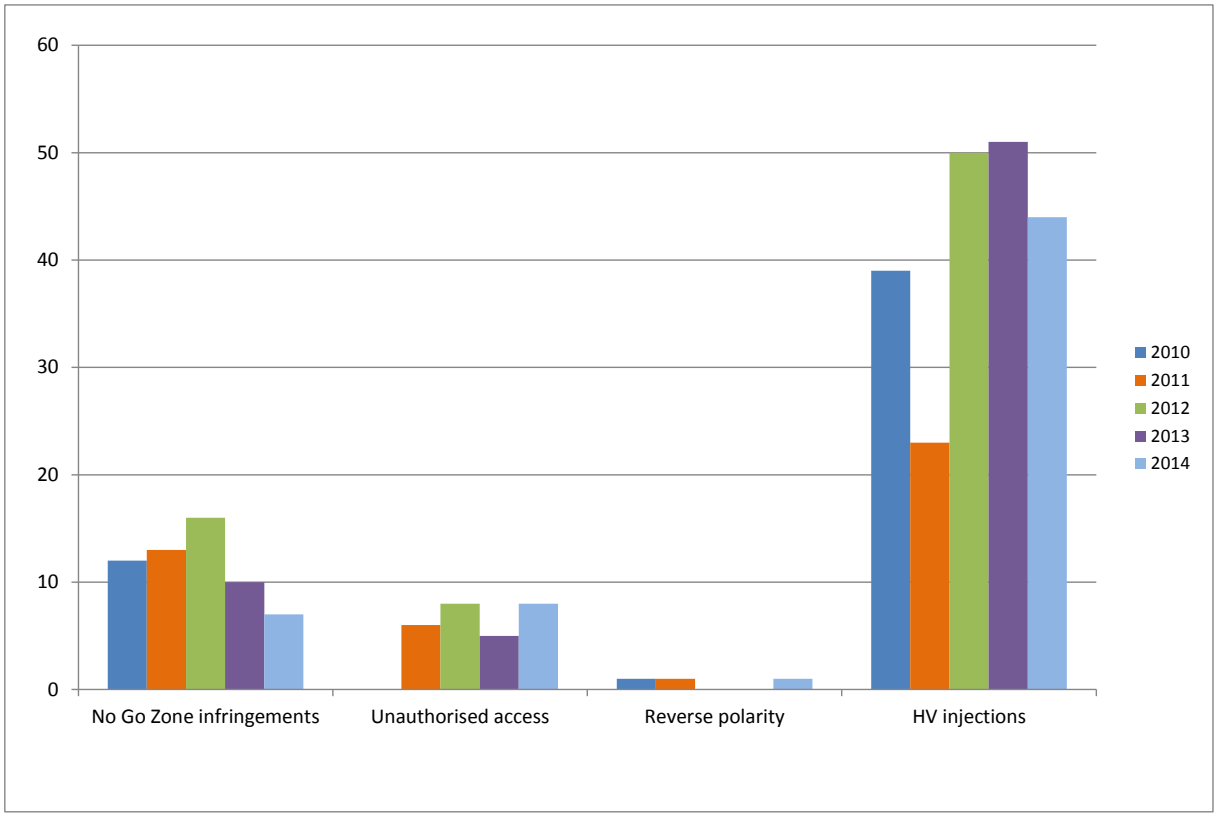

Figure 44: Safety incidents involving the public – United Energy

Table 44: Safety incidents involving the public – United Energy
n/a – not recorded

Item	Total	2010	2011	2012	2013	2014
No Go Zone infringements	**58**	12	13	16	10	7
Unauthorised access	**27**	0	6	8	5	8
Reverse polarity	**3**	1	1	0	0	1
HV injections	**207**	39	23	50	51	44
Total incidents	**295**	**52**	**43**	**74**	**66**	**60**

H.7.2 Asset failures

In 2014 United Energy reported a 23 per cent overall performance improvement in asset failures from 2013 (Figure 45 and Table 45). This is the first reduction in overall failure numbers since 2010. While this reduction is welcome, the evidence of the upward trend reversing will be if numbers continue to reduce in future years.

In 2014 United Energy reported a 40 per cent reduction in the number of crossarm failures and pole failures and a 19 per cent reduction in LV asset failures compared with 2013.

While there were fewer crossarm failures than in 2013, there is still an ongoing upward trend in such incidents over the last five years.[38] United Energy's crossarm failures also represent 32 per cent of all the crossarm failures reported across all distribution businesses in 2014. This is not proportional to the assets owned by United Energy. It therefore is an area that needs to be redressed.

While relatively stable, the number of LV asset failures remains high at 108. Together with crossarm failures, these represent 77 per cent of United Energy's total failures.

The number of conductor plus HV tie failures significantly increased from 31 in 2013 to 43 in 2014 (a 39 per cent increase). It is disappointing that there is an increasing trend in such failures over the last five years.

Pole failures and HV fuse failures both remain at relatively low levels. Pole failures seem to be stable. There may be an increase in HV fuse failure; however, the short time series does not yet warrant concern.

Even though there was a significant reduction in the number of failures of crossarms and LV assets in 2014 compared to 2013, these still remain the main assets that fail. These failures can lead to serious consequences such as bushfire, serious injury or death. ESV recommends that United Energy reviews its asset programs and addresses the root cause of these failures.

United Energy had an opportunity to address the current upward trend in crossarm failures when it set itself a significant safety program target for the EDPR period. United Energy needs to address its condition assessment practices to ensure that this upward trend is reversed (see also Section H.2.2).

[38] It should be noted that the decrease in the numbers of crossarm failure in 2014 could be due to United Energy's reclassification of failure events for 2014. This would make it appear that United Energy's performance has improved in 2014. Further discussion on this issue is provided in Section H.2.2.

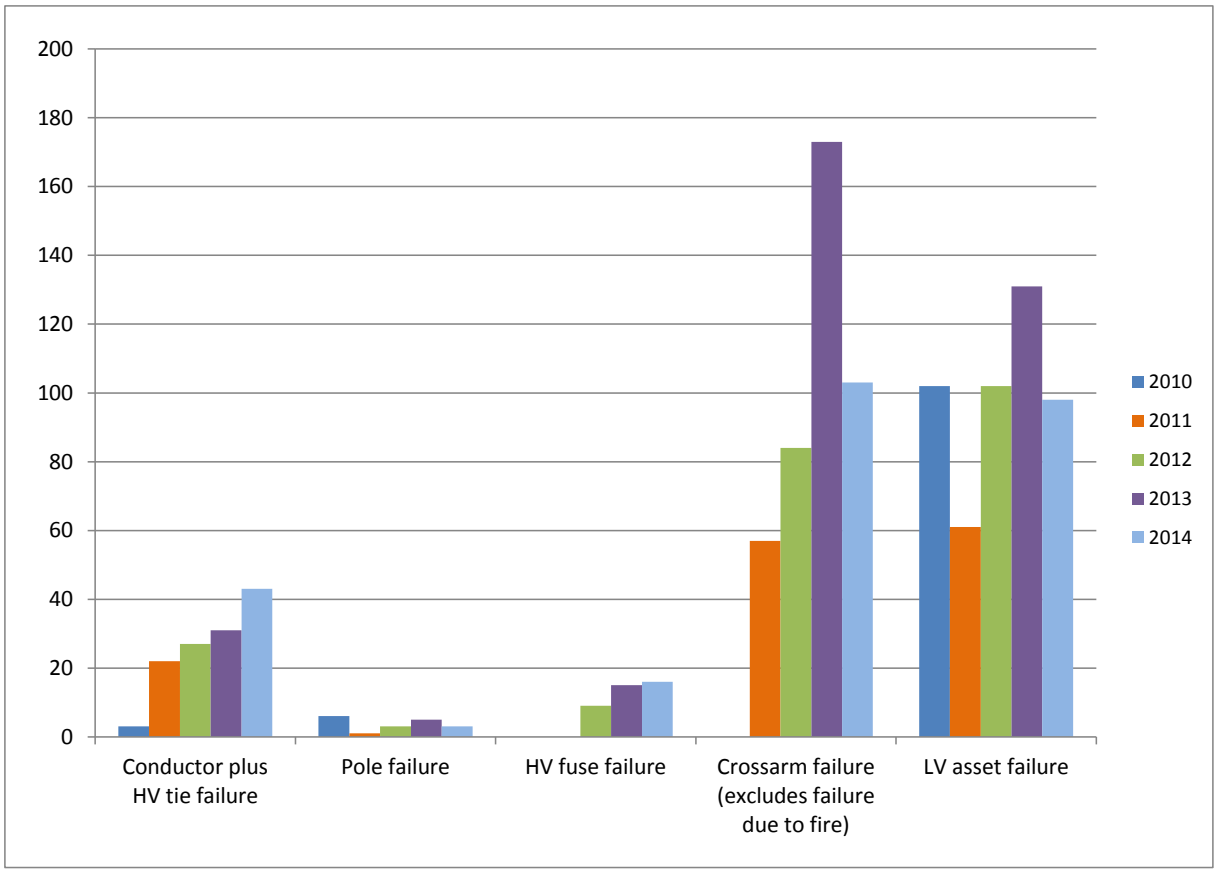

Figure 45: Asset failures by type – United Energy

Table 45: Asset failures by type – United Energy
n/a – not recorded

Item	Total	2010	2011	2012	2013	2014
Conductor plus HV tie failure	**126**	3	22	27	31	43
Pole failure	**18**	6	1	3	5	3
HV fuse failure	**39**	n/a	n/a	9	15	16
Crossarm failure (excludes failure due to fire)	**417**	n/a	57	84	173	103
LV asset failure	**502**	102	61	102	131	98
Total	**1095**	**111**	**141**	**225**	**355**	**263**

United Energy advised that previous inspection regimes had failed to identify pole-top structures that were due for replacement and some were being missed. This could have been a contributory factor to pole-top fires. United Energy asserted that, as a result of in-depth analysis of pole-top fires, it was reviewing the pole-top asset management strategy to reduce the likelihood of adverse weather initiating pole-top fires.

ESV notes that United Energy continues to rely on asset inspection to identify crossarms at risk of fire. ESV would also contend that adverse weather alone does not cause pole-top fires; such failures require a combination of commonly experienced weather conditions and

deteriorated assets. Of these factors only the latter is within the control of United Energy and should be the focus of its strategy.

ESV recommends that United Energy reviews its condition assessment practice (specifically its strategy for crossarm replacement) and demonstrates to ESV the engineering that informs the practice.

H.7.3 Vegetation fires due to asset failure or contact

Figure 46 shows the total numbers of vegetation fires due to asset failures and contact events. The detailed data are provided in Table 46 (asset failures) and Table 47 (contact events). United Energy reported a 31 per cent increase in the total number of vegetation fire starts from 39 in 2013 to 51 in 2014.

There is also an upward trend in total vegetation fires over the last four years. While undesirable, this trend does not increase significantly bushfire risk in United Energy's area due to its predominantly urban setting; however, this could still have implications for local fires and public safety.

Figure 47 and Figure 48 provide comparisons of the failure causes for asset failure fires and contact event fires respectively. These show an upward trend in fires resulting from LV asset failures, the main contributor to the upward increase in total vegetation fires. All other sources of asset-related vegetation fires are relatively stable, although fires from other assets are a significant contributor.

LV asset fires also contributed 18 out of a total of 51 asset-related fires in 2014. This represents 35 per cent of all United Energy's fire starts. LV asset fires also increased from 13 in 2013 to 18 in 2014 (a 39 per cent increase).

The root cause of LV asset failures should be investigated further so that a program to reduce the number of failures can be implemented.

Further assessment of other asset failures should also be undertaken to better understand the assets within this category and the root causes of these failures.

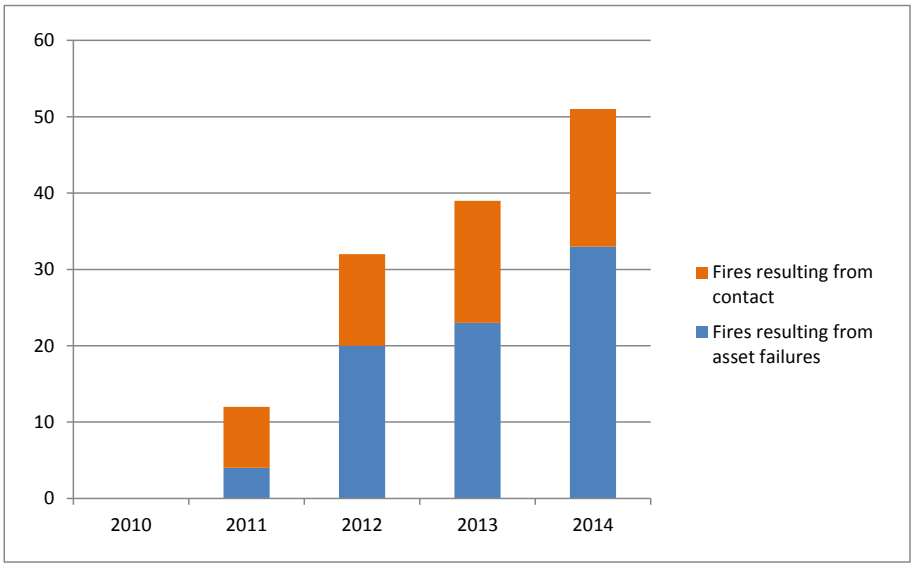

Figure 46: Vegetation fires due to asset failures and contact – United Energy
Note: There was no requirement to report on vegetation fires in 2010

Table 46: Asset failures resulting in vegetation fires – United Energy
n/a – not recorded

Cause of failure	Total	2011	2012	2013	2014
Pole and/or crossarm failure	**1**	0	0	1	0
Pole and/or crossarm fire	**5**	0	1	0	4
Oil-filled plant	**1**	1	0	0	0
HV fuse	**3**	1	1	1	0
LV asset failure	**39**	n/a	8	13	18
Other assets (e.g. street lights, surge arresters, etc.)	**31**	2	10	8	11
Total fires – asset failures	**80**	**4**	**20**	**23**	**33**

Table 47: Vegetation fires resulting from contact with assets – United Energy
n/a – not recorded

Cause of failure	Total	2011	2012	2013	2014
Animals	**17**	0	4	4	5
Third party (e.g. vehicle, vandalism)	**8**	n/a	0	4	4
Tree contact	**25**	n/a	8	8	9
Other causes	**8**	8	0	0	0
Total fires - contact	**54**	**8**	**12**	**16**	**18**

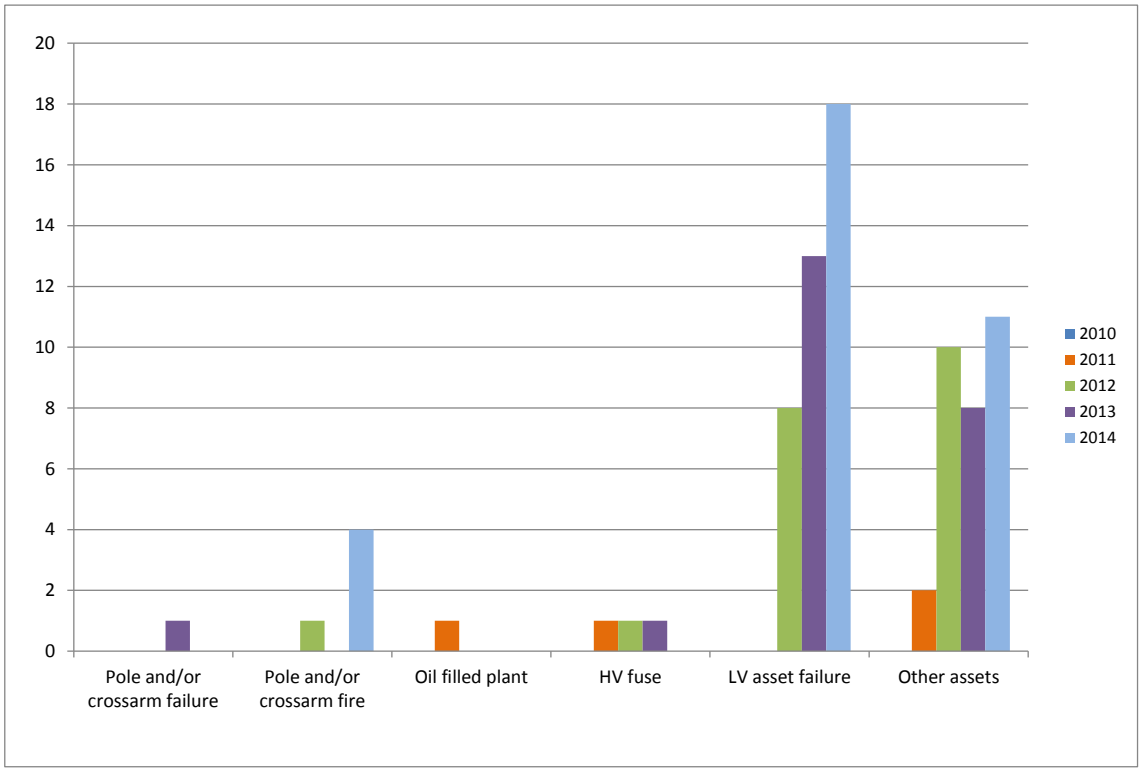

Figure 47: Vegetation fires resulting from asset failures – United Energy

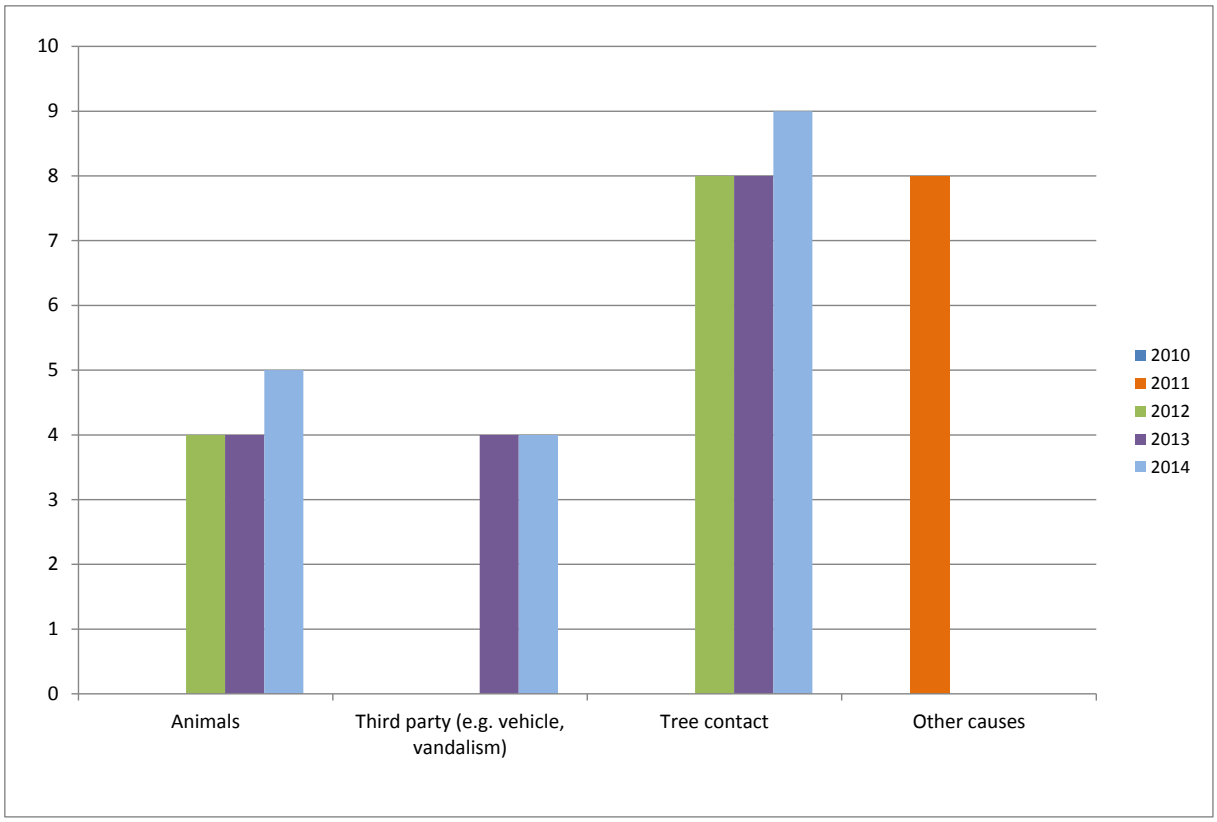

Figure 48: Contact with powerlines resulting in vegetation fires – United Energy

H.7.4 Fires on or in assets

Table 48 details the fires arising on or in United Energy's assets. In 2014 United Energy reported 163 fire starts. This was a significant (87 per cent) increase from 2013.

Figure 49 demonstrates the trends in the assets where these fires arise.

The number of fires from oil-filled plant and HV fuses remains stable and the fires arising on or in other assets are declining.

The fires associated with LV equipment are oscillating and currently increasing. No reason has been provided for the 244 per cent increase in LV fires between 2013 and 2014.

The major issue, as noted elsewhere in this appendix, is the significant escalation in issues associated with United Energy's poles and crossarms. Unlike the previous discussions where United Energy noted that crossarm failures may have been overestimated, the presence of fire cannot be explained away. This is a worrying trend that needs to be urgently addressed. Pole and crossarm fires (pole-top fires) represent 79 per cent of United Energy fires on or in assets in 2014. Addressing this issue would therefore significantly contribute to improvements in overall performance in this area.

Consistent with Sections H.2.2 and H.7.2, ESV recommends that United Energy reassess its decision not to use age as a criterion for crossarm replacement. Clearly, condition assessment by itself is not addressing the risk of crossarm failure and pole-top fires. This needs to be urgently addressed in order to reverse the upward trends in such failure and fire

events. The rate at which crossarms are replaced also needs to be increased in order to remove ageing and deteriorated assets from service before they fail or catch fire.

United Energy should also analyse the root cause of LV asset failures and implement a program to address the failure modes.

Table 48: Fires on or in assets – United Energy
n/a – not recorded

Item	Total	2011	2012	2013	2014
Pole and crossarm fire	**241**	6	30	76	129
Oil-filled plant	**2**	1	0	1	0
HV fuse	**3**	1	1	0	1
LV equipment	**55**	n/a	15	9	31
Other assets	**16**	7	6	1	2
Total fires	**317**	**15**	**52**	**87**	**163**

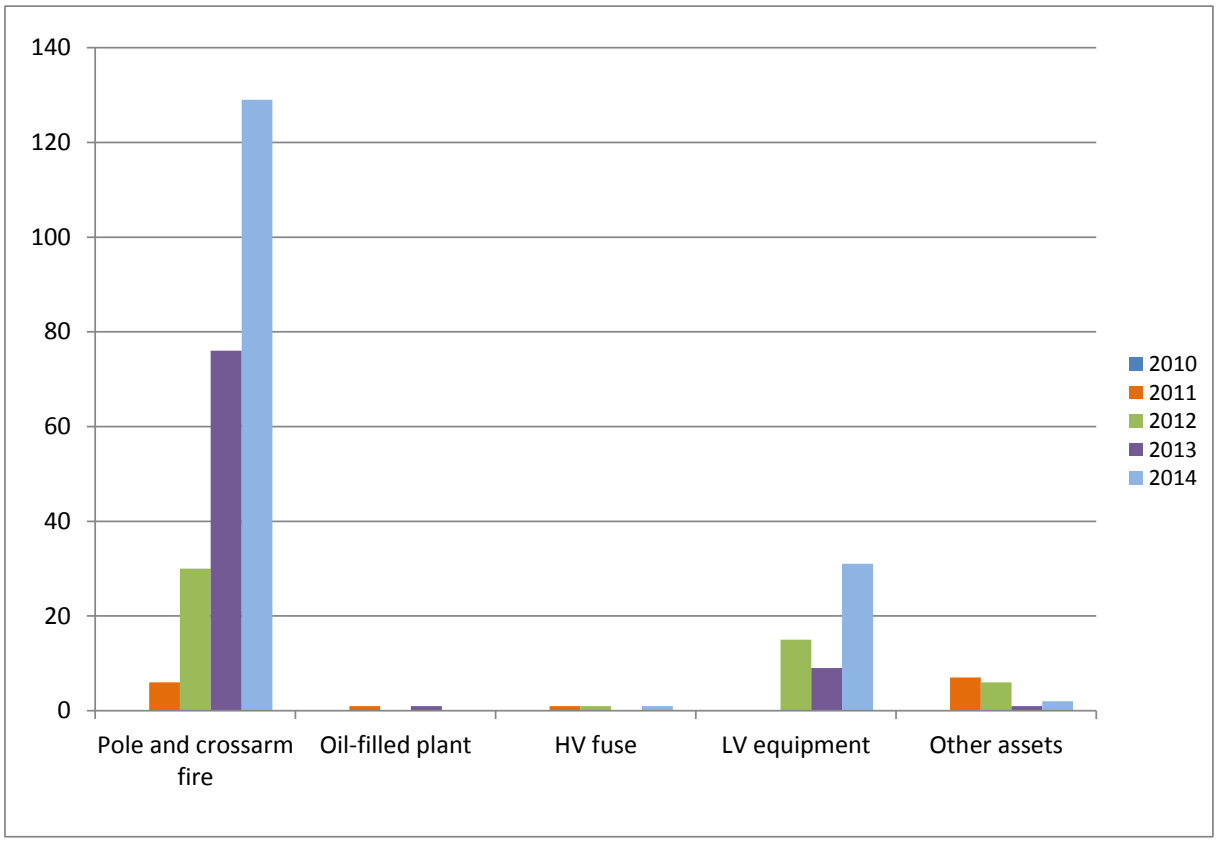

Figure 49: Fires on or in assets – United Energy