ABN 85 082 464 622

MANAGEMENT PLAN

BUSHFIRE MITIGATION (ASSET PROGRAMS)

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1. PURPOSE

The purpose of this management plan is to:

- Detail Aurora's approach to the asset component of bushfire mitigation, as reflected through legislative and regulatory obligations, the Network Management Strategy and Bushfire Mitigation Management Strategy;
- Outline the asset component of the Bushfire Mitigation Program for the regulatory period 2012/13 – 2016/17; and
- Forecast expenditure, including the basis upon which these forecasts are derived.

2. OBJECTIVES

The objectives of the Bushfire Mitigation Management Strategy are to:

1. Ensure compliance with regulatory requirements, in particular Chapter 8A of the TEC, ensuring the minimum standards and practices are delivered;
2. Ensure appropriate risk mitigation measures are in place to minimise the likelihood of distribution assets starting fires, including standards, reporting and rectification programs;
3. Deliver an annual bushfire mitigation program to identify and rectify any risks through each fire season, including working closely with our customers; and
4. Ensure activities undertaken by Aurora staff and contractors, and by the operation of the network minimise the likelihood of distribution assets starting fires.

3. SCOPE

This management plan covers fire mitigation activities associated with preventing distribution network assets from starting fires.

This plan does not cover mitigation associated with owning and operating distribution network assets, vegetation management and third party fire starts beyond Aurora's control. Refer to Management Plan 2011: Bushfire Mitigation (General Programs) (reference 1) for fire mitigation programs associated with these activities.

4. BACKGROUND

Aurora Energy is Tasmania's largest electricity distributor and retailer. Aurora manages a network of more than 22,000 km of high and low voltage overhead powerlines, upon which Tasmanian's have a very high dependency for contemporary living, wellbeing and business.

Aurora's distribution network supplies electricity to over 277,000 customer installations across 68,000 square kilometres in Tasmania. Over 90% of the distribution network consists of bare overhead high voltage (HV) and low voltage (LV) conductor, which cross a variety of terrains varying from built up urban areas through to cultivated farm land and bush.

The distribution network has approximately 15,000 km of overhead high voltage powerlines, 5,000km of overhead low voltage powerlines, 30,000 ground and pole mounted substations and 220,000 poles. There are also approximately 40,000 privately owned poles that Aurora has a duty of care to inspect.

Like all overhead electricity distribution networks in fire prone countries like Australia, Aurora's network assets have varying degrees of vulnerability to bushfires.

Further, in south-eastern Australia, electricity distribution network assets have in the past been implicated in causing some major fire events during severe weather conditions (notably the recent Black Saturday bushfires in Victoria), with most significant public safety, litigation, financial, and reputation risks arising.

Aurora is responsible for implementing a Bushfire Mitigation Management Strategy that ensures the risks from electricity distribution in relation to bushfire are mitigated in a way that is cost effective, and consistent with industry standards.

In addition, following the Victorian Bushfire Royal Commission outcomes Aurora is implementing additional systems and processes to support the strategy, and implementation of the plan.

In Tasmania, bushfires usually occur during the warmer months from November through to mid May due to the dry weather conditions during summer and autumn. They are unusual during the winter months, however, major bushfires have occurred as early as October.

Although electricity assets start less than 4% of all bushfires (reference 2) Aurora acknowledges that damage by bushfire started by Aurora's assets or activities is one its highest business risks due to the potential consequences and repercussions (reference 3).

Aurora also recognises that there is the potential to lose a significant number of its assets during a bushfire due to the spread of the assets across the state. An event of this kind would severely impact Aurora's ability to provide continuous electricity supply, which has serious consequences for Aurora and for the fire management capability of the emergency services and the safety of the public.

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5.2 Unknown Causes

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On average, Aurora records over 2000 outages every year where the cause of outage is unknown, nearly twenty five per cent of all of Aurora's unplanned outages.

Unknown causes of fire starts are considered a high fire risk to Aurora.

5.3 Insulator Failures

Insulators provide an insulated means of attaching the conductors to the cross-arm and pole. The type of insulator, size and make are dependent on the voltage of the conductors, the design requirements of the overhead lines and various external factors such as pollution, weather conditions and geographic conditions.

Insulators are predominantly porcelain or glass and bolt to the cross-arm or structure with a steel pin/bolt.

Insulators are susceptible to cracking, chipping and breaking due to vandalism and weathering caused by vandalism, pollution (salt, dirt mineral dust) and weather. When this occurs, the insulating properties and capabilities of the insulator are reduced. This increases the potential for current to track from the insulator to the ground, via the cross-arm and pole.

Pollution build-up due to salt, dirt or mineral dust can also cause tracking across insulators. Current tracking poses a risk to public safety and has the potential to start pole top fires.

On average, Aurora records approximately 100 instances of insulator failures every year.

Insulator failures are considered as a medium fire risk to Aurora.

5.4 HV Switchgear

Overhead switchgear is installed to provide isolation or disconnection of sections of HV or LV overhead line for the purposes of maintenance and the management of load and for protection purposes.

As a general rule, the overhead switchgear is located on either side of significant loads to allow for operational switching and network management activities, such as transferring loads between HV feeders or isolating a faulted section of network.

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5.4.1 HV Fuses

HV fuses are used in Aurora's distribution system to protect spur lines on feeders and pole mounted distribution transformers. The main types of HV fuses in the system are Expulsion Drop Out (EDO) fuses.

An EDO unit (Figure 4) consists of a fibreglass fuse holder or carrier, a fuse element and a porcelain mount. The fuse holder consists of a tube, the lower casting and the tube top with a pull ring. The mount consists of an insulator, a bracket, the top and bottom terminals, bottom hinge and top contacts.

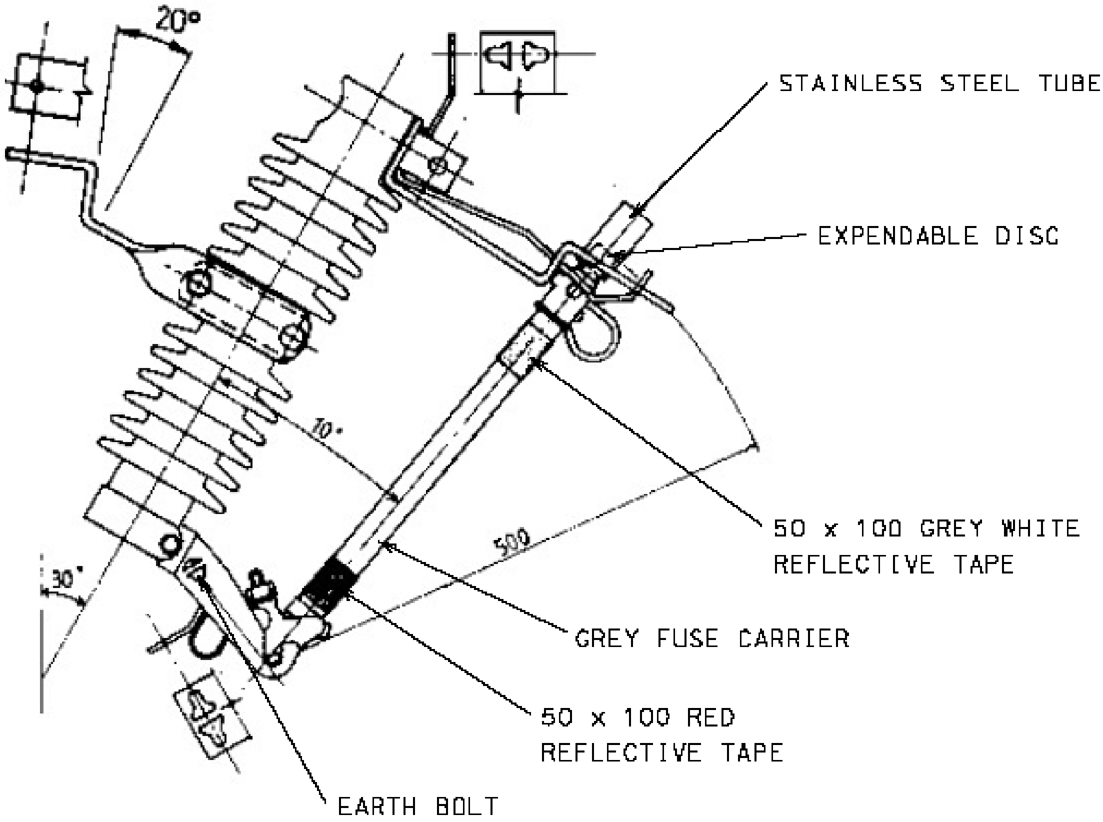

Figure 4: Expulsion Drop Out (EDO) Fuse

Under fault or overload conditions, the fuse element in the fuse holder will melt. This causes the fuse holder to drop down and interrupt supply, sectionalising the fault and protecting the spur or transformer. The hanging fuse holder provides a clear visual indicator that the fuse has operated.

When EDO fuses operate, there is an expulsion of hot plasma and particles from the base of the fuse tube, which has the potential to start a fire. Whilst spark catchers are available on the market, Aurora's experience is that these do little to mitigate the risk of fire starts.

As the tube of an EDO fuse weathers due to exposure to the elements the internal fibres to swell. This may cause the fusible link to stick preventing it from releasing following a downstream fault, that is the fuse switch does not drop out as designed. This results in electrical tracking inside the tube, which creates heat that in turn, results in the fuse tube catching fire, burning in half, dropping to the ground and potentially starting a fire. This is known as an EDO Hang Up.

On average, Aurora records approximately 200 outages where HV fuses operate as protection every year.

HV fuse related fire starts are considered a high fire risk to Aurora.

5.4.2 HV Loops and Links

HV loops and links are used to enable pieces of equipment to be isolated from the rest of the system. They provide no protection against fault currents and can burn out due to overloaded circuits and under fault conditions. This can lead to molten bits of metal dropping to the ground or a pole top fire.

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HV loops and links are considered a medium fire risk to Aurora.

5.4.3 HV Leads

HV leads are used for connections on pole mounted distribution transformers. HV leads can burn out and cause pole top fires due to overloaded circuits, under fault conditions or if the HV lead becomes loose and rests against the pole or crossarm.

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HV leads are considered a low fire risk to Aurora.

5.4.4 Air Break Switches (ABS)

ABS are used to provide isolation and disconnection of sections of HV or LV overhead line for the purposes of maintenance and the management of load.

ABS are three phase devices and correct adjustment of the operating mechanism is required to ensure correct opening and closing of contacts on all three phases. Pole shrinkage and thus loose fitting crossarms and hardware result in movement, misalignment of contacts and resultant arcing leading to pole top fires.

The number of ABS failures per year is difficult to ascertain from Aurora's outage and incident records however, Aurora records approximately five requests per year to replace ABS's per year due to condition.

5.5 Vegetation

Vegetation inside and outside of Aurora's maintained clearance zone causes numerous outages on Aurora's distribution network each year. Vegetation that grows within the clearance zone can contact Aurora's overhead powerlines, starting a vegetation fire, and vegetation outside the clearance zone can be displaced by strong winds, causing large trees to fall onto the overhead powerlines and blow limbs and bark onto the lines that can then ignite or bring the lines down.

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On average, Aurora records approximately 500 instances of vegetation related outages every year.

Vegetation related fire starts are considered a high fire risk to Aurora due to the types of asset failures that it causes.

5.6 Weather

Aurora's distribution network is strongly affected by weather events across the state. Storms, lightning strikes, floods and strong winds have been known to cause outages on the network.

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On average, Aurora records over 1000 incidents of weather related outages every year.

Weather related outages are considered a high fire risk to Aurora due to the types of asset failures that it causes.

5.7 Clashing Conductors

Clashing of bare overhead conductors can result in molten metal falling to the ground with the potential to start a fire.

The conductor separation required to avoid clashing of conductors is dependant on:

1. The type of conductor;
2. The span length;
3. The conductor sag;
4. The size of the cross-arm; and
5. The pole top configuration.

Slack spans, uneven sags and span lengths that are too long for the pole top configuration can result in result in poor conductor spacing.

Previous design and construction standards allowed for shorter sized cross-arms to be installed in the system. With the advent of newer, larger conductors that are now being used in the system, these cross-arms no longer provide adequate horizontal clearances between the conductors.

Vertical LV construction is particularly sensitive to variations in spacing and span length. An error in either of these elements can result in poor vertical conductor spacing.

Leaning poles also increase the risk of clashing conductors, as the angle of the leaning pole can detrimentally affect the spacing between the conductors.

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Clashing conductors are considered a high fire risk to Aurora.

5.8 Conductor Failure

Overhead conductors in poor mechanical condition increase the risk of conductor failure, which can present a fire risk as a result in the arcing of a live conductor on the ground.

The mechanical condition of conductors is affected by:

- Weathering;
- Geographic location;
- Aeolian vibration;
- Fault level; and
- Stringing tension.

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No. 8 gauge steel and 7/.044 and 7/.048 copper HV conductors do not meet the above requirements and are considered as substandard.

Live line clamps also contribute to the mechanical failure of conductors (Section 5.16).

Substandard ground clearances of Aurora's overhead lines can also lead to conductor failure due to third party contact with Aurora's assets e.g. excavators, irrigators, etc.

Vegetation, conductor tie failures, insulator failures, cross arm failures, poles failures and birds flying into the lines can also bring down Aurora's overhead conductors.

On average, Aurora records over 100 outages caused by the mechanical failure of conductors every year. This excludes conductor failures caused by other factors such as vegetation, other asset failures, birds and animals and external parties.

Conductor failure is considered a high fire risk to Aurora.

5.9 Conductor Tie Failure

Bare overhead conductors are attached to insulators, on top of poles or structures, using conductor ties (ties) that are generally the same material as the conductor.

A broken tie will cause the conductor to come off the insulator and potentially rest against the cross-arm or pole, swing about in the wind or potentially come in contact with the ground.

If the conductor comes into contact with the pole or cross-arm on a conductive pole the protection will operate and interrupt supply. However, if the conductor comes into contact with the pole or cross-arm on a wood pole, the protection may not operate (because of the high resistance of the pole restricting the fault current) and may lead to the pole top or any other combustible materials nearby, such as vegetation, catching fire.

If the conductor comes into contact with vegetation or the ground, again the protection may not operate, depending on the fault current, and may lead to vegetation catching fire.

Broken ties are more common in wind prone areas due to the vibration impact of the wind on the conductors and ties at the insulators.

Conductor tie failure is considered a medium fire risk to Aurora.

5.10 LV Switchgear

5.10.1 LV Links

LV links allow safe work on the assets by providing an isolation point at transformers but provide no protection for LV circuits. In the event of a fault on the LV network, a circuit with only LV links will be unable to clear the fault, thus posing a risk of equipment damage, fire start and public safety.

Previous design and construction standards did not require the installation of LV fuses on pole mounted transformers. As a result there are a number of pole mounted transformers with only LV links installed, relying on the HV fuse to provide protection for an LV fault.

In many circumstances, the HV protection is unlikely to detect an LV fault, which may result in conductors melting and falling to the ground, dropping bits of molten metal in the process.

Further details of this issue can be found in the LV Fuse Reach Management Plan (reference 5).

LV connections are considered a high fire risk to Aurora.

5.10.2 LV Fuses

LV fuses are used at the transformer to protect LV circuits from faults on the LV network. Previous design and construction standards have resulted in a number of situations where LV circuits are inadequately protected due to:

1. No LV fuses installed at the transformer;
2. Inadequately sized fuses for the fault level of the circuit resulting in the fuses not operating;
3. Circuits too long so that the fault level at the end of the circuit is not large enough for the fuses to operate.

In the event of a fault and the LV fuses not operating, the conductors may melt and fall to the ground, dropping bits of molten metal in the process.

Further details of this issue can be found in the LV Fuse Reach Management Plan (reference 5).

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LV protection systems are considered a high fire risk to Aurora.

5.11 LV Service Failure

Overloaded LV services and LV services in poor mechanical condition or with poor LV connections increase the risk of LV service failure, which can present a fire risk as a result of the service burning or melting and in arcing of the live service on the ground.

LV services are the final connection of Aurora's customers to the distribution network. They are low complexity, high volume assets that have the potential to adversly effect Aurora performance if not managed correctly.

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LV service failure is considered a low fire risk to Aurora.

5.12 Birds and Animals

The separation distances between conductors and pole top hardware are generally adequate to prevent current tracking down the pole to the ground. However, birds and animals occasionally bridge this gap, resulting in phase-to-phase contact of the conductors and the electrocution and potential combustion of the animal.

Birds can also cause conductors to clash due to mid span collisions with the overhead conductors near waterways.

Figure 7 shows the breakdown of fires caused by birds and animals.

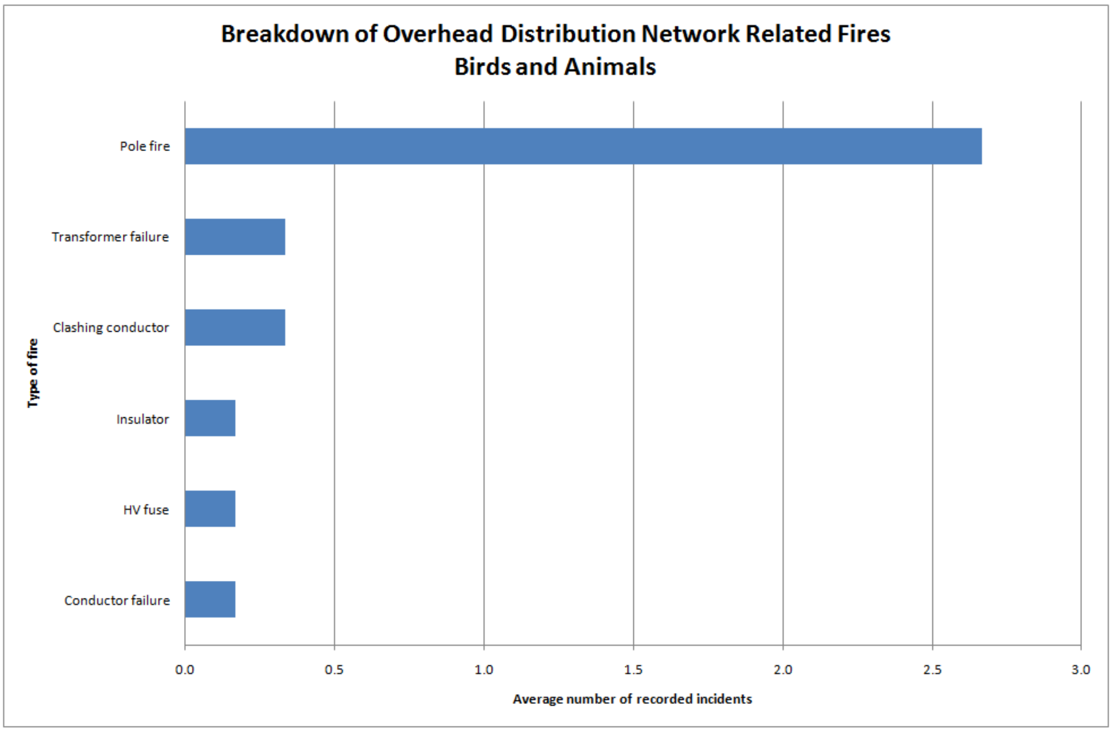

Figure 7: Breakdown of Overhead Distribution Network Related Fires caused by Birds and Animals

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Birds and animals are considered a medium fire risk to Aurora.

5.13 Transformer Failures

Transformers can fail in service due to overload, lightning strikes, internal failures, external asset failures, such as break down of insulation, and poor condition. Sometimes these failures can be quite dramatic with the transformer catching fire.

Pole mounted transformers are generally used to step up or step down voltages within the distribution system to delivery a usable supply to customers. Pole mounted transformers are mounted on a single or double pole structures. The physical size and weight of the unit limits pole mounted transformers to a maximum size of 500 kVA. Aurora has over 28,000 pole mounted transformers in it's overhead distribution network.

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Transformer failures are considered a low fire risk to Aurora.

5.14 ABC Fuse/Junction Box Failures

Thermal runaway in ABC fuses and junction boxes can lead to pole top fires.

ABC is an insulated overhead conductor of either two or three wire bundled or twisted configuration. Both HV and LV ABC are installed within the distribution system.

LV ABC is used extensively for low voltage distribution and overhead servicing to customer installations as it is the easiest and most cost effective conductor to install of the conductors presently in used within the industry.

ABC junction boxes are installed on poles where there are more than 8 LV ABC services requiring connection.

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ABC fuse and junction box failures are considered a low fire risk to Aurora.

5.15 Service Fuses and Metering Asset

Service fuses and metering assets provide protection and services to the customer's home. Service fuses can be mounted on poles, on the fascia of the customer's building or, in the case of an underground system, in a distribution turret. Metering assets are usually mounted on customer's building and consist of a mains connection board, fuses and switches.

Service fuses and metering assets can fail due to condition and overload, which can result in the assets melting and catching fire. Sicame fuses are a type of service fuse that Aurora has identified as a known fire start.

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Service fuses and metering asset failures are considered a low fire risk to Aurora.

5.16 HV Fittings

HV fittings are used to connect Aurora's assets to the overhead lines.

Live line clamps are known to cause conductor failure due to arcing at the point of connection of the clamp, causing erosion of individual strands of the conductors that leads to a reduction in strength.

In the past, live line clamps were used to connect new transformers directly to HV feeders without requiring an outage. This connection was intended to be a temporary connection and to be changed to a 'D-clamp' at the next planned outage. However, records were not well kept of installations connected using live line clamps and many were not changed to D-clamps.

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HV fittings are considered a medium fire risk to Aurora.

5.17 Crossarms

Cross arms are used to connect the insulators to the structure and provide adequate clearance between conductors.

Crossarm failures can occur due to shrinkage of the pole causing crossarms to become loose, loosening or corrosion of the bolt holding the crossarm or crossarm straps in place and other asset failures such as conductors failing and resting on the crossarm.

Crossarm failures can result in the pole top hardware become dislodged, pole top fires due to conductors coming off the insulators and conductor clashing as the clearances between the conductors reduces with the crossarm rotation on the pole.

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Crossarm failures are considered a low fire risk to Aurora.

5.18 Structures and Structural Supports

Structures provide support, insulation and adequate clearances between the overhead conductors, overhead switchgear and pole mounted transformers and the ground, vegetation and building infrastructure.

Failure of structures, such as leaning poles or broken poles, and structural supports, such as stays and stakes, can result in clearance issues with the overhead conductors, damage to the overhead assets and overhead assets falling to the ground.

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Structural related failures are considered a low fire risk to Aurora.

5.19 Road Light Fittings

Road lighting provides a lit environment for the safe movement of vehicular and pedestrian traffic during hours of darkness and to discourage illegal acts.

Road light fittings fail due to poor condition and degradation, vandalism, accidents, lightning and other asset failures.

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Road light fitting failures are considered a low fire risk to Aurora.

6. FACTORS INFLUENCING ASSET MANAGEMENT STRATEGIES

6.1 Minimise Cost of Supply to the Customer

- Ensuring cost effective trade-offs are made between pro-active and reactive maintenance practices
- Undertaking maintenance activities that cost effectively ensure a reasonable service life is achieved from the asset;
- Capturing adequate information on the assets to facilitate informed decision making; and
- Pursuing more cost effective options to replacements, and
- Ensuring all risks are identified and have adequate management plans integrated into the business' practices.

6.2 Maintaining Network Performance

- Aurora's asset bushfire mitigation programs are not influenced by the need to maintain network performance.

6.3 Managing Business Operating Risks

- Ensuring assets do not start a fire in identified high fire risk areas; and
- Ensuring adequate inspections are undertaken to minimise risk of assets failing in a manner that may start a fire.

6.4 Complying with Regulatory, Contractual and Legal Responsibilities

6.4.1 Changes to the Occupational Licensing Act 2005

Changes to the Occupational Licensing Act 2005 that became effective on 19 January 2009 require Aurora to be compliant with C(b)1 (reference 12) in the construction and operation of its distribution network. Before this date, C(b)1 was taken as standard industry practice for design and construction of distribution networks in Australia.

6.4.2 Electricity Supply Industry Act 1995

The Electricity Supply Industry (ESI) Act exists to:

1. Promote efficiency and competition in the electricity supply industry;
2. Establish and maintain a safe and efficient system of electricity generation, transmission, distribution and supply;
3. Establish and enforce proper standards of safety, security, reliability and quality in the electricity supply industry; and
4. Protect the interests of consumers of electricity.

The Act covers safety aspects at a fairly high level and is implicit regarding bushfire risks.

6.5 Electricity Industry Safety and Administration Act 1997

The Electricity Industry Safety and Administration (EIS&A) Act exists to establish safety standards for electrical articles, to provide for the investigation of accidents in the electricity industry and for related purposes.

The EIS&A Act covers:

1. Powers of entry and inspection;
2. Powers to order rectification;
3. Powers to order disconnection; and
4. Emergency powers.

6.6 The Tasmanian Electricity Code (TEC)

The Tasmanian Electricity Code (TEC) provides, inter alia, a statement of the relevant technical standards of the electricity supply industry, an access regime to facilitate new entry, guidance on price setting methodologies, a means of resolving disputes that may arise and establishes advisory committees to assist the Regulator. There has been on-going development and refinement of the Code to ensure that it best meets the needs of the Tasmanian electricity supply industry and customers.

7. MANAGEMENT PLAN

7.1 Preventative Maintenance Programs

7.1.1 Routine Line Inspection

Inspection of overhead lines for component and vegetation defects is undertaken every 3.5 years in conjunction with routine pole inspections.

Network Procedure NP R AM 03 Identification and Management of Overhead Line Defects (reference 6) describes defect-reporting and defect-management procedures for asset component defects and vegetation defects.

The procedure covers the identification, recording, assigning of priorities, timeframes for repair and management of the asset component and vegetation defects on all overhead powerlines throughout the state.

Of particular importance to fire mitigation are the following reportable defects:

1. Faulty possum guard;
2. Leaning/bending pole;
3. HV Insulator damage;
4. LV insulator pin;

5. Loose or faulty stay;
6. EDO – rusty fittings;
7. EDO – damaged tube;
8. Conductor – burnt midspan;
9. Broken or damaged conductor;
10. Vegetation touching HV;
11. Vegetation near HV;
12. Live Line Clamp;
13. Tie damage;
14. Ground clearance;
15. LV spreader broken or loose;
16. Cross-arm decayed; and
17. Cross-arm straps loose or disconnected.

In addition to routine line inspections, Aurora's Fault/Call Centre receives ad hoc asset and vegetation defect reports from employees and the public that are managed as per the defect priority in NP R AM 03.

More details of this program can be found in Management Plan 2011: Overhead System and Structures (reference 8).

7.1.2 Pre-Fire Season Asset Inspection Program

As the pole inspection process is focussed on the area immediately surrounding the pole and does not include a mid-span inspection, a specific fire mitigation asset inspection is undertaken annually.

The inspection is also undertaken to specifically target assets that are recognised fire start risks that may have been given a lower priority in the routine line inspection and to identify any asset component defects that may have occurred since the last routine inspection cycle

This inspection is undertaken by specialised staff and focuses on asset issues known to contribute to fire starts. These inspections feed into the fire mitigation asset repair and replacement programs.

Aurora has over 14,000 kilometres of overhead HV lines in very high and high fire danger areas. Areas are selected for inspection based on the following factors:

1. The number and priority of asset defects remaining from previous fire mitigation programs;
2. The date of the last inspection in an area;
3. The established fire and weather patterns of an area;
4. The rainfall of an area;

5. The length of the fire season;
6. The topography of an area;
7. The type of vegetation in an area;
8. The value of the assets in an area;
9. The impact on customers of losing the assets in an area;
10. Advice from the Tasmanian Fire Service;
11. The number of protection operations in an area;
12. The number and types of asset failures in an area; and
13. The previous fire history an area.

The number of areas selected for inspection varies from year to year based on the above factors and the financial and resource constraints to undertake the inspection and repair of defects. The 10/11 pre-fire season inspection program covered 1,600 kilometres of overhead line.

The types of asset component defects that are targeted are:

- Long spans;
- Slack spans;
- LV links on pole mounted transformers;
- Vertical LV conductor;
- Substandard condition:
  - Conductors;
  - Conductor ties;
  - HV and LV fittings;
  - HV and LV connections;
  - HV and LV fuses;
  - HV and LV switchgear;
  - Insulators;
  - Cross-arms and cross-arm bolts; and
  - Structural supports.

Pre-fire season asset inspections are undertaken at the end of a fire season in preparation for the next fire season.

7.1.3 Audits of Work Completed

Aurora undertakes an audit of the works completed as part of the fire mitigation program to ensure that the defects have been appropriately addressed prior to the bushfire season.

Aurora's internal Auditing and Inspection team undertake an initial audit of a percentage of the works to determine if further inspection is required. If the defects are completed to the appropriate standard and within the required time frames then no further action is taken.

If the defects are still in Aurora's system or the defect has not been adequately addressed, an incident is raised in Aurora's incident management system for Aurora's Network Division to investigate and a further audit is undertaken to determine the extent of the issue.

7.2 Corrective Maintenance

7.2.1 General Asset Repair Program

Aurora's general asset repair program covers the repair of minor defects that have been identified and have the potential to cause asset failure in the future or shorten the expected life of the asset. Public risk and reliability are the main drivers.

The majority of these defects are reported through the routine line inspection program and include minor work involving asset repair such as refixing loose material, replacing possum guards, repairing operating platforms, etc.

More details of this program can be found in NW#-*30161322 Overhead System and Structures Management Plan* (reference 8).

7.2.2 Fire Mitigation Asset Repair Program

The fire mitigation asset repair program exists to undertake repairs of minor asset component defects that pose a fire start risk outside of Aurora's standard defect system. A separate program is required due to the different natures of the programs and their prioritisation of defects and the time frames for repair.

For example, HV EDO fuses with rusty fittings or a damaged fuse tube with burn marks and tracking are classified a priority 4 defect by Aurora's standard defect repair program. Priority 4 means that the defect is routine and should be actioned within 4 months however, this is not a guarantee due to the competing importance of defects within the defect pool.

As part of Aurora's bushfire mitigation programs HV EDO fuses with rusty fittings or damaged fuse tubes identified in very high and high fire danger areas are classified as a priority 1 and must be replaced prior to the start of the bushfire season.

All priority 1 defects identified as part of the pre-fire season asset inspection programs must be repaired prior to the start of the bushfire season.

The repair of minor asset component defects includes:

1. Re-tensioning of slack or uneven spans and spans with low ground clearance as identified by asset inspectors through:
   a. The use of height sticks to measure the ground clearances;
   b. Assessment of the span length and pole top configuration of the cross arm and insulators; and
   c. Evidence of clashing (melted bits of conductor on the line).
2. Installation of mid-span spacers on bare LV spans exceeding 65 m in length as identified during asset inspection programs;
3. Tightening of any loose connections or bolts on the pole and pole top hardware; and
4. Minor repairs of any pole top and overhead defects that may cause fire starts.

Larger defects are rectified under the fire mitigation asset replacement programs (refer Section 7.3). All defects must be repaired by the 31st of October of that year.

7.3 Asset Replacement

7.3.1 General Asset Repair and Asset Replacement Programs

Aurora supplements its targeted fire mitigation programs, which cover the designated high fire risk areas only, with other general asset repair and replacement programs. These programs include:

- Conductor replacement due to safety and condition;
- Insulator washing and replacements based on condition;
- Live line clamp replacements;
- Switchgear replacements due to condition;
- LV network protection and reconfiguration;
- Conductor clearance repairs;
- Wildlife mitigation on pole top hardware; and
- Transformer replacements due to condition.

More details of these programs can be found in NW#-*30161322 Overhead System and Structures Management Plan* (reference 8).

7.3.2 Replace EDO Fuse Tube in Very High and High Fire Danger Areas

The aim of this program is to address the fire start issues associated with EDO fuse tubes due to incorrect operation of the devices.

The aim of this program is to ensure that by 2020 there are no EDO fuse tubes in the system that are greater than ten years old. Ten years was chosen as the preliminary as set life of the fuse tubes for replacement however, condition monitoring of new tubes will be undertaken to evaluate the legitimacy and effectiveness of a ten year replacement program.

The initial volumes for this program are:

1. Up to 150 sites per year in very high fire danger areas; and
2. Up to 260 sites per year in high fire danger areas.

The program is prioritised so that higher risk sites, such as transformers on the main feeder trunk, will be replaced first.

Replacements at this rate will not remove all EDO fuses in high fire danger areas by 2020 however, it is anticipated that this program will be accelerated in the future depending on the results of condition monitoring. This program does not include EDOs outside fire danger areas.

7.3.3 Replace EDO with Fire Safe Alternatives in Very High and High Fire Danger Areas

The aim of this program is to replace EDOs with fire safe alternatives, such as boric acid fuses, to reduce the risk of fire start associated with the operation of EDO fuses.

Devices such as boric acid fuses only expel gases and not plasma and particles like EDOs, are more resilient to lightning strikes and do not 'hang up' like EDOs.

Volumes are based on ensuring that all control station EDO fuses that protect multiple transformers are replaced by boric acid fuses by 2020.

The proposed volumes for this program are:

1. Up to 70 sites in very high fire danger areas; and
2. Up to115 sites in high fire danger areas.

The program is prioritised so that control stations in areas of high fault levels (>6 kA) and with large loads are replaced first.

This program does not include EDOs outside fire danger areas.

7.3.4 Undertake HV and LV Overhead Conductor Fire Mitigation Works in Very High and High Fire Danger Areas

The aim of this program is undertake asset replacements and major repairs on HV and LV overhead lines in fire danger areas to mitigate the risk of fire starts. The categories of work that fall under this program are detailed below.

Replace Long HV and LV Spans

To reduce the risk of fire start associated with long HV and LV spans that cannot be rectified easily by re-tensioning, Aurora has a prioritised program in place to change the pole top configuration and install new poles as required to reduce the risk of fire starts due to conductors clashing.

An extract of all HV conductors spans was taken from Aurora's geospatial information database, G-Tech. Information such as span length, conductor type, fire risk, number of conductors were included.

Table 1 shows the number of spans and total length of long HV spans in Aurora's distribution network.

Table 1 Aurora owned HV spans longer than 300 m

Fire Risk	Span Length	Data	Total
VERY HIGH	Greater than 300 m	Number of spans	327
		Span length (km)	124.4
HIGH	Greater than 300 m	Number of spans	827
		Span length (km)	325.0

Based on this information, Aurora can target asset inspection programs to identify sections of the HV network where the spans may be clashing and the pole top configurations are incorrect for the span length.

Long spans of LV can normally be addressed through the simple installation of an LV spacer however, in the event that this is not a viable solution, such as for vertical LV, the LV line will be replaced with bare horizontal LV or LV ABC.

Relocate Overhead Lines due to Vegetation Fire Risk

To reduce the risk of fire starts associated with heavily vegetated locations within the fire danger areas, HV and LV overhead lines may be relocated or undergrounded if either of these is a more cost and risk effective solution than constant vegetation maintenance.

8. OTHER CONSIDERATIONS

8.1 Network Design Standards

A major part of preventing fire starts is to ensure that the distribution network is initially built to a standard that will minimise the risk of Aurora's assets initiating fires.

Aurora's D S D OH 1 Distribution Overhead Line Design and Construction Standard (reference 9) is the standard to be used for the design and construction of all new overhead distribution assets. The standard outlines alternative line design options for Aurora's designers to consider when designing the network in fire danger areas.

8.2 Liaison with External Parties

Aurora works closely with the Tasmania Fire Service, Department of Parks and Wildlife Services, State Emergency Services, local government and other appropriate organisations and government departments about bushfire related matters to monitor events leading into each fire season and to improve its bushfire mitigation management capability.

Aurora actively:

- Provides representation on local and regional bushfire committees;
- Participates in local and regional emergency planning preparation and any operational exercises to test the plans; and
- Provides bushfire liaison officers for Fire Control Centres as a direct communications link between the fire control centre and Aurora's Operational Control Room.

8.3 Fire Start Reporting

A rigorous field-reporting regime is in place to ensure all instances of fires started by Aurora assets are recorded and categorised into appropriate fields. This data enables Aurora to develop and tailor specific fire mitigation activities relative to the risks.

AE-OHS-SYS-PRO-002 AuroraSafe Standard: Managing Incidents (reference 10) governs the reporting of all incidents and includes the reporting of environmental incidents such as fires.

The data collected in this system is then used to:

- Identify the cause of fire starts and trends;
- Identify sections of the distribution network that may pose a higher fire start risk; and
- Measure the effectiveness of bushfire mitigation management programs.

8.4 Public Awareness

Aurora engages with the community to assist with its program for bushfire mitigation through flyers, brochures, television advertisements and at community organised events such as Agfest. The main focus is the risks that vegetation can create when near power lines and how Aurora can be contacted to investigate potential hazards.

Owners of private network are also reminded of their responsibilities.

9. REVIEW OF HISTORICAL PRACTICES

Aurora's fire mitigation practices have been stable for a number of years and the impact of these practices can be seen on the declining number of recorded asset failures of the type that have been targeted such as clashing conductors and HV fuses (reference 11).

Unfortunately the number of pole fires and outages with unknown causes continue to increase, indicating that there is an asset failure mode in the distribution network that Aurora has not identified. Aurora plans to address this by increasing the rigour around reporting pole fires and undertaking investigations into the cause of pole fires.

Improved condition information of the assets through the use of new and improved technologies and targeted asset inspections will lead to a better understanding of the condition of the assets and potentially identify previously undetected modes of asset failure.

Although the volumes of HV fuse operations and insulator failures are low compared to other asset failure modes, the rate of fire starts for these two asset classes is disproportionate to the number of failures. Targeted programs have been proposed to address these issues.

10. PROPOSED OPEX PLAN

It is proposed to continue the current fire mitigation practices without significant change however, to focus more effort on asset inspections to improve our understanding of the condition of overhead assets.

Table 2 Asset Fire Mitigation OPEX Spend ($M)

	2009/10	2010/11	2012-2017
	Actual	**Proposed**	**Proposed**
Asset Inspection	0.00	0.45	0.90
Repair	0.11	0.22	0.16

The differences in expenditure in Table 2 are due to:

- A more structured fire mitigation inspection regime;
- Additional audit of fire mitigation works; and
- Efficiencies in the asset repair program.

11. PROPOSED CAPEX PLAN

Table 3 Overhead System CAPEX Spend ($M)

	2009/10	2010/11	2012-2017
	Actual	**Proposed**	**Proposed**
Asset Replacement	0.94	1.04	1.79

The differences in expenditure in Table 3 are due to:

- New programs to replace EDO fuse tubes at transformers in very high and high fire danger areas; and

- New programs to replace EDO units at control stations with fire safe alternatives in very high and high fire danger areas.

12. CAPEX-OPEX TRADE OFFS

Many operating expenditure programs identify assets which require corrective maintenance or replacement to mitigate the risk of a fire start. An example of this is the pre-fire season asset inspection program that specifically targets known fire start defects on Aurora's network, which leads to operational and capital expenditure depending on the extent of the defect.

Capital expenditure is only undertaken if an operational solution cannot be undertaken and for the proactive removal of assets that are known causes of fire starts, such as EDOs.

13. MANAGEMENT PLAN MONITORING

A review of this management plan will be conducted at the end of each financial year to measure the performance of this plan against the expected outcomes.

The activities and outcomes of this management plan will contribute to Network Project Plan *NA R AM 01 Fire Prevention Strategies for Overhead Powerlines in High Fire Risk Areas* (reference 7) and be reported annually to Aurora's board and executive.

14. RESPONSIBILITIES

Maintenance and implementation of this management plan is the responsibility of the Thread Leader – Overhead and Structures.

Approval of this management plan is the responsibility of the Group Manager – Asset Performance and Information.

15. REFERENCES

1. Management Plan 2011: Bushfire Mitigation (General Programs) (NW-#30170189)
2. The Nous Group 2009: Rural Electricity Networks National Workshop Melbourne 21 April 2010 Information Paper (NW-#30135992)
3. Aurora's Key Business Risk Directory (CO-#10093708)
4. Fire Start Analysis (NW-#30111032)
5. LV Fuse Reach Management Plan (NW-#30039649)
6. Network Procedure: Identification and Management of Overhead Line Defects (NP R AM 03)
7. Network Project Plan: Fire Prevention Strategies for Overhead Powerlines in High Fire Risk Areas (NA R AM 01)

8. Management Plan 2011: Overhead System and Structures (NW-#30161322)
9. Distribution Overhead Line Design and Construction Standard DS D OH 1 (NW-#10277265)
10. AE-OHS-SYS-PRO-002 AuroraSafe Standard (CO-#10279008)
11. Historical outage analysis from 2005/06 to 2009/10 (NW-#30163289)
12. ENA Guidelines for Design and Maintenance of Overhead Distribution and Transmission Lines (C(b)1)