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Creating a safer state with electricity and gas

Draft Report: The Condition of Power Poles in South West Victoria

Technical Investigation Report

May 2019

VICTORIA State Government

Preface

This draft technical investigation report has been prepared for public consultation by Energy Safe Victoria (ESV) pursuant to the objectives, powers and functions conferred on it by The Electricity Safety Act 1998 (Act).

Specifically, this includes investigations into the state of power poles in the South West Region of Victoria. ESV welcomes comment and feedback on this draft report.

Contents

Purpose

The purpose of this report is to document Energy Safe Victoria's (ESV) findings following investigations into the state of wooden power poles in the South West Region of Victoria and to determine where there is any immediate risk of failure. The report includes ESV's assessment of Powercor's approach to their inspection and maintenance of power poles and whether their practices will ensure that, as far as practicable, no pole will fail unassisted[1]. This report does not cover the legal investigations currently underway into the St Patrick Day Fires of 2018.

Scope and Approach

ESV's investigative approach involved a combination of practices, procedures and processes to independently verify the efficacy of Powercor's asset inspection practices by:

- requiring and analysing specific information including asset inspection and maintenance processes and records
- inspecting 1,200 poles in the South West by visual inspection and 'hammer' test[2] (of which 496 were also part of Powercor's 2019 non-routine inspection of 19,000 poles)
- analysing the raw data and results of the non-routine inspection of 19,000 poles
- further testing 112 poles using 'sonic tomography and electronic impedance testing'[3], identified as requiring follow up testing following the 1,200 poles inspected by ESV
- community engagement and consultation, including attending Powercor's community forum in Warrnambool
- analysing the conclusions of the independent breaking point tests[4] on the 13 poles removed from the South West, which was overseen by ESV and a technical expert engaged by ESV.

[1] Assisted pole failure includes outside forces such as fire, vehicle impact, third party or lightning strike

[2] An industry standard practice of sounding a pole to listen for sound that may suggest the presence of a cavity

[3] A non-destructive process for detecting the presence of cavities and rot in timber

[4] The 'Grafton Report'. The report is the property of Powercor and is not available to the public

Summary of ESV findings and next steps

ESV investigations have determined that:

- Powercor's power pole inspection and maintenance process is fit for purpose and there is no immediate systemic risk of pole failures in the South West
- 98% of poles in the South West exceed the required residual strength necessary to remain in service with an acceptable safety margin
- 2% of poles that are classified as limited life[5] or scheduled for replacement, will be safely managed due to Powercor's recent changes to their inspection and maintenance processes
- a subset of lower durability poles (durability class 3) are deteriorating faster than expected.

ESV's conclusions were reached after:

- ESV reviewed Powercor's existing inspection process, taking into account its recent changes, to determine if the process is fit for purpose in assessing the condition of poles. Powercor's two changes[6] to its inspection and testing process are:
    - an increase in the frequency of its inspection and testing process from 30 months to 12 months for all limited life poles. This results in a more accurate and timely indication of pole condition, minimising the risk of unanticipated failure
    - an increase to its safety factor from 1.25 to 1.40 for all poles on its network. The 25% safety factor assigned to prevent failure prior to replacement has now been increased to 40%. When a pole is identified for replacement, the 40% safety factor at that time ensures the pole is replaced well before it reaches a safety factor score of 1.00[7].
- as part of the inspection review, ESV found that the hammer test delivered conservative results when undertaken by a skilled asset inspector[8]. The test will identify if further testing (dig-and-drill[9] or Woodscan[10]) is required
- ESV assessed and reviewed Powercor's 2019 non-routine inspection of 19,000 poles in the South West, leading to the following insights:
    - 98% of power poles passed Powercor's inspection and testing process
    - Powercor's inspection and testing process correctly identified 1.3% of power poles would require replacement within a year
    - 0.7% of poles were classified as limited life, prompting Powercor to increase the frequency of its inspection and testing from 30 monthly to twelve monthly inspections. This will minimise the chance any unanticipated failures before pole replacement is due.
- ESV's independent inspection of 1,200 poles in the South West (half of which included poles that were part of Powercor's 2019 non-routine inspection) supported Powercor's results and led to the following insights:
    - Powercor's inspection and testing process correctly identifies the condition of a pole

[5] Poles that are safe, but are approaching the end of their life and require either increased monitoring or intervention by staking to return them to a fully serviceable status

[6] This will be formalised through ESV's acceptance of Powercor's Bushfire Mitigation Plan

[7] Outlined as per the Australian Standards for strength and durability ratings

[8] The hammer test, despite its subjectivity, did not miss any substantial internal pole cavities

[9] The traditional invasive pole test method of digging at least 300mm below ground, drilling and checking the amount of sound wood in the pole.

[10] Woodscan is a non-invasive inspection method used to complement traditional invasive test methods http://www.woodscan.co

    - Messmate[11] poles, a subset of durability class 3 poles, are deteriorating more quickly than expected. Powercor's inspection changes will adequately address this risk.
- to determine if poles that looked defective were safe, ESV and the technical expert engaged by ESV observed the breaking point tests[12] on 13 poles removed from service in the south west region and assessed the results. These tests were undertaken at an independent test facility in NSW, which found:
    - 12 of the 13 poles exceeded the then safety factor of 1.25 to remain in service. This safety factor has now been increased to 1.40
    - one pole did not meet the 1.25 safety factor. However, ESV is satisfied that the changes Powercor has made to its pole inspection and maintenance process effectively address any immediate risk of further unassisted pole failures.

ESV will do further work over the next six months to assure itself that Powercor's asset management practice will deliver sustainable safety outcomes for the community in the long term. To do this, ESV will continue its investigations into Powercor's power pole asset management practice to determine if it:

- replaces poles at an appropriate rate to ensure sustainable asset performance
- replaces the right categories of poles at the right time to ensure sustainable safety performance
- takes into account different pole degradation rates according to local conditions, wood type, etc.
- uses the right data for essential decisions
- reaches the right conclusions
- inspects at appropriate times to ensure up to date pole condition data implements suitable reinforcement activities, such as staking.

ESV will investigate the efficacy of Powercor's pole condition assessment process, including:

- the completeness of the work instructions and guidance material for hammer testing, dig and drill inspections and non-invasive technologies such as Woodscan
- whether non-destructive testing (e.g. Woodscan) should be triggered earlier in the life of a pole to better track the rate of degradation of poles
- staff training and assessment of competency to ensure consistency of practice
- the completeness and currency of training materials and records
- the nature and entirety of asset inspection records
- condition assessment results that lead to informed decision making.

ESV will provide a comprehensive, publicly available report that addresses the above matters before the end of 2019, unless ESV's investigations result in further lines of enquiry.

ESV will commence similar audits and investigations into the pole management practices of the other Victorian distribution businesses in 2020.

[11] Messmate is classified as a durability class 3 timber, (e.g. stringybark eucalypt – Australian native hardwood)

[12] Poles were tested to destruction (i.e. to breaking point) to compare with Powercor's inspection results

The remainder of this report is structured as follows:

Section 1 provides the background to the ESV review; an overview of power poles in the Victorian Electricity Industry; the legislative and statutory requirements that apply, and how ESV administers them.

Section 2 outlines Powercor's pole inspection and maintenance process.

1 ESV's approach to regulation

1.1 Background to St. Patrick's Day fires

High winds in Victoria's South West Region on 17 and 18 March 2018 led to six fire starts now known to involve electricity distribution assets. This resulted in significant fires, collectively known as the St Patrick's Day Fires, all of which led to serious property and stock loss.

Four of the fire starts were caused by trees or branches hitting powerlines.

- **Gazette fire** at Yatchaw
- **Gnotuk fire** at Gnotuk
- **Minjah fire** at Minjah
- **Warrnambool-Cobden fire** at Laang.

ESV determined that these four fires were caused by vegetation falling onto powerlines from outside the minimum clearance space required by electric line clearance regulations[13]. These were not trees that were close to the edge of the clearance space; some were many metres away. Therefore, ESV determined that it would not investigate these incidents further.

Two major fires were ignited by electricity distribution assets.

- **The Sisters fire** at Garvoc involving a broken power pole
- **P3 High Street Terang fire** involving clashing powerlines.

Technical investigation reports were completed on all six fire starts[14]. Legal and enforcement investigations are continuing into the Sisters and Terang fires and this report does not address those matters.

Since March 2018, there has been significant community concern with:

- the potential for further fires to be caused by electricity distribution assets
- the confidence in Powercor to manage their network safely
- Powercor's compliance with the legislative and statutory requirements
- whether the legislative and statutory requirements are appropriate
- the ability of ESV to appropriately test and challenge the inspection and maintenance processes of distribution businesses.

This report is the culmination of numerous technical investigations, reviews and forensic work, the insights of which now enable ESV to determine the safety of the South West network. However, tests for assurance never stop and further regulatory initiatives and ongoing regulatory vigilance is required to ensure that everything practicable is being done to minimise the risk of electricity assets starting bushfires.

[13] Electricity Safety (Electric Line Clearance) Regulations 2015 (http://www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst9.nsf/DDE300B846EED9C7CA257616000A3571/7DE34963A2FC803ECA257E6F001B13C5/$FILE/15-67sra001%20authorised.pdf).

[14] See https://www.esv.vic.gov.au/news/st-patricks-day-fires-technical-reports/

1.2 Power Poles

There are five million timber power poles currently in-service throughout Australia. Most are native hardwood forest species that have suitable structural characteristics and are highly resilient to rot.

In Victoria, 74% of all poles in-service are timber poles, and at least 50% of them were installed over 40 years ago[15]. Approximately 80 species of timber are classified by strength and durability classes, i.e. class 1, 2, 3 and 4 poles[16], and deteriorate at different rates due to local environmental conditions. The national timber pole standard[17] states that only durability class 1 and 2 can be used for power poles without preservative treatment[18].

Powercor, like all other electricity distribution businesses, use a mix of concrete, steel and copper chrome arsenate (CCA) treated timber poles in accordance with the overhead line design standard[19]. CCA, the current standard preservative for poles, will gradually replace hardwood poles and last 40-plus years. These poles can also withstand winds of up to 180km/h.

Currently the average annual number of unassisted pole failures across Australia is 0.007 per 100 poles with Victoria averaging 0.003 per 100 poles[20].

1.3 Legislative and Statutory Requirements

The electricity infrastructure safety regime (inclusive of Safety Cases & Electrical Safety Management Schemes) utilises principle, performance and outcome based regulatory approaches. The primary reason is that the safety risks are complex, geographically diverse, have significant consequences (regardless of frequency), and often require tailored solutions[21].

This approach recognises that distribution businesses best understand their network risk, and that network safety cannot be efficiently achieved through mandated, detailed and prescriptive requirements.

Therefore, ESV requires a safety proposition from the distribution business which it accepts, rejects or seeks modification. In this way the accountability for safety remains with the network business and, other than reflecting prescriptive statutory requirements, will rarely require that ESV develops its own view first of how the safety outcome is achieved.

ESV holds the distribution business to account by monitoring and enforcing the safety of the Victorian distribution businesses' design, construction, operation, maintenance and decommissioning of electrical transmission and distribution networks. It monitors distribution business compliance with their obligations under the Electricity Safety Act 1998 (the Act) to minimise risk "as far as practicable[22]" as articulated in the distribution business's Electrical Safety Management Scheme (ESMS) and Bushfire Mitigation Plan (BMP) accepted by ESV.

[15] Australian Timber Pole Resources for Energy Networks: http://era.daf.qld.gov.au/id/eprint/3071/2/dpiandena_timber_pole_review06-sec.pdf

[16] Australian Standard AS 5604-2005 Timber - Natural durability ratings

[17] Australian Standard AS 2209-1994 'Timber - Poles for overhead lines'

[18] Australian Standard AS 1604.1:2012 'Specification for preservative treatment Sawn and round timber'

[19] Australian Standard AS/NZS 7000:2016 'Overhead line design'

[20] Sourced from the Australian Energy Regulator's Regulatory Information Notice data submitted by: Victorian DNSPs 2011 to 2018; other DNSPs 2016 to 2018

[21] "Process-based regulation", p.7, in "Victorian Guide to Regulation (Updated July 2014) Toolkit 1: Purposes and types of regulation", http://www.dtf.vic.gov.au/Publications/Victoria-Economy-publications/Victorian-guide-to-regulation

[22] Part 10, S.98 of the Electricity Safety Act 1998 outlines the General duty of major electricity companies

ESV's process for ESMS acceptance involves:

1. ESV reviewing the distribution business's ESMS document and providing feedback to the distribution business to further amend the document until ESV is satisfied that it meets the requirements of the Act and relevant Regulations
2. ESV conducts a desktop review of all documented distribution business policies, procedures and manuals referenced in the ESMS document
3. ESV conducts validation audits conducted on eleven key system aspects of the ESMS at the distribution business's office
4. the validation audit finding reports are issued to, and subsequently responded to, by the distribution business
5. once all audit findings have been addressed to the satisfaction of ESV, the final ESV ESMS validation reports are developed
6. the validation reports and related documentation is presented to the ESV Electricity & Gas Network Evaluation Panel[23] seeking its endorsement prior to seeking final acceptance from the Director of Electrical Safety.

The ESV process for BMP acceptance involves:

1. ESV reviewing the distribution business's BMP and providing feedback to the distribution business to further amend the document until ESV is satisfied that it meets the requirements of the Act and BFM Regulations
2. ESV conducts a desktop assessment[24] of all documented distribution business policies, procedures and manuals referenced in the BMP document
3. once satisfied an ESV report of the assessment is developed for management approval
4. the assessment report passes through management for final acceptance by the Director of Energy Safety.

Specifically relating to poles, the distribution business's BMP outlines the inspection program commitments on how they will deliver the specific bushfire mitigation regulatory requirements for the minimum intervals for their asset inspections, being:

- intervals not exceeding 37 months from the date of the previous inspection in hazardous bushfire risk areas (HBRA), and
- intervals not exceeding 61 months from the date of the previous inspection in other areas (low bushfire risk areas (LBRA)).

In practice, distribution businesses adopt more frequent inspection cycles than those specified above, depending on the condition of the pole and associated risks. The detailed field processes and work practices are then carried out as documented in manuals and procedures referenced from the BMP.

ESV tests these practices and procedures regularly by conducting both systems (office based) audits and outcomes (field based) audits against ESMS and BMP undertakings as well as prescribed minimums. In this way the distribution business's network safety systems continue to evolve to manage risks in accordance with statutory obligations and their general duties.

[23] The ESV Electricity & Gas Network Evaluation Panel is comprised of senior management from across the organisation.

[24] The ESV desktop assessment is a systems check and does not delve into very detailed technical aspects such as safety factors. These detailed aspects are covered during the specifically targeted ESMS and BFM systems audits.

The regulatory regime does not prescribe each aspect of an asset inspection regime, for example the safety factor to be applied to poles. The regime is outcome focused and places the responsibility for determining these matters with the distribution business, which in turn is required to rely upon – as a minimum – Australian Standards[25] .

Audit topics or areas of focus are reviewed and determined annually in a systematic and structured approach informed by:

- analysis of all major risks, including critical control priorities
- critical control relationships to system audit findings
- review of ESMS audit findings, including ESMS validation and bushfire mitigation system audits
- review of field audit findings, including work practices observation and pre-summer audits
- analysis of causal factor trends of serious incidents reported to ESV
- consideration of the recommendations of the Independent Review of Victoria's Electricity and Gas Network Safety Framework.

The outcomes of ESV audit programs are publicly reported each year in our Annual Performance Report on Victorian Electricity Networks[26] as well as specific audits which can be found on our website[27].

[25] International standards in the absence of an Australian one

[26] https://www.esv.vic.gov.au/news/2018-safety-performance-report-on-victorian-electricity-networks-published/

[27] https://www.esv.vic.gov.au/about-esv/reports-and-publications/technical-reports-and-publications/electrical-safety-audit-reports/

2 Powercor's Pole Inspection and Maintenance Process

Powercor's pole inspection practices require that all serviceable poles in HBRA will each receive a full inspection every 30 months ± one month and a limited inspection every 30 months ± one month, which alternate on an overlapping cycle of 60 months.

Limited inspection (above ground inspection) includes:

- visual inspection of the condition of the pole and pole-top assets
- assessment of the condition of the pole from ground level up to two metres, including a sound 'hammer' test to identify any pole cavities requiring further investigation
- identifying the presence of wood destroying insects (e.g. termites).

Full inspection (above ground and below ground inspection) includes:

- the aforementioned limited inspection
- excavation and assessment of a wood poles condition of the pole from ground line to a minimum of 300 millimetres below ground and to inspect for termite infestation
- drilling the pole with a 12 millimetre auger bit below ground, and / or use Woodscan above ground to ascertain the amount of sound timber remaining
- internally treating hardwood poles with preservative where drilled.

The same inspection processes outlined above will apply to all Additional Controls Serviceable (ACS), formally known as limited life poles. They will each receive a full inspection 12 months ± one month and a limited inspection every 12 months ± one month, which alternate on an overlapping cycle of 24 months.

The key commitments of Powercor's inspection and maintenance processes are included in its BMP and submitted for ESV acceptance. Powercor's BMP includes references to policies, procedures and manuals that cover the inspection process in detail. Powercor is required to resubmit its BMP if it is subject to substantive change. A change to a procedure referenced in a BMP is not automatically recognised as a substantive change.

The results of pole inspection in HBRA are classified according to Powercor's system for maintenance action:

- Serviceable = fit for service, reinspect in 30 months where:
    - A durability class 1 hardwood pole has an internal sound wood thickness measurement greater or equal to 40 mm
    - A durability class 2 or 3 hardwood pole has an internal sound wood thickness measurement greater or equal to 50 mm.
- ACS = In addition to preservative treatment of hardwood during inspection, other potential treatments include pole staking to return to serviceable condition and extend pole life, or continue to monitor via 12 monthly inspections where:
    - A durability class 1 hardwood pole has an internal sound wood thickness measurement greater than or equal to 35 mm and below 40 mm
    - A durability class 2 or 3 hardwood pole has an internal sound wood thickness measurement greater than or equal to 35 mm and below 50 mm.
- Unserviceable P1 = requires pole to be replaced within 24 hours where:
    - A hardwood pole that has an internal measurement less than 16 mm.

- Unserviceable P2 = requires pole to be replaced within 32 weeks where:
    - A hardwood pole has an internal measurement below 35 mm and greater than or equal to 16 mm, or has a defect caused by fire, vehicle impact, third party or lightning strike
    - A defect has been identified below the excavation depth by the deep drill process
    - A defect has been identified above two metres on the pole and is visually assessed from the ground
    - Poles identified with wood destroying insects (e.g. termites)
    - Wood poles found with fungal fruiting bodies[28] above two metres.

[28] Type of fungi containing spores which rot poles

Consultation

ESV invites interested parties to make a submission on this draft report. The closing date for submissions is 5:00pm, 24th June 2019.

Email your submission to consultation@energysafe.vic.gov.au

or

Post your submission to:

Energy Safe Victoria
Consultation Response
PO Box 262
Collins St West VIC 8007

A community consultation program is also in place. More information is available at www.esv.vic.gov.au

In the interests of transparency ESV will make submissions on this draft report publicly available on our website. Should you wish any parts of your submission to remain confidential, clearly indicate the relevant sections of the submission and your reasoning for the request. ESV will determine whether or not to withhold or publish the submission following consultation with you.