

Warrnambool-Cobden Fire Ignition 17 March 2018

**Tree failure 2450 Warrnambool-
Cobden Road, Laang**

Technical investigation report

Preface

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

Specifically, these include, amongst other things, to investigate events or incidents, which have implications for electricity safety and to regulate, monitor and enforce the prevention and mitigation of bushfires that arise out of incidents involving electric lines or electrical installations and to monitor and enforce compliance with this Act and the regulations.

Contents

- Summary5**
- Introduction.....6**
 - Scope6
 - Objectives6
 - Methodology6
 - Background7
 - Declarations.....7
 - Powercor post event actions9
 - Analysis of photos and images.....13
 - Electric Line Clearance Regulations 201513
 - Prevailing weather information14
- Findings and conclusions15**
 - The source of the Warrnambool-Cobden fire15
 - Auto Circuit Recloser operations.....15
- Appendix A – Weather Observations16**

Figures

Figure 1: Incident site	7
Figure 2: Incident site map	8
Figure 3: Tree failure showing HV conductors on the ground.....	9
Figure 4: Tree position in relation to HV conductors	10
Figure 5: Images of burnt branches found onsite.....	11
Figure 6: Images of failure point on tree.....	11
Figure 7: LiDAR image of site provided by Powercor	12
Figure 8: Excerpt of Warrnambool weather record for March 2018.....	14

Tables

Table 1: TRG 005 Feeder operations.....	12
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Summary

On 17 March 2018 a high wind event passing through Victoria's South West Region caused a tree to fail. Part of the tree fell and contacted the electrical network and is the most likely source of ignition of a fire known as the Warrnambool-Cobden fire.

The fire originated close to the location of Powercor Australia Limited's distribution network on the 22 kilovolt (kV) High Voltage (HV) power line in a property 2450 Warrnambool–Cobden Rd, Laang.

Upon Energy Safe Victoria (ESV) review of the incident notification report from Powercor Australia Limited two ESV Compliance Officers (as electricity infrastructure and electric line clearance specialists respectively) attended the incident site on 13 April 2018 to further investigate the incident.

The failed tree was identified, with sign of where a large branch had broken away from the tree. A failed large branch was lying on the ground and aligned in the direction of the powerline.

Fire ignition is possible either through the contact of the tree with the 22kV HV Conductor or through the broken conductor hitting the ground; both circumstances could release enough electrical energy to ignite a fire on the ground.

The Powercor HV electrical protection system records indicate a phase to ground fault event occurred on the TRG 005 22kV circuit breaker. The time stamp recorded against this event in Table 1 is consistent with the time when damaging winds were experienced in the region.

ESV determined it is likely a tree in a paddock failed and fell onto the 22kV HV conductors, bringing them to ground. This resulted in the ignition of a fire at approximately 21:16 Australian Eastern Standard Time¹ (AEST) on 17 March 2018.

The failure point on the tree was 11.3 metres horizontally away from the closest conductor. The tree branch length was estimated to be in excess of 20 metres. This means that when the tree fell it was possible for it to contact the powerline.

From the evidence observed onsite and review of Google Maps, and LiDAR information provided by Powercor ESV determined that the failed branch was at a distance greater than the minimum clearance required under the Electricity Safety (Electric Line Clearance) Regulations 2015, however the branch was of sufficient length to contact the powerlines when it failed.

Based on the findings of this investigation, ESV concluded no further investigation into this incident is warranted.

¹ All time references in this report refer to Australian Eastern Standard Time

Introduction

Scope

This report details the findings of an Energy Safe Victoria (ESV) technical investigation of the causes of, and contributing factors to a fire that originated close to the location of Powercor Australia Limited's distribution network on the 22 kilovolt (kV) Terang 005 feeder (TRG 005) within 2450 Warrnambool-Cobden Road, Laang.

The investigation only details the evidence gathered to support the technical conclusion reached as well as outlining the relevant standard that applies to vegetation management near the distribution network at this location.

Objectives

ESV's investigative objectives were to:

- identify the entities involved
- establish the initial facts and possible causes of the incident
- source information from the Country Fire Authority (CFA)
- identify any standards relevant to the incident.

To meet these objectives, ESV sourced specific information that included:

- Bureau of Meteorology (BOM) data from the Hamilton weather station closest to the ignition source
- 22kV TRG 005 feeder protection equipment operation records
- the Powercor Australia Limited:
 - incident report
 - protection equipment operation records
 - accepted Electric Line Clearance Management Plan
 - LiDAR records of the incident site.
- CFA Information and photographs.

Methodology

ESV's investigative methodology involved a combination of practices, procedures, and processes that included:

- requiring and analysing specific information (including the incident report) from Powercor Australia Limited
- reviewing and analysing 22kV TRG 005 feeder protection equipment operation records
- reviewing weather records from the closest BOM weather stations
- reviewing photos taken at the site on the day of the ESV site visit
- reviewing photos provided by the Country Fire Authority (CFA)
- reviewing photos provided by Powercor Australia Ltd
- reviewing LiDAR information provided by Powercor.

Background

On 17 March 2018 a high wind event passing through Victoria's South West Region caused a tree to fail. Part of the tree fell and contact the electrical network and is the most likely source of ignition of a fire.

The fire originated in a paddock near 2450 Warrnambool-Cobden Road, Laang close to the Powercor Australia Limited distribution network on the 22 kilovolt (kV) Terang 005 feeder (TRG 005).

Upon ESV's review of the incident notification report from Powercor Australia Limited two ESV Compliance Officers (as electricity infrastructure and electric line clearance specialists respectively) attended the incident site on 13 April 2018.

Figure 1: Incident site



Declarations

The declarations relating to the period of the incident involved a Total Fire Ban (TFB) day, a Hazardous Bushfire Risk Area (HBRA), and Powercor Australia Limited special protection settings for TFB days.

Total Fire Ban day

On 17 and 18 March 2018, TFB days were in place for the Southwest Fire District, which includes the Laang area².

Hazardous Bushfire Risk Area

Figure 2 shows a map of the incident site in relation to the CFA declared Low Bushfire Risk Area (in green) and the HBRA area (in tan).

² Country Fire Authority 2018, State Government of Victoria, Melbourne, viewed 7 May 2018, www.cfa.vic.gov.au/warnings-restrictions/history-of-tfbs.

Figure 2: Incident site map



Powercor Australia Limited special protection settings

Powercor Australia Limited has an accepted (by ESV) Bushfire Mitigation Plan (including any actions required) for managing risk on TFB days. The plan, which considers a number of factors (including environmental) and includes initiating enhanced protection setting functionality for listed assets in a document referenced in the plan.

For the Terang 005 (TRG 005) Zone Substation feeder circuit breaker the settings that were applied were “Low Set Inv.Time O/C In Service, Reclose Normal”. The TRG 005 protection settings were logged as applied on 17 March 2018 and removed on 18 March 2018 (as per Table 1).

This terminology means that the protection was set to operate in a faster than normal timeframe, with a 1 fast, 1 slow circuit breaker reclose as the TRG 005 circuit breaker was listed as an asset to which TFB day settings should be applied³.

The Powercor HV electrical protection system records identified a phase to ground fault event on the time stamps recorded against this event which is consistent with the time when damaging winds were experienced in the region.

³ Powercor Australia Limited, Total Fire Ban Action Plan, Attachment A, 2018.

Technical investigation

Powercor post event actions

Powercor isolated the local section and repaired the HV Overhead line on 18 March 2018.

CFA site observations

CFA fire investigators attended site on 19 March 2018 and photographed the incident scene. Copies of these photos were provided to ESV to assist with the investigation.

These photos show the:

- tree and position of the break in tree
- fallen part of tree laying over all three HV conductors.

Figure 3: Tree failure showing HV conductors on the ground



Review of the photo provided by CFA indicates that there was a significant distance between the HV conductors and the failure point on the tree.

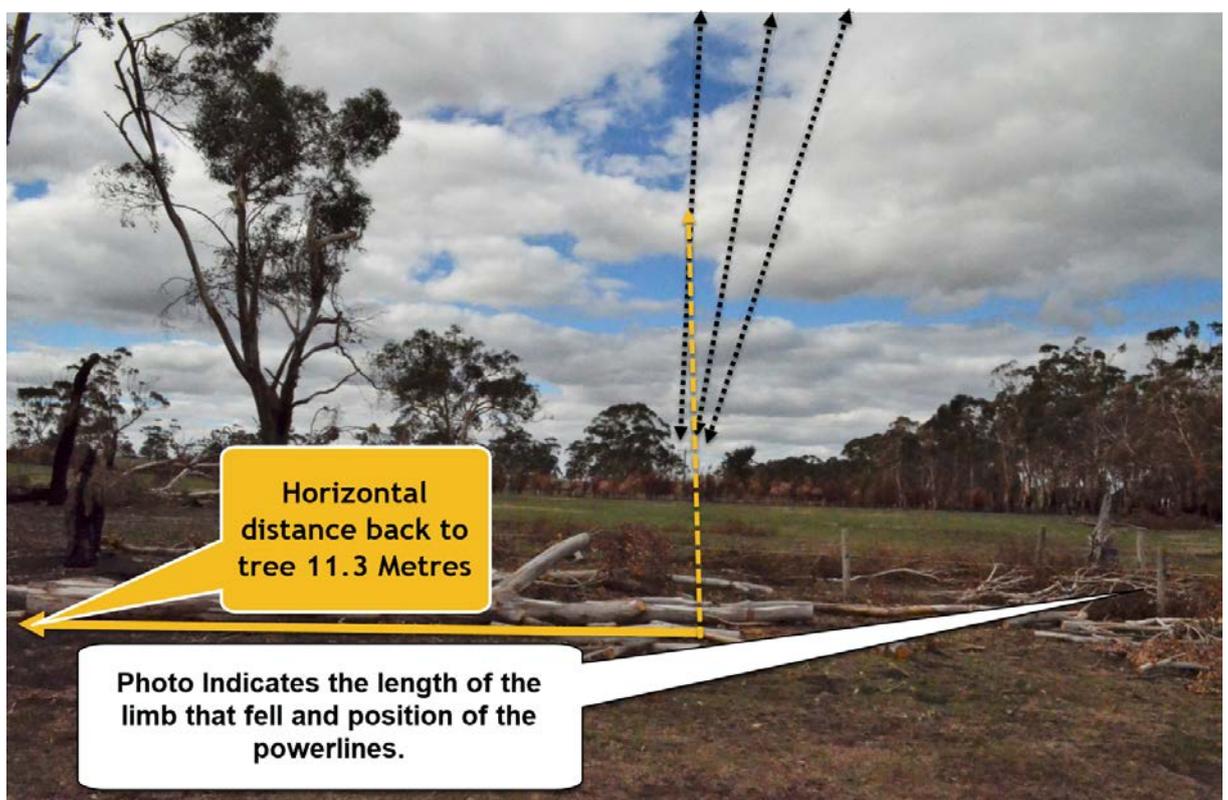
ESV observations

Two ESV Compliance Officers (as electricity infrastructure and electric line clearance specialists respectively) attended the site on 13 April 2018.

Site observations:

- The site visit indicated a tree, Eucalyptus species, had a large limb which failed
- much of the failed limb had been cut and removed, however remaining tree debris on the ground indicated the alignment of where the limb landed and its length
- The combined length of these sections was estimated to be 20 metres. The failure point was estimated to be four metres above the ground. This means the estimated height of the tree would be approximately 24 metres
- Failure point on the tree was approximately four metres above ground level and 11.3 metres horizontally adjacent to the closest HV conductor
- Given the estimated height of the tree it could reasonably be expected to make contact with HV Overhead conductors when it fell
- The tree falling is likely to have caused the fire ignition. This may have been due to the tree directly contacting the lines causing the fire ignition or by the tree falling on to the lines causing them to fall to the ground and causing the fire ignition
- The point of contact was approximately in the middle of the 307 metre conductor span as measured with a laser rangefinder⁴
- Remaining tree branches on the ground had burn marks consistent with contacting live high voltage conductor/s.

Figure 4: Tree position in relation to HV conductors



⁴ The TruePulse laser rangefinder is a handheld device which enables a user to obtain a measurement between two points. <http://www.lasertech.com/TruPulse-Laser-Rangefinder.aspx>

Figure 5: Images of burnt branches found onsite



Figure 6: Images of failure point on tree



Powercor incident report

ESV received an incident notification (20180322PWA_07) from Powercor on 12 April 2018 regarding the failure of a tree branch causing a fire. The report states that the HV overhead line was contacted by a tree falling from outside the required clearance requirements.

The details of the notification report are consistent with observations made by ESV during its site visit on 13 April 2018.

Powercor Protection equipment operation information

The Powercor HV electrical protection system records identified a white phase to earth fault event on the TRG 005 22kV feeder circuit breaker at 20:42 AEST.

Table 1: TRG 005 Feeder operations

TRG005-Feeder-protection-¶

Time (UTC)¶	Time (AEST) (+11)¶	Type¶	Magnitude @ Trip¶	Reclose¶
10:16:43.149¶	21:16:30.886¶	White-to-ground (Ph-g)¶	180 A¶	Yes¶

This information was provided by Powercor Australia Limited following a request from ESV. This confirms that the TRG 005 Zone Substation circuit breaker tripped to isolate the fault, then unsuccessfully attempted to reclose/re-energise, then ultimately locked open until the line had been inspected in line with Powercor policy.

LiDAR Information

Powercor provided ESV with a copy of the most recent LiDAR (Light Detection and Ranging) measurements that was recorded of the incident site. The information/data has been provided from the flight data recorded in 2017.

This indicates that the closest vegetation was assessed at 10.34 metres away from the closest HV conductor as per Figure 7.

Figure 7: LiDAR image of site provided by Powercor



Analysis of photos and images

Photos taken at the site by ESV on 13 April 2018 indicate:

- a number of tree branches were charred
- adjacent tree branches were of similar height.

Further review of recent (to the incident date) LiDAR data provides measurement of clearance from trees to the HV conductors and confirms that regulatory requirements were met.

Electric Line Clearance Regulations 2015

Section 84 of the Electricity Safety Act 1998 identifies Powercor as responsible for keeping trees appropriately clear of the electric line that is the subject of this technical investigation report. The electric line has been identified to be an uninsulated high voltage electric line that existed in a hazardous bushfire risk area (HBRA) as defined by the CFA.

Section 28 and Graph 5 of the Code of Practice for Electric Line Clearance (the Code) prescribes the minimum distance that trees should be kept clear from uninsulated high voltage electric lines (other than a 66,000 volt electric line) in HBRA. The Code is a schedule to the Electricity Safety (Electric Line Clearance) Regulations 2015.

Sub clause (4) states that “The applicable distance for the middle two thirds of the span is”- and the user then applies either paragraph (a) (b) or (c)

In this situation the span length is 307 metres in length and the contact position was within the middle two thirds of the span. Therefore paragraph (b) applies.

Section 28 (4)(b) applies:

(b) “if the span distance is greater than 45 metres and less than or equal to 500 metres—the distance calculated in accordance with the following expression—

1500 + ((SD - 45) x (500 ÷ 303)) where— SD is the span distance; or

Therefore the applicable minimum regulatory distance by calculation is;

$1500 + ((307 - 45) \times (500 \div 303)) = 1932$ millimetres or 1.93 metres

The tree of concern existed within the middle two thirds of the span therefore a minimum clearance distance of 1.93 metres was required in all directions from the HV overhead conductors.

From the evidence gathered and analysed, site observations made and review of available images ESV estimates the tree was more than 10 metres from the HV conductor and therefore ESV is satisfied that the minimum clearance distance has been maintained prior to the incident.

Prevailing weather information

Bureau of Meteorology Information

On the afternoon of 17 March 2018 damaging winds had passed through the Warrnambool area and South West region of Victoria.

The closest weather station to the investigation site was Warrnambool. The information from this station has been collected by accessing the Bureau of Meteorology Internet site.

Figure 8 below shows that Warrnambool weather station record recorded on 17 March 2018 at 20:00 AEST winds with a maximum gust of 104 km/h coming from a West North Westerly direction.

Figure 8: Excerpt of Warrnambool weather record for March 2018

Warrnambool, Victoria									
March 2018 Daily Weather Observations									
Date	Day	Temps		Rain	Evap	Sun	Max wind gust		
		Min	Max				Dirn	Spd	Time
		°C	°C	mm	mm	hours		km/h	local
1	Th	13.9	20.3	1.2			SSW	43	16:10
2	Fr	9.5	27.5	0.2			S	31	15:51
3	Sa	11.7	22.8	0			SW	50	14:47
4	Su	8.6	20.1	0.2			SSW	41	13:07
5	Mo	7.8	21.2	0			SSW	43	13:13
6	Tu	11.0	22.2	0			S	54	13:27
7	We	8.8	26.9	0			SSE	35	17:45
8	Th	9.2	28.8	0			S	33	14:53
9	Fr	12.0	31.4	0			SSW	33	15:08
10	Sa	12.8	36.6	0			NW	39	12:08
11	Su	14.5	21.1	0			SSW	44	14:51
12	Mo	14.7	19.9	0			SSW	44	15:18
13	Tu	14.5	21.0	0			SSW	46	13:47
14	We	12.9	20.6	0			SSW	37	12:24
15	Th	8.1	20.1	0			SW	37	13:01
16	Fr	5.9	23.7	0			NE	31	10:40
17	Sa	12.0	34.1	0.6			NW	104	20:00
18	Su	12.9	20.2	2.8			W	96	11:15

Findings and conclusions

ESV's findings and conclusions specifically relate to the source of the Warrnambool-Cobden fire and the role played by the electricity infrastructure.

The source of the Warrnambool-Cobden fire

The most likely source of the Warrnambool-Cobden fire ignition was either by the contact of the tree with the 22kV HV Conductor, or the result of the broken conductor hitting the ground following the contact of a failed tree branch. Either of the circumstances could have released enough electrical energy to ignite a fire on the ground.

Auto Circuit Recloser operations

The protection settings on the TRG 005 22kV feeder Circuit Breaker were set to trip to isolate the fault, then attempt to reclose/re-energise, then ultimately lock open until the line had been inspected. Whether or not the reclose operation on the line contributed to the ignition of the fire is unknown. The investigation confirmed that this occurred in line with Powercor policy and the current approved Powercor Bushfire Mitigation Plan.

Vegetation clearances

From the evidence gathered and analysed, ESV concludes that the failed branch made contact with the 22kV HV conductors of the 22kV TRG 005 feeder bringing them to ground. This resulted in the ignition of a fire at approximately 21:16 on 17 March 2018 near 2540 Warrnambool Cobden Rd, Laang.

From the evidence remaining onsite it appears that the failure point on the tree was 11.3 metres horizontally away from the closest conductor, and therefore ESV determines that the failed limb was outside the minimum clearance requirements under the Electricity Safety (Electric Line Clearance) Regulations 2015, however due to its height it was sufficient in length to contact the powerlines when it failed.

ESV determines that the branch that failed was compliant to the minimum Code clearance requirements under the Electricity Safety (Electric Line Clearance) Regulations 2015.

Therefore ESV will not be investigating this incident further.

Appendix A – Weather Observations

Warrnambool, Victoria March 2018 Daily Weather Observations



Date	Day	Temps		Rain mm	Evap mm	Sun hours	Max wind gust			9am						3pm						
		Min °C	Max °C				Dirn	Spd km/h	Time local	Temp °C	RH %	Cld eighths	Dirn	Spd km/h	MSLP hPa	Temp °C	RH %	Cld eighths	Dirn	Spd km/h	MSLP hPa	
1	Th	13.9	20.3	1.2			SSW	43	16:10	14.8	94		SW	15	1018.3	18.7	66		S	22	1018.4	
2	Fr	9.5	27.5	0.2			S	31	15:51	13.1	96		E	7	1015.7	26.1	34		ENE	9	1012.0	
3	Sa	11.7	22.8	0			SW	50	14:47	17.5	76		WNW	22	1008.7	20.2	64		SW	31	1010.7	
4	Su	8.6	20.1	0.2			SSW	41	13:07	16.5	70		SSW	7	1016.9	19.7	41		SSW	26	1017.2	
5	Mo	7.8	21.2	0			SSW	43	13:13	14.2	78		WNW	6	1020.4	19.0	44		S	28	1022.5	
6	Tu	11.0	22.2	0			S	54	13:27	16.5	67		SE	22	1026.3	20.3	58		SSE	37	1025.4	
7	We	8.8	26.9	0			SSE	35	17:45	15.3	89		ESE	7	1026.0	24.5	52		S	22	1023.8	
8	Th	9.2	28.8	0			S	33	14:53	17.1	75		NNE	15	1024.3	27.5	36		SSW	20	1022.9	
9	Fr	12.0	31.4	0			SSW	33	15:08	18.2	68		ENE	6	1025.2	30.1	31		SSW	19	1023.3	
10	Sa	12.8	36.6	0			NW	39	12:08	19.0	58		NNE	17	1023.3	35.8	13		W	13	1020.8	
11	Su	14.5	21.1	0			SSW	44	14:51	18.5	79		SSW	22	1024.2	19.0	59		SSW	30	1025.4	
12	Mo	14.7	19.9	0			SSW	44	15:18	15.8	69		SW	24	1024.8	18.8	56		SW	30	1024.0	
13	Tu	14.5	21.0	0			SSW	46	13:47	17.5	60		SSW	20	1024.5	19.0	50		SSW	26	1023.6	
14	We	12.9	20.6	0			SSW	37	12:24	16.2	64		S	13	1021.2	18.5	53		SSW	22	1018.6	
15	Th	8.1	20.1	0			SW	37	13:01	13.8	78		NNW	13	1015.4	17.9	70		WSW	26	1016.1	
16	Fr	5.9	23.7	0			NE	31	10:40	12.0	97		NNE	9	1016.3	23.3	41		NNW	15	1012.6	
17	Sa	12.0	34.1	0.6			NW	104	20:00	22.0	65		N	19	1009.5	32.8	22		N	46	1004.5	
18	Su	12.9	20.2	2.8			W	96	11:15	13.5	80		NW	31	1004.7	19.1	44		W	48	1011.0	
19	Mo	10.7	23.2	1.4			NW	65	13:08	15.5	82		NW	37	1013.1	21.4	59		WNW	39	1013.9	
20	Tu	13.0	18.9	1.4			SSE	52	15:42	14.1	53		S	28	1027.2	16.5	49		SSE	31	1029.5	
21	We	10.4	23.7	0			E	52	10:51	13.8	66		ESE	17	1029.0	22.6	44		E	31	1025.3	
22	Th	13.7	31.0	0			ENE	46	08:16	16.5	67		ENE	20	1024.4	30.3	29		N	24	1020.0	
23	Fr	14.4	31.4	0			N	50	11:51	20.3	52		NNE	22	1020.1	30.6	26		NNE	24	1015.4	
24	Sa	17.1	26.8	6.6			SW	39	03:12	17.6	95		NNE	20	1012.3	25.5	41		SW	15	1009.1	
25	Su	14.7	21.1	0.2			W	83	15:05	16.8	87		NW	30	1001.0	20.0	42		WNW	43	998.5	
26	Mo	7.6	17.7	8.4			W	70	05:05	13.3	70		WSW	37	1009.1	17.4	53		WSW	39	1011.9	
27	Tu	9.1	21.5	0			NNW	50	12:19	10.8	85		NNE	11	1015.8	20.5	41		NNW	28	1012.1	
28	We	10.8	22.6	0			WSW	52	12:35	18.1	48		NNW	17	1011.5	20.6	70		SSW	24	1014.3	
29	Th	13.2	22.4	0			WSW	48	14:46	14.8	73		NNW	13	1017.3	20.7	47		W	24	1015.3	
30	Fr	13.3	21.7	0			SW	52	13:57	15.3	86		NW	20	1015.9	19.6	63		SW	37	1017.3	
31	Sa	10.0	20.9	0			SW	39	13:33	12.2	88		N	9	1019.4	19.4	45		SSW	24	1016.7	
Statistics for March 2018																						
Mean		11.6	23.9							15.8	74			17	1018.1	22.4	46			27	1017.2	
Lowest		5.9	17.7							10.8	48		#	6	1001.0	16.5	13		ENE	9	998.5	
Highest		17.1	36.6	8.4			NW	104		22.0	97		#	37	1029.0	35.8	70		W	48	1029.5	
Total				23.0																		

Observations were drawn from Warrnambool Airport NDB (station 090186)

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