In the matter of

The 2009 Victorian Bushfires

Royal Commission

and

In the matter of

Powercor Australia Ltd

SUBMISSIONS ON BEHALF OF POWERCOR AUSTRALIA LTD
FIRE AT WEERITE / POMBORNEIT

INTRODUCTION

1 Powercor endorses Counsel Assisting's statement in opening on 24 September 2009 (T7833) about the weather conditions on 7 February 2009:

> *"The weather conditions at the time of the commencement of the fire were appalling. The temperature was recorded at 45°C the humidity was 8%, the forest fire danger index was in excess of 100 and the grassland fire danger index also well in excess of 100. Weather observations of Mortlake and Mt Gellibrand record the maximum wind gust around this time at 120km per hour in a north, north westerly direction with gusts of 90km per hour as standard."*

2 Mr Place at T7891 indicated that the weather conditions were at their most extreme at about 1.00pm. He identified from his readings that the temperature was 41°C with minimum wind speed 90km/hr gusting to 103km/hr with the direction from the north, north west.

3 Counsel Assisting's position is that the cause of the fire at Weerite/Pomborneit was ignition of dry vegetation by molten metal droplets/particles from a conductor clash between the aluminium 22kV and copper 66kV conductors. It is not suggested that ignition was caused by the plasma from an arc. It is also not argued that the arc itself came in contact with the ground.[1]

4 At paragraph 6.3 and 6.4 of the submissions, Counsel Assisting lists a number of events on 7 February 2009, which are stated to be *"not coincidence"*. It is asserted that *"this evidence provides a scenario that points strongly to the clashing of conductors as the cause of the Pomborneit fire."*

5 In his report dated 22 October 2009, Dr Sweeting states:

> *"When deciding whether a fire was ignited by electricity it is important to consider not only other obvious ignition sources but also equally rare events*

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[1] Powercor notes that Dr Sweeting gave evidence in respect of the Kilmore East fire about plasma. For ignition to occur, Dr Sweeting stated "*what that plasma has to do is hit the vegetation. If it would have gone beside the vegetation, it wouldn't have done anything*": Sweeting, T11361:21-23.

that can also only occur when the conditions conducive to electrical ignition are around[2]

...When a fire investigator looks for and fails to find confirming local evidence it is incorrect to conclude that the fire could have been electrically ignited simply because the investigator has failed to find an alternate source."[3]

6 The submissions of Counsel Assisting only consider part of the evidence.

7 Powercor's position is that the evidence is inconclusive as to the cause of the fire. Evidence was adduced in relation to glass on the side of the road, a history of arson along the line, clashing of conductors and debris contacting the conductors. If there was an electrical cause of the fire, the most likely cause of the Weerite fire was debris borne by the wind which contacted with the 22kV conductors causing an arc. The burning debris was then blown by the severe wind to an area on the south side of the Princes Highway, a distance of some 32 metres, where grass ignited.

8 The evidence is inconsistent with the initiation of a fire by a clash of powerlines. A clash of powerlines results in the ejection in all directions of a spray of hot metal particles or sparks. Such ejection will cause burning in the vicinity of the powerlines, especially beneath the powerlines. Particularly, Powercor points to the absence of burning in the vicinity of the powerlines or the absence of expelled metal particles found on the ground during investigation of the cause of the fire.

9 Corroborative objective evidence that the fire was not caused by a clash is the absence of record on the protection relays of an event consistent with the position taken by Counsel Assisting. The only fault on the 66kV line occurred at pole 981. At all other relevant times, the 66kV line was de-energised.

MR POWER

10 In his witness statement Mr Power identified that:

10.1 the power line running alongside the Princes Highway at Weerite is a double circuit line consisting of a 66kV circuit comprising the Colac to Camperdown 66kV line and a subsidiary 22kV feeder circuit;

10.2 physically the poles have three rows of 66kV copper conductors with two conductors per phase, above one row of three 22kV aluminium conductors;

10.3 the CFA identified damaged conductors approximately 32m from the edge of the burnt area in the span between poles 927 and 928; and

10.4 the Colac-Camperdown line was part of the system of power transmission lines constructed by the SEC in 1949.

11 Powercor, during its ownership of the abovementioned lines, has undertaken routine maintenance in accordance with Powercor's maintenance cycle.

12 Inspection of the site by Powercor employees after the fire showed no sign of any evidence of burnt grass under the conductors or within 32m of the line. There was a

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[2] Sweeting, VPO.001.039.0146; Exhibit 526
[3] Sweeting, VPO.001.039.0147; Exhibit 526

coverage of dry grass beneath the powerlines and to the nearest burnt area. The existence of such dry grass is confirmed in the photographs attached to the report of Mr Hensler.[4]

WITNESS EVIDENCE OF EYEWITNESSES

13 Two witnesses were put forward who saw the commencement or close to the commencement of the fire.

14 Ms Regina Beal was not called as a witness and her evidence could not be tested. The Royal Commission should attach little weight to the assertion by Counsel Assisting that two people saw a potential arcing event.[5] Ms Beal's untested evidence was that she saw a flash of light from the window of her house.[6] In her statement, Ms Beal says that her house is 2.3 kilometres from the intersection of the Princes Highway and Danedite Road. The Royal Commission should not accept that Ms Beal's evidence that an arcing/clash event occurred is proven, due to the significant distance from which Ms Beal made her observations, together with the inability to test her evidence.

15 Mrs Kerry-Lynn Callow gave evidence that, whilst driving at approximately 90 to 100km/hr,[7] she witnessed "*a flare*"[8], that "lasted 2 to 3 seconds"[9], or "*a couple of seconds*"[10], "that was *suspended in the air*"[11], that was *"stationary a while"*[12], then *"sort of rolled back on itself in a yellow flame"*[13], that travelled *"at least halfway across"* the roadway[14], which was at the height of the top of the pole[15]; *"the top of the flare would have been... at the height of the two cross-arms at the top and extended downwards from there"*[16], that had the shape of "*blanket-style lightening or a broad flame*"[17], and did not go to ground.[18] Mrs Callow stated that she witnessed this event whilst driving over the Weerite rail overpass,[19] which is approximately 770m away from the origin of the fire.[20]

16 The evidence of Mrs Callow is inconsistent with a clash of powerlines. She did not describe seeing sparks. Neither did Ms Beal. Powercor submits that Mrs Callow saw the results of conductive material, for example, farming or building material or airborne vegetation, bridging the two aluminium 22kV conductors somewhere in the span between poles 927 and 931, causing an arc, igniting, and being blown with the wind across to the south side of the highway.

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[4] Hensler, CFA.001.021.0327
[5] Rush, T7988;30-31; Counsel Assisting's submissions, page 9, paragraph 6.3(b).
[6] Beal, VPO.001.027.0015_R.
[7] Callow, T7849:14-15.
[8] Callow, T7848:19.
[9] Callow, T7848:20.
[10] Callow, T7854:13.
[11] Callow, T7848:24.
[12] Callow, T7848:25.
[13] Callow, T7848:25-26.
[14] Callow, T7849:3-6.
[15] Callow, T7849:17-19.
[16] Callow, T7854:25-31.
[17] Callow, T7854:12.
[18] Callow, T7863:19.
[19] Callow, WIT.7511.001.0001_R; T7861:24.
[20] Exhibit 7 to Supplementary Witness Statement of Ross Polvere (aerial photograph), WIT.7003.002.0004. Note that Mrs Callow conceded at T7860:25-27 that she was somewhere in the vicinity of half a kilometre away from where she saw the "flare".

17 An arc and a clash are not the same. Clashing is the contact of two conductors. An arc is the conduction of current between two points not in contact and the dissipation of energy from that conduction. The visual spectacle of an arc is called "plasma", which is the flow of ions between two electrodes at different voltages.

18 An arc can occur in a number of situations, including:

18.1 when conductors approach each other until they touch (at which point the arc stops). When the conductors separate from each other, the arc may return;

18.2 when the conductors get close enough to each other for the air insulation between them to break down, but do not touch[21]; or

18.3 when material with conductivity properties acts as a pathway for the current to travel between two conductors. This can happen when debris contacts the line and/or structures around a pole.

CFA INVESTIGATIONS AND EVIDENCE

19 The Fire Investigation Preliminary Report completed by Mr Gunning on 28 May 2009 stated as follows:

> *"The cause of the fire was initially treated as suspicious for two reasons.*
>
> - *Firstly there had been fires along the same highway in the same general area that had been deliberately lit on straight sections on the road.*
>
> - *Secondly there was no obvious signs of accidental cause, no machinery or metals were found at the point of origin of the fire.*
>
> *Powerlines on the north side of the highway were inspected on the evening of 7 February by Gary De Vercelli...The powerlines showed clash marks between the 66KV and the 22KV lines. Witnesses said there was a short blackout of power just prior to the fire. The powerlines were initially excluded from possibility as there were no beads on the line, or spray of beads or molten metal under or travelling away from the lines. The area of ignition was also approximately 30 degrees off the direction of the prevailing winds (checked against the AWS at Mortlake and Mt Gellibrand). A metallurgist suggested that evidence of bead spray would have been present from the clash."*[22]

20 The Fire Investigation Preliminary Report also identified that the point of origin was off wind direction at the time although the possibility of down draft winds associated with atmospheric instability could not be discounted. Witnesses placed a lot of dust and debris in the air due to excessive wind speeds. This may have assisted the conduction of the arc over a greater distance.[23]

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[21] Sweeting, VPO.001.039.0149, paragraph 84.
[22] Gunning, CFA.001.021.0101.
[23] Gunning, CFA.001.021.0102.

21 In conclusions as to cause in his report, Mr Gunning identified that the cause of the fire is most likely the arc from the powerlines contacting the ground, or materials that fell to the ground to heat and ignite very dry grass fields at the point of origin.[24]

22 In oral evidence, Mr Gunning said that the arc had been sustained and affected by dust in the air and the gases in the air at the time.[25] He believed it had not gone to ground *"but perhaps more likely ignited some sort of airborne material by way of bark or grass".*[26] Mr Gunning's oral evidence is to be preferred.

23 Mr Gunning gave evidence that he *"line searched the area of grass underneath the powerlines backwards and forwards on three separate occasions and found no evidence of any other fire or any other molten metal off the powerlines."*[27] In cross examination from Mr Tobin SC, Mr Gunning indicated that if a clash occurred between a 66kV and 22kV line then it would produce a high level of energy. He ran a magnet over the area of origin on the south side of the road but he did not find any metal globules. *"The other thing is it was my thoughts that if the clash had had produced metal globules then they would have sprayed under and the immediate south of the power lines, and I looked very hard for areas of fire or small blackened patches but didn't take hold."*[28]

24 Mr Gunning also made an investigation in the area of ignition on the south side of the road found no evidence of the existence of globules in that location.[29]

25 Mr Gunning gave evidence that, after undertaking his investigation, he concluded that *"the most likely* [cause of the fire] *to me at the time was that it was possibly deliberately lit. It was consistent with other fires I had investigated in previous years."* [30] Mr Gunning stated that he had *"studied text books far and wide"* and looked at Sir Eslar Barber's report from 1976/1977 and he *"still came to the conclusion that it had been unlikely that the powerlines had caused the fire without some sort of spray of metal."*[31]

26 It was only after hearing the witness statement of Mrs Beal and Mrs Callow about the *"coincidence"* of the flash and the point of origin of the fire, and the lack of vehicles in the area, that Mr Gunning *"felt there was little other to conclude than the arc had an effect on the cause of the fire."* He stated *"where that occurred, I'm still not to be convinced."*[32]

27 During cross examination by Mr Curtain QC, Mr Gunning accepted that the arc did not contact the ground and that if a clash of conductors occurred one is likely to get a spray of molten metal falling to the ground in the area of the clash.

28 At 7920:

> *"Q. Are you left with the proposition that the arcing caused some airborne debris to ignite?*

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[24] Gunning, CFA.001.021.0102.
[25] Gunning, T7910:2-5.
[26] Gunning, T7910:5-9.
[27] Gunning, T7908:1-5.
[28] Gunning, T7916:23-31; T7917:1.
[29] Gunning, T7916:23-27; T7918:7-10.
[30] Gunning, T7908:27-30.
[31] Gunning, T7909:12-24.
[32] Gunning, T7909:12-24.

A. I would say that's the most likely cause of this fire.

Q. Can airborne debris ignite even without arcing if it hits the wires?

A. It can.

Q. So you don't need an arc for airborne debris to catch fire?

A. Not generally, but my experience has been there needs to be some sort of short circuit so there is a differential of current for that material to ignite.

Q. Really, you would need a piece of airborne debris to span the two conductors.

A. That's correct.

Q. And make contact between them?

A. That's correct.

Q. And if it happened, do you know whether that could cause a flash?

A. If it was of sufficient ability it could, yes.

Q. If you have an arc that is sustained for several seconds, do you know whether that could record as a interruption to the supply or as effecting the supply for that period of time?

A. It is likely."

29 Mr Hensler in WIT.3020.002.0130R reported on an inspection of the location undertaken on 9 February 2009 appending a number of photographs of the view immediately beneath the electricity wires. He wrote:

> *"When electricity wires clash there is a spray of sparks (which are small drops of molten metal) in all directions, even the upwind direction. Some, at least, would reach the ground close to below the wires. These are likely to be hotter, having had a shorter trajectory, than those travelling further. This makes it more likely for such sparks to start a fire nearer, rather than at a distance from the wires. In the Ash Wednesday fire which I investigated, the fire started directly beneath the wires.*
>
> *The absence of any evidence of scorching in the grass on the north side of the highway makes it seem unlikely that sparks (if any) from the wires played any part in starting the fire. It seems improbable that sparks could remain airborne until they had crossed the road."*

30 At 7926 Mr Hensler gave evidence that the spray of molten metal droplets was somewhat analogous to a welding operation in that the contact between the wires at different voltages generates heat locally which can melt small particles of metal and those hot molten particles of metal can be detached and fall to the ground.

31 At T7937 Mr Hensler confirmed that he saw no burning or scorching between the powerlines and the roadway.

EVIDENCE OF POWERCOR WITNESSES ON THE EFFECT OF CLASHING

32 Mr Polvere at T9847 confirmed that if there was a clash of lines, particles would hit the ground very quickly below the conductors and in very close proximity to the conductors and would have high energy densities of up to 2.7 times those particles that landed at the site where the fire was identified. The probability of starting the fire at 38m and not starting one in the vicinity of the line was almost impossible. During cross examination by Mr Rush, Mr Polvere confirmed this evidence.

33 At T9851 Mr Polvere stated that flying debris striking the conductors could cause those items to ignite and be carried by the wind.

34 Mr Power at T9857 identified the possibility that a foreign object blowing into the conductors could have caused the fire. A piece of aluminium foil or building material could cause arcing. Such events are consistent with other experiences on that line and in other lines with materials being blown onto the powerlines.

35 Counsel assisting tendered PAL.009.001.1176. These documents were a report of event no. 13219, which was a report by Powercor of a fire reported on 23 March 2007 at 13:14 hours. The documents indicate that a grass fire occurred at the corner of Johnstones Road & Princess Highway, Weerite as a result of conductor clash. It is noted that weather conditions on 23 March 2007 (see Appendix 1 to these submissions) taken 16 minutes after fire ignition show the wind as north, north westerly, at a speed of 87 km/hr, gusting up to 106 km/hr. The photographs annexed to the report show burning beneath the conductors and to the roadway.[33] It is also noted that the clash of lines was recorded on Powercor's relays (see below). This is what one would expect to see following a clash of powerlines. In contrast, evidence of burning beneath the conductors was not seen at the fire site on 7 February 2009, despite the severity of the conditions on the day.

EVIDENCE OF DR SWEETING

36 On 19 November 2009, Dr David Sweeting was called to give evidence in relation to the Kilmore East fire. Dr Sweeting is an electrical engineer whose doctorate was specifically related to the topic of electrical arcs. Dr Sweeting provided the following evidence, which is relevant to the investigation into the fire at Weerite, and which has not been drawn to attention by counsel assisting:

36.1 [When conductors clash] "*in the air between the two conductors the current flows in an electric arc. The arc has three components, a cathode at one end, an anode at the other end and a constricted column in the middle.*"[34]

36.2 *"If the total energy dissipated in any particular spot* [on the conductor] *is sufficient it can melt the metal conductors and eject a molten drop of conductor material."*[35]

36.3 *"To be able to cause a fire the molten metal droplet, which will be of the order of a millimetre in diameter must fall to the ground and ignite flammable material."*[36]

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[33] Power, T9867:16-23 and T9868:1-3.
[34] Sweeting, VPO.001.039.0149; Exhibit 526, paragraph 87.
[35] Sweeting, VPO.001.039.0150; Exhibit 526, paragraph 93.

36.4 In examination by Dr Donaghue:

> *"Q. In relation to that mechanism, you will only get ignition or you will only get particles ejected in certain conditions?*
>
> *A. You need the arc route, the actual arc to stay still long enough for long enough and have enough current to actually melt the metal so that the pressure underneath the arc route an actually squirt the globular metal out and then that globular metal has to fall all the way down to the ground and when it hits the ground it has to hit a piece of material that is dry enough that, as it hits it, it can bring it up to ignition temperature and start a fire."*[37]

36.5 *"In my movies the one millimetre size is the sort of size that we eject out of arcs. That's the sort of size that I find on the ground after doing testing."*[38]

37 Dr Sweeting's evidence thus corroborates the witness evidence regarding the behaviour of arcs and metal globules given in regard to the Weerite fire, as set out above.

EVIDENCE OF ASSOCIATE PROFESSOR BLACKBURN

38 Associate Professor Blackburn in his evidence admitted the possibility that fire could be caused by contact with debris:

> *"The other possibility is that you may have some material, particularly in bushfires they may be burning embers or charred branches which have already got some conductivity and if they land onto conductors that are different voltage, then it is likely that you will get a flashover. In that case you will get a relatively rapid development of arc discharge between the two conductors and that material that caused them will effectively finish its role there."*[39]

39 Associate Professor Blackburn gave evidence that:

39.1 conductive material landing on conductors can cause an arc discharge;[40]

39.2 conductive material can cause a flashover;[41]

39.3 a flashover will manifest itself *"like a light being discharged"*;[42] and

39.4 *"yellow is certainly more consistent with burning"*.[43]

40 Despite such evidence, Associate Professor Blackburn would not accept that Mrs Callow's description of *"the blue colour came across the highway from north to south and then it rolled back as a yellow colour drifting in the other direction and then it*

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[36] Sweeting, VPO.001.039.0150; Exhibit 526, paragraph 96.
[37] Sweeting, T11368:15-25.
[38] Sweeting, T11381:29-31.
[39] Blackburn, T9931:4-12
[40] See above, para 38.
[41] Blackburn, T9931:8-9.
[42] Blackburn, T9931:22-23.
[43] Blackburn, T9932:2-3.

disappeared" (accepting the evidence that there are very strong winds at this time) is a description consistent with something burning in the air.[44] The Royal Commission should attach no weight on Associate Professor Blackburn's refusal to accept a summary of his own evidence that had been put to him.

41 Associate Professor Blackburn attempted to explain the lack of evidence of burning under the conductors by postulating that the alleged clash had been between the 66kV and 22kV conductors, rather than between two 22kV conductors. He said that he would imagine that if there was a clash between an aluminium 22kV conductor with and a 66kV copper conductor then, in that case, there would be less likely to have been incandescent particles able to cause a fire dropping down to the ground compared to the clashing that you might get between two horizontally displaced aluminium conductors at 22kV.

42 In cross examination by Mr Curtain QC, Associate Professor Blackburn said that the lack of fire underneath the span, directly underneath the span or just on the windward or the leeward side to the span, just seemed to him to make it more likely that there was a clash between the 22kV aluminium line and the 66kV copper line.[45]

43 The evidence of Associate Professor Blackburn about the lack of fire underneath the lines given at T9224-9926 should be disregarded. At T9225 he explained that, during a 22kV to 66kV clash, there would be particles ejected vertically downwards from the copper line but only upwards from the aluminium line because the arc would be rooted on the upper surface of the aluminium and on the lower surface of the copper.

44 If copper particles as Associate Professor Blackburn says were ejected downwards from the copper then they would have had sufficient retained heat when falling from a distance of 9 metres at $29ms^{-1}$ to start a fire.

45 Associate Professor Blackburn was evasive in his evidence regarding the ignition potential of copper particles. In cross-examination by Mr Curtain QC, the following exchange took place:

> *"Q. If the copper particles are sufficient to become molten, they would have been heated to a temperature in excess of 1000 degrees Centigrade?*
>
> *A. Correct, yes.*
>
> *Q. And if the distance from the wires that were described to you are correct and they were ejected at, say, 29 metres a second it would take about a third of a second for them to reach the ground below?*
>
> *A. Correct, yes.*
>
> *Q. They would still have a retained heat of about 800 degrees Centigrade?*
>
> *A. I'm not sure of that, but it may well be that temperature.*

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[44] Blackburn, T9932:4-13.
[45] Blackburn, T9224.

...

Q. *There would be no doubt it has a potential to cause fires at 800 degrees Centigrade?*

A. *Mmm, but if the particles were emitted directly downwards at 29 metres per second, then with a 29 metre per second wind they would be deflected by the wind and so they wouldn't fall directly under the line, they would be traversing an angle of 45 degrees and so they would go an equal distance the line is above the ground,* ***so they would go about nine or 10 metres to one side*** *and that may well be starting to get onto the road, and I'm not sure what the extent of the flammable material, the dry grass was south of the line.*[46]

(emphasis added).

46 The distance between the commencement of the road and directly beneath the powerlines is 18.4 metres. This was measured by Powercor surveyor, Jeff Hooper, and is demonstrated at Exhibit 6 of Mr Polvere's witness statement.[47] On Associate Professor Blackburn's evidence, if a clash had occurred between the 66kV and 22kV conductors, evidence of this clash should have been found on the north side of the road, within 9 to 10 metres of the powerlines. It was not.

47 Photographs of the grass underneath the powerlines on the north side of the Princess Highway are exhibited in Appendix A of the *CFA Fire Investigation Management System – Wildfire Report* by Mr Gunning.[48] Photograph 19, at CFA.001.021.0127, shows that the material on the north side of the road was long, dry and highly flammable grass.

48 Associate Professor Blackburn was not asked questions concerning the flammability of the material on the north side of the road. He was asked whether there was a potential to cause fires at 800 degrees Centigrade. His deferral to discussions of the flammability of the material, and speculation of the distance at which the road commenced, was evasive.

49 Powercor's case is that there was no clash on 7 February 2009. The entirety of the evidence from other parties, as summarised above, is that a clash of lines will result in a spray of molten metal globules in all directions including downwards, thus causing a fire to start below the lines. Further, Associate Professor Blackburn in his paper *"Conductor Clashing Characteristics of Overhead Lines"* given to the Electric Energy Conference in 1985 (annexed as Appendix 2 to these submissions) at page 214 has a photograph showing clashing arc particle emission with molten metal globules going in all directions, including downwards.

50 If aluminium particles had hit the ground below the conductors, then they would cause a fire. Mr Polvere at T9847 stated that the particles landing directly below the conductor and in very close proximity to the conductor would have energy densities of up to 2.7 times those particles that land at the site where the fire was identified and, as a result, the probability of starting a fire at 38 metres and not starting one in

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[46] Blackburn by Mr Curtain, T9926:1-31, T9927:1-9.
[47] WIT.7003.001.0055.
[48] CFA.001.021.0126 – CFA.001.021.0130.

the vicinity of the line would be almost impossible (T9848). The temperature of such aluminium particles would be 1500 degrees[49].

51 Associate Professor Blackburn accepted that without any voltage on the 66kV line, there would be no arcing in the event of clash between the 22kV and 66kV line.[50] The evidence of Wayne McDonald, discussed below, shows that the 66kV line was de-energised at the time of the fire, due to an outage caused by a fault approximately 5km away from the fire.

52 Associate Professor Blackburn is not to be accepted furthermore because he did not take account of the evidence of the relay equipment. The relay equipment provides crucial evidence as to:

52.1 the location of the faults;

52.2 the lack of interaction between the 22kV and 66kV lines; and

52.3 the fact that the 66kV line was de-energised at the time of the fire.

RELAY EQUIPMENT

53 Wayne McDonald, Senior Protection and Control Engineer with over 40 years of experience in the power industry provided a witness statement dated 1 September 2009 in relation to the electronic protection on the Colac-Camperdown 66kV transmission line.

54 In witness statement WIT.7001.001.001, he explained:

54.1 the 66kV CLC-CDN line is protected by distance relays at both Colac and Camperdown substations;

54.2 the distance relays are three zone relays. The zones relate to the time it takes for the relay to realise that there is an abnormality on the line;

54.3 the zone setting in which the fault is detected will indicate what point along the line the fault is detected. When the fault current and the impedance of the line are determined, the location of the fault can be calculated.

55 Powercor provided to the Royal Commission extensive material describing the operation of the electronic protection equipment on the CLC-CDN line as set out in paragraph 5 of the statement of Mr McDonald at WIT.7001.001.002. Mr McDonald explained to the Royal Commission that the relays are *"the box of electronics, basically, that looks after the protection and monitoring of everything associated with that line."*[51]

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[49] Blackburn, T9898:5-6.
[50] Blackburn, T9928:2-6.
[51] McDonald, T9882:24-26.

56 The relays have a distance to fault location feature within the equipment, which gives a *"far more precise"* location of where the fault occurred along the powerlines.[52]

57 The relay equipment is accurate and reliable. Mr McDonald took steps to confirm the accuracy of the relay equipment with the manufacturer, Schweitzer Engineering, and provided this information to the Royal Commission.[53] The manufacturer confirmed the accuracy of the distance to fault measurements of the relays protecting the 66kV CLC-CDN line. Mr McDonald explained to the Royal Commission that, unlike 66kV faults, Powercor does not generally rely on the distance-to-fault in the relay for 22kV fault location.[54]

58 At no time during evidence of cross examination of Mr McDonald was it suggested that Powercor's relay equipment was inaccurate or not state of the art.

Fault on the 66kV Line

59 The events recorded by the relays, called Events 3-13 in Mr McDonald's witness statement, reveal that the relays detected a fault on the 66kV line. The relays place the fault at Pole 981. At T9882, Mr McDonald gave evidence that the relay has a distance to fault location feature which gives a precise figure for location of fault. Accordingly it is incorrect to place a fault on the 66kV line at pole 928 or thereabouts.

60 At paragraph 35 of his statement, Mr McDonald identified that a physical inspection of the location around Pole 981 revealed physical evidence that is consistent with a fault.[55] He referred to splash mark evidence of damage on the cross-arm insulator and a missing bird cover from the white phase cross-arm. Mr McDonald's evidence, on which he was not cross-examined, was that airborne debris, such as bark or a branch from adjacent trees, lifted during extreme conditions on 7 February.[56] The debris made contact with the electrical structure and assets on Pole 981 in the various configurations so as to give rise to the faults recorded by the relays on the 66kV line at Camperdown and Colac.

61 It was put to Mr McDonald that the 66kV fault was not around Pole 981. Mr McDonald rejected the proposition. He said that the most accurate recording of the fault location, as explained to him by the manufacturers of the relay, was the recording of the single-ended fault.[57] This recording of the relays pointed to the fault on the 66kV line having occurred at pole 981.

62 If a clash had involved the 66kV conductors, as suggested in evidence by Associate Professor Blackburn,[58] the relays on the 66kV line would have detected a fault near the ignition point of the fire. They did not. Instead, the 66kV fault was detected approximately 5 kilometres away, at pole 981.

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[52] McDonald, T9882:20-22. Mr McDonald's evidence was that the distance to fault feature of the relays is far more precise than the zone setting of the substation in determining the location of the fault along the powerline.
[53] PAL.009.001.1258; Exhibit 436.
[54] McDonald, T9883:1-8.
[55] WIT.7001.001.007.
[56] Note that the adjacent trees were outside the vegetation clearance zone.
[57] McDonald, T9885.
[58] Blackburn, T9224.

63 If a clash had involved the 66kV together with the 22kV conductors, as suggested in evidence by Associate Professor Blackburn, then the injection of 66,000 volts into the 22kV feeder line would have created a power surge that would have been recorded on the protection equipment and would have caused damage to customers' electrical appliances. No record of such damage has been found and no complaints have been made by customers.

64 The evidence shows that power was cut to the 66kV line upon detection of the 66kV fault. Power was very briefly restored after approximately 3 seconds when the circuit breaker at Camperdown reclosed, however was lost again when the Camperdown relays on the 66kV line detected the fault again. The 66kV line then remained without power at all material times, until power was manually restored later in the day. [59]

Fault on the 22kV Line

65 The protection equipment also recorded faults on the 22kV feeder line. The following events are described in Mr McDonald's witness statement:

65.1 Event 4, at WIT.7001.001.007, explains that the relays on the 22kV line at Camperdown detected a phase and earth fault on the 22kV feeder; and

65.2 Event 8, at WIT.7001.001.008, explains that the 22kV feeder at Camperdown recorded a white to blue phase fault of maximum 1,300 amps.

66 After undertaking calculations based on the impedance of the line, Mr McDonald concluded that the 22kV fault was likely to be in the area of poles 931 to 927.[60]

67 Events 4 and 8 in Mr McDonald's witness statement detail the relays on the 22kV line detecting the event that Mrs Callow gave evidence of witnessing.[61] The event was the bridging of the 22kV conductors by airborne conductive material. The event only involved the 22kV conductors.

68 If the fault on the 22kV line had been the clashing of two 22kV aluminium conductors, contrary to the case advanced by Counsel Assisting, there would have been evidence of fire, metal droplets or scorching on the northern side of the Princes Highway, underneath the powerlines, or just on the windward side or the lee ward side of the span. No evidence was found.

69 While it is unusual to get two faults within a few minutes of each other at different locations that are not related,[62] the evidence indicates that this in fact occurred during the extreme weather conditions on 7 February 2009. Powercor again reiterates Dr Sweeting's evidence that it is important to consider rare events when determining whether a fire was ignited by electricity.[63]

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[59] See Exhibit 1 to Wayne McDonald's statement, at WIT.7001.001.0013.
[60] McDonald, T9890:10-12, PAL.009.001.1270 (Exhibit 436).
[61] Callow, T7848-7863, see paragraph 15 above.
[62] McDonald: T9888:28-29.
[63] Sweeting, VPO.001.039.0146; Exhibit 526.

Connection between 22kV and 66kV conductors

70 There is an instance on 7 February 2009 during which the relays indicate that a 22kV conductor came in contact with a 66kV conductor. 22,000 volts were recorded to be energising the 66kV CLC-CDN line for about a second and a quarter[64]. This can be seen at the top of the graph at Exhibit 1 of Mr McDonald's statement, and is attached as Appendix 3 to these submissions.[65] This occurred when the 66kV line was de-energised.[66] Mr McDonald explained at T9887 that the event could either have been clashing or could have been some debris coming in contact with the conductors and transferring the voltage between conductors.

71 This event did not cause the fire. At the time that contact was made between the 22kV conductor and the 66kV conductor, the 66kV line was de-energised, with *"very little, if any, current flowing at that time."*[67] Associate Professor Blackburn gave evidence that "*without any voltage on the 66, there would be no arcing*".[68]

72 Powercor's case therefore is that there was no clashing of lines at or around Pole 927 which could have ignited the fire.

OTHER ISSUES - WIND

73 Mr Gunning, at CFA.001.021.0101, reported in his fire investigation report that the area of ignition of the fire was approximately 30 degrees off the direction of the prevailing winds (checked against AWS at Mortlake and Mt Gellibrand). This evidence is more consistent with burning debris being blown in the direction of the prevailing wind after having contacted the powerlines upwind of the fire ignition point.

OTHER ISSUES – CLEARANCE BETWEEN CIRCUITS – PARAGRAPH 6.10(A) OF COUNSEL ASSISTING'S SUBMISSIONS

74 Counsel Assisting misinterprets the evidence in relation to the clearance distance between the 22kV and the 66kV conductors on poles 927 and 928. Counsel Assisting, at paragraph 6.10(a), relies on evidence that was put to Mr Polvere, who was not the appropriate witness to lead this evidence and who had stated:

> *Q. What's the distance that is meant to be kept between the circuits on these powerlines?*
>
> *A. Between?*
>
> *Q. Between the circuits, between the very level of powerline?*
>
> *A. I don't know.*

75 It was not Mr Polvere but Mr Power who gave evidence in his witness statement and during examination in relation to the clearance between circuits.

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[64] McDonald, T9887:3-8.
[65] McDonald, WIT.7001.001.0013.
[66] McDonald, T9886:7-17, 22-31; T9887:1-16. See description in paragraph 64 above of the power supply being stopped to the 66kV line after the recording by the relays of faults on the line.
[67] McDonald, T9886:14-16.
[68] Blackburn, T9928:5-6.

76 Mr Power explained that the design clearance for stringing lines requires that *at the extreme conditions*, that is, on a cold day of 5°C when the bottom conductor is switched off and therefore tightly strung, and the top conductor is at full load and therefore at maximum sag, a clearance of 900mm is required. Under those hypothetical conditions, the survey measurements of the span between poles 927 and 928 indicated that the circuit to circuit clearance would be 620mm. As the temperature was 45 °C and both circuits were operating on 7 February 2009, there is no evidence that the clearance between the 22kV and the 66kV on the day of the fire was 620mm.[69] Rather, when using the known temperature and load conditions on that day, calculations show that a clearance of 1500mm would have existed on the day.

77 The distance of 620mm has no causative relevance since, as appears above, there is no evidence of a clash between the 22kV and 66kV lines on 7 February 2009.

OTHER ISSUES – DAMAGE TO THE CONDUCTORS – PARAGRAPH 6.3(E) OF COUNSEL ASSISTING'S SUBMISSIONS

78 Evidence was provided to the Royal Commission that the conductors in the span between poles 927 and 928 showed damage in the form of blackened marks on the conductors. Mr Gunning measured the seat of the fire to be 38 metres from the blackened marks on the conductors.[70]

79 There is no certainty in the evidence as to when the damage occurred nor as to how the damage occurred. At T7972:8-12 and T7977:18-22, Garry de Vercelli gave evidence that he formed the opinion that the damage to the conductors between poles 927 and 928 was recent because the splash marks and copper bead on the conductors was "*bright*" and "*fairly shiny*".

80 This evidence is speculative. Mr de Vercelli did not make any independent investigation. His conclusions are unreliable and he was not qualified to give evidence in regard to oxidation rates of copper conductors.[71] To make a determination based on this evidence alone that the damage to conductors was caused on 7 February 2009, is unsafe.

81 The damage to the conductors could have occurred:

81.1 days, weeks or even a few months prior to Mr de Vercelli viewing it;

81.2 as a result of clashing and/or an arc generated during clashing;

81.3 as a result of an arc generated by debris bridging the conductors; or

81.4 as a result of lightening strikes.

82 Counsel Assisting's submissions focus on only one of possible conclusions and is not supported by verifiable evidence. Again, it should be noted that the evidence shows that the 66kV line was de-energised at the time of ignition of the fire.

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[69] Power, WIT.7002.0033.005; T9854:16-31; T9875:1-14 and T9876:2-8.
[70] Gunning, T7907:1-3.
[71] It was noted by Prof. Blackburn that the oxidation process of copper is much less rapid than in aluminium: Blackburn, T989725-31; T9898:1-8.

OTHER ISSUES – PARAGRAPH 6.3(A) OF COUNSEL ASSISTING'S SUBMISSIONS

83 At paragraph 6.3(a), Counsel Assisting states that:

> *"a fault was recorded on the 22kV circuit and the 66kV circuit tripped to lockout."*

84 The juxtaposition of two facts in this statement creates an incorrect inference.

85 The evidence before the Commission is that:

85.1 a fault was recorded on the 22kV circuit and the protection relays on the 22kV circuit responded. This fault was determined to be located between poles 927 and 931; and, quite separately

85.2 a fault was recorded on the 66kV circuit and the protection relays on the 66kV circuit responded, by tripping the 66kV line to lock-out. This fault was determined to be located at pole 981.[72]

86 Counsel Assisting appears to have mixed two individual and quite separate events. There is no evidence that the 66kV circuit tripped to lockout *because* of a fault that was recorded on the 22kV circuit.

OTHER ISSUES - PARAGRAPH 6.26 AND PROPOSED KEY FINDING 8.4 OF COUNSEL ASSISTING'S SUBMISSIONS

87 Counsel Assisting's submissions for the first time assert that it is appropriate to make a finding that the so-called *"long history of clashing conductors on this line in the general area of the clashing event of 7 February,"* should be characterised as an indictment of the management of the line. Powercor says that such a conclusion ought to be rejected.

88 If it were intended to make criticisms of management, natural justice would dictate that these criticisms ought to be put to Powercor's management witnesses during questioning, to give an opportunity to respond. This was not done. Shane Breheny, Powercor's CEO, gave evidence on 24 November 2009 and 3 December 2009. The issue was not raised with him. In the absence of such procedural fairness, the Commission should not make the finding recommended by Counsel Assisting.

89 In any event, the assertion should be rejected as being incorrect.

90 Mr Power gave evidence that, over the last five years, there has been a progressive implementation of repair works on the CLC-CDN line which have focused on a number of troublesome spans.[73] Contrary to Counsel Assisting's assertion, this demonstrates proactivity on the part of management to address concerns associated with this line.

91 To briefly address the allegations raised in paragraph 6.24 of Counsel Assisting's submissions, Powercor says as follows:

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[72] See discussion of Wayne McDonald's evidence above.
[73] Power, T9866:14-19 and T9867:30-31 to T9868:1.

91.1 6.24(a) – On 29 April 2000, conductors clashed in the span between poles 917 and 918. A re-design was undertaken and pole tops were reconstructed with new cross arms on these poles in December 2000, in time for the fire season;

91.2 6.24(b) - The event of 23 July 2000 between poles 917 and 918 occurred in the intervening period between the re-design referred to above and the completion of works. This event occurred in non-bushfire season, and the works were completed in time for the next fire season;

91.3 6.24(c) - The suspected clashing incident of 23 December 2005 between poles 926 and 927 was subsequently determined after a site visit on 18 January 2006 as being more likely to be as a result of a lightning strike. Evidence of this was given in the Royal Commission but ignored in the written submissions of Counsel Assisting;[74]

91.4 6.24(d) - A member of the public telephoned a report of *"conductors twisted together"* on 21 November 2006. There was a high number of storm related outages across the Powercor network on this day. A patrol of the Princess Highway near Camperdown did not identify any line clearance issues; and

91.5 6.24(e) – On 23 March 2007 a fire resulted from a clashing of conductors between pole 920 and 921. A design review was undertaken and the pole top was reconstructed with three new cross arms installed on pole 920 in October 2007. Similar work was also undertaken on poles 876, 895, 906, 908, 920, and 921.

92 The evidence shows that Powercor has actively managed the CLC-CDN line through inspections, maintenance and redesign activity where appropriate.

OTHER ISSUES – POWERCOR'S RECORDS – PARAGRAPH 6.25 OF COUNSEL ASSISTING'S SUBMISSIONS

93 At paragraph 6.25 of Counsel Assisting's submissions, it is stated that *"Powercor's records... may not be comprehensive."* This allegation is on account of the testimony of Terrance Place, who recalled a fire on the Princes Highway near Johnstones' Road caused by clashing of conductors on Christmas Day five-six years ago.[75]

94 Powercor has no record of an outage on the line on either 25 December 2004 or 25 December 2005. The event of 23 December 2005 described in paragraph 6.24 (c) of the submissions of Counsel Assisting is proximate to the time indicated by Mr Place. The Royal Commission should infer that Mr Place's memory relates to that event.

95 Powercor's Outage Management System records are accurate, extensive and comprehensive and no evidence has been lead to the contrary

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[74] Power, T9865:10-17; PAL.009.001.1167.
[75] Place, CORR.0906.0373_R.

CONCLUSION

96 It is recommended that the Royal Commission should make the following findings:

96.1 The evidence is inconclusive as to the cause of the fire.

96.2 Alternatively, the totality of the evidence is compatible with the fire having been ignited by the contact of airborne debris with the 22kV conductors. The airborne debris bridged the conductors, causing an electrical arc which was witnessed by Mrs Callow. The arc ignited the debris, which was blown across the road, also witnessed by Mrs Callow, and ignited the dry grass on the south side of the Princes Highway.

27 January 2010

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David Curtain Q.C.
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APPENDICES

Appendix 1 – Mt Gellibrand weather observations for 23 March 2007.

Appendix 2 – Blackburn, T. (1985) *"Conductor Clashing Characteristics of Overhead Lines"* page 214.

Appendix 3 – Graph: *CDN to CLC 66kV Line and CDN2 22kV Feeder Operations – 7 Feb 2009*, Exhibit 1 to Witness Statement of Wayne McDonald dated 1 September 2009; WIT.7001.001.0013.