IN THE MATTER OF:

2009 VICTORIAN BUSHFIRES
ROYAL COMMISSION

KILMORE EAST FIRE SUBMISSIONS
(Persons represented by Maurice Blackburn and Slidders Lawyers)

1. INTRODUCTION

1.1 The catastrophic bushfire now known as the "Kilmore East-Kinglake" fire was caused by a conductor failure between Poles 38 and 39 on the Pentadeen Spur SWER line at Kilmore East. The line is part of the SP AusNet ('SPA') network.

1.2 The Pole 38-39 span is unusually long, spanning a distance of 1.05km across a valley. At 11.45am on 7 February 2009 the conductor failed where it met the helical fitting at Pole 39. It sprang back toward Pole 38 and fell across the southern guy-wire (or "stay") supporting Pole 38. There was an arc that either ignited flammable material in its path, or caused burning steel particles to drop to the ground below, igniting the bone dry grass growing between basalt rocks.

1.3 The fire was reported to the CFA at 11.49am[1] and fire crews arrived on the scene within about 10 minutes of fire ignition,[2] however, in the prevailing weather conditions, the fire spread with great speed and ferocity and was unstoppable within minutes of ignition.[3]

1.4 The fire ignited by the Pentadeen Spur conductor devastated an area of 75,744 hectares, destroying 1244 homes and taking the lives of 121 people.[4]

1.5 These submissions address the following issues:

(a) the location and mechanism of ignition of the fire

(b) the cause, mechanism and sequence of failure of conductor between poles 38 and 39 on the Pentadeen Spur SWER line

(c) The adequacy of systems in place to prevent such failure

---

[1] Exhibit 4 – Statement of Reese, (WIT.004.002.0001) at [14]
[2] Exhibit 513 – Statement of Court, (WIT.3004.021.0292) at [39]
[3] Exhibit 513 – Statement of Court, (WIT.3004.021.0292) at [44]; Court T10964:21 to 30, T10965:1 to 12; Exhibit 652 – Statement of Dixon, (WIT.3004.021.0348) at [72.1]
[4] Exhibit 672, (CRC.300.007.0020_R) at 0047 and (CRC.300.001.0135) at 0147

2. LOCATION AND MECHANISM OF IGNITION

2.1 The evidence given at the Commission establishes that the fire started near Pole 38, as a result of the live conductor, having broken near Pole 39, recoiling and draping over the southern stay wire supporting Pole 38 and causing an arc to form either between the conductor and the stay wire or between the stay and thimble combination and the anchor rod. This evidence was not challenged and in the circumstances there can be no doubt that the fire was ignited by the downed conductor.

2.2 The only question which arises from Dr Sweeting's report is whether the ignition occurred because the electrical arc produced a "squirt" of plasma which enveloped some flammable material in or near the thimble, or because the arc ejected burning steel particles which dropped to the ground below.

2.3 Nothing turns on the question: on either explanation, it was the collapse of the conductor which caused an arc, and the arc caused ignition. The precise manner of ignition is irrelevant. For completeness, however, we do offer some observations regarding the manner of ignition.

2.4 Counsel for SPA appeared to suggest that there was something inherently improbable in a plasma squirt starting a fire. Such a suggestion should be rejected: plasma squirts are typically associated with clashing but clashing typically occurs between conductors in situ, well away from flammable material. At Kilmore East the conductor had already fallen and the so the clash, and arcing, occurred near flammable material. There is nothing inherently unusual in a plasma squirt in those circumstances igniting a fire.

2.5 Professor Sweeting concluded that plasma, rather than steel droplets was responsible for ignition. He reached this conclusion on the basis of a belief that steel droplets would have to have a diameter of 1mm or greater to cause ignition.[5] However, his interpretation of the HRL report was that the arc erosion on the conductor, stay wire, stay thimble and anchor rod (all of which were galvanised steel) was confined to erosion of the zinc galvanising, which would have vapourised[6] and, if particles were emitted from the steel, they would not be of sufficient diameter necessary to ignite the grass below.[7]

[5] Sweeting T11381:17 to 20

[6] Sweeting T11372:9-11373:5.

[7] Sweeting T11383:14-20.

2.6 However, we submit that the circumstances of the Kilmore fire are not inconsistent with particle ignition. In analysing the arc erosion the HRL Report specifically stated that *"the marks on the stay wire thimble and the anchor bar eye included well defined craters, indicative of material being ejected during arcing"*.[8]

2.7 While the size of the steel particles ejected is not known, it is not established that molten steel particles must be 1mm diameter or greater in order to ignite a fire in dry grass. Professor Sweeting did not identify the basis for his assumption that particles "of the order of" 1mm or greater[9] were necessary for ignition (save to state that he had "whole piles" of research and movies).[10] It may be that Professor Sweeting was referring to the considerable body of research from 1977 SECV tests, which did in fact find that an aluminium particle had to be at least 1mm in diameter to ignite a fire. However, that research was not for the purpose of correlation with fire starts simpliciter, but rather to determine how large aluminium particles needed to be to retain sufficient heat to start a fire after travelling a significant lateral and vertical distance from the conductor in situ.[11] The research only studied aluminium particles, not steel particles and did not look at propensity for ignition by steel particles falling a distance of only a few feet.

2.8 A study conducted by Professor Stokes showed that steel particles are more likely to ignite a fire than either copper or aluminium. Steel melts at more than twice the temperature of aluminium but continues to burn like aluminium after ejection by an arc.[12] In Stokes' tests, arcing between steel conductors caused ignition in 100% of tests involving dry barley grass in "still" conditions, and 60% in wind-exposed conditions.[13]

2.9 As well as burning significantly hotter than the aluminium particles, any steel particles ejected by arcing in this case would be falling from a significantly smaller distance than conductor height and so could retain sufficient heat while being smaller in size.

---

[8] Exhibit 525 – HRL Report (VPO.001.039.0016) at 0042

[9] Exhibit 426 –Sweeting Report (VPO.001.039.0132), at [96].

[10] Sweeting T11381:24-31. Note he refers to particles found "on the ground after testing". It is not apparent whether the tests related to steel conductors or what the other test conditions were.

[11] See discussion in Exhibit 437 – Statement of Professor Blackburn, (EXP.008.001.0001) at page 0006; Blackburn T9898:17 to 24

[12] Prof. A.D. Stokes "*Fire Ignition by Electrically Produced Incandescent Particles*", Appendix E to Australian Standard AS1033.1-1990 at [5.2] p.58; see also Professor Blackburn's paper "*Conductor Clashing Characteristics of Overhead Lines*", Electricity Energy Conference 1985; Sweeting T11382:6-26

[13] Prof. A.D. Stokes "*Fire Ignition by Electrically Produced Incandescent Particles*", Appendix E to Australian Standard AS1033:1-1990 at [5.2 p.57]; Sweeting T11382:19-26

3. MECHANISM AND SEQUENCE OF CONDUCTOR FAILURE

3.1 It is not disputed that the relevant break in the conductor occurred near the end of the helical fitting which attached the conductor to Pole 39. The real controversy in the evidence relates to the cause and timing of the failures of the three strands of wire comprising the conductor.

Sequence of failure

3.2 These three wires making up the conductor disclosed four fracture points. Three points were very close to the end of the helical fitting, while the fourth was some 2.78m from the end of the fitting, meaning that one of the wires broke in two places and a 2.78m section of that wire fell from the conductor.

3.3 HRL identified the fracture "faces" in three groups, being the faces on the wires still attached to Pole 39 (group 0802-001 faces 1, 2 and 3), those on the long conductor section approaching from the western (Pole 38) side (group 0802-002 faces 1, 2 and 3) and either end of the 2.78m span found on the ground near Pole 39 post-fire (group 0802-003 faces 1 and 2). The three faces aligned as shown in the diagram in Figure 4 of the report of Dr Rhys Jones and we will use the descriptions set out in that diagram.[14]

3.4 It is not disputed that Wire 3 failed last and that it failed by ductile overload, and that the western fracture on Wire 1 occurred after the eastern fracture, meaning that for some period of time, a 2.78m section of Wire 1 would have been unwound but still attached to the conductor. Beyond that the sequence of failures is uncertain.

Mechanism of failure

3.5 Much scientific evidence was given about the nature of the conductor fractures. Ultimately, the conflict between expert opinions may be summarised in the manner set out in the following paragraphs.

3.6 HRL examined the conductor on behalf of the Victoria Police. HRL metallurgists have extensive experience in analysing conductor failures. Mr Better of HRL testified that:[15]

(a) Wires 1 and 2 failed near the helical fitting because of metal fatigue. Wire 3 failed due to overload once Wires 1 and 2 failed.

(b) Metal fatigue in wires 1 and 2 was most likely due to high frequency low stress wind induced vibration of the conductor

[14] Exhibit 543 – Jones Report (EXP.5100.001.0001) at 0008
[15] Exhibit 525 – Better Report (VPO.001.039.00016) at 0051

(c) The fatigue cracking in Wires 1 and 2 originated at a small depression in the wires, coinciding with the ends of the helical fitting, where a layer of martensite had formed.

(d) The most likely mechanism for the formation of the martensite was fretting as the conductor strands moved and rubbed against the helical fitting and/or each other.[16]

(e) The time between initiation of fatigue cracking and failure of conductor was unknown, but it was a slow process, taking more than one or two years[17]

(f) The fact that the helical fitting was incorrectly seated in the thimble would have altered the mode of vibration and accelerated the failure of the conductor.

3.7 Dr Jones, engaged by SP AusNet, presented a contrary opinion. Although Dr Jones has significant experience in metallurgy in the aircraft industry, he does not have experience in fractures of steel conductors. In fact, he admitted that he has never examined fractures caused by Aeolian vibration. He stated that:

(a) Wires 1 and 2 failed due to a number of "high load" events and not due to fatigue caused by high frequency, low stress vibrations, such as Aeolian vibrations[18]

(b) The failure occurred rapidly, although the exact timeframe is unknown[19]

(c) The incorrect fitting of the helical in the thimble was unlikely to have any effect[20]

3.8 We would submit that, for a number of reasons set out below, Dr Jones' evidence should be rejected and the Commission should accept the conclusions of Mr Better and HRL because Dr Jones' evidence demonstrated a profound lack of precision and scientific rigour.

3.9 Dr Jones derived his conclusions from fractal analysis experiments, which were conducted on the conductor strands by a third party. These experiments purported to measure the "fractal dimension" and "mean surface roughness" of the fracture surfaces and draw a conclusion from the results about how quickly the fracture occurred. Dr Jones asserted that the high values obtained for fractal dimension and

[16] Better T11318:25 to T11319:14
[17] Better T11310:8.
[18] Exhibit 543 – Jones Report (EXP.5100.001.0001) at 0003; Jones T11769:19 to 24
[19] Exhibit 543 – Jones Report (EXP.5100.001.0001) at 0003
[20] Jones T11769:24 to 28

mean surface roughness "conclusively" proved that the fractures were not a result of high frequency, low stress vibrations of the wires, such as Aeolian vibrations.[21]

3.10 The most fundamental flaw in Dr Jones' evidence is that the analysis which he purports to use is simply not applicable to analysis of fracture in a practical situation such as the one at hand. It is not used or accepted by industry as a legitimate approach to fracture.[22] It is not taught in the relevant university courses.[23]

3.11 The primary source upon which Dr Jones relied, being the article by Elizabeth Bouchard, specifically stated that this analysis is not suitable for use in fracture analysis.[24] Dr Jones asserted that since then there have been "innumerable papers" showing that this analysis works when applied to crack growth, but failed to name any publications. None were cited in his report or applied in his analysis.[25] If such papers exist, it is surprising that Dr Jones did not at least refer to them, especially in light of Bouchard's warning that this analysis should not be used in the way used by Dr Jones.

3.12 One extraordinary example of lack of scientific rigour in Jones' analysis may be seen in his responses to the revellation that the results contained in his report should not be possible on the mathematical approach he purports to apply.

3.13 Dr Jones stated that in order to calculate the fractal dimension ('Rf') of a surface, he adopted a formula

$$Rf = 2 - \zeta$$

It is stated in the article by Bouchard and was admitted by Dr Jones that ζ has a value between 0 and 1. Therefore, the Rf value cannot be greater than 2. Dr Jones admitted that this conclusion is correct.[26]

3.14 However, the results contained in Dr Jones' report give Rf values well in excess of 2.[27] If Dr Jones' analysis was correct, such results should be impossible. This would require the experiments to obtain a negative value for ζ – which would be obviously erroneous. When questioned about this in cross-examination, he stated that this was a measurement error associated with inaccuracy in testing equipment.[28] If the

[21] Eg. Jones T11769: 19 to 24
[22] Exhibit 581 – Response to Questions Related to the Report Prepared by Professor Rhys Jones (CORR.0912.0003) at 0003; Jones T11825:16 to 20
[23] Exhibit 581 – Response to Questions Related to the Report Prepared by Professor Rhys Jones (CORR.0912.0003) at 0003
[24] Jones T11822:24 to T11823:16
[25] Jones T11823:17 to 25
[26] Jones T11827:24 to 28
[27] Exhibit 543 – Jones Report (EXP.5100.001.0001) at 0017, 0018, 0026 and 0028
[28] Jones T11827:21 to 23

impossibility of the result is indeed explained by measurement errors, the error is enormous – in many cases more than 0.4 or at least 20% of the highest possible value. The error margin is so large that even if the methodology was valid, the sensitivity of the measurements would not be adequate to be relied on.

3.15 Quite extraordinarily, Dr Jones did not mention in his report that the measurements were subject to large error margins. He did not attempt to calculate what the magnitude of error was. While it is obviously very large, there is no evidence before the Commission to conclude just how large the error margin is. Without that evidence the Commission ought to conclude that the measurements presented in the report are unreliable and have no validity at all.

3.16 Dr Jones insisted in his testimony that his calculations provided "conclusive" proof that the fractures were caused by "high load" events, but, prior to cross-examination, did not disclose to the Commission the fact that his results were impossible on his own analysis or that they were tainted by a large degree of error. He gave no examples of his methodology being used, anywhere in the world, for an analysis of this kind. He rejected out of hand any suggestion that the fractures could have been caused by Aeolian vibration[29] and yet admitted that he has never examined any fractures caused by Aeolian vibration[30]. Asked what could have caused the fractures on his theory, he suggested a truck backing into the pole.[31] His report and evidence are conspicuously lacking in both scientific method and credibility.

Cause of depressions at crack origin

3.17 At this time it is convenient to note that counsel for SPA raised the possibility that the depressions in the conductor wires at crack origin locations could have been caused by tools (such as pliers or screwdriver) when the helical fitting was installed. We note that HRL observed that wire as hard as the Gz/SC steel conductors could not be cut by anything short of bolt-cutters, which similarly suggests that an inadvertent nipping with pliers is unlikely.[32] It may be further noted that evidence before the Commission establishes that installing the conductor in a helical fitting is normally done manually, without use of tools.[33]

3.18 HRL identified two possible explanations for the depressions, namely wear against the ends of the helical fitting, and a sudden large local input of heat energy followed

[29] Jones T11769: 19 to 24
[30] Jones T11776: 13 to 19
[31] Jones T11820:8 to 13.
[32] Exhibit 525 – HRL Report (VPO.001.039.0016) at 0044, second dot point
[33] Northey T11060:29-31; Better T11340:2-18

by rapid cooling, for instance resulting from an arc between the conductor strands or the strands and the helical sleeve, or a lightning strike.[34] The absence of other damage, such as burn marks, suggested that lightning strikes or arcing did not occur.[35] The contiguity of the depressions and the end of the helical fitting seem to provide the more likely explanation.[36]

3.19 Moreover, other circumstances suggest that wear between the endpoints of the helical fitting and the sides of the conductor strands, was uncommonly likely at Pole 39. The reason was that the helical fitting was not properly seated in the thimble or open U-bolt around which it looped. The thimble curved around a clevis pin inside a clevis, which in turn held the whole helical assembly in place on the pole. The helical fitting, instead of sitting within the groove of the thimble around its length, ran over the edge of the groove and was jammed hard between the thimble and the inside face of the clevis.

3.20 The effect of the helical being incorrectly seated in the thimble was very likely that it prevented the thimble rotating around the clevis pin. This in turn would have meant that the thimble could not swivel with oscillations in the conductor, but instead operated like a rigid arm projecting out from the pole insulator assembly. The likely effect[37] was that oscillations in the conductor did not cause the thimble to "wobble" up and down on its pin but instead caused the conductor to flex back and forth at the point where it was gripped by the helical fitting – exactly where the depressions in the wire were subsequently observed by HRL and Dr Jones.

3.21 For the reasons set out above, we submit that the HRL explanation of the cause and sequence of failure and the impact of incorrect fitting in the thimble should be accepted.

4. SYSTEMS TO PREVENT CONDUCTOR FAILURES

4.1 The danger of metal fatigue and conductor failure at the points of attachment due to high frequency, small amplitude wind induced oscillations (commonly referred to as Aeolian vibration) is well known in the industry and is explored in industry manuals, as are the means for reducing the risk of such failure.[38]

---

[34] Exhibit 525 – HRL Report (VPO.001.039.0016) at 0036-7.

[35] Better T11314:1-4, 11317:30-11318:6.

[36] Mr Better did not express a concluded view but see T11318-11319:15.

[37] Better, T11319:3-14, T11328:9-11329:12.

[38] For example, Exhibit 520 – ENA C(b)1 (BCA.003.001.0060) at 0108 to 0114

4.2 The literature and evidence before the Commission established that Aeolian vibration is particularly a risk where the conductor is long, thin and strung over open or rolling terrain and/or strung at a higher tension. [39]

4.3 The conditions in which this conductor spent the 43 years of its life were ideally suited for causing fatigue between the conductor and the helical fitting: it was a very thin conductor with an uncommonly long span, of unknown tension, located in terrain (rolling hills) conducive to Aeolian vibration. Furthermore, the helical fitting was incorrectly seated in the thimble, reducing the scope of movement of the helical fitting and therefore reducing the self-damping properties of the system.

4.4 The fact that in February 2009 the conductor between Poles 38 and 39 was in such a condition as to be at immediate risk of complete failure was due to three identifiable factors:

Design and retrofitting

4.5 The first factor contributing to the state of Span 38-39 on Pentadeen Spur as at February 2009 was the design systems used by SPA. We do not criticise the fact that Span 38-39 was constructed as a single span high above the valley and therefore impossible to inspect along its length, but there were aspects of the design or installation of the span that were not reasonable:

(a) An easy and effective way to prevent fatigue due to vibration damage is to fit vibration dampers on the conductor. This measure is recommended by all industry manuals for conductors at risk of vibration damage[40] (as this conductor was). The Commission has heard evidence that SPA has a policy of not installing new or additional safety devices on spans after their initial construction ("retrofitting") and that this policy is applied without making an exception for a high risk spans such as the one in issue.[41] It seems from the evidence regarding the reconstruction of Span 38-39 after the fire that the policy even prevented an inexpensive plastic vibration damper being installed where the entire span was reconstructed.[42] Given the features of the span that increase the probability of vibration damage, including its unusual length, combined with its location in a high bushfire risk area – vibration dampers should have been fitted to it years ago.

[39] Exhibit 520 – ENA C(b)1 (BCA.003.001.0060) at 0113; Exhibit 520 – Conductor Vibration Control, (CORR.0911.0046) at 0046-0047
[40] Exhibit 520 – ENA C(b)1 (BCA.003.001.0060) at 0113; Exhibit 520 – Conductor Vibration Control, (CORR.0911.0046) at 0046-0047
[41] Lane T11090:17 to 23;
[42] Lane T11096:6 to 18

Even Mr Lane of SPA admitted that, with its unusual features, this conductor warranted special consideration for fitting of dampers.[43] Moreover, given that the span was effectively rebuilt after the fire, the failure to install dampers on the new line is inexcusable. SPA's construction guidelines would have required that vibration dampers be fitted at either end of Span 38-39 had it been built from scratch today, because of the known risk of damage and failure.[44]

(b) The evidence before the Commission shows that there was and is no measurement or record kept of the tension of the conductor. Higher conductor tensions increase the likelihood of vibration damage and industry guidelines stipulate that conductors should not be strung over a certain tension (in this case 20% of the conductor breaking load), unless dampers are fitted.[45] With no tension records or measurements and no dampers on the span, the conductor was and is at risk.

Inadequate inspection

4.6 The second contributing factor is that the inspections undertaken in respect of the Pole 39 pole-top assets (being the pole top attachments and the conductor) had not detected either the incorrect seating of the helical in the thimble, or the state of the conductor.

4.7 In relation to the incorrect seating of the helical within the thimble, the Commission's hearings have revealed several important shortcomings in the inspection systems of the electricity distribution businesses.

4.8 Historically, inspections were conducted by persons with a background in construction or repair of electricity assets. However, this is no longer the case. Asset inspections have been outsourced and the personnel in the field do not necessarily have a background in electricity asset installation or repairs.[46] The immediate example is the UAM inspector who inspected Pole 39 in February 2008. The individual had a background in carpentry with no prior electrical experience.[47]

4.9 The inspection regime and the training provided to the asset inspection personnel is primarily targeted at the poles rather than the pole-top assets (including the

[43] Lane T11095:26 to T11096:5
[44] Lane T11089:10 to 18 and T11090:11 to 16
[45] Lane T11163: 26 to 31
[46] Exhibit 521 – Barnbrook Statement (VPO.001.031.0343) at 0347
[47] Exhibit 528 – Resume of Jason Leech (WIT.7507.002.0014)

conductors). The frequency of inspections is determined entirely by the type of the pole.[48] The training provided to personnel focuses on the various tests addressing the state of the pole (rot, termites etc). On the material before the Commission the pole-top assets are the minority portion of the training program.[49] The evidence before the Commission discloses that no training is given to enable the inspectors to detect problems such as the correct placement of helical fitting within the thimble.[50] It is not to the point that incorrect placement in that respect may be quite unusual: part of the problem is that a person trained in asset installation would have noticed and appreciated the significance of incorrect placement. Persons with a different background (eg., carpentry) should have been given specific instruction in that regard. On the evidence, however, no such instruction was given.

4.10 Another deficiency in the system for conductor inspections, is that, notwithstanding the acknowledgement in SPA's Asset Inspection Manual that conductor damage can only adequately be detected from line height[51] – eg., from an elevated work platform ("EWP"), SPA's inspection program made no provision for line-height inspections of conductors to prevent failure. Line height inspection or work is done only reactively - when damage to the conductor or other pole-top assets has reached a point where it has been detected from the ground, or where pole-top work has been ordered for other reasons.[52] The routine method of inspection is from the ground.

4.11 Exacerbating that deficiency is the fact that the training given to at least some of the inspectors currently serving as SPA line-inspection personnel included instructions which discouraged the line inspectors from attempting a thorough inspection of conductors from the ground. The material before the Commission includes the UAM asset inspector training manual's direction to the effect that "the best" an inspector can do is "quickly scan" a conductor for signs of obvious damage.[53] Short of an explicit instruction "not to bother", a more dismissive treatment of conductor inspection can scarcely be imagined.

Asset management strategy

4.12 The third factor contributing to the failure of the conductor was the asset management strategy adopted by SPA. The strategy was described by SPA as a

[48] Exhibit 534 – Hastings Report (EXP.010.001.0011) at 0009-10
[49] See Exhibit 528 – Training of Asset Inspectors: Course Outline (WIT.7507.002.0018)
[50] Braden, T12314:2 to 6.
[51] Exhibit 532 – Asset Inspection Manual (SPN.005.001.0001) at 0083
[52] McCrohan, T11494:8 to 14.
[53] Exhibit 528 – Training of Asset Inspectors: Course Outline (WIT.7507.002.0018) at 0029

condition-based management strategy[54]. In fact it is nothing of the sort. So far as conductors are concerned it is in substance a “run to failure” policy.

4.13 The issues under this subheading can be addressed in two stages, first dealing with whether the asset management strategy that SPA has is what it claims to have and the second analysing the strategy which was available to SPA and which, as a matter of prudent risk management, ought to have been implemented.

“Condition-based” management

4.14 As noted, the witnesses and documents produced by SPA repeatedly described its asset-management system as reflecting a “condition-based” approach. In substance, the proposition was that that:

(a) the condition of installed infrastructure is monitored via the scheduled inspections carried out by the contracted field inspectors (eg., the UAM personnel) and supplemented by whatever inspections might be done by SPA’s own linesmen in the course of other work carried out near a given asset; and

(b) “planned” repair or replacement work is initiated when those inspections identify that the condition of the particular asset has degraded to a point where the work is required.[55]

4.15 However, on the basis of the evidence before the Commission it is clear that in reality the term “condition based” management, as used by SPA, is a misnomer, so far as conductors are concerned:

(a) first, the frequency of the scheduled inspections for assets associated with a given pole is determined by whether the pole is wood or not wood (concrete or steel). As Dr Hastings explained, the inspection cycle is designed by reference to the assumption that wood rot develops in a predictable, measurable and relatively slow sequence. Other causes of pole or attachment failures were disregarded in establishing the cycle;[56]

[54] See eg. Exhibit 558 – Adams Statement (WIT.5103.001.0039) at 0038

[55] “Unplanned work” describes repairs following actual failures of assets and need not be addressed in these submissions: see generally Exhibit 558 – Adams Statement (WIT.5103.001.0039) at 0039-40.

[56] This conclusion can fairly be applied to the Powercor inspection cycle as well. Although the shift from a 3-year to 5-year cycle took into account a “comprehensive” range of failure modes, the program as implemented recognised that (a) the 5-year cycle was “generally too long to be fully effective” and (b) elevated work-platform inspections should be (but evidently weren’t) implemented for conductors “identified as deteriorated, or in highly susceptible areas based on age profile”: see generally Hastings T12678:2-27, compare cross-examination at T12666:18-20.

(b) second, the inspection cycle takes no account of the age of either the poles or the pole-top assemblies or any risk factors – such as length of span or vibration potential;[57]

(c) third, as noted above, both the training of the inspectors, and the inspection procedure they follow, give little emphasis to the inspection of conductors. Conductors are only examined via a quick visual scan from the ground, although it is acknowledged that this inspection can, at best, only detect gross damage to conductors; and

(d) finally, notwithstanding the acknowledgement in the SPA Asset Inspection Manual that the condition of conductors can only properly be assessed from line height, no line-height inspections of conductors are ever scheduled as a preventative, as opposed to reactive, measure.

4.16 For these reasons it is simply not meaningful to describe SPA's asset management strategy in relation to conductors as one of "condition-based" management. There is no adequate system for routine inspection and for condition assessment. Conductors are retained in service unless they either degrade to a point where a ground-level inspection happens to detect the degradation; or until a defect happens to be detected during line-height work initiated for some other reason; or until they fail, as in fact happened here.

Reliability-centred management

4.17 SPA also professed some adherence to the principles of reliability-centred management ("RCM"). If there was any adherence, it was severely limited.

4.18 As Dr Hastings explained, a proper application of RCM principles would require identifying and taking into account the risk factors impacting on different classes of assets and on assets operating in different conditions.[58] Assets in different operating conditions will have different service lives as a result.

4.19 A proper RCM based system would require the collection, collation and analysis of data regarding both the existing of risk factors and the way in which they cause assets to fail. The information should then be used to inform decision-making about increased inspections, installation of safety devices and institution of an age-based replacement program, at least for assets in known high risk areas.

---

57 Lane T11131:5 to 14

58 Hastings T12651:24 to T12652:5

4.20 SPA's asset-management system cannot properly be described as a reflection of RCM practices. As discussed above, it does not collect, or does not use information about the various operating risks which bear on particular assets within its network.[59] It has set a relatively fixed inspection cycle which is applied regardless of the differential risk profiles of different types of assets or assets in different operating environments, and in fact never seems to reach a point where the asset is regarded as simply being too old and statistically at too high a risk of failure. SPA's approach of adopting a "one size fits all" inspection and maintenance schedule is not consistent with prudent RCM practice.

4.21 Furthermore, where the inspection program for conductors is not designed to detect most faults that can occur, as is the case with SPA conductor inspections, it is necessary to have a program of replacement of high risk conductors before the end of their potential life. As Dr Hastings observed, application of RCM principles would likely lead to a conclusion that conductors in high risk situations be assigned a "regulated life" that was shorter than non-high risk conductors.[60]

4.22 The evidence shows that SPA does not do so. Their inspection and information systems are not adequate or are not used to develop an appropriately tailored RCM approach to asset management of conductors. SPA do not record or analyse risk factors such as terrain, age, length, presence of protective devices in order to determine whether a conductor should be inspected more thoroughly or replaced earlier.

4.23 The SPA system in relation to conductors is in essence a "run to failure" policy. Conductors are replaced when they fail.

Dated: 27 January 2010

T. Tobin SC

L. Armstrong

Maurice Blackburn Lawyers

Slidders Lawyers

[59] Eg. Lane T11130:6 to 12; T11138:16 to 24.
[60] Hastings T12654:19 to 28;