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1977
Board of Inquiry

into

the Occurrence of Bush and Grass Fires in Victoria

Witnesses

John Charles Ellis + Neil Harrison Kirk

transcript pages 1524 to 1568

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MR. McDONALD: Would you have a look at Exhibit 26, photographs J and F? Do you see in those photographs where a low voltage conductor is in contact with and appears to be embedded in a tree branch?---In Exhibit J I can see a wire passing through, and one wire is obviously in contact with a branch.

Perhaps, Mr. Chairman, I could come round there so that I can see, and then I can show it.

THE BOARD: I could see it quite plainly with a magnifying glass.

MR. McDONALD: Do you see the point I am pointing out to you on Exhibit 26F?---Yes.

And if you look at Exhibit 26, photograph J which is taken from the other side, do you see the point where my finger is there?---Yes.

Perhaps I should show that to you, Mr. Chairman. F is taken from that side, and J from that side (indicating).

THE BOARD: Yes, I see it.

MR. McDONALD: Do you see, Mr. Oldham, in relation to both those photographs, the part where the conductor appears to be in hard contact with the limb is just below a fork in the limb? You might need to see them again.

THE BOARD: Do you want that glass? It might be of some assistance?--Yes, I would agree with that.

MR. McDONALD: And does the fork generally appear to be the fork that you see here?---Yes, it appears to be similar.

(THE WITNESS WITHDREW)

JOHN CHARLES ELLIS, sworn and examined:

MR. NIXON: Mr. Ellis, your name is John Charles Ellis, you live at 9 Rangeview Road, Lower Plenty, you are a metallurgist and you are the head of the Materials Technology Section of the Research and Development Department of the State Electricity Commission of Victoria, is that so?---Yes.

You have made a statement in relation to your observations at the property known as "Roanoke" near Glen Thompson?---I have.

And you have examined various conductors?

MR. BARNARD: We have not seen this, Mr. Nixon.

MR. LLOYD: I have not seen it.

MR. MARKS: Is it the subject of an order?

MR. NIXON: Yes. Mr. Marks has produced it, Mr. Chairman. It is one of the matters that were the subject of the order made on Friday. Perhaps it could be photostated at this stage.

THE BOARD: Have you a copy you can use?

MR. NIXON: No, I have only the one copy. Mr. Ellis, this matter, I think, is not covered in the report. You went to the origin of a fire at Penshurst, did you not?---That is correct.

Do you remember when it was that you went there?---I do not remember precisely, but I have the record of it.

Was it in March, or April, or - - -?---It was early April, I think - possibly April 1st.

And were you shown the general area where it is believed that the Penshurst fire originated on the 12th February?---I was.

In that area were there some high voltage conductors?---There were, yes.

Also some low voltage conductors?---Yes.

First of all, did you inspect the high voltage conductors?---A certain area of the high voltage conductor, yes, in the immediate region of where the fire was said to have started.

Did you have the use of an EPV?---I did, yes.

Perhaps you could have a look at Exhibit 78. Was the purpose of looking at the relevant section of the high voltage conductors to ascertain whether there were any clashes between those conductors?---If there had been any fusion due to contact between conductors, yes.

Did you observe any marks at all on those conductors?---None at all.

Did you also inspect the low voltage conductors in that area?---I inspected the low voltage conductor almost from the point where it was on the pole on the north side of the road, almost to the area where it passed over the fence on the southern side of the road, the stone wall.

Is that particular conductor shown in that photograph?---I cannot see the conductor, but I can see the pole to which it was connected.

Did you have the use of an EPV to inspect those conductors also?---Yes, I did.

Did you see any burn marks or any other sort of marks to indicate that the low voltage conductors had clashed at any stage?---None at all.

Did you conduct an examination of a steel conductor from the Tatyoon/Streatham fire?---Part of a steel conductor.

Do you have a report into your examination of that portion of the steel conductor?---I have it over there, yes.

Perhaps you should get it - that report, and also the one into the drop out type fuses at the Wallinduc/Cressy fire. Perhaps you could read the report that you have prepared into your examination of that portion of the steel conductor?--This is the Tatyoon/Streatham fire you are concerned about now?

Yes?---The subject of the report is "Examination of Steel Conductor, Tatyoon-Streatham Fire". The summary states, "Limited examinations were carried out on broken conductor samples to determine the circumstances surrounding their failure. Comparative examination of samples resulting from tests in which a tree limb falling across the conductor was simulated has indicated that this is a likely explanation of the failure."

ELLIS.

THE BOARD: That, interrupting you, was the subject of that dramatic movie we saw, was it?---That was the simulated test, yes.

1. INTRODUCTION

The start of a fire at Tatyoon on 12 February 1977 is believed to have been associated with the failure of a steel conductor of a 12.7kV single wire earth return (s.w.e.r.) installation. A length of the conductor from either side of the break was received at Herman Research Laboratory (HRL) for examination on 15 March and a visit was made to the site on 23 March. In addition a test was performed at the Electrical Plant Testing Laboratory, Fishermen's Bend on 31 March, simulating what was thought to be the conditions accompanying the failure of the conductor. The samples of failed conductor produced by this test were also examined.

Attempts to obtain access to the two samples of wire containing fractures held by the Police Forensic Science Laboratory were unsuccessful.

2. EXAMINATION OF THE SAMPLES FROM SITE

The samples received from the site consisted of two lengths of 3/12 galvanised steel conductor. These were labelled respectively:

"3/12 steel conductor. Ex Bay P11-P12. Cooper's Spur off Werchon Spur Tatyoon. Southern side of break. 2 strands have been removed. Remaining strand (long one) original break"; and

"3/12 steel conductor. Ex Bay P11-P12 of Cooper's Spur off Werchon Spur, Tatyoon. Northern side of break. Part of 2 strands have been removed. Remaining strand (long one) is original break".

The southern side sample was approximately 1.92 m long and that from the northern side approximately 2.0m. It was stated that all the strands had failed at the same point. Both samples had a sticky substance distributed irregularly over their outer surfaces.

2.1 Sample from Southern Side of Break

The surface of the sample of galvanised steel wire had been blackened over its entire length. Where slight unravelling of the ends had occurred it could be seen that the blackening was confined to the exposed outer surfaces of the wire. Generally this length of conductor had not unravelled.

The original fracture surface of one of the strands was still present (Figure 1, left-hand wire). (Figure 1 refers to photographs at the back of the report). Back approximately 70mm from this fracture another strand had been cut and the length containing the fracture removed. The third strand had also been broken, apparently be repeated bending, approximately 280mm back from the fracture and this length also removed.

The fracture was a ductile "cup and cone" type and showed a considerable reduction of area. A calculation made from measurements taken off the original wire diameter (2.63mm)

ELLIS.

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Fire.

and the diameter at the point of fracture (1.26mm) showed that the reduction of area was 77%.

Three bright indentations were present approximately 6, 10 and 15mm back from the fracture surface as shown on the left-hand wire in Figure 1. Their appearance suggested that they could have been made by a cutting took, after the fire, but since there were no corresponding marks on the opposite side of the wire, it is assumed that they were made while the other two wires were still present. There was some surface discolouration right up to the point of failure but a reduction in the amount of blackening was evident for approximately 30mm back from the failure.

2.2 Sample from Northern Side of Break

Except for an area adjacent to the fracture, the galvanised steel conductor from the northern side was not blackened and had the appearance expected for such a conductor exposed in a rural atmosphere for a number of years. The original fracture surface of one strand was present but the other two strands had been severed some distance back from the fracture, as had occurred in the samples from the southern side. Part of the strand with the original fracture is shown in the right-hand wire of Figure 1. A length of approximately 470mm had been removed, apparently by repeated bending from one strand and a length of approximately 660mm had been cut from another. It is assumed that both of these samples contained a fracture surface."

(Page 1528 follows)

THE WITNESS (Continuing): The fracture in this case was also a ductile type. Withan original wire diameter of 2.67 mm and a diametere at the fracture of 1.26 mm the reduction of area was 78%.

There was discolouration of the wire near the fracture reducing in intensity until it was negligible 100 mm back from the fracture. However, immediately adjacent to the fracture and extending approximately 13 mm back from the fracture the surface of the wire was bright and shiny. This shiny area formed a discreet boundary with the blackened area beyond. There was also a noticeable change in wire diameter at this boundary, the blackened area having the larger diameter. When viewed under a low-powered binocular microscope, this bright area had an appearance that suggested that local fashion fusion or sublimation of the zinc may have occurred.

3. VISIT TO SITE.

A visit to the site at Tatyoon was made on 23 March 1977. Discussion with local Commission employees and observations made elicited the following information:

a. the conductor broke at the point where a large limb of a gum tree had fallen across it;

b. the fire appeared to have started near this point and spread in a southerly direction;

c. the conductor on the southern side of the fracture had sprung into the burnt area after failure. At the time it was recovered it was entangled with partly burnt hay that had been removed from an adjacent hay shed;

d. the conductor on the northern side of the fracture had been recovered in an unburnt area; and

e. a suggestion that a "cover" had been present on the conductor at the point of failure, for some time prior to 12 February 1977, had not been substantiated by the recovery of any sleeve or other jointing material at the site at the time of repair or subsequently.

4. MISCROSCOPIC EXAMINATION.

Short lengths of wire were cut from the two samples of conductor remote from the fracture surfaces. In both cases these were from the same wire that contained the fracture. After preparation, these were examined with the following results.

4.1. Sample from Southern Side of Break.

The microstructure of the steel consisted of a deformed, unresolved pearlite, typical of what would be produced by cold drawing after patenting. The galvanised coating on the steel wire was approximately 0.05 mm thick and was in two layers. The inner layer appeared to be an iron-zinc intermetallic compound and the outer layer substantially pure zinc. This is a normal structure for a galvanised coating.

4.2. Sample from Northern side of Break.

The microstructure of this sample was similar to that of the sample from the southern side. The overall

thickness of the galvanised layer was approximately the same but the proportion of iron-zinc intermetallic phase appeared to be lower.

5. MECHANICAL PROPERTIES

5.1. Hardness Tests.

Hardness tests carried out on the samples of wire prepared for micro-examination gave the results listed below. An approximate equivalent tensile strength corresponding to these values is also shown.

Southern wire	454 HV30) 454 HV30)	Equivalent to 98 tonf/in^2
Northern wire	439 HV30) 436 HV30)	Equivalent to 97 tonf/in^2

5.2. Tensile tests.

A series of tensile tests were carried out on samples of galvanised steel wire from a similar but unrelated length of 3/12 conductors. The average of six of these tests gave a tensile strength value of 91 tonf/in^2. However, because all of these and three additional tests broke in the gripping device, appropriate values of percentage elongation and reduction of area were not obtained.

6. SIMULATED TESTS.

Two simulated tests were performed at Fishermens Bend on 31 March 1977. In each a length of 3/12 galvanised steel s.w.e.r. conductor was tensioned between two supports to the tension normal for this type of construction. A dynamometer attached to one end of the conductor gave a reading of 1450 lbf. Across the conductor, in mid span, a length of a limb recently cut from a gum tree and similar in diameter to the limb that is believed to have fallen over the conductor at Tatyoon, was supported. A 500 lb. mass was hung from the limb to represent the anticipated loading on the conductor induced by the actual limb at Tatyoon. This produced a reading of 1750 lbf on the dynamometer.

The end of the length of limb remote from the conductor was connected to earth by a system of tight metal packings. A voltage was rapidly and progressively applied to the conductor up to 12.7 kV. The current was kept within the limits of a 5 amp fuse.

As the maximum voltage was approached, heating in the region of the contact between the conductor and limb was apparent. Copious fumes and smoke were emitted and sparks and smouldering debris fell away. In less than 1 minute all three strands of the conductor parted and the limb fell. The surface of the limb was charred and burnt away in the area of contact. A deeper impression, corresponding to the shape of the conductor, was at one end of this area. The appearance was said to be very similar to that of the tree limb at site. These features are illustrated in Figure 2. This test was repeated with very similar results.

6.1. Examination of Conductor After Simulated Test.

A length of conductor from either side of the break, in the first test, was removed for examination (Figures 3 and 4. Visual examination showed that the three wires forming the conductor had broken at the one place,

namely the point of contact with the limb. All had necked before fracturing but two wires on the power supply side of the break appeared to have also fused at the tips, possibly due to arcing (Figures 5 and 6).

The wires on the power supply side of the fracture had unravelled for a distance of approximately 350 mm back from the fracture. For a distance of approximately 30 mm back from the fracture the outer surfaces of the wires had an irregular black coating on an otherwise bright surface. Beyond this for a further distance of approximately 40 mm the outer surfaces were covered with a continuous black layer that reduced in amount as the distance from the fracture increased.

The wires on the other side of the fracture remained in contact close up to the fracture. From the fracture, for a distance of approximately 12 mm, the surface of the wires, with the exception of some lightly adhering black material, was bright and shiny. Beyond this and defined by a sharp interface, the outer surfaces of the wires were coated with a continuous black layer for approximately another 55 mm. This reduced as the distance from the fracture increased.

6.2. Stress in Wires during Simulated Test.

Using the dynamometer reading of 1750 lbf applied to the conductor at the time of testing and the measured diameters of the wires, the stress during testing was calculated to be 30.5 tonf/in^2.

6.3. Reduction of Area.

Calculations of the reduction of area of the three strands during failure gave values of 63%, 61% and 44%.

6.4. Microexamination.

A 20 mm length, containing one of the fractures, was cut from one of the wires on the side away from the power supply and prepared for metallographic examination. This showed that the microstructure was similar to that of the samples previously examined, namely a structure of a patented steel wire. However, by comparison with the wires taken from Tatyoon, the microstructure was somewhat coarser and some of the pearlite was resolvable. There was no marked change in microstructure due to heating.

The galvanised layer was also similar to the previously examined samples, having an inner intermetallic layer with an outer layer of zinc. Close examination of the region where the surface changed abruptly from a bright to a black appearance showed that while both the intermetallic and zinc layer were present in the black area, the zinc layer had disappeared in the bright area (Figure 2). Closer to the actual fracture surface there was evidence of a greater degree of alloying between the steel and the zinc.

6.5. Hardness Tests.

Hardness tests on the microsection showed a reduction of hardness values towards the fracture surface. At a distance of 20 mm from the fracture the hardness was 410 HV5, reducing to 375 HV5 at the fracture.

7. COMMENTS AND CONCLUSIONS

To complete the investigation it will be necessary to more thoroughly examine the actual Tatyoon fractures to obtain a better identification of the conditions at the time of failure and so relate these to the conditions of the simulated test. At the time of writing, arrangements are being made for this further examination to be conducted elsewhere and as soon as the information is available it will be reported as an addendum to this report. Meanwhile, sufficient work has been done for a number of conclusion to be reached and for a number of assumptions to be made about the failure.

The physical appearance of the wire samples received from Tatyoon is consistent both with the observations made on site and those made from the simulated test. The blackening of the conductor to the south of the break is consistent with it having been burnt by the fire after the conductor had broken. Similarly the brighter appearance of the wire north of the break indicates that after the fracture it sprang into an area that was not burnt. The degree of blackening close to the fracture was equivalent to that produced in the simulated test.

The sticky substance noted on the samples received from site has not been analysed but as the investigation progressed it became apparent that this had been caused by the application and subsequent removal of insulation or masking tape as the samples were examined by numerous people after the failure.

It has not been possible to determine if the two intact fractures received were from the same wire. The indications at present are that they were not.

The ductility of the fractures as indicated by the high reduction of area values, the failure of the conductor at an apparent stress well below that normally required to cause fracture, and the elimination of the zinc layer from the wires adjacent to the fractures all suggest that at the time of failure the conductor was locally heated to a temperature in excess of 420°C but less than 700°C. The absence of similar effects away from the immediate area of the fracture shows that the heating was localised.

The remarkable similarity of the failures produced by the simulated test to that part of the conductor received for examination strongly suggests that a similar failure mode has applied. Access to the other four fracture surfaces from the field failure may have supplied further evidence to suppprt this assertion.

No evidence was found, either at the site or during subsequent laboratory examination to suggest that a sleeve or joint had been present in the region of the failure.

From observations made at the time of the simulated test, it seems likely that a fire could have been started shortly after the limb fell onto the conductor, either by debris falling from the point of contact or by sparks or resistance heating occurring at the point or points of contact of the limb to earth.

MR. NIXON: Attached to your report are some seven photographs in relation to the conductor at Tatyoon. Since you have

prepared that report, have you been in contact with Professor Polmear from Monash University?---I have.

Was that on Thursday of last week?---Yes.

Were you present when Professor Polmear carried out certain tests? ---We carried out certain tests together.

Are you in agreement with the conclusions Professor Polmear reached?---In verbal agreement. I have not seen a copy of his conclusions.

You have not seen the report he prepared?---No.

THE BOARD: Are you going to read the Polmear report into the transcript at any stage?

MR. NIXON: Yes.

MR. MARKS: The other reports are such that it is going to be difficult to put them all in. You may have to resort to the exhibit system with Mr. Ellis and Mr. Pleasant. It may be desirable to have the three together.

MR. NIXON: Perhaps the body of the report should be read out. There may be somebody who has not got a copy.

(Page 1533 follows)

MR. NIXON (Continuing): I will read this document:

"BOARD OF ENQUIRY INTO RURAL FIRES IN VICTORIA:
EXAMINATION OF STEEL ELECTRICAL CABLES
STREATHAM/TATYOON FIRE

Following an instruction from the Board, Mr. Sebire left with me on May 9th 1977, a number of samples of galvanized steel electrical cable received from the region of the Tatyoon fire of February 1977. These were numbered as Exhibits 96, 97, 98. Some information concerning these samples was provided by Mr. Sebire on Tuesday, May 10th, and I spoke in detail about them after being contacted by Mr. Ellis of the S.E.C.V. later that day. My instruction from Mr. Nixon, relayed by Mr. Sebire, was to carry out such examinations as may be requested by the S.E.C.V., and that a time should be set whereby the results of these examinations could be discussed with one of their staff members and with Mr. Hensler.

After telephone discussions with Mr. Ellis, it was decided to prepare longitudinal microsections through the ends of a strand of wire from each of the northern and southern parts of the cable (i.e. the house and active ends of the wires respectively) using wires from Exhibit 98. These sections were mounted in a cold setting resin and polished close to what is termed the longitudinal diametric sections. The microstructures were etched and examined, and Vickers hardness tests (5 kg load) were made taking traverses close to the centres of the wires, up to within about 0.75 mm of the respective fracture surfaces.

Before sectioning, a measurement was made of reduction in area that occurred during necking of the southern wire when fracture took place.

It may be noted that no evidence was found to support the suggestion that the wires had been joined where fracture occurred. It may also be noted that examination of several fractured ends did not allow any conclusions to be drawn as to whether or not failure had occurred by direct tension or by a sideways force.

Results

1. Microstructure

Time did not allow careful metallographic polishing so that some of the finer features of the microstructure could not be studied. It seemed, however, that the microstructures were similar in appearance to that described by Mr. Hensler. It was found that the galvanized coating was absent from samples of the northern end of the wire to a distance of some 12 mm from the fractured end as was noted in my earlier report dated 18.4.77. which concerned Exhibit No. 97.

2. Hardness Tests (see attached sheet)

(a) Southern (Active) wire

A value of 367 D.P.N. was recorded within 1 mm of the fracture which increased to 418 D.P.N. at 5 mm, 460 at 12 mm, and 487 at 28 mm. The softening noted close to the fracture was similar in pattern but more marked than that observed by Mr. Hensler.

(b) Northern (House) end

The hardness of the wires varied from 466 D.P.N. to 501 D.P.N., but no significant softening was recorded close to the fracture surface, except perhaps within 1 mm of the end.

3. Reduction in Area During Fracture

The southern wire of Exhibit 98 had a value for the reduction in area during necking and fracture of 81% which is similar to the value of 79% as reported by Mr. Hensler for Exhibit 96.

CONCLUSIONS

In my earlier report I suggested that the hardness of a sample of the northern or house end of the cable should be measured to determine whether or not it had softened in the way reported by Mr. Hensler for the southern or active end. My point here was that, if wires from both sides of the fracture had softened, then the conclusion by Mr. Hensler that this softening had caused the wires to fracture whilst supported between the poles would be confirmed. If the northern wire had not softened then failure may have been by overload and the softening of the southern wire may then be due to heating when this active wire made contact with the ground.

My hardness results do, in fact, show that the northern end had not softened, except perhaps within less than 1 mm from the fractured end. This indicated that, if this wire was heated at all, the effect was much less than that experienced by the southern wire. This situation could arise in two ways:-

1. The wires failed by overload without heating and the southern wire was heated when it made electrical contact with the ground as mentioned above.

2. The cable earthed through contact with a tree that fell across the line, as has been suggested elsewhere, and the current flow through what became the southern wires to the point of contact with the tree caused this part of the line to heat up much more than the adjoining "northern wires". Fracture then occurred where the softened regions of the "southern wires" joined the harder "northern wires". The relatively large reduction in area at fracture as compared with the value determined by Mr. Hensler for unheated wires, supports this second mechanism. So far as the Inquiry is concerned, the precise mechanism of failure may be only an academic question. What is clear is that the power line failed t by overload and that the southern part of the cable adjacent to the fracture became heated to a relatively high temperature.

Mr. Ellis of the S.E.C.V. has inspected the polished sections of the wires of Exhibit 98 mentioned above and has taken these sections so that he can obtain photographs for his own report. We have discussed the evidence and are in agreement with the comments made in this report. Mr. Hensler was unable to join us for the discussion.

With the exception of the polished sections given to Mr. Ellis, I have retained Exhibits 96,97 98 on

instruction from Mr. Sebire.

(Signed) I.J. Polmear
Professor : Chairman
Department of Materials
Engineering

12 May 1977.

HARDNESS TESTS ON WIRES

1 SOUTHERN (LIVE) WIRE

Distance from Fracture mm	Hardness (D.P.N.)
0.75	367
1.3	376
2	381
3.5	401
5	418
6.5	441
7.5	429
12	460
15	460
28	487

2 NORTHERN (HOUSE) WIRE

Distance from Fracture mm	Hardness (D.P.N.)
0.75	466
1.5	487
2.3	501
3	480
3.75	501
4.5	490 (av)
6	501
7.5	441
9.5	480
13	480
24	487"

Mr. Ellis, do you agree with the findings and contents of that report?---Yes, except that it could be contentious, the reason for the hardening on the northern line, whether this had not been softened or whether it hardened through the failure mechanism. I do not think either Professor Polmear or I would be dogmatic on this point.

Other than that, have you any comment to make?---No, I agree with it in general.

THE BOARD: One matter I would like some education on is overload, I am somewhat confused about that - you are talking about a physical load applied to the wire?---Yes, a physical load applied to the wire.

For a moment I thought you were talking about overload in the sense of current?---No, this is a mechanical overload.

That is not your phrase, it is Professor Polmear's phrase.

MR. NIXON: Perhaps I should tender that.

THE BOARD: Yes, I think it should also be an exhibit because it does contain those hardness tests which are attached to it, which appear to be of some significance.

MR. NIXON: I do not think I tendered Mr. Ellis's report in relation to the examination.

EXHIBIT 205.....Mr. Ellis's laboratory report of tests relating to Tatyoon wire.

EXHIBIT 206.....Professor Polmear's report on Tatyoon wire.

THE BOARD: No doubt you are now passing to Mr. Ellis the second report on the Wallinduc fire?

MR. NIXON: Mr. Ellis will be giving evidence also in relation to his observation at the Glenthompson or Strathmore fire.

THE BOARD: Perhaps you might throw him to the wolves on each fire.

MR. NIXON: Yes, I think that is the best course.

MR. BARNARD: The Chairman asked you about the question of overload; what happens is, is it not, that the failure is due to the combined effect of an electrical current and physical load? ---More correctly, the heating produced by electrical current and physical load.

So that as you have the weight of any object on a wire?---Yes.

The wire, if it has electrical current through it, will tend to heat up?---Yes.

And as it heats up, the weight has greater effect and both of them operate together towards failure?---As it heats up, the tensile strength of the heat in the wire is reduced to such a point that the load caused by the log, or tree in this case, causes the wire to fracture.

And the physical strength of the wire decreases?---Decreases progressively as the load takes place.

THE BOARD: Is there any difference in temperature in a wire through which the current is, in fact, flowing - I am leaving out tree branches falling on it - but the ordinary wire sitting up there conducting current to the farmers, is there any difference in the temperature of the wire where current is, in fact, flowing, to, for instance, a dead wire that has been de-energised?---There will be a difference in temperature to, I imagine, any swer conductor, the difference would be significant because you will be carrying very little current.

So, apart from trees or similar objects falling or contacting the line, there would have been no significant heating in the wire, in the conductor, or that day?---Probably no detectable heating.

MR. BARNARD: Following on that, you referred to the s.w.e.r. conductors - in fact, on the 240 volt conductors, again, there would be no detectable difference there, is that so? ---This is outside my expertise, but if the current is high there would be a greater detectable difference on low voltage conductors than on high voltage conductors, I am talking of high voltage conductors of the s.w.e.r. type.

Do you say there would be any detectable difference on low voltage? ---Again this is outside my expertise, but I would say yes, there could be because your current is going to be higher and the amount of heating is related to the current s.w.e.r.

It is of minute order?---Depending on the size of the conductor and the current flowing through.

Going back to the Tatyoon failure, the only conclusion you are coming to is that there was a load, be it side or longitudinal, a load on the conductor?---Yes.

And if, in fact, the conductor was being pulled by a post falling over, the same thing could happen?---Provided there was local heating occuring at the point where it fell.

Or alternatively, if this was the weakest point in the conductor?--- It is possible the failure could occur by this way. I would be surprised if a conductor of this significance and ambient temperature would fail due to a pole falling over it.

If there is a significant weight pulling on it longitudinally, failure would take place?---Yes.

And this leads to Professor Polmear's conclusion that you are unable to say whether the failure was direct, due to direct tension or sideways force?---The effect of the sideways force would be to increase the tensile stress in the conductor and if you lay a log across it, you can, with a sideways force, physically increase the tension in the conductor because of the load applied to the side.

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MR. BARNARD: Professor Polmeier said that the examination did not allow for any conclusion to be drawn as to whether or not failure had occurred through direction tension or by sideways force?---I think, and I would be interpreting here, what he is saying is that although the actual failures were tensile failures the load which produced this failure it is not possible to say whether that was tension applied to the ends of the wire or tensile failure of the wires falling across.

Would you agree with that?---Yes, I would agree with that.

MR. LLOYD: I have not seen the part of the statement that concerns me.

MR. NIXON: There is no statement.

MR. LLOYD: Could I cross-examine about Penshurst now?

THE BOARD: Very well.

MR. LLOYD: Mr. Ellis, when you were out there at the suggested source of the Penshurst fire, did you make a measurement of the distance, pole to pole, of the high voltage conductor ?---I made a paced out estimate of the distances.

What was that estimate?--- The distance from Pole 18, East, to Pole 17, was estimated to be 240 metres; the distance from Pole 18, West, to Pole 19 was estimated to be 190 metres.

240 and 190 metres?---Yes.

THE BOARD: 240 is a lot of metres, is it not?---Yes.

MR. LLOYD: Do you know anything about the fire, where it is suggested generally that clashing of power lines produced sparks?---Only at Glen Thompson.

THE BOARD: You have not looked at Beeac?

MR. LLOYD: Or Mingay, or Balliang?--No.

That is a fairly long distance?---I am not in any position to comment on this. I am a metallurgist and I am concerned with the metal itself, not with the design of transmissions.

What metallic information did you gain from pacing out the distance?--None at all. I anticipated questions like that.

What did you think might be the relevance of that?---I have no idea.

You just thought someone might ask you the distance between two power poles but you did not know why they would be interested?---The relevance, so far as I am concerned, is that the closer the poles are together, the less likelihood - assuming the spacing on the polesis the same - there is of adjacent conductors contacting.

It would be correct to say that the converse is true as well?--Yes.

Did you try and make the lines clash or did someone with you do that?--I did.

They would clash all right, given the right weather?--I would be surprised if they would. You are talking about high voltage wires?

Yes?---I could reach them with my arms outstretched (demonstrating) and I pulled them together with force, and they just touched, so the possibility of wires coming together in high winds is pretty remote.

It is possible though?---Yes.

I do not think you were asked this question in chief or in any statement you made for this inquiry?---I do not recall, but I can check.

How much longer would those wires be over that span in conditions of high temperature of the sort we have talked about on 12th February?---How much longer would they be?

Yes?---I do not know.

Does not aluminium expand when it heats up?---So does steel.

And this would be your field, the coefficient expansion of steel?---Yes, how a composite wire would perform. This is a composite steel/aluminium wire we are now talking about. I would not know how it would perform.

Could you assist us at all as to what would be the amount of expansion in the wires in a tempera ure of 36 degrees with a strong northerly wind?---The northerly wind would have nothing to do with it. I do not even recall the temperature but I think it is 10 minus 6 degrees centigrade. I prefer not to quote a figure because I do not recall the coefficient expansion of steel or aluminium at these temperatures.

Is that not something you would want to know if you were to determine whether those particular wires clashed on a particular day?---If I was asked to investigate this possibility, certainly.

It was 37 degrees centigrade, according to the major fire report, Exhibit 79. Have you seen, in your experience with the Commission, wires on hot days sagging down quite palpably?--Yes.

What was the temperature on the day you brought into coincidence these two conductors?---I did not measure it, but I would estimate it would be of the order of 22, something like that.

THE BOARD: That concludes the Penshurst fire. We now go on to what?

MR. NIXON: The Strathmore fire.

Mr. Ellis, I shall read your statement you prepared in relation to your observations at Strathmore/Glen Thompson. In your statement you say:

> I, John Charles Ellis of 9 Rangeview Road, Lower Plenty, Metallurgist, state -
>
> I am head of the Materials Technology Section of the Research and Development Department of the State Electricity Commission of Victoria.
>
> I hold the degree of Bachelor of Science and I am a Member of the Institution of Metallurgists (London). I have had 27 years' experience in metallurgy, specialising in the investigative field throughout that time.

ELLIS.

On 1 April 1977 I visited the property known as "Roanoke" near Glen Thompson.

I was there shown a conductor which I was informed had been removed from the low voltage span between the substation pole (Pole 11) and the home of Mr. Mick Lloyd. The conductor was about 27 metres long (90') and consisted of seven strands of .064 copper wire. It contained a McIntyre sleeve at one end and the other end was roughly formed into a loop.

I found marks consistent with electrical contact (fusing) with another conductor, singly or in groups, in ninety places along the conductor. Most of these marks were towards the McIntyre sleeve end of the conductor. With a low powered binocular microscope I examined these marks. While I find it impossible to say when the marks were made, at least some areas were consistent with contact having taken place on 12 February 1977.

I noted that individual wires of the conductor had broken in five places. All five were where fusing had taken place. Progressing from the McIntyre sleeve end there were:

1. One wire broken and unravelled from the conductor (frayed).

2. Two wires broken and frayed.

3. One wire broken.

4. Three wires broken.

5. One wire broken and frayed.

Except that it was not recent, I am unable to say how long ago the breaking and/or fraying occurred.

In my opinion neither the marks (fusing) found on the conductor, or the breaks in the wires were a consequence of the fire on 12 February 1977.

I also examined the conductor strung in the two bays to the north of Pole 11. I noted that the three conductors could be held together in groups both at mid-span, and for a considerable distance towards the poles at either end.

Using an elevating platform vehicle (EPV) and the low powered binocular microscope I examined the three conductors in the span running north from Pole 11 to the first private pole. Progressing from south (Pole 11) to the north I found marks consistent with contact by one conductor with another as follows:

(Page 1540 follows)

MR. WIXON (Continuing): "a. On the bottom and centre conductors -

i. a small area of fusing, the marks appearing to be old;

ii. a medium sized area, the marks appearing to be old.

b. On the top and centre conductors

i. a large area, the marks appearing to be old;

ii. a medium sized area, the marks appearing to be old;

iii. a small area, the marks appearing to be new, and consistent with contact on the 12 February 1977;

iv. a small area, the marks appearing to be new, and consistent with contact on 12 February 1977.

By small area I mean an area about one eighth inch long, by a medium area about one quarter of an inch long, and by a large area, more than one quarter inch long. The marks on the pairs of conductors were about the same distance from Pole 11, and were consistent with contact one with the other.

The marks described in (b) (iii) and (iv) above were at or about the centre of the span, the others somewhat south of them.

By the same means I also examined the conductors between the private pole immediately north of Pole 11 and the next private pole north. Progressing from south to north along the span I noted marks on the top and centre conductors as follows:

a. Between the pole and the line of trees adjacent to the tank stand -

i. a small area, appearing old;
ii. a medium area, appearing old.

b. Within the line of trees adjacent to tank stand -

i. a group of four large areas, all appeared old.

c. North of the line of trees -

i. a large area which appeared old. One strand of sire was broken at this point;

ii. a medium area, also appearing old;

iii. a small area, also appearing old;

iv. a small area, also appearing old;

v. a large area, appearing new, and consistent with contact on 12 February 1977. One strand in each conductor was broken at this point:

vi. a large area, which appeared old;

vii. a large area, appearing old.

The marks referred to in (a) above were in an area of trees from which a number of branches had been cut.

The majority of the marks were close to the line of trees."

That is your statement in relation to your observations at the property "Roanoke", is that correct?---Yes.

LUNCHEON ADJOURNMENT.

UPON RESUMING:

MR. MARKS: Mr. Chairman, it occurs to us that the reports of both Dr. Penman and the gentlemen we have been talking to, Mr. Pleasance and his offsider, are very difficult to follow. If they are to be meaningful, I think we would benefit from conferring with them, so that we could at least lead evidence we understood. I mean, at the moment I am only just getting what these things mean. I think the reason I am saying all this is to suggest we do not call those gentlemen until we have had a chance to get further elucidation, or alternatively, that we call Mr. Pleasance, let him read the report - - -

THE BOARD: And adjourn?

MR. MARKS: And perhaps let us clarify it. I do not know at the moment how to do it.

THE BOARD: We shall see how we are going for time at the end of the current witness's evidence.

(Discussion ensued).

THE BOARD: At present we shall continue with Mr. Ellis, and we shall see what stage of the day we have reached at the time we have finished with him. As I recall it, the statement had been read. Do you want to ask Mr. Ellis any further questions, Mr. Nixon?

MR. NIXON: No.

MR. BARNARD: You have given some evidence in relation to Penshurst, but Penshurst was, I think you made it clear, steel and aluminium conductors, is that corredt? ---Yes.

Incidentally, do you know the comparative melting points of those conductors compared to copper?---Aluminium is lower than copper, steel is higher. 600 plus for aluminium, about 1,020 for copper. Steel will vary, depending on its composition. It would be close to 1,200, in excess of 1,200 probably.

THE BOARD: It would be the highest?---Steel is the highest.

Copper next, and then aluminium?---Yes.

MR. BARNARD: What is the composite of copper and aluminium and steel?---What is the composite?

What is the melting point of the composite?---It is not a composition.

THE BOARD: One coated by the other, is it?---No, it is simply separate steel and aluminium wires stranded into a conductor.

MR. BARNARD: What is the melting point of copper then?---Copper, I think, from memory, is about 1,020, 1,040 - C., that is.

THE BOARD: Somewhere between aluminium and steel?

MR. BARNARD: Aluminium va ises at a relatively low point, does it not?---Normally you need to get considerably above the melting point for it to vapourise. I am not aware of any tendency for aluminium to vapourise at its melting point.

You do not know at what stage it does vapourise?---No, I do not.

Have you carried out any experiments about the heat exchange of copper?---The heat exchange of copper?

Yes - in other words, the rate of cooling of copper globules? ---No, I have not carried out any experiments of that sort.

THE BOARD: I must confess that in my innocence I always thought all these wires were copper. I am amazed to learn about the steel and aluminium. Have you any idea of the relative proportions of the two lots of wires? Do they mainly use steel with aluminium?---This is a bit out of my field.

Yes, I realise that?---I can speak, if you like, from what experience I have in this. S.w.e.r. lines, as I understand it, are entirely steel. The basis of the s.w.e.r. line is that you can use steel and put a higher tension load on the steel, and therefore increase your span and reduce the cost.

(Page 1542 follows)

THE WITNESS (Continuing): There are some conductors that are solely aluminium conductors, that is conductors made up of individual wires of aluminium woven together, and then there are steel reinforced aluminium conductors where the aluminium wires carry the current and the steel provides the strength so you can increase the tensile load on the thing to increase your span. There are not, as far as I am aware, and the distribution people would be able to inform you better on this, there are not many that are solely copper. It is too expensive. It has been almost universally replaced by aluminium where copper wire was used.

MR. BARNARD: Mr. Ellis, you looked at steel and aluminium wires? ---Yes.

Is it not possible for them to clash without leaving a mark on them? ---It is possible for them to clash, but it is not possible for them to clash and arc, and therefore fuse the surface without leaving a mark. If they clashed without any current flow it is possible, if they had no current flowing through them, they could clash physically and leave no mark. We are concerned, I presume with the production of molten particles as a result of clashing. If this occurs there are obvious indications of this on the conductors.

Let me understand that. Let me suggest to you a very minor clash and there being a mark but no molten particle coming off the conductor?---If there were a clash which involved physical damage, the two banging together, it is possible you could get an indentation from a stell wire into an aluminium wire, but this would not be very obvious.

It would be hard to see?---It would be hard to see.

For example, I am thinking of a welding mark. You can have metal marked and very clearly visibly marked without hot metal coming off?---Yes, this is so.

Can you get that with wires, that you get the mark without the hot metal coming off?---Yes, you can have the surface melting without necessarily any particles falling away from the surface and this, too, is apparent that this has occurred.

In fact, if metal does come away and you are using a binocular miscroscope, you can see that the metal has come away?--- You can see it without the use of a binocular microscope. If the amount of metal that came away could not be seen by the naked eye it would be not worth considering.

It would not start a fire?---Not at all.

Does the same hold true with regard to copper, that you can get marks there and see the marks where no molten metal has come away?---Yes. It would not always be possible where molten metal had come away or how much had come away from a clash with conductors. What happens is that the current flow of that arcing melts both surfaces. Some of this will solidify and remain attached to the individual strand in the conductor, some may fall away. It would be a difficult thing to look at a clashed conductor and say from a visual examination how much, if anything, of the metal had fallen from it. In extreme cases you could say some metal has gone, but the normal sort of thing, it is a quantitative assessment.

If there had been a significant amount of metal to come away such as would fall to the ground and light a fire, you would expect to be able to observe that absence or disruption of the

metal surface?---In a quantitative way rather than a qualitative way.

These marks on the conductors disappear fairly quickly, do they not?---No.

How long do they stay there?---Most of them would be there permanently - well, all of them. If fusion has occurred they would be there permanently.

The newness of it disappears quickly, does it not?---We are talking about terms like newness which I have used, but it is difficult to explain. What distinguishes a new clash or an old clash would not only be the appearanceof the surface, it would be the appearance of the surface, the build up of corrision products on the surface.

Looking at a particular mark which is recent, you are not really able to say whether it happened a week ago or four weeks ago, are you?---No.

You went up to Strathmore to Mr. Lloyd's property on what date, the 1st April, was that right?---Yes, 1st April.

At that stage you knew the allegation as to how the fire had started, is that so?---Yes.

What was the purpose of your visit?---As I understand it, someone, and I presume it was the Board of Inquiry, had asked that an expert be asked to look at these conductors and see if there was any evidence of fusion.

For what purpose were you looking at the conductors. Just to see if they had been clashing?---To see if clashing had occurred and if fusion had taken place as a result of this clashing.

Just fusion on the conductors?---Fusion on the conductors.

You understood the significance of that, did you?---Yes.

What did you understand to be the significance of it?---I understood there was a possibility that a fire could have started because of the clashing of conductors.

So you were looking for evidence of a fire starting because of conductors clashing and metal coming to the ground and starting the fire that way, is that so?---Well, yes and no, I was looking to see if conductors had clashed. Whether the clashing of conductors and the production of molten particles had caused the fire, that is not within my sphere of saying whether this is so or not.

You knew a high voltage explosion fuse had operated, did you not?---No. I knew there was a fuse on the pole, but I was not aware whether it had operated or had not operated.

You were not concerned to look for the cause of the operation?---of of the fuse?---I was asked to look at the conductors to see if the conductors had clashed, whether arcing and fusion had taken place. That was the sole requirement.

You knew where the fire had started, did you not?---I had been told where the fire started, yes.

You thought it was at the post or north of the post, pole eleven?---Exactly where in relation to the post it started there seemed to be some contention, because there was some

discussion about burn back. I believe it started close to that.

Pole eleven?---Pole eleven.

When you went up there, your belief was it had started in the vicinity of pole eleven, is that right?---Certainly.

You knew there had been a northerly wind on the relevant day, did you not?---Yes.

What were you looking at conductors that led through the trees to Mr. Lloyd's house for?---I was not looking - which Mr. Lloyd?

Mr. Mick Lloyd's house?---You are talking about the length of conductor that had been cut down?

Yes?---I was looking at that before the E.P.B. arrived to get an idea of what a conductor in this area in this environment may look like if clashing had occurred. I was using this as the indicator, if you like, the criterion and assessing, once I got on the E.P.B., the sort of things I would be likely to see.

(Page 1545 follows)

MR. BARNARD: So you did not make any notes of detailed observations of the conductors at Mr. Lloyd's that were taken down?---Yes, I did, of the conductors that were taken down.

You did, did you?---Yes.

Why did you make those notes?-- Why?

Yes?---Purely because I was interested to see what was on the conductor.

THE BOARD: Were you regarding that conductor as a sort of control to compare the other conductors with?---Yes, my charter, as I understood it, and these things are not always written down in black and white, was to look at the conductor at each side of the pole. While I was waiting for the EPV to arrive I was told there was a conductor by the house and I looked at that.

That conductor did not come from the span between Pole 11 and the pole to the south, it came from the second pole away from pole 11?---Yes, I believe so.

Were you also asked to look at that conductor and try to implicate Mr. Lloyd's trees as the cause of the fire?---I was not aware it even passed the trees and there was no suggestion that I would be looking at anything to implicate anyone, my involvement was purely scientific, I was not involved in the implication of anyone or anything.

You have set out in your statement you have told us of the broken wires you observed on this conductor that had been taken down?---Yes.

And you said none of those were recent, none of the breaking and fraying was recent?---If I said that - I would have to refresh my memory, but if it was in my statement, yes.

And you did make a note of where that conductor had come from?---I was told it had come from the pole south of Pole 11, between that pole and the house.

Did you make a note of which one - which of the conductors it was?---No, I did not.

So, in fact, I think the evidence suggests it was the centre one, and you are not able to say that there was any contact between the conductors, which other conductor that one had been making contact with?---No, so far as I was concerned there was a length of conductor that had been removed from the pole south of Pole 11, the span between the pole south of Pole 11 and Lloyd's house. I do not know if it was or not, I was told this and I was using this purely as a guide to see what the clashing was, so I would know when I got up in the EPV precisely what I was looking for.

Do you know where Mr. Fred Lloyd's is?--The son's house?

Yes?---Yes.

But you did have a look at the conductors going across to there, did you not?---From Pole 11 to Mr. Fred Lloyd's house?

Yes?---No.

Not at all?---Not at all.

THE BOARD: I am sorry, the conductors that you looked at with the aid of the vehicle, which one's were they, then?---They were the conductors on the spans both north and south of Pole 11. I may be mistaken here, Mr. Fred Lloyd's house, north-east of pole 11, and there was a conductor running from Pole 11 to that house.

That is so?---No, I did not look at that conductor.

Whether it was also tattered and marked, with broken wires on it, you are not able to say?---No.

You told us how you pulled the wires together at Penshurst?---Yes.

Did you try to make wires contact at Strathmore, too, at Mr. Lloyd's property?---Yes, they came together very readily.

Will they not always come together readily?---I do not know, I have not been involved in field inspections on these conductors, very frequently.

They also come down in a dip, do they not, they have a sag in them, those wires?---True.

And if you lift the bottom wire up, you have only to lift it up a foot to contact the ones at the top, do you not?---This is not within the bounds of my knowledge, but I would assume - and this is only an assumption - that if conductors are property strung, they should be strung in which a way that they cannot clash.

That may be so, but are you suggesting that there could be situations in spans of this size where wires properly strung would not be able to be pulled together or to touch one another?---This would be an assumption on my part, this I would assume, that it would be desirable or designed so that conductors could not clash, otherwise there would be no point in stringing them separately.

You do not know whether that is possible or not in a span of this size?

THE BOARD: I think that is the point he is making, obviously they must be strung with the intent that they do not clash, otherwise the three wires would be running together, they are spaced in the hope that they do not clash?---That is how I would describe it.

And presumably there may be some areas or stretches of wires which are put up by the SEC that actually do not clash, we hope.

MR. BARNARD: You are speaking of this observation in relation to the conductors being capable of being touched together in the span south of Pole 11, is that so?---Both south and north of Pole 11.

And the span south of Pole 11, it just had one wire replaced and had been retentioned?---I did not know about this.

We have had evidence that that happened prior to 1st April, you say even if it had been rewired and retentioned - - -?---It was possible for them to come together?

You are not saying it is not able to happen in a span of this size?---I am not saying I am able to say it.

Is there any significance in your written statement that they are capable of being touched together?---The significance there is if they can touch together you are liable to get arcing taking place.

You are saying if you can pull them together manually, then they can clash?---There is a possibility they can clash, yes.

As you examined the span south of Pole 11, you have told us of the fraying, which I think you said was not recent?---South of Pole 11?

South of Pole 11?--My memory suggests there was not much wrong with the span south of Pole 11.

The second one south of Pole 11?---I was examining the span, I examined a length of conductor that was said to have been taken from that span.

And the fraying or unravelling did not appear to be recent?---There again, if I said that, that is the case, yes.

(Page 1547 follows)

MR. BARNARD: You did see other marks on this conductor, is that so? ---Yes, other marks in the areas of fusion.

When you say some areas were consistent with contact having taken place on 12th February, certainly all you are meaning by that is that those marks appear to be recent, is that so?---Recent.

When you say that, do you mean two months or three months?---I would not endeavour to put a time on that. These judgments, as I have said, are subjective. If I were pressed as to time, I would say within four months but - - -

But it could be six months?---Yes, it could be six months. They had not been there for two years. It depends upon a number of conditions including weather, which is the main factor - depending on how much they change after fusing,

With respect to those marks on the conductor which was on the ground, as far as you are concerned, they could all have been forced by a contact with the neutral or top conductor of the three, is that so?---With another conductor.

You are unable to say which?---I do not know. The conductor I examined, whether that was neutral, alive or what, to me, it was a length of stranded copper conductor.

If the evidence is that this was the middle of the three conductors he replaced, you are still not able to say whether they were caused by contact with the neutral or the live? ---No.

As you proceeded to the north of pole 11, I think you described about six marks there in the span immediately to the north of pole 11 and you referred to the last two or the northern-most of the two marks, as I understand it, as appearing to be new or recent, is that so?---Yes.

Those two northernmost marks you described as being small?---Yes.

I suggest to you that those two marks are of such a size that they are not consistent with there having been a contact and fusion which could have caused molten metal to fall to the ground of the size which would start a fire?---I cannot answer the question because I do not know at what size molten metal will cause a fire. All I can say is they were consistent with molten metal having escaped from the point of contact. I do not know whether they were sufficient to cause a fire.

They were small marks?---Yes.

You would agree, if the marks are small, it is unlikely that sufficient molten metal would fall to cause a fire? ---I cannot say yea or nay to that because I do not know how much molten metal is sufficient to cause a fire.

By looking at any mark you are not in a position to say what is a sufficient amount of molten metal to fall and cause a fire?---No.

It is clear that the first two marks you observed were marks which involved the top and middle conductor, the neutral and middle conductor?

MR. McDONALD: I think he calls it the top and centre.

MR. BARNARD: The top and centre conductor?---If that is what it says in the report, then that is the case. I do not remember all these things in detail.

I have lost the statement.

MR. McDONALD: Are you not referring to page 2(b)(iii) and (iv)? ---Yes, that is right.

MR. BARNARD: Then, moving up to the next span, that is the second span away to the north of pole 11, I think your statement again indicates that all the marks there that you observed were marks indicating contact between the neutral and centre conductor - all of them?---The top and centre conductors?

And none on the bottom.

MR.MARKS: He does not know?---No, I do not think so.

MR. BARNARD: Is it also correct to say that where there was a broken strand on the conductor, that broken strand was in fact well clear of the poplar tree or any branches of the poplar tree?---There were strands broken north of the line.

How far north of the line?---I cannot tell you exactly how far north they were. These would have been viewed from the north side. How far the trees spread before I examined them, I do not know, because the trees had been cut at the time I had examined them.

You did look at the span immediately to the south of pole 11?---Yes.

You got up on the EPV to look at that?---That is right.

Why did you look at that span?---Because that was the span I was requested to examine.

Someone nominated the span you were to examine?---Yes.

Who was that?---It was nominated exactly to me by Reg James but I understood it came from this Inquiry as towhat span should be examined.

Mr. James told you to examine the spans immediately to the south and all spans to the north?---Two spans to the north.

MR. MARKS: I do not know what is being suggested by this but we did get specific permission from you, Mr. Chairman, for Mr. Ellis to go down there on a particular day. You remember, there was a discussion?

MR. BARNARD: I do not think we had a discussion.

MR. MARKS: My learned friends paranoia has developed with the effluxion of time. This arose from a request by Mr. Barnard for an examination to take place on that day. We requested permission for Mr. Ellis to go and examine the wire that had been taken down, and that was granted. There was no secret about it at the time.

THE BOARD: I do not think there is much point in asking Mr.EEllis why did he look at this and how stupid it was to look at something else. He said that is all this Inquiry asked him to do.

MR. BARNARD: The Inquiry did not limit his field of investigation.

THE BOARD: I do not know. It was not that the Inquiry did not limit it but he would have had no right to go onto the place at all if the Inquiry had not directed him to do it.

MR. BARNARD: Mr. Ellis, you did not look at the conductors leading to Mr. Fred Lloyd's place, the son's place, because you were not asked to, is that right?---Yes.

You are unable to say that any wires clashed on 12th February 1977 as a result of your examination?---Am I unable to say?

I am suggesting you are unable to say that any wires clashed on 12th February 1977?---I am unable to say precisely that clashing took place on 12th February.

Or on any other date within four months prior to your examination? ---My evidence would suggest that some clashing had taken place during that time but I would be unable to pin it to one day.

There is no reason to prefer 12th February to any other period in that time, is that right? Would you agree there was no evidence on which you would prefer the 12th February? ---No, no evidence from examination of the wires.

(Page 1550 follows)

THE BOARD: It does seem to be common ground that there was a fire that day.

MR. MARKS: And a wind. (To witness) There is something I forgot about. You took some photographs, did you not, when you were there?---Yes, I did.

We have a lot of exhibits of photographs. Perhaps I could have a look at them and show them to Mr. Nixon, and see if it is desired to tender them.

THE WITNESS: These are unmarked.

MR. MARKS: These are photographs you took?---Yes.

If you could give us the whole packet, we can sort them out. What are they of?---Generally of conductors.

Do they show these marks you have been speaking of?---They show old marks and new marks, yes. There will be some duplication.

We shall have to have the witness identify them, I think.

EXHIBIT 207.....Report of Mr. Ellis on Strathmore.

EXHIBIT 208.....Three photographs taken by Mr. Ellis.

THE BOARD: Would you be good enough to write on the three exhibit photographs what they are?---In relation to the statement?

Yes?---I shall do that.

MR. NIXON: Perhaps they can be tendered just as three photographs at this stage, and they can be identified later.

MR. MARKS: Has the witness some means of identifying them?

MR. NICON: From another statement prepared.

THE WITNESS: Shall I put it this way? I wrote a statement myself of my observations. This was then given to Mr. Scofield. He used a different designation from that I used.

MR. NIXON: The third investigation that you conducted was into expulsion drop out type fuses connected with the Wallinduc/ Cressy fire, is that correct?---Yes.

The summary is that an examination was made of an E.D.O. fuse carrier that operated in a location and at a time when a fire started; comparative examinations have been made of similar fuses; the conclusion reached is that at the time the fuse operated, the top cap was not in position, with the result that molten debris may have been expelled from the top of the fuse. That conclusion is pretty conservative, is it not? It is almost certain that debris was expelled from the top of the fuse?---Debris could have been expelled from both the top and the bottom. Whether it came from the top and the bottom, I do not know.

Have you seen tests conducted down at Fisherman's Bend?---No.

You have prepared a report in relation to the Wallinduc/Cressy fire? ---Yes.

Have you that report with you?---I have that here.

Will you read it?.

"EXAMINATION OF EXPULSION DROP-OUT TYPE FUSES
WALLINDUC-CRESSY FIRE.

Report No. M77-48.

1. Introduction

On Saturday 12 February 1977 a fire was reported to have started near Pole 66 on the 12.7 kV single wire earth return line that supplied the property of Mr. White in Berrybank Road, Wallinduc. Two expulsion drop-out type (EDO) fuses are mounted on Pole 66, one on the north side and one on the west. The one on the west protects the line to Mr. White's property. It is believed that at about the time the fire started, a tree limb fell over this line, some kilometers away, causing the fuse to operate. The other fuse, on the north side of the pole, operated some time later as a result of subsequent fire damage to a pole on the line that it was protecting.

The EDO fuse is so designed that when it operates, any debris from the melting fuse is expelled from the fibre tube in which it is enclosed and caught in a metal catcher placed below for this purpose. Expulsion of any of this material and the top end of the fuse link from the top of the fibre tube is prevented by a metallic cap that screws on to the top. The bottom end of the fuse link is held by a thumb screw near the bottom of the fibre tube.

When the fuse elements were replaced on Pole 66 on the evening of 12 February, it was noticed by the linesman that the top cap was missing from the fuse on the west side of the pole, i.e. the fuse that is believed to have operated first.

If this cap had been absent at the time the fuse operated it is possible that the material expelled from the top of the fibre tube may have caused the fire. The aim ofthis investigation is, therefore, to determine, if possible, whether the cap was present on the top metal fitting of the fuse when it operated on 12 February. For this purpose the fuse carrier was removed from the west side of Pole 66 for examination. Subsequently the other fuse from Pole 66 and a fuse believed to be of the same design and age and exposed in a similar environment were also received for comparative purposes.

It was requested that the investigation be carried out parallel with, but independent from, a similar investigation being carried out by Technisearch Ltd. The same samples were to be used for both investigations.

2. Samples

The first sample was received on 15 March 1977 and was labelled:

"Fuse Carrier Ex Pole 66. Wallinduc Line. Delivered to R E James, 8-3-77)'.

This was said to be from the west side of Pole 66, protecting the line to Mr. White's property. Throughout this report it will be referred to as the 'WHITE FUSE'.

Two further samples were received on 18 March. One was said to be from the north side of Pole 66 and was labelled:

'Glenfine S/Line. Pole 66'.

This fuse will be referred to as the 'GLENFINE FUSE'. The other fuse received on the same day was labelled:

'Dowling Forest No 2. Last op. 2/6/76'.

This will be referred to as the 'DOWLING FOREST FUSE'.

3. Visual Examination.

3.1. White Fuse.

As received, the white fuse was without a top cap but the actual fuse, fuse link and washer were still in position. Visual examination showed that the surfaces of all exposed metal parts, with the exception of the washer and top end of the fuse link, had evidence of corrosion. The area at the top of the fuse that would normally be covered by a cap was also corroded.

A number of photographs of this fuse are shown in Figures 1 to 6. Figure 7 shows a general view of the fuse after the fuse link has been removed; Figures 8 and 9 the appearance of the top end of the fuse.

Features that can be seen in the photographs include:

(a) evidence of surface corrosion is present on all exposed metallic parts;

(b) there is no apparent difference between the extent of corrosion on the area normally covered by the cap and other adjacent metal parts, although the lower threads on the top fitting appear to be slightly less severely corroded than the upper threads (Figures 2, 3, 6 and 7);

(c) the fibre tube was covered for most of its length by a black plastic sleeve (Figures 1 and 7);

(d) some exfoliation of the fibre material was evident at the bottom of the tube (Figure 5);

(e) the thread on the top metal fitting was covered with corrosion products and other debris and showed no signs of recent contact with a matching metal part (Figure 6);

(f) one wing at the top end of the fuse had been distorted from its normal position (Figure 4);

(g) burn marks, probably caused by arcing during operation, were on the wings at the top of the fuse (Figures 3 and 4) and to a lesser extent on the hinge pins at the bottom of the fuse (Figure 5);

(h) what appeared to be arc burns were present on the lip of the top metal fitting and in a number of places on the int rnal surface (Figures 8 and 9);

(i) there was evidence of corrosion on the internal surface of the top metal fitting (Figures 8 and 9).

Other observations made, but not illustrated by photographs, were:

(j) there was some scoring of the internal surface of the fibre tube but otherwise it appeared to be in good condition;

(k) there was no apparent deposition of material from the fibre tube on the internal surface of the metal fitting;

(l) the thumb screw holding the bottom end of the fuse link was corroded on its external surface but when removed showed relatively bright inner surfaces.

(Page 1552 follows)

THE WITNESS (Continuing):Further examination, using a low magnification binocular microscope, confirmed the observations made visually. In particular it was possible to make a close examination of the threads in the fuse top fitting and observe the presence of corrosion products, dust and debris that showed no evidence of recent disturbance. This can be seen in Figure 10.

3.2 Glenfine Fuse

The Glenfine fuse was received with the top cap screwed on. Several marks, probably due to arcing, were present on the cap (Figure 11). In general appearance this fuse was very similar to the White fuse.

The cap was easily removed, revealing the condition of the top metal fitting. This is shown in Figure 12 and the White and Glenfine fuse tops are shown juxtaposed in Figure 13. It will be seen that, although there is some corrosion of the area under the cap in the Glenfine fuse, it is considerably less extensive than that on the White fuse and also the corrosion on the adjacent areas not covered by the cap.

Low magnification binocular microscope examination confirmed this, and close examination of the top threads showed limited corrosion pitting and some debris but, as expected, clear evidence of recent disturbance of the thread surfaces by contact with the cap threads (Figure 14).

3.3 Dowling Forest Fuse

The most obvious difference between the Dowling Forest fuse and the two previously examined was that the fibre tube of the Dowling Forest fuse was not covered by a black plastic sleeve. As a result there was some evidence of weathering and discolouration of the tube surface. In other respects the fuses were similar. A top cap was fitted and showed an apparent arc mark (Figure 15). Exposed metal parts showed evidence of corrosion.

The cap was removed to show the condition of the metal fitting underneath (Figures 16, 17 and 18). It was noticeable that the washer at the top of the fuse link could be readily displaced from its central position (Figure 17).

Comparison with the Glenfine fuse showed that corrosion had occurred for a further distance up the threads of the top fitting and there was some fairly substantial corrosion in one area at the top of the thread (Figure 16). Apart from this, however, the top fitting, normally under the cap, showed little corrosion either externally (Figure 16) or internally (Figure 18). What at first sight appeared to be two arc marks on the top metal fitting were seen on closer examination to be a stain on the internal surface. One unusual feature was the presence of corrosion product on the inner surface of the cap.

The top of the Dowling Forest fuse is shown in juxtaposition with the White fuse (Figure 19) and the three fuse tops are shown together in Figure 20.

4 SECTIONING

To enable further examination to take place, the top metal fitting was released from the White and Glenfine fuses by removing the rivets holding the two sides of the operating ring plate together. The fittings after removal are shown in Figures 21 and 22.

ELLIS.

There was some evidence of corrosion of the fittings under the plates and both showed the presence of a brown deposit around part of the circumference in this region. This shows more clearly in Figure 22 and is probably due to the entrapment of fine dust.

Each fitting was then cut in two, longitudinally, one half being retained for examination at the Herman Research Laboratory, the other being forwarded to the Technisearch Ltd. for its examination.

Sectioning permitted closer examination of the internal surfaces of the fittings. The White fuse showed six areas where arcing had occurred, three on the internal surface and three on the inner edge of the top rim of the fitting. Since there was no evidence of corrosion products on these spots, it is assumed that they were of recent origin.

After scanning electron microscopy, further sections were cut for optical microscopy and chemical analysis.

5 CHEMICAL ANALYSIS

Chemical analysis of samples from the White and Glenfine fuse top fittings gave the following results:

	WHITE FUSE	GLENFINE FUSE
Copper %	57.1	57.4
Lead %	2.9	2.8
Iron %	0.10	0.10
Tin %	0.20	0.14
Nickel %	0.04	0.04
Zinc %	>39.0	>39.0

Both of these analyses comply with the requirements for a free cutting brass, Australian Standard alloy designation 385C.

6 OPTICAL MICROSCOPY

A complete radial longitudinal section was cut from both the White and Glenfine fuses. After preparation these were microscopically examined with the following results.

Both samples showed microstructures typical of a free cutting a-B brass, that is B phase in a matrix of a phase with dispersed lead globules throughout the structure. The surfaces were coated with a thin metal layer, identified in other tests as tin. Where surface corrosion had occurred the tin had been partially or totally removed. Further to this, in some corroded regions, dezincification of the B phase was evident. However, the distribution of the dezincification was different to the two fuses.

On the White fuse, dezincification was present on most external surfaces with the exception of the top of the fitting in the area that would have been covered by the fuse link washer. Except for a small area near the bottom the internal surface was not dezincified.

On the Glenfine fuse, dezincification was more limited. None was present on the top, bottom or internal surfaces and it was confined on the outer surface to an area below the second thread from the top. The area above this, that is the area covered by the cap, was free of dezincification.

ELLIS.

16.GT/RLP.
Fire.

Photomicrographs at the outer surfaces of the two fittings were taken and are shown in Figures 23, 24 and 25. Figure 26 shows where these were located on the fuse fitting sections.

A microsection was also taken to include an area that appeared to be an arc burn on the White fuse (Figure 27). Fusion of the surface metal has occurred, producing a number of shrinkage cracks on resolidification and minor intergranular penetration by molten lead.

7 SCANNING ELECTRON MICROSCOPY

Scanning electron microscopy was carried out on the outer surfaces of the top fittings from both fuses. As well as confirming what had been established by visual observation, that is the presence or absence of corrosion products and debris on different parts of the surfaces, it was possible to identify the brown deposit shown in Figure 22 as a clay type substance.

A scanning electron micrograph of one of the fused areas on the top rim of the White fuse fitting is shown in Figure 28.

8 ELECTRON MICROPROBE ANALYSIS

Electron microprobe analyses were carried out on selected areas along the surfaces of the top fittings from the White and Glenfine fuses. The following elements were detected:

tin, copper, zinc, aluminium, silicon, sulphur, chlorine, iron, phosphorus.

Not all elements were present at each selected area and the relative proportions varied in different areas. Copper and zinc are present in the base metal; the tin in the surface coating. The other elements could be present as dust, contamination from handling and possibly airborne or air-sprayed fertilisers.

The pattern of variation of the element quantities was consistent with both the visual observation of the surfaces and the microscopic examination. Where extensive corrosion was apparent the proportion of zinc and copper was greater in relation to the amount of tin. Where the surface was substantially uncorroded the proportion of tin was greater. That is, a high proportion of zinc and copper was indicative of perforation or thinning of the tin layer. In areas contaminated by debris of various types, the other elements were detected in larger amounts.

The difference between the areas that would normally be covered by a cap on the White and Glenfine fuses was also consistent with greater corrosion of the tin having occurred on the White fuse.

9 EXAMINATION OF THE INTERNAL SURFACE OF THE FIBRE TUBE

The fibre tube from the White fuse was cut transversely near the bottom and the top portion was then cut longitudinally in two. It was apparent that the tube consisted of two concentric tubes of different material.

Examination of the internal surfaces showed charring in the area where the actual fusing takes place. Some scoring of the surface was consistent with fuse link tails being threaded through the tube or being dragged out. However, there was nothing to indicate whether, at the last operation, the top end of the link had been expelled from the top end of the tube or not.

10 FURTHER TESTS

To obtain an indication of the time that would be required for a fuse top fitting to corrode to the extent observed on the White fuse, a pair of similar fuses has been exposed in each of two locations for a period of 23 days, equivalent to the time from the fire to when the White fuse was removed from Pole 66.

Each pair had one fuse with a cap screwed on and the other without a cap but with the fuse link and washer in position. One pair was exposed on the roof of the Herman Research Laboratory and the other in a rural area near Ballarat, judged to have a similar environment to that at Wallinduc.

So far only a visual examination of these has been possible but this has been sufficient to show that the corrosion on the top of the White fuse is most unlikely to have occurred between 12 February and 7 March 1977.

11 COMMENTS AND CONCLUSIONS

All the observations made and all the tests performed indicate that the cap was not in position on the top of the White fuse on 12 February 1977. It has not been possible to assess precisely how long the cap has been missing from the fuse but the extent of corrosion in the area normally covered by the cap was similar to that in the areas not covered on both the White and Clenfine fuses. From this it could be deduced that the cap may have been missing for a considerable proportion of the fuse's service life.

The fuse could operate quite successfully without the cap being present and lateral displacement of the top washer on the fuse link would not prevent this. This displacement would allow water to enter the top of the fitting, causing internal corrosion.

The presence of what appear to be recent arc marks on the top metal fitting may also be consistent with the absence of the cap when the fuse operated, the arcing being caused by unrestrained movement of the top portion of the fuse link when the fuse operated. Further investigations would be necessary to confirm this.

The internal corrosion of the Dowling Forest cap has not been explained but it is possible that this could have occurred before the fuse went into service. Other features such as arc marks on the caps and distortion of the wing of the White fuse are not inconsistent with normal operation.

MR. NIXON: Mr. Ellis, the second last paragraph of your report on page 7 refers to what appears to be recent arc marks on the top metal fitting, and that further investigations would be necessary to confirm the view you expressed there. Have you conducted these investigations or not?---No, I do not have facilities to do that.

Do you know the results of the investigation carried out by Technisearch Ltd.?---I have not seen the report but we co-operated throughout this investigation, and I gather that their conclusions, certainly their conclusions of visual examination which we conducted simultaneously , were comparable to our own.

It is clear in your view from the tests that you conducted that the cap on top of the fuse was probably not in position on what you have described as the White fuse at the time the fuse blew?---That is correct.

THE BOARD: Who employed these other research people?

MR. MARKS: I think we must have.
(To witness): It was the SEC which brought in Technisearch?--I understand that Technisearch was brought in to carry out a parallel but separate investigation because of the possibility that any investigation carried out by the SEC could be biased.

The SEC retained a consultant engineer, Mr. Freedman, who is not a metallurgist. Mr. Freedman is sometimes a spotter for experts, apart from being one himself. I think he introduced the SEC to Technisearch.

THE BOARD: I had assumed, when I heard there may be other people in it, that they were introduced by some other party. I do not think it was in anybody's interests to attack Mr. Ellis' findings on this and it does not seem worth cluttering the place up with extra information if the result is relatively the same.

MR. MARKS: As you are not bound by evidence, and it is possible to accept evidence from the Bar table, I shall find out what happened.

THE BOARD: Unless they have some contrary view, Mr. Marks, I would be happy to accept your statement in substantial agreement.

MR. MARKS: (To witness) Who from Technisearch was doing sets with you?---Dr. John Higgins.

Do you know whether he has put in a report?---I have not seen a report. I believe he did put in a report but I have not seen it.

You do not know who has it?---No.

(Page 1557 follows)

MR. BARNARD: There is no doubt in your mind that the particles which are expelled on the operation of a high voltage fuse can cause fire, whether they come out the top or the bottom, is that right?---No, that is not right. My answer to that would be the same as the answer I gave you in relation to the conductors. I have no knowledge as to whether molten or heated particles will cause a fire when they hit the ground or not. I have my own opinion as to what may happen, but I have no knowledge to support it one way or the other.

In your own opinion is it likely to cause fire?---No, my own opinion would be it is unlikely to.

Have you ever carried out any tests?---No, I have not carried out any tests and this is purely an opinion, not substantiated in any way.

You have, no doubt, seen the fire records or fire statistics of the Commission, have you?---No, I have not.

THE BOARD: I cannot help feeling you are putting up an Aunt Sally to knock it down again. He never says a word about this. You ask him and he says, "I am not an expert, this is not my field . If you ask me whether I think it is likely or not, as an individual, intelligent citizen, not claiming any special expertise, I would say it is most unlikely". You cannot get much more out of him.

MR. BARNARD: I am interested to see what he does say. Mr. Ellis, you have seen the fire statistics of the SEC?---I do not know what you mean by the fire statistics.

The records, such as they are, of fires that have been caused by SEC installations?---I have seen newspaper reports, I have seen maps on the wall which indicate fires have occurred and I have heard suggestions that these were caused in some cases by SEC equipment, but I have not seen any records.

You have never seen records of the number of fires caused by expulsion fuses?---No.

You know that they fit fire chokes to those fuses?---Yes.

Why do you imagine they are fitted?---I imagine because of the possibility that a fire may be started by them.

If there were records of fires having been caused by operation of expulsion fuses, you would consider they could be caused that way?---I have no consideration of it at all.

MR. DUNNE: Mr. Ellis, in paragraph 9 of your report you say there was nothing to indicate whether at the last operation, the top end of the link had been expelled from the top end of the tube or not?---That is so, this is the examination of the internal surface of the fibre tube?

Yes, but there was evidence of some sort of arcing activity explosion inside the top end?---The top metal fitting that sits on top of the fibre tube. The metal fitting is removed, you will see it in one of these coloured photographs, that is the top metal fitting there that fits into a fibre tube. Paragraph 9 refers to the examination of the fibre tube, not the metal fitting.

THE BOARD: We are now making this report, which is Mr. Ellis' report on Wallinduc, an exhibit.

EXHIBIT 209.....Report by Mr. Ellis on Wallinduc fire.

MR. DUNNE: You say it could be deduced that the cap may have been missing for a considerable proportion of the fuse's service life?---Yes.

What do you believe to be a fuse's service life?---Talking about this particular fuse's service life and I am using the assumption this fuse or both fuses were placed on the pole at the same time, I do not know when this line was erected, but I assume they both went up together, because of the extent of corrosion appears to be the same on the area normally under the cap on the white fuse and the area not covered by the cap on the white fuse, and the area not covered by the cap on the Glenfine fuse, I am assuming that both the Glenfine fuse and the white fuse have had a similar service life and because the extent of corrosion is such on the cap area of the white fuse, my deduction is that this has been exposed to the elements for most of its service life.

That is a result of a comparison between two fuses, assuming they are of equal age?---And also two parts of the same fitting of the same fuse.

And you are not able to put a term of years on how long that might have been the case?---No.

MR. LLOYD: Did you regard yourself in these investigations as giving specialist metallurgical assistance to an investigation which was basically being carried out by engineers?---Yes.

I am not suggesting it was any of your business tofind this out in the course of that assistance, but just by keeping your ears open are you able to say or do you know whether this engineering investigation into how likely it is for certain installations to cause fires has ever been conducted by the SEC before?---I am not in a position to know.

How long have you been in the SEC?---Eighteen years.

You have spent most of the time doing that, have you not, giving metallurgical assistance to basically engineering investigations?---Yes.

Have you been required to look at fires before?---On one occasion, yes, but quite unrelated to fuses.

Related to what on that occasion?---This was related to a tie wire breaking.

THE BOARD: What is a tie wire?---A tie wire ties the conductor to the insulator.

(Page 1559 follows)

MR. NIXON: Before Mr. Kirk is called, he is the man who has prepared notes from statistics concerning fires allegedly involving the S.E.C. or S.E.C. installations. On Friday I was handed some statistics and about ten minutes ago I was handed a further set of statistics relating to these fires. They could be of some importance and I believe that all members at the Bar table would probably require copies of this latter background that I have. I am not in a position to have it photocopied, I should not think, before 4 o'clock.

MR. MARKS: May I explain what has happened? Everyone has copies of the documents which were handed around the other day but the document I was handed just after the luncheon adjournment, I have not sufficient copies of to give everybody. I have one for Mr. Nixon and one for myself. The document does not refer to any additional fires but the same fires, categorized per region and per year and then categorized again with details of the number of specific fires under the categories of trees or limbs falling on them. I regret there have not been enough copies made available. Could I ask my instructor whether he can get more through our organization?

THE BOARD: Very well.

MR. NIXON: I have a copy. I think we can probably use the time usefully by calling Mr. Kirk.

NEIL HARRISON KIRK, sworn and examined:

MR. NIXON: What is your full name?---Neil Harrison Kirk.

Where do you reside?---661 The Boulevarde, Heidelberg.

What is your occupation?---My title is Assistant Chief Claims Officer, Risk Management.

You have prepared certain statistics taken from fires allegedly involving the S.E.C. from 8th January 1959 to 30th March of this year, is that correct?---That is correct.

TLet me read your statement and you can correct it if it is wrong. You say: "

"Statistics - Fires Allegedly Involving S.E.C. 8/1/59 - 30/3/77.

The statistics have been produced from reports received of fires alleged caused electrically or by the S.E.C.

Not all fires are reported but it may be accepted that all significant fires are reported. In 1969 and 1977 more fires were reported than would otherwise be the case because of specific requests for all reports for certain periods.

The results or consequences of 'faults' are purely fortuitous and 'faults' which do not cause fires, outages or damage are not reported.

For the period 8/1/59-30/3/77 399 fires were reported. It is understood this would represent only a very small percentage of the total fires from all causes over this period. About half only involved an area of a few square yards. 111 or 29% of them occurred on two days - 8/1/69 and 12/2/77. The balance 288 or 71%, an average

of about 15 per year occurred over the roughly 18-year period.

Region Schedule

South Western 130 or 32% - 2 days (8/1/69 and 12/2/77)
26 and balance 104

North Eastern 83 or 21% - 2 days (8/1/69 and 12/2/77)
9 and balance 75

Northern and Midland 50 or 13% - 2 days (8/1/69 and 12/2/77)
17 and balance 33

Eastern Metropolitan 44 or 11% - 2 days (8/1/69 and 12/2/77)
20 and balance 24

Mid Western 27 or 7% - 2 days (8/1/69 and 12/2/77)
17 and balance 10

Other 5 Regions all less than 20 or 5 %

Wimmera and Mallee had none on the two bad days.

Size Schedule

over 10,000 acres 7 out of 9 (2%) occurred on the two bad days

1000 and under 10,000 acres 10 out of 12 (3%) occurred on the two bad days

100 and under 1000 acres 11 out of 37 (9%) occurred on the two bad days

75% of fires were less than 10 acres.

Alleged Cause Schedule

Trees

Falling 83 or 21%)
Contact 51 or 12%) 134 - 33%

8/1/69 and 12/2/77 - 53 or 13% - balance 81 - 20%

out of 111 or 29% on those 2 days.

Probably a further 16 or 4 % involving trees are included in other categories, e.g. low voltage clashing - high voltage fuses.

Conductors Clashing.

Low Voltage only 58 or 14%)
Others 9 or 2%) 67 - 16%

8/1/69 and 12/2/77 - 34 or 8% - balance 33 - 8%

out of 111 or 29% on those 2 days.

Fuse Operations

High voltage 37 or 9%)
Low voltage 5 or 1%) 42 - 11%

8/1/69 and 12/2/77 - 7 or 2% - balance 35 or 9%

On the two bad days 111 fires were reported of which 5 were caused by some outside agency.

Of the remaining 106, 53 involved trees, 34 conductors clashing and 7 fuse operations. The next highest category is miscellaneous and this includes the Strathmore low voltage clashing or clamp-on fuse and Mingay L.A. fires.

Files relating to incidents occurring prior to 1967 have been destroyed.'

(Page 1562 follows)

MR. NIXON: You have prepared a statement in which you deal with the fires from 8th January 1959 to the 30th March 1977, taking it year by year, the total fires and the regions in which they occur?---Yes.

You have done the same thing with a schedule on the same basis, taking it from 8th January 1959 up to the 30th March 1977, dealing with the size of particular fires in each year, is that correct?---Correct.

You have also, in addition, prepared under each category, whether it be trees or limbs falling or the operation of fuses or lightning arresters, statistics dealing with the various fires year by year, is that correct?---Yes.

I shall tender those in due course, Mr. Chairman.
(To witness): Mr. Kirk, for how long have you held your position?---With this particular title, only, I think, three or four years, but I have been doing a similar job in relation to statistics and fire statistics for over 20 years.

Probably the most serious fires until the fires of 12th February this year, were the figures which occurred on the 8th January 1969, is that right?---Correct.

Were you called on by the SEC to produce statistics after those fires dealing with the causes of fires?---Not specifically. I have produced these for over 20 years.

THE BOARD: I would like to know two things. First of all, where do these statistics come from? Where do you collect them from?---From reports of fires from regions and any other area within the Commission.

Then you record these on some way or other?---Yes.

How, physically? On cards, or in books, or - - -?---No.

Or on SIFs, or what?---No. Most of them are given a file number, and at the end of the year I went through all of the files and took out these and other statistics.

I see. Of course, these all come to you because of either claims or potential claims, is that right?---No, not necessarily. There is a request to all regions to report all fires.

I see. Then, having taken out your statistics annually, what happens to them? To whom do you show them, or who publishes them, or where are they - - -?---A copy goes to the secretary each year, probably with a memorandum, and also they are passed on to all regional managers and distribution engineers departments.

MR. NIXON: And each fire is reported - or you hope it is reported if there is one - by a regional manager, is that right?---Where they occur within regional authority, yes.

THE BOARD: Can they occur outside regional authority?---Yes.

Where is that?---The regions are only the distribution area of the Commission. There are also transmission departments. There are very few from other areas, of course.

MR. NIXON: You obtain these details and you open a file, is that right?---There is not a file opened in every case. Sometimes, if it is one memorandum containing a number of small fires, no file will be opened as such, but there will be an admission memorandum.

Some of the fires that you deal with have just "Memo" beside them?---Yes, "Memo" or a dash shows that it was not registered as a specific fire.

But if you take a number, just taking one at random, like PR8269, for example, you would have opened a fire on that?---Yes, that is registered and a file is opened.

And you put all material that you are presented with into that file?--That is correct.

And you have provided there the dates of these particular fires - just taking that PR8269 - 12th February 1977; locality: Mingay; and the region, I take it, after that - SW - south-west region?---South-west region, that is correct.

Damage: 8000 acres. "Alleged cause". Who decides that? Did you decide that?---Yes.

You did not give much let-out for the SEC there. In fact, you gave them a quinella, lightning arrester or EDO fuse. You reached that conclusion yourself, did you?---I made an arbitrary decision under the headings in the first place. I tried to place all of these under the heading of the allegations that came to me.

THE BOARD: Have you a heading for "act of God"?

MR. NIXON: You have, I take it, read the file dealing with that Mingay fire?---Yes.

It is one, of course, of the larger fires involved in this inquiry, is it not?---Yes.

Having read the file, you put the alleged cause down to either lightning arrester or operation of an EDO fuse?---Yes. I did not make the decision that that was the cause. These are the causes that have been alleged.

By whom?---By a number of people, in this case.

Such as? No one here, Mr. Kirk, has ever suggested, until this was produced, that the file at Mingay could have been caused by the operation of the EDO fuse, has he? Or do you not know?--I am unaware of that.

Let us accept what I say for the moment, that no one has to date suggested that the fire at Mingay was caused by the operation of the EDO fuse. Apparently someone within your department has made that suggestion?---I have been aware of the suggestion from some source. I could not say precisely who.

I take it there is an SEC file, quite a big one, dealing with Mingay?--Yes.

And that is available?---Yes.

THE BOARD: Of course, your only interest, I suppose, statistically in saying anything about the cause is for the purpose of categorizing under various heads, is that right?---Yes.

But you do not just have a guess as to what the cause is? Somebody tells you, I take it?---Yes.

And that, in turn, would be who, the regional officer, or - - -?---In most cases, the regional officer. Sometimes it originates from a claimant. Generally speaking, it is the regional officer.

Like the insurance companies have when they get fire claims, do you have an investigator who goes around and has a look at these things?---Yes.

MR. NIXON: Do you know who made that suggestion?---No, I could not say.

There will be some document, I suppose, which has "Could be EDO fuse operation" or something like that on it?---Not necessarily a document. It may have been something I heard somewhere.

Did you do the investigation into this particular fire at Mingay?--- I did visit the scene and make some inquiries, yes.

Did you reach any conclusion yourself?---No.

(Page 1565 follows)

MR. NIXON: Mr. Kirk, a number of fires have allegedly occurred by the operation of the EDO fuse. They appear mainly, I have not checked them yet and counted them up, with the words "no choke". That is the fire choke?---That is correct.

There are some fires which have started with the operation of the EDO fuse with the choke?---Yes.

Just taking one I can see here, a small fire on the 30th January 1969 at Inglewood, PR.4R.18, EDO fuse with choke, damage two acres. Do you recall that or not?---Not specifically.

Another one, file No. PR.7814, 18th February 1975 at Heywood, EDO fuse, choke fitted, 4 acres; PR.8646, 17th February 1977, Kiata, EDO fuses, chokes fitted, small fire and then there is a dash, you did not open a file for that one. On 20th February 1977, Gippsland area, EDO fuse, choke fitted, small fire. Another one, 21st December 1973, Beulah West, PR.3274, EDO fuse, choke fitted, 600 acres burnt. Do you recall that one?---Not specifically, no. I know it is there.

I take it they are your conclusions again with the alleged cause of the fire was the operation of the EDO fuse in spite of the fact that therew was a fire choke?---Yes, I think from memory in each case you have mentioned a conclusion is reached from what is passed on by the region.

Passed on by the SEC's authorities in that particular region?---Yes.

Mr. Kirk, in the light of four or five, maybe six fires occurring by the operation of these EDO fuses with the choke fitted, have you reported to anybody on that in the SEC?---On that specifically, it has been passed on but not specifically that alone.

Passed on by you?---Yes.

To whom?---By way of statistics in the normal course of events.

Who do you give the statistics to?---The Secretary obtains a copy as do all Regional Managers of each area.

As a claims officer with the SEC, has it been a matter of concern to you that fires have started apparently by the operation of this fuse in spite of the fact a fire choke is fitted? ---Yes.

Have you expressed that concern to anybody in the Commission?---Yes.

To whom?---If I may expand this a little, any fire is a matter of concern to me and these statistics have been passed on in the usual way each year. Comments are usually made with the statistics and this sort of comment, I am aware, I have made.

Just comments that you have made to the Secretary when you pass on the statistics?---And also regional managers.

Have you investigated, in the course of your endeavours, why the fire choke has not caught the particle?---Not in any great detail. I am aware that in certain cases there is some reason for it in that either insects or birds have been involved, something to do with the choke.

If a lot of insects or a bird was caught in the fire choke, that type of thing?---Or if a bird was trying to build a nest there or something of this nature.

KIRK.

Is that a problem that the SEC has encountered?---I could not really answer that.

THE BOARD: Is it a fact that birds may endeavour to nest there? ---I do not really know the answer. I do not believe it is a major problem.

That is what you think would be normally the cause of the choke not acting, as it were?---Certainly, quite often.

THE BOARD: Has Mr. Kirk a separate statement as well as these statistics?

MR. NIXON: It is really a preamble to Exhibit 202.

THE BOARD ADJOURNED UNTIL 10.30 A.M. ON WEDNESDAY, 18TH MAY, 1977.