Department of **Consumer and Employment Protection**
Government of **Western Australia**

Energy Safety

ELECTRICAL INCIDENT REPORT

INVESTIGATION OF WILDFIRE ON 2 DECEMBER 2004 AT LOCATION 1478 SOUTH COAST HIGHWAY ESPERANCE WESTERN AUSTRALIA

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2004-1367

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1 INTRODUCTION

A wildfire occurred at Location 1478, South Coast Highway about 75km west of Esperance on Thursday 2 December 2004. It was reported by the Fire Emergency Services (FESA) that the cause of the fire might have electrical origins.

As a result an investigation was carried out by Energy Safety, the technical and safety regulator for the electricity industry in WA. This report summarises the findings.

The cooperation and assistance of officers of FESA, Western Power Corporation (WPC) and Police Arson Unit is acknowledged.

1.1 Location of Incident

Location 1478, South Coast Highway about 75km west of Esperance.

1.2 Time and Date of Occurrence

Approximately 1630 hrs on Thursday 2 December 2004.

1.3 Notification of Incident

An Officer of FESA notified the Energy Safety Division, of the incident on the morning of Friday 3 December 2004.

1.4 Investigating Inspector

The investigation was carried out by Mr Gary Scott, Senior Electrical Inspector, Energy Safety Division designated Inspector (Electricity).

Mr Scott visited the site on 5 and 8 December 2004.

2 SUMMARY

Energy Safety investigated the cause of the fire at Location 1478 South Coast Highway about 75km west of Esperance on Thursday 2 December 2004 and concluded that:

- A 19.1 kV phase conductor clashed with the underslung running earth conductor, at or near ground level, resulting in a flashover that released hot metal particles, which ignited dry harvested canola stubble, commencing the wildfire.
- The conductor clashed as a result of WPC wood pole (D595/8 south) failing (breaking and falling over) due to strong winds recorded in the western Esperance region on that day.
- Pole D595/8 south failed because the structural strength of the pole had deteriorated to a level where the pole was no longer able to perform its normal duties.
- Pole D595/8 south should have withstood the expected wind load.

3 ORIGIN OF THE WILDFIRE

No witnesses who claim to have seen the actual start of the ground fire have come forward. The first person to notice the fire was the property owner's neighbour who contacted the property owner and FESA volunteers.

The northerly most point of the wildfire was near where WPC wood pole (D595/8 south) failed. The origin of the fire was approximately 100 metres from the failed pole towards the next pole east, which is consistent with the 19.1 kV aerial phase and earth conductors clashing.

The property owner estimates that an area of approximately 50 acres had been burnt. It was evident that the fire was driven by wind in a southerly direction away from the fallen WPC pole. This is consistent with the fire being driven away from the suspected point of ignition, by wind coming from a northerly direction, as was the case at the time of the fire.

In summary, it was concluded that the fire was ignited when the 19.1 kV phase conductor clashed with the underslung running earth conductor when the WPC wood pole (D595/8 south) failed and fell over in a south easterly direction [Photographs, Appendix A].

4 INVESTIGATION

The property owner stated that the fire started at approximately 1630 hrs on Thursday 2 December 2004. She referred to the winds at the time as being like a mini cyclone and the worst she had seen for ten years.

The adjoining property owner stated that the fire started at approximately 1650 hrs on 2 December 2004. He also stated that he estimated the winds were 70 - 90 km/h.

4.1 WPC's Equipment

The WPC powerline was constructed as follows:

- Single phase 19.1 kV arrangement utilising a single active phase conductor (1 x 3/2.75 scgz) with an underslung steel running earth conductor (1 x 3/2.75 scgz);
- The spans either side of pole D595/8 south were, 280m to the east (pole D595/9) and 290m to the west (pole D595/7);
- The feeder supplying this system is called the Dalyup Feeder, which is electrically protected by a circuit breaker (D505) with auto reclose facility;
- The height of the pole was 9.22m from ground level; and
- The measurement from the active phase conductor to the underslung running earth conductor was 1.5m.

4.2 Examination and Findings

The following facts were determined from information provided by the property owner, the property owner's neighbour, WPC Esperance depot staff and on site inspection:

- On arrival of the WPC repair crew on the afternoon of Friday 3 December 2004, the WPC pole (D595/8 south) was lying on the ground pointing in a south westerly direction. The phase and earth conductors were both attached to the insulators still fixed to pole D595/8 south.
- WPC Distribution Systems Officer stated at the interview that pole D595/8 south was last inspected on the 26 March 2001 by a WPC wood pole inspection contractor. WPC records indicate that pole D595/8 south was installed on 1 January 1980.
- The pole inspection measurements recorded for the base of pole D595/8 south on the WPC DFMS Inspection Record sheet stated that the pole diameter at the ground line was 220mm. Energy Safety's, Senior Electrical Inspector, Gary Scott, measured the pole (D595/8 south) diameter at ground level (at WPC's Esperance depot on Tuesday 7 December 2004) and the result was 200mm, with 220mm measured at 25mm from the base of the pole.
- The associated WPC wood pole contractor has since advised Energy Safety that the inspector identified on the inspection record may not have been the actual inspector who carried out the inspection. This was due to delays in WPC issuing new inspector authorisation identification (ID) numbers (2-3 months delay) following inspector training. Therefore, a new inspector would utilise another inspectors ID for this period, as WPC's records could not be updated without an inspectors ID. Therefore, there has to be some doubt about the accuracy of WPC's records.

- The next pole east of the replaced pole (D595/9 south) appeared to be in a poor condition (where it enters the ground) and the earthing conductor connected to an electrode and attached to that pole was broken approximately a metre from the ground.
- Pole D595/8 south and surrounding poles were not reinforced (i.e. no RSJ columns/steels fitted).
- The Dalyup Feeder Circuit Breaker (D505) recorded a fault (operation) on Thursday 2 December 2004 at 1624 hrs.

4.3 Weather Conditions

The Bureau of Meteorology provided the following weather information for 2 December 2004 regarding the Esperance region:

> "*The region was subject to a strong wind warning, NE/N'ly winds 40/60 kmph ahead of a 40/60 kmph southerly change. Squalls to 80kmh with change".*

The Bureau of Meteorology provided the following weather information from Cheadunup weather station (near Munglinup), for 2 December 2004 at 1400 hrs.

Northerly wind at 38.9 kmph
Wind gusts at 72.2 kmph
Relative Humidity 11%.
Ambient air temperature 34.3ºC

4.4 Other Recent Pole failures

Information received on other pole failures in the western Esperance region that were related to the high winds on the 2 December 2004 were as follows:

- Four (4) other poles on the Dalyup Feeder, west of Esperance failed (i.e. fell over) on 2 December 2004 during or following the strong winds. A wildfire was the result of these pole failures. The pole No's were: D577/4 east, D318/35/10/8, D99/12/6 & D250/16/5. The poles were not reinforced. These pole failures are subject to separate investigation and report.

- WPC's Distribution Systems Officer stated at interview that three (3) other poles, west of Esperance failed (i.e. fell over) on 2 December 2004. These pole failures did not result in a fire. The area at the time was subject to strong wind conditions. The pole No's were: GS499/179/97 (Lort River), D888/98/8 (Melaleuca Rd, Munglinup) & D667 (South Coast Highway, Coomalbidgup).

4.5 Independent Scientific Inspection Results

Scientific inspection of the pole butt (above and below ground samples adjacent to the break) by the Forest Products Commission found:

4.5.1 Pole (D595/8 south) Stump (below ground sample)

The pole was split below the ground line and there was 2-3mm of rot on the weathered surface that would have little effect on overall strength. As expected, the centre of the pole had a brittle heart. There was decaying sapwood below the ground line. Overall the wood appeared to be sound.

4.5.2 Pole (D595/8 south) End (above ground sample)

There was some splintery fracture around the circumference, and the brittle inner heartwood. Residual sapwood above the ground was in good condition. Drill holes were through sound wood, and the sapwood above the ground line was sound.

Overall it was considered that the cause of the pole failure was the increasing brittleness of the wood with increasing age and years in service. Jarrah is rated in Australian Standard AS5604-2003 'Timber – Natural durability ratings' as CSIRO Durability Class 2, i.e. the outer heartwood should give 15 to 25 years service in ground.

4.6 Analysis

It is prudent to assume that WPC's overhead powerlines would have been designed to ESAA C(b)1 "Guidelines for the design and maintenance of overhead distribution and transmission lines" {referred to as "ESAA C(b)1"} or equivalent or higher standard, considering that ESAA C(b)1 has been the accepted standard for overhead powerline design in the Electricity Supply Industry for many years.

The guidelines specified design factors of safety (FOS) for supports such as poles, considering wind loads and other types of loads. It can be expected that with the deterioration of a pole with age, the FOS would gradually reduce. However, it is expected that WPC's pole inspection and maintenance system would identify and initiate action when the FOS of a pole is less than 2.0. This is because poles with a FOS of less than 1.5 are considered to be unsafe and must be replaced or reinforced such that the FOS is greater than 2.0.

The reported wind speeds on the afternoon of 2 December 2004 – northerly winds at 40km/h with gusts to 72km/h – are substantially less than the design wind speeds specified in the ESAA C(b)1. The wind loads specified in the different versions of ESAA C(b)1 1964 to 1991 to be accommodated in the wood pole design have not changed substantially over the past 35 years and these have been calculated based on a maximum wind speed of 146km/hr.

5 CONCLUSIONS

There are a number of factors that occurred on the day of the wildfire that need to be considered. These are summarised below:

- No witnesses, who claim to have seen the actual start of the wildfire, have come forward. However, the person who reported the fire claims to have arrived at the scene shortly after the fire started at approx 1630 hrs on Thursday 2 December 2004.
- Gusty winds from the north caused the wildfire to spread over an area of approximately 50 hectares until it was brought under control by FESA.
- None of the poles in the immediate area of WPC pole D595/8 south were reinforced at ground level (i.e. RSJ columns – steels fitted).
- WPC's pole inspection records cannot be relied upon to identify the inspector who inspected the poles and hence the data in the pole inspection report cannot be verified with that inspector.
- Scientific testing of the pole sample stump and pole end by the Forest Products Commission indicated that the samples showed signs of brittleness due to age.
- Pole (D595/8 south) failed because the structural strength of the pole had deteriorated to a level where the pole was no longer able to perform its normal duties.
- Pole (D595/8 south) should have withstood the recorded wind loads.

6 RECOMMENDATIONS

This investigation has identified that the WPC wood pole (D595/8 south) failed along with a number of other WPC wood poles in the area around the same period. As the mode of failure is similar in all cases (although the detail of the other cases is not covered in this report), it raises real concern about the structural adequacy of wood poles erected on or before 1985 in WPC's rural power system.

Energy Safety is currently conducting a compliance audit of WPC's wood pole management system to assess compliance with the *Electricity (Supply Standards and System Safety) Regulations 2001*. A copy of this report will be provided to the compliance auditors.

It is recommended that Western Power Corporation:

1. Changes its wood pole inspection practices and procedures to ensure that the inspector who conducted the pole inspection can be clearly and positively identified;

2. Inspects all the poles in the rural area to the west of Esperance that were erected in 1985 or earlier to determine the remaining structural strength and factor of safety (FOS) of those poles;

3. Reinforces or replaces all poles that do not have a residual FOS of 2.0 in respect of the loads specified in ESAA C(b)1; and

4. Prepares a plan and program to manage this work.

Energy Safety will be reviewing Western Power's actions and will ultimately decide whether or not it is necessary to issue an Order to ensure this work is completed to appropriate Standards and timeframe.

APPENDIX A - PHOTOGRAPHS

Photograph of Fire Scene with the New Replacement Steel Pole (D595/8 south)

Photograph of Broken End of Pole D595/8 South

Photograph of WPC Pole (D595/8 south) Stump End and Pole End Samples