



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

**Energy Safety**

## **ELECTRICAL INCIDENT REPORT**

**INVESTIGATION OF WILDFIRE  
ON 10 DECEMBER 2004  
AT LOCATION 1482  
SOUTH COAST HIGHWAY  
ESPERANCE WESTERN AUSTRALIA**

24 May 2005

2004-1370

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## **1 INTRODUCTION**

A wildfire occurred at Location 1482, South Coast Highway about 72km west of Esperance on Friday 10 December 2004. It was reported by Western Power Corporation (WPC) that the cause of the fire may have electrical origins and that a calf may have made contact with a 'Live' HV conductor in the area of a fallen WPC pole.

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 and Western Power Corporation (WPC) is acknowledged.

### **1.1 Location of Incident**

Location 1482 South Coast Highway about 72km west of Esperance.

### **1.2 Time and Date of Occurrence**

Approximately 1200 hrs on Friday 10 December 2004.

### **1.3 Notification of Incident**

WPC's Esperance Distribution's Officer notified Energy Safety Division of the incident on the afternoon of Friday 10 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 13 and 16 December 2004.

## 2 SUMMARY

Energy Safety investigated the cause of the fire at Location 1482 South Coast Highway about 72km west of Esperance on Monday 13 December 2004 and concluded that:

- On the morning of Friday 10 December 2004 the caretaker of the property let a herd of cattle into the paddock where pole (D577/4 east) is located.
- A calf then came in contact with a 19.1 kV phase conductor, at or near ground level, resulting in the electrocution (death) of the calf. The heat generated from the current flow through the calf ignited the dry harvested stubble commencing the wildfire [Photographs, Appendix A].
- It is considered that the 19.1 kV wood pole (D577/4 east) failed (broke and fell over) on the Thursday 2 December 2004 due to strong winds recorded in the western Esperance region on that day. Only light wind speeds have been recorded since 2 December 2004 up until the 10 December 2004.
- The pole failure did not cause the activation of WPCs high voltage powerline protection devices as the pole was lying on the ground with the 'live' insulator and conductor suspended about 1 metre from the ground.
- It is considered this pole remained in this condition for eight days until the calf contacted the live conductor.
- Pole D577/4 east 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 D577/4 east 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 caretaker.

The southerly most point of the wildfire was near where WPC wood pole (D577/4 east) failed and the dead calf was located. The origin of the fire was in the immediate area of the failed pole and dead calf, which is consistent with the 19.1 kV aerial phase conductor coming into contact with the calf.

The property owner estimates that an area of approximately 100 acres had been burnt. It was evident the fire was driven by wind in a northerly direction away from the fallen WPC pole and the dead calf. This is consistent with the fire being driven away from the suspected point of ignition located at the dead calf, near the fallen pole, by wind coming from a southerly direction, as was the case at the time of the fire.

In summary, it was concluded that the fire was ignited when a calf came into contact with a 19.1 kV phase conductor connected to a failed WPC wood pole (D577/4 east) lying in an elevated position in a southerly direction [Photographs, Appendix A]

The dead calf had distinctive burn marks around the calf's facial area and there was unburnt paddock grass observed underneath the carcass [Photographs, Appendix A].

## 4 INVESTIGATION

The property owner stated that the fire started at approximately 12.00 hrs on Friday 10 December 2004 after a neighbour informed her of a fire.

### 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 D577/4 east were, 250m to the east (pole D577/3 east) and 270m to the west (pole D577/5 east);
- The feeder supplying this system is called the Dalyup Feeder, which is electrically protected by a circuit breaker and recloser (D505) with auto reclose facility;
- The height of the pole from the top of the phase insulator was 11m from the 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, WPC Esperance depot staff and on site inspection:

- WPC repair crew staff stated that they arrived at the scene of the fire on the afternoon of Friday 10 December 2004, to isolate the 'live' 19.1 kV powerline. The WPC crew advised that they found a dead calf between the active and running earth conductors about five metres west of the fallen WPC pole (D577/4 east). The crew also stated that the phase conductor and insulator, that was attached to the fallen pole, was suspended about one metre above the ground. The phase and earth conductors were both attached to the insulators still fixed to pole D577/4 east.
- The failed WPC pole (D577/4 east) was lying in a southerly direction toward a dead calf, which is consistent with the strong northerly winds associated with Thursday 2 December 2004 and not the southerly winds on the day of the fire.
- It is considered that pole D577/4 remained in this fallen condition for eight days until the caretaker of the property let a herd of cattle into the paddock on the morning of fire on Friday 10 December 2004.
- WPC Distribution Systems Officer stated at the interview that pole D577/4 east was last inspected on the 25 March 2001 by a WPC wood pole inspection contractor. WPC records indicate that pole D577/4 east was installed on 1 January 1980.
- 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 west of the replaced pole (D577/4 east) appeared to be in a poor condition (where it enters the ground).

- Pole D577/4 east and surrounding poles were not reinforced (i.e. no RSJ columns/steels fitted).
- The Dalyup Feeder Circuit Breaker and Recloser (D505) recorded no operations on Friday 10 December 2004 and the spur was still active at the time WPC's repair crew arrived to replace the pole

### 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 also provided the following weather information from the Cheadunup weather station (near Munglinup), for 12.00 hours on Friday 10 December 2004:

Southerly wind at 13 kmph  
 Wind gusts of up to 24.1 kmph  
 Relative Humidity at 11.1%  
 Maximum air temperature of 31°C

### 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: D595/8 south, 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 (D577/4 east) Stump (below ground sample)**

A newly installed pole would have a splintery fracture around the outer heartwood, although there will always be a brittle fracture in the inner heartwood. The photograph shows at the break that the outer heartwood also had the characteristic brittle fracture that occurs in an aging pole.

It should be taken into account that the stresses in the timber range from a maximum at the circumference to zero in the inner heart. When the outer heartwood becomes more brittle, the pole strength is reduced.

### **4.5.2 Pole (D577/4 east) End (above ground sample)**

This section confirmed the assessment of the condition of the stump section, i.e. that the wood would have appeared sound at the time of the last inspection, although information of timing was not received. It was noted that the (non-durable) sapwood above the ground was in good condition apart from some developing white rot.

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 property's caretaker claims to have arrived at the scene shortly after the fire started and observed that the fire was heading in a northerly direction being fanned by a southerly wind. She states that the fire started at approx 1200 hrs on Friday 10 December 2004.
- Winds from the south caused the wildfire to spread over an area of approximately 100 acres until FESA volunteers brought it under control.
- None of the poles in the immediate area of WPC pole D577/4 east were reinforced at ground level (i.e. no 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 (D577/4 east) 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 (D577/4 east) should have withstood the recorded wind loads.



## 6 RECOMMENDATIONS

This investigation has identified that the WPC wood pole (D577/4 east) 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 Replacement Steel Pole and Failed Wooden Pole (D577/4 east)**



**Photograph of the Failed Wooden Pole (D577/4 east)**



**Photograph of Fire Scene with Original Wood Pole (D577/4 east) and Dead Calf**



**Photograph of Fire Scene showing the Unburnt Area Under the Dead Calf**





Photograph of WPC Pole (D577/4 east) Stump End and Pole End Samples

