ELECTRICAL INCIDENT REPORT

INVESTIGATION OF WILDFIRE
AT WUNGONG, WESTERN AUSTRALIA
ON 14 DECEMBER 2004

23 December 2004

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TABLE OF CONTENTS

1. INTRODUCTION
   1.1 Time and date of occurrence.
   1.2 Notification of Incident.
   1.3 Investigating Inspectors.

2. SUMMARY

3. ORIGIN OF THE GROUND FIRE

4. INVESTIGATION ANALYSIS
   4.1 Burning of the Low Voltage Open Fuse Link.
   4.2 Weather Conditions and Topography.

5. CONCLUSIONS

6. COMMENTS AND RECOMMENDATIONS

7. APPENDICES
   Appendix 1 Location Map
   Appendix 2 Network Diagram
   Appendix 3 The blown fuse and burnt connectors
   Appendix 4 Pictures of the fire location
1. INTRODUCTION

A ground wild fire occurred at Gull Street in Wungong about 5km south of Armadale on 14 December 2004. It was reported by the Fire and Emergency Service (FESA) that the cause of the fire may have had electrical origins, as reports had been received that part of a low voltage fuse had fallen to the ground underneath a power pole near the apparent source of the fire.

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 is acknowledged.

1.1 Time and Date of Occurrence

Approximately 6:45 hours on Tuesday 14 December 2004.

1.2 Notification of Incident

Energy Safety Division, was notified of the incident by Mr Terry Shehan an officer of the Western Australian Fire and Emergency Service (FESA) on the morning of Tuesday 14 December 2004.

1.3 Investigating Inspectors

The investigation was carried out by the following designated Inspectors (Electricity):

- Mr Anthony D Seneviratne, Senior Engineer Electricity Supply; Energy Safety Division, Department of Consumer & Employment Protection; assisted by

- Mr Peter Johnston, Senior Electrical Inspector, Energy Safety Division; Department of Consumer & Employment Protection.

Mr Seneviratne and Mr Johnston visited the site on 14 December 2004.
2. SUMMARY

Energy Safety officers investigated the cause of the wildfire at Gull Street in Wungong about 5km south of Armadale on 14 December 2004 and concluded that:

(a) Western Power's failure to ensure that trees were kept clear of its 3 phase low voltage (415/240V) power line in the area allowed power line conductors to clash when strong gusty winds were experienced that day.

(b) This clashing caused the operation of a low voltage circuit fuse fitted to the local transformer pole, located in Gull Street, Wungong.

(c) Hot metal debris from the blown fuse link then fell to the ground, and the dry grass covering the ground ignited, commencing the wildfire.

(d) The fuse link was a piece of bare copper wire that had been installed by Western Power. It was inappropriate and unsuitable for the purpose. Normal electricity industry practice is to use HRC (high rupturing capacity) cartridge type fuses which result in no emissions of hot debris on operation, and this type of fuse link should have been installed.

3. ORIGIN OF THE GROUND FIRE

No witnesses who claim to have seen the actual start of the ground fire have come forward. The first person at the site of the fire, Mr Vincent Woods, who was passing the site, had reported the fire to the emergency “000” number. Mr Woods claims that he noticed the fire and when he arrived at the scene, the fire had progressed approximately 6 metres in a westerly direction from a transformer pole that is part of a 3 phase, low voltage (415/240V) Western Power line.

An inspection of the area of origin of the fire as determined by FESA, indicated that three grass paddocks, covering an area of approximately 10 hectares, had burnt out. It was evident the fire was driven by wind in a westerly direction away from the transformer pole and the three-phase low voltage power line. That is consistent with the fire being driven forward from the suspected point of ignition near the pole, by wind coming from an easterly direction, as was the case at the time of the fire.

In summary, it was concluded that the fire under the Western Power transformer pole No: 145984 (see appendix 2) was ignited by hot metal debris falling from a low voltage bare fuse wire mounted on this pole. Investigators were able to recover a part of the melted fused wire. Recent electric arc burn marks on two conductors of the low voltage power line, four conductor spans away from the transformer pole and fuse location, led to the conclusion that conductors clashed due to tree branches blowing into them under windy conditions and would almost certainly have been the cause of the fuse operating (melting), resulting in hot molten fuse wire particles falling on dry grass on the ground under the pole.
4. INVESTIGATION ANALYSIS

4.1 Operation of the Low Voltage Open Fuse link

Three single phase bare wire fuse links had apparently been installed on Western Power pole number 145984 in order to protect a low voltage power line on Gull Street, Wungong, from overloads and short circuit faults. A 63 kVA transformer is also installed on the same concrete pole. The transformer is fed off Western Power’s 22kV Butcher feeder from Byford Zone Substation. Expulsion Drop Out (EDO) high voltage fuses are installed on the tee-off pole which is one span north of pole 145984.

It is normal and accepted industry practice to use High Rupturing Capacity (HRC) low voltage cartridge fuses for this type of application. HRC fuses have an enclosed fuse link, however in this case bare fuse wire links had been used in place of HRC fuses. The use of bare wire fuse links is not good practice as it is a potential fire hazard when the ground underneath is covered with dry grass, as in this instance. The bare wire fuse links were subsequently replaced by HRC fuses by a Western Power worker who was called upon to attend the fire scene.

Inspection of the damaged fuse link (white phase) indicated that the middle part of the fuse link had completely melted and the hot debris that fell on the ground would have caused dry grass below to ignite resulting in a fire. The condition of the blue phase fuse link shows evidence of annealing, which is an indication that a high fault current must have passed through it, causing heating. The red phase fuse had not been affected which, together with the condition of the other two fuse links, implies that there was a short circuit fault between blue and white phases.

In this case, the fault downstream from the fuse links was evidently caused by tree branches in windy conditions hitting the power line conductors, which resulted in the clashing of the blue and white phase conductors and momentary short circuiting.

The clashing occurred in spite of conductor spacers being installed about 8 metres from the probable point of clashing. The parallel groove clamps connecting blue and white phase conductors on pole 146001 (see appendix 3) had burn marks visible from the ground that is further evidence that a high fault current passed through those two conductors. By the time Energy Safety investigators arrived on the scene, the offending tree branches had been cut by Western Power and were on the ground.

4.2 Weather Conditions and Topography

The Bureau of Meteorology provided the following weather information from Bickley weather station, for 14 December 2004.

- Easterly wind at 28 kmph
- Wind gusts at 39 kmph
- Relative Humidity 60%
- Ambient air temperature 17.8°C

The ground was covered with dry grass, including the area around the base of the pole.
5. CONCLUSIONS

There are a number of inter-related events and factors 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 ground fire have come forward. However, a person who reported the fire and claims to have arrived at the scene shortly after the fire started, had observed that the fire at approximately 6 metres in a westerly direction from the transformer pole.
- The weather conditions at the time of the fire were strong gusting winds from the east.
- There were some tree branches that had been recently cut and were seen lying under the power line between the second and third poles on Lambert Lane.
- Inspection of the power line from the ground, just above the cut tree branches, revealed recent electric arc burn marks on the blue and white phase conductors.
- These tree branches had evidently caused conductor clashing and/or arcing in gusty wind conditions.
- Three single phase bare wire fuse links were installed on the transformer pole to “protect” the low voltage power line.
- The fuse link was a piece of bare copper wire that had been installed by Western Power. It was inappropriate and unsuitable for the purpose. Normal electricity industry practice is to use HRC (high rupturing capacity) cartridge type fuses which result in no emissions of hot debris on operation, and this type of fuse link should have been installed.
- Clashing of the blue and white phase conductors resulted in the white phase fuse link operating.
- Hot metal debris from the blown fuse link fell on dry grass under the power pole, igniting dry grass and initiating the fire.
- Strong gusty winds caused the fire to spread over an area of approximately 10 hectares until it was brought under control by FESA.
6. COMMENTS AND RECOMMENDATIONS

This investigation has identified that the combination of the failure to control vegetation near the power line and the use of an inappropriate and unsuitable type of low voltage fuse link initiated the wildfire. It is possible that this problem may exist in other parts of Western Power’s network.

To this end, Energy Safety will require by formal order, Western Power to:

- promptly carry out a survey to identify all low voltage fuse fittings on the network equipped with bare wire fuse links, and replace them with appropriate HRC fuses as a matter of urgency; and

- to improve its vegetation management to prevent similar incidents initiated by its failure to appropriately control vegetation near power lines.
APPENDIX 1 LOCATION MAP
APPENDIX 2 NETWORK DIAGRAM
APPENDIX  3 THE BLOWN FUSE AND BURNT CONNECTORS
APPENDIX 4  PICTURES OF THE FIRE LOCATION