

Power System Operating Incident Report – Trip of Three 500 kV Circuit Breakers at Hazelwood Terminal Station on 7 February 2014

PREPARED BY: Systems Capability

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STATUS: FINAL

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Version Release History

VERSION	DATE	BY	CHANGES	CHECKED BY	AUTHORISED BY
1	24 April 2014	A Makin	FINAL	S Darnell	P Biddle

Incident Classifications

Time and date and of incident	1030 hrs Friday 7 February 2014
Region of incident	Victoria
Affected regions	Victoria
Event type	TT – Loss of multiple transmission elements
Primary cause	PTN & CTR – Protection and Control
Impact	Nil (No Impact)
Associated reports	N/A

Abbreviations

Abbreviation	Term
AEMO	Australian Energy Market Operator
CB	Circuit Breaker
EMMS	Electricity Market Management System
EMS	Energy Management System
kV	Kilovolt
MW	Megawatt
NER	National Electricity Rules

1 Introduction

This report reviews a power system operating incident that occurred on 7 February 2014 in the Victoria region at Hazelwood Terminal Station. AEMO is required to review this incident as it is classified as a non-credible contingency that satisfies the requirements of a reviewable operating incident under the National Electricity Rules¹ (NER).

The purpose of this incident review is to assess power system security over the course of the incident. The NER requires AEMO to assess the adequacy of the provision and response of facilities and services and the appropriateness of actions taken to restore or maintain power system security².

This report is based upon information provided by AEMO and SP AusNet³. Data from AEMO's Energy Management System (EMS) and Electricity Market Management System (EMMS) has also been used in analysing the incident.

National Electricity Market time (Australian Eastern Standard Time) is used in this report.

2 The Incident

On Friday 7 February 2014, at 1030 hrs, the following 500 kV circuit breakers (CBs) tripped at Hazelwood Terminal Station:

- Hazelwood No.1 Transformer - this resulted in the offloading of No.1 500/220 kV Transformer
- Hazelwood No.3 Transformer No 1 500kV Busbar
- Hazelwood No.4 Transformer No 1 500kV Busbar

During this power system disturbance there was no loss of generation or load.

The reason for investigating this incident is that three 500kV CBs connected to the Hazelwood No 1 500 kV Busbar tripped automatically when no fault could be identified.

3 SP AusNet Investigation

This incident was investigated by SP AusNet. SP AusNet found no definitive cause for the trip of the three CBs. At the time of the incident there were, however, two work groups present in the relay room: fitters running cables and a contract painter.

SP AusNet found that the No.1 500 kV Y Busbar Protection tripped the three CBs. The No.1 and No.3 500 kV Busbars are connected at Hazelwood Terminal Station but have separate Busbar protection schemes. For this event only the No.1 Busbar Protection operated. The incident is therefore most likely to have resulted from an inadvertent relay trip because both the No.1 and No.3 Busbar Protection would have operated for a power system fault.

SP AusNet then tested the No.1 Y Busbar Protection to determine if it could be operated by bumping, knocking or applying any type of sudden external force. SP AusNet found that the No. 1 Y Busbar Protection Trip Relay would not operate by applying such external forces.

¹ NER v60 Clause 4.8.15(a)(1)(i) and AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

² NER v60 Clause 4.8.15 (b)

³ SP AusNet is the Transmission Network Service Provider in Victoria. Information provided by SP AusNet has been provided on a without prejudice basis and nothing in this report is intended to constitute, or may be taken by any person as constituting, an admission of fault, liability, wrongdoing, negligence, bad faith or the like on behalf of SP AusNet (or its respective associated companies, businesses, partners, directors, officers or employees).

SP AusNet did identify however that the No.1 Y High Impedance Busbar Protection Relay could be bumped in such a way as to initiate the No.1 Y Busbar Protection Trip Relay without the No.1 500 kV Y High Impedance Busbar Protection Relay being flagged as the initiating protection. The Y High Impedance Busbar Protection Relay could have therefore been inadvertently operated to cause the trip of the three CBs.

4 System Diagrams

The status of the power system prior to the incident is shown in Figure 1 and after the incident in Figure 2. For clarity only equipment relevant to this incident has been included in the diagrams. Figure 2 shows the 500 kV CBs that opened as a result of this incident.

Figure 1 - Status of the power system prior to the incident

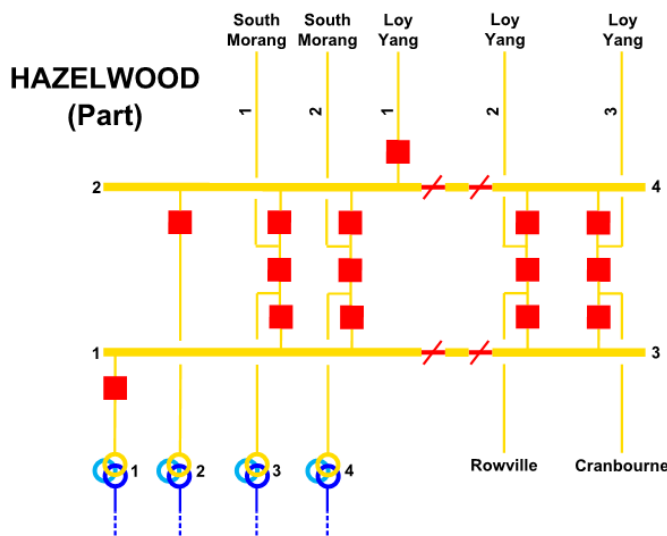
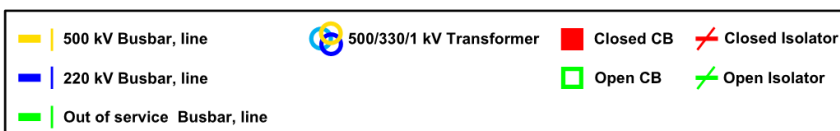
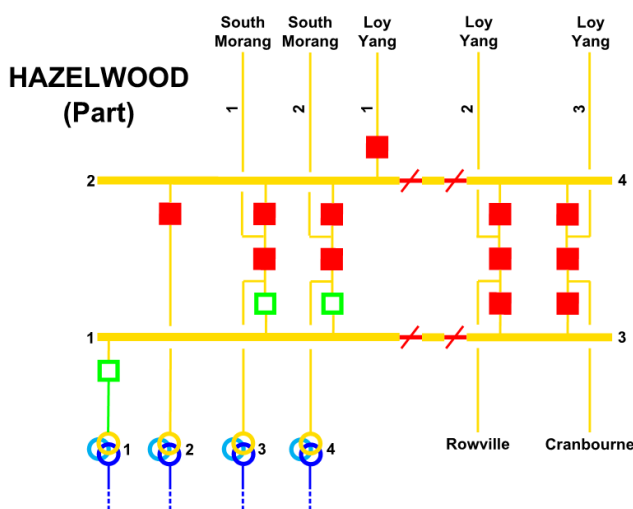


Figure 2 - Status of the power system immediately after the incident



5 Incident Event Log

The sequence of events comprising the incident are itemised in Table 1. The incident spanned approximately nine minutes from Hazelwood A1 Transformer operating to Hazelwood A1 Transformer being returned to service.

Table 1 – Event Log

Time and Date	Event
1030 hrs 7 Feb 2014	The following circuit breakers tripped <ul style="list-style-type: none"> • Hazelwood A1 Transformer 500kV CB • Hazelwood A3 Transformer No 1 Busbar 500kV CB • Hazelwood A4 Transformer No 1 Busbar 500kV CB.
1030 hrs 7 Feb 2014	Hazelwood No1 500/220kV Transformer and HWPS – HWTS No1 220kV line off loaded
1035 hrs 7 Feb 2014	Constraint Set V-HWTS_A1_R invoked (dispatch period ending 1040 hrs)
1039 hrs 7 Feb 2014	All CBs returned to service. Hazelwood No1 500/220kV Transformer and HWPS – HWTS No1 220kV line returned to service.
1050 hrs 7 Feb 2014	Constraint Set V-HWTS_A1_R revoked.
1121 hrs 7 Feb 2014	Market Notice 44911 issued – notification of a non-credible contingency event and that the event would not be reclassified as credible contingency

6 Immediate Response

This section assess the immediate response to the incident.

AEMO invoked constraint set V-HWTS_A1_R approximately five minutes after the incident. This action ensured that the power system was in a secure operating state.⁴

SP AusNet determined that the No.1 500kV Busbar was still energized (therefore no fault present). At 1038 hrs SP AusNet closed the Hazelwood No.1 Transformer 500kV CB, which then returned No.1 Transformer to service, and then closed the two remaining open CBs.

7 Follow-up Response

This section assesses the follow-up response to resolve the incident.

AEMO assessed whether or not to reclassify the event as a credible contingency⁵. For this incident there was no evidence of a high voltage network fault, and SP AusNet had advised AEMO that staff were working in the relay room at the time of the incident. AEMO determined, based on information available, that the most likely cause of this event was an inadvertent relay operation.

AEMO issued Market Notice 44911 at 1121 hrs approximately 51 minutes after the incident to notify the market of a non-credible contingency event,⁶ and that the event would not be reclassified as a credible contingency.

⁴ AEMO is required to return the power system to a secure state within thirty minutes following a contingency event - NER v60 Clause 4.2.6 (b)

⁵ For a non-credible contingency AEMO is required to assess whether or not to reclassify a non-credible contingency event as a credible contingency (NER v60 Clause 4.2.3A (c)) and to report how re-classification criteria were applied NER v60 Clause 4.8.15 (ca). AEMO has to determine if the condition that caused the non-credible contingency event has been resolved.

⁶ This is within two hours of the event in which AEMO is required to notify the market of a non-credible contingency event - AEMO, Power System Security Guidelines, v56 Section 10.3

No further follow-up actions were required.

8 Power System Security

For this incident the constraint set V-HWTS_A1_R was invoked to ensure the power system remained secure over the course of the incident.

AEMO correctly assessed the incident and did not reclassify the incident as a credible contingency.

Power system frequency, and voltage remained within limits.

9 Conclusions

1. The reason the No.1 500 kV Y Busbar Protection operated and tripped the three circuit breakers at Hazelwood Terminal Station could not be definitively identified. AEMO considered that the incident was most likely caused by an inadvertent relay trip.
2. Throughout the course of this incident, power system security was maintained.

10 Recommendations

There are no recommendations arising from this incident.