AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Trip of Munmorah Main 330 kV Busbar on 1 February 2020

September 2020

Reviewable Operating Incident Report under the National Electricity Rules

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of Incident	1307 hrs on 1 February 2020
Region of incident	New South Wales
Affected regions	New South Wales
Event type	Other - Induced circulating current in the current transformer
Generation impact	No generating unit was disconnected or had its output limited as a result of this incident
Customer load impact	No customer load was disconnected as a result of this incident
Associated reports	Nil

ABBREVIATIONS

Abbreviation	Term
A	Ampere
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
kV	Kilovolt
MVA	Megavolt ampere
NEM	National Electricity Market
NER	National Electricity Rules
TNSP	Transmission Network Service Provider

Important notice

PURPOSE

AEMO has prepared this report in accordance with clause 4.8.15(c) of the National Electricity Rules, using information available as at the date of publication, unless otherwise specified.

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Contents

1.	**Overview**	**5**
2.	**The incident**	**5**
2.1	Pre-incident conditions	5
2.2	The incident	5
2.3	Analysis	6
3.	**Power system security**	**6**
3.1	Reclassification	7
4.	**Market information**	**7**
5.	**Conclusions**	**7**

1. Overview

This report relates to a reviewable operating incident[1] that occurred on 1 February 2020 in New South Wales. The incident involved the trip of Munmorah Main 330 kilovolt (kV) Busbar (Munmorah Main Busbar).

There was no loss of generation or customer load as a result of this incident.

As this was a reviewable operating incident, AEMO is required 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 security[2]. AEMO has concluded that:

1. The trip of Munmorah Main Busbar was due to induced circulating current in the current transformer of 232M circuit breaker which contributed to the Main Busbar protection operation.
2. The Main Busbar protection operated as expected and as designed.
3. AEMO was satisfied that the reason had been identified and a reoccurrence of this incident was unlikely, therefore the incident was not reclassified as a credible contingency.
4. The power system remained in a secure operating state throughout this incident.

This report is prepared in accordance with clause 4.8.15(c) of the National Electricity Rules (NER). It is based on information provided by TransGrid[3] and AEMO.

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

2. The incident

2.1 Pre-incident conditions

Prior to the incident on 1 February 2020, the 232M circuit breaker was undergoing routine maintenance resulting in the circuit breaker being out of service. With the 232M circuit breaker at Munmorah out of service, the 23 line remained in service via the 232G circuit breaker and the Munmorah Generator Busbar.

2.2 The incident

At 1307 hrs on 1 February 2020, the Main Busbar Protection at Munmorah operated, resulting in operation of all closed circuit breakers on the Main Busbar, including the circuit breakers of Munmorah – Tuggerah (2M) 330 kV line (2M2M circuit breaker), Munmorah – Sydney West (26) 330 kV line (262M circuit breaker), Colongra Gas Turbine (C12 circuit breaker), and No. 3 transformer (5432M circuit breaker). With the circuit breakers of the Munmorah Main Busbar out of service, all the lines remained in service via the Munmorah Generator Busbar and its circuit breakers. The Munmorah Main Busbar was returned to service at 1505 hrs on 1 February 2020.

[1] See NER clause 4.8.15(a)(1)(i), as the event relates to a non-credible contingency event; and the Australian Energy Market Commission (AEMC) Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

[2] See NER clause 4.8.15(b).

[3] TransGrid is the Transmission Network Service Provider (TNSP) for New South Wales.

2.3 Analysis

The following is based on information provided by TransGrid.

Prior to the incident, TransGrid's maintenance staff were carrying out routine maintenance in the 232M circuit breaker. The circuit breaker was isolated and earthed. To perform the maintenance, the circuit breaker was required to be manually closed. As a result, a closed loop between the earth grid and the HV conductors was created. As the 232M circuit breaker is below the 23 line that was carrying approximately 900 megavolt amperes (MVA) at the time of the trip, the circulating current was induced due to circuit breaker contacts being closed.

The proximity of the 232M circuit breaker to the 23 line indicated that the induced current was significant and investigations by TransGrid revealed that there was approximately 80 amperes (A) flowing continuously in the Red and Blue phases of high voltage conductors of the 232M circuit breaker and its associated current transformer, even though the circuit breaker was isolated and earthed. White phase was being worked on and its high voltage connections had been removed. TransGrid confirmed that an unbalance current of 80 A in the primary winding of the 232M current transformer was sufficient to operate the Main Busbar Protection.

The maintenance staff were then requested to isolate the 232M current transformer contributions to the Main Busbar Protection before completing the maintenance.

The Main Busbar Protection operated as expected according to design and opened all circuit breakers on the Main Busbar.

TransGrid's Operating Manual defines criteria for locations where isolation of the low voltage circuits is required when working on equipment. The Munmorah Busbar is not on that list, as it does not meet the criteria. As the Munmorah site has been recently reconstructed, TransGrid advised that there is a possibility of earthing issues due to physical changes on the site and as a result, further investigations are being arranged on the earthing system within the 23 line switch bay. The 232M circuit breaker has temporarily been added to a Works Management list to request the low voltage circuits be isolated when requesting an outage to work on the equipment. The 232M circuit breaker will remain on this list until the earth grid is tested and any possible poor connectivity resulting in a larger earth loop than designed is located and fixed. This work is scheduled to be completed by the end of October 2020.

3. Power system security

AEMO is responsible for power system security in the NEM. This means AEMO is required to operate the power system in a secure operating state to the extent practicable and take all reasonable actions to return the power system to a secure state following a contingency event in accordance with the NER[4].

The power system was in a secure operating state throughout this incident. The only action required by AEMO in relation to power system security was to invoke constraint set F-N_MM_CB_12_32[5] at 1315 hrs on 1 February 2020 due to outage of the C12 circuit breaker. Constraint set F-N_MM_CB_12_32 was revoked at 1510 hrs on 1 February 2020 after the Main Busbar was returned to service at 1505 hrs on the same day.

[4] Refer to AEMO's functions in section 49 of the National Electricity Law and the power system security principles in clause 4.2.6 of the NER.

[5] FCAS Raise requirements for outage of Munmorah 330 kV circuit breaker C12 or C32

3.1 Reclassification

AEMO assessed whether to reclassify this incident as a credible contingency event[6]. As reported in Section 2, TransGrid advised AEMO that the cause of the trip of Munmorah Main Busbar had been identified and the incident was unlikely to reoccur. Based on this advice, AEMO determined the incident was unlikely to reoccur and therefore correctly determined that reclassification as a credible contingency event was not required.

4. Market information

AEMO is required by the NER and operating procedures to inform the market about incidents as they progress. This section assesses how AEMO informed the market[7] over the course of this incident. For this incident, AEMO informed the market on the following matters:

1. A non-credible contingency event – notify within two hours of the event[8].
   - AEMO issued Market Notice 73008 at 1323 hrs on 1 February 2020, 16 minutes after the event, to advise of the non-credible contingency event. The trip of Munmorah Main Busbar resulted in constraint set F-N_MM_CB_12_32 being invoked from 1315 hrs on 1 February 2020 as the C12 circuit breaker was disconnected. The constraint set was revoked at 1510 hrs on 1 February 2020 after the Main Busbar was returned to service at 1505 hrs on the same day.
2. Reclassification, details, and cancellation of a non-credible contingency – notify as soon as practical[9].
   - AEMO issued Market Notices 73347 at 1518 hrs on 1 February 2020 to advise that the cause of this non-credible contingency event had been identified, AEMO was satisfied that another occurrence of this event was unlikely under the current circumstances, and AEMO would not reclassify the trip of Munmorah Main Busbar as a credible contingency event.

5. Conclusions

AEMO has assessed this incident in accordance with clause 4.8.15(b) of the NER. In particular, AEMO has assessed the adequacy of the provision and response of facilities or services, and the appropriateness of actions taken to restore or maintain power system security.

AEMO has concluded that:

1. The trip of Munmorah Main Busbar was due to induced circulating current in the current transformer of 232M circuit breaker which contributed to the Main Busbar protection operation.
2. The Main Busbar protection operated as expected and as designed.

[6] AEMO is required to assess whether or not to reclassify a non-credible contingency event as a credible contingency event – NER clause 4.2.3A(c) – and to report how the reclassification criteria were applied – NER clause 4.8.15(ca).

[7] AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see https://www.aemo.com.au/Market-Notices.

[8] AEMO is required to notify the market of a non-credible contingency event within two hours of the event – AEMO, Power System Security Guidelines, Section 7.3.

[9] AEMO is required to notify the market of a reclassification – NER clause 4.2.3(g), details of the reclassification – 4.2.3(c), and when AEMO cancels the reclassification – 4.2.3(h).

3. AEMO was satisfied that the reason had been identified and a reoccurrence of this incident was unlikely, therefore the incident was not reclassified as a credible contingency.
4. The power system remained in a secure operating state throughout this incident.