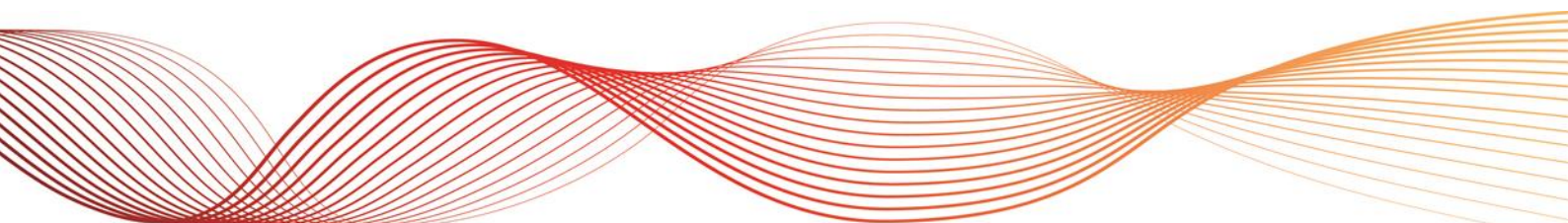




Trip of Torrens Island Units B3 and B4 on 14 July 2014

AN AEMO POWER SYSTEM OPERATING INCIDENT REPORT FOR THE NATIONAL ELECTRICITY MARKET

PUBLISHED NOVEMBER 2014



VERSION RELEASE HISTORY

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1	19 Nov 2014	A Makin	FINAL	S Darnell	P Biddle

INCIDENT CLASSIFICATIONS

Time and date and of incident	1939 hrs on 14 July 2014
Region of incident	South Australia
Affected regions	South Australia
Event type	GG – Loss of multiple generating units
Primary cause	PS – Power station internal issues
Impact	VS (Very Significant)
Associated reports	Nil

ABBREVIATIONS

Abbreviation	Term
AEMO	Australian Energy Market Operator
AGL	AGL Energy Limited
CB	Circuit Breaker
kV	Kilovolt
MW	Megawatt
NER	National Electricity Rules
SA	South Australia
TIB3	Torrens Island Unit 3
TIB4	Torrens Island Unit 4

IMPORTANT NOTICE

Purpose

AEMO has prepared this document to provide information about this particular Power System Operating Incident.

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1. OVERVIEW

This report reviews a power system operating incident that occurred on 14 July 2014 at Torrens Island B Power Station¹ in South Australia. This incident involved the trip of two 200MW generating units and was caused by problems associated with a new burner management system. No customer load was lost as a result of this incident.

AEMO is required to assess power system security over the course of this incident as the incident is classified as a non-credible contingency under the National Electricity Rules (NER).² Specifically, 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.³

AEMO concluded the power system was briefly in an unsatisfactory state immediately following the incident, but otherwise power system security was adequately restored and maintained over the course of the incident.

This report is based on information provided by AGL⁴ and AEMO. National Electricity Market time (Australian Eastern Standard Time) is used in this report.

2. THE INCIDENT

On Monday 14 July 2014, at 1939 hrs, Torrens Island (TI) generating units B3 and B4 simultaneously tripped disconnecting 400MW of generation from the power system in South Australia (SA). As a result, additional power flowed from Victoria into SA and the Vic – SA interconnector operated above its limit for approximately 4.5 minutes. No load was lost as a result of this incident.

The reason for investigating this incident is that both TIB3 and TIB4 tripped simultaneously. Generally, generating units should operate independently and not be affected by the operations of other generating units. In power system security terms this is a non-credible contingency event.⁵ This means that the power system may not return to a satisfactory operating state following an incident.⁶

See Appendix 1 for a system diagram and a graph illustrating the incident, and Appendix 2 for a chronological log of the events comprising the incident.

3. AGL INVESTIGATION

AGL investigated the incident and found that the root cause of the two trips was problems associated with a new burner management system recently commissioned for TIB3 and TIB4 gas fired boilers. The new burner management system incorporated a new, mandated, fuel-rich safety trip function. An instrument error caused a fuel-rich trip on TIB4 and an inappropriate timer setting caused a fuel-rich trip on TIB3.

¹ Torrens Island B Power Station consists of four 200MW generators driven by steam turbines supplied from gas fired boilers. At the time of the incident Units 1 and 2 were off-line and Units 3 and 4 were generating at 200MW each.

² Clause 4.8.15(a)(1)(i) and AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

³ NER Clause 4.8.15 (b)

⁴ AGL Energy Limited is the operator of Torrens Island Power Station

⁵ Generally, a credible contingency is a power system event that AEMO considers to be reasonably possible e.g. the trip of a transmission line or a generating unit; a non-credible contingency is an event other than a credible contingency. See NER 4.2.3 for definitions.

⁶ AEMO is required to operate the power system in a secure state which means that the power system will return to a satisfactory state following a credible contingency event. See NER 4.2.2 and 4.2.4

TIB4 tripped first due to an instrument error (a chromatograph) which determined an incorrect gas-heating value. TIB3 then tripped, 10 seconds later, due to a fuel-rich protection trip which was caused by a transient gas pressure change as a result of the TIB3 trip.

AGL has since rectified the causes of the trips. The instrument that caused TIB4 to trip has been corrected, and a fuel-rich trip timer, that caused TIB3 to trip, has since been adjusted to prevent a transient gas pressure change from initiating a boiler trip.

4. POWER SYSTEM SECURITY

This section assesses how power system security was managed over the course of the incident.⁷

1. As a result of the incident, the VIC-SA interconnector satisfactory limit was exceeded for approximately 4.5 minutes. This means the power system was not in a satisfactory operating state during this period. Power system frequency fell during this period but remained within the frequency operating standard. The power system returned to a satisfactory operating state after 4.5 minutes due to generation response and frequency relief, and to secure operating state during the following dispatch period.
2. AEMO issued Market Notice 46035 at 1957 hrs approximately 18 minutes after the event to notify the market of a non-credible contingency event.⁸
3. TIB4 and TIB3 returned to service at 2215 and 2350 hrs respectively.
4. AEMO then assessed whether or not to reclassify the incident as a credible contingency⁹. AEMO re-classified the incident because AGL had not yet identified cause of the incident and AEMO thereby considered the incident could reoccur. At 0053 hrs on 15 July AEMO:
 - a. Issued Market Notice 46048 to notify the market that the incident had been reclassified as a credible contingency (Simultaneous trip of TIB3 and TIB4).
 - b. Invoked constraint set #SA1_E-20140715 to limit the collective output of TIB3 and TIB4 to 273MW. This constraint limits the contingency to the same output of the largest generating unit in SA. This was a temporary constraint to manage power system security until AEMO had studied the contingency in detail and constructed a dedicated constraint.
5. On 16 July at 1050 hrs AEMO revoked constraint set #SA1_E-20140715 and invoked constraint set S-NIL_TIPSB3-4_N-2 (a dedicated constraint for the contingency). AEMO issued Market Notice 46058 to notify the market of this change.
6. Later, on 16 July, AGL informed AEMO that the unit trips were associated with the boiler fuel mixture, and that the problem does not occur below 165MW for TIB3 and 180 MW for TIB4. AEMO then revoked constraint set S-NIL_TIPSB3-4_N-2 and invoked constraints sets #TORRENSB3_E and #TORRENSB4_E to limit the capacity of the units to 165MW and 180MW respectively. AEMO issued Market Notice 46060 to notify the market of this change.

⁷ AEMO is responsible for power system security in the NEM and is required to operate the power system in a secure operating state (NER Clause 4.2.4 (a)). AEMO must thereby ensure that the power system is maintained in, or returned to, a secure operating state following a contingency event.

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 10.3

⁹ For a non-credible contingency event AEMO is required to assess whether or not to reclassify a non-credible contingency event as a credible contingency (NER Clause 4.2.3A (c)) and to report how re-classification criteria were applied NER Clause 4.8.15 (ca). AEMO has to determine if the condition that caused the non-credible contingency event has been resolved.

7. AGL informed AEMO on 18 July that the cause of the trips had been resolved. AEMO revoked constraint sets #TORRENSB3_E and #TORRENSB4_E and cancelled the reclassification of the simultaneous trip of both TIPS B3 and B4 as a credible contingency. AEMO issued Market Notice 46074 to notify the market of this change.

For this incident the power system was temporarily in an unsatisfactory operating state but returned to a satisfactory operating state within 4.5 minutes, and to a secure operating state by the next dispatch period. AEMO correctly assessed the incident and reclassified the incident as a credible contingency, and appropriate notifications were issued.

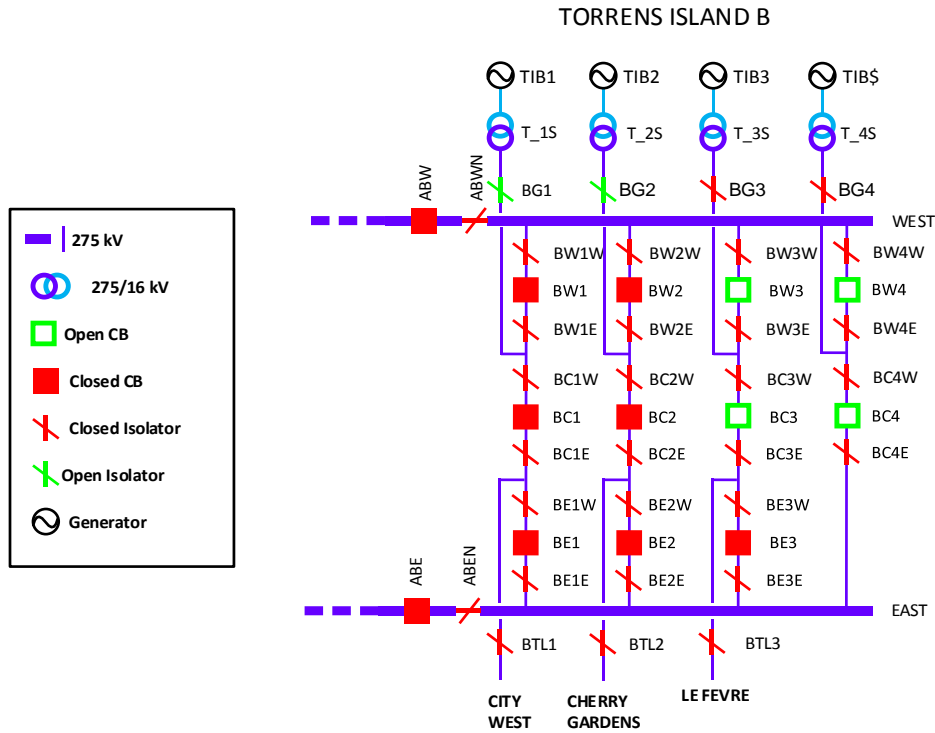
5. CONCLUSIONS

AEMO concluded that:

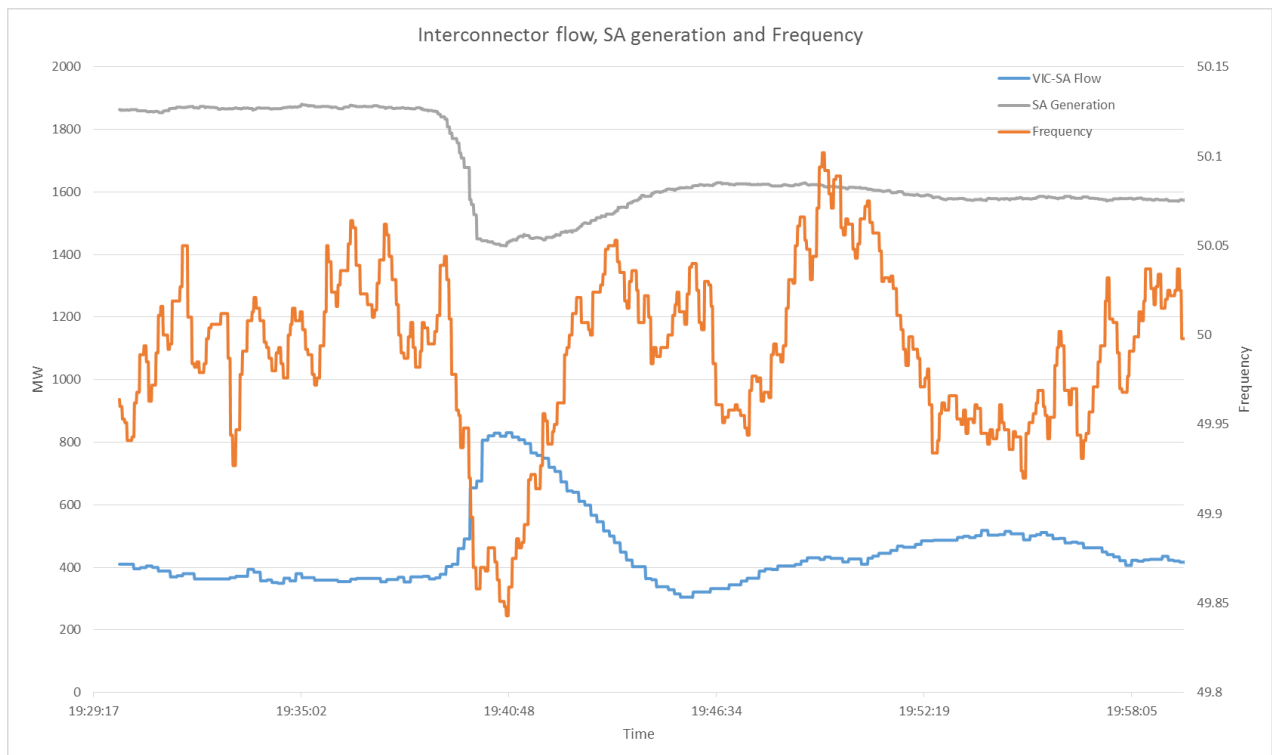
1. TIB3 and TIB4 tripped due to problems associated with a recently commissioned burner management system. The problems were subsequently resolved.
2. The power system was in an unsatisfactory state for approximately 4.5 minutes due to the flow on the VIC-SA interconnector exceeding limits.
3. The provision and response of facilities and services were adequate to restore and maintain power system security over the course of the incident.
4. There are no outstanding issues to resolve as a result of this incident.

APPENDIX 1 – POWER SYSTEM

Diagram illustrating the power system at Torrens Island B substation after the incident. Circuit breakers BW3, BW4, BC3, and BC4 opened as a result of the incident.



Graph showing frequency, the VIC_SA interconnector flow and generation in South Australia



APPENDIX 2 – EVENT LOG

Time and Date	Event
1939 hrs 14 July 2014	Torren Island Units B3 and B4 tripped
1957 hrs 14 July 2014	Market Notice 40635 issued – Notification of Non-credible contingency event
2215 hrs 14 July 2014	TIPS B4 returned to service
2350 hrs 14 July 2014	TIPS B3 returned to service
0050 hrs 15 July 2014	Constraint set #SA1_E-20140715 invoked
0053 hrs 15 July 2014	Market Notice 46048 issued: Notification of TIPS B3 and B4 reclassified as a credible contingency, and constraint set #SA1_E-20140715 invoked
1050 hrs 16 July 2014	Constraint set #SA1_E_20140715 revoked
1050 hrs 16 July 2014	Constraint set S-NIL_TIPSB3-4_N-2 invoked
1110 hrs 16 July 2014	Market Notice 46058 issued: Notification that constraint set #SA1_E_20140715 revoked and constraint set S-NIL_TIPSB_3_4_N-2 invoked
1705 hrs 16 July 2014	Constraint set S-NIL_TIPSB3-4_N-2 revoked
	Market Notice 46060 issued: Notification that constraint set S-NIL_TIPSB_3-4_N-2 revoked and constraint sets #TORRB3_E and #TORRB4_E invoked
1655 hrs 18 July 2014	Constraint sets #TORRB3_E and #TORRB4_E revoked
1655 hrs 18 July 2014	Market Notice 46074 issued – Notification of cancellation of the reclassification of the non-credible contingency event and constraint sets #TORRB3_E and #TORRB4_E revoked