
Torrens Island Power Station A 275 kV West bus, 20 January 2020

July 2020

Reviewable Operating Incident Report under the
National Electricity Rules

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	0004 hrs on 20 January 2020
Region of incident	South Australia
Affected regions	South Australia
Event type	Environmental
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
ACDT	Australian Central Daylight Time
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
CB	Circuit Breaker
CT	Current Transformer
DGA	Dissolved Gas Analysis
HV	High Voltage
kV	Kilovolt
MSP	Maintenance Service Provider
NER	National Electricity Rules
PSSWG	Power System Security Working Group
SA	South Australia
TIPS	Torrens Island Power Station

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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1. Overview

This report relates to a reviewable operating incident¹ that occurred on 20 January 2020 in South Australia. The incident involved the trip of the Torrens Island Power Station (TIPS) A 275 kilovolt (kV) West Bus.

No generation was lost as a result of this incident. No customer load was directly disconnected as a result of the incident, however approximately 100MW of customer load was lost due to the voltage depression caused by the fault, distributed across the South Australian power network.

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 security².

AEMO has concluded that:

1. The trip of the TIPS A 275 kV West Bus was due to an external flashover on a current transformer (CT).
2. All protection systems operated as designed and as expected to clear the fault.
3. The probable cause of the flashover on the CT was a build-up of foreign particulates on the CT followed by light rain creating an external path for electrical flashover.
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 ElectraNet³.

National Electricity Market time (Australian Eastern Standard Time [AEST]) is used in this report. At the time of this incident, local time in South Australia (Australian Central Daylight Time [ACDT]), AEST plus 30 minutes.

2. The incident

2.1 Pre-incident conditions

Prior to this incident, bushfires had increased atmospheric pollution in the area.

Immediately prior to the incident, the network configuration at TIPS A was normal, with AGL Energy Generators A1, A2, A3 and A4 not generating.

2.2 The incident

At 0004 hrs on 20 January 2020, the TIPS A 275 kV West Bus tripped due to TIPS A West Bus protection operation. Isolations were put in place around circuit breaker (CB) CBAW4 and its associated CTs, with the TIPS A 275 kV West Bus reenergised at 0833 hrs of the same day.

Following further testing, CB AW4 was reenergised and returned to normal service at 1227 hrs on 29 January 2020.

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

² See NER clause 4.8.15(b).

³ ElectraNet is the Transmission Network Service Provider (TNSP) for South Australia.

2.3 ElectraNet investigation

The following is based on information provided by ElectraNet.

2.3.1 Trip of TIPS A 275 kV West Bus

At 0004 hrs on 20 January 2020, the TIPS A 275 kV West Bus tripped. ElectraNet advised there were indications of a severe voltage depression across a number of sites, with approximately 100 megawatts (MW) of load interrupted.

Figure 1 in Appendix A2 shows the network configuration at TIPS A 275 kV substation following the trips of the TIPS A 275 kV West Bus. Investigation by ElectraNet determined that CBs AW1, AW2, AW3, AW4, and AWT had tripped at TIPS A 275 kV substation, with CB ABW tripping at TIPS B 275 kV substation. A sequence of events for the incident is provided in Table 1 of Appendix A1.

Isolations were put in place to allow ElectraNet ground crew to investigate the TIPS A 275 kV substation equipment. It was determined that a flashover had taken place on the 'V' phase of CT AW4W. Further isolations were made to allow for the 275 kV West Bus to be reenergised at 0833 on the 20 January 2020 while additional investigations were conducted around CT AW4W.

ElectraNet completed Dissolved Gas Analysis (DGA), High Voltage (HV) Electrical, and CT analyser tests to assess the condition of the CT following the external flashover. The test results did not indicate any internal damage to the CT had taken place, indicating the fault was external to the CT rather than internal.

There had been significant atmospheric pollution in the area prior to the incident due to recent bushfires.

At the time of the incident, rain had begun to fall, with 9.6 mm of rainfall recorded in the area⁴.

ElectraNet investigations stated the probable root cause of the flashover on CT AW4W as build-up of pollution from bushfire smoke in the air which may have settled on the CT. As the light rain began, this likely created an external path for flashover at the CT resulting in the subsequent 275 kV West Bus trip. Continuing rain after the incident is believed to have then washed the residue from the CT.

The TIPS A CTs are washed annually. The last wash on CT AW4W was in March 2019, with the next wash scheduled for 4 March 2020. ElectraNet also monitors pollution through a combination of online leakage current measurement, air pollution monitoring and pre-dawn patrols. ElectraNet has not experienced this type of flashover event on plant still in service⁵, and has therefore not modified their strategy to immediately react to abrupt and intense pollution from environmental events other than where initiated by the regular inspections. The strategy is reviewed annually with the next review scheduled for June⁶.

A detailed inspection of CT AW4W 'V' phase in addition to adjacent plant was undertaken by ElectraNet, and the porcelain insulators of CT AW4W were cleaned. The CT was then reenergised at 1227 hrs on 29 January 2020.

2.3.2 Impact on Customer Load

ElectraNet records for 20 January 2020, following the tripping of the TIPS A West Bus, show a reduction of approximately 100 MW of load from SA Power Networks. ElectraNet reported this reduction was most likely due to the momentary voltage depression caused by the flashover fault at the TIPS A 275 kV substation.

Figure 2 in Appendix A3 shows the recorded power on the South Australian power network at the time of the incident, indicating a sharp drop in power levels at the time of the TIPS A 275 kV West Bus trip.

⁴ As recorded by Weatherzone.

⁵ This was historically an issue in older substations such as Waterloo and Playford which have now been demolished/rebuilt.

⁶ ElectraNet review of equipment inspection strategy had not been conducted at the time of report.

3. Power system security

AEMO is responsible for power system security in the National Electricity Market (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 NER⁷.

The power system was in a secure operating state throughout this incident. No action was required by AEMO in relation to power system security.

3.1 Reclassification

AEMO assessed whether or not to reclassify this incident as a credible contingency event⁸.

At 0830 hrs on 20 January 2020, ElectraNet advised AEMO operations that the cause of the trip was due to a flash over on the CT associated with circuit breaker AW4 and that the equipment had been isolated. The protection system operated as per design to trip the TIPS A 275 kV West Bus.

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.

AEMO also reviewed the bushfire classification processes at the Power System Security Working Group (PSSWG) meeting on 7 February 2020 with no change recommended. Due to the number of variables involved in reliably identifying the risks associated with pollution and other indirect impacts of bushfires, asset owners were deemed to be best placed to identify and advise AEMO of any abnormal conditions.

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 market⁹ 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 event¹⁰.
 - AEMO issued Market Notice 72743 at 0020 hrs on 20 January 2020, 16 minutes after the event, to advise of the non-credible contingency event.
2. Reclassification, details, and cancellation of a non-credible contingency – notify as soon as practical.
 - AEMO issued Market Notice 72753 at 0856 hrs on 20 January 2020, to advise that the TIPS A 275 kV West Bus had been returned to service and that AEMO would not reclassify this event as a credible contingency event.

⁷ 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.

⁸ 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).

⁹ AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see <https://www.aemo.com.au/Market-Notices>.

¹⁰ 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.

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 the TIPS A 275 kV West Bus was due to an external flashover on a CT.
2. All protection systems operated as designed and as expected to clear the fault.
3. The probable cause of the flashover on the CT was a build-up of foreign particulates on the CT followed by light rain creating an external path for electrical flashover.
4. The power system remained in a secure operating state throughout this incident.

A1. Sequence of events

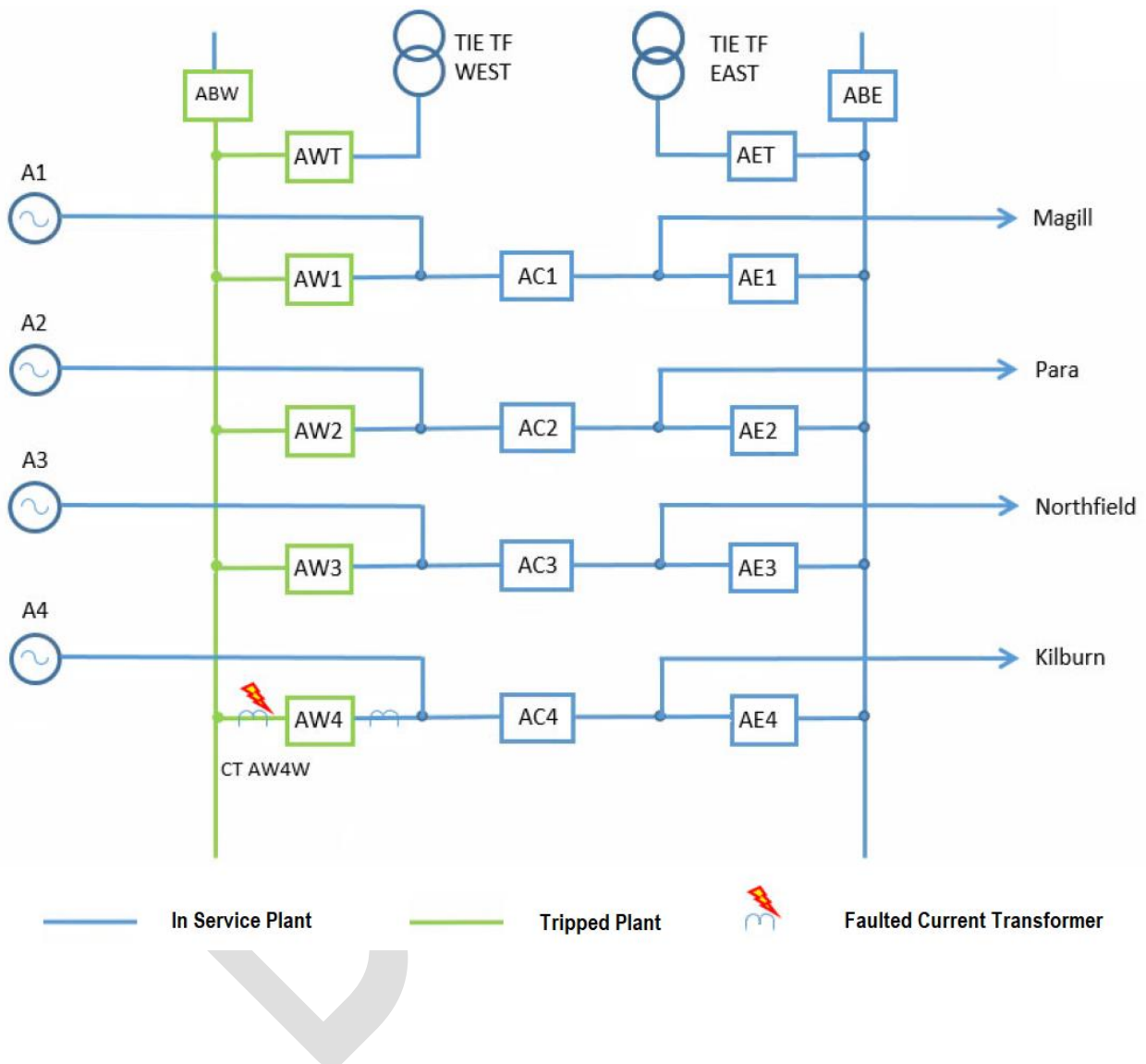
Table 1 Sequence of events

Time	Event
Monday 20/1/2020	
00:04	TIPS A Bus Zone West 275 kV X and Y Protection Trip Alarms.
00:04	TIPS A CBAW1, CBAW2, CBAW2, CBAW4 CBAWT and CBABW trip.
00:04	TIPS A West Bus de-energised.
00:05	Report from AGL Security Staff that they had witnessed an event in the A yard.
00:20	AEMO Market Notice 72743 issued – Non-credible contingency event – SA region – 20/01/2020.
01:11	MSP arrives at TIPS A for yard inspection.
01:11	Suspected damage on CT between CB AWT and Tie TF West, propose to deenergise (CT AWTE).
01:36	Open CB6W3.
01:45	Open Isolator 6W3W and Isolator AWTW to isolate suspected damaged equipment for inspection in daylight.
01:50	ElectraNet advise AEMO that cause of trip was due to CT failure on the AWT circuit breaker (HV circuit breaker of the West tie transformer).
05:47	Confirmation from yard inspection that CT AWTE was not the cause of the flashover.
07:01	Commenced opening of Isolators AW1E, AW2E, AW3E and AW4E before West Bus Inspection.
07:59	West Bus Inspection commenced.
08:29	Report CT AW4W discovered to have flash marks top and bottom.
08:30	ElectraNet advised AEMO that the cause of the trip was due to a flash over to “V phase” on the CT associated with circuit breaker AW4, and the equipment had been isolated. The protection operated as per design.
08:31	Open Isolator AW4W.
08:33	Reenergisation of West Bus and Tie TF West.
08:36	Isolators AW4W and AW4E locked out to complete isolation of CT AW4W.
08:56	AEMO Market Notice 72753 issued – Update Non-credible contingency event – SA region – 20/01/2020.
11:36	Oil Sampling of CT AW4W V phase.
Wednesday 29/1/2020	
12:27	Reenergisation of CT AW4W.

A2. System diagram

The diagram below provides an overview of part of the power system immediately after the incident.

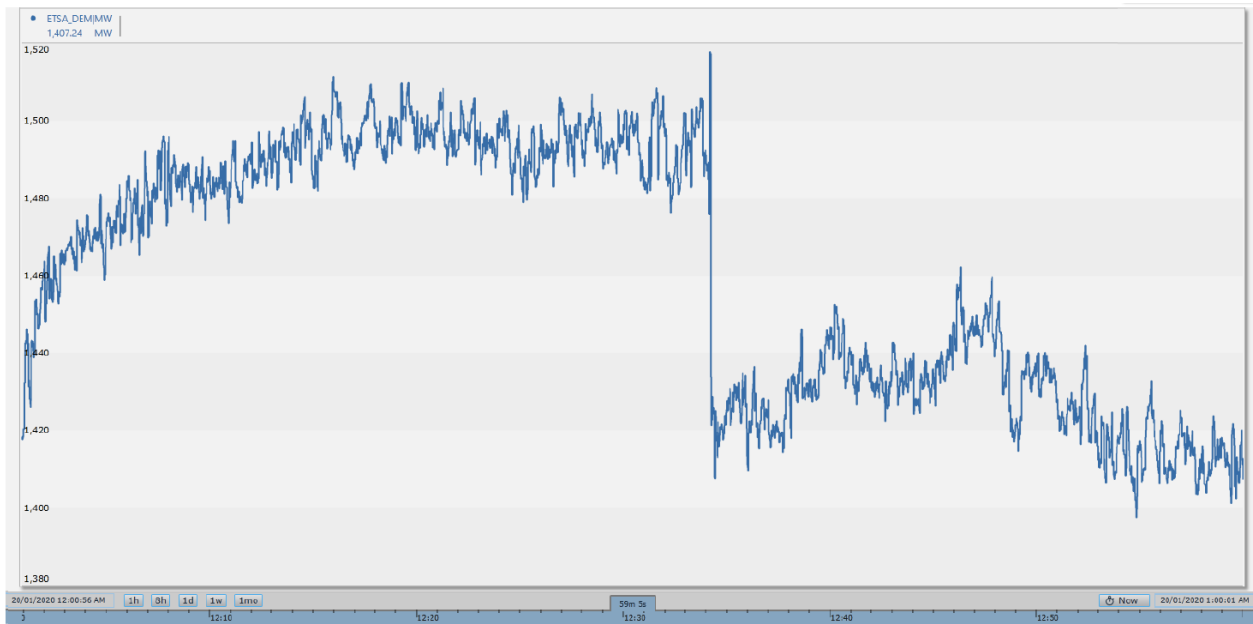
Figure 1 TIPS A 275 kV substation network configuration, post-incident.



A3. System load trend

The chart below shows the recorded power on the SA power network at the time of the incident¹¹, indicating a sharp drop in the power levels at the time of the TIPS A 275 kV West Bus trip, equivalent to approximately 100 MW of customer load.

Figure 2 ElectraNet record of SA power network active power (MW) load during the incident.



¹¹ Data is recorded and displayed at local ACDT time.