
Trip of Collinsville North – Clare South
and Strathmore – Clare South 110 kV
lines, and Strathmore Static Var
Compensator, on 9 January 2019

November 2019

Reviewable Operating Incident Report under the
National Electricity Rules

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	2133 hrs on 9 January 2019
Region of incident	Queensland
Affected regions	Queensland
Event type	Control system failure
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
AEMO	Australian Energy Market Operator
AC	Alternating current
kV	Kilovolt
NEM	National Electricity Market
NER	National Electricity Rules
SVC	Static Var Compensator

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 9 January 2019 in Queensland. The incident involved the trip of the 7128 Collinsville North to Clare South and 7208 Strathmore to Clare South 132 kV transmission lines (7128 and 7208 lines) and the Strathmore No. 1 Static Var Compensator (1 SVC).

No generation or customer load was lost 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 security².

AEMO has concluded that:

1. The trip of the 7128 and 7208 lines was due to lightning and all protection operated as designed and as expected to clear this fault.
2. The trip of 1 SVC was due to a loss of the AC auxiliary supply to the SVC cooling system. Powerlink have advised this was the result of a design issue in the AC auxiliary supply changeover system and is unique to the Strathmore substation. Modifications to the AC auxiliary supply system at Strathmore have been completed to correct the design issue.
3. AEMO correctly reclassified the simultaneous trip of the 7128 and 7208 lines as a credible contingency. These lines have subsequently been deemed as vulnerable to lightning in the category of proven.
4. AEMO correctly reclassified the simultaneous trip of a transmission line ex the Strathmore substation and 1 SVC as a credible contingency.
5. 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 Powerlink³ and AEMO.

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

2. The incident

2.1 The incident

At 2133 hrs on 9 January 2019, the 7128 and 7208 lines tripped simultaneously and successfully autoreclosed five seconds after the trip. These lines share the same dual circuit towers for part of their length. At the same time, the 1 SVC tripped. The 1 SVC was returned to service at 0736 hrs on 10 January 2019.

2.2 Powerlink investigation

The following is based on information provided by Powerlink.

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 Powerlink is the Transmission Network Service Provider (TNSP) for Queensland.

2.2.1 Trip of 7128 and 7208 lines

At 21:33:20 hrs on 9 January 2019, the 7128 and 7208 lines tripped due to high voltage faults on each line. Both of these lines run on the same towers in the area of the faults. The faults occurred simultaneously with a lightning strike recorded near the lines, with protection systems indicating the faults were at similar location on both lines. All protection systems operated correctly and as expected to clear the faults within the time frames specified in the NER⁴. Approximately five seconds after the lines tripped, both lines autoreclosed successfully.

Powerlink identified and replaced flashed insulators at the predicted fault location.

2.2.2 Trip of 1 SVC

At 21:33:22 hrs on 9 January 2019, the 1 SVC tripped due to loss of AC supply to the cooling system. The SVC has two independent sources of AC auxiliary supply, with an automatic changeover if one should fail. Powerlink has identified a design issue with the AC auxiliary supply automatic changeover. Normally, the automatic changeover should not operate for short duration transient voltage reductions caused by faults on the power system. In this case, the automatic changeover was initiated in response to a transient voltage reduction caused by the faults on the 7128 and 7208 lines. However, as the alternative AC supply was also affected by the voltage transient, the automatic changeover system then waited for it to be considered healthy before completing the changeover. This resulted in a loss of AC auxiliary supply to the SVC cooling system, which then initiated an SVC trip. In November 2019 Powerlink implemented changes to the AC auxiliary supply system at Strathmore to prevent this type of incident recurring.

Until the issue with the automatic changeover was resolved, there remained the potential for the 1 SVC to trip in response to a fault on the 132 kV transmission lines to/from Strathmore. AEMO reclassified the loss of any of the 132 kV transmission line to/from Strathmore and 1 SVC as a credible contingency until the issue with the automatic changeover was resolved. Refer to Section 3.1 for details.

Powerlink has advised that this design issue on the automatic changeover system is unique to the Strathmore SVC and does not occur elsewhere.

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 operating state following a contingency event in accordance with the NER⁵.

As both the 7128 and 7208 lines returned to service within five seconds, the only action required by AEMO was in relation to the outage of the 1 SVC. AEMO invoked constraint set Q-H35STM_SVC⁶ at 2140 hrs on 9 January 2019 to ensure the power system remained in a secure operating state. The constraint set was revoked at 0750 hrs on 10 January 2019, after the SVC had been returned to service. None of the constraint equations in this constraint set bound during this period, indicating the constraint set had no market impact.

The power system remained in a secure operating state during this incident.

⁴ NER clause S5.1a.8

⁵ 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.

⁶ Out= H35 Strathmore SVC, Central – North Queensland Intra-regional limit

3.1 Reclassification

AEMO assessed whether or not to reclassify this incident as a credible contingency event⁷.

Although AEMO was aware of lightning in the vicinity of the 7128 and 7208 lines prior to the faults on the lines, AEMO was not required to reclassify the loss of both lines as a credible contingency, because, in accordance with the Power System Security Guidelines, the lines were not considered as vulnerable to lightning.

At 2256 hrs on 9 January 2019, Powerlink advised AEMO that the trip of the 7128 and 7208 lines was due to lightning. Based on this information, AEMO reclassified the simultaneous loss of both these lines as a credible contingency from 2317 hrs on 9 January 2019. No constraints were required to be invoked as part of this reclassification. This reclassification was cancelled at 1455 hrs on 10 January 2019, after lightning activity had cleared the area.

There was a period of 83 minutes between the incident occurring and AEMO reclassifying the loss of 7128 and 7208 as a credible contingency. As Powerlink could not immediately advise AEMO of the cause of the contingency, and the lines had been returned to service, on further consideration AEMO believes that if these circumstances were to re-occur it would be appropriate to reclassify the simultaneous loss of the 7128 and 7208 lines as a credible contingency immediately after the incident. Operating procedures have been updated to clarify this for the future.

After the 1 SVC was returned to service at 0736 hrs on 10 January 2019, Powerlink advised AEMO the cause of the trip had been identified and was unlikely to reoccur. Based on this information, AEMO considered that reclassification of the simultaneous loss of the 1 SVC and the 7128 and 7208 lines was not required.

On 11 January 2019, Powerlink provided an update to AEMO on the analysis of this event and advised that the 1 SVC may trip coincident with a close in high voltage fault on any lines connecting to Strathmore substation, due to the transient voltage reduction. Based on this information, AEMO reclassified the simultaneous loss of any transmission line ex Strathmore and 1 SVC as a credible contingency from 1600 hrs on 11 January 2019.

On 14 January 2019, Powerlink updated its advice to AEMO to say the the 1 SVC is only likely to trip coincident with a fault on a 132 kV line ex Strathmore, and not the 275 kV lines. This reclassification was cancelled on 5 November 2019 after modifications to the AC auxiliary supply to 1 SVC had been completed. No constraint sets were required to be invoked in response to this reclassification.

As noted above, prior to this incident the 7128 and 7208 lines were not considered as vulnerable to lightning. As a result of this incident, AEMO now considers these lines as vulnerable in the category of probable. The Power System Security Guidelines⁸ have been updated to reflect this change.

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:

⁷ 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).

⁸ See [SO OP 3715 Power System Security Guidelines](#).

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

1. A non-credible contingency event – notify within two hours of the event¹⁰.
 - AEMO issued Market Notice 66304 at 2218 hrs on 9 January 2019, 45 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 practical¹¹.
 - AEMO issued Market Notice 66305 at 2317 hrs on 9 January 2019 to advise that the simultaneous trip of the 7128 and 7208 lines had been reclassified as a credible contingency.
 - AEMO issued Market Notices 66312 and 66313 at 1352 hrs on 10 January 2019 to advise the causes of the non-credible contingency had been identified and the reclassification of 7127 and 7208 lines remained in place.
 - AEMO issued Market Notice 66314 at 1353 hrs on 10 January to advise that AEMO now considered that the 7128 and 7208 lines were now vulnerable to lightning in the category of probable.
 - AEMO issued Market Notice 66315 at 1530 hrs on 10 January to advise the reclassification of the 7128 and 7208 lines had been cancelled.
 - AEMO issued Market Notice 66329 at 1602 hrs on 11 January to advise that the simultaneous trip of any transmission line ex the Strathmore substation and 1 SVC had been reclassified as a credible contingency.
 - AEMO issued Market Notice 70933 at 1158 hrs on 5 November to advise the reclassification involving the simultaneous trip of any transmission line ex the Strathmore substation and 1 SVC had been cancelled.

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 7128 and 7208 lines was due to lightning and all protection operated as designed and as expected to clear these faults.
2. The trip of 1 SVC was due to a loss of the AC auxiliary supply to the SVC cooling system. Powerlink have advised this was the result of a design issue in the AC auxiliary supply changeover system and is unique to the Strathmore substation. Modifications to the AC auxiliary supply system at Strathmore have been completed to correct the design issue..
3. AEMO correctly reclassified the simultaneous trip of the 7128 and 7208 lines as a credible contingency. These lines have subsequently been deemed as vulnerable to lightning in the category of proven.
4. AEMO correctly reclassified the simultaneous trip of a transmission line ex the Strathmore substation and 1 SVC as a credible contingency.
5. The power system remained in a secure operating state throughout this incident.

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 10.3, available at [SO OP3715 Power System Security Guidelines](#).

¹¹ 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).