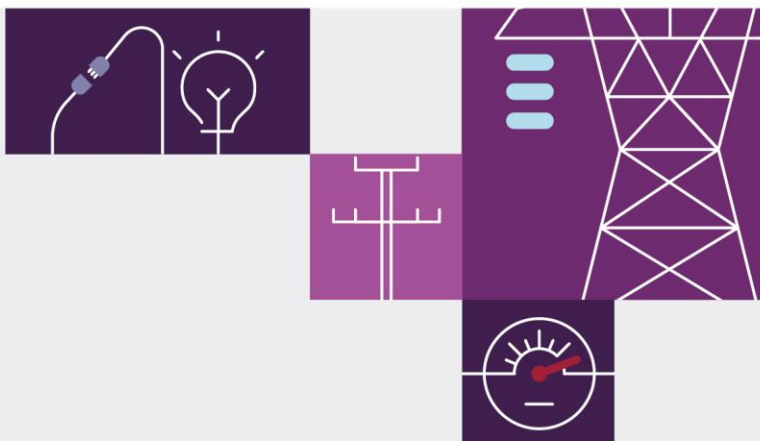




# February 2024

# Reviewable Operating Incident Report under the National Electricity Rules





# 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.

## Disclaimer

To inform its review and the findings expressed in this report, AEMO has been provided with data by registered participants as to the status or response of some facilities before, during and after the reviewable incident, and has also collated information from its own observations, records and systems. Any views expressed in this report are those of AEMO unless otherwise stated, and may be based on information given to AEMO by other persons. AEMO has made reasonable efforts to ensure the quality of the information in this report but cannot guarantee its accuracy or completeness. Any views expressed in this report may be based on information given to AEMO by other persons.

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## Contact

If you have any questions or comments in relation to this report, please contact AEMO at [system.incident@aemo.com.au](mailto:system.incident@aemo.com.au).

The NEM operates on Australian Eastern Standard Time (AEST). All times in this report are in AEST.



# Abbreviations

Abbreviation	Term
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
CB	circuit breaker
FOS	Frequency Operating Standard
kV	kilovolt/s
ms	milliseconds
NEM	National Electricity Market
NER	National Electricity Rules
PSSWG	Power System Security Working Group
TNSP	Transmission Network Service Provider

# Incident review

This reviewable operating incident<sup>1</sup> report is prepared in accordance with clause 4.8.15(c) of the National Electricity Rules (NER). It has been prepared using information provided by Powerlink<sup>2</sup> and from AEMO systems.

**Table 1 Summary of event**

	Details
<b>Reviewable operating incident type</b>	Non-credible contingency event impacting critical transmission elements.
<b>Incident details</b>	This report relates to a reviewable operating incident <sup>3</sup> that occurred on 30 August 2023 in Queensland. The incident involved the tripping of Chalumbin 275/132 kilovolt (kV) No. 1 transformer during a planned outage of the Chalumbin – Ross 275 kV No. 857 line.
<b>Incident classification</b>	Transmission equipment failure – Arc/flashover across open contacts of circuit breaker (CB) 5032 at Chalumbin substation due to pollution build-up on CB interrupter insulation.
<b>Generation impact</b>	No generation was lost as a result of this incident.
<b>Customer load impact</b>	No load was lost as a result of this incident.
<b>Pre-incident conditions</b>	Immediately prior to this incident, the Chalumbin – Ross 275 kV No. 857 line was switched out of service for a planned outage.
<b>Incident key events</b>	<ul style="list-style-type: none"> <li>On 30 August 2023, the following events occurred:               <ul style="list-style-type: none"> <li>At 0903 hrs, the Chalumbin – Ross 275 kV No. 857 line was switched out of service for a planned outage.</li> <li>Immediately following this, the Chalumbin 275/132 kV No. 1 transformer and Chalumbin 275 kV No. 2 reactor tripped due to the operation of their respective protection systems.</li> <li>At 1048 hrs, CB 5032 was isolated from the power system and the Chalumbin 275/132 kV No. 1 transformer was returned to service.</li> </ul> </li> <li>On 31 August 2023, at 0955 hrs, the Chalumbin – Ross 275 kV No. 857 line and the Chalumbin 275 kV No. 2 reactor were returned to service.</li> <li>Following minor repairs, CB 5032 was returned to service at 1431 hrs on 1 September 2023.</li> </ul>
<b>Incident cause</b>	<p>Powerlink's post-incident investigation has concluded that:</p> <ul style="list-style-type: none"> <li>Immediately prior to the incident at 0903.50 hrs on 30 August 2023, the Chalumbin – Ross 275 kV No. 857 line was switched out of service by opening CB 8572 and CB 5032 at Chalumbin and CB 8572 at Ross substation. This switching occurred as part of a planned outage of the Chalumbin – Ross 275 kV No. 857 line.</li> <li>An external flashover occurred across the open interrupters of A and C phases of the open CB 5032 at Chalumbin (effectively energising the Chalumbin – Ross 275 kV No. 857 line and Chalumbin 275 kV No. 2 reactor on two phases only). While CB 5032 was open, it was still energised on one side of the CB interrupters via CB 5412 and the Chalumbin 275 kV No. 2 busbar (see Figure 1).</li> <li>The protection of Chalumbin 275 kV No. 2 reactor, which was energised on A and C phase via the flashover of CB 5032, detected a negative phase sequence condition and tripped the reactor circuit breaker CB 8572/1.</li> <li>The arc on the A phase of CB 5032 evolved and contacted an adjacent earthed structure which resulted in a phase to ground fault in the Chalumbin 275/132 kV No. 1 transformer protection zone. The transformer protection operated and tripped CB 5412, CB 4412 and CB 2712 as expected and within primary protection clearing times<sup>4</sup> (see Figure 2).</li> </ul>

<sup>1</sup> Reviewable operating incidents are defined by NER 4.8.15(a) and the Australian Energy Market Commission (AEMC) Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

<sup>2</sup> Participant is a Transmission Network Service Provider (TNSP) for Queensland.

<sup>3</sup> See NER 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.

<sup>4</sup> Under NER S5.1a.8(b)–(c) primary protection fault clearance is required within 100 milliseconds (ms) at the near end and 120 ms at the remote end of 275 kV lines.

Details	
	Powerlink inspected CB 5032 after the incident and reported evidence of pollution on the CB interrupter insulation.
<b>Power system response (facilities and services)</b>	There was no other material impact on the broader power system, load or generation.
<b>Rectification</b>	<p>A visual inspection of CB 5032 was completed, followed by interrupter insulation cleaning and minor repairs, and the circuit breaker was returned to service on 1 September 2023. All other 275 kV breakers at Chalumbin were inspected with none showing evidence of pollution to the same level as CB 5032.</p> <p>Powerlink advised that removal of pollution is part of its normal maintenance activities where required. In addition, Powerlink advised that pollution occurs from local environmental conditions and pollution is normally minimised by natural washing from rain.</p> <p>Based on this information, Powerlink considers the probability of a recurrence is low.</p>
<b>Power system security</b>	<p>At the time of the event, the fault was originally considered unrelated to the planned line outage. Given that CB 5032 formed part of the Chalumbin 275/132 kV No. 1 transformer protection zone and that the transformer protection operated as designed, AEMO concluded that the event was a credible contingency.</p> <p>Powerlink's post-incident investigation subsequently identified that the de-energisation of the Chalumbin – Ross 275 kV No. 857 line caused a voltage difference over the open CB 5032, which, given the presence of the pollution on the CB insulation, was significant enough to result in an external flashover across the open CB interrupters. This arc then evolved, causing the Chalumbin 275/132 kV No. 1 transformer protection to operate. AEMO therefore concluded this to be a non-credible contingency event.</p> <p>The power system remained in a secure operating state throughout this incident and the Frequency Operating Standard<sup>5</sup> (FOS) was met for this incident.</p>
<b>Reclassification</b>	<p>AEMO assessed whether to reclassify this incident as a credible contingency event<sup>6</sup>.</p> <p>CB 5032 remained out of service immediately following the incident until the incident root cause was investigated. CB 5032 was subsequently cleaned, before being returned to service. Therefore, AEMO assessed at that time that there was no increased likelihood of this event re-occurring and did not re-classify the simultaneous trip of Chalumbin – Ross 275 kV No. 857 line and the Chalumbin 275/132 kV No. 1 transformer as a credible contingency event.</p> <p>Therefore, AEMO appropriately identified that reclassification was not required.</p>
<b>Market information</b>	<p>At the time of the incident (based on the information available) AEMO considered the event was a credible contingency and subsequently no market notices were issued for this event.</p> <p>When AEMO became aware of the non-credible contingency event, any abnormal conditions related to this incident were no longer present and AEMO identified that this non-credible contingency was not likely to reoccur.</p>
<b>Conclusions</b>	<p>AEMO has concluded that:</p> <ul style="list-style-type: none"> <li>At 0903 hrs on 30 August 2023, an external flashover across the interrupters of the open CB 5032 caused the Chalumbin 275/132 kV No. 1 transformer and Chalumbin 275 kV No. 2 reactor to trip.</li> <li>The power system remained in a secure operating state and the FOS was met throughout this incident.</li> <li>The cause of the incident was identified by Powerlink as pollution build-up on the interrupter insulation of CB 5032.</li> <li>As the arc arose under routine switching and not in response to a fault on the Chalumbin – Ross 275 kV No. 857 line, fault clearing times were within primary protection times.</li> </ul>
<b>Recommendations</b>	<ul style="list-style-type: none"> <li>AEMO and Powerlink to share the findings of this incident with the Power System Security Working Group (PSSWG) by Q2 2024.</li> </ul>

<sup>5</sup> Frequency Operating Standard; see <https://www.aemc.gov.au/sites/default/files/2020-01/Frequency%20operating%20standard%20-%20effective%201%20January%202020%20-%20TYPO%20corrected%2019DEC2019.PDF>.

<sup>6</sup> AEMO is required to assess whether or not to reclassify a non-credible contingency event as a credible contingency event – NER 4.2.3A(e)-(g) – and to report how the reclassification criteria were applied – NER 4.8.15(ca).

Figure 1 Pre-incident diagram – Chalumbin substation

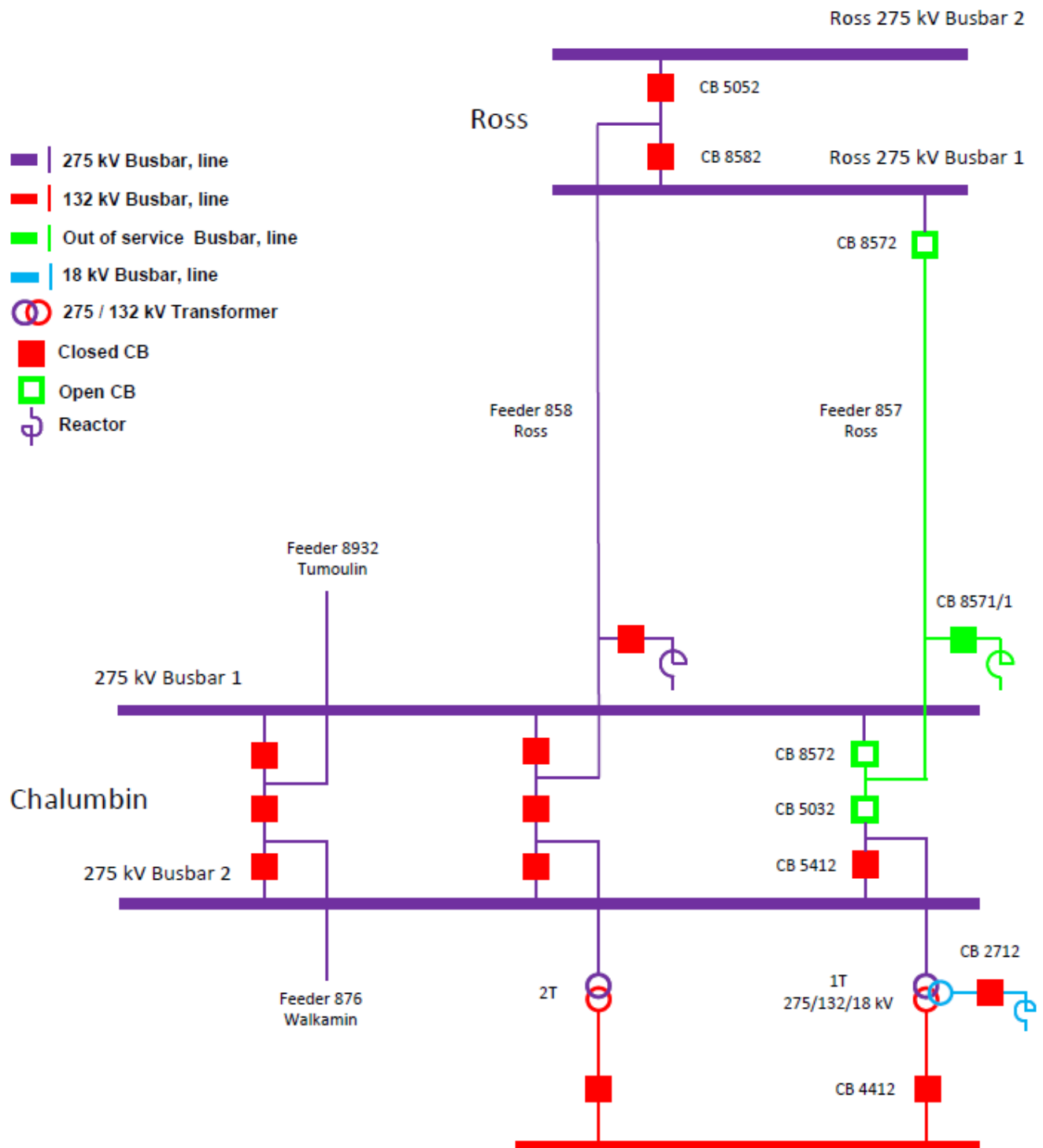


Figure 2 Post-incident diagram – Chalumbin substation

