
Eraring 500 kV Main Busbar trip on 31 August 2021

November 2021

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.

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CONTACT

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

Abbreviations

Abbreviation	Term
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
kV	Kilovolt
MW	Megawatts
NEM	National Electricity Market
NER	National Electricity Rules
TNSP	Transmission Network Service Provider

Incident review

This reviewable operating incident¹ 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 Transgrid² and from AEMO systems.

Table 1 Summary of event – Eraring 500 kV Main Busbar trip

	Details
Reviewable operating incident type	Non-credible contingency event impacting critical transmission elements.
Incident details	This report relates to a reviewable operating incident ³ that occurred on 31 August 2021 in New South Wales. The incident involved the trip of the Eraring 500 kilovolt (kV) Main Busbar.
Incident classification	Transmission equipment failure.
Generation impact	Nil
Customer load impact	Nil
Incident key events	<ol style="list-style-type: none"> At 1140 hrs on 31 August 2021, the Eraring 500 kV Main Busbar tripped. At 1634 hrs, Transgrid confirmed the cause of the trip as a faulty surge arrester⁴. This surge arrester was subsequently isolated by Transgrid. At 1746 hrs on 31 August 2021, the Eraring 500 kV Main busbar was returned to service.
Incident cause	Post incident investigation has confirmed that a surge arrester connected to the Eraring 500 kV Main Busbar failed, causing a White phase to ground fault. This fault was cleared by the Eraring 500 kV Main Busbar protection.
Power system response (facilities and services)	<p>Transgrid has confirmed that:</p> <ul style="list-style-type: none"> Prior to the fault, voltages at Eraring 500 kV substation were within normal levels (see Figure 1). The surge arrester suffered an internal failure. The reason for this failure is still to be confirmed, however, it is presumed to be the result of moisture ingress, and possibly related to the age of the surge arrester, which is estimated to be 40 years. The White phase to ground fault was identified and cleared by the Eraring 500 kV Main Busbar No. 1 and No. 2 protections, tripping the Main Busbar. Both of these protections operated as per their design. Due to the circuit breaker and a half configuration at Eraring 500 kV substation, the busbar trip did not cause any other equipment to trip/disconnect from the system (see Figure 2).
Rectification	The faulty surge arrester was isolated at 1647 hrs, prior to the Eraring 500 kV Main Busbar being returned to service.

¹ Reviewable operating incidents are defined by NER clause 4.8.15(a) and the AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

² Transgrid is a Transmission Network Service Provider (TNSP) for New South Wales.

³ 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.

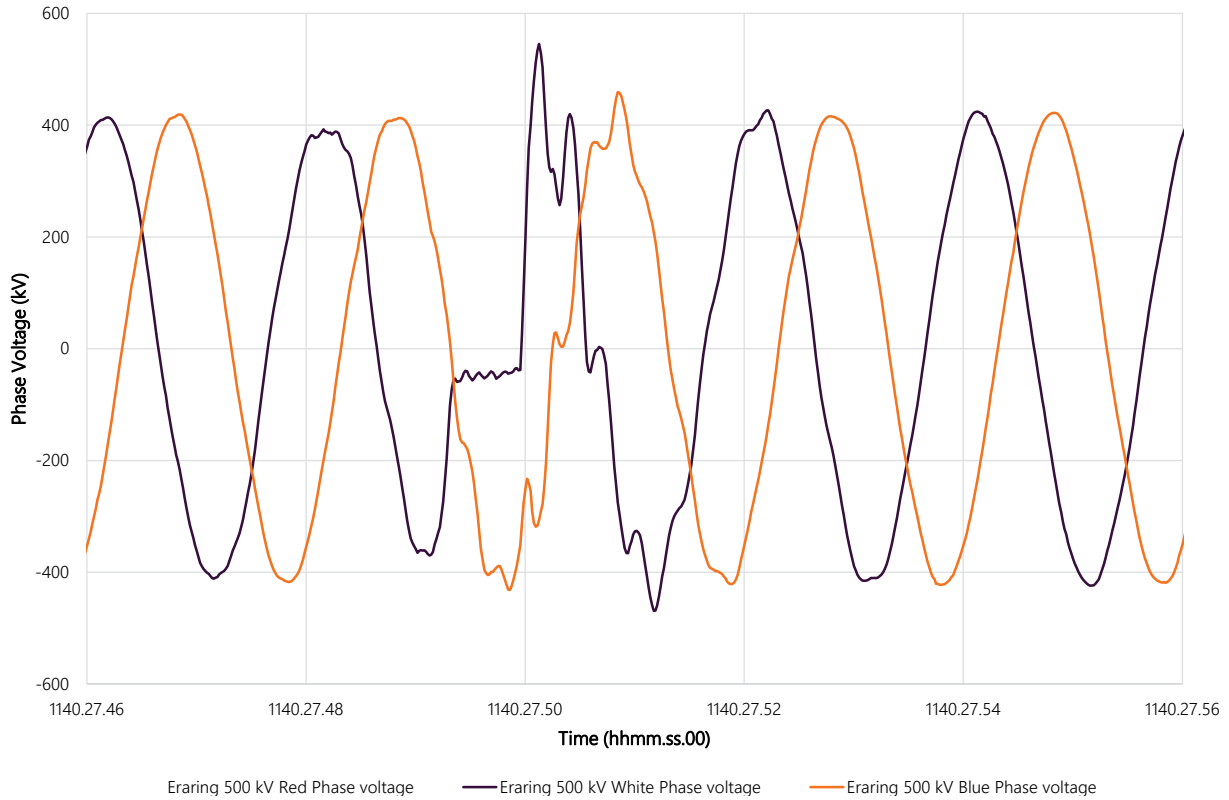
⁴ A surge arrester is a device which protects transmission equipment from short-term high voltages, such as those that can be seen when the system is struck by lightning. When a sufficiently high voltage is applied to a surge arrester, it is designed to create a temporary current path to ground, interrupting current flow and dissipating the high voltage.

	Details
	<p>Transgrid has confirmed that:</p> <ul style="list-style-type: none"> • Due to the number of healthy surge arrestors still connected to the Eraring 500 kV Main Busbar, there is no operational impact associated with leaving the faulty surge arrestor disconnected. • A design review will be carried out to determine whether the isolated faulty surge arrestor needs to be replaced. A timeline for the completion of this review is not available at this time. • No other surge arrestors of the type which failed during this incident are connected to Transgrid's network.
Power system security	The power system remained in a secure operating state throughout this incident and the Frequency Operating Standard (FOS) ⁵ was met.
Reclassification	<p>AEMO assessed whether to reclassify this incident as a credible contingency event⁶.</p> <p>Prior to returning the Eraring 500 kV Main Busbar to service, Transgrid advised AEMO that the cause of the busbar trip had been identified as a faulty surge arrestor. Transgrid also advised that this surge arrestor had been isolated and the contingency was unlikely to re-occur.</p> <p>As the cause of the fault was identified and isolated prior to the affected equipment's return to service, AEMO responded correctly and did not reclassify this non-credible contingency as a credible contingency event.</p>
Market information	<p>For this incident, AEMO issued the following market notices (all market notices for this incident were issued in accordance with NER requirements):</p> <ul style="list-style-type: none"> • AEMO issued Market Notice 90077 at 1317 hrs on 31 August 2021 (97 minutes after the incident) to advise of the non-credible contingency event. • AEMO issued Market Notice 90094 at 1800 hrs on 31 August 2021 to advise that the cause of the non-credible contingency had been identified and was unlikely to re-occur.
Conclusions	<p>AEMO has concluded that:</p> <ol style="list-style-type: none"> 1. An internal fault in a surge arrestor connected to the Eraring 500 kV Main Busbar caused a White phase to ground fault. 2. This White phase to ground fault was cleared by the Eraring 500 kV Main Busbar protection as per its design. No other equipment tripped as a result of this protection operation. 3. Transgrid isolated the faulty surge arrestor prior to returning the Eraring 500 kV Main Busbar to service. Transgrid has also confirmed that no other surge arrestors of the same type are connected to its network. 4. The power system remained in a secure operating state throughout this incident and the FOS was met for this incident.
Recommendations	<ol style="list-style-type: none"> 1. Transgrid to complete design review of surge arrestors at Eraring 500 kV substation. This review should confirm whether the faulty surge arrestor needs to be replaced. 2. Pending completion of Transgrid's investigation: <ul style="list-style-type: none"> – AEMO to share information on the type of surge arrestor and the failure mode in this incident with the Power System Security Working Group. – Other TNSPs to review their own networks and identify if any surge arrestors of a similar type/age are connected and at risk of failure.

⁵ The FOS is available at <https://www.aemc.gov.au/sites/default/files/2020-01/Frequency%20operating%20standard%20-%20effective%201%20January%202020%20-%20TYPO%20corrected%2019DEC2019.PDF>.

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).

Figure 1 Eraring 500 kV phase voltage at time of incident



Note: Voltage measured from fault recorder at the Eraring 500 kV substation end of the Eraring – Kemps Creek 500 kV circuit.

Figure 2 Incident diagram – Eraring 500 kV substation post incident single line diagram

