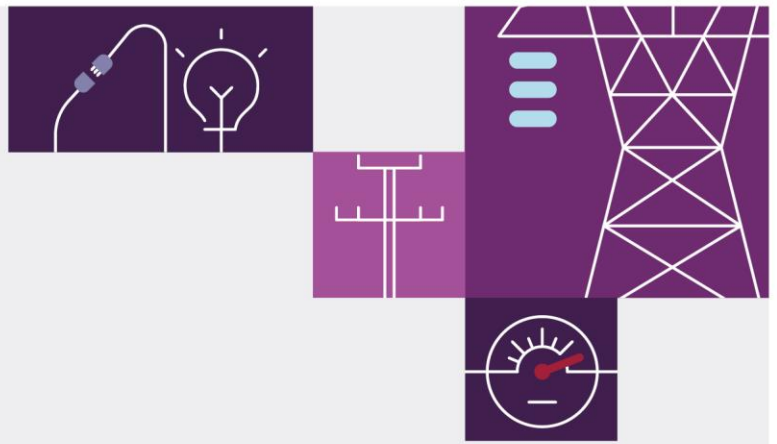


Trip of Bell Bay No. 3 and No. 4 Potlines on 1 January 2022

June 2022

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

AEMO has made every reasonable effort 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.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of this document:

- make no representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of the information in this document; and
- are not liable (whether by reason of negligence or otherwise) for any statements or representations in this document, or any omissions from it, or for any use or reliance on the information in it.

Contact

If you have any questions or comments in relation to this report, please contact AEMO at 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
FCAS	Frequency Control Ancillary Services
Hz	Hertz
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 Rio Tinto Aluminium², TasNetworks³ and from AEMO systems.

Table 1 Summary of event

Details	
Reviewable operating incident type	Operation of over frequency protection and control scheme(s).
Incident details	This report relates to a reviewable operating incident ⁴ that occurred on 1 January 2022 in Tasmania. The incident involved the trip of Bell Bay No. 3 and No. 4 Potline and the operation of the Tasmania lower frequency control ancillary services (FCAS) reduction scheme ⁵ .
Incident classification	Protection/control system – operation of lower FCAS reduction scheme.
Generation impact	14 MW of generation was lost as a result of this incident.
Customer load impact	224 MW of load was lost as a result of this incident.
Pre-incident conditions	Prior to the incident at 2339 hrs on 1 January 2022, TasNetworks informed AEMO that Bell Bay Aluminium planned to perform an emergency load reduction of approximately 100 MW. At the time, Bell Bay Aluminium No. 3 and No. 4 potlines were operating at 100 MW and 105 MW respectively. Rectifier RF43 was on standby prior to the incident.
Incident key events	<ol style="list-style-type: none"> Two minutes later at 2341 hrs on 1 January 2022, Bell Bay Aluminium No. 3 and No. 4 potlines tripped, causing the frequency to increase to a peak of approximately 51.09 Hz and operation of the Tasmania lower FCAS reduction scheme. The scheme operated as designed and tripped the Wayatina No. 1 generator. At 2345 hrs on 1 January 2022, Wayatina No. 1 generator returned to service. At 0005 hrs on 2 January 2022, Bell Bay Aluminium No. 3 potline returned to service via rectifier RF46. At 0017 hrs on 2 January 2022, Bell Bay Aluminium No. 4 potline returned to service via rectifier RF46.
Incident cause	<p>Post incident investigations from Rio Tinto Aluminium and TasNetworks concluded that at 2341 hrs on 1 January 2022, Bell Bay staff disconnected the Bell Bay Aluminium No. 3 potline from the system in response to conditions in the potline. At the same time, Bell Bay Aluminium No. 4 potline unexpectedly tripped due to operation of rectifier RF43's⁶ earth fault protection. Rectifier RF43 was isolated and had its intertrip links removed to prevent the risk of further tripping, until the cause of the incident was identified and rectified.</p> <p>Further investigation showed there was an additional earth loop in the secondary system of the No. 4 potline's rectifier which was introduced during the rectifier's installation. As a result, when Bell Bay Aluminium No. 3 potline was disconnected from the system, an unexpected neutral/earth current circulated through the earth loop in rectifier RF43. This neutral/earth current caused the unexpected operation of its earth fault protection relay and tripped the No. 4 potline.</p>
Power system response (facilities and services)	At 2341 hrs on 1 January 2022, immediately after the trip of Bell Bay Aluminium No. 3 and No. 4 potlines, the frequency in Tasmania increased above 50.90 Hz (see Figure 1). This caused the Tasmania lower FCAS reduction scheme to operate and trip the Wayatina No. 1 generator. The frequency returned to 50.15 Hz 30 seconds after the operation of the Tasmania lower FCAS reduction scheme, which operated in line with its expected performance.

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 Rio Tinto Aluminium is the owner of Bell Bay No.3 and No. 4 Potlines.

³ TasNetworks is a Transmission Network Service owner of Bell Bay No.3 and No. 4 Potlines.

³ TasNetworks is a transmission network service provider (TNSP) for Tasmania.

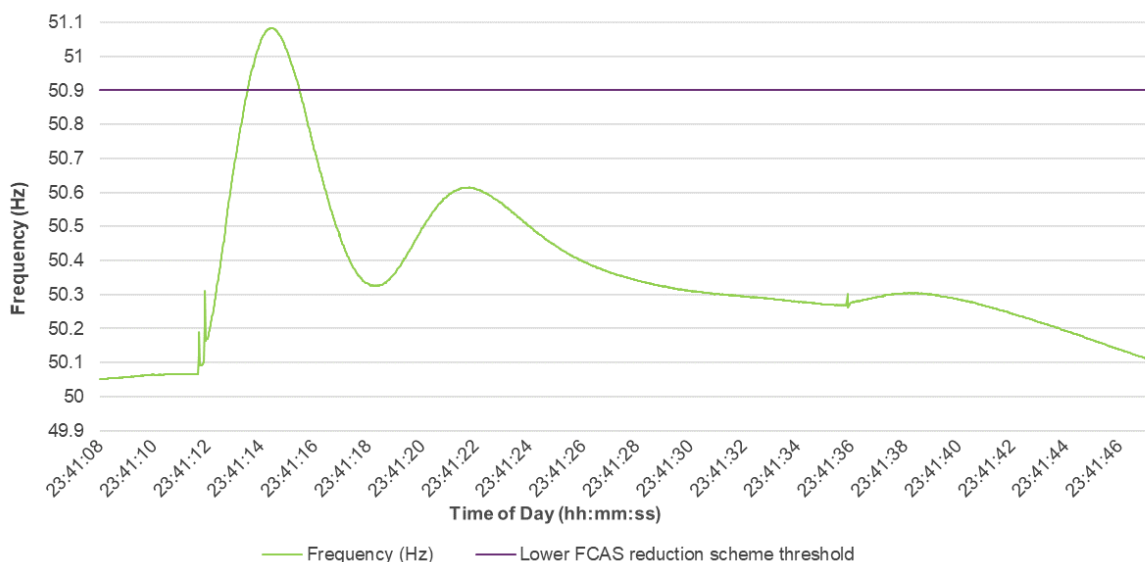
⁴ See NER clause 4.8.15(a)(3), as the event involves the operation of under-frequency or over-frequency protection and control schemes; and the AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

⁵ Tasmania lower FCAS reduction scheme is designed to trip designated generators when the system frequency rises to a frequency between 51 Hz and 52 Hz.

⁶ A rectifier is a combined transformer and rectifier. Its primary purpose is to convert alternating current in direct current.

Details	
	There were no other material impacts on the broader power system, load, or generation.
Rectification	Between 4 January 2022 and 5 January 2022, Bell Bay Aluminium conducted tests on the Potline No.4 rectifier RF43 to identify the unexpected earth loop. This unexpected secondary earth loop was removed at the protection relay, and the unit was tested to ensure only a single earth loop was present, which reduced the risk of a re-occurrence of this incident. Bell Bay Aluminium have confirmed the issue has not been replicated anywhere else in their system.
Power system security	The power system remained in a secure operating state throughout this incident and the Frequency Operating Standard ⁷ was met.
Reclassification	AEMO assessed whether to reclassify this incident as a credible contingency event ⁸ . At 0004 hrs on 2 January 2022, prior to the return to service of both potlines, TasNetworks informed AEMO that Bell Bay Aluminium had identified the cause of the trip of Bell Bay Aluminium No. 4 potline and advised that a reoccurrence was unlikely. Based on this information, AEMO correctly did not reclassify the incident as a credible contingency event. Subsequent further investigation by Bell Bay Aluminium identified the root cause of the incident as an unexpected secondary earth loop which was removed between 4 January 2022 and 5 January 2022.
Market information	For this incident, AEMO issued the following market notice (all market notices for this incident were issued in accordance with NER requirements) – AEMO issued Market Notice 93522 at 0028 hrs on 2 January 2022 to advise of a non-credible contingency event.
Conclusions	AEMO has concluded that: <ol style="list-style-type: none"> 1. The trip of Bell Bay Aluminium No. 4 potline was caused by earth current circulating through an unexpected earth loop in rectifier RF43. This caused the mal operation of the earth fault protection relay in the rectifier. 2. Bell Bay Aluminium conducted tests on the rectifier RF43 and removed the unexpected earth loop to ensure only a single earth loop was present. Bell Bay Aluminium have confirmed this action will reduce the risk of a re-occurrence of this incident. 3. The Tasmanian lower FCAS reduction scheme operated correctly in response to the rise of frequency above 50.90 Hz in Tasmania. 4. AEMO correctly identified there was no requirement to reclassify this incident as a credible contingency. 5. The power system remained in a secure operating state and the Frequency Operating Standard was met for this incident.

Figure 1 Tasmania frequency response during the incident on 1 January 2022



⁷ Please see <https://www.aemc.gov.au/sites/default/files/2020-01/Frequency%20operating%20standard%20-%20effective%201%20January%202020%20-%20TYPO%20corrected%2019DEC2019.PDF>.

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).