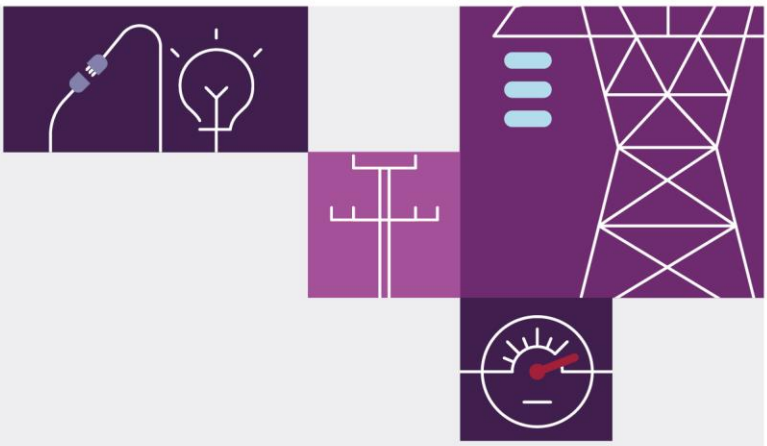
Trip of Kincraig – Penola West 132 kV line at Kincraig end only during planned switching of Kincraig No. 1 transformer on 17 October 2023

March 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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Abbreviations

Abbreviation	Term
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
CB	circuit breaker
CBF	circuit breaker fail
CBM	circuit breaker management
kV	kilovolt/s
MW	megawatt/s
NEM	National Electricity Market
NER	National Electricity Rules
PSSWG	Power System Security Working Group
SPAR	single phase auto reclose relay
TNSP	Transmission Network Service Provider

Incident review

This reviewable operating incident[1] 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 ElectraNet[2] and from AEMO systems.

Table 1 Summary of event

	Details
Reviewable operating incident type	Non credible contingency event impacting critical transmission elements[3]. The switching of the Kincraig No. 1 132/33/11 kV transformer and trip of the Kincraig – Penola West 132 kV line at the Kincraig end only is considered to be part of the same event.
Incident details	This report relates to a reviewable operating incident[4] that occurred on 17 October 2023 in South Australia. The incident involved the trip of Kincraig – Penola West 132 kilovolt (kV) line at the Kincraig end only, during planned switching of the Kincraig No. 1 132/33/11 kV transformer.
Incident classification	Cause unknown – suspected protection/control equipment maloperation.
Generation impact	No generation was lost as a result of this event.
Customer load impact	No customer load was tripped or automatically shed in response to this incident.
Pre-incident conditions	Prior to the event, switching for a planned outage of the Kincraig No. 1 132/33/11 kV transformer was in progress. The Kincraig – Penola West 132 kV line was in service and operating normally.
Incident key events	On 17 October 2023 the following events occurred: 1. At 0711.18 hrs the Kincraig circuit breaker (CB) 6140 was opened as part of the switching for the planned outage of the Kincraig No. 1 132/33/11 kV transformer. 2. At 0711.38 hrs the Kincraig CB 6141 was opened as part of the switching for the planned outage of the Kincraig No. 1 132/33/11 kV transformer. The Kincraig CB 6142 tripped unexpectedly, resulting in a trip of the Kincraig – Penola West 132 kV line at one end only (see Figure 1). 3. At 0835 hrs, ElectraNet identified that the Kincraig CB 6142 had tripped due to possible incorrect wiring installed during recent circuit breaker fail (CBF) protection work. ElectraNet isolated the trip circuits between CB 6141 CBF protection and CB 6142 CBF protection and advised AEMO that the non-credible event was unlikely to reoccur. 4. At 0845 hrs, the Kincraig – Penola West 132 kV line returned to service.
Incident cause	Post incident investigation by ElectraNet has confirmed that: • ElectraNet initially believed the cause of CB 6142 tripping was caused by a spurious direct intertrip signal received by the Kincraig – Penola West set 2 line protection relay. Further investigations determined this was unlikely to be the cause. • ElectraNet identified that prior to the incident, the protection and control circuits for the Kincraig No. 1 132/33/11 kV transformer were in a temporary arrangement, with a mix of old and new secondary equipment operating in parallel. Several temporary wiring bridges were installed to enable the new protection to interface with the old equipment, prior to the old equipment being removed. • ElectraNet confirmed the new CBF set 2 protection relays for CB 6141 and CB 6142 recorded a pulsing input/trigger at the time the control command to open CB 6141 was sent. The pulsing signal continued for several seconds following the trip of CB 6141 and CB 6142. ElectraNet suspects a possible maloperation of the single phase auto reclose (SPAR) relay controlling CB 6141. This type of relay has previously been

[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] ElectraNet is a Transmission Network Service Provider (TNSP) for South Australia.

[3] The Kincraig – Penola West 132 kV line and the Kincraig No. 1 132/33/11 kV transformer are classified as critical transmission elements for the purpose of identifying reviewable operating incidents, see https://www.aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/critical_transmission_elements_for_identifying_reviewable_operating_incidents.pdf?la=en&hash=A42E4D16528E629B2221F7657AD61B5B.

[4] 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.

	Details
	known to maloperate in the described manner. ElectraNet was unable to replicate the protection operation/pulsing input trigger during its investigation as the old protection relays (CBM and SPAR) for Kincraig No. 1 transformer, CB 6141 and CB 6142 were replaced with new equipment and the temporary wiring arrangement was removed. Therefore, ElectraNet were unable to establish a definitive root cause for this incident.
Power system response (facilities and services)	There was no other material impact on the broader power system, load or generation.
Rectification	ElectraNet has confirmed the old protection relays (transformer relay and SPAR) and temporary wiring bridges for the Kincraig No. 1 132/33/11 kV transformer, CB 6141 and CB 6142 have been removed and the new equipment has been successfully tested without further incident.
Power system security	The power system remained in a secure operating state throughout this incident and the Frequency Operating Standard[5] was met for this incident.
Reclassification	AEMO assessed whether to reclassify this incident as a credible contingency event[6]. Immediately following the incident, AEMO was advised by ElectraNet that the cause of this incident was identified (see Incident Cause above) and AEMO was satisfied that another occurrence of this event was unlikely under the current circumstances. Therefore, AEMO appropriately identified that reclassification was not required. AEMO was advised on 15 December 2023 the post incident investigation by ElectraNet was unable to determine a definitive root cause of the incident. However, as part of the planned works on 17 October 2023, the old protection relays (CBM and SPAR) for Kincraig No. 1 transformer, CB 6141 and CB 6142 were removed and replaced with new equipment which were tested without further incident. As such, AEMO appropriately applied the reclassification criteria and determined the reclassification criteria were not met based on the information available to AEMO at the time.
Market information	For this incident, AEMO issued the following market notices (all market notices for this incident were issued in accordance with NER requirements): • AEMO issued Market Notice 110288 at 0739 hrs on 17 October 2023 – advice of inter-regional transfer limit variation in South Australia involving the Kincraig – Penola West 132 kV line that was offloaded at one end only, during switching for a planned outage of the Kincraig No. 1 132/33/11 kV transformer. • AEMO issued Market Notice 110289 at 0825 hrs on 17 October 2023 – advice of a non-credible contingency event in South Australia involving the Kincraig – Penola West 132 kV line that was offloaded at one end only, during switching for a planned outage of the Kincraig No. 1 132/33 kV/11 transformer. • AEMO issued Market Notice 110291 at 0920 hrs on 17 October 2023 – providing an update that at 0845 hrs on 17 October 2023, the Kincraig – Penola West 132 kV line was returned to service, the cause had been identified and the event was unlikely to reoccur.
Conclusions	AEMO and ElectraNet have concluded that: 1. At 0711 hrs on 17 October 2023 the Kincraig CB 6141 was opened as part of the switching for the planned outage of the Kincraig No. 1 132/33/11 kV transformer. Kincraig CB 6142 tripped unexpectedly resulting in a trip of the Kincraig – Penola West 132 kV line at one end only. 2. ElectraNet suspect a possible maloperation of the SPAR relay controlling CB 6141. This type of relay has previously been known to maloperate in the described manner. However, a definitive root cause for this incident could not be established. 3. The old protection relays (CBM and SPAR) for Kincraig No. 1 transformer, CB 6141 and CB 6142 have been removed and replaced with new equipment which were tested without further incident. 4. The power system remained in a secure operating state and the Frequency Operating Standard was met throughout this incident.
Recommendations	AEMO recommends: 1. ElectraNet review other substations where the older-type SPAR relays are installed and assess the risk of similar relay maloperation occurring and advise AEMO if there is a potential impact to power system security. 2. ElectraNet to share the findings from this event with the Power System Security Working Group (PSSWG) by Q2 2024.

[5] Frequency Operating Standard, effective 9 October 2023, available at https://www.aemc.gov.au/media/87484.

[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 Post Incident diagram – Kincraig substation following the trip of the Kincraig – Penola West 132 kV line at the Kincraig end only during switching of Kincraig No. 1 132/33/11 kV transformer.