POWER SYSTEM INCIDENT REPORT

BUSHFIRES IN THE NSW REGION 28 NOVEMBER 2009

PREPARED BY: Electricity System Operations Planning and Performance

FINAL(v2.0)

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Version Release History

VERSION	DATE	BY	CHANGES
2.0	16/4/2010	ESOPP	Final Report amended to ensure that Tomago Aluminium Potlines are correctly referenced in the report. Also the legend in Figures 5 and 6 has been updated with correct descriptors.
1.0	26/3/2010	ESOPP	Final Report Published

1. Introduction

Extreme weather conditions on 28 November 2009 in the NSW resulted in around 60 bushfires including several in the vicinity of Newcastle.

Prior to the event the NSW demand was approximately 11280 MW and temperature recorded at Bankstown was 38^{o}C.

At 15:52 hours the 94 Newcastle -Tomago 330 kV transmission line tripped due to a bushfire in the vicinity. The transmission line auto-reclosed several seconds later, tripped again and locked out. The 960 and 961 Newcastle - Merewether 132 kV transmission lines (Energy Australia) also tripped at 15:54 hours interrupting supply to a number of sub-transmission substations. The bushfires had caused these transmission lines to trip. In addition Hydro Aluminium (Kurri) and Tomago Aluminium Company (TAC) potlines were interrupted.

This report has been prepared under clause 4.8.15 of the Rules 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 security.

Information for this report has been supplied to AEMO by TransGrid, Energy Australia, Hydro Aluminium (Kurri) and Tomago Aluminium Company (TAC). Data from AEMO's Energy Management System has also been used in analysing the event.

All references to time in this report refer to Market time (Australian Eastern Standard Time).

2. Summary of Events

Events that occurred on 28 November 2009 are summarised in chronological order and shown in Table 1.

TABLE 1 – 28 NOVEMBER 2009 EVENTS SHOWN IN CHRONOLOGICAL ORDER

TIME HRS	EVENT / ACTION
15:52	94 Newcastle – Tomago 330 kV transmission line tripped
15:53	94 Newcastle – Tomago 330 kV transmission line auto reclosed
15:53	94 Newcastle – Tomago 330 kV transmission line tripped and locked out
15:53	Hydro Aluminium (Kurri) No.1 Potline tripped from 107 MW
15:54	960 Newcastle - Merewether 132 kV transmission line tripped automatically
15:54	961 Newcastle - Merewether 132 kV transmission line tripped automatically
15:55	Hydro Aluminium (Kurri) No.2 Potline tripped from 105 MW
16:09	94 Newcastle – Tomago 330 kV transmission line energised

16:10	94 Newcastle – Tomago 330 kV transmission line placed on load (returned to service)
16:12	960 Newcastle - Merewether 132 kV transmission line was returned to service
16:12	961 Newcastle - Merewether 132 kV transmission line was returned to service
16:12	TAC Potline No.1 out of service, load reduction was approximately 280 MW
16:13	TAC Potline No.3 out of service, load reduction was approximately 285 MW
16:19	Whisper power system incident message issued
16:27	TAC Potline No.2 out of service, load reduction was approximately 280 MW
16:30	Hydro Aluminium (Kurri) No.1 Potline returned to service
16:40	Hydro Aluminium (Kurri) No.2 potline returned to service
16:49	Market Notice 29113 issued
16:49	All load that could be restored was in service
17:12	Market Notice 29115 update issued
17:13	96Z Newcastle-Maryland transmission line switched on load (this transmission line was out of service prior to the event)
17:48	TAC Potline No.3 returned to service
18:01	TAC Potline No.2 returned to service
18:19	TAC Potline No.1 returned to service

At 15:52 hours the Newcastle – Tomago 330 kV transmission line tripped, auto re-closed, tripped and locked out while bushfire activity was present in the area. A severe voltage depression was observed on 330 kV transmission network at Newcastle following the trip, auto-reclose and trip of 94 Newcastle – Tomago transmission line.

The transmission network configuration at Tomago 330 kV substation after the trip of 94 transmission line is shown in Figure 1. Note Tomago Aluminium Load Block 4 (Auxiliary Load) was out of service prior to the event. Transmission arrangements at Newcastle 330 kV are shown in Figure 3.

Hydro Aluminium (Kurri) Potline No.1 tripped at 15:53 hours from approximately 107 MW (refer to Figure 2).

The Newcastle – Merewether 132 kV transmission lines 960 and 961 tripped soon afterwards at 15:54 hours with no auto reclose attempt. Bushfires were present under the transmission lines. The outage of 960 and 961 transmission lines interrupted supply to Argenton and Merewether sub-transmission substations in the area, disconnecting approximately 243 MW of customer load. Figure 3 shows the relevant transmission network arrangements at Newcastle 330 kV and 132 kV substations.

Hydro Aluminium (Kurri) No.2 potline tripped at 15:55 hours disconnecting approximately 105 MW of load (refer to Figure 2). A total of approximately 450 MW of load was disconnected by 15:55 hours.

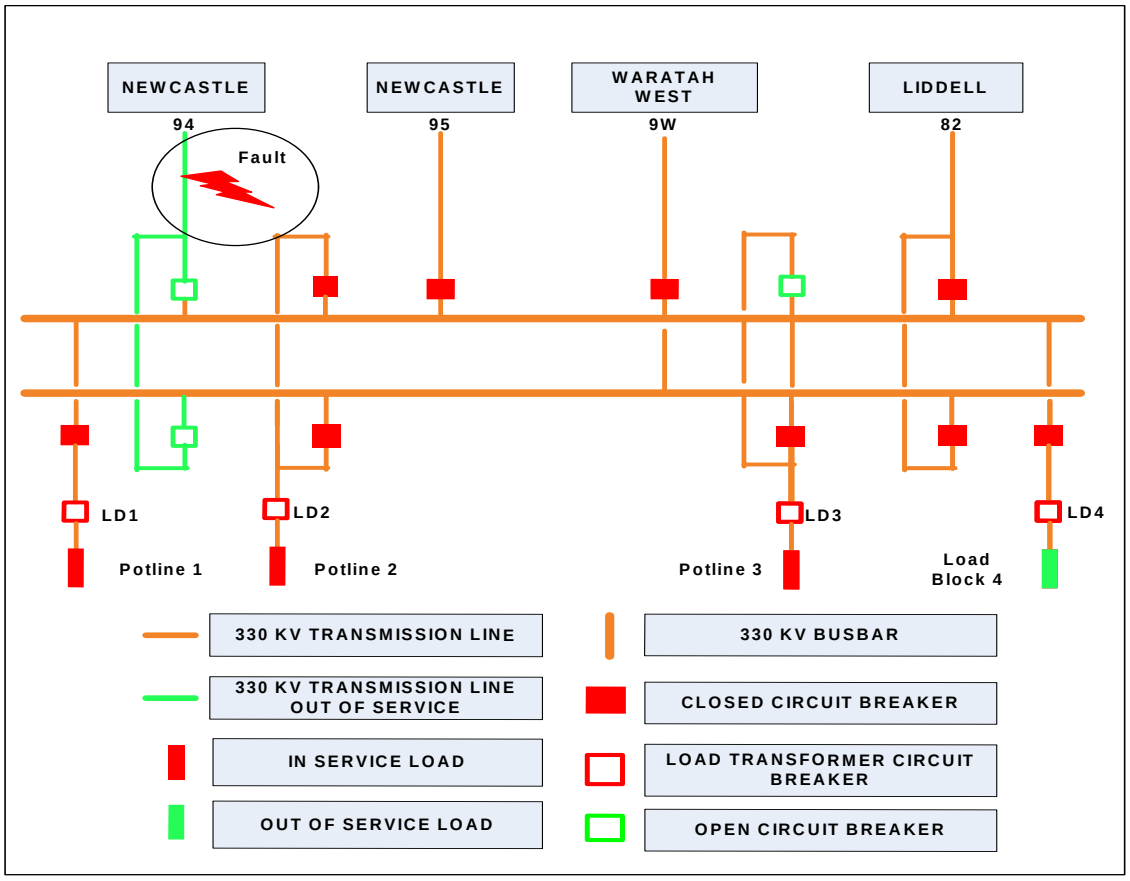

FIGURE 1: RELEVANT TRANSMISSION NETWORK CONFIGURATION AT TOMAGO 330 KV SUBSTATION AFTER BUSHFIRES TRIPPED 94 TRANSMISSION LINE

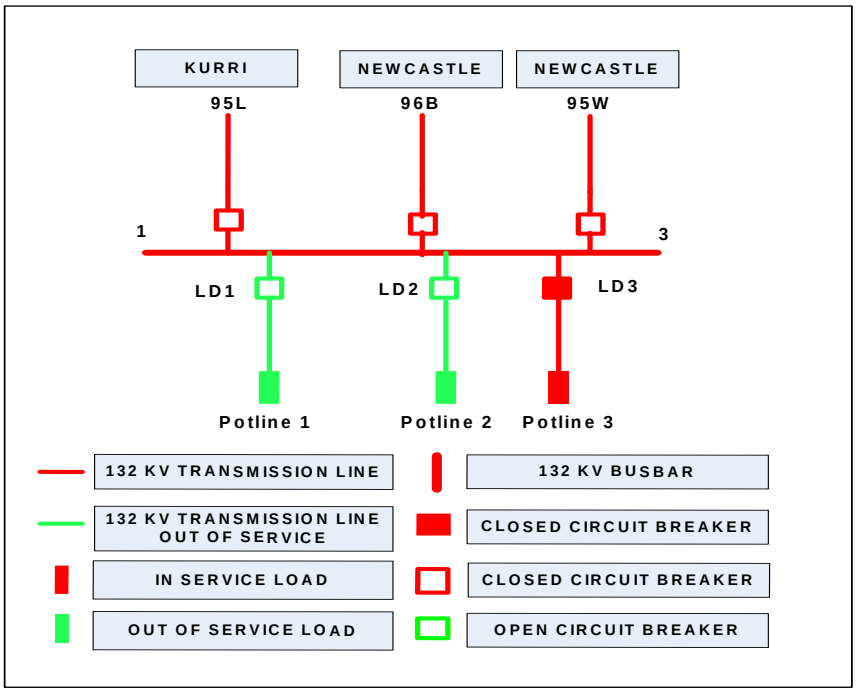

FIGURE 2: RELEVANT TRANSMISSION NETWORK CONFIGURATION AT HYDRO ALUMINIUM (KURRI) 132 KV SUBSTATION AFTER POTLINES 1 AND 3 TRIPPED OUT OF SERVICE

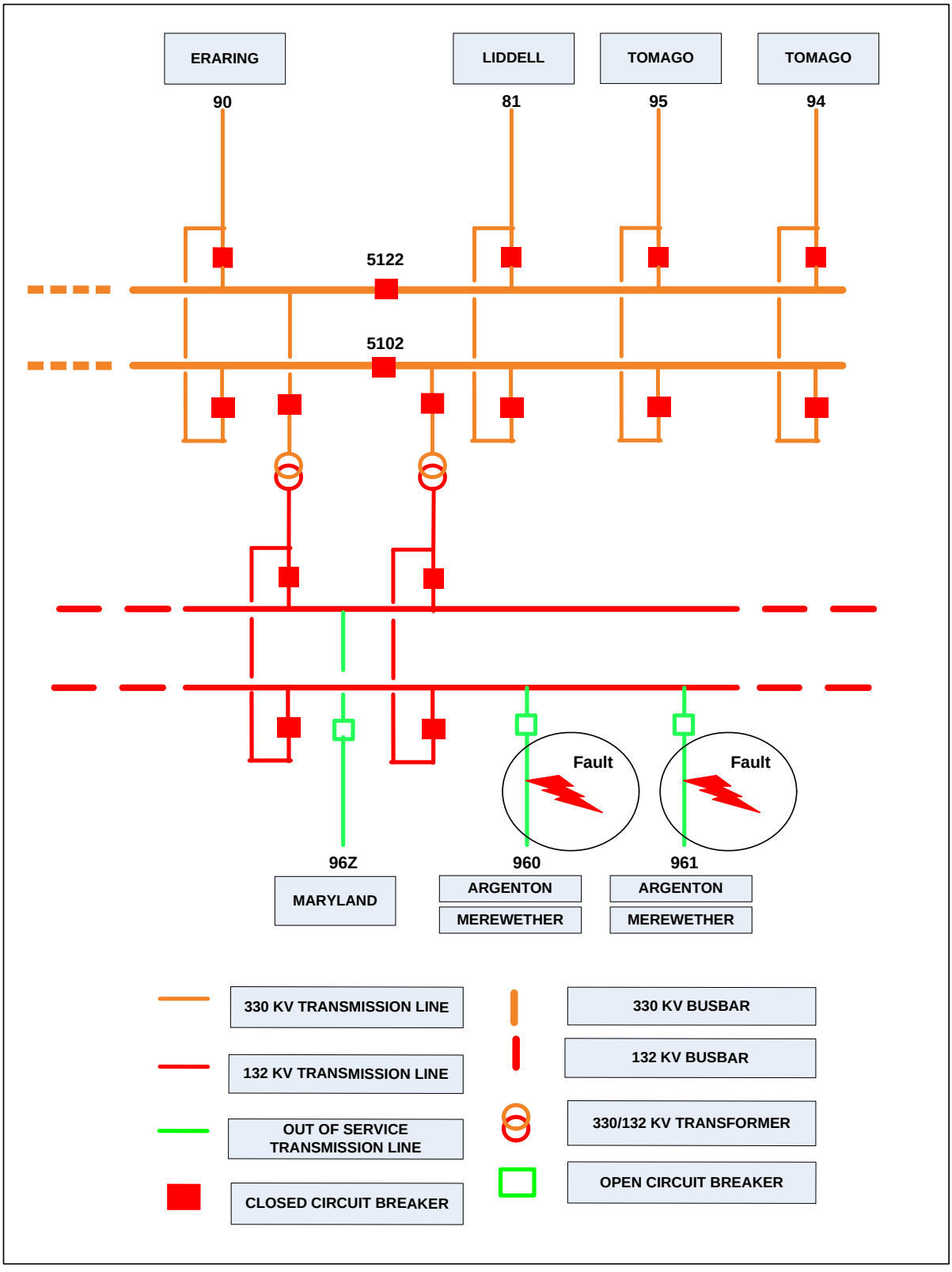

FIGURE 3: RELEVANT TRANSMISSION NETWORK CONFIGURATION AT NEWCASTLE 330 KV AND 132 KV SUBSTATIONS AFTER BUSHFIRES TRIPPED 961 AND 960 TRANSMISSION LINES

Hydro Aluminium (Kurri) advised that Potlines 1 and 2 tripped due to voltage fluctuation on the transmission network at the time of the event causing a phase failure protection relay on the 415V supply to the rectifiers of both potlines to operate causing the potlines to trip.

At 16:08 hours AEMO control room was informed by TransGrid that TAC had an air supply problem and it was likely that all three potlines that were in service at the time would have to come out of service.

TAC confirmed after the event that a voltage depression on the 330 kV transmission network, which occurred at the time of the trip of 94 Tomago-Newcastle 330 kV transmission line caused operational problems with compressor plant resulting in air supply pressure to fall to low levels requiring manual shutdown of the potlines.

At 16:10 hours 94 Newcastle – Tomago 330 kV transmission line was returned to service after the bush fire had passed through the area.

At 16:10 hours TAC potlines commenced coming out of service. The potline No.1 was offloaded from approximately 290 MW to only 10 MW by 16:12 hours.

At 16:12 hours Energy Australia returned 960 and 961 transmission lines into service.

At 16:13 hours the TAC potline 3 was shutdown from approximately 285 MW. TAC Potline 2 commenced coming out of service at 16:24 hours reducing from 280 MW to just 4 MW at 16:27 hours. By 16:27 hours all three Tomago potlines, approximately 840 MW in total, were shutdown. Figure 4 shows all Tomago potlines out of service.

By 18:19 hours all load had been returned to service.

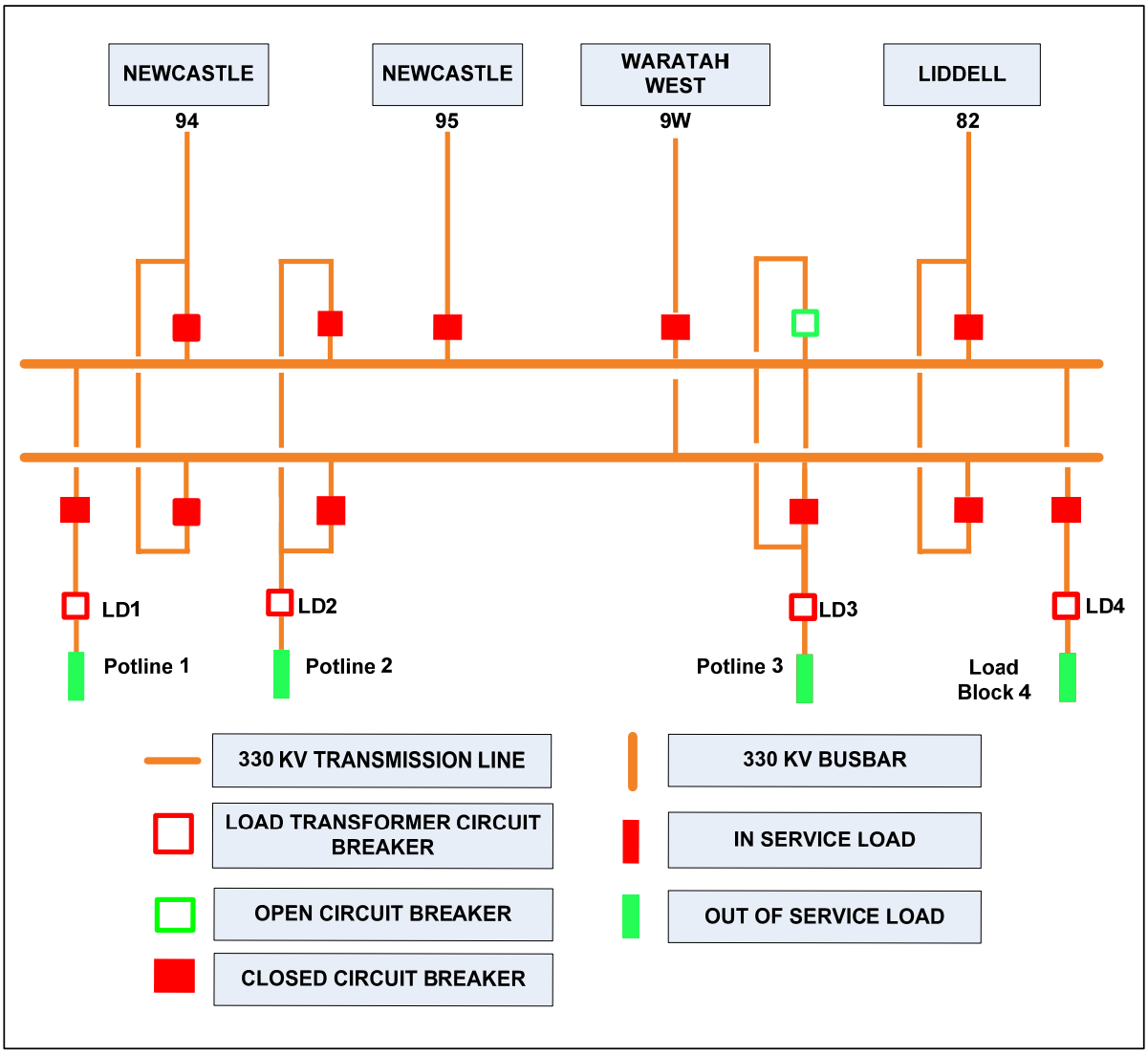

FIGURE 4: RELEVANT TRANSMISSION NETWORK CONFIGURATION AT TOMAGO 330 KV SUBSTATION, TAC POTLINES SHOWN OUT OF SERVICE AND 94 LINE HAD BEEN RETURNED TO SERVICE

3. Power System Security Assessment

The power system remained in a secure operating state during this event on 28 November 2009.

Protection systems operated correctly to disconnect the three transmission lines that were affected by the bushfires.

Following the loss of Newcastle to Merewether lines (shown in Figure 5) the disconnection of customer load supplied from Argenton/Merewether substations and disconnection of Hydro Aluminium (Kurri) potlines the power system frequency progressively increased to a maximum of 50.18 Hz at 15:55:20 hours. Power system frequency remained outside the

normal operating frequency band for 64 seconds however the frequency remained well within the frequency operating standards for a multiple contingency event.

Power system frequency again progressively increased to 50.16 Hz at 16:15:04 hours following the manual shutdown of Tomago Potlines (shown in Figure 6). The frequency remained outside the normal operating frequency band for 16 seconds however the frequency remained well within the frequency operating standards for a multiple contingency event.

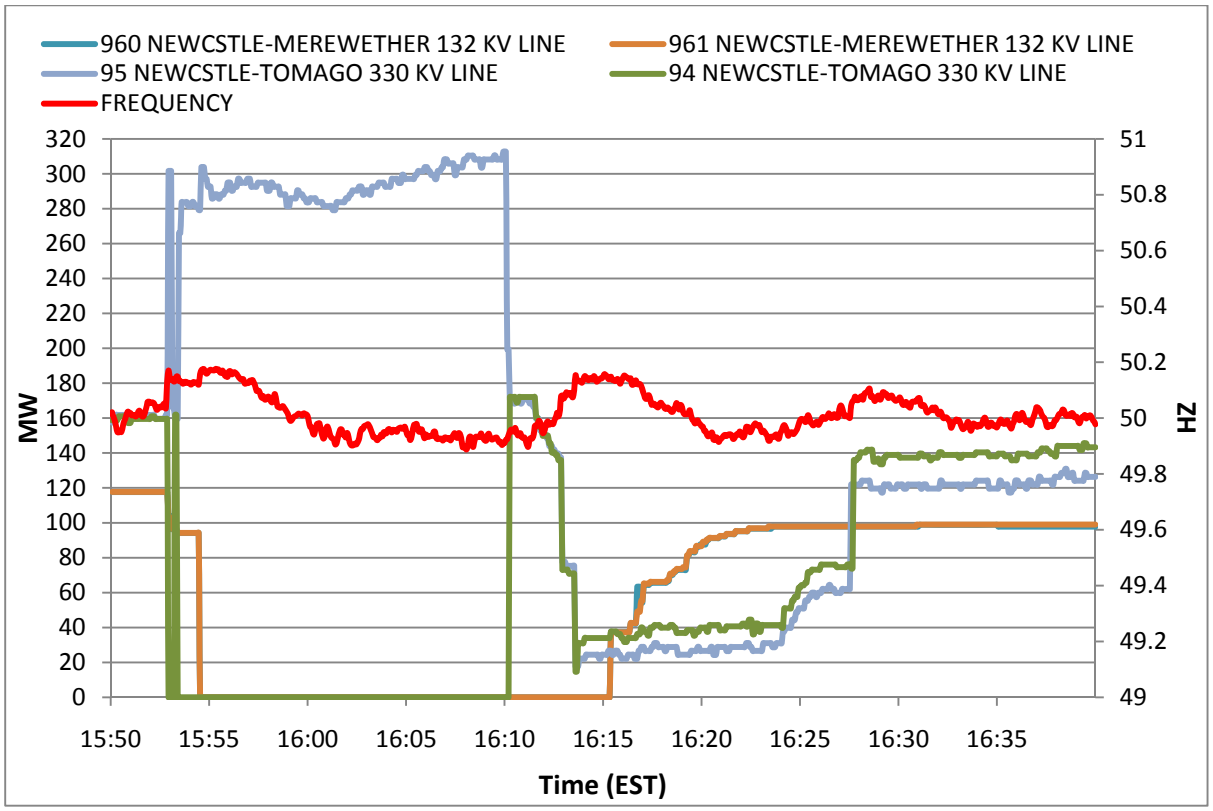

FIGURE 5: POWER FLOW ON NEWCASTLE - TOMAGO 330 KV AND NEWCASTLE-MEREWETHER 132 KV TRANSMISSION LINES [MW] AND THE POWER SYSTEM FREQUENCY [HZ]

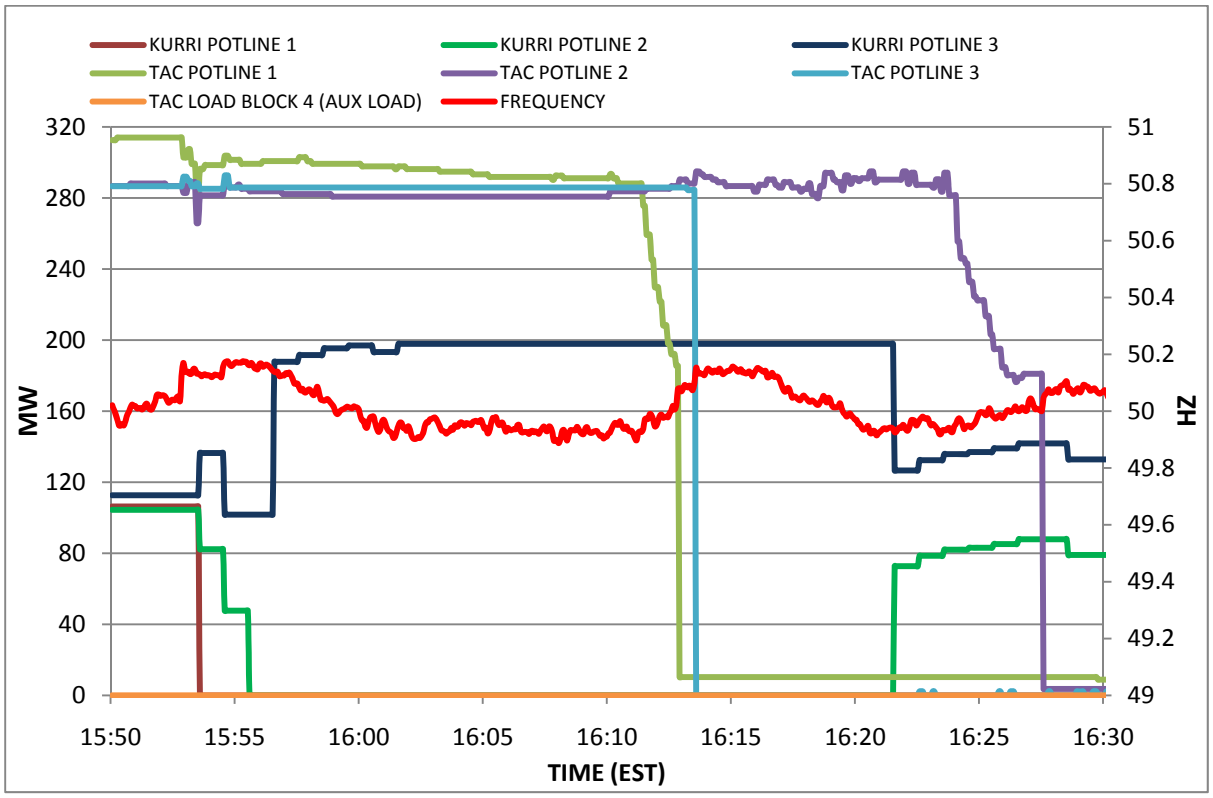

FIGURE 6: HYDRO ALUMINIUM (KURRI) AND TAC POTLINES LOAD [MW] AND THE POWER SYSTEM FREQUENCY [HZ]

4. Follow up Actions

AEMO issued a Market Notice and Whisper message advising of the occurrence of the power system incident in NSW region.

Energy Australia advised that supply interruption to Argenton and Merewether sub-transmission substations was restored 22 minutes after the trip of Newcastle-Merewether 132 kV transmission lines.

Hydro Aluminium (Kurri) potlines were restored at 16:40 hours.

At 18:19 hours all Tomago Aluminium potlines have been returned to service.

5. Conclusion

On the 28 November 2009, severe weather conditions caused bushfires and subsequent tripping of 3 major transmission lines in NSW region. As a result of the trip of 960 and 961 Newcastle to Merewether 132 kV transmission lines 243 MW of load supplied from Argenton/Merewether sub-transmission substations was interrupted.

The Hydro aluminium (Kurri) Potlines 1 and 2 were also disconnected, one prior to tripping of 960 and 961 lines and the other soon after the lines tripped. Approximately 400 MW of load was disconnected by 15:55 hours.

TAC potlines were manually shutdown following the voltage depression that occurred at the time of the trip, auto-reclose, trip and lockout of 94 Tomago – Newcastle 330 kV transmission line. The potlines commenced shutdown at 16:10 hours. By 16:27 all TAC potlines were shutdown, disconnecting approximately 840 MW of load. Due to the controlled manner in which these potlines were shutdown the power system frequency remained within the frequency operating standards.

Interruption to Argenton/Merewether substations lasted for 22 minutes.

Hydro Aluminium (Kurri) Potlines were restored to service by 16:40 hours and TAC potlines returned to service by 18:19 hours.