AUSTRALIAN ENERGY MARKET COMMISSION

Reliability Panel

System operating incidents guidelines

Final Determination

September 2006

ISBN 0975800707

Reliability Panel Members

The Panel's Members represent all sectors of the electricity industry. As of 1 January 2006, the Panel comprises the following members:

Ian Woodward	Chairman (AEMC Commissioner)
Jeff Dimery	General Manager Victoria, AGL (market customers)
Mark Grenning	General Manager Energy, Comalco Aluminium
Les Hosking	Managing Director and CEO, NEMMCO
Gordon Jardine	Chief Executive, Powerlink (TNSPs)
George Maltabarow	Managing Director, EnergyAustralia (DNSPs)
Stephen Orr	Commercial Director, International Power Australia (generators)
Jim Wellsmore	Senior Policy Officer, Public Interest Advocacy Centre (end use customers)
Geoff Willis	Former CEO, Hydro Tasmania.

Contents

Executive Summary

Following the making of the National Electricity Amendment (Timely Information to NEMMCO after Operating Incidents) Rule 2006 No. 3, clause 8.8.1(a)(9) of the National Electricity Rules (Rules) requires the AEMC Reliability Panel (Panel) to prepare a set of guidelines for determining which incidents the National Electricity Market Management Company (NEMMCO) should investigate under clause 4.8.15(b) of the Rules.

The Panel formed a technical reference group (TRG) to assist it in preparing a set of draft guidelines. The guidelines provide clarification in respect of the five criteria in clause 4.8.15(a)(1) for determining if an incident is significant, and hence reviewable, and to determine whether any additional criteria are needed under clause 4.8.15(a)(3).

The Panel published the draft guidelines for consultation in accordance with clause 8.8.3 of the National Electricity Rules (Rules) on 24 July 2006. Submissions on the draft guidelines closed on 8 September 2006.

The Panel also offered to hold a meeting open to all Registered Participants on its draft guidelines. The Panel did not receive any requests to attend this public meeting by the close of registrations on 1 September 2006 and, therefore, did not hold the meeting.

The Panel received submissions from NEMMCO and the National Generators Forum (NGF). These submissions are available on the AEMC website (www.aemc.gov.au). The Panel considered the submissions when finalising these guidelines. Appendix 3 sets out the final guidelines.

1. Introduction

1.1. Background

Under 4.8.15(b) of the Rules NEMMCO must conduct a review of every "reviewable operating incident" in order to assess the nature of the incident, the adequacy of the provision and response of facilities or services, and the appropriateness of the actions taken in restoring or maintaining power system security. NEMMCO is then required, under clause 4.8.15(c), to publish a report on its review.

On 2 February 2006 the AEMC made the National Electricity Amendment (Timely Information to NEMMCO after Operating Incidents) Rule 2006 No.3[1]. The primary purpose of this Rule was to require participants to provide NEMMCO with the information necessary to complete its review in a timely manner. The AEMC noted in its Rule Determination for this Rule that the Rules did not give NEMMCO clear guidance as to which incidents should be investigated.

The information gained from reviewing a range of operating incidents can lead to improvements to the reliability and security of the power system. Reviews also impose costs on market participants, both through requirements for participants to take part in reviews and through costs to NEMMCO to conduct them, which are eventually passed onto participants. The AEMC considered that more transparent criteria for determining which incidents should be reviewed would provide greater certainty to the market as to where the balance lies between these two considerations. Therefore, in its Rule Determination the AEMC incorporated criteria into the Rules for specifying which operating incidents should be reviewed and gave the Reliability Panel (Panel) the responsibility for preparing guidelines for applying these criteria.

The relevant clauses of the Rules are now as follows:

- clause 8.8.1(a)(9) requires the Panel to:

  determine guidelines identifying or providing for the identification of operating incidents and other incidents that are of significance for the purposes of the definitions of "reviewable operating incidents" in clause 4.8.15;

- clause 4.8.15(a) defines a reviewable operating incident as:

  (1) an incident comprising:

  (i) a non-credible contingency event or multiple contingency events on the transmission system; or

  (ii) a black system condition; or

  (iii) an event where power system frequency is outside limits specified in the power system security and reliability standards; or

  (iv) an event where the power system is not in a secure operating state for more than 30 minutes; or

  (v) an event where NEMMCO issues a clause 4.8.9 instruction for load shedding,

1 The National Electricity Amendment (Timely Information to NEMMCO after Operating Incidents) Rule 2006 No 3 is available on the AEMC website at http://www.aemc.gov.au/.

being an incident identified, in accordance with guidelines determined by the Reliability Panel under clause 8.8, to be of significance to the operation of the power system or a significant deviation from normal operating conditions; or

(2) an incident where NEMMCO has been responsible for the disconnection of facilities of a Registered Participant under the circumstances described in clause 5.9.5; or

(3) any other operating incident identified, in accordance with guidelines determined by the Reliability Panel under clause 8.8, to be of significance to the operation of the power system or a significant deviation from normal operating conditions,

but does not include an incident in respect of which NEMMCO is required to conduct a review under clause 3.14.3(c)[2]; and

- clause 4.8.15(b) specifies that:

  NEMMCO must conduct a review of every reviewable operating incident in order to assess the adequacy of the provision and response of facilities or services, and the appropriateness of actions taken to restore or maintain power system security.

- clause 8.8.3(a)(4) requires the Panel to determine the guidelines in accordance with clause 8.8.3 as soon as is practicable.

1.2. System operating incidents guidelines reference group

The Panel formed a technical reference group (TRG) to assist it to prepare draft guidelines for consultation. The TRG's terms of reference appear in Appendix 1, with a list of members in Appendix 2. The TRG was chaired by Jeff Dimery, the retail representative on the Panel.

[2] Clause 3.14.3(c) specifies that NEMMCO must conduct a review of each occasion when it suspends the spot market.

2. Consultation process

The Panel is required to follow the process set out in clause 8.8.3 of the Rules when making its determination. The Panel made its determination on the final guidelines according to the following timetable:

Date	Step
24 July 2006	Panel issues a consultation notice, publishes the draft guidelines and invites written submissions.
8 September 2006	Submissions close
28 September 2006	Panel makes its determination

The Panel also offered to hold a meeting open to all Registered Participants on its draft guidelines. This was scheduled for 22 September 2006. The Panel did not receive any requests to attend this public meeting by the close of registrations on 1 September 2006 and, therefore, did not hold the meeting.

The Panel received submissions from NEMMCO and the National Generators Forum (NGF). These submissions are available at the AEMC website (www.aemc.gov.au). The Panel considered the submissions and finalised these guidelines on 28 September 2006. Appendix 3 sets out the final guidelines.

3. Issues, options and recommendations

The Panel's guidelines for identifying reviewable operating incidents need to consider whether:

- the five criteria in Rules clause 4.8.15(a)(1) need to be clarified or expanded; and
- any additional criteria need to be added under clause 4.8.15(a)(3).

This section sets out the Panel's views on each of these issues.

3.1. Non-credible and multiple contingencies

Clause 4.8.15(a)(1)(i) of the Rules provides that a reviewable operating incident includes "a non-credible contingency event or multiple contingency events on the transmission system".

Detailed definitions of credible and non-credible contingencies are provided in clauses 4.2.3(b) and (e), respectively. In short:

- a credible contingency is an event that NEMMCO considers is reasonably possible to occur, for example the forced outage of a single network element or generating unit; while
- a non-credible contingency is an event that NEMMCO considers is unlikely to occur, such as multiple contingencies or three phase faults on the power system.

Multiple contingencies are not defined in the Rules. In its draft guidelines, the Panel considered that a suitable definition of a multiple contingency is when:

- one or more contingencies (credible or non-credible) occur within 30 minutes of each other and the residual impact of an earlier contingency interacts with a later contingency; and
- the total capacity of affected generating units exceeds the largest unit size in any of the regions that includes one or more of the affected generating units.

The Panel also considered that the definition of non-credible or multiple contingency events on the transmission system should include inappropriate operation of transmission elements. Also the definitions should extend to incidents on the distribution network that affect system security, for example prolonged faults on the distribution system that constitute a threat to the security of the transmission system.

In its submission NEMMCO suggested that:

- "inappropriate operation" should include both automatic and manual operation; and
- the requirement for the total capacity of affected generating units exceeding the largest unit size should only apply to distribution connected units.

The Panel agreed and has included these changes in the guidelines.

3.2. Black system condition

The definition of a reviewable operating incident in clause 4.8.15(a)(1)(ii) includes "a black system condition".

The Panel considers that a system black condition is a very significant deviation from normal operation and that all such events should be investigated. The Glossary in Chapter 10 of the Rules defines a black system as:

> the absence of voltage on all or a significant part of a transmission system or within a region, following a major supply disruption affecting one or more power stations and a significant number of customers.

In its operating procedure for power system emergencies[3], NEMMCO interprets "a significant part of a transmission system or within a region" as 60% of predicted regional load, except in the case of:

- regions with minimal load (for example the Snowy region); and
- the Queensland region, where the loss of 60% of the load (excluding the pot line loads) in any of the Northern Queensland, Central Queensland or Southern Queensland areas is considered to be a black system condition.

The Panel could find no reason for the guidelines to adopt a different definition of black system condition than that used by NEMMCO. In any event, a system operating incident that satisfies a reasonable definition of a black system condition would be investigated by NEMMCO as it would either result from a non-credible or multiple contingency or from the power system being operated in an insecure state.

The principle of aligning the definition of black system used in these guidelines with that used by NEMMCO was supported by the submission from NEMMCO, subject to some rewording for clarity proposed in that.

The Panel has therefore incorporated NEMMCO's definition of a black system condition in these guidelines.

3.3. Performance against the frequency standards

The definition of a reviewable operating incident in clause 4.8.15(a)(1)(iii) includes "an event where power system frequency is outside limits specified in the power system security and reliability standards". Operating the power system outside the limits specified in the frequency standards puts the power system at a greater risk of becoming insecure or unsatisfactory following a contingency.

The Panel notes that NEMMCO currently prepares a monthly report on the performance of the power system against the NEM frequency standards[4]. NEMMCO considers that monthly reporting is efficient and suited to capturing trends, especially in the case of regulation frequency control ancillary services (FCAS), which are statistical in nature. NEMMCO's monthly reports identify the circumstance of each event where the power system frequency deviated outside the frequency standards. The Panel agrees that the monthly reports prepared by NEMMCO provide

3 NEMMCO Operating Procedure "Failure of Market or Market Systems Document Number: SO_OP3706", 15 May 2006, available at http://www.nemmco.com.au/powersystemops/so_op3706v021.pdf.

4 The NEMMCO monthly reports "Frequency & Time Deviation Monitoring in the NEM" are available on its website at http://www.nemmco.com.au/powersystemops/powersystemops.htm, under the heading "Power System Performance Monitoring".

a suitable summary of the performance of the power system for small deviations in the power system frequency and these events do not need to be individual investigated.

However, the Panel considers that incidents where the frequency is outside the operational frequency tolerance band (currently set by the Panel at 49 to 51 Hz on the mainland[5] and 47.5 to 53 Hz in Tasmania[6]) should be investigated as these circumstances represent a significant increase in the risk to power system security.

3.4. Incidents where the power system is insecure for more than 30 minutes

The definition of a reviewable operating incident in Rules clause 4.8.15(a)(1)(iv) includes "an event where the power system is not in a secure operating state for more than 30 minutes".

When the power system is operating in an insecure state it is possible that a single credible contingency could lead to a major power system incident, potentially with a significant loss of load and possible damage to power system plant. This risk to the operation of the power system is managed in clause 4.2.6(b) which requires that:

> Following a contingency event (whether or not a credible contingency event) or a significant change in power system conditions, NEMMCO should take all reasonable actions:
>
> (1) to adjust, wherever possible, the operating conditions with a view to returning the power system to a secure operating state as soon as it is practical to do so, and, in any event, within thirty minutes;
>
> (2) if any principles and guidelines have been published under clause 8.8.1(a)(2a), to adjust, wherever possible, the operating conditions, in accordance with such principles and guidelines, with a view to returning the power system to a secure operating state within at most thirty minutes.

The Panel considers that any incident where the system was in an insecure state for more than 30 minutes should be investigated because it represents a significant risk to power system security. The Panel does not consider that this clause requires further clarification.

3.5. NEMMCO load shedding instructions

The definition of a reviewable operating incident in Rules clause 4.8.15(a)(1)(v) includes "an event where NEMMCO issues a clause 4.8.9 instruction for load shedding".

A clause 4.8.9 instruction for load shedding is an instruction by NEMMCO to a Registered Participant requiring it to shed load if NEMMCO is satisfied that it is necessary to do so to maintain or re-establish the power system to a secure or satisfactory operating state or for public safety.

In addition to a clause 4.8.9 instruction, automatic under frequency load shedding is also a form of involuntary load shedding. The Panel considers that any event that leads to involuntary load shedding should be investigated to determine its cause and what, if any, actions can be taken to avoid similar events in the future. Therefore the Panel considers that the guidelines should

5 The Reliability Panel's determination on the frequency standards, September 2001, applies on the mainland of the NEM and is available on the NECA website at www.neca.com.au.

6 The Tasmanian frequency standard was determined by the Panel in May 2006 and is available on the AEMC website www.aemc.gov.au.

identify incidents that result in automatic under frequency load shedding as reviewable operating incidents.

The Panel also considers that incidents that result in the tripping of generating units due to over frequency should also be classified as reviewable operating incidents, in the same way that it is proposing that automatic load shedding events should be reviewed.

The Panel notes that, under the reliability safety net provisions in clause 3.12.1, NEMMCO can contract for additional capacity at time of low projected reserves, and that in general these reserves have been in the form of contracts with major end use customers for load reduction. Rules clause 3.13.6(a) requires NEMMCO to report the circumstances whenever it dispatches contracted reserves under clause 4.8.6. The Panel considers that, while the dispatch of contract reserves by NEMMCO is a significant event for the market, it is not a significant power system operating event. The Panel therefore considers that the reporting requirements of clause 3.13.6(a) are sufficient and that it is not necessary to classify such an event as reviewable unless it meets one of the other criteria in clause 4.8.15(a) or these guidelines.

3.6. Additional criteria for identifying reviewable operating incidents

In addition to the five criteria in Rules clause 4.8.15 (a)(1), the Panel considered whether other criteria need to be included in the guidelines under clause 4.8.15(a)(3). To this end the Panel added the following two criteria for identifying reviewable operating incidents:

- the system not being in a satisfactory operating state for more than 5 minutes; and
- NEMMCO's steady state monitoring systems detecting a potential instability for 30 minutes, continuously.

NEMMCO is required under the Rules to operate the power system in a secure operating state[7], that is, able to withstand a credible contingency. Therefore, the Panel considers that whenever the power system is not in a satisfactory operating state[8], that is, all power system equipment is operating within its rating, this should be investigated. This is because such a state would occur following a multiple contingency or when NEMMCO or a Market Participant has failed to meet their obligations with regard to system security under Chapter 4 of the Rules. The Panel considers that incidents should only be investigated where the power system is unsatisfactory for more than 5 minutes. This would prevent unnecessary investigations when the system is in an unsatisfactory state during the transients following an incident on the power system.

NEMMCO operates a number of systems that monitor the stability of the power system. These systems include a dynamic stability analysis tool that tests the transient stability of the system for a set of credible contingencies and steady analysis tools that monitor the damping of the power system. The Panel considers that incidents where these NEMMCO analysis tools detect an apparent instability should also be investigated under clause 4.8.15 where the instability persists for 30 minutes. The Panel does not suggest investigating apparent instabilities that do not persist for 30 minutes to allow NEMMCO sufficient time to investigate whether its analysis tools are operating correctly and to remove the effects of noise and transients in the measurements of system damping.

3.7. Ad hoc requests from the Panel

While the Panel has attempted to develop a comprehensive set of guidelines it considers that identifying all possible system incidents that should be investigated is not possible in advance of

7 The definition of a secure operating state is in Rules clauses 4.2.4.
8 The definition of a satisfactory operating state is in Rules clauses 4.2.2.

the incidents taking place. Therefore, the Panel has included a provision in the draft guidelines to allow it to request NEMMCO to investigate an incident on an ad hoc basis where the guidelines do not classify an incident as reviewable but where the Panel considers that there could potentially be positive net benefits to the NEM if NEMMCO reviewed the incident.

When deciding whether to request NEMMCO to perform an ad hoc investigation, the Panel intends to consider whether:

- the incident represented a threat to system security; and
- the benefits to the NEM are likely to exceed the cost to NEMMCO and the affected participants.

The Panel considers that the following parties should be able to apply to the Panel for it to request NEMMCO to investigate an incident:

- a Registered Participant, or group of Registered Participants;
- a participating jurisdiction, or group of participating jurisdictions; or
- NEMMCO (for clarification).

This provision in the guidelines was supported by both the NEMMCO and the NGF submissions.

Appendix 1 Terms of reference

The Panel directed the TRG to develop guidelines that:

- meet the requirements on the Panel contained in clause 8.8.1(a)(9);
- identify what operating incidents should be reviewed under clause 4.8.15(a)(3), including consideration whether investigating routine contingencies, near misses and repeated forced equipment outages would be appropriate and taking into account the cost of performing reviews of operating incidents against the potential to reduce the risks to the operation of the NEM power system; and
- consider the need for a provision for the Panel to request that NEMMCO review specific operating incidents on an ad hoc basis when the Panel considers that the review would be valuable but the incident is not otherwise captured by the guidelines.

The TRG should deliver recommended guidelines, including their rationale, in a form suitable for release as a consultation paper to the Panel for approval prior their 30 June 2006 meeting.

The Panel may request further assistance from the reference group during, or immediately following, the consultation process.

Appendix 2 Technical reference group membership

The TRG comprises the following members:

- Jeff Dimery (AGL - chair)
- Mark Miller (NEMMCO – representing the system operator)
- Ben Skinner (TRUenergy - representing generators)
- Chrys Chandraraj (AGL - representing retailers)
- Greg Hesse (Powerlink - representing TNSPs)
- Mike Winspear (EnergyAustralia - representing DNSPs)
- Julian Eggleston (AEMC - secretariat)

Appendix 3 Guidelines

AEMC Reliability Panel

Guidelines for identifying reviewable operating incidents

When determining whether a power system operating incident is of significance under clause 4.8.15(a), and hence reviewable, NEMMCO should apply the following guidelines:

1. Under clause 4.8.15(a)(1)(i): Apply the definition of a non-credible contingency in clause 4.2.3 and define a multiple contingency event as reviewable when the events, including any inappropriate automatic or manual operation of a transmission element, occur within 30 minutes of each other and the residual impact of an earlier contingency interacts with a later contingency.
2. Under clause 4.8.15(a)(1)(ii): Apply the definition of "black system" in Chapter 10 of the Rules. For this purpose a major supply disruption affecting a significant number of customers is considered as one resulting in loss of at least 60% of the predicted regional load with the exception of:
    - regions with minimal load (for example the Snowy region): and
    - the Queensland region, where the loss of 60% of the load (excluding the pot line loads) in any of the Northern Queensland, Central Queensland or Southern Queensland areas is also considered to be a major supply disruption.
3. Under clause 4.8.15(a)(1)(iii): Define as reviewable all incidents where the frequency is outside the operational frequency tolerance band (currently set by the Panel at 49 to 51 Hz on the mainland and 47.5 to 53 Hz in Tasmania).
4. Under clause 4.8.15(a)(1)(iv): Define all incidents where the power system is insecure for more than 30 minutes as reviewable operating incidents.
5. Under clause 4.8.15(a)(1)(v): Define all incidents where there is load shedding due to a clause 4.8.9 instruction as reviewable operating incidents.
6. Under clause 4.8.15(a)(3): A reviewable operating incident includes incidents that satisfy one or more of the following descriptions:
    (a) the power system is not in a satisfactory operating state for more than 5 minutes (excluding issues resulted to potential oscillatory or transient stability);
    (b) NEMMCO's on-line oscillatory and transient stability monitoring systems detecting a potential instability for 30 minutes, continuously;
    (c) incidents on a distribution network that affect the security of the transmission system including:
        - faults of extended duration within the distribution network where these have had a material impact on the transmission system; and
        - loss of multiple embedded generating units the total capacity of which exceeds the capacity of the largest generating unit within any region including an affected generating unit;
    (d) incidents that result in the operation of under frequency or over-frequency protection and control schemes including:
        - automatic under frequency load shedding; and

- automatic tripping of a generating unit due to over-frequency; or

(e) where the AEMC Reliability Panel requests NEMMCO to review and report on an incident under clauses 4.8.15(b) and (c)[9], after considering whether:

- the incident represented a threat to system security; and
- the benefits to the NEM are likely to exceed the cost to NEMMCO and the affected participants.

[9] The Panel considers that the following parties should be able to apply to the Panel for it to request NEMMCO to investigate an incident:
- a registered participant, or group of registered participants;
- a participating jurisdiction, or group of participating jurisdictions; or
- NEMMCO (for clarification).