

WEM PROCEDURE: CREDIBLE CONTINGENCY EVENTS

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VERSION RELEASE HISTORY

Version	Effective Date	Summary of Changes
0.1	18 January 2021	Initial draft for consultation.

IMPORTANT NOTICE - EXPLANATORY NOTES

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CONTENTS

1.	INTROD	UCTION	4
1.1.	Purpose	and scope	4
1.2.	Definitic	ns	4
1.3.	Interpre	tation	4
1.4.	Related	documents	5
2.	CONTIN	IGENCY EVENT FRAMEWORK	5
2.1.	Process	for Determination and Classification of Credible Contingency Events	5
2.2.	Non-cre	dible Contingency Event Reclassification Process	8
2.3.	Notificat	tion of Reclassification	9
APPE	NDIX A.	RELEVANT CLAUSES OF THE WEM RULES	10
APPE	NDIX B.	INDEPENDENT LIKELIHOOD ASSESSMENTS FOR RECLASSIFICATION	11

TABLES

Table 1	Definitions	4
Table 2	Related documents	5
Table 3	Power System Elements	6
Table 4	Relevant clauses of the WEM Rules	



1. INTRODUCTION

1.1. Purpose and scope

- 1.1.1. This WEM Procedure: Credible Contingency Events (Procedure) is made in accordance with AEMO's functions under clause 2.1A.2(h) of the Wholesale Electricity Market Rules (WEM Rules).
- 1.1.2. The *Electricity Industry Act 2004*, the WEM Regulations and the WEM Rules prevail over this Procedure to the extent of any inconsistency.
- 1.1.3. In this Procedure, where obligations are conferred on a Rule Participant, that Rule Participant must comply with the relevant obligations in accordance with clause 2.9.7A or 2.9.8 of the WEM Rules, as applicable.
- 1.1.4. The purpose of this Procedure is to describe AEMO's:
 - (a) process for determination and classification of Credible Contingency Events;
 - (b) Contingency Reclassification Conditions
 - (c) factors taken into account in reclassifying a Contingency Event
 - (d) process for reclassifying a Non-credible Contingency Event as a Credible Contingency Event
 - (e) procedures for notifying affected Rule Participants when AEMO determines a new Contingency Event or reclassifies a Non-credible Contingency Event as a Credible Contingency Event; and
 - (f) a description of the Contingency Events that are generally considered as Credible Contingency Events, taking into consideration relevant requirements in the Technical Rules of the relevant Network Operator.
- 1.1.5. Appendix A of this Procedure outlines the head of power clauses that this Procedure is made under, as well as other obligations in the WEM Rules covered by this Procedure.

1.2. Definitions

- 1.2.1. Terms defined in the *Electricity Industry Act 2004*, the WEM Regulations and the WEM Rules have the same meanings in this Procedure unless the context requires otherwise.
- 1.2.2. The following definitions apply in this Procedure unless the context requires otherwise.

Table 1 Definitions

Term	Meaning
Power System Elements	Means items of equipment of Networks and Facilities as listed in paragraph 2.1.2

1.3. Interpretation

- 1.3.1. The following principles of interpretation apply in this Procedure unless the context requires otherwise.
 - (a) Clauses 1.3 to 1.5 of the WEM Rules apply in this Procedure.



- (b) References to time are references to Australian Western Standard Time.
- (c) Terms that are capitalised, but not defined in this Procedure, have the meaning given in the WEM Rules.
- (d) A reference to the WEM Rules or WEM Procedures includes any associated forms required or contemplated by the WEM Rules or WEM Procedures.
- (e) Words expressed in the singular include the plural and vice versa.
- (f) A reference to a paragraph refers to a paragraph of this Procedure.
- (g) A reference to a clause refers to a clause or section of the WEM Rules.
- (h) References to WEM Rules in this Procedure in bold and square brackets [Clause XXX] are included for convenience only, and do not form part of this Procedure.
- (i) Text located in boxes and headed as Explanatory Note X in this Procedure is included by way of explanation only and does not form part of this Procedure. This Procedure prevails to the extent of any inconsistency with the explanatory notes contained within it.

1.4. Related documents

1.4.1. The documents in Table 2 are associated with this Procedure.

Table 2Related documents

Reference	Title	Location
Technical Rules	Technical Rules Revision 3 (1 December 2016)	Economic Regulation Authority website ¹

2. CONTINGENCY EVENT FRAMEWORK

2.1. Process for Determination and Classification of Credible Contingency Events

- 2.1.1. For the purpose of clause 3.8A.2 of the WEM Rules, AEMO considers the following occurrences to be reasonably possible under normal operating conditions:
 - (a) the failure or removal from operational service of any single Power System Element.
 - (b) a probable sequence of connected events involving multiple Power System Elements, identified by AEMO.
- 2.1.2. The process for determining and classifying a Contingency Event as a Credible Contingency Event is as follows:
 - (a) AEMO must identify:
 - (i) the applicable circumstances under paragraph 2.1.1; and
 - (ii) the relevant Power System Elements outlined in paragraph 2.1.3; and
 - (b) AEMO must classify the Contingency Event in accordance with the requirements of paragraphs 2.1.4 to 2.1.6

¹ https://www.erawa.com.au/electricity/electricity-access/western-power-network/technical-rules/approved-technical-rules



2.1.3. The Power System Elements include the items listed in Table 3:

Table 3Power System Elements

Element	Description	Example physical equipment
Node	Electrically equivalent location.	Substation busbar
Circuit	Single electrical connection between two or more nodes.	Overhead transmission line, underground cable, transformer.
Single terminal device	Auxiliary network equipment connected to a node.	Shunt reactor / capacitor, static VAR compensator.
Protection Scheme	Scheme that detects an electrical fault and disconnects any other Power System Element to prevent damage.	Special Protection Scheme designed to disconnect a generator under certain fault conditions.
Communications link	Means or path for information flow between nodes.	Fibre-optic cable, microwave transmitter.
Measurement device or sensor	Source of information about power system conditions.	Current transformer, voltage transformer, weather sensor (e.g. temperature, wind speed, solar radiation).
Generation or load system	Producer or consumer of electrical power.	Gas-fired generator, transmission connected load.



E[A] Explanatory Note – Credible Contingency Event definition

A Power System Element is a standard industry abstraction to simplify functional groups of physical equipment for the purpose of system operations and analysis. In the interest of operational efficiency, simplicity, and standard power system engineering practice, AEMO considers the credible loss of any *single* Power System Element to be consistent with the overall design and reliability standards of the WEM, such that it must be considered as credible.

For example, a "circuit" is a simplification of the multitude of physical components needed to electrically connect two locations, e.g. conductors, fixtures, towers, cables, bushings, switching isolators, grounding and shielding devices etc. Each of these components have a variety of failure modes with different likelihoods and possible consequences. However, for simplicity AEMO will classify the loss of any single branch as a Credible Contingency Event independently of the physical detail, as the result is electrically equivalent.

Certain network designs or configuration can also result in a circuit that connects more than two nodes, forming for example, a "T-junction" between three substations. Normally, the entire multi-ended connection defines the circuit and is considered a Credible Contingency Event (as opposed to the individual branches), as the electrical protection scheme will isolate at all substations for a fault at any location in the circuit.

2.1.4. In cases under paragraph 2.1.1(a) where the statistical occurrence of a single Power System Element failure is negligible such that AEMO considers the occurrence to not be reasonably possible, AEMO must not classify the relevant Contingency Event as a Credible Contingency Event to improve operational and market efficiency.

E[B] Explanatory Note – Exclusions from single-element Credible Contingency Events

For example, AEMO's standard practice is to classify the loss of nodes representing transmission substation busbars as non-credible, as a failure or fault of this equipment under normal operating conditions is statistically unlikely such that is not reasonably possible.

However, the chance of these failures has been observed to increase during certain types of substation maintenance work. AEMO may reclassify the loss of substation busbars as Credible Contingency Events during these works (see paragraph 2.2.1.).

- 2.1.5. In identifying a probable sequence of connected events for paragraph 2.1.1(b), AEMO must obtain evidence that the sequence has occurred or could occur in the future based on one or a combination of the following:
 - (a) Direct advice from an asset owner or expert.
 - (b) Historical frequency of the failure occurring.
 - (c) AEMO's analysis of field measurements or asset data finds a failure may occur under specified circumstances.
 - (d) Reclassification has occurred in accordance with paragraph 2.2.1
 - (e) AEMO's analysis of relevant evidence, circumstances or other information.



E[C] Explanatory Note – Example of multiple-element Credible Contingency Events

For example:

- A Network Operator may meet certain requirements of the Technical Rules using a special Protection Scheme that simultaneously disconnects or reconfigures multiple Power System Elements under certain conditions. Upon being advised of the scheme's operation and status, AEMO would classify the action of the scheme as a Credible Contingency Event while the scheme is in service.
- Where multiple transmission circuits run in close physical proximity (e.g. sharing a support structure or easement), a single lightning strike can trigger the simultaneous loss of both circuits. Though a combination of weather data, advice from the Network Operator and emergency response organisations, AEMO would make a judgement (under paragraph 2.2.1(c)) in real time, and potentially reclassify the simultaneous loss of multiple circuits as a Credible Contingency Event as storms pass overhead.

In these instances, AEMO would:

- Issue a Dispatch Advisory as soon as practicable to inform the market (paragraph 2.3.1).
- Publish the determination or reclassification on the WEM Website (clause 3.8A.6)
- 2.1.6. Considering the relevant requirements in the Technical Rules of the relevant Network Operator, examples of Contingency Events that generally are considered Credible Contingency Events under paragraph 2.1.1 include:
 - (a) Disconnection of a transmission circuit following a three-phase to earth fault, cleared with the fastest main Protection Scheme out of service.
 - (b) Sudden disconnection of a Generating Unit.
 - (c) Sudden loss of any single Protection Scheme, communications path or weather station.

2.2. Non-credible Contingency Event Reclassification Process

- 2.2.1. The process AEMO must apply for reclassifying a Non-credible Contingency Event as a Credible Contingency Event is as follows:
 - (a) Where present or future system conditions may result in an increased likelihood of a Noncredible Contingency Event occurring, AEMO may consider reclassifying the Non-credible Contingency Event as a Credible Contingency Event.
 - (b) The relevant Contingency Reclassification Conditions that AEMO may consider includes:
 - (i) Lightning storms, bushfires or other severe weather conditions;
 - (ii) Pollution, geomagnetic-disturbances or other atmospheric phenomena that may interfere with operation of SWIS;
 - (iii) The presence of personnel or equipment not normally in the vicinity of the Network or other power system assets; and
 - (iv) Any other unusual threats to the SWIS, including but not limited to generation fuel supplies, communications systems or other supporting infrastructure.



E[D] Explanatory Note – Specific example scenarios under the Contingency Reclassification Conditions

Examples of conditions under paragraph 2.2.1(b)(iii) or 2.2.1(b)(iv) include, but are not limited to:

- Certain planned works involving site (e.g. substation, transmission easement, generation or other electrical plant infrastructure) access by electrical maintenance staff.
- Unauthorised site access by the public or animals
- Encroachment of normal network clearances due to public works (e.g. construction, underground piping) or transport of very large equipment.
- Threats of terrorism or damage to the power system or supporting infrastructure.
 - (c) For the duration of any relevant Contingency Reclassification Conditions identified, AEMO may reclassify the Non-credible Contingency Event where AEMO identifies a material increase in the likelihood of the Non-credible Contingency Event following an assessment. The factors that AEMO may take into account in undertaking this assessment are:
 - (i) Direct advice from an asset owner or expert.
 - (ii) Previous experience of the failure occurring.
 - (iii) Independent likelihood assessments by AEMO of the Contingency Reclassification Conditions and best information available to AEMO at the time of the assessment, in accordance with Appendix B of this Procedure.
- 2.2.2. Following reclassification of a Non-credible Contingency Event in accordance with the process in paragraph 2.2.1, AEMO may reapply the process in paragraph 2.2.1 to modify the details or duration (extend or reduce) of the reclassification as Contingency Reclassification Conditions evolve and new forecast or other information becomes available.

2.3. Notification of Reclassification

- 2.3.1. Where AEMO:
 - (a) Determines a new Credible Contingency Event under paragraph 2.1.1;
 - (b) Reclassifies a Non-credible Contingency Event as a Credible Contingency Event under paragraph 2.2.1;
 - (c) Modifies an existing reclassification under paragraph 2.2.2; or
 - (d) if any information provided to Rule Participants in accordance with clause 3.8A.6 of the WEM Rules changes in any other material respect,

AEMO must as soon as practicable issue either a new or updated Dispatch Advisory, as appropriate, with all relevant information (required under clause 3.8A.6(b) of the WEM Rules) available at the time of issue. This notification requirement operates in addition to AEMO's requirement under clause 3.8A.6(a) of the WEM Rules to publish the determination or reclassification on the WEM Website.



APPENDIX A. RELEVANT CLAUSES OF THE WEM RULES

Table 4 details:

- (a) the head of power clauses in the WEM Rules under which the Procedure has been developed; and
- (b) each clause in the WEM Rules requiring an obligation, process or requirement be documented in a WEM Procedure, where the obligation, process or requirement has been documented in this Procedure.

Clause	
3.8A.4 (a)	
3.8A.4 (b)	
3.8A.4 (c)	
3.8A.4 (d)	
3.8A.4 (e)	
3.8A.4 (f)	
3.8A.6 (b)	
3.8A.7	

Table 4 Relevant clauses of the WEM Rules



APPENDIX B. INDEPENDENT LIKELIHOOD ASSESSMENTS FOR RECLASSIFICATION

E[E] Explanatory Note – Independent likelihood assessment development

For initial publication 1 February 2021, there are no processes for independent likelihood assessments to be included in this Procedure. This appendix is included for consultation purposes and will be removed prior to publication.

Following initial publication, independent likelihood assessments will be developed progressively in consultation with relevant industry experts covering areas such as:

- Reclassification due to on-site works
- Reclassification due to bushfires
- Reclassification due to storm activity

and added to this appendix once ready for operational application.