Independent Market Operator

System Management PSOP Working Group

Agenda

Meeting No.	1/2008
Location:	IMO Board Room Level 3, Governor Stirling Tower, 197 St Georges Terrace, Perth
Date:	Tuesday, 30 September 2008
Time:	2:00pm till 4:00pm

Item	Subject	Responsible	Time
1.	**WELCOME AND APOLOGIES / ATTENDANCE**	**System Management**	5 minutes
2.	**MINUTES OF PREVIOUS MEETING / ACTIONS ARISING**	**System Management**	5 minutes
3.	**POWER SYSTEM OPERATION PROCEDURE (PSOP) REVIEW. PROCESS AND TIMELINE** System Management will explain the reasons behind its decision not to actively monitor rule participants' compliance with the PSOPs as outlined in its briefing note to the Working Group.	**System Management**	30 minutes
4.	**PSOP: SECURITY. REVIEW AMENDED PSOP** A comparison between the original and revised Power System Security PSOPs is to take place.	**System Management**	60 minutes
5.	**OTHER BUSINESS** Discussion on any other matters that fall within the scope of the Working Group's Terms of Reference.	**ALL**	15 minutes
6.	**NEXT MEETING** The next PSOP Working Group meeting to be scheduled.	**System Management**	5 minutes

System Management Power System Operating Procedures

Update Note

Purpose

The Power System Operating Procedures (**PSOPs**) constitute various processes which were created to comply with System Management's obligations established in the Wholesale Electricity Market Rules.

The purpose of this document is to:

1. provide an explanation for System Management's decision not to actively monitor rule participants' compliance with the PSOPs to date; and

2. detail the steps which System Management will take over 2008/09 to identify and progress amendments to the PSOPs.

Monitoring compliance with the PSOPs

To date, System Management has not sought to actively monitor compliance with the requirements of the PSOPs.

This decision is principally due to the fact that the PSOPs as drafted largely overlap and repeat the Market Rules; they do not themselves create additional obligations. In addition, with significant changes to the Market Rules since market commencement on 21 September 2006, the PSOPs are no longer up-to-date, making compliance monitoring difficult and, in an environment of constraint, not where System Management has determined that necessarily scant resources should be directed to.

Additionally, through much of 2007/08 System Management was required to direct focus towards addressing and resolving significant operational issues which arose in the SWIS. For example:

- System Management spent a significant period of time assessing and responding to issues arising from a system disturbance on 28 November 2007. This itself produced a significant body of work relating to benchmarking the delivery of ancillary services;
- gas shortages which occurred in January and through June to September 2008 diverted significant resources to ensuring that the effect on the security and reliability of the SWIS was minimised; and
- extensive effort was directed towards preparing detailed operational plans to restart the SWIS in the event of a black system incident. This culminated in the commencement of procurement processes for system restart ancillary services (see http://www.westernpower.com.au/mainContent/workingWithPower/systemManagement/System_Restart_Services.html).

Importantly, System Management has created internal processes to ensure compliance with the Market Rules, and actively monitors its own and participants' compliance with those rules.

Reviewing the PSOPs

System Management now has two years experience of operating and performing functions in the wholesale electricity market. With the benefit of that experience, it is System Management's intention to significantly revise the PSOPs to create a suite of documents which better represent System Management's performance of its functions and provides a sound basis for the monitoring of compliance.

As there are a large number of PSOPs, System Management has selected one PSOP (PSOP: Power System Security) to amend and use as a base both to seek market participant's views concerning the amendments, and to provide guidance for the review of the other PSOPs.

The process which System Management will follow in assessing and amending the various PSOPs is as follows.

1. The current versions of the PSOPs contain extensive overlap and repetition of the Market Rules, leading to the risk of inconsistency when the rules change, or incorrect phrasing of rule requirements. System Management will remove those parts of the PSOP which are direct extracts from the Market Rules, and replace with generalised statements and references.

2. Identify additional items which should be included or removed.

3. Convene a series of meetings of the System Management Procedure Change Working Group and examine each amended PSOP as compared to the initial version.

4. Make further amendments as required following the Working Group process.

5. Initiate the procedure change process in clause 2.10 of the Market Rules.

Review timeline

As indicated, System Management will amend PSOP: Power System Security to provide a framework for subsequent PSOP reviews.

It is proposed to then tackle the remaining PSOPs over a period of time in common groupings. The timeline that System Management presently imagines is achievable is as follows:

1. Facility Outages, Short Term Projected Assessment of System Adequacy (ST PASA) and Medium Term Projected Assessment of System Adequacy (MT PASA). These PSOP's are proposed to be redrafted and the procedure change process will commence from October 2008 to January 2009.
2. Dispatch (Non-EGC Facility), Scheduling and Dispatch of Electricity Generation Corporation (EGC) Facilities and Cleansing of Generation Facility MWh output data. These PSOP's are proposed to be redrafted and the procedure change process will commence from January 2009 to May 2009.

3. Commissioning and Testing, Communications and Control Systems, and Monitoring and Reporting Protocol. These PSOP's are proposed to be redrafted and the procedure change process will commence from May 2009 to July 2009.

ELECTRICITY INDUSTRY ACT

ELECTRICITY INDUSTRY (WHOLESALE ELECTRICITY MARKET) REGULATIONS 2004

WHOLESALE ELECTRICITY MARKET RULES

Power System Operation Procedure:

Power System Security

Commencement: This Market Procedure is to have effect from 8:00am (WST) on the same date as the Wholesale Electricity Market Rule, in which this procedure is made in accordance with, commences.

Market Procedures Published by the Minister

I, FRANCIS LOGAN, Minister for Energy for the State of Western Australia, under regulation 9(2) of the Electricity Industry (Wholesale Electricity Market) Regulations 2004 hereby approve the publication of the Power System Operation: Power System Security Procedure contained in this document.

This Market Procedure is to have effect from 8:00am (WST) on the same date as the Wholesale Electricity Market Rule, in which this procedure is made in accordance with, commences.

… … … … … … … … … … … … … … … …

Dated at Perth this … … … day of … … … … …2006.

TABLE OF CONTENTS

1 POWER SYSTEM SECURITY PROCEDURE

The Power System Security Procedure sets out the security standards that must be maintained on the SWIS and the processes for maintaining these standards while electricity is traded through the Western Australian Wholesale Electricity Market

1.1 Relationship with Market Rules

This Procedure has been developed in accordance with clause 3.2.7 of the Market Rules and documents the processes which must be followed by:

a. System Management and Participants in maintaining Equipment information;
b. Network Operators and System Management in determining the Security Limits for the SWIS network, and maintaining Security Limit information;
c. System Management in establishing and modifying the Technical Envelope;
d. System Management to enable it to operate the SWIS according to the Technical Envelope applicable to each Operating State; and
e. System Management and Participants in Voltage Control, Frequency Control and Load Control.

Appendix II of this procedure provides an overview of the security management procedure set out in this document.

This procedure is made in accordance with Market Rule 3.2.7.

2 ASSOCIATED PROCEDURES AND OPERATING STANDARDS

a. SWIS Technical Rules and Operating Standards
b. Power System Operation Procedure – Dispatch
c. Power System Operation Procedure - Ancillary Services Procedure
d. Power System Operation Procedure – Communications and Control Systems.

3 EQUIPMENT LIMITS

System Management must maintain details of all Equipment Limits of which it is informed.

3.1 Equipment Limits

1. An Equipment Limit means any limit on the operation of a Facility's equipment that is provided as Standing Data for the Facility to System Management by the IMO in accordance with this section 3. [**MR 2.34.1(b)**]

2. The IMO must provide the Standing Data and any revisions of the Standing Data to System Management as soon as practical.

3. Equipment Limit information will include all thermal rating data for all generator and network equipment that form the SWIS, and any other Standing Data that is relevant to the capability of the equipment to operate at its maximum rating.

3.2 System Management to maintain list of Equipment Limits

1. System Management must maintain a list of all Equipment Limits provided by the IMO to System Management, and must ensure that the database in System Management's SCADA monitoring system is updated to reflect any additions or changes to Equipment Limits.

2. System Management must arrange for the SCADA system to monitor the power flow within each item of equipment or Facility for which Equipment Limits is provided.

3. System Management must update the SCADA database with any new Equipment Limit prior to the data becoming operational.

4. Where System Management becomes aware that an Equipment Limit is inaccurate or will become inaccurate in the future, System Management must notify IMO of this as soon as practical.

4 SECURITY LIMITS.

1. A Security Limit means any technical limit on the operation of the SWIS as a whole or on a region of the SWIS, necessary to maintain power system security, including both static and dynamic limits, and including limits to allow for and manage contingencies [**MR 3.2.3**].

2. The Security Limits will be those technical requirements and standards in the Technical Rules that represent constraints on the operation of the SWIS, imposed for the purpose of managing electricity quality and security.

3. The Security Limits include:

    a. SWIS Operating Standards that stipulate maximum and minimum voltage and frequency conditions for the overall SWIS network; and

    b. voltage and security limits that apply to a region of the SWIS network, and are specified by a Network Operator.

4.1 SWIS Operating Standards

1. The SWIS Operating Standards are those quality and security standards that apply to the entire SWIS network and represents a minimum requirement or transmission limit that must be complied with.

2. A description of the main SWIS Operating Standards is contained in Table 1 (references to Technical Rules provisions are current at the date of this procedure's commencement).

Table 1

SWIS Operating Standard	Reference in Technical Rules	Standard description (abbreviated)
Frequency Standard	Section 2.2 and 2.6	The SWIS supply frequency should not exceed the: i. Normal Operating Frequency Band of 49.8 to 50.2Hz ii. the Normal maximum frequency excursion band of 48.75 to 51 Hz for a single contingency event iii Maximum accumulated time error of 10 seconds
Voltage Standard	Section 2.2.2	The steady state transmission voltage should stay within the design range of 90-110% of nominal voltage
Voltage Fluctuation Standard	Section 2.2.3	The voltage flicker levels contained in AS/ANZ 61000.3.7:2001
Voltage Waveform Distortion standard	Section 2.2.4	The harmonic levels contained in AS/ANZ 61000.3.6:2001
Voltage Unbalance standard	Section 2.2.5	Voltage unbalance levels specified in 2.2.5

4.2 Regional Security Limits.

1. A Network Operator may specify Security Limits additional to the SWIS Operating Standards which apply to a specific location or region of the SWIS network.

2. These regional Security Limits will generally be more restrictive than the limits in the SWIS Operating Standards and may arise through:

    a. a requirement for tighter transmission voltage limits than the 90-110% design range specified in the Technical Rules;

    b. a steady state or dynamic stability limit restricting the transfer of electrical power between two points in the network; and

    c. the application of regional security criteria other than the SWIS Security Criteria specified in Appendix 1 of this procedure (eg. other than N-1).

3. Where a Network Operator wishes to impose a regional Security Limit to a section of the network over which it has ownership status, the Network Operator must provide System Management with the details of the regional Security Limits and a description of the region over which the Limits will apply.

4.3 Network Operators to provide information on regional Security Limits

1. Each Network Operator will provide System Management with information relating to any specific Security Limit it wishes to apply within a region of the SWIS network formed from that Network Operator's network facilities.

2. The Security Limit must meet the general conditions of the Technical Rules, established under the *Electricity Networks Access Code 2004*.

3. System Management must record the time it receives Security Limit data.

4. System Management must examine each provisional Security Limit submitted by a Network Operator in relation to this section 4.3 to confirm these Security Limits can be applied without creating a conflict between adjacent networks or adjacent network quality and Security Limits.

5. Where there are issues or conflicts, System Management must endeavour to resolve these with the affected Network Operators.

6. Network Operators must provide any additional information sought by System Management where it is requested in order to clarify the application of a proposed new Security Limit.

7. Where a Network Operator does not provide such information, System Management will operate the SWIS system according to the previous information it possesses in relation to that Security Limit.

4.4 System Management to maintain list of Security Limits

1. System Management must maintain a list of all Security Limits provided by Network Operators that represents actual or potential constraints on the transfer of energy across the SWIS network.

2. System Management must represent these Security Limits on the SCADA monitoring system where it is practical to do so.

3. Where System Management becomes aware that a Security Limit provided by a Network Operator may be inaccurate or may become inaccurate in the future, System Management must inform the Network Operator providing the Security Limit data of this concern as soon as practical.

5 TECHNICAL ENVELOPE

1. System Management must establish and modify the Technical Envelope that represents the limits within which the SWIS can be operated in each SWIS Operating State.

2. In establishing and modifying the Technical Envelope, System Management must [**MR 3.2.5**]:

    a. respect all Equipment Limits;
    b. respect all Security Limits;
    c. respect all SWIS Operating Standards;
    d. respect all Ancillary Service standards specified in section 10 of this procedure; and
    e. take into account those parts of the SWIS not designed to be operated to the security criteria set out in Appendix 1 of this procedure.

3. System Management must ensure that the technical boundary limits that represent limits to the SWIS Technical Envelope are represented on System Management's SCADA system. The technical boundary limits will include both Equipment and Security Limits for Normal, High Risk and Emergency Operating States.

4. System Management must ensure that when generation or transmission facilities or equipment are connected or disconnected from the SWIS, these changes to the connection status are dynamically updated on System Management's SCADA system to reflect the altered boundaries of the Technical Envelope.

6 NORMAL OPERATING STATE

A Normal Operating State is when the power system is in a secure and reliable state and operating within normal operating ranges. In a Normal Operating State, System Management must observe Security Limits and Equipment Limits, while maintaining ancillary service standards and dispatching EGC generation and where necessary, adjusting the resources plans of non-EGC generation based on the prevailing merit order.

System Management must endeavor to maintain the SWIS system in a Normal Operating State and not take any actions that in its opinion would be reasonably likely to lead to either a High Risk Operating State or an Emergency Operating State.

6.1 Conditions for Normal Operating State

The SWIS is in a normal operating state when System Management considers that all of the circumstances set out below apply [**MR 3.3**]:

1. **Network Voltage Levels**: the voltage magnitudes at all energised busbars at every switchhouse, switchyard or substation of the SWIS are operating within the applicable Security Limits, and

    Network voltages will remain within the allowable voltage range following any credible contingency event as defined in the SWIS Security Criteria.

2. **SWIS Security and Stability levels**: the MVA flows on all Facilities are within the applicable Security Limits, and;

    remain within the Security Limits following any credible contingency event as

defined in the SWIS Security Criteria.

3. **All other electric plant**: all other electrical equipment forming part of, or having or likely to have a material impact on the operation of the SWIS is being operated within any applicable Equipment Limits and Security Limits, where

   the Equipment Limits for network Facilities include both static rating and any time based dynamic rating of which System Management has been informed by the Network Operator as applying in the Normal Operating State.

4. **Equipment Fault Levels**: the configuration of the SWIS is such that the severity of any potential fault is within the capability of circuit breakers to disconnect the faulted circuit or equipment.

5. **System Frequency**: the frequency at all energised busbars at every switchhouse, switchyard or substation of the SWIS is within the frequency range of the SWIS Operating Standard, and where,

   the SWIS Operating Standard relating to frequency is set out in Appendix II of this procedure.

6. **Ancillary Services**: the levels of all Ancillary Services being provided meet the Ancillary Service Standards set out in section 10 of this procedure.

7. **Technical Envelope**: conditions on the SWIS are secure in accordance with the requirements of the Technical Envelope.

6.2 System Management responsibilities in the Normal Operating State

1. System Management must endeavour to maintain the power system in a Normal Operating State and within the limits permitted by the prevailing Technical envelope.

2. While in a Normal Operating State, System Management must [**MR 3.3.2**]:

   a. **Equipment and Security Limits:** not require a Facility to be operated inconsistently with the Security Limits or its Equipment Limits for the Normal Operating State.

   b. **Security Standards:** meet the SWIS Security Criteria (section 6.3 of this procedure).

   c. **Overload Capacity of Scheduled Generators** not utilise the overload capacity of Scheduled Generators (as indicated in Standing Data).

   d. **Emergency Ramp rates**: not utilise the emergency ramp up and down rates of Scheduled Generators (as indicated by Standing Data).

   e. **Dispatch generation:** dispatch generation facilities in accordance with the Power System Operation Procedure - Dispatch.

f. **Ancillary Services:** schedule and dispatch Ancillary Services in accordance with the Power System Operation Procedure - Ancillary Services (section 10 of this procedure).

g. **Outage procedures:** subject to the Power System Operation Procedure – Facility Outages, accept applications for the scheduling of outages unless System Management considers that these would endanger Power System Security or Power System Reliability.

h. **Prudent Operation:** not take any actions that in the opinion of System Management would be reasonably likely to lead to a High Risk Operating State.

6.3 Power System Reliability Criteria

1. A condition of a Normal Operating State is that the SWIS Security Criteria are met.

2. The SWIS Security Criteria require that the power system is capable of withstanding the occurrence of a credible contingency event without causing:

    a. the unexpected disconnection of an item of equipment;
    b. the overloading of an item of equipment beyond its Equipment Limits; or
    c. the curtailment of non-dispatchable load, with the exception of the sudden loss of the largest generator connected at the time to the SWIS, where a portion of the first block of the under-frequency load scheme may be tripped if the frequency falls to 48.75 Hertz.

3. A credible contingency event means an event that System Management considers reasonably possible, and generally applies to the tripping or sudden loss of a generator unit or item of transmission equipment.

4. The credible contingent events which System Management must allow for are set out in Appendix I of this procedure.

5. Where a Network Operator wishes to vary the network security criteria for a particular region of the SWIS over which it has ownership rights, that Network Operator should provide the applicable information in accordance with section 4.3 of this procedure.

7 HIGH RISK OPERATING STATE

A High Risk Operating State exists when normal security levels are not being met and the power system is exposed to a higher than normal probability of serious consequences in the event of a failure of a generator, transmission circuit or other equipment. In a High Risk Operating State, System Management may take additional steps to increase the security of the power system and lessen the severity of the High Risk Operating State.

When a High Risk Operating State occurs, System Management must endeavour to return the SWIS system to a Normal Operating State as soon as practical.

7.1 Conditions for High Risk Operating State

1. The SWIS is in a High Risk Operating State when System Management considers that any of the following circumstances exist, or are likely to exist within the next 15 minutes [**MR 3.4.1**], or are likely to exist at a time beyond the next fifteen minutes but actions other than those allowed under the Normal Operating State must be implemented immediately by System Management so as to moderate or avoid the circumstance:

    a. **Spinning Reserve violation:** there is insufficient Spinning Reserve available to meet the levels specified in the frequency management procedure (section 10 of this procedure).

    b. **Load following reserve violation:** there is insufficient Load Following Reserve available to meet the levels specified in the frequency management procedure (section 10 of this procedure).

    c. **Voltage Violations:** there is a voltage deviation that exceeds the allowable range specified in section 2.2.2 of the Technical Rules, without any immediate likelihood of returning to the allowable range.

    d. **Steady state frequency deviation:** there is a frequency deviation of greater than +/- 0.12 Hertz beyond the Normal Operating Frequency Band of 49.8 to 50.2 Hertz at an energised busbar within the SWIS network, and the deviation is expected to continue because of a shortage of Ancillary Services.

    e. **Transmission overloads:** a transmission circuit, transformer, circuit breaker or switch is overloaded but the overload can be managed for the period up to when the overload is expected to be rectified.

    f. **Short circuit capability:** there is a short circuit condition that could result in equipment fault levels being exceeded.

    g. **Power system stability:** there would be an overload, under-voltage situation or threat to the stability of the power system if a credible contingency occurred.

    h. **Fuel Supply Situation:** System Management is aware that one or more Market Participants have been notified by fuel suppliers and/or fuel transporters that a fuel shortfall is likely in relation to one or more Facility, where such fuel shortfall will limit the availability of generation during the next 24 hours, and where this might affect power system security or power system reliability.

    i. **Generator Unavailability:** System Management is aware of imminent generator unavailability that would cause total MW supply capacity to fall below total MW load on the SWIS system.

j. **Transmission Unavailability:** System Management is aware of imminent transmission unavailability that would cause supply to fall below load on part or whole of the SWIS system.

k. **SCADA Degradation:** significant SCADA system degradation is occurring which limits System Management's ability to control the power system.

l. **Fires or natural disasters:** there is a major bushfire or storm near, or forecast to be near, elements of the SWIS.

m. **Other circumstances:** any other circumstance having a substantially similar effect to any of the above occurs in connection with the SWIS.

7.2 System Management Responsibilities in a High Risk Operating State

1. System Management must return the SWIS from a High Risk Operating State to a Normal Operating State as soon as it is able [**MR 3.4.5**].

2. When the SWIS is in a High Risk Operating State, System Management must identify the actions needed to restore the SWIS to a Normal Operating State.

3. In planning the restoration of a Normal Operating State and in the subsequent restoration, System Management must:

    a. not require Facilities to operate inconsistently with the Security Standards or their Equipment Limits for the High Risk Operating State;

    b. must schedule and dispatch Ancillary Services appropriate for the High Risk Operating State, and

    c. endeavour to restore Ancillary Service levels to normal as soon as practical, but noting that restoration of any involuntary curtailed load is first priority.

4. In planning the restoration of the Normal Operating State and in the subsequent restoration, System Management may:

    a. dispatch generators in an order other than submitted to System Management in the dispatch merit order;

    b. utilise the overload capacity of Scheduled Generators (as indicated in Standing Data);

    c. cancel or defer Planned Outages that have not yet commenced;

    d. require the return to service in accordance with the relevant Outage Contingency Plan of Network equipment undergoing Planned Outages, or take other measures contained in the relevant Outage Contingency Plan for any Facility;

e. require the return to service in accordance with the relevant Outage Contingency plan of a generating unit;

f. utilise or otherwise, the generating Facilities that can provide Ready Reserve;

g. Have regard to the process for voltage control and frequency control in sections 9 and 10 of this procedure;

h. have regard to information provided by EGC on the dispatch of Generating Facilities for restoring a Normal Operating State; and

i. take any other actions as it considers are required, consistent with good electricity industry practice, to return the SWIS to a Normal Operating State, provided that System Management acts such that there is as little disruption to electricity supply and to the implementation of Resource Plans that it has received from the IMO for Non-EGC Facilities as is reasonably practicable in the circumstances.

5. When the power system has been returned to a Normal Operating State, System Management should inform all Participates through publication of a Dispatch Advisory Notice.

7.3 Participant Responsibilities in High Risk Operating State

1. When a Participant has been informed by System Management of a High Risk Operating State, the Participant must [**MR 3.4.6**]:

    a. comply with directions issued by System Management in accordance with section 7.2 of this procedure; and

    b. use reasonable endeavours to assist System Management to return the SWIS to a Normal Operating State, except that a Participant is not required to comply with directions issued by System Management in accordance with section 7.2 if such compliance would endanger the safety of any person, damage equipment, or breach any applicable law.

2. Where a Rule Participant cannot comply with a direction issued by System Management in relation to section 7.2 of this procedure, it must inform System Management immediately.

8 EMERGENCY OPERATING STATE

The power system is in an Emergency Operating State when applying the normal Security Limits and Ancillary Service Standards would require, or likely require, the involuntary curtailment of demand. In an Emergency Operating State, System Management may direct Market Participants and Network Operators and generally take whatever actions are necessary to restore the power system to a Normal Operating State.

When an Emergency Operating State occurs, System Management must endeavour to return the SWIS system to a Normal Operating State as soon as practical.

8.1 Conditions for Emergency Operating State

The SWIS is in an Emergency Operating State when System Management considers that any of the following circumstances exist, or are likely to exist within the next fifteen minutes, or are likely to exist after fifteen minutes but actions other than those allowed under the Normal Operating State or High-Risk Operating State must be implemented immediately by System Management so as to moderate or avoid the circumstance [**MR 3.5.1**]:

1. **Frequency deviation**: there is a frequency deviation that is outside the short term frequency excursion limits specified in section 2.2 of the Technical Rules and there is a risk of cascade failure of SWIS facilities.

2. **Voltage Violation**: there is a voltage violation that exceeds the design range of transmission network equipment, and there is a risk of damage or cascade failure of SWIS facilities.

3. **Network Facility loadings**: network currents exceed the facility static and dynamic ratings of Network facilities.

4. **Generation Shortfall**: System Management expects a significant generation shortfall.

5. **Interruption of demand**: significant involuntary load interruption is occurring.

6. **Risk to personal and public safety**: operation under a Normal Operating State or a High Risk Operating State would pose a significant risk to the physical safety of the public or industry employees.l

7. **SCADA failure**: significant primary SCADA system failure is occurring which has forced System Management to move power system control away from its primary control centre.

8. **Transmission separation**: significant transmission separation is occurring, or is imminent, resulting in a limitation in the level of electricity that can be transmitted, or power system instability.

9. **Any other circumstance**: any other circumstance having a substantially similar effect to any of the above occurs in connection with the SWIS.

8.2 An Emergency Operating State is not a Civil Emergency

An Emergency Operating State as defined in these Market Rules does not necessarily correspond to a civil emergency, or emergencies as defined in legislation but may commence as a result of these [**MR 3.5.2**].

8.3 System Management responsibilities in an Emergency Operating State

1. System Management must return the SWIS from an Emergency Operating State to a Normal Operating State as soon as it is able [**MR 3.5.6**].

2. When the SWIS is in an Emergency Operating State, System Management must identify the actions needed to restore the SWIS to a Normal Operating State, and implement the identified actions.

3. In planning the restoration of a Normal Operating State and in the subsequent restoration, System Management must [**MR 3.5.7**]:

    a. attempt to operate the SWIS in such a way as to, firstly, minimise the disruption to supply to consumers;

    b. secondly, minimise the disruption to the implementation of Resource Plans to the extent that is reasonably practicable to do so in the circumstances;

    c. not require facilities to operate inconsistently with the Security Standards or the Facility's Equipment Limits for the Emergency Operating State; and

    d. refer to the Emergency Operating State when requiring a participant to undertake special action authorized only under an Emergency Operating State.

4. In planning the restoration of a Normal Operating State and in the subsequent restoration, System Management may:

    a. direct any Participant to provide Ancillary Services, whether that Participant has an Ancillary Services Contract in relation to the relevant Facility or not;

    b. utilise the overload capacity and emergency ramp up and down capability of Scheduled Generators (as indicated by Standing Data);

    c. cancel or defer Planned Outages, require the return to service in accordance with the relevant Outage Contingency Plan of Facilities undergoing Planned Outages or take other measures contained in the relevant Outage Contingency Plans;

    d. issue directions to Participants to operate their facilities in specific ways; and

    e. take such other actions as it considers are required, consistent with good electricity industry practice, to restore the SWIS to a Normal Operating State, or to restore the SWIS to a High Risk Operating State where a Normal Operating State is not immediately achievable.

5. When the power system has been returned to a Normal Operating State, System Management should inform all Participates through publication of a Dispatch Advisory Notice.

8.4 Participant responsibilities in Emergency Operating State

1. When a Participant has been informed by System Management that the SWIS is in an Emergency Operating State, Rule Participants must [**MR 3.5.8**]:

a. subject to subsection 8.4(3), comply with directions issued by System Management in accordance with the Emergency Operating State procedures; and

b. use their best endeavors to assist System Management to return the SWIS to a Normal Operating State.

2. A Rule Participant is not required to comply with directions issued by System Management, issued in accordance with section 8.4, if such compliance would endanger the safety of any person, damage equipment, or breach any applicable law.

3. Where a Rule Participant cannot comply with a direction issued by System Management in accordance with section 8.4, it must inform System Management immediately.

9 VOLTAGE CONTROL AND MANAGEMENT

1. System Management must endeavour to maintain voltage levels throughout the SWIS within the limits specified in the Technical Rules and within the Equipment and Security Limits provided to System Management in accordance with sections 3 and 4 of this procedure.

2. System Management must undertake the necessary voltage management actions to maintain a Normal Operating State, or return the condition of the SWIS to a Normal Operating State.

3. System Management may meet the voltage operating standards through a combination of the measures set out in table 2.

Table 2

VOLTAGE CONTROL MEASURES		
1	Use of Network voltage regulating facilities	As provided by Network Operators for the purpose of voltage regulation
2	Use of Generator voltage regulating facilities	Provided as requirement of Technical Rules
3	Switching of Network Facilities	Through modification of network topology.
4	Demand Management	Through dispatch of Demand Management Facilities
5	EGC Generation Facilities	Through re-dispatch of EGC Generation Facilities, including the synchronizing and constraining on of EGC Generators
6	Non-EGC Generation Facilities	Through adjustment of non-EGC Generation Resource Plans
7	Demand interruption	Through voluntary demand reduction
8	Demand reduction	Through mandatory load control

4. In determining the voltage management measures to be implemented, System Management must have regard to:

    a. good industry practice for voltage management;
    b. the likely need to implement measures concurrently and in a different order than that contained in table 2;
    c. the severity of the voltage violation and its impact on power system and consumer equipment; and
    d. the likely impact of the violation on the ongoing security of the SWIS.

5. System Management must only have recourse to mandatory load curtailment in the event of a High Risk or Emergency Operating state, in which case the conditions relevant to sections 7 and 8 of this procedure apply.

10 FREQUENCY CONTROL AND MANAGEMENT

System Management must endeavour to maintain the SWIS frequency within the limits specified in the Technical Rules (Appendix II) through appropriate scheduling and dispatch of Ancillary Services and Generating facilities. This may include the involuntary curtailment of demand, both in the High Risk Operating State such as can occur following the tripping of the largest generating unit, and in the Emergency Operating State.

The Ancillary Services and load control processes to be utilised for frequency management are listed below.

10.1 Load Following Reserves

1. System Management must dispatch Load Following Reserve at a level that is sufficient to provide minimum Frequency Keeping Capacity Frequency, where the minimum Frequency Keeping Capacity is the greater of [**MR 3.10.1**]:

    a. 30MW; and

    b. the capacity sufficient to cover 99.9% of the short term fluctuations in load and output of Non-Scheduled Generators and uninstructed output fluctuations from Scheduled Generators, measured as the variance of 1 minute average readings around a thirty minute rolling average.

2. System Management will measure the short term fluctuations in load and generation output through either power system measurement or through analysis of the SWIS's (δMW/δfreq) load/frequency sensitivity. System Management will prepare its assessment of the Load Following Reserve requirements to meet condition (b) above from these measurements and analysis.

3. System Management may prepare estimates of Load Following Reserve quantities for different time periods or for different generating patterns and scenarios where these periods or situations require different levels of load following reserve to be dispatched.

4. System Management must dispatch Load Following Reserves based on its estimate of Load Following Reserve quantities from (2) or (3) above, except that System Management may reduce the level of Load Following Service:

    a. following a single or multiple contingency event where there are insufficient quantities of Load Following Reserve available or where System Management considers that in view of power system conditions, this is a reasonable action to take; or

    b. where System Management cannot meet the Ancillary Service Standard without shedding load, providing that System Management considers that reducing the levels is not inconsistent with maintaining power system security.

10.2 Spinning Reserve

1. System Management must schedule and dispatch sufficient Spinning Reserve to satisfy the principles set out below [**MR 3.10.2**].

2. The Spinning Reserve level must be sufficient to cover the greater of:

    a. 70% of the total output, including parasitic load, of the generation unit synchronised to the SWIS with the highest total output at that time, [alternatively described as the net output of that generator unit after accounting for any local unit load]; and

    b. the maximum SWIS load ramp expected over a period of 15 minutes.

3. The Spinning Reserve level must include capacity utilized to meet the Load Following Service standard under section 10.1 of this procedure, so that the capacity provided to meet the Load Following requirement is counted as providing part of the Spinning Reserve requirement.

4. The Spinning Reserve level may be relaxed by:

    a. up to 12% by System Management where it expects that the shortfall will be for a period of less than 30 minutes, where the level referred to is the quantity of Spinning Reserve estimated under section 10.2.1(a); and

    b. up to 100% following activation of Spinning Reserve if all reserves are exhausted and to maintain reserves would require involuntary load shedding. In such situations, the levels must be restored as soon as practical.

5. The level of Spinning Reserve service may also be reduced below the level in section10.2.2(a):

    a. following a single or multiple contingency event where there are insufficient quantities of Spinning Reserve available or where System Management considers that in view of power system conditions, this is a reasonable action to take; or

b. where System Management cannot meet the Spinning Reserve standard without shedding load, providing that System Management considers that reducing the levels is not inconsistent with maintaining power system security.

6. Where there is a sudden loss of the highest output generating unit connected at the time, the SWIS Security Criteria allows for the possibility that the SWIS frequency may fall to 48.75 Hertz and automatic under-frequency load shedding may occur. The requirement for automatic under-frequency scheme to initiate load tripping at 48.75 Hertz is set out in section 10.5 of this procedure.

10.3 Ready Reserve

1. Ready Reserve generation is that class of generating Facility that can synchronise and generate a significant portion of its rated MW capacity within 15 minutes of receipt of a Dispatch Instruction, and operate at full output for at least 4 hours.

2. Ready reserve generation provides an important contribution to the security of the SWIS power system by being available to start quickly and provide “make-up” energy in the event of the sudden loss of a large generating unit or energy in-feed. The “make–up” energy enables load tripped on under-frequency to be quickly restored, Interruptible Load to be reconnected and Spinning Reserve levels to be reinstated within four hours.

3. Sufficient generating capacity with Ready Reserve characteristics is normally available on the SWIS, such that Ready Reserve capacity does not need to be specially scheduled and dispatched to maintain the necessary minimum levels of Ready Reserve. However if a large amount of this class of generator is not available because of scheduled maintenance, it is possible there could be insufficient Ready Reserve generation to meet the objective of quickly restoring a Normal Operating State after tripping of a large generator.

4. The requirement to ensure adequate Ready Reserve is available following approval of Generator Outage Plans is covered in the Power System Operation Procedure – Facility Outage.

5. The requirement for a minimum level of Ready Reserve to be maintained will be managed through the Power System Operation Procedure - EGC Dispatch that governs the dispatch of EGC Generation Facilities.

10.4 Load Rejection Reserve

1. System Management must dispatch Load Rejection Reserve at a level sufficient to satisfy the following principles [**MR 3.10.4**]:

    a. the level sufficient to keep over-frequency below 51 Hertz for all credible load rejection events; or

    b. this level may be relaxed by up to 25% by System Management where it considers that the probability of transmission faults is low.

2. System Management may also reduce the level of Load Rejection Reserve below the level set out in section 10.4.1:

    a. following a single or multiple contingency event where there are insufficient quantities of Load Rejection Reserve available or where System Management considers that in view of power system conditions, this is a reasonable action to take; or

    b. where System Management cannot meet the Load Rejection Reserve without causing low cost generating units to be desynchronized with significant adverse affects on power system security.

10.5 Demand Control

1. The principle governing the use of demand control (mandatory curtailment) is that it should be used in circumstances where demand reduction is required to:

    a. preserve a minimum level of power system security;
    b. avoid a deteriorating security situation which will likely lead to the prospect of further mandatory load shedding; or
    c. avoid possible damage to power system facilities or consumer equipment due to severe violation of voltage, frequency standards or equipment ratings.

2. System Management must only use mandatory load curtailment in conjunction with a High Risk or an Emergency Operating State.

3. Load control measures described in section 10 of this procedure exclude curtailment of load associated with a Curtailable Load, or interruption of load associated with an Interruptible Load.

10.5.1 Load Control Measures

1. System Management may undertake one or more of the following load control measures in the event the situation described in section 10.4 of this procedure occurs:

    a. request Demand Participants and/or Consumers to undertake voluntary load reduction, actioned through a Dispatch Advisory Notice;
    b. through controlled reduction of voltage on the network and/or at consumer premises, actioned through a Dispatch Advisory Notice;
    c. through manual load shedding;
    d. through automatic under-voltage load shedding; and
    e. through automatic under-frequency load shedding.

10.5.2 Load Shedding Facilities

1. **Manual load shedding**: Network Operators must ensure that 75% of the power system load is available at any time for remote disconnection through System Management's centralised SCADA system.

2. **Automatic Load Shedding**: Network Operators must ensure that automatic under frequency loads shedding facilities are installed in accordance with relevant provisions of the Technical Rules covering access to the SWIS network and that:

    a. the feeders on each under-frequency block are reviewed following a major interruption event, taking into account the nature of the load on each feeder and the consequence of potential interruptions to different consumers;

    b. the automatic load shedding equipment is maintained in good condition; and

    c. the automatic load shedding relays are set in accordance with the under-frequency load shedding scheme settings in relevant provisions of the Technical Rules.

10.6 Black Start

1. Following a blackout of part or whole of the SWIS system, System Management must return the SWIS to a Normal Operating State as soon as practical, taking account of the information System Management possesses on the circumstance of the blackout, and good power system operating practice.

2. System Management must provide a reconnection plan to each generating Facility that provides black start services to System Management on establishment of a black start contract.

3. The generating Facility will initiate action according to this plan on occurrence of the black start condition.

4. Regardless of whether System Management has notified an Emergency Operating State as part of a Dispatch Advisory, the situation will be deemed an Emergency Operating State and all Participants are to:

    a. comply with Dispatch Instructions, subject to the conditions in section 8.4; and
    b. use best endeavors to assist System Management to return the SWIS to a Normal Operating State.

5. System Management must endeavour to reconnect demand and ancillary service levels as soon as practical, consistent with good power system operating practice.

11 DISCLOSURE OF INFORMATION

1. In performing its functions under the Market Rules, System Management may be required to disclose certain information to Market Participants and Network Operators. In selecting the information which may be disclosed, System Management will utilise best endeavours and act in good faith to disclose only the information reasonably required by the application of the Market Rules.

APPENDIX I

SWIS Security Criteria and credible contingency events

The Security Limits shall be maintained such that the following contingent events can be sustained without:

a. exceeding any Equipment Limit or
b. causing the unexpected loss of another item of equipment, or
c. exceeding the voltage limits applicable to the network, or a section of the network.

The sudden tripping of a:

i. Transmission Circuit

ii. Transformer

iii. Capacitor

iv. Reactor

v. SVC

vi. Connected load

vii. Generator: except that where the tripping of a generator causes the SWIS frequency to fall to 48.75 Hertz as could be the case for tripping of the largest unit on the SWIS system, automatic under-frequency load shedding will commence and assist Spinning Reserve in returning the frequency to normal.

viii. A known protection system that for a single event caused by external influences results in the loss of more than one transmission element (*eg* pilot cable).

ix. The loss of a section of busbar in a substation or terminal station yard when (and only when) there are people working either:
   a. in the section of busbar concerned under a primary system; or
   b. on protection systems in the substation concerned.

x. The loss of a particular transmission element or set of transmission elements as a history of causing the loss of a particular source of energy infeed or a load.

CREDIBLE CONTINGENCIES OF SIGNIFICANTLY LOWER PROBABILITY

The following is considered a credible contingency of significantly lower probability:

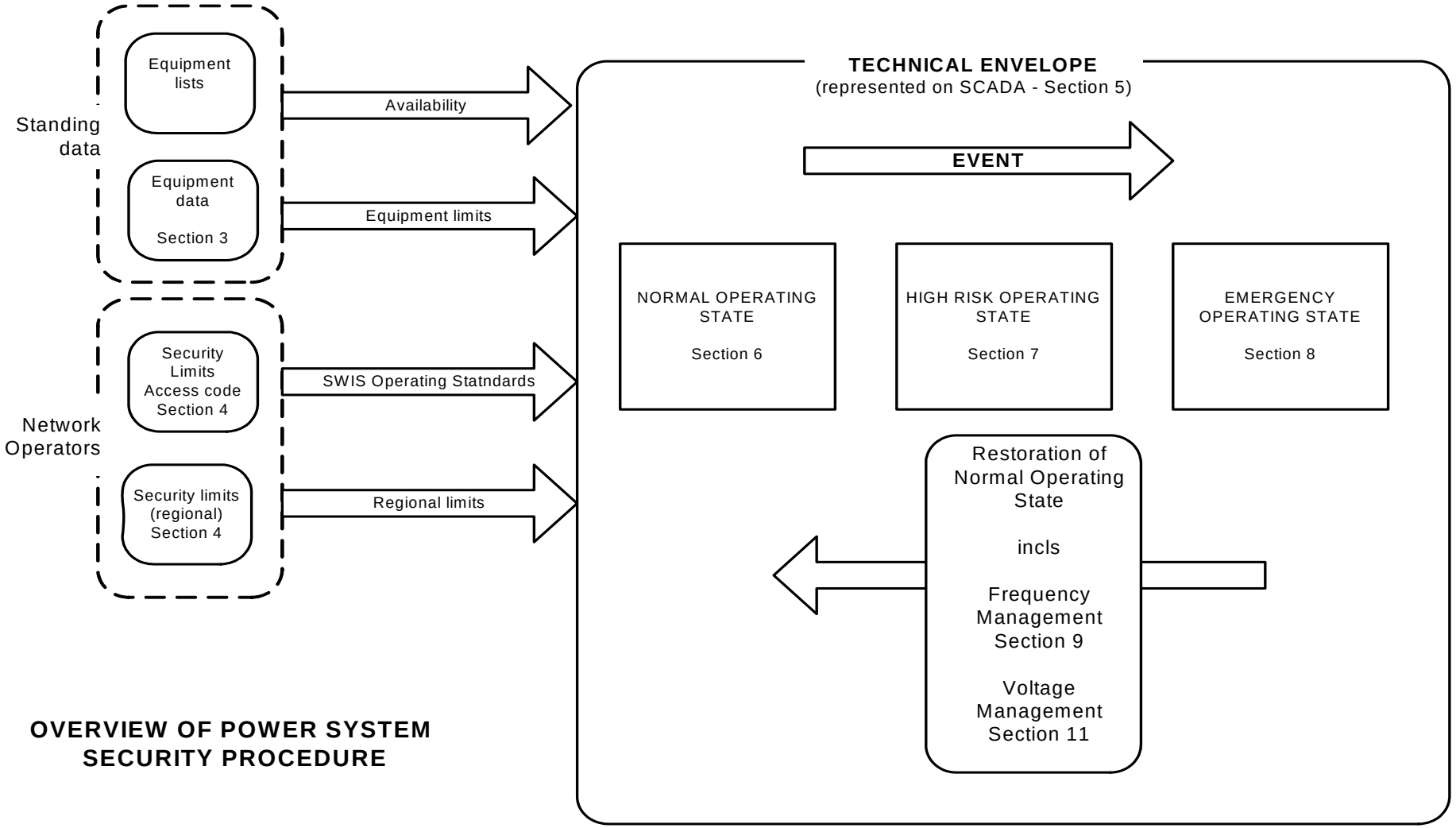
1. The loss of a section of busbar when (and only when) there are people working on a non-adjacent or non-adjoining section of the same busbar.

APPENDIX II

SWIS Frequency Operating Standards (Section 2.2 of Technical Rules)

Condition	Frequency Band	Target Recovery Time
No disturbance in SWIS :	49.8 to 50.2 Hz for 99% of time	
Single contingency	48.75 to 51 Hz	49.8 to 50.2 Hz within 25 minutes For over-frequency events: 51.0 to 50.5 Hz within 2 minutes
Multiple Contingency	47.0 to 52.0 Hz	49. 8 to 50.2 Hz within 25 minutes For under-frequency events: 47.0 to 47.5 Hz within 10 seconds 47.5 to 48.0 Hz within 5 minutes 48.0 to 48.5 Hz within 15 minutes For over-frequency events: 52.0 to 51.5 Hz within 1 minute 51.5 to 51.0 Hz within 2 minutes 51.0 to 50.5 Hz within 5 minute

APPENDIX III



OVERVIEW OF POWER SYSTEM SECURITY PROCEDURE

ELECTRICITY INDUSTRY ACT

ELECTRICITY INDUSTRY (WHOLESALE ELECTRICITY MARKET) REGULATIONS 2004

WHOLESALE ELECTRICITY MARKET RULES

Power System Operation Procedure:

Power System Security

Commencement: This Power System Operation Procedure commences on XX.

TABLE OF CONTENTS

1 POWER SYSTEM SECURITY

The Power System Security Procedure sets out the security standards that must be maintained on the SWIS and the processes for maintaining these standards while electricity is traded through the Western Australian Wholesale Electricity Market

2 RELATIONSHIP WITH MARKET RULES

1. This Procedure has been developed in accordance with, and should be read in conjunction with sections 3.1 to 3.6, and 3.10 of the Wholesale Electricity Market (WEM) Rules (Market Rules).

2. References to particular Market Rules within the Procedure in bold and square brackets **[MR XX]** are included for convenience only, and are not part of this procedure.

3. In performing its functions under the Market Rules, System Management may be required to disclose certain information to Market Participants and Network Operators. In selecting the information that may be disclosed, System Management will utilise best endeavours and act in good faith to disclose only the information reasonably required by the application of the Market Rules.

3 SCOPE

This procedure documents the processes which must be followed by:

a. System Management and Participants in maintaining Equipment information;
b. Network Operators and System Management in determining the Security Limits for the SWIS network, and maintaining Security Limit information;
c. System Management in establishing and modifying the Technical Envelope;
d. System Management to enable it to operate the SWIS according to the Technical Envelope applicable to each Operating State; and
e. System Management and Participants in Load Shedding Control.

4 ASSOCIATED PROCEDURES AND OPERATING STANDARDS

a. SWIS Technical Rules and Operating Standards
b. Power System Operation Procedure – Dispatch
c. Power System Operation Procedure – Ancillary Services Procedure
d. Power System Operation Procedure – Communications and Control Systems.
e. Power System Operation Procedure – System Restart Overview

5 EQUIPMENT LIMITS

The requirements that System Management must follow to record details of all Equipment Limits of which it is informed are specified in the Market Rules **[MR 3.2.2],** and includes all security limits as defined in section 6 of this procedure.

5.1 Equipment Limits

1. The definition of an Equipment Limit is specified in the Market Rules **[MR 2.34.1(b)]** which is deemed as Standing Data, however it must also include any information that System Management is otherwise aware of.

2. The IMO must provide the Standing Data and any revisions of the Standing Data to System Management as soon as practical.

3. Equipment Limit information will include all thermal rating data for all generator and network equipment that form the SWIS, and any other Standing Data that are relevant to the capability of the equipment to operate at its maximum rating, especially information on security constraints for a network.

5.2 System Management to maintain list of Equipment Limits

1. System Management must maintain a list of all Equipment Limits provided by the IMO to System Management, and must ensure that the database in System Management's SCADA monitoring system is updated to reflect any additions or changes to Equipment Limits.

2. System Management must arrange for the SCADA system to monitor the power flow within each item of equipment or Facility for which Equipment Limits is provided.

3. System Management must update the SCADA database with any new Equipment Limit prior to the data becoming operational.

4. Where System Management becomes aware that a generator Equipment Limit is inaccurate or will become inaccurate in the future, System Management must notify IMO of this as soon as practical.

6 SECURITY LIMITS.

1. The definition of a Security Limit is specified in the Market Rules **[MR 3.2.3].**

2. The Security Limits will be those technical requirements and standards in the Technical Rules that represent constraints on the operation of the SWIS, imposed for the purpose of managing electricity quality and security.

3. A Network Operator must consult with System Management in determining any Security Limits.

4. The Security Limits include:

a. SWIS Operating Standards that stipulate maximum and minimum voltage and frequency conditions for the overall SWIS network; and

b. voltage and security limits that apply to a region of the SWIS network, and are specified by a Network Operator.

5. System Management must maintain a list of all Security Limits provided by Network Operators that represents actual or potential constraints on the transfer of energy across the SWIS network.

6. When a Network Operator has not provided sufficient Security, Network or Equipment Limit information, System Management must operate the SWIS network according to its best estimate of the Security or Equipment Limits based on prior information, or information it possesses which is relevant to similar equipment elsewhere in the SWIS.

6.1 SWIS Operating Standards

1. The SWIS Operating Standards are those quality and security standards that apply to the entire SWIS network and represent a minimum requirement or transmission limit that must be complied with.

2. The SWIS Operating Standards are included in Table 2.1 and subsection 2.2.2 of the Technical Rules. These standards are extracted in Appendix I of this procedure, and are current as at 26 April 2007. Readers should refer to the Technical Rules to ensure currency of the Standards.

6.2 Regional Security Limits.

1. A Network Operator may specify Security Limits additional to the SWIS Operating Standards that apply to a specific location or region of the SWIS network, as provided in Equipment Limits.

7 TECHNICAL ENVELOPE

1. The definition of the Technical Envelope and the requirements that System Management must follow in establishing and modifying the Technical Envelope are specified in the Market Rules **[MR 3.2.5 and MR 3.2.6].**

2. In a Normal Operating State, the conditions set out in the Technical Rules apply to the Technical Envelope.

3. In a High Risk Operating State or Emergency Operating State:

- the frequency for a multiple contingency event; and
- the emergency condition voltage level

applies as specified in the Technical Envelope.

4. The Technical Envelope must take into account the circumstances of a potential High Risk Operating State or Emergency Operating State and System Management's powers as set out in the Market Rules **[MR 3.4 and 3.5].**

5. Where there are changes to the commissioning status of generation or transmission facilities or equipment, the boundaries of the Technical Envelope (ie Technical Limits and Security Data) must be dynamically updated in System Management's SCADA system, to reflect the application of the Technical Envelope. System Management must also update the network and generator topology accordingly.

6. As System Management's Technical Envelope is based on the requirement of the Technical Rules, any modification to the Technical Rules will also modify the Technical Envelope, in so far as it is relevant. **[The Technical Envelope may be referred to in DMS #4040062]**

8 NORMAL OPERATING STATE

1. The definition of the Normal Operating State and the requirements that System Management must follow are specified in the Market Rules **[MR 3.3].**

8.1 Normal Operating State Reliability Criteria

1. A condition of a Normal Operating State is that the SWIS Security Criteria are met.

2. The SWIS Security Criteria require that the power system is capable of withstanding the occurrence of a credible contingency event without causing:

   a. the unexpected disconnection of an item of equipment;
   b. the overloading of an item of equipment beyond its Equipment Limits; or
   c. the curtailment of non-dispatchable load, with the exception of the sudden loss of the largest generator connected at the time to the SWIS, where a portion of the first block of the under-frequency load scheme may be tripped if the frequency falls to 48.75 Hertz.

3. A credible contingency event means an event that System Management considers reasonably possible, and generally applies to the tripping or sudden loss of a generator unit or item of transmission equipment.

4. The credible contingency events which System Management must allow for are set out in Appendix II of this procedure.

9 VOLTAGE CONTROL

1. System Management must use its reasonable endeavours to maintain voltage levels throughout the SWIS within the limits specified in the Technical Envelope.

10 FREQUENCY CONTROL

1. System Management must use its reasonable endeavours to maintain the SWIS frequency within the limits specified in the Technical Envelope.

11 READY RESERVE

1. Ready Reserve generation is that class of generating Facility that can synchronise and generate a significant portion of its rated MW capacity within 15 minutes of receipt of a Dispatch Instruction or dispatch order, and operate at full output for at least 4 hours.

2. Ready reserve generation provides an important contribution to the security of the SWIS power system by being available to start quickly and provide “make-up” energy in the event of the sudden loss of a large generating unit or energy in-feed. The “make–up” energy enables load tripped on under-frequency to be quickly restored, Interruptible Load to be reconnected and Spinning Reserve levels to be reinstated within four hours.

3. Sufficient generating capacity with Ready Reserve characteristics is normally available on the SWIS, such that Ready Reserve capacity does not need to be specially scheduled and dispatched to maintain the necessary minimum

levels of Ready Reserve. However if a large amount of this class of generator is not available because of scheduled maintenance, it is possible there could be insufficient Ready Reserve generation to meet the objective of quickly restoring a Normal Operating State after tripping of a large generator.

4. The requirement to ensure adequate Ready Reserve is available following approval of Generator Outage Plans is covered in the Power System Operation Procedure – Facility Outage.

5. The requirement for a minimum level of Ready Reserve to be maintained will be managed through the Power System Operation Procedure - EGC Dispatch that governs the dispatch of EGC Generation Facilities.

12 HIGH RISK & EMERGENCY OPERATING STATES

1. When in a High Risk or Emergency Operating State, one or more Power System Reliability Criteria may not be achieved or maintained by System Management.

2. The definition of a High Risk Operating State and the requirements that System Management and Rule Participants must follow are specified in the Market Rules **[MR 3.4].**

3. The definition of an Emergency Operating State and the requirements that Rule System Management and Participants must follow are specified in the Market Rules **[MR 3.5]**

13 COMMUNICATION WITHIN THE SWIS

An Operating State may be changed following requirements detailed in the Power System Operating Procedure: Communications and Control Systems.

14 LOAD SHEDDING

1. The requirements that System Management and Network Operators must follow in determining and implementing automatic under frequency load shedding and manual load shedding plans are specified in the Market Rules **[MR 3.6]**

2. The principle governing the use of mandatory curtailment is that it should be used in circumstances where demand reduction is required to:

    a. preserve a minimum level of power system security;
    b. avoid a deteriorating security situation which will likely lead to the prospect of further mandatory load shedding; or
    c. avoid possible damage to power system facilities or consumer equipment due to severe violation of voltage, frequency standards or equipment ratings.

3. Manual Load Shedding: Network Operators must ensure that 75% of the power system load is available at any time for remote disconnection through System Management's centralised SCADA system.

4. Automatic Under Frequency Load Shedding: The feeders on each under-frequency block are reviewed following a major interruption event, taking into

account the nature of the load on each feeder and the consequence of potential interruptions to different consumers.

Appendix I **SWIS FREQUENCY OPERATING STANDARDS**
[Extracted from Section 2.2 of the Technical Rules Current as at 26 April 2007]

Table 2.1 *Frequency* Operating Standards for the *South West Interconnected Network*.

Condition	***Frequency* Band**	**Target Recovery Time**
Normal Range:		
South West	49.8 to 50.2 Hz for 99% of the time	
Island(1)	49.5 to 50.5 Hz	
Single contingency event	48.75 to 51 Hz	Normal Range: within 15 minutes. For over-*frequency* events: below 50.5 Hz within 2 minutes
Multiple *contingency event*	47.0 to 52.0 Hz	Normal Range within 15 minutes For under-*frequency* events: (a) above 47.5 Hz within 10 seconds (b) above 48.0 Hz within 5 minutes (c) above 48.5 Hz within 15 minutes. (d) For over-*frequency* events: (e) below 51.5 Hz within 1 minute (f) below 51.0 Hz within 2 minutes (g) below 50.5 Hz within 5 minutes

Note:

An island is formed when the *interconnection* between parts of the *interconnected transmission system* is broken, for example if the *interconnection* between the south-west and the Goldfields is broken.

2.2.2 Steady State Power *Frequency Voltage*

(a) Except as a consequence of a non-credible contingency event, the minimum steady state *voltage* on the *transmission* system and those parts of the *distribution system* operating at *voltages* of 6 kV and above must be 90% of nominal *voltage* and the maximum steady state *voltage* must be 110% of nominal *voltage*. For those parts of the *distribution* system operating below *voltages* of 6 kV, the steady state *voltage* must be within:

(1) ± 6% of the nominal *voltage* during *normal operating state*

(2) ± 8% of the nominal *voltage* during *maintenance conditions*,

(3) ±10% of the nominal *voltage* during *emergency conditions*.

(b) Step *changes* in steady state *voltage* levels resulting from switching operations must not exceed the limits given in Table 2.2.

Table 2.2 Step - change *voltage* limits

Cause	**Pre-*tap-changing (quasi steady-state)***		**Post-*tap-changing* (final steady state)**	
	≥ 66 kV	< 66 kV	≥ 66 kV	< 66 kV
Routine Switching[1]	±4.0 % (max)	±4.0% (max)	*Transmission voltages* must be between 110% and 90% of nominal *voltage*	Must attain previous set point
Infrequent Switching[2]	+6%, –10% (max)	+6%, –10% (max)	*Transmission voltages* must be between 110% and 90% of nominal *voltage*	Must attain previous set point

Notes:

1. For example, capacitor switching, *transformer* tap action, motor starting, start-up and shutdown of *generating units*.
2. For example, tripping of *generating units*, *loads*, lines and other components.

(c) Where more precise control of voltage is required than is provided for under clause 2.2.2(a), a target range of *voltage* magnitude at a *connection point,* may be agreed with a *User* and specified in a *connection agreement*. This may include different target ranges under normal and post-contingency conditions (and how these may vary with *load*). Where more than one *User* is supplied at a *connection point* such that independent control of the *voltage* supplied to an individual *User* at that *connection point* is not possible, a target must be agreed by all relevant *Users* and the *Network Service Provider*. Where voltage magnitude targets are specified in a *connection agreement, Users* should allow for short-time variations within 5% of the target values in the design of their equipment

APPENDIX II SWIS SECURITY CRITERIA AND CREDIBLE CONTINGENCY EVENTS

The Security Limits shall be maintained such that when operating in a Normal Operating State, the following contingency events can be sustained without:

a. exceeding any Equipment Limit or
b. causing the unexpected loss of another item of equipment, or
c. exceeding the voltage limits applicable to the network, or a section of the network.

The sudden tripping of a:

i. Transmission Circuit

ii. Transformer

iii. Capacitor

iv. Reactor

v. SVC

vi. Connected load

vii. Generator: except that where the tripping of a generator causes the SWIS frequency to fall to 48.75 Hertz as could be the case for tripping of the largest unit on the SWIS system, automatic under-frequency load shedding will commence and assist Spinning Reserve in returning the frequency to normal.

viii. A known protection system that for a single event caused by external influences results in the loss of more than one transmission element (*eg* pilot cable).

ix. The loss of a section of busbar in a substation or terminal station yard when (and only when) there are people working either:
    a. in the section of busbar concerned under a primary system; or
    b. on protection systems in the substation concerned.

x. The loss of a particular transmission element or set of transmission elements as a history of causing the loss of a particular source of energy infeed or a load.

CREDIBLE CONTINGENCIES OF SIGNIFICANTLY LOWER PROBABILITY

The following is considered a credible contingency of significantly lower probability:

1. The loss of a section of busbar when (and only when) there are people working on a non-adjacent or non-adjoining section of the same busbar.