

PUBLIC

## **WESM Market Manual**

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# **Emergency Procedures Issue 3.0**

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Abstract	This document prescribes general procedures that will be followed by the System Operator and by all WESM Participants whenever there is the existence of a situation which has an adverse material effect on electricity supply or which poses as a significant threat to system security.
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### Document Change History

Issue No.	Proponent	Date of Effectivity	Reason for Amendment
	SO Subcommittee		New Document
1	Interim Rules Change Committee		Revisions were made to incorporate the comments of the RCC.
2	Interim Rules Change Committee		Revisions were made on procedures during system over-frequency in Section 6.2 requiring generators under tests to ramp down to Pmin level or shutdown if critical over-frequency occurs.
3	National Grid Corporation of the Philippines		Revisions were made to align the pertinent provisions of the WESM Manual on Emergency Procedures with the changes in the power industry due to the technical requirements and stricter implementation of applicable/amended rules of the Grid Code.

### Document Approval

Issue No.	RCC Approval	RCC Resolution No.	PEM Board Approval	PEM Board Resolution No.	DOE Approval	DOE DC No.
1.0	28 July 2005	2005-02	17 August 2005	2005-14		
2.0	27 July 2006	2006-31	27 September 2006	2006-52		
3.0	03 March 2016	2016-04	31 March 2016	2016-13	24 June 2016	2016-06-0011

### Reference Documents

Document ID	Document Title
	WESM Rules
	Philippine Grid Code
	Philippine Distribution Code

## **Table of Contents**

SECTION 1 INTRODUCTION	1
SECTION 2 DEFINITION OF TERMS	2
SECTION 3 OBJECTIVE	4
SECTION 4 SCOPE	4
SECTION 5 RESPONSIBILITIES	4
SECTION 6 EMERGENCY PROCEDURES	5
SECTION 7 AMENDMENTS, PUBLICATION AND EFFECTIVITY	13

<b>SECTION 1 INTRODUCTION</b>
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Maintaining continuous power supply to the customers is the primary concern in the Philippine electricity industry. Thus, system should account for minimal interruption of service to the customers. However, even with the latest state-of-the-art design, planning, and/or maintenance criteria, it is inevitable that the system will experience disturbances. Hence, the system should be able to react to and withstand any system disturbances. It implies that the system will remain intact even after outages or other equipment failures occur.

The System Operator and Market Operator are in the forefront in ensuring that the power system is reliable and secure. Scheduling of ancillary services and system reserve requirements are being done by System Operator while the Market Operator considers the N-1 security criteria requirement of the Grid Code in their dispatch simulations in order to make the system more reliable and secure.

To further improve system reliability and security, System Operator has also installed various equipment and protection schemes throughout the power system. Redundant protection devices are installed and are continuously being upgraded (to numerical devices) to ensure that system disturbances could be isolated the fastest possible time even if there is a failure of one fault clearance system component. Automatic load dropping (ALD) scheme are in place to arrest deterioration of the system that could eventually lead to system collapse. System integrity protection scheme (SIPS) are also in place in identified critical lines to further increase the system's N-1 security criteria to N-2. This is done to arrest cascading outages that could eventually also lead to system collapse. Contingency analysis of the system is continuously done by the national control center/regional control center personnel to determine the best possible operator action in case of any unplanned outage.

However, in reality, even the best protection system, contingency planning and preparation could be derailed by an incident or a series of incidents endangering the system and placing the system in an extreme state condition that would require operator intervention. During this condition, the system is considered to be in an emergency state.

The System Operator is responsible for giving directions and coordinating actions, which are to be undertaken by WESM Participants and Market Operator when there is market intervention. During emergency, the System Operator and Market Operator will coordinate their actions to restore normal operation of the power system and the market. The System Operator will declare an emergency when it determines the existence of a situation which has an adverse material effect on electricity supply or which poses as a significant threat to system security.

Emergency procedures are the actions to be taken by WESM Participants and Market Operator at the direction of the System Operator to maintain system security and/or avert or reduce the effect of an adverse system condition. These are the procedures undertaken to restore the power system to a satisfactory operating state immediately after an emergency.

<b>SECTION 2 DEFINITION OF TERMS</b>
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**Automatic Load Dropping (ALD).** The process of automatically and deliberately removing pre-selected loads from a power system in response to an abnormal condition in order to maintain the integrity of the power system. It can be classified as: 1) Under frequency load shedding (UFLS); and 2) Undervoltage load shedding (UVLS).

**Availability.** The long-term average fraction of time that a component or system is in service and satisfactorily performing its intended function. This is also the steady-state probability that a component or system is in service.

**Cascading Outage.** The uncontrolled successive loss of system elements triggered by an incident at any location.

**Contingency.** The outage of one component of the grid that cannot be predicted in advance but which excludes scheduled maintenance.

**Customer.** Any person/entity supplied with electric service under a contract with a Distributor or Supplier.

**Disturbance.** An unplanned event that produces an abnormal system condition.

**Emergency.** Any abnormal system condition that requires automatic or immediate manual action to prevent or limit loss of transmission facilities or generation supply that could adversely affect the reliability of the electric system.

**Emergency State.** The grid shall be considered in the emergency state when:

- (a) Single outage contingency (N-1) criterion is not met. Imminent threat in system security would exist should a credible n-1 contingency occur that would result in the cascading outages of lines and equipment if not corrected immediately.
- (b) There is generation deficiency or operating margin is zero.
- (c) Grid transmission voltage is outside the limits of -10% or +10% of the nominal value.
- (d) The loading levels of all transmission lines and substation equipment are beyond the threshold as set by the PGC.
- (e) The grid frequency is beyond the limits of 59.4 Hz and 60.6 Hz.

**Fault.** An event occurring on an electric system such as a short circuit, a broken wire, or an intermittent connection.

**Manual Load Dropping (MLD).** The process of manually and deliberately removing pre-selected loads from a power system in response to an abnormal condition in order to maintain the integrity of the system.

**Multiple Outage Contingency.** An event caused by the failure of two (2) or more components of the grid including generating units, transmission lines, and transformers.

**Normal State.** The grid operating condition when the system frequency, voltage, and transmission line and equipment loading are within their normal operating limits, the operating margin is sufficient, and the grid configuration is such that any fault current can be interrupted and the faulted equipment isolated from the grid.

**N-0 Condition.** Depicts a system in base case or in its normal steady-state operation, with all components that are expected to be in service are in fact in service. For avoidance of doubt, resetting to new N-0 shall be applied after occurrence of a long lasting contingency / prolonged outage.

**N-1-1 Condition.** Depicts a contingency where a sequence of events consisting of an initial outage of a component followed by a secondary loss.

**N-k Condition.** Depicts a contingency of multiple outages happening at the same time.

**Reliability.** The performance of the elements of the bulk electric system that results in electricity being delivered to customers within accepted standards and in the amount desired. Reliability may be measured by the frequency, duration, and magnitude of adverse effects on the electric supply.

**Security.** The ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements.

**Single Outage Contingency (N-1).** An event caused by the failure of one component of the grid including those enumerated under GO 6.2.1.1 of the PGC.

**Single Outage Contingency (N-1) Criterion.** A system security criterion where the grid, following a credible N-1 contingency (GO 6.2.1.1 of PGC), is required to be capable to operate within certain minimum performance (GO 6.2.1.2 of PGC) and tolerate the outage.

**System Integrity Protection Scheme (SIPS).** A protection system that is designed to detect abnormal or predetermined system conditions, and take automatic corrective actions.

**Stability.** The ability of the dynamic components to return to a normal or stable operating point after being subjected to some form of change or disturbance.

**Voltage Collapse.** An event that occurs when an electric system does not have adequate reactive support to maintain voltage stability. Voltage collapse may result in outage of system elements and may include interruption in service to customers.

**Voltage Control.** Any actions undertaken by the System Operator or user to maintain the voltage of the grid within the limits prescribed by the Philippine Grid Code such as, but not limited to, adjustment of generator reactive output, adjustment in transformer taps or switching of capacitors or reactors.

### **SECTION 3 OBJECTIVE**

Restoring the power system to a normal operating state immediately after an emergency is the primary objective of establishing these procedures. This mandate is clearly vested under Clause 3.8.2.1 (d) of the WESM Rules which stipulates that, the System Operator will intervene, where necessary, as provided during system emergencies.

This document prescribes general actions that must be undertaken by all WESM Participants, System Operator and Market Operator to restore the power system to a satisfactory operating state immediately after an emergency in the Luzon, Visayas and Mindanao power systems. These guidelines are based on existing practices, the Grid Code and Distribution Code requirements and developed in accordance with Clause 6.3.2.4 of the WESM Rules which states that the System Operator in consultation with the Market Operator will develop appropriate emergency procedures and publish the details of the approved procedures in accordance with the Grid Code and Distribution Code, subject to approval of the PEM Board.

### **SECTION 4 SCOPE**

These guidelines apply to the following WESM Participants:

- (a) Market Operator;
- (b) System Operator;
- (c) Generation Companies;
- (d) Ancillary Service Providers;
- (e) Distribution Utilities;
- (f) Suppliers;
- (g) Bulk Consumers / End-users; and
- (h) Other similar entities, authorized by the Energy Regulatory Commission (ERC) to become members of the WESM.

### **SECTION 5 RESPONSIBILITIES**

#### **5.1 System Operator**

- 5.1.1 The System Operator shall give emergency instructions or directives when it determines the existence of a situation which has an adverse material effect on electricity supply or which poses as a significant threat to system security.

The System Operator shall prepare and submit a significant incident report to the ERC, PEM Board, DOE, Grid Management Committee and the Market Operator.

- 5.1.2 May from time to time specify procedures for communicating the existence of an emergency and all relevant information relating to the emergency to the WESM Participants.
- 5.1.3 Review and update the emergency procedures in consultation with the Market Operator as the need arises.

## **5.2 The WESM Participants**

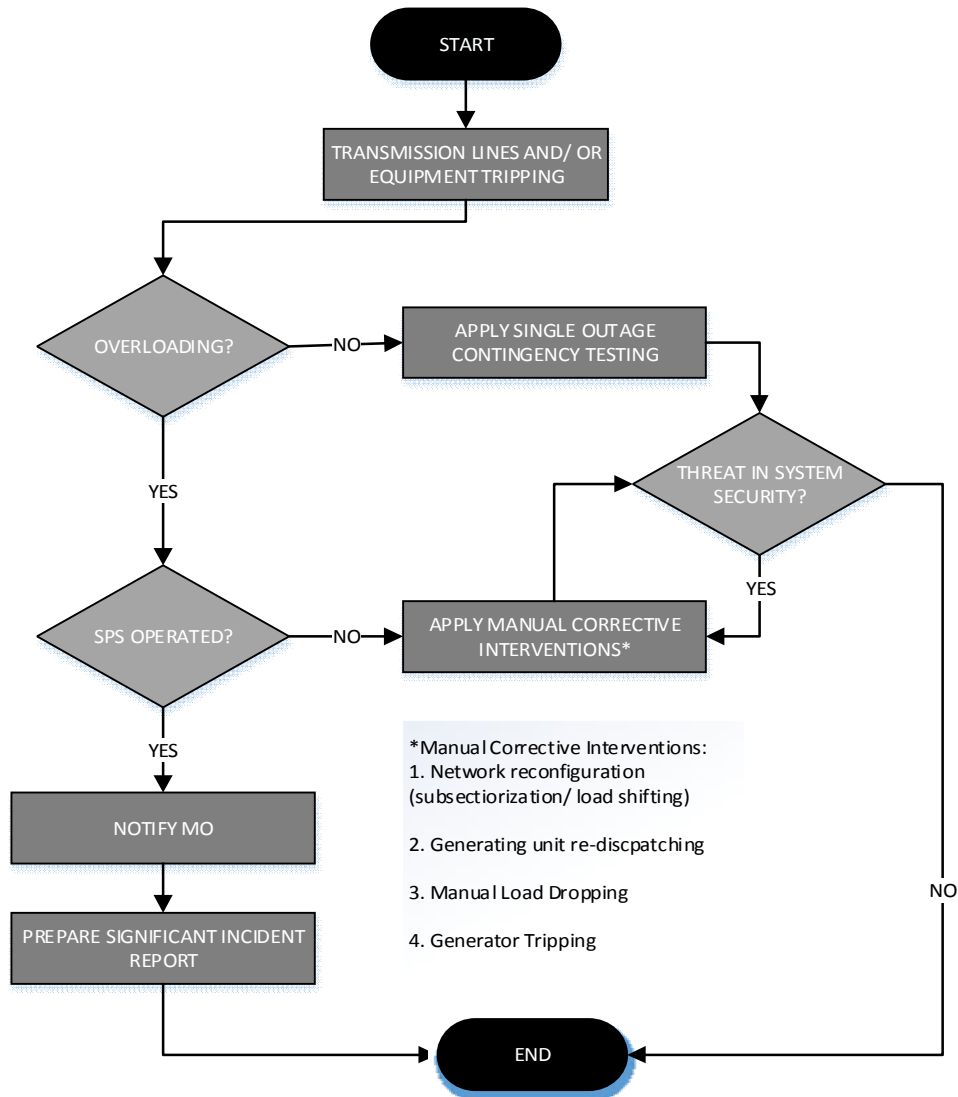
- 5.2.1 Notify the System Operator as soon as practicable of:
  - (a) Any event or situation of which the WESM Participant becomes aware where, in the reasonable opinion of the WESM Participant, that event or situation is of a kind described as an emergency; and
  - (b) Any action taken by the WESM Participant under its safety procedures otherwise in response to that event or situation, in accordance with the Grid Code and Distribution Code.
- 5.2.2 Ensure that its safety plan permits it to comply with emergency directions.
- 5.2.3 Comply with any emergency direction given by the System Operator, including emergency directions requiring the disconnection of equipment from a transmission system or distribution system for reliability purposes, unless the WESM Participants reasonably believes that an emergency direction given by the System Operator poses a real and substantial risk of damage to its equipment, to the safety of its employees or the public, or of undue injury to the environment.
- 5.2.4 Notify the System Operator if it intends not to follow the emergency direction for any of the reasons described in Section 5.2.3.
- 5.2.5 Comply with the System Operator's direction to the fullest extent possible without causing the harms described in Section 5.2.3

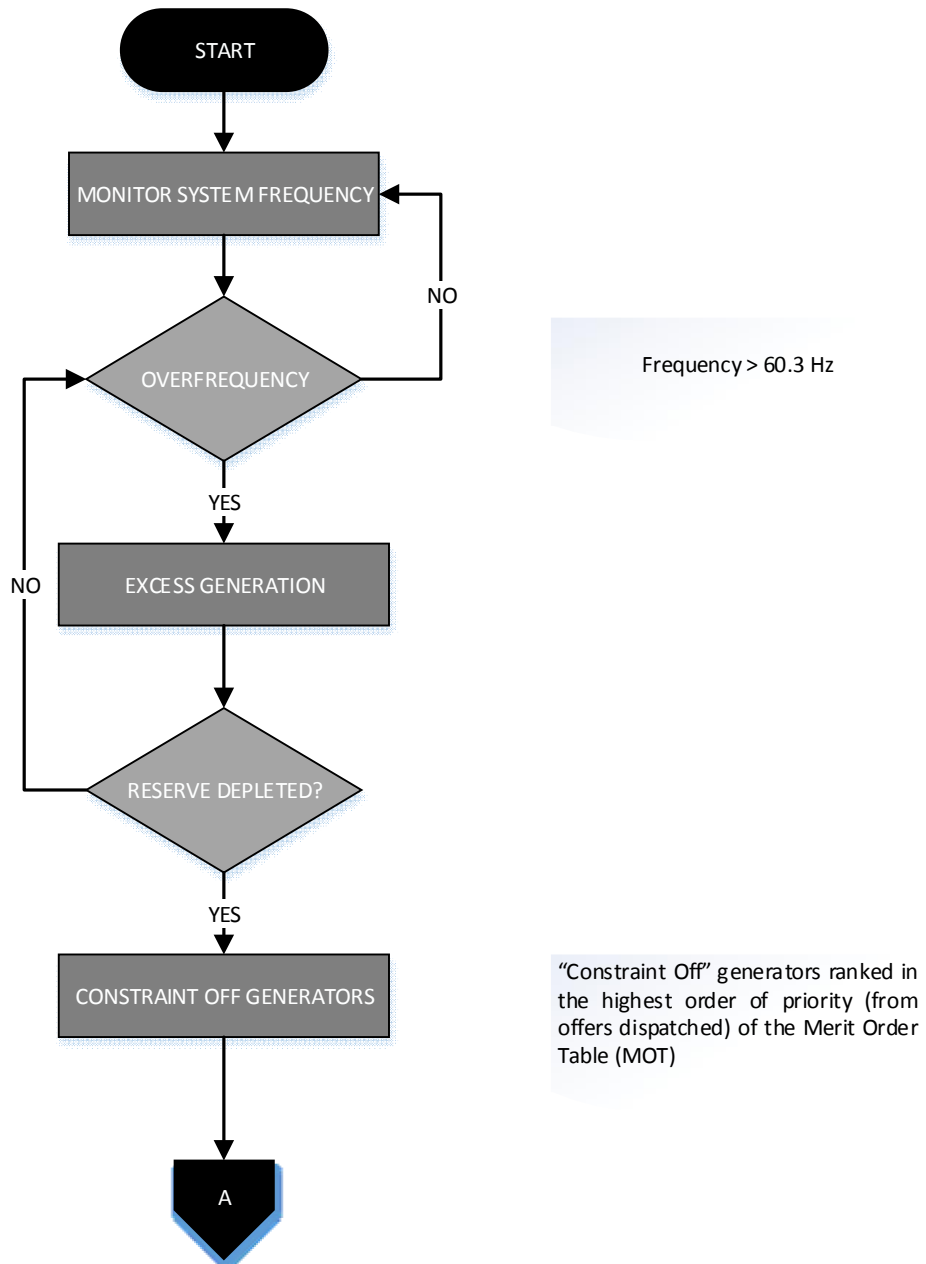
<b>SECTION 6 EMERGENCY PROCEDURES</b>
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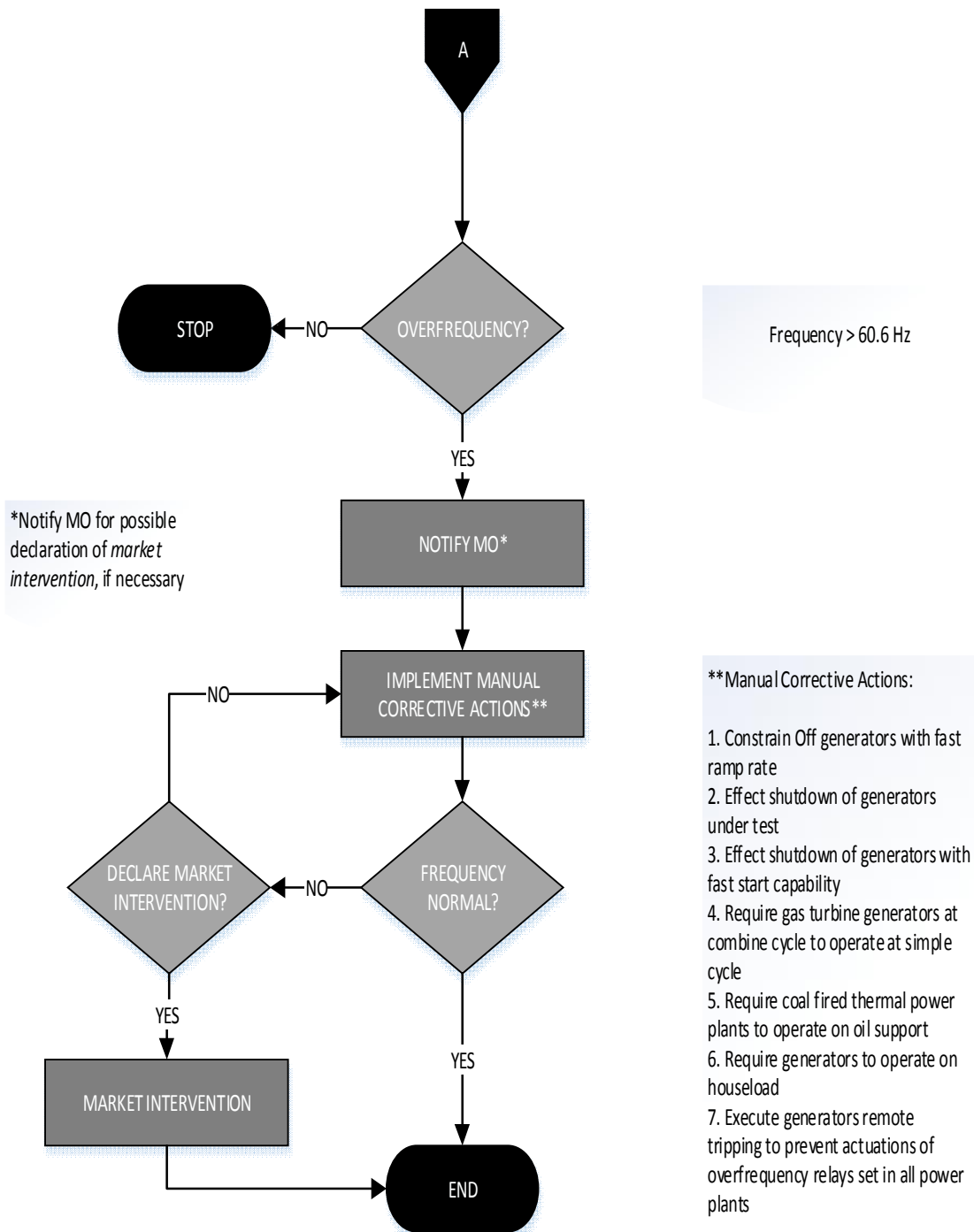
The power system will be operated to achieve the highest practical degree of service reliability. Appropriate emergency actions will be taken promptly to prevent cascading outage and further deterioration of the system that may lead to system collapse. As a guiding principle, System Operator will consider in its emergency action, those contingencies which would have the greatest impact in immediately relieving the overloaded lines and/or equipment.



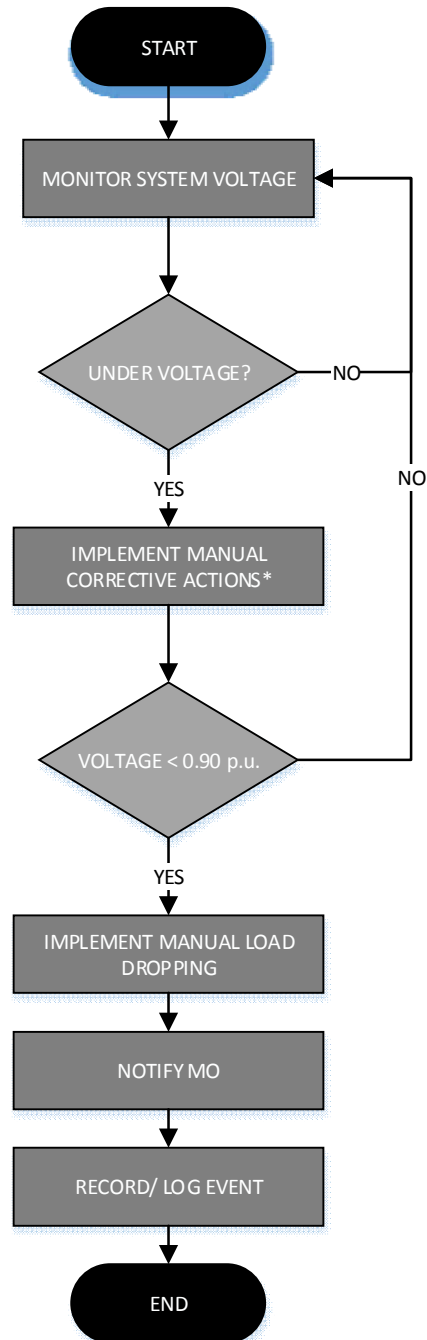
### 6.1 Emergency Procedure During Overload (Due to line and/or equipment tripping)



**6.2 Emergency Procedure During Excess Generation**



### 6.3 Emergency Procedure During Under Voltage Condition

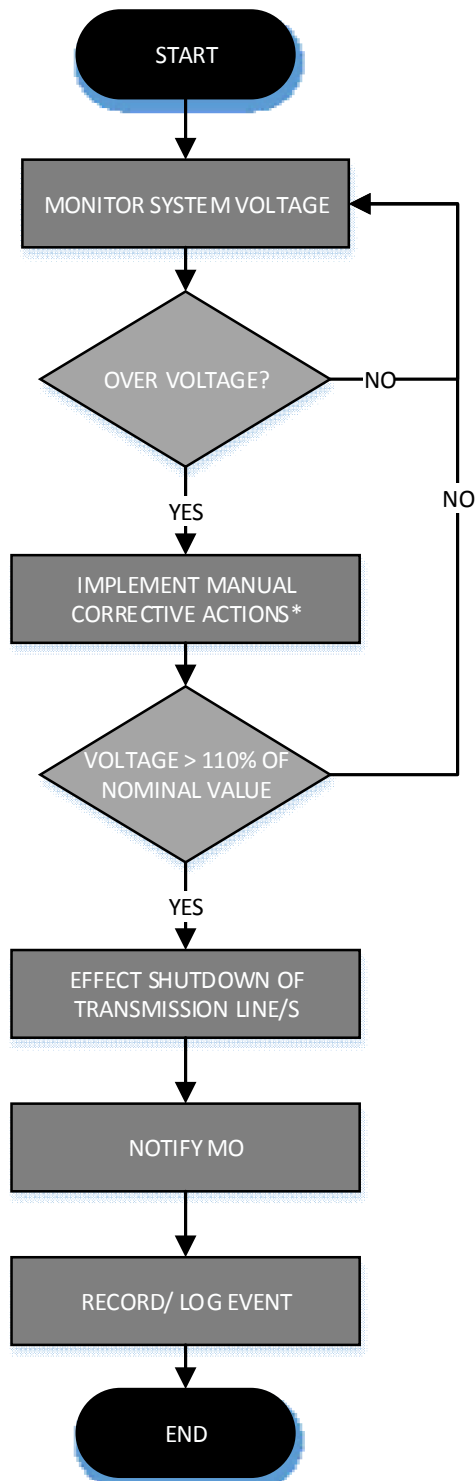


**\*Manual Corrective Actions:**

1. Instruct the plant operator/s to provide the required MVAR adjustment on their generating units to correct the system voltage based on the declared generator capability curve (within 0.85 lagging power factor as specified in the PGC.)
2. Switch on capacitor banks if offline and switch off shunt reactors if online.
3. Instruct plant operator/s of a generator with certified reactive ancillary providers with approved nomination to provide per the Ancillary Service Contract (below 0.85 lagging power factor)

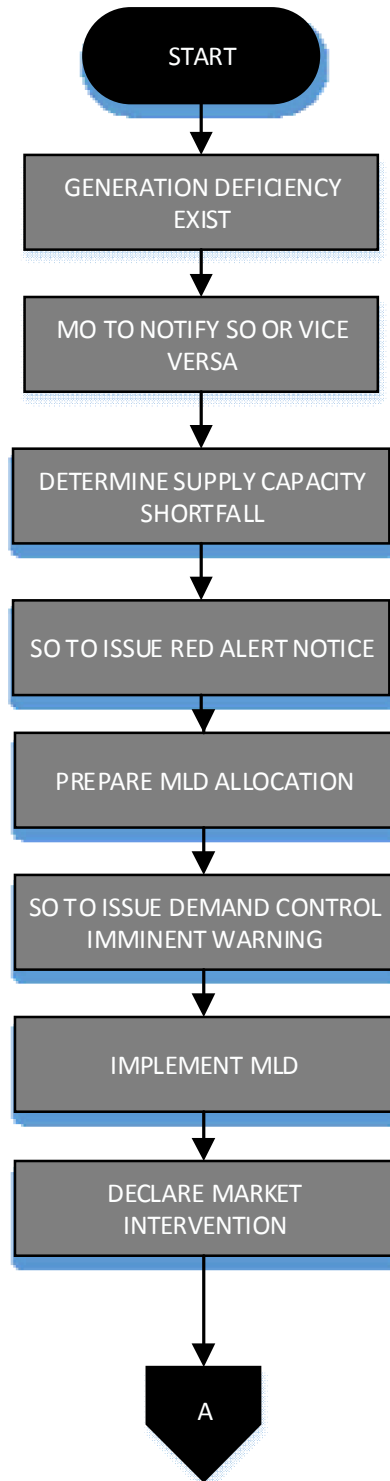


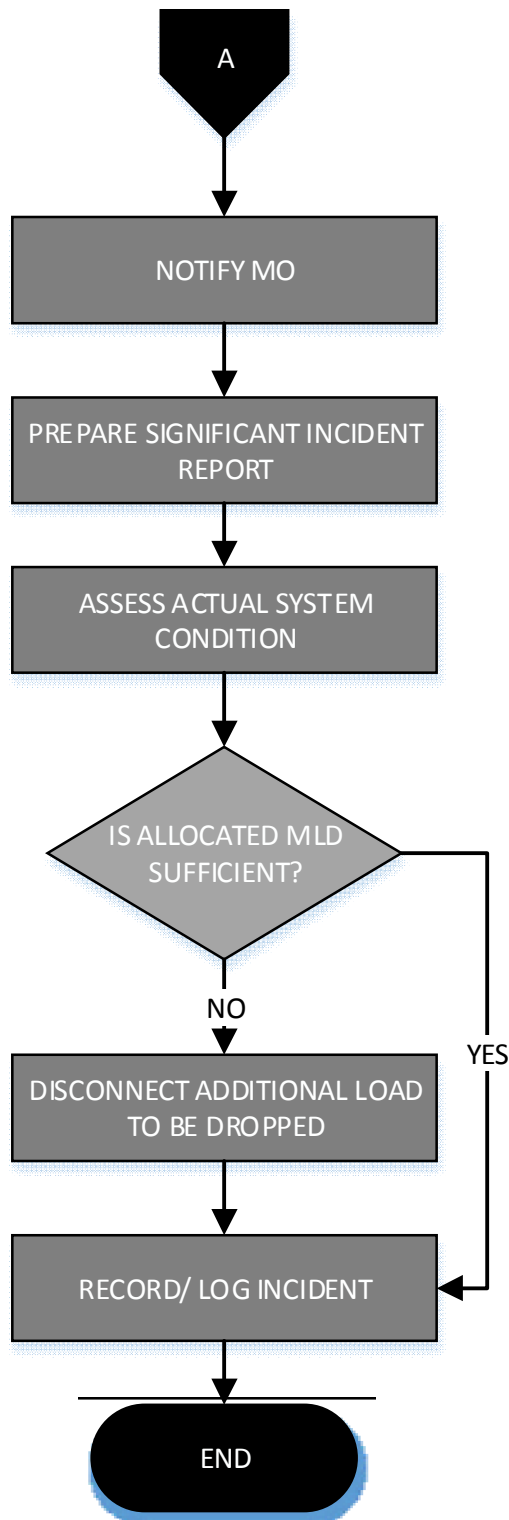
## 6.4 Emergency Procedure During Over Voltage



### \*Manual Corrective Actions:

1. Instruct the plant operator/s to provide the required MVAR adjustment on their generating units to correct the system voltage based on the declared generator capability curve (within 0.85 lagging power factor and 0.90 leading power factor as specified in the PGC).
2. Switch off capacitor banks if online and switch on shunt reactors if off line.
3. Instruct plant operator/s of a generator with certified reactive ancillary providers with approved nomination to provide reactive support as per Ancillary Service Contract (above 0.90 leading power factor).
4. Shutdown transmission line/s for extreme cases of high voltage condition. Voltage is above 1.10 p.u.

**6.5 Emergency Procedure During Manual Load Dropping**





<b>SECTION 7 AMENDMENTS, PUBLICATION AND EFFECTIVITY</b>
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**7.1 Amendments**

Any amendments to this Manual shall be approved by the PEM Board, following the procedures for changes to the Market Manual set out in the WESM Rules and in the relevant Market Manual.

**7.2 Publication and Effectivity**

This Market Manual, as it may be amended from time to time, shall be published in the market information website maintained by the Market Operator.

This Market Manual or any amendments thereto shall become effective upon approval of the DOE in accordance with the WESM Rules Clause 8.6.4. The date of effectivity shall be indicated in this document.