# PJM Manual 13:

Emergency Operations

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Prepared by
System Operations Division

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## Approval

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Donald Bielak, Sr. Manager, Dispatch

## Current Revision

**Revision 89 (7/26/2023):**

- Periodic Review
- Section 2.2, 2.3.2 Grammatical cleanup
- Section 2.3.2, 5.2 Replaced eCapacity reference with Capacity Exchange
- Section 3.3.2 Removed extra bullets & adjusted bullets under PJM actions to clearly show sequence
- Section 3.9 Note cleanup
- Section 4.2 Removed the PJM Shift Supervisor’s phone number reference
- Section 5.4 Removed extra bullet
- Attachment E Manual Load Dump Allocation table updated for 2023
- Attachment F Exhibit 6 updated for 2023

# Introduction

Welcome to the ***PJM Manual for Emergency Operations***. In this Introduction, you will find the following information:

- What you can expect from the PJM Manuals in general (see "*About PJM Manuals*").
- What you can expect from this PJM Manual (see "*About This Manual*").
- How to use this manual (see "*Using This Manual*").

## About PJM Manuals

The PJM Manuals are the instructions, rules, procedures, and guidelines established by PJM for the operation, planning, and accounting requirements of PJM and the PJM Energy Market. The manuals are grouped under the following categories:

- Transmission
- PJM Energy Market
- Generation and Transmission interconnection
- Reserve
- Accounting and Billing
- PJM administrative services

For a complete list of PJM manuals, go to the Library section on PJM.com.

## About This Manual

The ***PJM Manual for Emergency Operations*** focuses on how PJM and the PJM Members are expected to respond to emergency conditions and is the designated PJM RC, BA and TOP Operating Plan to mitigate operating Emergencies per EOP-011. Emergency conditions include:

- Any abnormal condition requiring manual or automatic action to maintain system frequency or to prevent loss of firm load, equipment damage, or tripping of system elements that could adversely affect the reliability of an electric system or the safety of persons or property.
- A fuel shortage requiring departure from normal operating procedures in order to minimize the use of such scarce fuel.
- A condition that requires implementation of emergency procedures as defined in the manuals.

The ***PJM Manual for Emergency Operations*** consists of six sections and twelve attachments. These sections are listed in the table of contents beginning on page 2.

### Intended Audience

The Intended Audiences for the ***PJM Manual for Emergency Operations*** are:

- PJM dispatchers — Declare and implement emergency procedures

- Local Control Center (LCC) and Market Operations Centers (MOC) dispatchers — respond to PJM dispatcher requests for emergency procedures
- PJM operations staff — Perform system studies
- Government, Regulatory, and Emergency Response personnel
- All PJM Members
- PJM neighboring or internal Transmission Operators (TOP), Balancing Authorities (BA), and Reliability Coordinators (RC), and appropriate Regional Reliability Organizations (RRO)

### References

The references to other documents that provide background or additional detail directly related to the ***PJM Manual for Emergency Operations*** are:

- PJM Manual for Control Center and Data Exchange Requirements (M-01)
- PJM Manual for Transmission Service Request (M-02)
- PJM Manual for Transmission Operations (M-3)
- PJM Manual for Pre-Scheduling Operations (M-10)
- PJM Manual for Balancing Operations (M-12)
- PJM Manual for Generator Operational Requirements (M-14D)
- PJM Manual for Operating Agreement Accounting (M-28)
- PJM Manual for System Restoration (M-36)

## Using This Manual

We believe that explaining concepts is just as important as presenting procedures. This philosophy is reflected in the way we organize the material in this manual. We start each section with an overview. Then, we present details, procedures or references to procedures found in other PJM manuals. The following provides an orientation to the manual's structure.

### What You Will Find In This Manual

- A table of contents that lists two levels of subheadings within each of the sections
- An approval page that lists the required approvals and the brief outline of the current revision.
- Sections containing the specific guidelines, requirements, or procedures including PJM actions and PJM Member actions. Attachments that include additional supporting documents, forms, or tables in this PJM Manual
- A section at the end detailing all previous revisions of this PJM Manual.

# Section 1: Overview

Welcome to the Overview section of the **PJM Manual for Emergency Operations**.

This section of the manual addresses PJM and the PJM Members' responsive actions to emergency conditions. An Emergency in the PJM RTO is defined as:

- An abnormal system condition requiring manual or automatic action to maintain system frequency, to prevent loss of firm load, equipment damage, or tripping of system elements that could adversely affect the reliability of an electric system or the safety of persons or property.
- Capacity deficiency or capacity excess conditions.
- A fuel shortage requiring departure from normal operating procedures in order to minimize the use of such scarce fuel.
- Abnormal natural events or man-made threats that would require conservative operations to posture the system in a more reliable state.
- An abnormal event external to the PJM service territory that may require PJM action.

This manual constitutes PJM's Emergency Operations Plan per NERC and RFC EOP standards for mitigating operating emergencies. PJM will review this plan annually and provide notification of such action to PJM neighboring and internal Transmission Operators (TOP), Balancing Authorities (BA), and Reliability Coordinators (RC), and appropriate Regional Reliability Organizations (RRO).

## 1.1 Policy Statements

The policy of PJM is to maintain, at all times, the integrity of the PJM RTO transmission systems and the Eastern Interconnection, and to give maximum reasonable assistance to adjacent systems when a disturbance that is external to the PJM RTO occurs. Power system disturbances are most likely to occur as the result of loss of generating equipment, transmission facilities, or as the result of unexpected load changes. These disturbances may be of, or develop into, a magnitude sufficient to affect the reliable operation of the PJM RTO and/or the Eastern Interconnection. These events demand timely, decisive action to prevent further propagation of the disturbance.

Every effort is made to avoid interrupting system load. However, under certain operating conditions, it is necessary to curtail or interrupt customer load. PJM will work to interrupt the minimum amount of load necessary to adequately respond to the emergency. The PJM dispatcher requests the local transmission dispatcher (or agent in the case of Load Management / LM programs) to curtail or interrupt customer load as necessary. The PJM dispatcher has the absolute authority to order load shed within the PJM RTO in order to preserve system reliability in accordance with NERC Transmission Operations (TOP) standards and the PJM Operating Agreement (Section 1.6.2, "Scope of Services" and Section 1.7.11, "Emergencies").

**PJM Actions**

In general, PJM is responsible for the following activities:

- Taking actions it determines are consistent with Good Utility Practice and are necessary to maintain the operational integrity of the PJM RTO and the Eastern Interconnection.
- PJM may issue a Production System Change Freeze where PJM will refrain from updating business application systems, programs, data, systems software, hardware and other aspect of the information-processing environment at PJM.
- Declaring an Emergency exists or has ceased to exist.
- Implementing the Emergency procedures of agreements with other neighboring Reliability Coordinators & Balancing Authorities.
- Implementing Emergency Procedures for the PJM Reliability Coordinator footprint consistent with NERC Policies.
- Purchasing emergency energy from outside the PJM RTO, as needed, to alleviate or end an Emergency.
- Selling emergency energy to other Control Areas as requested during Emergency conditions in other Control Areas.
- Directing the operations of any PJM Member as necessary to manage, alleviate, or end an Emergency, including but not limited to:
    - Load shedding while minimizing overlap with automatic load shedding,
    - Increasing or decreasing generation output,
    - Transmission system reconfiguration,
    - Recalling/cancelling non-critical Generation and Transmission testing or maintenance.
- Documenting emergency procedures in PJM's Emergency Procedures (https://emergencyprocedures.pjm.com/) logging application as well as its own internal Smartlog application. In addition, PJM's PCLLRW tool is utilized for issuance and tracking of PCLLRW-related events, but also logged within the Emergency Procedures and Smartlog applications. All logging data shall be retained for a period of no less than 6 years.
- Providing information to and receiving information from PJM Members in the PJM RTO and other control areas, as appropriate to manage, alleviate, or end an Emergency in the PJM RTO or in another Control Area.
- Retain evidence (operator logs, voice recordings, electronic communications, etc.) of PJM's implementation of capacity and energy emergency actions per NERC EOP Standards.
- Providing information to the PJM Members, as needed, in order to facilitate notification of governmental authorities and other interested entities of Emergency conditions and providing such notification if appropriate.
- Posting to the Reliability Coordinator Information System [RCIS] as appropriate and in accordance with NERC standards.

- Preparing or assisting the PJM Members in preparing reports required by governmental or industry agencies as a result of an Emergency.
- Coordinating restoration of all or parts of the bulk power system in the PJM RTO, as necessary.
- PJM shall annually review and update this manual and provide a copy to neighboring and internal Reliability Coordinators, Transmission Operators, Balancing Authorities, and appropriate Regional Reliability Organizations.

**PJM Member Actions**

PJM Members will review this manual on an annual basis in accordance with NERC, RF and SERC standards through the System Operations Subcommittee (SOS). The SOS is an operational stakeholder group for coordinated transmission and generation operations. The SOS is composed of two groups. One group, System Operations Subcommittee-Transmission (SOS-T) consists of only Transmission Owners and the other, System Operations Subcommittee-Joint (SOS-J), consists of both Generation Owners and Transmission Owners.

When an Emergency is declared by PJM, the PJM Members are responsible for performing the following activities:

- Taking other actions, as requested or directed by PJM, to manage, alleviate, or end an Emergency.
- Cooperating with each other and PJM to carry out the Emergency procedures and to implement requests and instructions received from PJM for the purpose of managing, alleviating, or ending an Emergency.
- Providing notification and other information to governmental agencies as appropriate.
- Collecting, storing, and providing data and other information to PJM, as necessary, to facilitate preparation of reports required by governmental or industry agencies as a result of an Emergency.
- Cooperating and coordinating with PJM and other PJM Members in the restoration of all or parts of the bulk power system in the PJM RTO.

A PJM Generation owner controlling the output of a Capacity Resource must take or arrange for any or all of the following actions as directed by PJM in order to manage alleviate, or end an Emergency, or such actions as PJM may deem appropriate for these purposes:

- Reporting the operating status and resource limitations.
- Canceling, or recall of, Generator testing and maintenance.
- Canceling GMS/EMS Database or communication link testing and maintenance.
- Reducing non-critical plant load.
- Reducing non-essential office load.
- Directing personnel to unattended generation sites.
- Increase/Decrease generation output in alignment with PJM redispatch.

- Starting, including black-start, and loading such generation, as directed.
- Increasing output to Maximum Emergency generation.
- Reducing output to Emergency Minimum Generation.
- Shutting down such generation.
- Interrupting sales for delivery to loads outside the PJM RTO.
- Selling energy to other control areas.
- Maintaining records of emergency actions taken and the results achieved.

A Transmission Owner (TO) or Distribution Provider (DP) must take any or all of the following actions as directed by PJM in order to manage alleviate, or end an Emergency, or such actions as PJM may deem appropriate for these purposes:

- Canceling, or recall of, Transmission testing and maintenance.
- Transmission system reconfiguration.
- Canceling EMS Database or communication link testing and maintenance.
- Maintaining under frequency load shedding relays.
- Providing capability for manual shedding of specified amounts of load.
- Reducing energy purchases (DP only).
- Reducing non-essential office load.
- Implementing voltage reductions.
- Requesting voluntary customer energy conservation or load curtailment.
- Implementing manual load shed, looking to minimize overlap with automatic Under Frequency Load Shedding (UFLS), and capable of being implemented in a timeframe adequate for mitigating the Emergency.
- Managing, curtailing, or interrupting load, including PJM programs such as Load Management (LM) or other Load Reduction Programs.
- Maintaining records of Emergency actions taken and the results achieved.

PJM Members taking action to manage, alleviate, or end an Emergency affecting any facilities not designated as part of the bulk electric system (BES) in the PJM RTO must perform the following actions:

- Exerting their best efforts to avoid impairing the operational integrity of the bulk power system in the PJM RTO.
- Notifying PJM in advance of taking any such action if possible, or if not provide such notification immediately after taking such action.

**Note:**
All alerts, warnings, and actions are communicated to Transmission / Generation dispatchers via an ALL-CALL message (and/or, direct operator to operator communication for local events) and posted on selected PJM web-sites. Unless prior agreement is in place with PJM, Transmission Owner dispatchers are responsible for notifying Distribution Providers (DPs), assuring they receive the same information.

PJM Emergency Authority: Section 10.4, of the PJM Operating Agreement (OA) provides that the Office of the Interconnection has the responsibility to "direct the operations of the Members as necessary to manage, alleviate, or end an Emergency". Likewise, Section 11.3.1 (e), of the (OA) states that PJM members must comply with "all directives of the Office of the Interconnection to take any action for the purpose of managing, alleviating or ending an Emergency".

Synchronized Reserves: Section 1, Definitions, of the PJM Operating Agreement (OA) defines Synchronized Reserves as "the reserve capability of generation resources that can be converted fully into energy or Demand Resources whose demand can be reduced within ten minutes from the request of the Office of the Interconnection dispatcher, and is provided by equipment that is electrically synchronized to the Transmission System." Synchronized Reserves are supplied from 10-minute synchronized generating resources (i.e., Spinning Reserves) and 10-minute demand-side response resources. Interruptible load resources cannot be part of the 10 minute synchronized generating reserves component of Synchronized Reserves.

Operating Reserves: Section 1, Definitions, of the PJM Operating Agreement (OA) defines Operating Reserves as "the amount of generating capacity scheduled to be available for a specified period of an Operating Day to ensure the reliable operation of the PJM Region". Operating Reserves are supplied from synchronized and non-synchronized generating resources, and demand-side response resources, available within 30-minutes.

## 1.2 Governmental Notifications & Public Appeals Procedures

When the potential exists for a PJM bulk power emergency, PJM advises PJM participants as far in advance as possible. This permits participants and PJM the maximum lead-time in determining the appropriate steps to take, including governmental and public notification. Depending on the situation, Transmission Owners and PJM may each have responsibilities in notifying local, state or federal agencies. Generation owners may have separate reporting obligations related to plant restrictions / operating conditions. Due to the wide variety of conditions and the potential for the conditions to change rapidly, it is difficult to provide precise criteria that fit all situations to trigger the issuance of an early advisory or alert to the governmental agencies and the public. Each situation is evaluated to determine if any early advisory/alert to governmental agencies is required, and if an early advisory/alert to the public is appropriate. It is the ultimate responsibility of each Transmission and Generation Owner to adjust their guidelines to respond to any escalated concerns from governmental agencies. It is also essential that the Transmission and Generation Owners and PJM are informed of any owners' unilateral actions or anticipated restrictions.

Each of the advisories, alerts, warnings, and actions described in this manual should be considered for notification to government agencies as conditions and time permits.

When Maximum Emergency generation is added to the schedule, a severe weather condition is issued, or a transmission system limitation affecting area supply is anticipated, PJM performs a situation analysis and prepares a capacity/load/reserve projection for the appropriate area and future time periods, including the effect of possible imports due to the supply situation of various neighbors. The analysis indicates expected emergency conditions.

**Note:**
Public / Media Notification Messages are contained in Attachment A. Depending on the severity of projected system conditions, these messages may be modified and issued in advance to ensure sufficient notification is provided to the public. Public / Media Notification Messages W1, W2 and W3 may need to be issued the night before due to load realized during a cold morning pick-up.

Government agencies, and other interested parties, can sign up for notifications around PJM Emergency Procedures through the use of PJM tools. Further information can be found here: http://www.pjm.com/markets-and-operations/etools/emerg-procedure.aspx

## 1.3 Communications

Effective communications are critical to ensure reliability during emergency operations. PJM conducts regular conference calls with System Operations Subcommittee representatives (TOs) as well as neighboring RCs Bas and TOPs during emergency operations. Attachment B defines Teleconference Protocol Guidelines.

Electronic communications and data quality are also critical. Interruptions to electronic communications can result in inaccurate analysis, inefficient dispatch and potential unreliable operations. Effective operator-to-operator or operator-to-support staff communications are essential to ensure reliable operations and quickly restore data communications.

# Section 2: Capacity Emergencies

Welcome to the *Capacity Emergencies* section of the ***PJM Manual for Emergency Operations***. In this section, you will find the following information:

- A general description of the system alert and emergency actions (see "Overview").
- A general overview of Reserve Requirements by Control Zone (see "Reserve Requirements").
- How PJM and the PJM Members respond to capacity shortage situations (see "Capacity Shortages").
- How PJM and the PJM Members respond to capacity excess situations (see "Light Load Procedures").

## 2.1 Overview

PJM is responsible for determining and declaring that an Emergency is expected to exist, exists, or has ceased to exist in any part of the PJM RTO or in any other Control Area that is interconnected directly or indirectly with the PJM RTO. PJM directs the operations of the PJM Members as necessary to manage, allocate, or alleviate an emergency.

- *PJM RTO Reserve Deficiencies* — If PJM determines that PJM-scheduled resources available for an Operating Day in combination with Capacity Resources operating on a self-scheduled basis are not sufficient to maintain appropriate reserve levels for the PJM RTO, PJM performs the following actions:
- Recalls energy from Capacity Resources that otherwise deliver to loads outside the Control Area and dispatches that energy to serve load in the Control Area.
- Purchases capacity or energy from resources outside the Control Area. PJM uses its best efforts to purchase capacity or energy at the lowest prices available at the time such capacity or energy is needed. The price of any such capacity or energy is eligible to determine Locational Marginal Prices in the PJM Energy Market. The cost of capacity or energy is allocated among the Market Buyers as described in the PJM Manual for Operating Agreement Accounting (M-28).
- *Light Load Procedures* — If PJM determines that the forecasted load in the PJM RTO falls below a margin of 2,500 megawatts above the sum of the output of the self-scheduled resources and the total Normal Minimum Generation of all PJM-scheduled resources, PJM implements the alert and possibly Minimum Generation Emergency procedures as described later in this section. To the extent it deems appropriate in order to avoid or reduce the cost of a Minimum Generation Emergency, PJM sells energy to other Control Areas. Any costs or revenues resulting from such sales are allocated as described in the PJM Manual for Operating Agreement Accounting (M-28).

If PJM is requested to purchase energy from another Control Area in order to alleviate an actual or threatened Minimum Generation Emergency in the other control area, PJM may purchase energy if PJM determines that the purchases can be made without adversely affecting the safe or reliable operation of generators within the PJM RTO and without unduly increasing the cost

of energy of the PJM Members. Any energy purchased and associated costs or revenues are allocated as described in the PJM Manual for Operating Agreement Accounting (M-28).

**Note:**
Emergency power purchases by PJM to assist in alleviating external Minimum Emergency Conditions should be accepted at a quote below the PJM system cost (unconstrained conditions) or interface locational marginal price.

## 2.2 Reserve Requirements

PJM schedules reserves on a day-ahead basis and operates in real-time to ensure Contingency/Primary (10 minute) Synchronized/Spinning and Secondary/Operating reserve requirements are maintained. Day Ahead and Real Time Reserve Requirements are as follows:

| | Reserve Service | | |
|---|---|---|---|
| | Synchronized Reserve (SR) | Primary Reserve (PR) | 30-Minute Reserve (30-Min) |
| Reliability Requirement | Largest Single Contingency | 150% of Synchronized Reserve Reliability Requirement | Greater of (Primary Reserve Reliability Requirement, 3000 MW, or largest active gas contingency) |

The table above defines the Reliability Requirement for both the PJM RTO and active subzone. In the event the largest single contingency in the active subzone is greater than the RTO, the RTO Reliability Requirement will be set to the active subzone value. For more information on active subzones, refer to PJM Manual 11: Energy and Ancillary Service Market Operations.

As system conditions dictate, PJM Dispatch will load Synchronized and Primary Reserves. Members are expected to take actions as indicated in PJM's Balancing Operations Manual (M-12): Section 4.1.2 "Loading Reserves".

- PJM periodically evaluates the Synchronized and Primary reserve estimates in real time via the Instantaneous Reserve Check (IRC) process documented in PJM Balancing Operations Manual (M-12): Section 4.1.1 "Monitoring Reserves".

**Note:**
PJM must schedule sufficient Regulating Reserves to satisfy control standards. Regulating Reserves shall be made up of not less than 75% Spinning Reserves, and resources allocated to regulating reserves shall not be included as part of Contingency Reserves.

PJM schedules sufficient Contingency Reserves to satisfy the Reliability *First* (RF) Regional Criteria. Contingency Reserves shall not be less than the largest contingency. Contingency Reserves must be made up of at least 50% Spinning Reserves. No more than 33% of Contingency Reserves should be interruptible load. (NERC Standard BAL-002-3)

In order to meet Reliability First (RF) Regional Criteria, PJM may schedule additional Contingency Reserves on a temporary basis in order to meet the Largest Single Contingency, as necessary to account for resource performance. PJM shall post details regarding additional scheduling of reserves in Markets Gateway.

The Regulation Requirement for the PJM RTO is defined in section 4, *Providing Ancillary Services*, of PJM M-12, Balancing Operations.

RF Contingency and Synchronized Reserve requirements are reviewed and set on an annual basis.

PJM schedules reserves on a day-ahead and real-time basis to ensure Contingency/ Primary Synchronized/Spinning and Secondary/Operating reserve requirements are maintained. Reserves are scheduled on a sub-zonal basis to recognize transmission constraints while scheduling sufficient localized reserves in the active subzone as further described in Manual 11: Energy and Ancillary Service Market Operation. The cost of capacity or energy is allocated among the Market Buyers as described in the PJM Manual for Operating Agreement Accounting (M-28)**.**

PJM identifies its Most Severe Single Contingency by surveying the greatest MW loss due to a single contingency. PJM monitors and reviews both generation and transmission element losses based on system model configurations to identify contingencies. PJM updates these models appropriately for scheduled outages that can change the monitored contingency.

In the event PJM forecasts a credible natural gas pipeline contingency(s), as described in Section 3.9 of this manual, the hourly 30 minute Reserve requirement is calculated as the greater of:

- The 30 minute Reserve Requirement, as defined above, plus any increase to the 30 minute Reserve Requirement to address operational uncertainty or any increase to the 30 minute Reserve Requirement due Hot or Cold Weather Alert or escalating emergency procedures, as described in PJM Manual 11: Energy & Ancillary Services Market Operations, Section 4.3 OR
- The sum of the Economic Max of Resources defined as part of the largest credible natural gas pipeline contingency

PJM commits generation real-time on an economic basis, considering resource characteristics (start-up, min run, starts per day) and anticipated system changes (load curve, interchange, must-run generation) while honoring system constraints.

PJM issues capacity emergencies across the entire PJM RTO except for PJM Load Dump Warnings/Actions, which are solely issued on a Control Zone basis. However, transmission constraints may force Emergency Procedure warnings/actions to be issued on a Control Zone or a subset of a Control Zone. For example, if known transmission constraints would prohibit delivery of Maximum Emergency generation capacity from one Control Zone to another, a Maximum Generation Alert would not be issued for the Control Zone with undeliverable energy.

## 2.3 Capacity Shortages

PJM is responsible for declaring the existence of an Emergency, and for directing the operations of the PJM Members as necessary to manage, alleviate, or end an Emergency. PJM also is responsible for transferring energy on the PJM Members' behalf to resolve an Emergency. PJM is also responsible for executing agreements with other Control Areas interconnected with the PJM RTO for the mutual provision of service to meet an Emergency. In addition, in accordance with EOP-011 R5, if PJM receives an Emergency notification from a Transmission Operator within the RTO, PJM will notify within 30-minutes other Transmission Operators within the RTO and neighboring Reliability Coordinators via All-Call and RCIS postings.

Exhibit 1 illustrates that there are three general levels of emergency actions for capacity shortages, as well as an Advisory level.

Emergency Procedure level types are identified below:

- ***Advisory*** – issued one or more days in advance of the operating day. General in nature and for elevated awareness only. No preparations required. [Advisory is not a capacity shortage type at this time, and is used in Light Load and Cold Weather Procedures.]
- ***Alerts*** – issued one or more days in advance of the operating day for elevated awareness and to give time for advanced preparations.
- ***Warnings*** – issued real-time, typically preceding, and with an estimated time/window for a potential future Action
- ***Actions*** – issued real-time and requires PJM and/or Member response
    - PJM actions are consistent with NERC EOP standards.

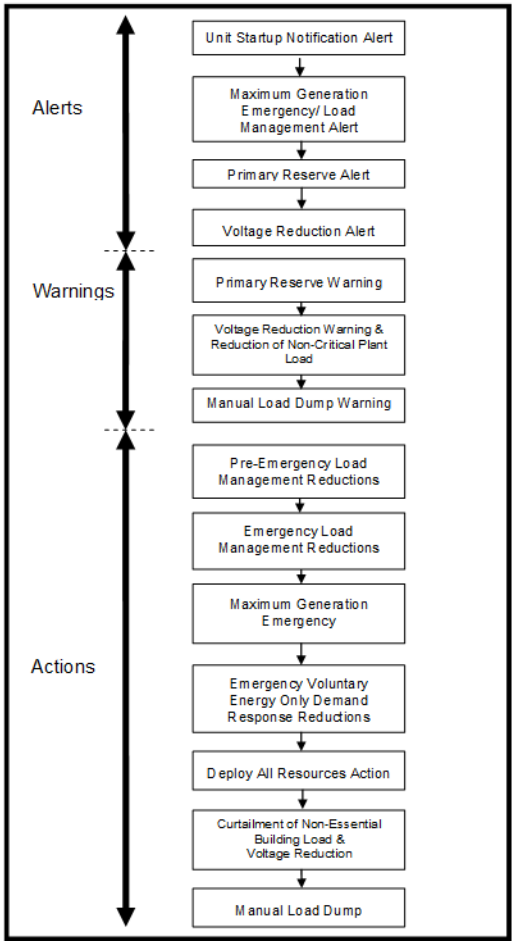



*Exhibit 1: Emergency Levels*

Exiting emergency procedures are achieved in a controlled, deliberate manner so as to not adversely affect system reliability, while minimizing the impact of these emergency actions on the DPs customers. PJM members are expected to implement all emergency procedures immediately to achieve the desired relief within 30 minutes unless otherwise directed. PJM dispatchers have the flexibility of implementing the emergency procedures in whatever order is required to ensure overall system reliability. PJM dispatchers have the flexibility to exit the emergency procedures in a different order than they are implemented when conditions necessitate.

PJM strives to meet customer energy demands either through the use of available generating resources, power purchases from PJM Members, or through the use of planned load management programs. If customer demand cannot be met, Emergency actions, such as voltage reductions, and as a last resort, manual load shedding that minimizes overlap with automatic load shedding, are used.

During unconstrained operations, PJM Control Zones will jointly implement Emergency Procedures up to the point of a Manual Load Dump Action. Prior to the implementation of a Manual Load Dump Action, PJM Dispatch will review each PJM Control Zone energy / reserves calculation to determine their relative level of capacity deficiency (reserves evaluated via PJM

EMS system). If all PJM Control Zones are capacity deficient, Manual Load Dump Actions will be implemented proportionally, based on the level of shortage, otherwise only the deficient Control Zones will be required to shed load.

Transmission constraints may result in PJM Dispatch implementing emergency procedures, including load shed, on a Control Zone specific basis or a subset of a Control Zone.

**Note:**
Unless otherwise noted, all capacity related Alerts / Warnings / Actions are to be communicated via ALL-CALL to local Transmission / Generation owners/ Curtailment Service Providers. Regardless of communication methodology, Emergency Procedures are posted to selected PJM web-sites.

**Unit Startup Notification Alert**

The purpose of the Unit Startup Notification Alert is to alert members to place units in state of readiness so they can be brought online within 48 hours for an anticipated shortage of operating capacity, stability issues or constrained operations for future periods. It is implemented when a reliability assessment determines that long lead time generation is needed for future periods and can be issued for the RTO, specific Control Zone(s) or individual unit basis. The Unit Startup Notification Alert is issued so that units can be ready to come online in 48 hours or less, based on the lesser of submitted notification time + startup time or 6 days. After reaching the state of readiness, if a unit fails to come online within 48 hours when called by PJM, the unit will be considered as forced outage until it can be online or PJM cancels the unit.

**PJM Actions**

- PJM Dispatch notifies PJM management and members.
- PJM Dispatch issues the Alert to members, stating the Alert period(s) and the affected areas. An Alert can be issued for the RTO, specific Control Zone(s) or individual unit basis on the projected location of transmission constraints and should be issued as soon as practicable (typically 6 days or less) prior to the anticipated need for long lead time generation to come online.

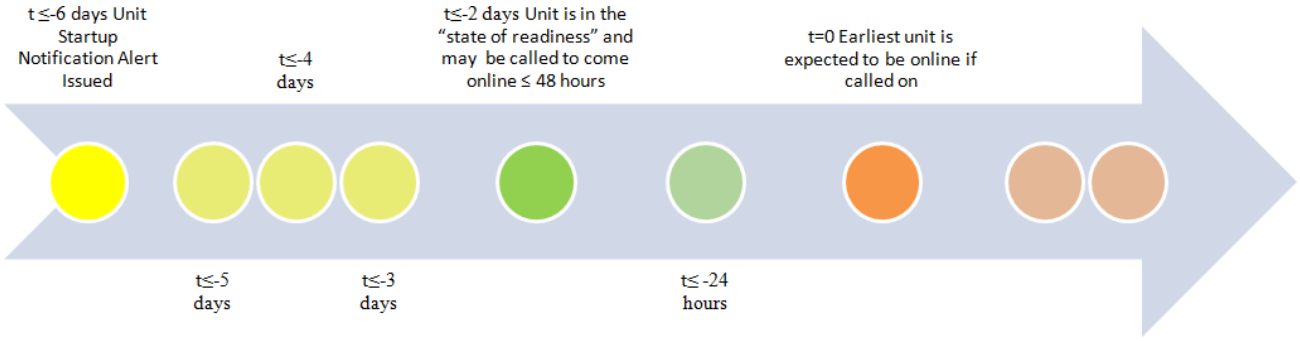
**Note:**
If the Alert is issued for the RTO or a control zone, it will be issued via the ALL-CALL system. Otherwise individual unit owners will be called.

- PJM will schedule an amount of long lead time generation anticipated to be needed for the operating day(s) in economic order respecting unit operating parameters. Once a generator is scheduled its offer price is locked for the operating day.
- PJM Dispatch will evaluate system conditions daily to determine whether to release units from the Alert, to keep the units in the state of readiness or to call the units online.
- PJM Dispatch cancels the Alert, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the Alert.

- Transmission / Generation dispatchers advise all stations and key personnel.
- Generation dispatchers orders unit(s) to be in the state of readiness (i.e. able to be online within 48 hours) in the lesser of (submitted notification time + startup time or 6 days) minus 48 hours.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway and update PJM Dispatch as appropriate.




### 2.3.1 Advanced Notice Emergency Procedures: Alerts

The intent of the alert(s) is to keep all affected system personnel aware of the forecasted and/or actual status of the PJM RTO. All alerts and cancellation thereof are broadcast on the ALL-CALL system and posted to selected PJM web-sites to assure that all members receive the same information.

Alerts are issued in advance of a scheduled load period to allow sufficient time for members to prepare for anticipated initial capacity shortages.

**Maximum Generation Emergency / Load Management Alert**

The purpose of the Maximum Generation Emergency/ Load Management Alert is to provide an early alert that system conditions may require the use of the PJM emergency procedures. It is implemented when Maximum Emergency generation is called into the operating capacity or if Demand Response is projected to be implemented.

**PJM Actions**

- PJM Dispatch notifies PJM management.
- PJM dispatchers perform a situation analysis and prepare capacity/load/ interchange/ reserve projections for that day and appropriate future operating periods considering potential bottled generation based on location of transmission constraints.
- PJM Dispatch issues an alert to members, stating the amount of estimated operating reserve capacity and the requirement. Alert can be issued for entire PJM RTO or for specific Control Zones and should be issued 1 or more days prior to the operating day.
- PJM Dispatch reports significant changes in the estimated operating reserve capacity.
- PJM Dispatch issues a NERC Energy Emergency Alert Level 1 (EEA1 = ALERT LEVEL 1 / THREAT LEVEL = ELEVATED / THREAT COLOR = YELLOW) via the Reliability

Coordinator Information System (RCIS) to ensure all Reliability Authorities clearly understand potential and actual PJM system energy emergencies. EEA1 signals that PJM foresees or is experiencing conditions where all available resources are scheduled to meet firm load, firm transactions, and reserve commitments, and is concerned about sustaining its required Contingency Reserves.

- PJM Dispatch reviews the level of dependency on External Transactions to serve PJM load and contacts PJM support staff if the need to implement Capacity Benefit Margin (CBM) is required (refer to PJM Manual for Transmission Service Request, (M-02), Section 2 for additional details regarding Capacity Benefit Margin). PJM Dispatch shall log occurrences where CBM is implemented base on the results of support staff analysis. PJM shall notify external systems via RCIS and PJM members via the PJM website and issue appropriate NERC alert levels consistent with NERC EOP-011, Attachment 1.
- PJM Dispatch cancels the Alert, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the alert.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Transmission / Generation dispatchers review plans to determine if any maintenance or testing, scheduled or being performed, on any monitoring, control, transmission, or generating equipment can be deferred or cancelled.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.
- Transmission / Generation dispatchers suspend any high risk testing of generating or transmission equipment.
- Generation dispatchers will update the “early return time” for any Planned generator outages as indicated in PJM’s Manual for Pre-Scheduling Operations (M-10), Section 2.2.

**Primary Reserve Alert**

The purpose of the Primary Reserve Alert is to alert members of the anticipated shortage of operating reserve capacity for a future critical period. It is implemented when estimated operating reserve capacity is less than the forecasted primary reserve requirement.

**PJM Actions**

- PJM Dispatch notifies PJM management and members.
- PJM Dispatch issues alert to members, stating the amount of estimated operating reserve capacity and the requirement. An Alert can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints and should be issued 1 or more days prior to the operating day.
- PJM Dispatch reports significant changes in the estimated operating reserve capacity.
- PJM Dispatch cancels the Alert, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the alert.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Transmission / Generation dispatchers review plans to determine if any maintenance or testing, scheduled or being performed, on any generating equipment or critical monitoring, control, or bulk power transmission facility can be deferred or cancelled.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.
- Generation Dispatchers are to inform PJM of any environmentally restricted units and may consider the need to obtain a temporary variance from environmental regulators for specific generators in accordance with Attachment M to assist in preventing load shed. PJM is not responsible for obtaining a temporary variance from environmental regulations but will assist the member company if requested.

**Voltage Reduction Alert**

The purpose of the Voltage Reduction Alert is to alert members that a voltage reduction may be required during a future critical period. It is implemented when the estimated operating reserve capacity is less than the forecasted synchronized reserve requirement. A summary table below lists the estimated times to implement and approximate load relief.

**PJM Actions**

- PJM Dispatch notifies PJM management.
- PJM Dispatch issues an alert to members, stating the amount of estimated operating reserve capacity and the requirement. An Alert can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints and should be issued 1 or more days prior to the operating day.
- PJM Dispatch advises members that a possibility exists that a Voltage Reduction Action will be issued and the estimated hour of implementation.
- PJM dispatcher cancels the Alert, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the alert.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Transmission dispatchers / DPs proceed on the basis that a Voltage Reduction Warning will be issued during this future period and take steps that could expedite implementation of a Voltage Reduction Action, should one become necessary.
- SOS members / PJM Management consider issuing the appropriate system-wide or Control Zone-specific Public/Media Notification Message See Attachment A.
- PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases.

**Note:**
Substations without SCADA control will be expected to be staffed in order to implement a Voltage Reduction Action if needed.

## Voltage Reduction Summary Table:

PJM MID-ATLANTIC

| | TIME (min) | Voltage Reduction % | Load Reduction % | Sum Est. PEAK LOAD | Sum Est. Load Reduction (MW) | Winter Est. PEAK LOAD | Winter Est. Load Reduction (MW) | SCADA | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| **PPL** | 2 | 5% | 2% | 7,269 | 109.0 | 7,512 | 112.7 | Y | |
| **PSEG** | 5 | 5% | 1% | 9,923 | 99.2 | 6,759 | 67.6 | Y | |
| **DPL** | 5 | 5% | 2% | 3,906 | 78.1 | 3,891 | 77.8 | Y | |
| **ACE** | 5 | 5% | 2% | 2,492 | 49.8 | 1,541 | 30.8 | Y | |
| **PECO** | 2 | 5% | 1% | 8,451 | 84.5 | 6,681 | 66.8 | Y | |
| **RECO** | 5 | 5% | 2% | 395 | 7.9 | 213 | 4.3 | Y | |
| **UGI** | 2 | 5% | 1% | 195 | 2.0 | 200 | 2.0 | Y | Implemented at the Mountain station. |
| **PEPCO** | 5 | 5% | 2% | 5,814 | 116.3 | 5,670 | 113.4 | Y | |
| **BGE** | 2 | 5% | 3% | 6,606 | 165.2 | 6,056 | 151.4 | Y | Initially distribution voltages are lowered automatically. Additional adjustments are made to push voltage change up the transmission system through manual tap changes through SCADA. These additional operation steps take up to 15 min. |
| **FE East - (JCPL ZONE)** | 10 | 5% | 1.00% | 5,891 | 58.9 | 3,683 | 36.8 | Y | The Distribution Operator implements 5% voltages reduction via SCADA to distribution transformers with automatic ULTC. There are 17 control points in EMS and each control point sends the reduction signal to multiple stations. |
| **FE East - (PENLC ZONE)** | 10 | 5% | 1.00% | 2,924 | 29.2 | 2,857 | 28.6 | Y | The Distribution Operator implements a 5% voltage reduction by operating individual ULTC from SCADA. |
| **FE East - (METED ZONE)** | 10 | 5% | 1.00% | 3,085 | 30.9 | 2,711 | 27.1 | Y | The TSO implements a 5% voltage reduction on the 69 kV sub-transmission system by operating individual ULTC from SCADA and the Distribution Operator implements a 5% voltage reduction via SCADA to distribution transformers with automatic ULTC. The Distribution Operator has 14 control points in EMS and each control point sends the reduction signal to multiple stations. |
| **TOTAL** | | | 1.46% | 56,951 | 831.0 | 47,774 | 719.3 | | |

| PJM SOUTH AND WEST | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TIME (min) | Voltage Reduction % | Load Reduction % | Sum Est. PEAK LOAD | Sum Est. Load Reduction (MW) | Winter Est. PEAK LOAD | Winter Est. Load Reduction (MW) | SCADA (Y/N) | COMMENTS |
| DUQU | 60 | 5.0% | 2% | 2,796 | 55.9 | 2,115 | 42.3 | Y | |
| DOM | 2 | 5.0% | 2% | 20,248 | 303.7 | 20,499 | 307.5 | Y | |
| FE South - APS | 10 | 5% | 1.7% | 8,907 | 151.4 | 8,910 | 151.5 | Y | FE South's voltage reduction program implements a 5% voltage reduction, in accordance with PJM procedures. The SCADA implemented program is capable of a 2.5% voltage reduction, however this would not be used during the PJM Voltage Reduction Action. |
| COMED | 30 | 2.5% 5% | 3% | 20,304 | 629.4 | 14,563 | 451.5 | Y | COMED can get 1.3% Load reduction in 15 minutes, then another 1.8% in the next 15 minutes. 2.5% voltage reduction inside Chicago. 5% voltage reduction outside Chicago. |
| DAYTON | 10 | 5% | 1.00% | 3,430 | 34.3 | 2,974 | 29.7 | Y | 20 Sub-Stations can be manually controlled with a 5% Voltage Reduction with a 1% Est. Load Reduction. DAYTON will required 2 hour minimum notification to man stations. |
| AEP | | | | 22,776 | | 22,408 | | N | AEP does not have a Voltage Reduction Program |
| FE West - ATSI | | | | 12,622 | - | 10,985 | | N | FE West does not have a voltage reduction program. |
| DEOK | | | | 5,440 | - | 4,691 | | N | DEOK does not have a voltage reduction program. |
| EKPC | | | | 2,145 | - | 2,827 | | N | EKPC does not have a voltage reduction program. |
| OVEC | | | | 90 | - | 120 | | N | |
| TOTAL | | | 1.2% | 98,758 | 1,174.8 | 90,092 | 982.4 | | |
| | | | | | | | | | |
| RTO TOTAL | | | 1.3% | 155,709 | 2,005.8 | 137,866 | 1,701.7 | | |

### 2.3.2 Real-Time Emergency Procedures (Warnings and Actions)

All warning and actions are issued in real-time. Warnings are issued during present operations to inform members of actual capacity shortages or contingencies that may jeopardize the reliable operation of the PJM RTO. Disturbance control actions per NERC standard BAL-002 are described in PJM Manual 12, “Balancing Operations” (M-12), Section 4, “Providing Ancillary Services”. Generally, a warning precedes an associated action. The intent of warnings is to keep all affected system personnel aware of the forecast and/or actual status of the PJM RTO.

**Note:**
All Warnings and Actions listed in Steps 1 to 10 below will trigger a capacity **Performance Assessment Internal (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The PJM RTO is normally loaded according to bid prices; however, during periods of reserve deficiencies, other measures must be taken to maintain system reliability. These measures involve:

- loading generation that is restricted for reasons other than cost

- recalling non-capacity backed off-system sales
- purchasing emergency energy from participants / surrounding pools
- load relief measures

Due to system conditions and the time required to obtain results, PJM dispatchers may find it necessary to vary the order of application to achieve the best overall system reliability. Issuance and cancellation of emergency procedures are broadcast over the ALL-CALL and posted to selected PJM web-sites. Only affected systems take action. PJM dispatchers broadcast the current and projected PJM RTO status periodically using the ALL-CALL during the extent of the implementation of the emergency procedures. Upon receipt of the ALL-CALL, impacted members are expected to begin implementing the PJM Member Actions listed as soon as possible/indicated to help ensure the emergency conditions are mitigated.

**Note:**

The Real-Time Emergency Procedures section combines Warnings and Actions in their most probable sequence based on notification requirements during extreme peak conditions. Depending on the severity of the capacity deficiency, it is unlikely that some Steps would be implemented.

**Actions taken prior to entering into capacity related Emergency Procedures:**

1. Review weather projections, load forecasts, reserve projections and generation performance.
2. Ensure LMPs are reflective of system conditions
3. Curtail all non-Firm exports and issue an EEA1, as required by EOP-011 Attachment 1, via the RCIS and Emergency Procedures webpage.
4. Dispatch may elect to implement an interchange cap to stabilize the amount of interchange during peak hours to protect against volatility.

**Step 1:**

**Pre-Emergency Load Management Reduction Action** (30, 60 or 120-minute)

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

Applicability: Any site registered in the PJM Demand Response program as a demand resource (a.k.a. DR) type that needs 30, 60 or 120 minute lead time to make its reductions. These reductions are mandatory when dispatched during the product availability window.

**Note:**
The minimum dispatch duration is 1 hour.

**PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM dispatcher advises members to consider the use of public appeals to conserve electricity usage. PJM dispatcher notifies other Control Areas through the RCIS.
- PJM Dispatch, via the DR Hub System and Emergency Procedures website, will post detailed instructions to the Curtailment Service Providers (CSP) to dispatch 30, 60 and/or 120 minute Pre-Emergency Load Management Reductions. An Action can be issued for the entire PJM RTO, specific Transmission Zone(s) or a Transmission Sub-zone(s) if transmission limitations exist. PJM dispatcher will also issue an ALL-CALL informing the Members and CSPs to check the DR Hub and Emergency Procedures postings for the detailed information pertaining to the Pre-Emergency Load Management that has been called.
- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Member Curtailment Service Providers implement load management reductions as requested by PJM dispatchers.

**Step 2:**

**Emergency Load Management Reduction Action** (30, 60 or 120-minute)

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

Applicability: Any site registered in the PJM Demand Response program as a demand resource (a.k.a. DR) type that needs 30, 60 or 120 minute lead time to make its reductions. These reductions are mandatory when dispatched during the product availability window.

**Note:**
The minimum dispatch duration is 1 hour.

The purpose of the Load Management Reduction is to provide additional load relief by using PJM controllable load management programs. Load relief is expected to be required after initiating Maximum Emergency generation.

**PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM Dispatch advises members to consider the use of public appeals to conserve electricity usage. PJM Dispatch notifies other Control Areas through the RCIS.
- PJM Dispatch, via DR Hub System and Emergency Procedures website, will post detailed instructions to the Curtailment Service Providers (CSP) to implement dispatch 30, 60 and/or 120 minute Emergency Load Management Reductions (Long Lead Time). An Action can be issued for the entire PJM RTO, specific Transmission Zone(s) or a subset of a Transmission Sub-zone(s) if transmission limitations exist. PJM Dispatch will also issue an ALL-CALL informing the Members and CSPs to check the DR

Hub and Emergency Procedures postings for the detailed information pertaining to the Emergency Load Management that has been called.

- PJM Dispatch issues a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Emergency Load Management Reductions. NERC EEA2 is issued when the following has occurred: Public appeals to reduce demand, voltage reduction, and interruption of non-firm load in accordance with applicable contracts, demand side management, or utility load conservation measures.
- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Member Curtailment Service Providers implement load management reductions as requested by PJM dispatchers.
- Member dispatchers notify management of the emergency procedure and that they should consider the use of public appeals to conserve electricity usage.
- Member dispatchers notify governmental agencies, as applicable.

**Note:**
**1:** Load management programs, whether under PJM control and directed by PJM Dispatch or solely under the Local Control Center's direction, have various names including, but not limited to Active Load Management, interruptibles, curtailables, or load management. To simplify operations during these emergency situations, all PJM issued reductions are referred to as Pre-Emergency or Emergency Load Management Reductions.

**Note 2:** PJM RTO Load Management Reductions are not to be used to provide assistance to adjacent Control Areas beyond PJM. Restoration of Load Management Reductions is undertaken in a stepped approach, as necessary. PJM Control Zones implement Emergency Procedures concurrently until a Manual Load Dump Action, which will only occur in the deficient Control Area.

**Note 3:** Pre-Emergency and Emergency Load Management Reductions are available for Demand Resources as defined in the Reliability Assurance Agreement (RAA).

**Note 4: EEA Levels:** PJM dispatcher issue a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the Reliability Coordinator Information System (RCIS) to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Emergency Load Management Reductions. A NERC EEA2 may be issued when the following has occurred: Public appeals to reduce demand, voltage reduction, interruption of non-firm load in accordance with applicable contracts, demand side management/active load management, or utility load conservation measures.

**Note 5: Capacity Benefit Margin (CBM)**: Under NERC Energy Emergency Alert Level 2, the PJM dispatcher may request import energy over firm transfer capability set aside as CBM. If so, dispatch will waive any real-time operating timing and ramp requirements and document such actions in compliance with MOD-004-1.

**Step 3 (Real-time):**

**Primary Reserve Warning**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of the Primary Reserve Warning is to warn members that the available primary reserve is less than required and present operations are becoming critical. It is implemented when available primary reserve capacity is less than the primary reserve requirement, but greater than the synchronized reserve requirement.

**PJM Actions**

- PJM Dispatch issues a warning to members and PJM management stating the amount of adjusted primary reserve capacity and the requirement. A Warning can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints.
- PJM Dispatch notifies PJM public information personnel.
- PJM Dispatch rechecks with members to assure that all available equipment is scheduled and that requested secondary reserve is brought to primary reserve status.
- PJM Dispatch ensures that all deferrable maintenance or testing on the control and communications systems has halted at PJM Control Center. PJM dispatcher should provide as much advance notification as possible to ensure maintenance/testing does not impact operations. This notification may occur prior to declaration of Primary Reserve Warning.
- PJM Dispatch cancels the Warning, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the warning.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Generation dispatchers prepare to load all available primary reserve, if requested.
- Transmission / Generation dispatchers ensure that all deferrable maintenance or testing affecting capacity or critical transmission is halted. Any monitoring or control maintenance work that may impact operation of the system is halted.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.
- Generation Dispatchers are to inform PJM of any environmentally restricted units and may consider the need to obtain a temporary variance from environmental regulators for specific generators in accordance with Attachment M to assist in preventing load shed. PJM is not responsible for obtaining a temporary variance form environmental regulations but will assist the member company if requested.

- PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases.

**Step 4 A (Real-time):**

**Maximum Generation Emergency Action**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of the Maximum Generation Emergency Action is to increase the PJM RTO generation above the maximum economic level. It is implemented whenever generation is needed that is greater than the highest incremental cost level.

**Note:**
Maximum Emergency Generation can only be included in the daily operating capacity when requested by PJM Dispatch.

**PJM Actions**

- PJM Dispatch issues a Maximum Generation Emergency Action. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Dispatch notifies PJM management, PJM public information personnel, and member dispatchers.
- PJM Dispatch implements the Emergency Bid-Process, requesting Emergency bids by posting messages to selected PJM web-sites, RCIS, and contacting the neighboring control areas.
- PJM Dispatch instructs members to suspend Regulation on all resources, except hydro generation.
- PJM Dispatch determines the feasibility recalling off-system capacity sales that are recallable (network resources).
    - PJM Dispatch will determine any limiting transmission constraints internal to PJM that would impact the ability to cut transactions to a specific interface.
    - PJM Dispatch will identify off-system capacity sales associated with the identified interfaces.
    - PJM Dispatch will contact the sink Balancing Authority to determine the impact of transaction curtailment.
- If the net result of cutting off-system capacity sales would put the sink Balancing Authority into load shed then PJM will not curtail the transactions unless it would prevent load shedding within PJM.

- If the net result of cutting off-system capacity sales would put PJM in a more severe capacity emergency than it is in currently in due to reciprocal transaction curtailments from the sink Balancing Authority, PJM will not initiate curtailing the transactions.
- PJM Dispatch declares a Maximum Generation Emergency Action and begins to load Maximum Emergency generation or purchase available emergency energy from PJM Members (Emergency Bid Process) and from neighboring Control Areas based on economics and availability.
- PJM Dispatch loads Maximum Emergency generation incrementally as required, if the entire amount of Maximum Emergency generation is not needed. PJM dispatchers generally load Maximum Emergency CTs prior to loading Maximum Emergency Steam in order to preserve synchronized reserve.

**Note:**
Emergency Bid-Process: Following issuance of a Maximum Generation Emergency Action, PJM may purchase available energy from any PJM Member (as emergency) that is available up to the amount required or until there is no more available, recognizing the impact on transmission constraints. The following rules are used to provide an orderly operation.

PJM should consider loading of shared reserves with neighboring systems prior to implementing voltage reduction, while recognizing the impact on transmission limits.

- The PJM Member is responsible for delivering (i.e., securing all transmission service) of the energy to one of PJM's borders with a neighboring control area. To ensure deliverability, firm transmission service may be required if external Reliability Authorities have issued TLRs.
- PJM attempts to provide 60-minutes notice before the energy is required by posting on selected PJM web-sites an emergency procedure message stating that PJM anticipates requiring emergency energy purchases beginning at a specific time.
- Once PJM posts the request for emergency purchases all PJM Members can submit "bids" to make emergency energy sales to PJM. PJM Members should use email as primary means of submitting bids with fax as a secondary means if email is unavailable and call PJM to confirm receipt. The Emergency Bid form is found in Attachment D along with the rules for submitting. Bids may also be called into a pre-assigned, recorded voice line. They should be structured as follows:
  - time – of energy available
  - amount – of energy available
  - price of energy
  - duration (hours) energy is available and limits on minimum time required to take
  - notification time to cancel/accept
  - PJM Member identification
  - interface and contract path
- PJM accepts the offers and schedules the energy using the following guidelines:

- Energy is accepted based on economics (least cost offers will be accepted first based on energy price and minimum hours) if more energy is offered than required.
- Energy is accepted as required based on economics from the available bids (i.e., if PJM requires 500 MW immediately it takes the cheapest 500 MW bid at the time). PJM adjusts current schedules to correct economics if time permits (i.e., if a cheaper scheduled is bid after a more expensive schedule is loaded PJM only cancels the first if reasonable time exists to cancel one and load the other).
- Similarly priced offers are selected based on timestamps (i.e., first in first selected).

Bids accepted by PJM are Emergency Purchases by PJM and will set the Locational Marginal Price. The energy received is accounted for according to the current Emergency Energy accounting procedures. See the PJM Manual for Operating Agreement Accounting (M-28) for more details.

PJM reserves the right to load Maximum Emergency generation as required to control the system regardless of whether any bids were/were not accepted (i.e., sudden unit loss may not allow time to accept bids).

PJM implements and curtails emergency purchase transactions with as much notice as practical to allow for a reliable transition into and out of emergency conditions.

PJM requests emergency energy from neighboring Control Areas (under current Control Area agreements) after all energy offered by the PJM Members is accepted, unless there is an immediate need for the energy.

PJM can deviate from or change the order of the above actions as/if necessary.

- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the emergency procedure.
- PJM Marketers recall off-system capacity sales that are recallable as directed by PJM dispatchers.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.
- Generation dispatchers suspend regulation, as requested, and load all units to the Maximum Emergency generation level, as required.
- Generation dispatchers notify PJM dispatching of any Maximum Emergency generation loaded prior to PJM requesting Maximum Emergency generation is loaded.
- Maximum Generation Emergency Action is identified as a trigger to load Non-Retail Behind the Meter Generation.

**Step 4 B (Real-time):**

**Emergency Voluntary Energy Only Demand Response Reduction Action**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

Applicability: Any site registered in the PJM Demand Response program as an emergency energy only resource. These reductions are voluntary.

The purpose of this Load Reduction Action is to request end-use customers, who participate in the Emergency Voluntary Energy Only Demand Response Program, to reduce load during emergency conditions.

**PJM Actions**

- PJM Dispatch issues Action via the PJM ALL-CALL and post message to selected PJM Web-sites. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Dispatch notifies PJM management, PJM public information personnel, and PJM Markets personnel.
- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Curtailment Service Providers with Demand Resource(s) registered in the Energy Only Option of Emergency Load Response reduce load.
- Transmission / Generation dispatchers notify management of the emergency procedure.

**Step 5 (Real-time):**

**Voltage Reduction Warning & Reduction of Non-Critical Plant Load**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of the Voltage Reduction Warning & Reduction of Non-Critical Plant Load is to warn members that the available synchronized reserve is less than the Synchronized Reserve Requirement and that present operations have deteriorated such that a voltage reduction may be required. It is implemented when the available synchronized reserve capacity is less than the synchronized reserve requirement, after all available secondary and primary reserve capacity (except restricted Maximum Emergency capacity) is brought to a synchronized reserve status and emergency operating capacity is scheduled from adjacent systems.

**PJM Actions**

- PJM Dispatch issues a warning to members and PJM management, stating the amount of adjusted synchronized reserve capacity and the requirement. A Warning can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints.
- PJM Dispatch notifies PJM public information personnel.

- PJM notifies the Department of Energy (DOE).
- PJM Dispatch cancels the Warning, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the warning.
- Transmission / Generation dispatchers notify governmental agencies, as applicable.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Generation dispatchers order all generating stations to curtail non-critical station light and power.
- Transmission dispatchers / DPs prepare to reduce voltage, if requested.
- Transmission dispatchers / DPs and Curtailment Service Providers notify appropriate personnel that there is a potential need to implement load management programs, in addition to interrupting their interruptible/curtailable customers in the manner prescribed by each policy, if it has not already been implemented previously. PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases.

**Step 6 (Real-time):**

**Curtailment of Non-Essential Building Load**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of the Curtailment of Non-Essential Building Load is to provide additional load relief, to be expedited prior to, but no later than, the issuance of a Voltage Reduction Action.

**PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM dispatcher advises members to consider the use of public appeals to conserve electricity usage. PJM dispatcher notifies outside systems through the RCIS.
- PJM Dispatch issues a request to curtail non-essential building load. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the emergency procedure and to consider the use of public appeals to conserve electricity usage.
- Transmission dispatchers notify governmental agencies, as applicable.
- Transmission / Generation dispatchers / DPs switch off all non-essential light and power in DP-owned commercial, operations, and administration offices.

**Step 7 (Real-time):**

**Deploy All Resources Action**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

For emergency events that evolve over time, PJM will dispatch generation and Load Management resources via the normal mechanisms of SCED, DR Hub and direct phone calls. However, for emergency events that develop rapidly and without prior warning, PJM may need to dispatch all resources in a large area very quickly. The purpose of the Deploy All Resources Action, during such emergency conditions, is to instruct PJM Members that all generation resources are needed online immediately and that all Load Management resources dispatched need to reduce load immediately. This step is issued when unplanned events such as the loss of a transmission or generating facility(s) have resulted in reliable operations being jeopardized such that a Voltage Reduction Action or a Manual Load Dump Action may be required.

**PJM Actions**

- PJM Dispatch issues the Deploy All Resources Action. This Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist and the sub-zone was previously defined.
- PJM Dispatch will suspend all reserve assignments and regulation assignments.
- PJM dispatches Load Management via DR Hub.
- PJM recalls any external capacity.
- PJM Dispatch issues a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Emergency Load Management Reductions.
    - NERC EEA2 is issued when the following has occurred: Public appeals to reduce demand, voltage reduction, and interruption of non-firm load in accordance with applicable contracts, demand side management, or utility load conservation measures.
- PJM Dispatch notifies PJM management, PJM public information personnel, and member dispatchers.
- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Member Generation Dispatchers raise all available online generating units to full output (Emergency Maximum).
- Member Generation Dispatchers start up all offline generation and ramp to full output (Emergency Maximum), utilizing the communication methods below:
    - Generators that can be online in less than 30-minutes should start immediately upon receipt of the ALL-CALL and then notify PJM Dispatch when they are on-line.

  - Generators that require more than 30-minutes to be on-line should call the PJM dispatcher prior to initiating the start sequence.
- Member Curtailment Service Providers with Load Management (Pre-Emergency and/or Emergency) reduce load immediately when dispatched.
- Transmission/Generation Dispatchers notify management of the emergency procedure and that they should consider the use of public appeals to conserve electricity usage.
- Member dispatchers notify governmental agencies, as applicable.
- Upon cancellation of this procedure:
  - Units that have not started should abort their start if possible.
  - Online units should return to following SCED basepoints as well as any regulation or reserve assignments.
- Deploy All Resource Action is identified as a trigger to load Non-Retail Behind the Meter Generation.

**Step 8 (Real-time):**

**Manual Load Dump Warning**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of the Manual Load Dump Warning is to warn members of the increasingly critical condition of present operations that may require manually shedding load.. It is issued when available primary reserve capacity is less than the largest operating generator or the loss of a transmission facility jeopardizes reliable operations after all other possible measures are taken to increase reserve. The amount of load and the location of areas(s) are specified.

**PJM Actions**

- PJM Dispatch issues the warning to members and PJM management, stating the estimated amount of load relief that is required (if applicable). A Warning can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints.
- PJM Dispatch notifies PJM public information personnel.
- PJM Dispatch notifies FERC via the FERC Division of Reliability's email emergency@FERC.gov, consistent with FERC Order No. 659.
- PJM Dispatch issues a NERC Energy Emergency Alert Level 3 (EEA3 = ALERT LEVEL 3) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual level of PJM System Emergencies. An EEA 3 is issued when the BA is unable to meet minimum Contingency Reserve Requirements.
- PJM Dispatch establishes a mutual awareness with the appropriate member dispatchers of the need to address the occurrence of a serious contingency with minimum delay.
- PJM Dispatch examines bulk power bus voltages and alerts the appropriate member dispatchers of the situation.

- PJM dispatcher cancels the Warning, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the warning.
- Transmission dispatchers notify governmental agencies, as applicable.
- Transmission / Generation dispatchers advise all station and key personnel.
- Transmission dispatchers / DPs review local procedures and prepare to shed load in the amount requested.
- Transmission dispatchers / DPs reinforce internal communications so that load shed can occur with minimum delay.
- PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases.
- Transmission Owner may coordinate with BtMG facility interconnected to the transmission system, or through the relevant electric distribution utility, during expected prolonged emergency load dump/shed or as otherwise necessary to help mitigate a grid emergency. As BtMG facilities do not participate in the wholesale energy market, any request to operate for the purpose of helping to mitigate a wholesale market issue is on a voluntary basis at the discretion of the BtMG owner, othan than the existing Non-Retail BtMG provisions. Any request to operate to mitigate a wholesale market issue will be communicated to the BtMG as a voluntary request at the discretion of the BtMG owner, other than the existing Non-Retail BtMG provisions. Refer to Manual 14D Appendix A for more information regarding BtMG.

**Step 9 (Real-time):**

**Voltage Reduction Action**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of Voltage Reduction during capacity deficient conditions is to reduce voltage on the distribution system in order to reduce demand and therefore provide a sufficient amount of reserve to maintain tie flow schedules and preserve limited energy sources. It is implemented when load relief is still needed to maintain tie schedules. The lead times needed to implement the voltage reduction vary by TO and are listed in the Voltage Reduction Summary Table.

**Note:**
Voltage reductions can also be implemented to increase transmission system voltages.

**PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM dispatcher advises members to consider the use of public appeals to conserve electricity usage. PJM dispatcher notifies outside systems through the RCIS.

PJM Dispatch notifies DOE. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.

- PJM Management may issue system-wide or Control Zone-specific Public/Media Notification Message W2. See Attachment A.
- PJM Dispatch investigates loading of shared reserves with neighboring systems prior to implementation of a voltage reduction, recognizing the impact on transmission limits.
- PJM Dispatch issues the order for a 5% Voltage Reduction Action.

**Note:**
See Voltage Reduction Summary Table above for known exceptions to 5% Voltage Reduction Action.

- PJM Dispatch issues a NERC Energy Emergency Alert Level 2 or Level 3 via the RCIS to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Active Load Management Curtailables / Full Emergency Load Response (formerly known as ALM).
  - NERC EEA2 is issued when the following has occurred: Public appeals to reduce demand, voltage reduction, and interruption of non-firm load in accordance with applicable contracts, demand side management/active load management, or utility load conservation measures.
  - NERC EEA3 is issued when the BA is unable to meet minimum Contingency Reserve Requirements.
- If it has not already begun, the PJM Dispatch will initiate Shortage Pricing if the region where the voltage reduction action has been initiated corresponds with an entire Synchronized Reserve Zone or Sub-Zone.
- PJM dispatcher cancels the Action, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the emergency procedure and to consider the use of public appeals to conserve electricity usage.
- Member Transmission dispatchers notify governmental agencies, as applicable.
- Member Transmission dispatchers / DPs take steps to implement the voltage reduction.

**Step 10 (Real-time):**

**Manual Load Dump Action**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The Manual Load Dump Action is an Operating Instruction from PJM to shed firm load when the PJM RTO cannot provide adequate capacity to meet the PJM RTO's load and tie schedules, or

critically overloaded transmission lines or equipment cannot be relieved in any other way. Under capacity deficient conditions, the PJM EMS load dump allocation calculator was modified to institute changes to the Operating Agreement set forth in Schedule 1, Section 1.7.11 that states that "…the Office of Interconnection may not order a manual load dump in a Control Zone solely to address capacity deficiencies in another Control Zone."

The load shed calculation determines which Control Zone(s) is short based on real-time load and energy values from EMS and capacity values received daily from the Capacity Adequacy Planning Department. Real-time energy values are used as a surrogate for available capacity, because in a capacity shortage situation all available generation should be loaded to full capacity. Since most of the values used in the load shed calculation are real-time dynamic numbers, the calculation is performed in the PJM EMS. Load Serving Entities will be able to designate within Capacity Exchange that capacity resources are being used to serve load in a specific Control Zone. Similarly ExSchedule users will be able to specify that an external energy schedule is designated for a specific Control Zone. Resources that are not designated for a specific Control Zone will be considered an RTO resource for load shed calculation purposes and allocated across all Control Zones according to load ratio share. Only Control Zones that are determined to be deficient will be assigned a share of a load shed request initiated due to RTO capacity deficiencies. If the PJM Mid-Atlantic Region is determined to be deficient, its share will be further allocated according to Attachment E.

**PJM Actions**

- PJM Dispatch verifies separations have not occurred and load shed is desirable on the system being controlled (i.e., make sure load shed will help, not aggravate the condition).
- PJM Dispatch instructs members to suspend all remaining regulation, if not already suspended previously.
- PJM Dispatch determines which Control Zone (s) are capacity deficient and the relative proportion of deficiency. PJM Dispatch estimates the total amount of load to be dumped and utilizes the PJM EMS to determine deficient Control Zones and their share of load shed required.
- PJM Dispatch orders the appropriate member dispatchers to shed load according to PJM EMS calculations. The PJM Mid-Atlantic Region share will be further allocated according to Attachment E. PJM Dispatch will implement load shedding, while minimizing overlap with automatic load shedding, in controlled step sizes to minimize system impact and further uncontrolled separation.
- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM Dispatch advises members to consider the use of public appeals to conserve electricity usage and public announcements of the emergency. PJM Dispatch notifies other Control Areas through the RCIS, and notifies DOE, FEMA, and NERC offices, using established procedures.
- PJM Dispatch notifies FERC via the FERC Division of Reliability's email emergency@FERC.gov, consistent with FERC Order No. 659.
- PJM Dispatch issues a NERC Energy Emergency Alert Level 3 (EEA3 = ALERT LEVEL 3) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual level of PJM System Emergencies.

- PJM Management issues a system-wide or Control Zone specific Public/Media Notification Message W3. Typically, this would be issued prior to a Manual Load Dump. See Attachment A.
- If it has not already begun, the PJM Dispatch will initiate Shortage Pricing if the region where the manual load shed action has been initiated corresponds with an entire Synchronized Reserve Zone or Sub-Zone.
- PJM Dispatch cancels the Action, when appropriate.

**Note:**
If partial restoration of the load shed is requested by PJM dispatcher, confirmation of the load restored by each member must be made prior to further restoration requests by PJM dispatcher.

If step 1 of UFLS is insufficient to return frequency to acceptable ranges and if emergency procedures cannot be implemented in a timely fashion then PJM Dispatch shall shed sufficient load to restore system frequency.

**PJM Member Actions**

- Generation dispatchers suspend remaining regulation, when directed by PJM prior to shedding load.
- Transmission dispatchers / DPs shed an amount of load equal to or in excess of the amount requested by PJM dispatcher (Mid-Atlantic Region operators refer to Attachment E for specific allocation) within 5 minutes of the issued directive. The load shed plan must consider/recognize priority/critical load as described in the Note below.
- Transmission / Generation dispatchers notify management of the emergency procedure.
- Transmission dispatchers / DPs consider the use (or continued use) of public appeals to conserve electricity usage and consider the use of public announcements of the emergency.
- Transmission dispatchers notify governmental agencies, as applicable.
- Transmission dispatchers / DPs maintain the requested amount of load relief until the load shed order is cancelled by PJM dispatcher.
- Transmission Owner may coordinate with BtMG facility interconnected to the transmission system, or through the relevant electric distribution utility, during expected prolonged emergency load dump/shed or as otherwise necessary to help mitigate a grid emergency. As BtMG facilities do not participate in the wholesale energy market, any request to operate for the purpose of helping to mitigate a wholesale market issue is on a voluntary basis at the discretion of the BtMG owner, other than the existing Non-Retail BtMG provisions. Any request to operate to mitigate a wholesale market issue will be communicated to the BtMG as a voluntary request at the discretion of the BtMG owner, other than the existing Non-Retail BtMG provisions. Refer to Manual 14D Appendix A for more information regarding BtMG.
- Transmission dispatchers report the amount of load curtailed / restored upon implementation to the PJM Power Dispatcher.

**Note:**
Member Load shed plans must recognize priority and critical load including: Essential health and public safety facilities such as hospitals, police, fire facilities, 911 facilities, wastewater treatment facilities; Facilities providing electric service to facilities associated with the Bulk Electric System including off-site power to generating stations, substation light and power; Critical gas infrastructure used to supply gas pipeline pumping plants, processing and production facilities; and Telecommunication facilities.

Plans should be reviewed and updated at least annually including Attachment F of M-13.

Consider using automated programs in member's EMS to facilitate shedding the specified amount of load with the required timeline.

Rotate load that is shed when feasible to reduce impact to end use customers.

**Note:**
PJM Dispatch should take necessary actions to support system frequency, consistent with good utility practices. These actions may include emergency procedures to arrest frequency decline, but PJM will not violate BAAL (Balancing Authority ACE Limit) limits by over-generating to correct for a low frequency. PJM shall only use the assistance provided by the

Interconnection's frequency bias for the time needed to implement corrective actions. PJM will not unilaterally adjust generation in an attempt to return

Interconnection frequency to normal beyond that supplied through frequency bias action and Interchange Schedule changes. In general, emergency procedures are preserved to ensure PJM net tie deviation is not adversely impacting system frequency after all economic options have been exhausted. However, Emergency Procedures should be exhausted, including Manual Load Dump, to arrest frequency decline once Under Frequency Load Shedding Schemes (UFLS) have triggered but prior to generating stations tripping off-line (57.5 Hz). Under-frequency Load Shedding Plan settings are defined in Attachment F, "PJM Manual Load Dump Capacity."

## 2.4 Light Load Procedures

Each Control Area has a commitment to control its generation in a manner so as not to burden the interconnected systems. Failure to provide adequate control can result in deviations in frequency and inadvertent power flow, stability issues or transmission constraints. For the PJM RTO to meet its commitment during light load periods, it may be necessary to deviate appreciably from normal operating procedures. PJM scheduling personnel are responsible for identifying light load conditions and projecting the extent of operating procedures.

The exhibit below illustrates that there are four general levels of emergency procedures intended for use during light load periods.

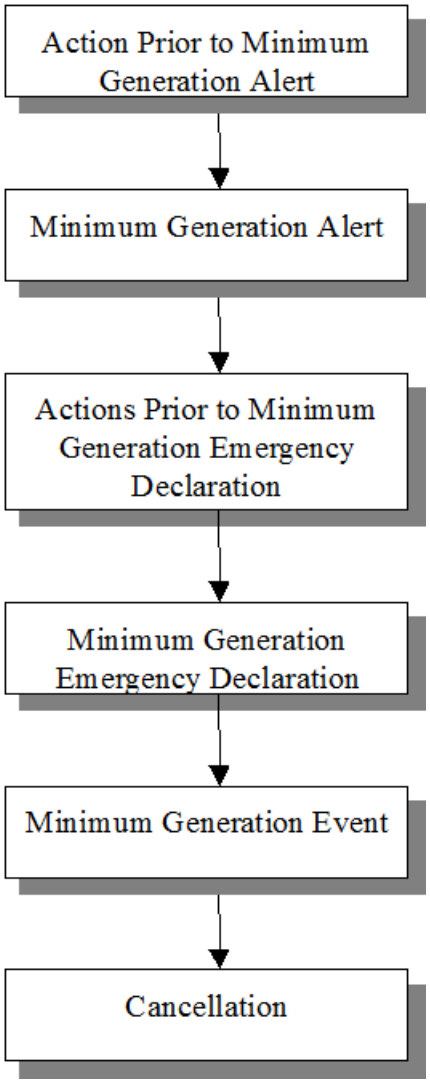



*Exhibit 2: Sequence of Actions*

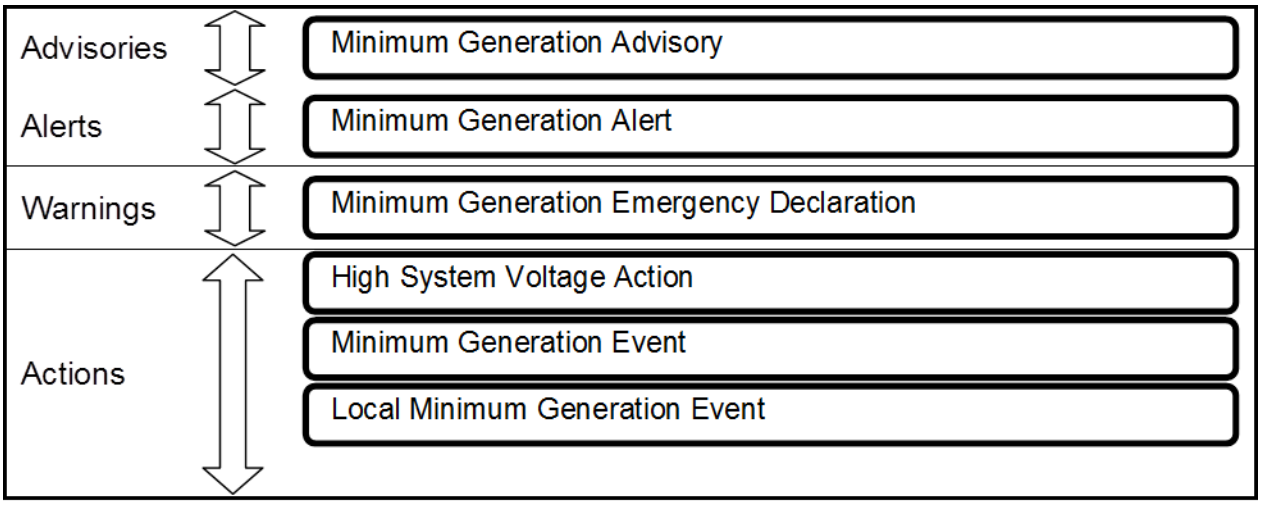



*Exhibit 3: Light Load Related Problems*

### 2.4.1 Actions Prior to Minimum Generation Alert

The purpose of the Minimum Generation Advisory/Alert is to provide an early alert that system conditions may require the use of the PJM Emergency Procedures. They are implemented when the expected generation level is within 2,500 MW of normal minimum energy limits. They differ in their time of issuance ahead of the event in that an Advisory is issued when PJM is aware two or more days in advance of the event, and an Alert is issued one day in advance of the event.

**Minimum Generation Advisory**

**PJM Actions**

- PJM reviews the valley load forecasts for the next several days. If the RTO load is projected to be at or below 70,000MWs (Summer/Winter) or 65,000MWs (Spring/Fall), PJM Issues a **Minimum Generation Advisory** message to the Emergency Procedures site 1 or more days ahead of time to provide an informational only notice that a Min Gen Alert/Action is likely.
- PJM prepares Minimum Generation Worksheet (see Minimum Generation Calculation exhibit or eDART Minimum Generation Calculation Worksheet exhibit, each in Attachment H) to determine if Minimum Generation Alert criteria are met and if Light Load Procedures are required for upcoming scheduling period.
- PJM personnel formulate a scheduling strategy for the light load period. Hydro plant schedules are reviewed to ensure, where possible, pumping at pumped storage plants is maximized and generation at run-of–river plants is minimized during the light load period(s).
- PJM Dispatch cancels the Advisory, when appropriate.

**PJM Member Actions**

- Generation dispatchers should utilize the advanced notification provided by an Advisory in order to prepare for any action associated with a Minimum Generation Alert.

### 2.4.2 Minimum Generation Alert

**Minimum Generation Alert**

**PJM Actions**

- If the expected generation level is within 2,500 MW of normal minimum energy limits, PJM Dispatch issues the Alert for the specified light load period via the ALL-CALL and posts the alert on selected PJM web-sites and the NERC RCIS. Adjusted Minimum generation, valley load estimate, and margin values are given to members.
- PJM Dispatch cancels the Alert, when appropriate.

**PJM Member Actions**

- Generation dispatchers review with station operating personnel, unit normal maximum and minimum energy limits, as well as emergency minimum energy limits.

**Note:**
**1:** In order to ensure resources do not force emergency procedures they must be dispatchable (Dispatchable Generation) in the range between the greater of the resource's physical minimum operating level or Capacity Interconnection Rights (CIR) and Maximum Facility Output (MFO) (i.e. fixed gen flag must not be selected).

**Note 2:** Resources may not submit an economic minimum that exceeds the greater of the resource's physical minimum operating level or the level of their CIR in the real-time energy market. This restriction does not apply to the day-ahead market.

**Note 3:** An intermittent resource's Economic Minimum shall represent the lowest operating MW point of the resource.~~not exceed the level of its CIR.~~

**Note 4:** An intermittent resource's Emergency Minimum should be set to 0.

- Generation dispatchers compile their emergency reducible information and report to the PJM Master dispatcher via eDART (see Attachment H, eDART ERG Reporting Form). The amount reported in the Reducible on Declaration Column is, by region, the Emergency Reducible Generation (ERG) that will be started down when PJM makes the Minimum Generation Emergency Declaration, before the actual Minimum Generation Event. The amount reported in the Total Reducible Generation is the total reducible generation available for both the Declaration and Event. Joint-owned generation is reported by the operating company.
- Generation dispatchers schedule additional unit maintenance, as appropriate, for the expected light load periods. PJM dispatchers are informed of any maintenance scheduled.
- Generation dispatchers renew and update resource data in PJM's computer systems. Particular attention is given to resource availability and energy limits (normal maximum, normal minimum, and emergency minimum).
- Generation dispatchers should contact PJM Dispatch if ramp limits are prohibiting the ability to export energy from the PJM system during projected minimum emergency

conditions. To assist in system control, exports should coincide with load drop-out periods (refer to Data Viewer application for plotted load).

- PJM Dispatch cancels the Alert, when appropriate.

### 2.4.3 Actions Prior to Minimum Generation Emergency Declaration

**PJM Actions**

- Re-evaluate valley load estimate and amount of Spot-in transactions.
- PJM Dispatch updates the amount of emergency reducible generation available. Final strategy is determined from the results, including the anticipated amount of reducible generation to be reduced (by percentage) and a forecasted time of the reduction.
- Reduce units to normal minimum generation. Review units assigned to regulate. Relieve units that are unable to regulate at or near normal minimum levels.
- Reduce System LMP to “0” and reduce Spot-in contracts as required to maintain system control.

**Note:**
**1:** The unit default cost/price bid will be assumed 0 unless provided via Markets Gateway.

**Note 2:** Other system conditions may at times require the reducing of System LMP to 0 or below. The implementation of any steps under the Light Load Procedures is NOT a pre-requisite of moving System LMP to 0.

### 2.4.4 Minimum Generation Emergency Declaration

**Minimum Generation Emergency Declaration**

Minimum Generation Emergency Declaration is to notify members of Min Gen survey results and strategy, including the anticipated amount of reducible generation and forecasted time of the reduction.

**PJM Actions**

- PJM Dispatch issues via the ALL-CALL a Minimum Generation Emergency Declaration and notifies members of survey results and strategy, including the anticipated amount of reducible generation to be reduced (by percentage) and a forecast time of the reduction. PJM dispatcher also posts the Declaration on selected PJM web-sites and the NERC RCIS.
- PJM Dispatch cancels the Warning, when appropriate.

**PJM Member Actions**

- Generation Dispatchers ensure their units are following PJM economic base points to Economic Minimum output.
- Wind or Solar Generator Operators will adjust ~~Wind Turbine~~ Control Systems or manually adjust resource~~turbine~~ output to achieve the desired SCED base point.

- Generation dispatchers reduce generation as reported via eDART on the Minimum Generation Form in the Reducible on Declaration column. (See eDART ERG Reporting Form in Attachment H.)
- Generation dispatchers determine the specific units that will be reduced and the sequence and timing of reductions based on the direction given by PJM.
- Generation dispatchers contact PJM Master Coordinator and report additional Reducible Generation that is reduced beyond what is reported on the Minimum Generation Form upon a Minimum Generation Emergency Declaration.

### 2.4.5 Minimum Generation Event

**Minimum Generation Event**

Minimum Generation Emergency Event is implemented when PJM Dispatch can no longer match the decreasing load and utilization of emergency reducible generation is necessary. PJM shall not differentiate between resource types during a Minimum Generation Emergency Event. All resources are expected to reduce proportionally based on the percentage Emergency Reducible Generation declared.

**PJM Actions**

- If Transmission constrained, follow the Guidelines for Constrained Operations.
- PJM Dispatch issues via the ALL-CALL the Minimum Generation Emergency Event and requests Local Generation dispatchers to reduce Emergency Reducible Generation (ERG), in proportion to the total amount of ERG reported minus what was reported as being reducible on declaration. PJM Dispatch also posts the Event on selected PJM web-sites and the NERC RCIS.

**Note:**
Example: If Member reported 200 MW as total ERG with 100 MW reported as Reducible on Declaration, 100 MW would have been started down when PJM issued the Minimum Generation Emergency Declaration. If when issuing the Minimum Generation Event, PJM requests 20% reducibles, Member would reduce 20 MW from the 100 MW that was reported as targeted for reduction on the Event.

- Attempt to sell Emergency Energy to external systems.
- After all internal PJM resources are reduced to Emergency Minimum Levels (100% Reducible Generation implemented), reduce Network External Designated purchases as required to maintain system control.
- In concert with individual members, PJM Dispatch recommends the shutdown of specific units that are not required for area protection during the current load period or the subsequent on-peak period. PJM Dispatch recommends return times for these units.

**Note:**
Having reviewed the conditions for the next on-peak period, PJM Dispatch recommends the sequence of units being removed from service at this time and recommends the sequence of return for the units that would be needed for reliable operation for the next on-peak period.

- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Generation dispatchers follow the direction of PJM dispatcher.

**Note:**
Implementation of Emergency Reducible Generation Curtailments should be achieved within 15 minutes or within a timeframe that the technology permits. PJM should be notified if curtailment is expected to exceed 15 minutes.

### 2.4.6 Local Minimum Generation Event

**Local Minimum Generation Event**

A Local Minimum Generation Emergency Event is implemented when there is an excess generation situation in a localized area or set of areas, which has the potential to result in stability issues or constrained operations.

**PJM Actions**

- After reducing effective local generation to their economic minimum levels, curtailing dispatchable contracts and Spot Market Imports (as applicable), the PJM dispatcher issues a Local Minimum Generation Emergency Event and requests Local Generation dispatchers to reduce Emergency Reducible Generation (ERG) under PJM control, in proportion to the total amount of ERG reported. The PJM dispatcher posts the Event on selected PJM web-sites.
- Attempt to sell Emergency Energy to external systems (as applicable).
- After all effective PJM resources are reduced to Emergency Minimum Levels (100% Reducible Generation implemented), reduce Network External Designated purchases.
- PJM Dispatch directs the shutdown of effective units that are not required for area protection during the current load period or the subsequent on-peak period. The PJM dispatcher recommends return times for these units.

**Note:**
Having reviewed the conditions for the next on-peak period, the PJM dispatcher recommends the sequence of units being removed from service at this time and recommends the sequence of return for the units that would be needed for reliable operation for the next on-peak period.

- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Generation dispatchers follow the direction of PJM Dispatch via eDART (see eDART ERG Reporting Form in Attachment H).

**Note:**
If reduction of emergency reducible generation is requested, no update of the PJM Dispatch lambda program is required.

### 2.4.7 High System Voltage

**High System Voltage**

To prepare the system for expected high voltages, PJM will coordinate with the Transmission owners to proactively take steps to control high voltages prior to entering the light load period. These steps are outlined in PJM Manual M-03, Section 3.7. The steps below will be taken in real time when portions of the PJM RTO are experiencing a low load / high voltage condition. PJM will issue an ALL-CALL to PJM members to trigger the following steps:

**PJM Actions**

- PJM issues High System Voltage messages directing all companies to take the actions listed below to control high system voltages.
- PJM may coordinate with Transmission and Generation Owners to direct generators to be operated outside of their voltage schedule bandwidth on a case by case basis.
- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Transmission Owners ensure all appropriate substation switchable capacitors, including distribution capacitors, are out of service as well as SVC's in the lead.
- Transmission Owners ensure all available shunt reactors are in service.
- Transmission Owners are requested to review and adjust LTC settings as appropriate. All LTC (230 kV and above) and voltage schedule adjustments shall be coordinated with PJM Dispatch.
- PECO will set the Elroy 500kV capacitors to manual.
- Transmission Owners are requested to review and adjust generator voltage schedules to have generators absorb reactive power as modeled in the unit D-curve or as appropriate. Voltage schedule adjustments (including default voltage schedule) shall be coordinated with PJM Dispatch. (Generation owners should not take voltage actions outside their voltage schedule prior to coordinating with the local Transmission Owner.)
- Generation Owners communicate with PJM and the Transmission Owner restrictions to their generator's ability to absorb MVARs if that capability varies from the existing "D" curve.
- Generation Owners will operate generators at the lower bandwidth of their voltage schedule when possible.
    - Example: A generator following the PJM default 230 kV voltage schedule of 235 kV +/- 4 kV should be operating as close to 231 kV as possible.

## 2.5 General Assistance to Adjacent Control Areas

When adjacent Balancing Areas are deficient in generation and are requesting assistance from the PJM RTO, actions are taken, provided the adjacent Balancing Area has taken the same actions requested of PJM.

**PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and Local Control Center dispatchers. PJM Dispatch notifies outside Control Areas using the RCIS, and the NERC hotline if necessary.
- PJM Dispatch orders, as required, increased generation, including Maximum Emergency generation (with the exception of resource limited capacity). PJM Dispatch also implements a 5% Voltage Reduction to provide the required assistance provided that the power system requesting assistance is already in a 5% Voltage Reduction.

**Note:**
PJM load management programs are not to be used to provide assistance to adjacent Balancing Areas. PJM Dispatch prefaces these procedures by the words “due to PJM providing emergency assistance to an adjacent Control Area(s), PJM is issuing an (*appropriate alert or action message*)”.

**PJM Member Actions**

- The Local Transmission / Generation dispatchers notify management.
- The Local Transmission dispatchers notify governmental agencies, as applicable.
- The Local Transmission / Generation dispatchers implement all emergency procedure requests issued by PJM dispatcher and notify appropriate Local Control Center personnel.

# Section 3: Weather/Environmental Emergencies

Welcome to the *Weather/Environmental Emergencies* section of the ***PJM Manual for Emergency Operations***. In this section, you will find the following information:

- A description of the conditions that warrant conservative operation (see "*General* Conditions").
- How PJM responds to thunderstorms, tornadoes, and other severe weather conditions (see "*Thunderstorms and Tornadoes*").
- How PJM responds to geo-magnetic disturbances (see "*Geo-Magnetic Disturbances*").

## 3.1 Overview

To maximize the PJM RTO's ability to operate reliably during periods of extreme and/or prolonged severe weather conditions, procedures are necessary to keep all affected system personnel aware of the forecast and/or actual status of the system and to ensure that maximum levels of resource availability are attained.

The purpose of this section is to explain how severe weather conditions are identified and to describe when it is necessary to provide additional capacity and to staff the necessary generating sites for a future critical period. For example, Combustion turbine (CT) start up reliability may be adversely affected by extreme cold temperatures.

PJM's analysis of system conditions considers higher levels of resource unavailability during severe weather conditions. PJM uses its best judgment about the magnitude of the projected unavailability of equipment, considering the length of the forecasted and actual weather conditions.

Participants monitor their fuel supplies, emission hours, demineralized water, cooling water, and other consumables inventories and keep PJM updated about station/units that are experiencing or projected to experience resource limitations via Markets Gateway, as described in Section 6.4. Conference calls are scheduled to review the operating situations, as appropriate.

Coordination and communication with the applicable natural gas transmission pipelines, in conjunction with neighboring RTOs/ISOs, should be implemented during extreme weather conditions to ensure that the availability of the natural gas-fired generation resources is assessed and contingency plans developed, if necessary.

Generally, any resource restricted unit (< 72 hours at max capacity), should be classified as a Resource Limited Unit. Natural gas-fired units that experience fuel supply/transportation restrictions are not considered Resource Limited Units due to the daily nature of their restrictions, and are excluded from this reporting. Instead, natural gas-fired units should reflect these fuel restrictions when updating their unit offer parameters within Markets Gateway, and report unplanned outages if they are unable to run.

PJM needs to be informed about the number of hours available for all Resource Limited Generation with restrictions related to fuel, emissions hours, water, or other consumables via Markets Gateway. In addition, when PJM declares Conservative Operations/Cold or Hot Weather Alert, certain minimum levels have been established for Resource Limited Generation. See Section 6.4 of this manual for more details.

In general, two days is sufficient to alert governmental agencies of the situation and to receive assistance. Depending on the situation, units may be forced out of service (full or partial) prior to these guidelines in order to protect plant equipment or for future system needs.

## 3.2 Conservative Operations

**Conservative Operations**

The need to operate the PJM RTO more conservatively can be triggered by any number of weather, environmental, physical or cyber security events, including but not limited to:

- potential fuel delivery issues identified
- forest fires/brush fires that threaten major transmission circuits
- weather-related events, such as ice/snow/wind storms, hurricanes, tornadoes, severe thunderstorms, and floods
- environmental alerts
- geo-magnetic disturbance events
- PJM enters an unknown operating state
- Physical or Cyber-attacks, including credible threats

During conservative operations, system operations may reflect conservative transfer limit values, selected double-contingencies, and/or maximum credible disturbances.

**PJM Actions**

- PJM notifies PJM management, PJM public information personnel and members that Conservative Operations has been declared, including the reason.
- PJM conducts SOS conference calls, as needed, to review and coordinate operations with members.
- PJM Dispatch reviews and considers recalling/cancelling non-critical Generation & Transmission maintenance outages.
- PJM Dispatch communicates whether resource limited units are required to be placed into Maximum Emergency Category.
- PJM dispatcher has the authority to reduce transfers into, across, or through the PJM RTO or take other actions, such as cost assignments to increase reserves and reduce power flows on selected facilities.
- It is PJM dispatcher’s responsibility to analyze the reliability of the PJM RTO and determine if it is in jeopardy. If required, operations planning branch staff are called upon to develop revised limitation curves.
- PJM issues a Production System Change Freeze: PJM will refrain from updating business application systems, programs, data, systems software, hardware and other aspect of the information-processing environment at PJM.
- PJM cancels Conservative Operations when appropriate.

**Note:**
A Production System Change Freeze is a procedure that is implemented to ensure a stable production environment over a defined period of time.

The production change freeze has two objectives. First, it is designed to ensure staff is available for critical activities, should the need arise. Second, it is designed to help ensure stable technical environments to support PJM's business and reliability functions.

The change freeze announcement will identify start date/time and the predicted duration or end date/time of the freeze period. At any point during the change freeze window, system conditions will be evaluated and an announcement regarding the lifting or extension of the change freeze will be made. Exceptions to the Change Freeze will only be granted with PJM management authorization.

During a Production System Change Freeze, Transmission Owners and Generation Owners should refrain from scheduling ICCP/EMS outages and/or failovers.

**PJM Member Actions**

- Transmission/Generation dispatchers notify management of the declaration.
- Transmission/Generation dispatchers and PJM Marketers respond, as required, to specific requests and directions of PJM dispatcher.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.
- Participate in PJM hosted SOS conference calls.

## 3.3 Cold Weather Advisory / Alert

### 3.3.1 Cold Weather Advisory

The purpose of the Cold Weather Advisory is to provide an early notice that forecasted temperatures may call for a Cold Weather Alert. The early notification of an Advisory is intended to provide PJM members ample time to gather information required by NERC standards EOP-011, Emergency Preparedness and Operations, IRO-010 RC Data Specification and Collection, and TOP-003 Operational Reliability Data.

Members are to take any necessary precautions to prepare generating facilities for cold weather operations.

PJM will attempt to issue the advisory as far in advance as possible, typically within 3-5 days but given fluctuating and changing weather forecasts advisories could be issued up to 24 hours in advance.

**PJM Actions**

- PJM Dispatch notifies members via All-Call of forecasted temperatures and effective dates
- PJM issues Cold Weather Advisory via Emergency Procedures Posting

**Member Actions**

- Prepare to take freeze protection actions such as erecting temporary windbreaks or shelters, positioning heaters, verifying heat trace systems, or draining equipment prone to freezing
- Review weather forecasts determine any forecasted operational changes, and notify PJM of any changes
- Members are to update Markets Gateway by entering unit specific operation limitations associated with cold weather preparedness. Operating limitations include:
- Generator capability and availability
- Fuel supply and inventory concerns
- Fuel switching capabilities
- Environmental constraints
- Generating unit minimums (design temperature, historical operating temperature or current cold weather performance temperature as determined by an engineering analysis

### 3.3.2 Cold Weather Alert

The purpose of the Cold Weather Alert is to prepare personnel and facilities for expected extreme cold weather conditions. As a general guide, PJM can initiate a Cold Weather Alert across the RTO or on a Control Zone basis when the forecasted weather conditions approach minimum or actual temperatures of 10 degrees Fahrenheit or below. PJM can initiate a Cold Weather Alert at higher temperatures if PJM anticipates increased winds or if PJM projects a portion of gas fired capacity is unable to obtain spot market gas during load pick-up periods (refer to Inter RTO Natural Gas Coordination Procedure below). PJM will initiate the Cold Weather Alert for the appropriate region(s) in advance of the operating day based upon historical experience, information supplied by the pipelines and/or information supplied from the generator owners.

**PJM Actions**

- PJM dispatcher notifies PJM management, PJM public information personnel, and members.
- PJM dispatcher issues an Alert and provides the following information:
    - Control Zone
    - Forecasted low temperature
    - The forecasted duration of the condition
    - Amount of estimated operating reserve and reserve requirement
    - Reminder to Gen Owners to update their unit parameters in Markets Gateway to reflect revised Start-up and Notification times, max run times, min run times, etc.
    - PJM Dispatch communicates whether resource limited units are required to be placed into Maximum Emergency Category.

- PJM Dispatch recalls/cancels non-critical Generation & Transmission maintenance outages.

**Note:**
Generator Maintenance Outages recalls will be performed in accordance with M-10 Section 2.3.2.

- PJM Dispatch reviews the load forecast, interchange forecast, the increased MW unavailability from the tables below and generator Times to Start (Start-Up + Notification in Markets Gateway) to confirm if the Day Ahead Market will be able to clear sufficient generation that can be on-line to meet the reliability needs of the system for the operating day. If sufficient generation cannot be cleared in the Day Ahead market based the start-up + notification time, the following processes will be used to commit generation in advance of the Day Ahead Market:

**Note:**
Any discussions on unit commitment outside of the Day Ahead Market must be predicated on the unit parameters listed in Markets Gateway which include: notification/start-up time, min run time, max run time, cost and price schedule.

- Natural gas generating units:
  - PJM Dispatch will notify the generator owner that the unit is required to be online and ready to follow PJM Dispatch signals at XX:XXhrs on XX day for reliability. The unit parameters and the offer will then be confirmed and the unit will be offer capped with the schedule being 'locked in' as indicated in PJM's Manual for Energy & Ancillary Services Market Operations (M-11). PJM Dispatch will inform the gen owner to run for the greater of:
    - The unit's Min Run time OR
    - The duration that PJM requires the unit to run for reliability reasons.
  - Generators committed under this procedure will be run for the hours scheduled, assuming no reliability issues, and will be included in the DA Market as indicated in M-11.
  - The PJM OATT does not allow for stranded fuel recovery for any reason to include forced outage, failure to meet start profiles, or decommited due to reliability issues.
- Non-natural gas generating units:
  - PJM Dispatch will notify the generator owner that the unit is required to be online and ready to follow PJM Dispatch signals at XX:XXhrs on XXday for reliability. The unit parameters and the offer will then be confirmed and the unit will be offer capped. PJM Dispatch will NOT commit to run the unit longer than its Min Run time.
  - Generators committed under this procedure will be run for the hours scheduled and will be included in the DA Market as indicated in M-11.

**Note:**
The unit may also be cancelled at any time prior to coming on-line if system conditions change. Costs will be recoverable as indicated in M-11.

**Note:**
Since a Cold Weather Alert may only be issued on a portion of the PJM footprint, and since PJM schedules and operates the footprint as a single Balancing Authority, PJM may elect not to automatically place Resource Limited Units into the Maximum Emergency Category.

PJM utilizes the following weather locations and approximate unavailability rates to declare Cold Weather Alerts on a PJM Control Area or Control Zone basis.

| Control Zone | Region | Weather | Unavailability |
|---|---|---|---|
| Mid Atlantic | Mid-Atlantic | Philadelphia | 4000 - 5000 MW |
| FE-South/Duq | Western | Pittsburgh | 500 – 1000 MW |
| AEP | Western | Columbus | 1000 – 1500 MW |
| Dayton | Western | Dayton | 500 – 1000 MW |
| ComEd | Western | Chicago | 2000 – 3000 MW |
| Dominion | Southern | Richmond | 1000 – 2000 MW |
| FE-West | Western | Cleveland | 500 – 1000 MW |
| DEOK | Western | Cincinnati | 200 – 300 MW |
| EKPC | Western | Winchester | 200 – 300 MW |

**Note:**

Unavailability numbers are conservative estimates and are not necessarily additive. During the start of extreme cold weather unavailability rates are typically higher. Values can be adjusted based on the duration of cold weather, actual unity performance during cold weather, the impact on fuel sources (i.e., frozen coal, gas interruptions, etc.), the projected level of combined cycle/ combustion turbine usage, and level of scheduled long-lead/seldom-run generation.

- When scheduling for a period covered by a Cold Weather Alert, PJM dispatcher may assume an unavailability factor for scheduled interchange that could range from 25% to 75% of the pre-scheduled interchange. PJM Dispatch will make this decision based on the severity of the conditions, recent interchange curtailment experience, and the current/projected impact of the weather system on other Control Areas. This decrease may require the commitment of additional steam units and/or the purchase of emergency power from external systems.

- When in PJM's judgment combustion turbines in excess of 2000 MW are needed to operate within a control zone, PJM will notify the respective combustion turbine owners that PJM expects these units to be run. If the predicted minimum temperature is -5 degrees Fahrenheit or less or if recent unit performance has shown a significant increase in unit unavailability, an additional level of unavailability is added to the amount of CTs expected to operate. PJM will notify these additional combustion turbine owners that PJM expects these units to be run.
- PJM confers with generator owners and if appropriate, directs them to call in or schedule personnel in sufficient time to ensure that all combustion turbines and diesel generators that are expected to operate are started and available for loading when needed for the morning pick up. This includes operations, maintenance, and technical personnel that are necessary to gradually start all equipment during the midnight period. Directions may also be given to bring units on at engine idle, or loaded as necessary to maintain reliability. Once units are started, they remain on-line until PJM dispatcher requests the units be shut down. Running CTs to provide for Synchronized Reserve is monitored closely for units where fuel and delivery may be hampered. Most troublesome or unreliable units should be started first. PJM Dispatch should make this notification on afternoon shift the day prior, paying particular attention to weekend staffing levels.
- PJM Dispatch should poll large combined cycle units regarding projected availability during reserve adequacy run.
- PJM Dispatch reports significant changes in the estimated operating reserve capacity.
- PJM Dispatch cancels the alert if the weather forecast is changed or when the alert period is over.

**PJM Member Actions**

- Transmission/Generation dispatchers notify management of the alert.
- Generation dispatchers update their unit parameters, including the Start-up and Notification, Min Run Time, Max Run Time, Eco Min, Eco Max, etc. in Markets Gateway. This includes updating PLS schedule parameters as indicated in Manual 11 Section 2.3.4.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.
- Generation dispatchers with dual fuel determine whether alternate fuel will be made available to PJM for dispatch. If made available, any known alternate fuel resource limitations will be communicated via Markets Gateway as described in Section 6.4.
- Generation dispatchers, based on direction received from PJM call in or schedule personnel in sufficient time to ensure that all combustion turbines and diesel generators that are expected to operate are started and available for loading when needed for the morning pick up. This includes operations, maintenance, and technical personnel that are necessary to gradually start all equipment during the midnight period. The units are brought on at engine idle, where possible, and loaded as necessary to maintain reliability. Once units are started, they remain on-line until PJM dispatcher requests the

units be shut down. Running CTs to provide for Synchronized Reserve is monitored closely for units where fuel and delivery may be hampered. Each generator owner attempts to start their most troublesome or unreliable units first.

**Note:**
When a unit that PJM alerted to be prepared to run is not started, the owner of this unit can receive compensation for its costs. The Generation Owner must submit a letter to the PJM Manager of Market Settlements within 45 days identifying the actual costs of staffing the unit. After such notification, PJM will compensate the unit from Operating Reserves for these cancellation costs up to the capped start-up costs (as per the PJM Operating Agreement, Section 1.10.2d Pool Scheduled Resources and Section 2.3g Operating Reserves Credits; for detailed process see PJM's Manual for Operating Agreement Accounting (M-28), Section 5.2 - Operating Reserves Credits).

- Generation dispatchers review their combustion turbine capacities, specifically units burning No. 2 fuel oil that do not have sufficient additive to protect them from the predicted low temperature.
- Generation dispatchers review fuel supply/delivery schedules in anticipation of greater than normal operation of units.
- Generation dispatchers monitor and report projected fuel limitations to PJM dispatcher and update the unit Max Run field in Markets Gateway if less than 24 hours of runtime remaining.
- Generation dispatcher contact PJM Dispatch if it is anticipated that spot market gas is unavailable, resulting in unavailability of bid-in generation.
- Transmission/Generation dispatchers review plans to determine if any maintenance or testing, scheduled or being performed, on any monitoring, control, transmission, or generating equipment can be deferred or cancelled.
- Generation dispatchers will update the "early return time" for any Planned generator outages as indicated in PJM Manual for Pre-Scheduling Operations (M-10), Section 2.2.2.

## 3.4 Hot Weather Alert

**Hot Weather Alert**

The purpose of the Hot Weather Alert is to prepare personnel and facilities for extreme hot and/or humid weather conditions which may cause capacity requirements/unit unavailability to be substantially higher than forecast are expected to persist for an extended period. In general, a Hot Weather alert can be issued on a Control Zone basis, if projected temperatures are to exceed 90 degrees with high humidity for multiple days. A Hot Weather Alert will be issued for the Dominion and EKPC Control Zones when projected temperatures are to exceed 93 degrees with high humidity for multiple days. PJM may also issue a Hot Weather Alert at lower

temperatures during the spring and fall periods if there are significant amounts of generation and transmission outages that reduce available generating capacity.

PJM utilizes the following weather locations and approximate unavailability rates to declare Hot Weather Alerts on a PJM Control Area or Control Zone basis.

| Control Zone | Region | Weather | Unavailability |
|---|---|---|---|
| Mid-Atlantic | Mid-Atlantic | Philadelphia | 2000 - 2500 MW |
| FE South/Duq | Western | Pittsburgh | 300 – 500 MW |
| AEP | Western | Columbus | 500 – 1000 MW |
| Dayton | Western | Dayton | 300 – 500 MW |
| ComEd | Western | Chicago | 1000 – 1500 MW |
| Dominion | Southern | Richmond | 500 - 1000 MW |
| FE West | Western | Cleveland | 300 – 500 MW |
| DEOK | Western | Cincinnati | 100 – 200 MW |
| EKPC | Western | Winchester | 100 – 200 MW |

**Note:**
Unavailability numbers are conservative estimates and are not necessarily additive. As extreme hot weather continues unavailability rates may begin to increase. Values can be adjusted based on the duration of hot weather, actual unit performance during hot weather, projected environmental impacts (i.e. river water temperatures, hydro elevation) and level of scheduled long lead/seldom run generation.

PJM Actions:

- PJM Dispatch notifies PJM management and member dispatchers.
- PJM Dispatch issues an Alert stating the amount of estimated operating reserve capacity and the reserve requirement.
- PJM Dispatch recalls/cancels non-critical Generation & Transmission maintenance outages.

**Note:**
Generator Maintenance Outages recalls will be performed in accordance with PJM Manual for Pre-Scheduling Operations (M-10), Section 2.3.2.

- Reminder to Gen Owners to update their unit parameters in Markets Gateway to reflect revised Start-up and Notification times, max run times, min run times, etc. This includes updating PLS schedule parameters as indicated in Manual 11 Section 2.3.4

- PJM Dispatch communicates whether resource limited units are required to be placed into Maximum Emergency Category for Hot Weather/Cold Weather Alerts.
- PJM Dispatch reviews the load forecast, interchange forecast, the increased MW unavailability from the tables below and generator Times to Start (Start-Up + Notification in Markets Gateway) to confirm if the Day Ahead Market will be able to clear sufficient generation that can be on-line to meet the reliability needs of the system for the operating day. If sufficient generation cannot be cleared in the Day Ahead market based the start-up + notification time, the following processes will be used to commit generation in advance of the Day Ahead Market:

**Note:**
Any discussions on unit commitment outside of the Day Ahead Market must be predicated on the unit parameters listed in Markets Gateway which include: notification/start-up time, min run time, max run time, cost and price schedule.

- Natural gas generating units:
- PJM Dispatch will notify the generator owner that the unit is required to be online and ready to follow PJM Dispatch signals at XX:XXhrs on XX day for reliability. The unit parameters and the offer will then be confirmed and the unit will be offer capped with the schedule being 'locked in' as indicated in M-11. PJM Dispatch will inform the gen owner to run for the greater of:
  - The unit's Min Run time **OR**
  - The duration that PJM requires the unit to run for reliability reasons.
- Generators committed under this procedure will be run for the hours scheduled, assuming no reliability issues, and will be included in the Day Ahead Market as indicated in PJM M-11.
- The PJM OATT does not allow for stranded fuel recovery for any reason to include forced outage, failure to meet start profiles, or decommited due to reliability issues.
  - Non-natural gas generating units:
- PJM Dispatch will notify the generator owner that the unit is required to be online and ready to follow PJM Dispatch signals at XX:XXhrs on XXday for reliability. The unit parameters and the offer will then be confirmed and the unit will be offer capped. PJM Dispatch will NOT commit to run the unit longer than its Min Run time.
- Generators committed under this procedure will be run for the hours scheduled and will be included in the Day Ahead Market as indicated in PJM M-11.
  - Note: The unit may also be cancelled at any time prior to coming on-line if system conditions change. Costs will be recoverable as indicated in PJM M-11.

**Note:**
Since a Hot Weather Alert may only be issued on a portion of the PJM footprint, and since PJM schedules and operates the footprint as a single Balancing Authority, PJM may elect not to automatically place Resource Limited Units into the Maximum Emergency Category.

- PJM Dispatch reports significant changes in the estimated operating reserve capacity.
- PJM Dispatch cancels the alert, when appropriate.

PJM Member Actions:

- Transmission/Generation dispatchers notify management of the alert.
- Generation dispatchers update their unit parameters, including the Start-up and Notification, Min Run Time, Max Run Time, Eco Min, Eco Max, etc. in Markets Gateway.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.
- Generation dispatchers with dual fuel determine whether alternate fuel will be made available to PJM for dispatch. If made available, any known alternate fuel resource limitations will be communicated via Markets Gateway as described in Section 6.4.
- Generation dispatchers advise all generating stations and key personnel.
- Transmission/Generation dispatchers review plans to determine if any maintenance or testing, scheduled or being performed, on any monitoring, control, transmission, or generating equipment can be deferred or cancelled.
- Generation dispatchers report to PJM dispatcher all resource limited facilities as they occur and update PJM dispatcher as appropriate and update the unit Max Run field in Markets Gateway if less than 24 hours of runtime remaining.
- Generation dispatchers will update the “early return time” for any Planned generator outages as indicated in PJM Manual for Pre-Scheduling Operations (M-10), Section 2.2.

## 3.5 Long Duration Extreme Events

To prepare for and operate through extreme events expected to last more than 72 hours, during which wide-scale fuel disruptions may occur, PJM may extend the “Resource Limited Unit” reporting requirement for generators to evaluate a timeframe beyond 72 hours, as needed. PJM may also change the minimum run time requirements for Resource Limited Units to be placed into the Maximum Emergency Category. Examples of long-duration extreme events with the potential to cause wide-scale fuel disruptions include, but are not limited to:

- Extended Cold Weather
- Long-Duration Blizzard and/or Icing Conditions
- Wide-Area Flooding

- Impacts of Extreme Weather (i.e Hurricane Damage) expected to last more than 72 hours
- Physical or Cyber Events

As the extreme event progresses, PJM dispatchers will continuously evaluate the condition, assess system damage, and gauge the severity of fuel disruption. As conditions change, PJM will update “Resource Limited Unit” reporting time-frame and minimum run time requirements for units in the Maximum Emergency Category. For Resource Limitation Reporting requirements please refer to Section 6.4 of this manual.

**PJM Member Actions:**

- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.

## 3.6 Inter RTO Natural Gas Coordination Procedure

PJM, ISO New England, and New York ISO rely on natural gas-fired generation resources for a significant amount of their capacity. During periods of extremely cold weather, the natural gas supply to gas-fired generators may become impacted due to the various demands placed on the pipelines and the manner in which the generation owners may have contracted for their gas transportation.

During normal operations, and when extremely cold weather is expected in any or all parts of the Northeast US, ISO New England, New York ISO, and PJM (the RTOs) will jointly act to communicate with the interstate natural gas pipelines, and coordinate actions to be taken to manage potential gas supply inadequacy situations as described in the Memorandum of Understanding on Natural Gas & Electric Interdependency.

To facilitate this process, PJM has (1) developed a database of natural gas-fired generation on its system, including its interstate pipeline supplier or LDC, connection point on the gas pipeline system, and contract arrangements for gas supply and transmission; (2) a complete set of maps of the interstate gas pipelines serving units on its system; and (3) a contact list for people at the gas pipelines or LDC. This information will be shared among the RTOs and combined such that each RTO has a complete set of information for facilities in the combined area.

The following actions are considered a part of normal operations; however, these procedures are an essential step in cold weather operations.

**PJM Actions**

- PJM will monitor weather conditions in the PJM area and identify forecast conditions which could trigger the need for a Cold Weather Alert (see Cold Weather Alert above).
- PJM will analyze and forecast the need for natural gas-fired resources, given forecast weather conditions, and determine the need for invoking this procedure.
- PJM will request a conference call with ISO New England and New York ISO to request the invoking of the procedures. [The RTOs may decide to invoke the procedures

across the combined area or portions of the combined area.] Each RTO will share its assessment of the need for its natural gas-fired resources.

- The RTOs will jointly communicate with the interstate pipelines. The communication will include:
  - High level summary of the expected electrical demand and capacity conditions in the RTOs during the forecasted weather event.
  - Expected need for the natural gas-fired generation.
  - Contact information in each RTO for the interstate pipelines to obtain additional information.
- Each RTO will follow up individually with each of its interstate pipeline suppliers in its respective area, requesting (1) the operational status of the pipeline, (2) the presence or anticipation of any Operational Flow Orders (OFOs) or other emergency procedures, and (3) an assessment of the pipelines ability to serve contracts for gas-fired generation through the expected duration of the weather event.
- After the data collection effort with the pipelines, the RTOs will share the information with each other, reconvene, and determine actions to be taken, based on the collective assessment. Actions could include: (1) modification of the generation dispatch day-ahead to account for expected unavailability of gas-fired generation; (2) limitation of the granting of outages to maximize availability of generation resources; (3) adoption of conservative operations actions intended to mitigate risks associated with gas system contingencies or gas-fired generation unavailability.
- After a course of action has been determined, it will be communicated to the PJM System Operations Subcommittee.

**PJM Member Actions**

- Prior to the winter season, the gas-fired generation owners will be requested to provide information on their facilities, above that requested of other generation owners. That information will be considered confidential and only shared with the other RTOs for the purpose of facilitating this process and communications with the pipeline companies.
- The gas-fired generation owners will be requested to provide any information that they have relative to delivery limitations to their gas supply that they may have received from their gas supplier or gas transmission provider.
- The gas-fired generation owners will be expected to comply with any special instructions or emergency procedures that may be requested by PJM either via an SOS conference call or ALL-CALL message during a severe weather event.

## 3.7 Thunderstorms and Tornados

If automatic reclosing schemes are not in service and a severe thunderstorm(s) exist in the vicinity of a critical bulk power transmission facility, it is necessary to take action. When thunderstorms are in the vicinity of the PJM RTO, automatic reclosing capability should be in service for all EHV and critical 230 kV and above circuits. If tornadoes are reported in an

area, the failure of automatic reclosing to restore a transmission facility to service should be interpreted as a more serious failure existing. The Transmission Owner will generally dispatch a patrol of the line to ensure that the line can be safely returned to service or that additional maintenance or repair activity needs to be done.

**PJM Actions**

- PJM Dispatch requests that automatic reclosing capability be put in service on those critical facilities. The Local Control Center at either end of a tie line or PJM Dispatch can request that the reclosers be restored.
- Where practical, PJM Dispatch requests that any maintenance and testing being performed on any critical transmission generating, control, or monitoring equipment be deferred or cancelled.
- PJM Dispatch informs affected Members of any storms moving in their direction.

**PJM Member Actions**

- Transmission dispatchers inform PJM dispatcher of any storms in their systems.
- Transmission dispatchers determine when reclosers are to be restored to service and report this information to PJM dispatcher.
- Transmission dispatchers place reclosers in service.
    - Transmission dispatchers may elect to manually disable recloser on certain lines that experience multiple re-close attempts during storms or other times during increased likelihood of “non-self-clearing” faults. Transmission dispatchers may disable auto-reclose at their own discretion. However, Transmission dispatchers are required to inform PJM when they disable auto-reclose on any transmission facilities.

## 3.8 Geo-Magnetic Disturbance (GMD) Operating Plan (EOP-010-1)

Geomagnetically-induced currents (GIC) caused by geo-magnetic disturbances (GMD) that result from solar storms flow through the power system equipment and facilities may cause increases in system reactive requirements, equipment damage, voltage drops, and disruption of interconnected system operation.

Transmission Owners are not required to have GMD Operating Plans. However, TOs that do have GMD Operating Plans are required to provide copies of those Plans to PJM, as indicted in PJM’s Manual for Control Center and Data Exchange Requirements (M-01), Attachment B, and are also required to coordinate any actions in their Plans with PJM prior to implementation.

### 3.8.1 GMD Warning

**Geomagnetic Disturbance Warning**

If the National Oceanic and Atmospheric Administration (NOAA) issues a warning or an alert for a potential geo-magnetic storm of severity K7 or greater, PJM will provide notification via the ALL-CALL system and Emergency Procedure application.

**PJM Actions**

- PJM Dispatch notifies members (Generation and Transmission) via the PJM ALL-CALL of GMD warnings/alerts issued by the National Oceanic and Atmospheric Administration (NOAA) via the RCIS and/or the NERC Hotline.
- If GIC measurements exceed the associated GIC operating limit (in amperes) at one and only one of the transformers monitored for GIC flow, PJM Dispatch confirms that this measurement is a result of a severe geomagnetic storm by contacting the TO or GO in order to verify that the readings are accurate.

**PJM Member Actions**

- Transmission/Generation dispatchers provide confirmation of measurement values as requested by PJM Dispatch.
- Generation dispatchers provide as much advance notification as possible regarding details of more restrictive plant procedures that may result in plant reductions to protect equipment.

### 3.8.2 GMD Action

**Geomagnetic Disturbance Action**

When conditions warrant, the PJM dispatcher may take action as soon as necessary for a GMD disturbance but must take action if conditions persist for 10 minutes.

If GIC measurements exceed the associated GIC operating limit (in amperes) at two or more transformers monitored for GIC flow, PJM Dispatch contacts the TO(s) and GO(s) in order to verify the readings are accurate and determine if excess MVAR exist at area transformers. PJM also checks the NOAA GMD (http://www.swpc.noaa.gov/) to confirm if any storm warnings or alerts have been issued, but this confirmation is not required for implementation of procedures if measurements are indicative of a geomagnetic disturbance.

Upon identification of a geomagnetic disturbance, PJM Dispatch declares a Geomagnetic Disturbance Action and operates the system to geomagnetic disturbance (GMD) transfer limits. The geomagnetic disturbance transfer limits are determined from studies modeling various scenarios, including:

- partial or complete loss of Hydro Quebec Phase 2 DC line to Sandy Pond
- reduction or complete loss of generation at Artificial Island
- tripping of certain EHV capacitors

These studies are performed by PJM's Operations Planning Division and Transmission Planning department group on a seasonal basis and are updated for current conditions, as required, when PJM Dispatch implements this procedure.

**PJM Actions**

- PJM Dispatch notifies members (Generation and Transmission) and neighbors via the PJM ALL-CALL, postings on selected PJM web-sties and the NERC RCIS of a Geomagnetic Disturbance Action to mitigate the effects of GMD events on the system. PJM dispatcher begins to operate the system to the geomagnetic disturbance transfer limits.

- To mitigate the effects of GMD events on the system, when the GMD transfer limit is approached or exceeded, generation re-dispatch assignments are made in the most effective areas to control this limit. PJM Dispatch also evaluates the impact of the existing inter-area transfers and modifies the schedules that adversely affect the GMD transfer limit. If insufficient generation is available to control this limit, the emergency procedures contained in Section 2 of this Manual are implemented. If it appears that these emergency procedures are required, an operations engineer is requested to validate the GMD transfer limit and develop a voltage drop curve for the GMD transfer limit contingency. Pre-contingency load shed will not be used to control transfers to the GMD transfer limit.
- After GIC measurements at all monitored transformers have fallen below the associated GIC operating limit, PJM Dispatch continues to operate the system to the geomagnetic disturbance transfer limits for a period of three hours. PJM Dispatch must again confirm this measurement by contacting TOs and GOs. If the measurement values are confirmed to remain below the GIC operating limits for three hours, members are notified that the Geomagnetic Disturbance Action is cancelled. PJM Dispatch restores the appropriate transfer limits for operation of the system.

**PJM Member Actions**

- Transmission/Generation dispatchers provide confirmation of measurement values as requested by PJM Dispatch.
- Generation dispatchers provide as much advance notification as possible regarding details of more restrictive plant procedures that may result in plant reductions to protect equipment.
- Upon notification of the implementation of this procedure, members that operate facilities with instrumentation installed to record GIC neutral measurements at remote locations dispatch personnel to ensure that measurement equipment working properly. Members employing a MVAR summing algorithm method also initiate data collection at this time. It is requested that any data collected during a geomagnetic storm be forwarded to PJM for further analysis.
- The member dispatchers report all actions to PJM Dispatch.

## 3.9 Assessing Gas Infrastructure Contingency Impacts on the Electric System

Under certain system conditions or events affecting either the electric or gas infrastructure, PJM will operate to reflect the impact of gas infrastructure contingencies on the PJM RTO due to their potential impact on natural gas generators within the PJM footprint.

Electric system conditions that may result in the initiation of the gas infrastructure contingency assessment process are:

- Cold or Hot Weather Alerts
- Capacity Emergency procedures

Similarly, gas infrastructure events impacting PJM gas generators that may result in the initiation of the gas infrastructure contingency assessment process are:

- Pipeline Operational Flow Orders (OFOs)
- Significant pipeline maintenance outages
- Significant force majeure events
- Credible cyber/physical threats to the gas infrastructure

Resulting from a coordinated effort with gas pipeline operators to assess gas pipeline redundancy, a set of contingencies have been defined, which simulate the impact of gas infrastructure component failures on PJM gas generators based on their pipeline connectivity. Examples of these gas infrastructure contingencies are pipeline breaks or loss of critical pipeline compressor stations resulting in gas pressure degradation, which would result in the loss of the gas generators within a short period of time. PJM will initiate this procedure under peak gas/electric system conditions that coincide with gas pipeline capacity limitations when potential impact to the gas generators is most credible and severe.

The gas infrastructure contingency assessment involves analyzing the initiating conditions or events to determine the applicable set of pre-defined gas infrastructure contingencies to be studied Day-ahead and/or Real-time in the PJM EMS and coordinating with gas pipelines and PJM Generation Owners/Operators to refine the EMS contingencies, accounting for current fuel supply options for impacted generators. These contingencies will be refined to account for the impact of firm service pipeline contracts on the impacted generators under non cyber/physical threat scenarios.

The detailed pre-defined gas infrastructure contingencies are documented in the CEII portal, which requires additional access for review.

**PJM Actions:**

- Monitor the electric and gas system conditions for initiating events.
- Initiate the assessment process in the event of:
  - PJM issued Cold/Hot Weather Alerts or Capacity Emergency procedures.
  - Pipeline issued Operational Flow Orders (OFOs), significant pipeline maintenance outages, or force majeure events.
  - E-ISAC or G-ISAC communicated cyber/physical threats to gas infrastructure serving PJM generators.
- Study the impact of pre-defined gas infrastructure contingencies. These contingencies involve the loss of gas power plants supplied by critical compressor stations, pipeline breaks, and local distribution centers (LDC).
  - Determine whether contingencies cause thermal or voltage constraints exceeding their Load Dump (LD) limits.
- If the pre-defined gas infrastructure contingency does result in thermal or voltage constraints exceeding their Load Dump limits, coordinate with the impacted pipeline(s) to confirm projected impact to affected PJM gas generators.

  - Confirm status of critical compressor stations identified as limiting contingencies in PJM analysis.
  - Provide current details on redundancy of pipeline infrastructure that may mitigate projected impacts to PJM gas generators.
- Notify PJM Members of credible gas pipeline contingency(s) being monitored by PJM via PJM Emergency Procedures application.
- Coordinate with impacted generators with alternate gas pipeline connections or alternate fuel capability to mitigate projected impact to the electric system.
  - Request generator(s) to be prepared to switch to their alternate pipeline or to alternate fuel on a post-contingency basis.

**Note:**
Under cyber/physical threat conditions, PJM will discuss the identified threat conditions and resultant fuel supply risk with the generation owner and will request notification from the generation owner if they will be taking any voluntary pre-contingency actions to mitigate these fuels supply risks.

- Modify EMS contingencies for Real-time Operations based on the assessment. For these contingencies:
  - Monitor and control thermal and voltage constraints to their Load Dump limits using transmission line and capacitor switching, and economic generation re-dispatch as needed
  - Carry additional reserves to mitigate deficit between 30 minute reserves and contingency generation loss as needed.
    - In day-ahead commitment, schedule additional resources to cover deficit in day-ahead scheduled reserves.
    - In real-time conditions, clear additional synchronized resources to cover deficit in real-time operating reserves.
  - PJM Dispatch will determine the eligibility of resources that are part of the contingency to provide reserves depending on the severity of the contingency and other system conditions in order to ensure system reliability is maintained.
- Notify PJM Members of credible gas pipeline contingency(s) being monitored by PJM via PJM Emergency Procedures application.

**Note:**
Given that generation loss from a gas infrastructure contingency is seldom instantaneous, and that there will be sufficient time post-contingency to implement PJM Emergency Procedures, PJM will only re-dispatch economic generation, and not implement PJM Emergency Procedures to control gas-pipeline contingencies to within the transmission facility load dump limits.

### PJM Generator Owner/Operator Actions:

- Coordinate with PJM to confirm alternate gas pipeline supply options, and/or ability to operate on secondary fuel and transition time in order to mitigate projected impact to the electric system.
- Notify PJM if voluntary pre-contingency fuel switching will be implemented.

### PJM Transmission Owner Actions:

- Implement requested switching of transmission lines or voltage control devices upon PJM's request for constraint control.

# Section 4: Sabotage/Terrorism Emergencies

This is the *Sabotage/Terrorism Emergencies* section. Sabotage reporting should be conducted in accordance with EOP-004. In this section, you will find the following information:

- A description of the conditions that warrant conservative operation (see "General Conditions").
- An understanding of actions that PJM may take in the event of these potential and/or realized manmade threats.
- Centralize information related to preparing and responding to man-made threats/attacks.

This section is **not** intended to be any of the following:

- A fixed blueprint for action – the very nature of a crisis requires a tailored solution. Even if such a solution existed, it would not be printed in this public document.
- The definitive guide for PJM's members to determine what physical or cyber security measures they should take to protect their assets. The focus of this section is upon power system operations and communications.

PJM Sabotage Definition:

PJM defines sabotage as deliberate or planned disturbances and events that could potentially threaten the reliability of the Bulk Electric System (BES) or lead to cascading outages. Such disturbances and events include, but are not limited to, the following:

- Any physical threat that could impact the operability of a set of electrical equipment that operate as a single BES element.
- Any unauthorized addition or modification of software or data intended to disrupt the proper operation of cyber assets.
- Sudden loss of BES situation awareness.
- Suspected malicious cyber events that result in actual or potential intrusion to a PJM critical computer or PJM telecom system.
- Suspected malicious physical events that cause damage to PJM facilities.
- Suspected malicious physical or cyber events that cause transmission outages, loss of generation, loss of load, damage to facilities.
- Threats received to PJM and its members Facilities (e.g. bomb, mail, telephone).

## 4.1 General Conditions

As a result of man-made threats, the need may exist to operate the PJM RTO more conservatively (i.e., operate some margin away from the reactive transfer limit or some margin away from the post-contingency flow value) than in normal conditions.

Examples of conditions warranting possible conservative operations include:

- Terrorist threats and/or attacks upon the transmission system and related infrastructures (i.e., Telecom, Fuel, Transportation)
- Intelligence from the Federal Government or other credible sources (i.e., DOE, DHS, Reliability Authority, PJM Member)
- Suspicious events on either PJM or neighboring systems
- Other system conditions or outages with unknown causes

The significant triggers for PJM action during crisis will be the Homeland Security Threat Levels and Threat Advisories. However, if PJM becomes aware of a possible threat before any one of these triggers (e.g., PJM sees a significant terrorist attack on CNN) PJM may decide to act before any such alerts. Each of these alerts is further explained in the attached appendices.

This section of the manual will address possible PJM conservative operations in the event of a man-made threat to the bulk power grid and/or other significant infrastructures.

The tailored response to any of these triggers will include a multi-faceted plan to safeguard personnel and maintain reliable operations. The facets of this response include power system operations, communications, cyber security, and physical security. The emphasis of this section is upon the Operations and Communications measures that may be taken based upon the threat and intelligence.

As PJM progresses into ever increasing alert levels the actions of the higher level include the actions of the lower levels such that when the highest alert level is issued, PJM may have implemented all actions for prior threat levels. Given the ability for the Department of Homeland Security (DHS) to issue alerts out of sequence, the order that the steps are presented does not mandate a set implementation plan.

The DHS has revised the threat level system in order to simplify the threat notification process. The new system which is referred to as the National Terrorism Advisory System (NTAS) consists of the following two alerts:

- ***Imminent Threat Alert:*** warns of a credible, specific, and impending terrorist threat against the United States.
- ***Elevated Threat Alert:*** warns of a credible terrorist threat against the United States.

NTAS alerts also include a sunset provision which provides a specific end date for each alert while also allowing for extensions when new information or threats occur.

For an NTAS ***Elevated Threat Alert***, or if suspicious activity is reported by an adjacent system, potential PJM and Member actions include:

**PJM Actions:**

- Communicate credible threats over ALL-CALL
- PJM will pass along credible/actionable intelligence to affected members
- PJM will remind all operators to maintain vigilance and reporting
- Maintenance Outages Analyzed – additional coordination with TO/GO to confirm emergency return times, if necessary

- PJM Reliability Engineer will analyze Maximum Credible Contingencies
- PJM will analyze Hydro Schedules for possible interruption to increase Black Start capability
- If necessary, PJM will Initiate Black Start Assessment– to determine fuel limitations
- PJM will perform Satellite Phone Checks (daily upon initiation and weekly thereafter)
- Enhance Voice Communications Security (Operators who do not recognize another operator, should call back to the entity or organizations should have a password to validate directives)
- As needed PJM conducts Conference Calls with Generation Owners and Transmission Owners – no exchange of market sensitive data permitted
- PJM conducts SOS meetings and conference calls, as needed, to review crisis response posture
- PJM staffs an Incident Response Team [to coordinate physical security measures, media responses, and communications to PJM staff not on site]
- If an attack occurs, PJM will immediately notify members via the ALL-CALL (identify any immediate actions and a conference call time)

**PJM Member Actions:**

- Maintain a high level of vigilance and reporting
- All operations centers should review reporting requirements/process
- Participate in PJM hosted GO, TO, and SOS conference calls
- Members should consider limited, or full, activation of their organization's emergency preparedness action plans

If the NTAS issues an ***Imminent Threat Alert***, refer to Section 4.3: physical threats for necessary actions.

## 4.2 Communications Plan

The following outlines the manner in which communications will flow from the Federal Government to PJM and other Reliability Coordinators as well as between PJM and its members. Timely and clear communications between PJM and its Members, in both directions, is a key to the successful management of any suspected or actual crisis.

- The Electric Sector – Information Sharing and Analysis Center (ES-ISAC) receives information from a US or Canadian Federal Agency, a Reliability Coordinator, an ES Entity (e.g. Region, Control Area, Purchasing Selling Entity, other), another Sector ISAC, or – potentially - outside the Sector. The ES-ISAC will review the information (which may be classified).
- If the information is specific and has any credibility at all, the ES-ISAC will contact the involved Entity directly (this may be the Reliability Coordinator of the Entity, depending upon contact information. If any PJM member company operator has been contacted by

ES-ISAC or the information is releasable immediately, contact appropriate parties in the Interconnection in the event of sabotage to include the PJM Shift Supervisor.

- In the event a PJM member company operator has received or observed a sabotage event, contact the PJM Shift Supervisor.
- PJM and its members should evaluate threat information and share indicators of potential cyber or physical attacks with the E-ISAC. When feasible according to Member's internal policies, information that requires timely dissemination to maintain the reliability of the Bulk Electric System should be posted to "E-ISAC AOO Members" on the E-ISAC portal to allow immediate distribution to asset owners and operators.
- PJM will communicate the information to other Reliability Coordinators, via RCIS as appropriate.
- If the information is urgent or time sensitive, the information will be passed to the personnel on the call, and a Reliability Coordinator conference call will be requested (the on-duty personnel will alert the call participants). PJM will rapidly assess the information and pass the information to its members via the ALL-CALL for urgent/time sensitive information or via SOS conference calls or e-mail if the information is of a general/non-actionable nature.
- The ES-ISAC will notify other Electricity Sector Entities (including the EEI Security Committee, APPA, EEI, EPSA, NEI, NRECA, and CEA) as appropriate; no information shared by Reliability Coordinators will be passed on without approval.
- Any information shared in this manner will be noted as to any restrictions on further distribution. No information shared is to be delivered to the public media.

## 4.3 Physical Threats

As a result of physical threats, the need may exist to operate the PJM RTO more conservatively (i.e., operate some margin away from the reactive transfer limit or some margin away from the post-contingency limit) than in normal conditions.

Examples of conditions warranting possible conservative operations include:

- National Terrorism Advisory System (NTAS) Alert: Imminent Threat Level
- Intelligence of an impending attack on a PJM facility
- Significant terrorist activity beyond the East Coast (situational dependent)
- Physical attack at multiple sites (control center or grid assets-lines, substations, generators)

This section of the manual will address possible PJM conservative operations in the event of a man-made threat to the bulk power grid and/or other significant infrastructures.

The tailored response to any of these triggers will include a multi-faceted plan to safeguard personnel and maintain reliable operations. The facets of this response include power system operations, communications, cyber security, and physical security. The emphasis of this section

is upon the Operations and Communications measures that may be taken based upon the threat and intelligence.

**PJM Actions:**

- Communicate threat over ALL-CALL
- Operate to more conservative modeling measures which may include double contingencies, maximum credible disturbances, or lower reactive transfer limits
- Increase available 30 Minute Reserves
- Cancel maintenance outages in the impacted area, and attempt to return outaged equipment to service. [Consider invoking a “no touch” maintenance stance]
- Consider staffing selected substations for communications
- Consider staffing combustion turbine sites
- Increase Synchronized Reserve
- Obtain emergency energy bids as a precaution
- Initiate Black Start Assessment to determine fuel limitations
- Consider staffing critical Black Start units
- PJM recommends enhanced physical security at critical substations.
- Institute daily conference call, as necessary, with GOs and TOs to assess posture
- PJM Dispatchers will alert PJM’s Operations Emergency Response Team (OERT)
- PJM maintains 24 hour Operations management presence
- Consider providing instructions to units to operate within a given set of parameters if communication is lost
- PJM will not post emergency actions on its Emergency Procedures website
- PJM will reassess the level of allowable communications that is acceptable between Generators and Transmission Owners in order to facilitate necessary communications

**PJM Member Actions**

- Transmission/Generation dispatchers notify management of the declaration.
- Transmission/Generation dispatchers consider activating their emergency preparedness plans per their internal procedures.
- Transmission/Generation dispatchers respond, as required, to specific requests and directions of PJM dispatcher.
- Transmission/Generation dispatchers staff Back-Up Control Centers (BUCC), as necessary
- Transmission dispatchers consider enhancing security at critical substation via the entities' own procedures and processes
- Transmission dispatchers consider staffing selected substations for communications

- If directed by PJM, Generator Operators staff critical combustion turbine sites identified by PJM
- If directed by PJM, Generator Operators staff critical Black Start units

## 4.4 Cyber Threats against PJM

PJM performs constant cyber security monitoring to ensure PJM cyber assets maintain reliable operations. If the Security Monitoring Team determines there is a credible cyber threat that could impact operations:

**PJM Actions:**

- PJM Cyber Security Incident Response Team (CSIRT) notifies PJM Incident Response Team
- PJM Incident Response Team (IRT) will meet to determine which systems are impacted
- IRT will contact PJM Dispatch Shift Supervisor with impacts to operations
- Conservative Operations will be triggered by PJM Shift Supervisor as necessary
- PJM will notify members of impacted systems and necessary actions via the All-Call

### 4.4.1 Loss or Degradation of ICCP or EMS Capabilities:

For a cyber event that has (or imminently will) shut down PJM control center ICCP or EMS capability:

**PJM Actions:**

- Communicate threat over ALL-CALL
- PJM dispatchers will begin Manual Dispatch procedure per Manual 1, section 3.8.2
- Operate to more conservative modeling measures which may include double contingencies, maximum credible disturbances, or lower reactive transfer limits
- Increase Available 30-Minute Reserves
- Cancel Maintenance Outages – [Consider invoking a “no touch” maintenance stance]
- Consider staffing selected substations for communications
- Consider staffing combustion turbine sites
- Increase Synchronized Reserve
- Obtain emergency energy bids as a precaution
- Initiate Black Start Assessment to determine fuel limitations
- Consider staffing critical Black Start units
- Institute daily conference call, as necessary, with GOs and TOs to assess posture
- PJM maintains 24 hour Operations management presence
- Staff additional Master Dispatcher/Generation Dispatcher on shift 24x7 to assist with communication

- Consider providing instructions to units to operate within a given set of parameters if communication is lost
- PJM will not post emergency actions on its Emergency Procedures website
- PJM will reassess the level of allowable communications that is acceptable between Generators and Transmission Owners in order to facilitate necessary communications
- PJM will provide updates to members with regard to the severity of the situation, and the expected time until the situation is remediated.

**PJM Member Actions**

- Transmission/Generation dispatchers notify management of the declaration
- Transmission/Generation dispatchers consider activating their emergency preparedness plans per their internal procedures
- Transmission/Generation dispatchers respond, as required, to specific requests and directions of PJM dispatcher
- Transmission/Generation dispatchers will follow PJM's Manual Dispatch procedure per Manual 1, section 3.8.2
- Transmission/Generation dispatchers staff Back-Up Control Centers (BUCC), as necessary
- Transmission dispatchers consider staffing selected substations for communications
- If directed by PJM, Generator Operators staff critical combustion turbine sites identified by PJM
- If directed by PJM, Generator Operators staff Critical Black Start Units

### 4.4.2 Loss of Internet:

For a cyber event that has (or imminently will) shut down all PJM control center internet capabilities:

**PJM Actions:**

- Communicate threat over ALL-CALL
- PJM dispatchers manually update PJM databases with critical, near term information.
- Staff an additional Master Dispatcher/Generation Dispatcher on shift to assist with communication
- PJM will provide updates to members with regard to the severity of the situation, and the expected time until the situation is remediated.

**PJM Member Actions:**

- Transmission/Generation dispatchers will call into PJM to provide critical near term system updates, including transmission facility outages, generation outages, generator parameter updates, and Ancillary Service changes.

### 4.4.3 Loss of all telecommunications:

PJM has multiple levels of redundancy for voice telecommunications. However in the event of a loss of ALL telecommunications, including Internet, ICCP, and all voice communications:

**PJM Actions**

- PJM will work with telecom companies and to establish communication to Transmission Owners and Generation Owners

**PJM Member Actions:**

- Generation/Transmission Owners should have readily available and continuously check back-up voice communication systems for PJM communication, including Business Voice System, Cellular Telephones, and Satellite Telephones (See Manual 1, Section 4 for Voice Communication requirements)
- Transmission Owners should check communication capability with Generation Owners in their area and with neighboring Transmission Owners to verify extent of outage and attempt to re-establish communications with PJM through Generation Owners or neighboring Transmission Owners
- Generation Owners should check communication capability with their area's Transmission Owners to verify extent of outage and attempt to re-establish communications with PJM through area's Transmission Owner
- If communications cannot be re-established to PJM, Generation Owners should follow NERC Reliability Guideline, Generating Unit Operations During Complete Loss of Communications v3.0, until communication is re-established with PJM

## 4.5 Cyber Threats against Member

This section will discuss operations and communication protocols for cyber threats to PJM's member companies that also impact PJM operations. Two types of cyber threats will be addressed:

- Consistent Bad or "Altered" data exchange with PJM EMS
- Transmission or Generation asset(s) operated by an unauthorized entity with malicious intent. Suspected malicious cyber events that cause transmission outages, loss of generation, loss of load, damage to facilities.

### 4.5.1 Bad Data Exchange with Member

PJM's EMS relies on data exchange with PJM member Transmission Owner and Generation Owner companies. If a PJM member company experiences a cyber event that impacts the accuracy or quality of data exchanged with PJMs EMS to a point where PJM's EMS accuracy is unacceptable (i.e. State Estimator cannot solve, State Estimator solution is questionable across widespread area) the following actions shall be taken:

**PJM Actions:**

- PJM Dispatcher verifies the accuracy of the EMS results.
- PJM Dispatcher attempts to resolve inaccurate EMS results by troubleshooting data inputs and manually overriding incorrect device statuses, tuning parameters, etc.

- PJM Dispatcher notifies support personnel and PJM Incident Response Team (IRT).
- If appropriate, PJM Dispatcher switches to alternate data sources or EMS.
- If data quality issues still cannot be resolved, PJM will disable the member's data link
  - PJM will overwrite bad data exchange from member company with corresponding data from the most recent solved State Estimator solution that is verified as accurate.
- PJM Dispatcher notifies companies via the All–Call of PJM's EMS status.
- PJM Dispatch notifies Transmission Owners and external systems via RCIS if unable to monitor system via alternate EMS.
- PJM Shift Supervisor will trigger Conservative Operations as necessary.
- Consider staffing selected substations for communications
- PJM returns to normal operations when appropriate

**PJM Member Actions:**

- If a Transmission Owner or Generation Owner questions the accuracy of data exchanged with PJM's EMS, they will notify PJM dispatchers immediately
- Affected PJM Member's will cooperate with PJM dispatchers, PJM support personnel, and PJM Incident Response Team to resolve the issue.
- Transmission dispatchers consider staffing selected substations for communications
- Member will provide updates to PJM with regard to the severity of the situation, and the expected time until the situation is remediated.

### 4.5.2 Unauthorized Remote Operation of BES Asset

There is also a risk that a Transmission Owner or Generation Owner has an asset operated by an unauthorized entity for malicious intent. This includes any malicious cyber events that cause transmission outages, loss of generation, loss of load, damage to facilities, such as:

- Opening and/or closing a circuit breaker or other switching device
- Energizing and/or removing from service a line, transformer, or other BES facility
- Unauthorized changes to protective relay settings of a BES facility
- Shutting down or tripping a generator remotely

Given an unexpected suspicious operation of a system asset, PJM will work with the Transmission/Generation owner to verify that a malicious cyber event has occurred, mitigate BES system risks of additional unauthorized operations, and resolve the threat with the member company.

**PJM Actions:**

- PJM Dispatcher confirms with affected Transmission/Generation asset owner that the remote operation of the asset was initiated by an unauthorized entity.
- PJM Dispatchers will alert PJM's Operations Emergency Response Team (OERT) to determine the best operational strategy

- PJM Shift Supervisor will trigger Conservative Operations as necessary.
- PJM Dispatchers will cancel Maintenance Outages in the impacted area – attempt to return outaged equipment to service. [Consider invoking a “no touch” maintenance stance]
- PJM will initiate a SOS-T conference to communicate threat and operational response plan, as determined by the OERT, with Transmission Owners.
- Initiate Black Start Assessment to determine fuel limitations
- Consider staffing Critical Black Start Units
- PJM Dispatchers will notify the PJM Incident Response Team
- PJM Dispatchers notify external systems via RCIS
- PJM Dispatchers notify all other companies via the All–Call

**PJM Member Actions:**

- Transmission and Generation Owners shall report any unauthorized operation of BES facilities to PJM dispatchers
- Transmission / Generation dispatchers respond, as required, to specific requests and directions of PJM dispatcher.
- If directed by PJM, Generator Operators staff Critical Black Start Units
- Member will provide updates to PJM with regard to the severity of the situation, and the expected time until the situation is remediated.
- After the cyber threat has been resolved, and consistent with the member company’s cyber response procedures, the affected member company will identify its affected/ potentially affected BES facilities, and verify protective relay settings of those affected/ potentially affected BES facilities

## 4.6 High-Altitude Electromagnetic Pulse

A high-altitude Nuclear Weapon detonation above PJMs footprint has the potential to create an Electromagnetic Pulse (EMP) that would have detrimental impact to the BES. This resultant High-Altitude Electromagnetic Pulse (HEMP) consists of 3 types of pulses in the following order: E1 pulse, E2 pulse, and E3 pulse. These pulse components differ in duration and magnitude, causing varying effects on different electrical devices:

- E1 pulse - expected to happen quickly, damaging small electrical components and disabling protective relaying, monitoring equipment, and communication devices.
- E2 pulse - effects on power system component are negligible.
- E3 pulse - causes high-magnitude GMD-like effects across a wide-spread area for 4-5 minutes. This would cause hot-spots on power transformers and greater reactive consumption, increasing the risk of equipment failure and possible voltage collapse.

The dual threat to communication devices and overall system voltage stability amplifies the negative effects of HEMP on PJMs ability to monitor and operate the BES system. While this

is considered a High-Impact Low-Frequency (HILF) event, PJM believes that the multifaceted, wide-area, extreme impacts of an HEMP event on the BES system warrant having an action plan for PJM operations.

PJM does NOT expect there to be a sufficient amount time before an HEMP event to communicate a credible threat warning to members and/or position the system to withstand such an event. So PJM's response plan assumes that no sufficient warning would be provided. This plan outline is:

1. Re-Establish Communication with Members
2. Assess System Damage
3. Prepare for Black Start if necessary

The biggest challenge expected after a HEMP event is the potential complete loss of communications without prior warning. To mitigate this risk, PJM members are strongly encouraged to store back-up satellite phones in shielded bags when not in use. PJM will work with telecom companies to restore verbal and data communications to member companies.

**PJM Actions:**

- PJM Dispatchers will test all communication methods, both verbal and data, to evaluate communication capabilities with members, neighboring entities, and governmental authorities.
- PJM Dispatchers will alert PJM's Operations Emergency Response Team (OERT)
- PJM Dispatchers will alert PJM's Incident Response Team (IRT)
- PJM maintains 24 hour Operations Management Presence
- PJM staffs additional Dispatchers on shift 24x7 to assist with communication
- PJM Dispatchers will gather operational information from Generation/Transmission Owners, including:
    - Damage to BES Transmission Facilities and Generators
    - Load lost
    - Monitoring/control capabilities
    - Communication capabilities
    - Protective relaying damage
    - Black Start generator unit status and cranking path damage.
- PJM Dispatchers will communicate system status to members and the public, then take the corresponding actions:
    - Minimal HEMP Impacts – Operate under Conservative Operations
    - Interconnection Stable – Begin Restoration of isolated parts of system
    - Blackout – Coordinate Black Start efforts with Transmission Owners and Generation Owners

**PJM Member Actions:**

- Generation/Transmission Owners should have readily available and continuously check back-up voice communication systems for PJM communication, including Business Voice System, Cellular Telephones, and Satellite Telephones (See Manual 1, Section 4 for Voice Communication requirements).
- If all normal communication means with PJM are interrupted, Transmission Owners should check communication capability with Generation Operators in their area and with neighboring Transmission Owners to verify extent of outage and attempt to re-establish communications with PJM through Generation Owners or neighboring Transmission Owners.
- If all normal communication means with PJM are interrupted, Generation Owners should check communication capability with their area's Transmission Owners to verify extent of outage and attempt to re-establish communications with PJM through area's Transmission Owners.
- Transmission Owners should gather the following information about their system and be prepared to report to PJM when communication is re-established:
  - Damage to BES Transmission Facilities
  - Load lost
  - Monitoring/control capabilities
  - Communication capabilities
  - Protective relaying damage
  - Cranking Path Status
- Generation Owners should gather the following information about their units and be prepared to report to PJM when communication is re-established:
  - Damage to Generators
  - Monitoring/control capabilities
  - Communication capabilities
  - Protective relaying damage
  - Black Start Unit Status
- Generator Operators should staff Critical Black Start Units

# Section 5: Transmission Security Emergencies

Welcome to the *Transmission Security Emergencies* section of the ***PJM Manual for Emergency Operations***. In this section, you will find the following information:

- How PJM anticipates/responds to potential Heavy Load/Low Voltage conditions
- How PJM implements Capacity Related Emergency Procedures to control Transmission Constraints.
- An explanation of the use of the Post Contingency Local Load Relief Warning to alert local control center operators of the potential need to perform local load shedding due to the lack of any other available load relief options.
- How PJM uses the NERC Transmission Loading Relief procedure to reduce loadings.
- PJM is responsible for determining and declaring that an Emergency is expected to exist, exists or has ceased to exist in any part of the PJM RTO or in any other Control Area that is interconnected directly or indirectly with PJM RTO. PJM directs the operations of the PJM Members as necessary to manage, allocate, or alleviate an emergency. These actions are consistent with NERC and RFC EOP standards.
- In accordance with EOP-011 R5, if PJM receives an Emergency notification from a Transmission Operator within the RTO, PJM will notify within 30-minutes other Transmission Operators within the RTO and neighboring Reliability Coordinators via All-Call and RCIS postings.

**Note:**
This section of the manual is intended to supplement PJM's Transmission Operations Manual (M-03), Section 2: Thermal Operation Guidelines and Section 3: Voltage and Stability Operating Guidelines. M-03 specifies corrective actions for actual and post-contingency simulated loadings and associates targeted time to correct. Section 5 of this manual specifies in which emergency procedures would be issued.

## 5.1 Heavy Load, Low Voltage Conditions

The following may be used to supplement other existing procedures when system loads are heavy and bulk power voltage levels are, on an anticipated or actual basis, at or approaching voltage limits. These procedures consist of the following:

- Low Voltage Alert
- Heavy Load Voltage Schedule Warning
- Heavy Load Voltage Schedule Action

### 5.1.1 Low Voltage Alert

The purpose of the Low Voltage Alert is to heighten awareness, increase planning, analysis, and preparation efforts when heavy loads and low voltages are anticipated in upcoming operating periods. PJM will issue this alert to members (Generation and Transmission) when projections show these conditions are expected. This Alert can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of Control Zone(s).

**PJM Actions**

- PJM will conduct power flow analysis of the impact of future load and transfer increases upon the PJM system. Using this forward analysis, evaluation and planning will take place; including ensuring any reasonable necessary off-cost generation is ready to respond to anticipated transfer constraints. In this evaluation, consideration will also be given to changing the Reactive Transfer back-off limit from its normal value of 50 MW to 300 MW (interface dependent). If the decision is made to implement this measure, PJM will continually reassess the impact of this change on operations.
- PJM will review generation and transmission outages (internal and external) and their impact on projected voltage problems.
- PJM will assess the impact of transfers and be prepared to rapidly identify any curtailable transactions that are adversely impacting reactive transfer limits.
- Using the NERC Interchange Distribution Calculator (IDC), PJM will assess the impact of parallel flows on its own facilities and transfer limits. If these flows are seen to be significant, PJM will be prepared, prior to shedding load, to invoke the NERC Transmission Loading Relief (TLR) process to provide relief from these parallel flows.
- PJM will monitor overuse of the 5018 line between NYISO and PJM.
- PJM will enhance reactive reporting from members by requesting a Reactive Reserve Check. (Also see the PJM Manual for Generator Operational Requirements (M14D), Attachment D: PJM Generating Unit Reactive Capability Curve Specification and Reporting Procedures.)
- PJM will enhance communications among SOS Transmission members via SOS conference calls to discuss the status of critical equipment, voltage trends, and possible corrective actions.
- PJM Dispatch cancels the alert, when appropriate.

**PJM Member Actions**

- Transmission/Generation dispatchers notify their management and advise all stations and key personnel.
- Transmission/Generation dispatchers ensure that all deferrable maintenance or testing affecting capacity or critical transmission is halted. Any monitoring or control maintenance work that may impact operation of the system is halted.

Transmission dispatchers to respond to Reactive Reserve Check by checking status and availability of all critical reactive resources. This includes polling generating stations of their reactive capabilities and the status of automatic voltage regulators. Any deviations or deficiencies of any equipment's reactive capabilities from what is modeled in the PJM EMS must be reported to PJM Power Dispatch. (Also see Attachment D, PJM Generating Unit Reactive Capability Curve Specification and Reporting Procedures in PJM's Manual for Generator Operational Requirements (M-14D).

### 5.1.2 Heavy Load Voltage Schedule Warning

A Heavy Load Voltage Schedule Warning is issued to members via the ALL-CALL system (Generation and Transmission) to request members to prepare for maximum support of voltages

on the bulk power system. This Warning can be issued for entire PJM RTO, specific Control Zone(s) or a subset of Control Zone(s).

**PJM Actions**

- Four hours prior to requesting the actual implementation of the Heavy Load Voltage Schedule, PJM may give advance notice to members of the upcoming need for this schedule. At that time, impacted members will be requested to verify that all actions have been taken on the distribution and sub-transmission systems to support the voltage at the EHV level.
- PJM dispatcher cancels the Heavy Load Voltage Schedule Warning, when appropriate.

**PJM Member Actions**

- While observing established limits, impacted transmission dispatchers should ensure that where possible, all underlying reactors are out of service, all capacitors on the underlying system are in service, and transformer taps are adjusted to ensure distribution capacitors are in-service.
- Generation dispatchers should ensure all unit voltage regulators are in service.

### 5.1.3 Heavy Load Voltage Schedule Action

A Heavy Load Voltage Schedule is issued to members (Generation and Transmission) at peak load periods via the ALL-CALL system to request maximum support of voltages on the bulk power system and increase reactive reserves at the EHV level. This Action can be issued for entire PJM RTO, specific Control Zone(s) or a subset of Control Zone(s).

**PJM Actions**

- At peak load period, request all companies implement the Heavy Load Voltage Schedule via the ALL-CALL system.
- PJM Dispatch cancels the Heavy Load Voltage Schedule, when appropriate.

**PJM Member Actions**

- While observing established limits, impacted transmission dispatchers should ensure that where possible, all reactors are out of service, all capacitors on the underlying system are in service, capacitors at the EHV level with PLC's are in service where required.
- Generation dispatchers should ensure all unit voltage regulators are in service.
- Impacted Transmission/Generation dispatchers should ensure all units on the 230kV system and below should increase MVAR output as necessary to maintain designated bus voltage schedules or nominal voltage, whichever is greater. Voltage levels should be maintained within predetermined limits at all times. Results of real-time monitoring tools shall be used by PJM and the LCC's, to maintain sufficient reactive reserves on these systems to ensure operations within established operating criteria. When Real-time monitoring tools are unavailable, PJM in coordination with LCC's, may need to commit additional local resources to ensure sufficient local reactive reserves are available for contingency response.

- Impacted Transmission / Generation dispatchers should ensure all units connected at the EHV level are operated so that reasonable MVAR reserve is maintained as determined by real-time monitoring tools or good engineering judgment. Reactive moves on these units should be coordinated through the PJM Power Dispatcher.
- Transmission / Generation dispatchers should keep the PJM Power Dispatcher informed of any units approaching maximum MVAR output, any abnormal unit MVAR restrictions, and any voltage regulators that are out of service.

## 5.2 Transmission Security Emergency Procedures

PJM is responsible for implementing selected Emergency Procedures identified in Section 2 in order to control transmission loading to ensure continued reliable operations. These Emergency Procedures are separated into Alerts, Warnings, Actions and are called on a portion of the PJM RTO (Control Zone, Transmission Zone(s) or portion of a Transmission Zone). Alerts are issued day-ahead. Warnings and Actions are implemented real-time. PJM and PJM Member Actions in response to the Emergency Procedure should be implemented consistent with Section 2 of this manual.

**Unit Startup Notification Alert**

The purpose of the Unit Startup Notification Alert is to alert members to place units in state of readiness so they can be brought online within 48 hours for an anticipated shortage of operating capacity, stability issues or constrained operations for future periods. It is implemented when a reliability assessment determines that long lead time generation is needed for future periods and can be issued for the RTO, specific Control Zone(s) or individual unit basis. The Unit Startup Notification Alert is issued so that units can be ready to come online in 48 hours or less, based on the lesser of submitted notification time + startup time or 6 days. After reaching the state of readiness, if a unit fails to come online within 48 hours when called by PJM, the unit will be considered as forced outage until it can be online or PJM cancels the unit.

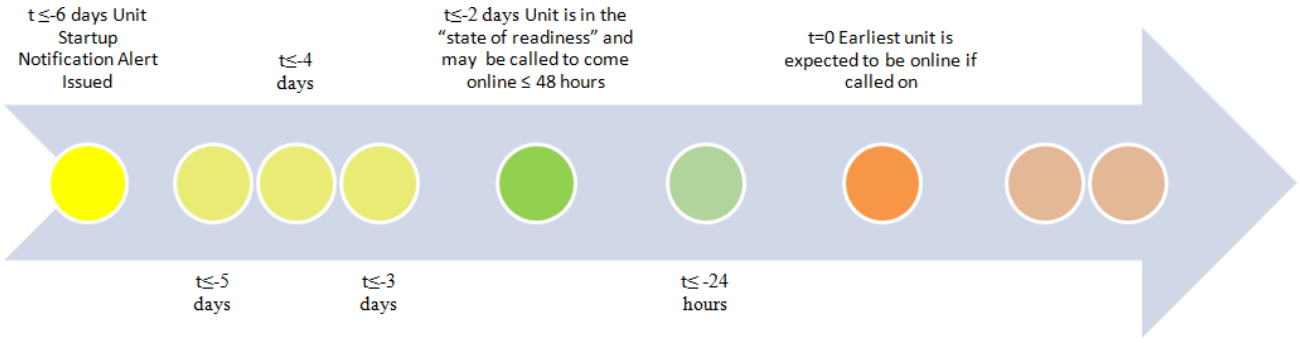
**PJM Actions**

- PJM Dispatch notifies PJM management and members.
- PJM Dispatch issues the Alert to members, stating the Alert period(s) and the affected areas. An Alert can be issued for the RTO, specific Control Zone(s) or individual unit basis on the projected location of transmission constraints and should be issued as soon as practicable (typically 6 days or less) prior to the anticipated need for long time to start generation.
- PJM will schedule an amount of long lead time generation anticipated to be needed for the operating day(s) in economic order respecting unit operating parameters. Once a generator is scheduled its offer price is locked for the operating day.
- PJM Dispatch will evaluate system conditions daily to determine whether to release units from the Alert, to keep the units in the state of readiness or to call the units online.
- PJM Dispatch cancels the Alert, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the Alert.

- Transmission / Generation dispatchers advise all stations and key personnel.
- Generation dispatchers orders unit(s) to be in the state of readiness (i.e. able to be online within 48 hours) in the lesser of (submitted notification time + startup time or 6 days) minus 48 hours.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.




**Day-Ahead Transmission Security Emergency Procedures**

**Maximum Generation Emergency/ Load Management Alert** (for Transmission Security)

The purpose of the Maximum Generation Emergency / Load Management Alert for Transmission Security is to provide an early alert that Security Analysis projections indicate the need for generation in excess of economics to ensure Transmission Reliability. It is implemented when Maximum Emergency generation is called into the operating capacity on a portion of the PJM System or if Demand Response is projected to be implemented to ensure Transmission Reliability.

***Triggers:***

PJM Day-ahead Study analysis identifies Transmission Reliability issues that cannot be resolved via economic generation adjustments.

**PJM Actions**

- PJM Dispatch notifies PJM management and members.
- PJM Dispatch issues the Alert to members, stating the Alert period(s) and the affected areas. An Alert can be issued for the RTO or specific Control Zone(s).

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the Alert.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Curtailment Service Providers notify key personnel

- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.

**Voltage Reduction Alert** (for Transmission Security)

The purpose of the Voltage Reduction Alert for Transmission Security is to alert members that a voltage reduction may be required during a future critical period to ensure Transmission Reliability. It is implemented when the projected loading of Maximum Emergency generation is insufficient to ensure Transmission Reliability.

***Triggers:***

PJM Day-ahead Study analysis identifies Transmission Reliability issues that cannot be resolved via economic generation adjustments and loading of Maximum Emergency generation.

**Note:**
Substations without SCADA control will be expected to be staffed in order to implement a Voltage Reduction Action, if needed.

**PJM Actions**

- PJM Dispatch notifies PJM management and members.
- PJM Dispatch issues the Alert to members, stating the Alert period(s) and the affected areas. An Alert can be issued for the RTO or specific Control Zone(s).

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the Alert.
- Transmission / Generation dispatchers advise all stations and key personnel.

**Real-Time Transmission Security Emergency Procedures**

All warning and actions are issued in real-time. Warnings are issued during present operations to inform members of actual capacity shortages or contingencies that may jeopardize the reliable operation of the PJM RTO. Generally, a warning precedes an associated action. The intent of warnings is to keep all affected system personnel aware of the forecast and/or actual status of the PJM RTO.

**Note:**
All Warnings and Actions listed in Steps 1 to 10 below will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The PJM RTO is normally loaded according to bid prices; however, during periods of reserve deficiencies, other measures must be taken to maintain system reliability. These measures involve:

- loading generation that is restricted for reasons other than cost.

- recalling non-capacity backed off-system sales and issue an EEA1, as required by EOP-011 Attachment 1, via the RCIS and Emergency Procedures webpage.
- purchasing emergency energy from participants / surrounding pools.
- load relief measures.

Due to system conditions and the time required to obtain results, PJM Dispatch may find it necessary to vary the order of application to achieve the best overall system reliability. Issuance and cancellation of emergency procedures are broadcast over the ALL-CALL and posted to selected PJM web-sites. Only affected systems take action. PJM Dispatch broadcasts the current and projected PJM RTO status periodically using the ALL-CALL during the extent of the implementation of the emergency procedures.

**Note:**
The Real-Time Emergency Procedures section combines Warnings and Actions in their most probable sequence based on notification requirements during extreme peak conditions. Depending on the severity of the capacity deficiency, it is unlikely that some Steps would be implemented.

**Step 1: Pre-Emergency Load Management Reduction Action** (30, 60 or 120-minute)

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

Applicability: Any site registered in the PJM Demand Response program as a demand resource (a.k.a. DR) type that needs 30, 60 or 120 minute lead time to make its reductions. These reductions are mandatory when dispatched during the product availability window.

**Note:**
The minimum dispatch duration is 1-hr.

**PJM Actions**

- PJM dispatcher notifies PJM management, PJM public information personnel, and members. PJM dispatcher advises members to consider the use of public appeals to conserve electricity usage. PJM dispatcher notifies other Control Areas through the RCIS.
- PJM dispatcher, via the DR Hub System and Emergency Procedures website, will post detailed instructions to the Curtailment Service Providers (CSP) to dispatch 30, 60 and/or 120 minute Pre-Emergency Load Management Reductions. An Action can be issued for the entire PJM RTO, specific Transmission Zone(s) or a Transmission Sub-zone(s) if transmission limitations exist. PJM dispatcher will also issue an ALL-CALL informing the Members and CSPs to check the DR Hub and Emergency Procedures postings for the detailed information pertaining to the Pre-Emergency Load Management that has been called.

- PJM dispatcher cancels the Action, when appropriate.

**PJM Member Actions**

- Member Curtailment Service Providers implement load management reductions as requested by PJM dispatchers.

**Step 2: Emergency Load Management Reduction Action** ( 30, 60 or 120-minute)

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

Applicability: Any site registered in the PJM Demand Response program as a demand resource (a.k.a. DR) type that needs 30, 60 or 120 minute lead time to make its reductions. These reductions are mandatory when dispatched during the product availability window.

**Note:**
The minimum dispatch duration is 1-hr.

The purpose of the Load Management Reduction Action is to provide additional load relief by using PJM controllable load management programs. Load relief is expected to be required after initiating Maximum Emergency generation.

**PJM Actions**

- PJM dispatcher notifies PJM management, PJM public information personnel, and members. PJM dispatcher advises members to consider the use of public appeals to conserve electricity usage. PJM dispatcher notifies other Control Areas through the RCIS.
- PJM dispatcher, via the DR Hub System and Emergency Procedures website, will post detailed instructions to the Curtailment Service Providers (CSP) to implement dispatch 30, 60 and/or 120 minute Emergency Load Management Reductions. An Action can be issued for the entire PJM RTO, specific Transmission Zone(s) or a Transmission Sub-zone(s) if transmission limitations exist. PJM dispatcher will also issue an ALL-CALL informing the Members and CSPs to check the DR Hub and Emergency Procedures postings for the detailed information pertaining to the Emergency Load Management that has been called.
- PJM dispatcher issues a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Emergency Load Management Reductions. NERC EEA2 is issued when the following has occurred: Public appeals to reduce demand, voltage reduction, and interruption of non-firm load in accordance with applicable contracts, demand side management, or utility load conservation measures.
- PJM dispatcher cancels the Action, when appropriate.

PJM Member Actions

- Member Curtailment Service Providers implement load management reductions as requested by PJM dispatchers.
- Member dispatchers notify management of the emergency procedure and that they should consider the use of public appeals to conserve electricity usage.
- Member dispatchers notify governmental agencies, as applicable.

**Note:**
**1:** Load management programs, whether under PJM control and directed by PJM dispatcher or solely under the Local Control Center's direction, have various names including, but not limited to Active Load Management, interruptibles, curtailables, or load management. To simplify operations during these emergency situations, all PJM issued reductions are referred to as Pre-Emergency or Emergency Load Management Reductions.

**Note 2:** PJM RTO Load Management Reductions are not to be used to provide assistance to adjacent Control Areas beyond PJM. Restoration of Load Management Reductions is undertaken in a stepped approach, as necessary. PJM Control Zones implement Emergency Procedures concurrently until a Manual Load Dump Action, which will only occur in the deficient Control Area.

**Note 3:** Pre-Emergency and Emergency Load Management Reductions are available for Demand Resources as defined in the Reliability Assurance Agreement (RAA).

**Note 4**, **EEA Levels**: PJM dispatcher issue a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the Reliability Coordinator Information System (RCIS) to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Emergency Load Management Reductions. A NERC EEA2 may be issued when the following has occurred: Public appeals to reduce demand, voltage reduction, and interruption of non-firm load in accordance with applicable contracts, demand side management/active load management, or utility load conservation measures.

**Note 5, Capacity Benefit Margin (CBM)**: Under NERC Energy Emergency Alert Level 2, the PJM dispatcher may request import energy over firm transfer capability set aside as CBM. If so, dispatch will waive any real-time operating timing and ramp requirements and document such actions in compliance with MOD-004-1.

**Step 3 (Real-time): Primary Reserve Warning**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

The purpose of the Primary Reserve Warning is to warn members that the available primary reserve is less than required and present operations are becoming critical. It is implemented when available primary reserve capacity is less than the primary reserve requirement, but greater than the synchronized reserve requirement.

**PJM Actions**

- PJM Dispatch issues a warning to members and PJM management stating the amount of adjusted primary reserve capacity and the requirement. A Warning can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints.
- PJM Dispatch notifies PJM public information personnel.
- PJM Dispatch rechecks with members to assure that all available equipment is scheduled and that requested secondary reserve is brought to primary reserve status.
- PJM Dispatch ensures that all deferrable maintenance or testing on the control and communications systems has halted at PJM Control Center. PJM Dispatch should provide as much advance notification as possible to ensure maintenance/testing does not impact operations. This notification may occur prior to declaration of Primary Reserve Warning.
- PJM Dispatch cancels the Warning, when appropriate.

**PJM Member Actions**

- Transmission/Generation dispatchers notify management of the warning.
- Transmission/Generation dispatchers advise all stations and key personnel.
- Generation dispatchers prepare to load all available primary reserve, if requested.
- Transmission/Generation dispatchers ensure that all deferrable maintenance or testing affecting capacity or critical transmission is halted. Any monitoring or control maintenance work that may impact operation of the system is halted.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.
- Generation Dispatchers are to inform PJM of any environmentally restricted units and may consider the need to obtain a temporary variance from environmental regulators for specific generators in accordance with Attachment M to assist in preventing load shed. PJM is not responsible for obtaining a temporary variance form environmental regulations but will assist the member company if requested.
- PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases.

**Step 4 A (Real-time): Maximum Generation Emergency Action**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

The purpose of the Maximum Generation Emergency Action is to increase the PJM RTO generation above the maximum economic level. It is implemented whenever generation is needed that is greater than the highest incremental cost level.

**Note:**
Maximum Emergency generation can only be included in the daily operating capacity when requested by PJM Dispatch.

**PJM Actions**

- PJM Dispatch issues a Maximum Generation Emergency Action. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Dispatch notifies PJM management, PJM public information personnel, and member dispatchers.
- PJM Dispatch implements the Emergency Bid-Process, requesting Emergency bids by posting messages to selected PJM web-sites, RCIS, and contacting the neighboring control areas.
- PJM Dispatch instructs members to suspend Regulation on all resources, except hydro generation.
- PJM Dispatch determines the feasibility recalling off-system capacity sales that are recallable (network resources).
    - PJM Dispatch will determine any limiting transmission constraints internal to PJM that would impact the ability to cut transactions to a specific interface.
    - PJM Dispatch will identify off-system capacity sales associated with the identified interfaces.
    - PJM Dispatch will contact the sink Balancing Authority to determine the impact of transaction curtailment.
- If the net result of cutting off-system capacity sales would put the sink Balancing Authority into load shed then PJM will not curtail the transactions unless it would prevent load shedding within PJM.
- If the net result of cutting off-system capacity sales would put PJM in a more severe capacity emergency than it is in currently in due to reciprocal transaction curtailments from the sink Balancing Authority, PJM will not initiate curtailing the transactions.
- PJM Dispatch declares a Maximum Generation Emergency Action and begins to load Maximum Emergency generation or purchase available emergency energy from PJM Members (Emergency Bid Process) and from neighboring Control Areas based on economics and availability.
- PJM Dispatch loads Maximum Emergency generation incrementally as required, if the entire amount of Maximum Emergency generation is not needed. PJM dispatchers generally load Maximum Emergency CTs prior to loading Maximum Emergency Steam in order to preserve synchronized reserve.

- PJM Dispatch cancels, when appropriate.

**Note:**
**1:** Emergency Bid-Process: Following issuance of a Maximum Generation Emergency Action, PJM may purchase available energy from any PJM Member (as emergency) that is available up to the amount required or until there is no more available, recognizing the impact on transmission constraints. The following rules are used to provide an orderly operation.

**Note 2:** PJM should consider loading of shared reserves with neighboring systems prior to implementing voltage reduction, while recognizing the impact on transmission limits.

- The PJM Member is responsible for delivering (i.e., securing all transmission service) of the energy to one of PJM's borders with a neighboring control area. To ensure deliverability, firm transmission service may be required if external Reliability Authorities have issued TLRs.
- PJM attempts to provide 60-minutes notice before the energy is required by posting on selected PJM web-sites an emergency procedure message stating that PJM anticipates requiring emergency energy purchases beginning at a specific time.
- Once PJM posts the request for emergency purchases all PJM Members can submit "bids" to make emergency energy sales to PJM. PJM Members should submit bids via email. If email is unavailable PJM Members can fax in their bids. PJM Members then call PJM Dispatch to confirm receipt. The Emergency Bid form is found in Attachment D along with the rules for submitting. Bids may also be called into a pre-assigned, recorded voice line. They should be structured as follows:
  - Time – of energy available
  - Amount – of energy available
  - Price of energy
  - Duration (hours) energy is available and limits on minimum time required to take
  - Notification time to cancel/accept
  - PJM Member identification
  - Interface and contract path
- PJM accepts the offers and schedules the energy using the following guidelines:
  - Energy is accepted based on economics (least cost offers will be accepted first based on energy price and minimum hours) if more energy is offered than required.
  - Energy is accepted as required based on economics from the available bids (i.e., if PJM requires 500 MW immediately it takes the cheapest 500 MW bid at the time). PJM adjusts current schedules to correct economics if time permits (i.e., if a cheaper scheduled is bid after a more expensive schedule is loaded PJM only cancels the first if reasonable time exists to cancel one and load the other).
  - Similarly priced offers are selected based on timestamps (i.e., first in first selected).

- Bids accepted by PJM are Emergency Purchases by PJM and are eligible to set the Locational Marginal Price. The energy received is accounted for according to the current Emergency Energy accounting procedures. See the PJM Manual for Operating Agreement Accounting (M-28) for more details.
- PJM reserves the right to load maximum emergency equipment as required to control the system regardless of whether any bids were/were not accepted (i.e., sudden unit loss may not allow time to accept bids).
- PJM implements and curtails emergency purchase transactions with as much notice as practical to allow for a reliable transition into and out of emergency conditions.
- PJM requests emergency energy from neighboring Control Areas (under current Control Area agreements) after all energy offered by the PJM Members is accepted, unless there is an immediate need for the energy.
- PJM can deviate from or change the order of the above actions as/if necessary.
    - PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Transmission/Generation dispatchers notify management of the emergency procedure.
- PJM Marketers recall off-system capacity sales that are recallable as directed by PJM dispatchers.
- Generation dispatchers report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, as described in Section 6.4, and update PJM Dispatch as appropriate.
- Generation dispatchers suspend regulation, as requested, and load all units to the Maximum Emergency generation level, as required.
- Generation dispatchers notify PJM dispatching of any Maximum Emergency (ME) generation loaded prior to PJM requesting ME generation is loaded.
- Maximum Generation Emergency Action is identified as a trigger to load Non-Retail Behind the Meter Generation.

**Step 4 B (Real-time): Emergency Voluntary Energy Only Demand Response reduction Action**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

Applicability: Any site registered in the PJM Demand Response program as an emergency energy only resource. These reductions are voluntary.

The purpose of this Load Reduction Action is to request end-use customers, who participate in the Emergency Voluntary Energy Only Demand Response Program, to reduce load during emergency conditions.

**PJM Actions**

- PJM Dispatch issues Action via the PJM ALL-CALL and post message to selected PJM Web-sites and the NERC RCIS. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Dispatch notifies PJM management, PJM public information personnel, and PJM Markets personnel.
- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Curtailment Service Providers with Demand Resource(s) registered in the Energy Only Option of Emergency Load Response reduce load.
- Transmission / Generation dispatchers notify management of the emergency procedure.

**Step 5 (Real-time): Voltage Reduction Warning & Reduction of Non-Critical Plant Load**

The purpose of the Voltage Reduction Warning & Reduction of Non-Critical Plant Load is to warn members that the available synchronized reserve is less than the Synchronized Reserve Requirement and that present operations have deteriorated such that a voltage reduction may be required. It is implemented when the available synchronized reserve capacity is less than the synchronized reserve requirement, after all available secondary and primary reserve capacity (except restricted maximum emergency capacity) is brought to a synchronized reserve status and emergency operating capacity is scheduled from adjacent systems.

**PJM Actions**

- PJM Dispatch issues a warning to members and PJM management, stating the amount of adjusted synchronized reserve capacity and the requirement. A Warning can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints.
- PJM Dispatch notifies PJM public information personnel.
- PJM notifies the Department of Energy (DOE).
- PJM Dispatch cancels the Warning, when appropriate.

**PJM Member Actions**

- Transmission / Generation dispatchers notify management of the warning.
- Transmission / Generation dispatchers notify governmental agencies, as applicable.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Generation dispatchers order all generating stations to curtail non-critical station light and power.
- Transmission dispatchers / DPs prepare to reduce voltage, if requested.
- Transmission dispatchers / DPs and Curtailment Service Providers notify appropriate personnel that there is a potential need to implement load management programs, in addition to interrupting their interruptible/curtailable customers in the manner prescribed by each policy, if it has not already been implemented previously.

- PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases.

**Step 6 (Real-time): Curtailment of Non-Essential Building Load**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

The purpose of the Curtailment of Non-Essential Building Load is to provide additional load relief, to be expedited prior to, but no later than the issuance of a Voltage Reduction Action.

**PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM dispatcher advises members to consider the use of public appeals to conserve electricity usage. PJM dispatcher notifies outside systems through the RCIS.
- PJM Dispatch issues a request to curtail non-essential building load. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Transmission/Generation dispatchers notify management of the emergency procedure and to consider the use of public appeals to conserve electricity usage.
- Transmission dispatchers notify governmental agencies, as applicable.
- Transmission/Generation dispatchers/DPs switch off all non-essential light and power in DP-owned commercial, operations, and administration offices.

**Step 7 (Real-time): Deploy All Resources Action**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

For emergency events that evolve over time, PJM will dispatch generation and Load Management resources via the normal mechanisms of SCED, DR Hub and direct phone calls. However, for emergency events that develop rapidly and without prior warning, PJM may need to dispatch all resources in a large area very quickly. The purpose of the Deploy All Resources Action, during such emergency conditions, is to instruct PJM Members that all generation resources are needed online immediately and that all Load Management resources dispatched need to reduce load immediately. This step is issued when unplanned events such as the loss of a transmission or generating facility(s) have resulted in reliable operations being jeopardized such that a Voltage Reduction Action or a Manual Load Dump Action may be required.

**PJM Actions**

- PJM Dispatch issues the Deploy All Resources Action. This Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist and the sub-zone was previously defined.
- PJM Dispatch will suspend all reserve assignments and regulation assignments

- PJM dispatches Load Management via DR Hub.
- PJM recalls any external capacity
- PJM Dispatch issues a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Emergency Load Management Reductions.
    - NERC EEA2 is issued when the following has occurred: Public appeals to reduce demand, voltage reduction, and interruption of non-firm load in accordance with applicable contracts, demand side management, or utility load conservation measures.
- PJM Dispatch notifies PJM management, PJM public information personnel, and member dispatchers.
- PJM Dispatch cancels the Action when appropriate.

**PJM Member Actions**

- Member Generation Dispatchers raise all available online generating units to full output (Emergency Maximum).
- Member Generation Dispatchers start up all offline generation and ramp to full output (Emergency Maximum), utilizing the communication methods below:
    - Generators that can be online in less than 30-minutes should start immediately upon receipt of the ALL-CALL and then notify PJM Dispatch when they are on-line.
    - Generators that require more than 30-minutes to be on-line should call the PJM dispatcher prior to initiating the start sequence.
- Member Curtailment Service Providers with Load Management (Pre-Emergency and/or Emergency) reduce load immediately when dispatched.
- Transmission/Generation Dispatchers notify management of the emergency procedure and that they should consider the use of public appeals to conserve electricity usage.
- Member dispatchers notify governmental agencies, as applicable.
- Upon cancellation of this procedure:
    - Units that have not started should abort their start if possible.
    - Online units should return to following SCED basepoints as well as any regulation or reserve assignments.
- Deploy All Resource Action is identified as a trigger to load Non-Retail Behind the Meter Generation.

**Step 8 (Real-time): Manual Load Dump Warning**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

The purpose of the Manual Load Dump Warning is to warn members of the increasingly critical condition of present operations that may require manually shedding load. It is issued when available primary reserve capacity is less than the largest operating generator or the loss of a transmission facility jeopardizes reliable operations after all other possible measures are taken to increase reserve. The amount of load and the location of areas(s) are specified.

**PJM Actions**

- PJM Dispatch issues the warning to members and PJM management, stating the estimated amount of load relief that is required (if applicable). A Warning can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints.
- PJM Dispatch notifies PJM public information personnel.
- PJM Dispatch issues a NERC Energy Emergency Alert Level 3 (EEA3 = ALERT LEVEL 3) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual level of PJM System Emergencies. An EEA 3 is issued when the BA is unable to meet minimum Contingency Reserve Requirements.
- PJM Dispatch notifies FERC via the FERC Division of Reliability's email emergency@FERC.gov, consistent with FERC Order No. 659.
- PJM Dispatch establishes a mutual awareness with the appropriate member dispatchers of the need to address the occurrence of a serious contingency with minimum delay.
- PJM Dispatch examines bulk power bus voltages and alerts the appropriate member dispatchers of the situation.
- PJM Dispatch cancels the Warning, when appropriate.

**PJM Member Actions**

- Transmission/Generation dispatchers notify management of the warning.
- Transmission dispatchers notify governmental agencies, as applicable.
- Transmission/Generation dispatchers advise all station and key personnel.
- Transmission dispatchers/DPs review local procedures and prepare to shed load in the amount requested.
- Transmission dispatchers/DPs reinforce internal communications so load shed can occur with minimum delay.
- PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases.

**Step 9 (Real-time): Voltage Reduction action**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

The purpose of Voltage Reduction during capacity deficient conditions is to reduce voltage on the distribution system in order to reduce demand and provide a sufficient amount of reserve to

maintain tie flow schedules and preserve limited energy sources.. It is implemented when load relief is still needed to maintain tie schedules.

**Note:**
Voltage reductions can also be implemented to increase transmission system voltages.

**PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM Dispatch advises members to consider the use of public appeals to conserve electricity usage. PJM Dispatch notifies outside systems through the RCIS. PJM Dispatch notifies DOE. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Management may issue system-wide or Control Zone-specific Public/Media Notification Message W2. See Attachment A.
- PJM Dispatch investigates loading of shared reserves with neighboring systems prior to implementation of a voltage reduction, recognizing the impact on transmission limits.
- PJM Dispatch issues the order for a 5% Voltage Reduction Action.

**Note:**
See Voltage Reduction Summary Table above for known exceptions to the 5% Voltage Reduction Action.

- PJM Dispatch issues a NERC Energy Emergency Alert Level 2 or Level 3 via the RCIS to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Active Load Management Curtailables/Full Emergency Load Response (formerly known as ALM).
    - NERC EEA2 is issued when the following has occurred: Public appeals to reduce demand, voltage reduction, and interruption of non-firm load in accordance with applicable contracts, demand side management/active load management, or utility load conservation measures.
    - NERC EEA3 is issued when the BA is unable to meet minimum Contingency Reserve Requirements.
- If it has not already begun, the PJM Dispatch will initiate Shortage Pricing if the region where the voltage reduction action has been initiated corresponds with an entire Synchronized Reserve Zone or Sub-Zone.
- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Transmission/Generation dispatchers notify management of the emergency procedure and to consider the use of public appeals to conserve electricity usage.

- Member Transmission dispatchers notify governmental agencies, as applicable.
- Member Transmission dispatchers/DPs take steps to implement the voltage reduction.

**Step 10 (Real-time): Manual Load Dump Action**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

The Manual Load Dump Action is an Operating Instruction from PJM to shed firm load when the PJM RTO cannot provide adequate capacity to meet the PJM RTO's load and tie schedules, or critically overloaded transmission lines or equipment cannot be relieved in any other way. Under capacity deficient conditions, the PJM EMS load dump allocation calculator was modified to institute changes to the PJM Operating Agreement set forth in Schedule 1, Section 1.7.11 that states that "…the Office of Interconnection may not order a manual load dump in a Control Zone solely to address capacity deficiencies in another Control Zone."

The load shed calculation determines which Control Zone(s) is short based on real-time load and energy values from EMS and capacity values received daily from the Capacity Adequacy Planning Department. Real-time energy values are used as a surrogate for available capacity, because in a capacity shortage situation all available generation should be loaded to full capacity. Since most of the values used in the load shed calculation are real-time dynamic numbers, the calculation is performed in the PJM EMS. Load Serving Entities will be able to designate within Capacity Exchange that capacity resources are being used to serve load in a specific Control Zone. Similarly ExSchedule users will be able to specify that an external energy schedule is designated for a specific Control Zone. Resources that are not designated for a specific Control Zone will be considered an RTO resource for load shed calculation purposes and allocated across all Control Zones according to load ratio share. Only Control Zones that are determined to be deficient will be assigned a share of a load shed request initiated due to RTO capacity deficiencies. If the PJM Mid-Atlantic Region is determined to be deficient, its share will be further allocated according to Attachment E.

**PJM Actions**

- PJM Dispatch verifies separations have not occurred and load shed is desirable on the system being controlled (i.e., make sure load shed will help, not aggravate the condition).
- PJM Dispatch instructs members to suspend all remaining regulation, if not already suspended previously.
- PJM Dispatch determines which Control Zone (s) are capacity deficient and the relative proportion of deficiency. PJM Dispatch estimates the total amount of load to be shed and utilizes the PJM EMS to determine deficient Control Zones and their share of load shed required.
- PJM Dispatch orders the appropriate member dispatchers to shed load according to PJM EMS calculations. The PJM Mid-Atlantic Region share will be further allocated according to Attachment E.

- PJM Dispatch will implement load shedding, while minimizing overlap with automatic load shedding, in controlled step sizes to minimize system impact and further uncontrolled separation.
- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM Dispatch advises members to consider the use of public appeals to conserve electricity usage and public announcements of the emergency. PJM Dispatch notifies other Control Areas through the RCIS, and notifies DOE, FEMA, and NERC offices, using established procedures.
- PJM Dispatch notifies FERC via the FERC Division of Reliability's email emergency@FERC.gov, consistent with FERC Order No. 659.
- PJM Dispatch issues a NERC Energy Emergency Alert Level 3 (EEA3 = ALERT LEVEL 3) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual level of PJM System Emergencies.
- PJM Management issues a system-wide or Control Zone specific Public/Media Notification MessageW3. Typically, this would be issued prior to a Manual Load Dump. See Attachment A.
- If it has not already begun, the PJM Dispatch will initiate Shortage Pricing if the region where the manual load shed action has been initiated corresponds with an entire Synchronized Reserve Zone or Sub-Zone.
- PJM Dispatch cancels the load shed order and restores required regulation, when appropriate.

**Note:**
**1:** If partial restoration of the load shed is requested by PJM Dispatch, confirmation of the load restored by each member must be made prior to further restoration requests by PJM dispatcher.

**Note 2:** If step 1 of UFLS is insufficient to return frequency to acceptable ranges and if emergency procedures cannot be implemented in a timely fashion then PJM Dispatch shall shed sufficient load to restore system frequency.

**PJM Member Actions**

- Generation dispatchers suspend remaining regulation, when directed by PJM prior to shedding load.
- Transmission dispatchers/DPs promptly shed an amount of load equal to or in excess of the amount requested by PJM dispatcher (Mid-Atlantic Region operators refer to Attachment E for specific allocation). The load shed plan should consider/recognize priority/critical load.
- Transmission/Generation dispatchers notify management of the emergency procedure.
- Transmission dispatchers/DPs consider the use (or continued use) of public appeals to conserve electricity usage and consider the use of public announcements of the emergency.
- Transmission dispatchers notify governmental agencies, as applicable.

- Transmission dispatchers/DPs maintain the requested amount of load relief until the load shed order is cancelled by PJM dispatcher.
- Transmission dispatchers report the amount of load curtailed/restored upon implementation to the PJM Power Dispatcher.

**Note:**
PJM Dispatch should take necessary actions to support system frequency, consistent with good utility practices. These actions may include emergency procedures to arrest frequency decline, but PJM will not violate BAAL (Balancing Authority ACE Limit) limits by over-generating to correct for a low frequency. In general, emergency procedures are preserved to ensure PJM net tie deviation is not adversely impacting system frequency after all economic options have been exhausted. However, Emergency Procedures should be exhausted, including Manual Load Dump, to arrest frequency decline once Under Frequency Load Shedding Schemes (UFLS) have triggered but prior to generating stations tripping off-line (57.5 Hz). Under-frequency Load Shedding Plan settings are defined in Attachment F, “PJM Manual Load Dump Capacity.”

## 5.3 Shortage Pricing Conditions and Procedures

Shortage pricing conditions are triggered based on the existence of a Primary or Synchronized Reserve shortage in a Synchronized Reserve Zone or Sub-Zone. The intent of the Shortage Pricing design is to provide a seamless transition from normal operations into shortage conditions. As such, Primary and Synchronized Reserve shortages are intended to be detected by PJM’s dispatch software without the need for manual operator intervention. However, PJM dispatchers have the ability to override the system state from a non-shortage condition to a shortage condition if current operations dictate the need to do so. Additionally, the initiation of either a Voltage Reduction Action or Manual Load Dump Action in an entire Synchronized Reserve Zone or Sub-Zone will also automatically trigger shortage pricing if a shortage does not currently exist.

For purposes of defining shortage conditions, PJM will consider generators that have been classified as Maximum Emergency only if they fall in one of the following categories:

- Environmental limits. If the unit has a hard cap on its run hours imposed by an environmental regulator that will temporarily significantly limit its availability.
- Fuel limits. If physical events beyond the control of the unit owner result in the temporary interruption of fuel supply and there is limited on-site fuel storage. A fuel supplier's exercise of a contractual right to interrupt supply or delivery under an interruptible service agreement shall not qualify as an event beyond the control of the unit owner.
- Temporary emergency conditions at the unit. If temporary emergency physical conditions at the unit significantly limit its availability.
- Temporary megawatt additions. If a unit can provide additional megawatts on a temporary basis by oil topping, boiler overpressure, or similar techniques and such megawatts are not ordinarily otherwise available.

On days when PJM has declared, prior to 1800 hours on the day prior to the operating day, a Maximum Generation Emergency Alert, Primary Reserve Alert or Voltage Reduction Alert for the entire PJM Control Area, specific Control Zones, Synchronized Reserve Zones or Sub-Zones, the only units for which all of part of their capability may be designated as Maximum Emergency are those that meet the criteria described above. Should PJM declare a Maximum Generation Warning during the operating day for which the alert is effective, generation owners will be responsible for removing any unit availability from the Maximum Generation category that does not meet the above criteria within 4 hours of the issuance of the alert. PJM will make a mechanism available to participants so they may inform PJM of their generating capability that meets the above criteria and indicate which of the criteria it meets.

Termination of Shortage Conditions

- Shortage Pricing will be terminated in a Synchronized Reserve Zone or Sub-Zone when demand and reserves can be fully satisfied without the use of a Voltage Reduction Action or Manual Load Dump Action.

## 5.4 Post-Contingency Local Load Relief Warning

**Post-Contingency Local Load Relief Warning**

**Non-Market Post-Contingency Local Load Relief Warning**

The purpose of the Post -Contingency Local Load Relief Warning (PCLLRW) is to provide advance notice to a Transmission Owner(s) (TOs) of the potential for load shed in their area(s). It is issued after all other means of transmission constraint control have been exhausted (consistent with guidance provided in Manual 12, Attachment B.2) or until sufficient generation is on-line to control the constraint within designated limits and timelines as identified in the PJM Manual for Transmission Operations (M-03), Section 2 – Thermal Operating Guidelines and Section 3 – Voltage & Stability Operating Guidelines.

For Transmission Facilities which are not Monitored Priority 1 “Reliability & Markets” facilities, PJM will issue a corresponding Non-Market Post-Contingency Local Load Relief Warning. For the purposes of this procedure, the steps and actions listed in this section apply to both Market and Non-Market PCLLRWs.

A Post-Contingency Local Load Relief Warning is to be communicated to the applicable TO(s) and posted via the Emergency Procedures Posting Application and is not communicated via the PJM ALL-CALL. The PCLLRW is not considered a standing Directive to the TO for load shed. If the contingency for which the PCLLRW was issued occurs, PJM will evaluate the system conditions and then, if needed, issue a Load Shed Directive. The Load Shed Directive will be posted via the Emergency Procedures Posting Application. This procedure is distinct and separate from the MANUAL LOAD DUMP WARNING (Use “ALL-CALL”). Refer to Manual Load Dump Warning procedure for Capacity Shortages, Reactive Transfer Interface (i.e.) IROL Constraint Management or Multi Area Transmission Constraint Management.

**Note:**
Except for the single area “Post-Contingency Local Load Relief Warning”, the Manual Load Dump Warning is unchanged. This change should preserve the sense of urgency appropriate for both.

Post-Contingency Local Load Relief Warnings are intended to relieve localized constraints, generally 230kV and below. A Manual Load Dump Warning should still be used for Capacity Shortage conditions, Reactive Transfer Interface (i.e.) IROL Constraint or Multi Area Transmission Constraint Management.

Attachment I, Local Post-Contingency Operating Guide, contains planning guidelines to identify and document known contingency pairs where post-contingency load shed would be acceptable in lieu of transmission reinforcements. These guidelines do not impact how PJM Dispatch implements Post-Contingency Local Load Relief Warnings.

PJM Dispatch operates more conservatively for designated Interconnection Reliability Operating Limits (IROL).

PCLLRW should be implemented as post-contingency exceedances approach 60 minutes in duration. PCLLRW can be issued sooner at the request of the Transmission Owner or at the discretion of the PJM dispatcher if it is anticipated that generator startup + notification will exceed 60 minutes.

**PJM Actions**

- PJM and TO dispatcher(s) review contingency results / limits and discuss off-cost operations/switching solutions prior to implementation of a Post-Contingency Local Load Relief Warning, system conditions and time permitting.
- PJM and TO dispatcher(s) review and implement acceptable pre-contingency switching, load transfer, and generation redispatch options. If post-contingency actions are required, PJM will issue a Post-Contingency Local Load Relief Warning.

**Note:**
If post contingency flows exceed the Load Dump rating, PJM will direct the Transmission Owner to implement any available switching solutions, provided they do not create any pre-contingency exceedances of normal ratings or post-contingency exceedances of the emergency limits.

- PJM Dispatch commits/de-commits effective generation consistent with Manual 12 – Dispatch Operations, Attachment B – Transmission Constraint Control Guidelines, including adjusting hydro/pumping schedules, curtailing interchange transactions, and/or committing quick-start generation to control flows/voltages within acceptable limits, as appropriate. Market-to-Market redispatch shall be implemented where applicable.

**Note:**
As indicated in M-12, for “Reliability Only” facilities (i.e. facilities not under PJM Congestion Management) the Transmission Owners have the option to pay for generation redispatch on a pre-contingency basis or accept a PCLLRW. However, if a “Reliability Only” facility exceeds its Load Dump rating, PJM will manually dispatch generation to maintain flows/voltages within the Load Dump limits. Transmission Owners will be responsible for financial impacts of generation that is redispatched to control a facility exceeding its Load Dump Rating.

- PJM Dispatch declares a Local Maximum Generation Emergency Event as appropriate.
- PJM Dispatch issues the Post-Contingency Local Load Relief Warning to TO dispatchers responsible for impactful load to be shed that will alleviate the loading on the limiting equipment. Thus the PCLLRW may be issued to the Transmission Owner of the limiting equipment and/or neighboring Transmission Owner with load downstream of the limited equipment. PJM will inform/ coordinate the post contingency load shed plan with the Transmission Owner of the equipment along with each Transmission Owner identified within the PCLLRW. The PCLLRW will state that enough load must be shed to maintain flows/voltage levels on the monitored facility within the Emergency limit or an agreed upon level.
- If a TO informs PJM that it does not have sufficient load to shed or sufficient time to shed the load to comply, PJM will review the PCLLRW to include additional neighboring TO loads if applicable or develop an alternative plan to control.
- PJM Dispatch provides the load distribution factor report to the impacted TO dispatcher(s) via PJM’s PCLLRW application and via e-mail. Load Distribution Factor reports should be redistributed as changes to system reconfiguration warrant. Any post-contingency switching solutions or post-contingency generation redispatch will be documented in the PCLLRW application.
- PJM will include the Transmission Owner verified Behind the Meter Generation (BtMG) information in the Post Contingency Local Load Relief Warning (“PCLLRW”) tool or other as applicable. PJM dispatch will NOT instruct the TO to schedule BtMG, other than for existing Non-Retail BtMG provisions. This information is provided for awareness only, unless for existing Non-Retail BtMG provisions.
- PJM’s PCLLRW application link: https://pjmpcllrw.pjm.com/
- PJM Dispatch posts a Post Contingency Local Load Relief Warning via Emergency Procedure Posting Application. The posting will indicate if post-contingency switching or generation is available
- PJM and TO dispatcher(s) periodically review acceptable post-contingency switching options. Post-contingency switching, generator reduction, or load transfer options should be implemented prior to implementing a Load Shed Directive.
- PJM and TO dispatcher(s) should review potential post-contingency manual generation trip schemes. Manual generation trip schemes should be identified and agreed to in advance.

- PJM and TO dispatcher (s) should agree upon post-contingency load transfer options. Transmission Owner dispatcher(s) would need to periodically re-evaluate the load transfer solution.
- PJM Dispatch establishes a mutual awareness with the appropriate TO dispatcher(s) of the need to address the occurrence of a serious contingency with minimum delay.
- PJM Dispatch examines area bulk power bus voltages and alerts the appropriate TO dispatcher(s) of the situation.
- PJM Dispatch shall be prepared to issue a Load Shed Directive to the applicable Transmission Owners if post-contingency switching, generator reduction, or load transfer options fail and the contingency occurs. The Load Shed Directive will be posted via the Emergency Procedures Posting Application.
- PJM Dispatch cancels the Post Contingency Local Load Relief Warning, when appropriate.

**Note:**
A Load Shed Directive will be issued in accordance with the Load Shed Directive Operating Procedure as outlined in the Section 5.7

**PJM Member Actions**

- PJM and the TO dispatcher(s) discuss the amount of load to be curtailed to return flows/voltage levels within the emergency limits and the effective location(s). The TO dispatcher(s) shall utilize the PJM PCLLRW application to identify load to be shed should a Load Shed Directive action be requested. The TO dispatcher(s) will also notify PJM if there is not sufficient load to shed, or sufficient time to implement the load shed, to restore the post contingency flows/voltage levels within the emergency limits.
- TO dispatcher(s) shall identify other concerns which would necessitate additional load shed to restore post-contingency flows/voltage limits within the emergency limits.
- TO dispatcher(s) continues to monitor the post-contingency solution and adjusts their load shed strategy as appropriate in the PJM PCLLRW application.
- TO dispatcher(s) advise appropriate station(s) and key personnel.
- TO dispatcher(s) review local procedures and prepare to shed load in the amount requested.
- TO dispatcher(s) reinforce internal communications so load shed can occur with minimum delay.
- TO dispatcher(s) shall be prepared to implement post-contingency switching options, manual generation trip schemes or load transfer via SCADA with minimum delay.
- TO dispatcher(s) shall be prepared to implement a Load Shed Directive if post-contingency switching, generator reduction, or load transfer options fail.
- TO dispatcher(s) shall direct personnel to substations as necessary if SCADA control is unavailable or insufficient.

- TO dispatcher (s) shall notify PJM Dispatch if post-contingency flows/voltage limits fall within the Emergency limits and the PCLLRW has not been canceled.
- Generator Operators to reduce/trip generation if instructed by PJM.
- TO dispatcher (s) shall periodically review the PCLLRW application to ensure that enough load is selected for the issued PCLLRWs and that the status is not deficient.

### 5.4.1 Post-Contingency Load Dump Limit Exceedance Analysis (Cascade Analysis)

As indicated in section 5.4, a PCLLRW is issued after all other means of transmission constraint control have been exhausted or until sufficient generation is on-line to control the constraint within designated limits and timelines as identified in PJM Manual 03, Transmission Operations, Section 2 – Thermal Operating Guidelines. However, if post-contingency flows were to exceed the 15-minute Load Dump rating and the contingency were to occur, there is a concern that the facility may trip before actions could be implemented to reduce the flow within limits. To prepare for this potential N-2 (initial contingency plus the overloaded facility) and prevent a cascade, PJM will perform up to an N-5 analysis on facilities over 115% of their 15-minute Load Dump rating.

As indicated in PRC-023 R1.2 and R1.11, transmission line relays and transformer overload protection relays are set so they do not operate at or below 115% of the facility's highest emergency rating. For PJM facilities, the highest rating is the Load Dump rating. Therefore, PJM will perform the following cascade analysis for any facility that reaches or exceeds 115% of its Load Dump limit:

**Note:**
NOTE 1: In the event the post-contingency load dump exceedance was caused by the sudden loss of a generating resource or transmission element, the PJM dispatcher will immediately take action to mitigate the overload. The cascade analysis will be performed if it is determined there is not sufficient controlling actions to mitigate the initial overload below 115% of the load dump rating within 30-minutes of its identification.

**Cascade Analysis:**

- If a facility approaches 115% of its Load Dump limit post-contingency, the PJM operator will study the loss of the contingency element and the overloaded facility.
  - If the study results indicate no additional facilities will be overloaded over 115% of their Load Dump limit, this is determined to be a localized event and no additional pre-contingency actions will be taken.
  - If the study results in an additional facility(s) over 115% of its Load Dump rating, the operator will continue the analysis to also simulate trip the additional facilities. This analysis will be performed tripping a maximum of 5 facilities. If the study indicates either a non-converged case (See NOTE 2) OR if the analysis continues to show facilities exceeding 115% of their Load Dump limits, this will be considered a potential cascade situation. The PJM operator will review the results with the Transmission Owner and direct pre-contingency Load Shed (see NOTE 3).

**Note:**
NOTE 2: If both PJM and the impacted TO(s) operators agree the non-convergence is the result of an unsupportable radial load pocket in the final state after taking out the initial contingency and overloaded elements (i.e. local voltage collapse), this will be considered a local event and pre-contingency load shed will NOT be instructed by PJM.

**Note:**
NOTE 3: Load Shed will be directed in the amount needed to maintain the post contingency flow below 115% of the Load Dump limit on the original contingency within 30-minutes of verification of the potential cascade situation.

## 5.5 Interconnection Reliability Operating Limits (IROL) Manual Load Dump Warning/Action

**IROL: Manual Load Dump Warning / Manual Load Dump Action**

PJM identifies specific facilities that if loaded above a designated limit could significantly impact system reliability. Such facilities are not localized constraint, rather wide-area limits that are a result of excessive transfers or an indication of wide-area capacity deficiencies. PJM Dispatch must quickly act to mitigate IROL facilities in accordance with operating procedures identified in PJM's Manual for Transmission Operations (M-03), Section 2: Thermal Operating Guidelines and Section 3: Voltage & Stability Operating Guidelines**,** and the PJM's Manual for Emergency Operations (M-13) Section 5: Transmission Security Emergencies. Identified IROL facilities are as follows (PJM's Manual for Reliability Coordination (M37), Section 3.1):

- Eastern Reactive Transfer Interface
- Central Reactive Transfer Interface
- 5004/5005 Reactive Transfer Interface
- Western Reactive Transfer Interface
- AP South Reactive Transfer Interface
- Bedington – Black Oak Reactive Transfer Interface
- AEP-DOM Reactive Transfer Limit
- Cleveland Reactive Transfer Interface
- CE-East Reactive Transfer Interface

The purpose of the IROL Manual Load Dump Action is to provide loading relief on IROL facilities as a last step to prevent exceeding an IROL Limit for 30 minutes (IROL Violation).

**Note:**
As part of normal operations, PJM Dispatch operates more conservative limits (Reactive Transfer Limit / LTE rating) for designated IROL facilities. The IROL Limit is the limit at the last convergent Reactive Transfer case or transmission facility Load Dump Limit.

Post-Contingency Local Load Relief Warnings are intended to relieve localized constraints, generally 230kV and below. IROL facilities are an indication of Capacity Shortage/Heavy Transfer conditions which result in IROL Limit Violations.

The IROL Manual Load Dump allocation results in individual Transmission Owner multipliers to determine the amount of load that needs to be curtailed to relieve IROL facility loading. The IROL Manual Load Dump allocation factors are developed by dividing the Load Ratio Share of effective load, based on typical distribution factor effects as periodically developed by the PJM EMS, which occurs annually or upon major transmission system enhancements.

**PJM Actions**

- Implement operating strategy consistent with PJM's Manual for Transmission Operations (M-03) and PJM's Emergency Operations Manual (M-13).
- PJM issues an IROL Manual Load Dump Warning via the PJM ALL-CALL System when the IROL Limit has been exceeded for 5 minutes or longer in order to prepare Transmission dispatchers / DPs to curtail load.
- PJM issues an IROL Manual Load Dump Action via the PJM ALL-CALL System when the IROL Limit has been exceeded for 25 minutes, allowing Transmission dispatchers / DPs to curtail load within 5 minutes to return flows below the IROL Limit. PJM should curtail sufficient load to return flows within Reactive Transfer or LTE limits indicating the IROL facility and the amount of transmission load relief required.
- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM dispatcher notifies other Control Areas through the RCIS, and notifies DOE, FEMA, and NERC offices, using established procedures.
- PJM Dispatch notifies FERC via the FERC Division of Reliability's email emergency@FERC.gov, consistent with FERC Order No. 659.
- If shortage pricing is not already in effect, the PJM dispatcher initiates it based on the issuance of an IROL Manual Load Dump Action.
- PJM Dispatch cancels the load shed order and restores required regulation, when appropriate.

**PJM Member Actions**

- Transmission dispatchers / DPs immediately review IROL Manual Load Dump Allocation Table (Attachment N) in preparation of Manual Load Dump once an IROL Manual Load Dump Warning has been implemented.
- After 25 minutes Transmission dispatchers / DPs shed an amount of load equal to or in excess of the amount requested by PJM dispatcher in accordance with Attachment

N The load shed plan should consider/recognize priority/critical load. This step will be implemented within 5 minutes.

- Transmission / Generation dispatchers notify management of the emergency procedure.
- Transmission dispatchers notify governmental agencies, as applicable.
- Transmission dispatchers / DPs maintain the requested amount of load relief until the load shed order is cancelled by PJM dispatcher.
- Transmission dispatchers report the amount of load curtailed / restored upon implementation to the PJM Power Dispatcher.

**Note:**
Example: If PJM issues an IROL Manual Load Dump Action for 300 MW of relief on the Eastern Reactive Transfer IROL Limit Violation. PJM transmission dispatchers / DPs shall refer to the IROL Load Dump Table (Attachment N) and multiply the load shed request (300 MW) by the IROL Manual Load Dump allocation factors in Attachment N. For example the PS Operator would multiple (300 MW Load * XX Eastern Reactive Transfer IROL Manual Load Dump Allocation Factor) = XX MW Load.

**Note:**
Member Load shed plans must recognize priority and critical load including: Essential health and public safety facilities such as hospitals, police, fire facilities, 911 facilities, wastewater treatment facilities; Facilities providing electric service to facilities associated with Bulk Electric System including off-site power to generating stations, substation light and power; Critical gas infrastructure used to supply gas pipeline pumping plants, processing and production facilities; and Telecommunication facilities.

Plans should be reviewed and updated at least annually including Attachment N of M-13.

Consider using automated programs in member's EMS to facilitate shedding the specified amount of load with the required timeline.

Rotate load that is shed when feasible to reduce impact to end use customers.

## 5.6 Transmission Loading Relief (TLR)

**TLR**

PJM monitors designated transmission facilities within the PJM RTO as well as tie-lines with adjacent interconnected control areas. When PJM determines overload conditions exist on any designated facility, or would exist for the first contingency loss of another facility, PJM will take all reasonable necessary action(s) to restore transmission facilities within operating security limits.

During periods of excessive circulation, PJM will issue a TLR and curtail transactions that are not willing to pay congestion on the PJM system. However, under normal system conditions,

PJM will redispatch internal generation to the extent possible and if more relief is needed, PJM will perform the following actions:

- Implement the NERC Transmission Loading Relief Procedure.
- Curtail external transactions and/or charge external customers for the cost of congestion as specified in the PJM Open Access Transmission Tariff.

If all transactions for which transmission customers have elected not to pay through congestion have been curtailed and further relief is still required on the transmission facility, PJM will begin to curtail all transactions (internal and external) for which transmission customers have elected to pay through congestion, in priority order.

The exhibit below presents the general sequence of events leading to the initiation of the NERC TLR Process.

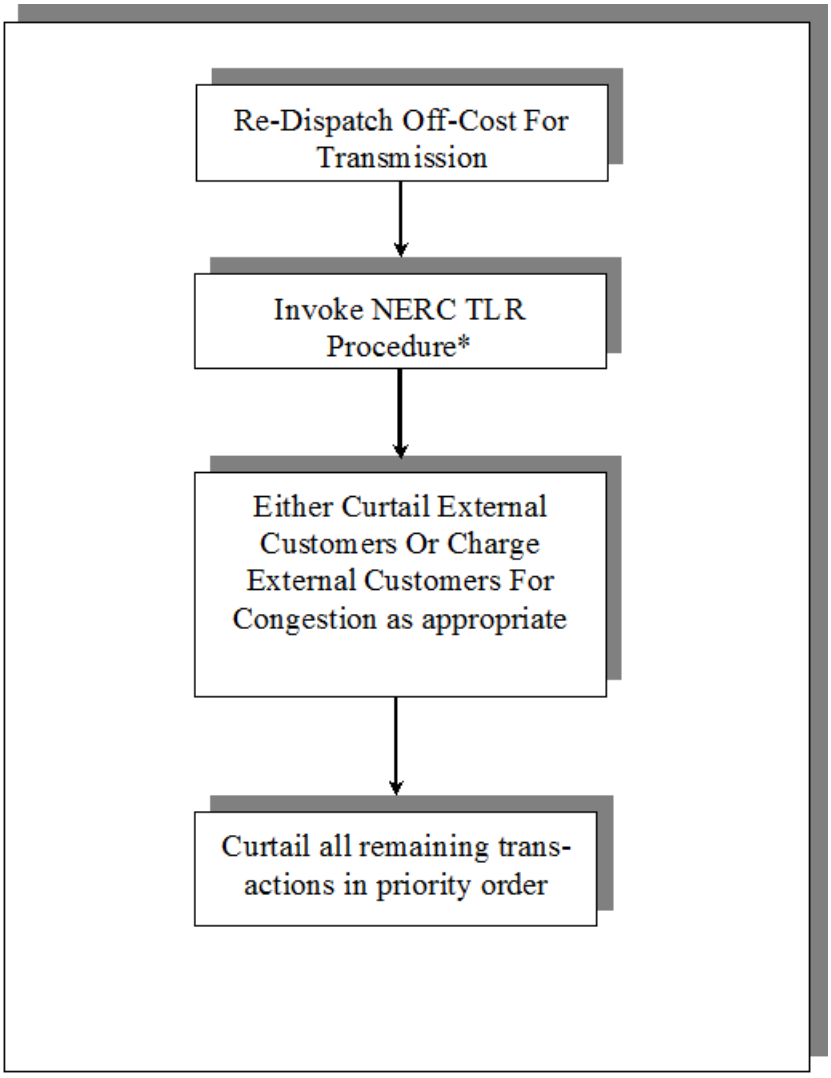



*Exhibit 4: Initiation of NERC TLR Process*

*See NERC Standard IRO-006-EAST for details on the NERC TLR Procedure

### PJM Actions

- PJM implements all non-cost measures to control transmission flows.
- PJM curtails transactions with transmission service in PJM that are “not willing to pay through congestion”.
- PJM adjusts output of generators off-cost to alleviate overloads.
- PJM redispatches to the fullest extent possible, excluding Maximum Emergency generation, and then initiates the NERC TLR procedure.
- PJM curtails external transmission customers not willing to pay through congestion and charges other external customers willing to pay for the cost of congestion, as set forth in the PJM Open Access Transmission Tariff (OATT).
- PJM curtails transmission customers willing to pay through congestion (and no longer charges those curtailed for congestion) in priority order.

### PJM Transmission Customer Actions

- External transmission customers may elect, in accordance with Section 1.10.6A of the Open Access Transmission Tariff, to pay congestion charges during Transmission Loading Relief in the PJM RTO.
- PJM transmission customers may elect to curtail their own transactions at any time if congestion charges have become too great.

## 5.7 Load Shed Directive Procedure

**Load Shed Directive**

**Note:**
Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market.*

For a facility exceeding its LTE, STE or LD thermal rating, PJM and TO Operators should utilize the following steps to determine when to Shed Load:

**STEP 1:** Contact between the PJM and TO should be made immediately. In particular for a facility exceeding its LD rating, there is minimal time for delay outside of the initial recognition of the event.

**STEP 2:** Compare real-time (RT) flows to state estimator (SE) flows.

- If there are no discrepancies, move on to **STEP 3.**
- For any discrepancies:
  - If the reason for the discrepancies is NOT immediately obvious, PJM and TO shall agree upon the most-conservative values.

- If the reason for the discrepancies is immediately obvious, and the facility is determined not to be in an LTE, STE or LD overload:
  - PJM and TO should work together as needed to resolve the discrepancy.
  - PJM and TO operators should log the discrepancy.
  - Cease Load Shed Determination Procedure if it is determined that the facility is not in an overload situation. Otherwise, go to next step.

**STEP 3:** Compare LD and Emergency (LTE and STE, if both are provided) ratings between PJM and TO.

- If there are no ratings discrepancies, move on to **STEP 4.**
- For any discrepancies:
  - If the reason for the discrepancies is NOT immediately obvious, PJM and TO shall agree upon the most-conservative/lowest values.
  - If the reason for the discrepancies is immediately obvious, and the facility is determined not to be in an LTE, STE or LD overload:
    - PJM and TO should work together as needed to resolve the discrepancy.
    - PJM and TO operators should log the discrepancy.
    - Cease Load Shed Determination Procedure if it is determined that the facility is not in an overload situation. Otherwise, go to next step.

**STEP 4:** Switching and or Generation Option

**Step 4A:** Flow exceeds LD

- There are only 3 options available to alleviate to ensure flow is brought below limits within 5 minutes:
- A reclose attempt on a facility that just tripped and caused the present Load Dump overload; and/or
- A Pre-Studied Switching Solution; and/or
- ONLINE Generation Redispatch; Provided the generation has significant enough ramp-rate and relief potential to alleviate the overload within the given time constraints (5 minutes for a LD overload from the time Flow exceeded the LD rating). If reducing generation or shedding load are both options, generation should be reduced or tripped offline before shedding load.
- If a Pre-Studied Switching Solution or ONLINE Generation Redispatch is not immediately implemented … Go to **STEP 5**.

**Step 4B:** Flow exceeds STE but not LD (including if STE = LTE)

- Operators have some time to study Switching Solutions and/or Generation Redispatch.
- If no controlling actions are identified or if the actions will not alleviate the overload within 15 minutes from identification of the overload…Go to **STEP 5**.

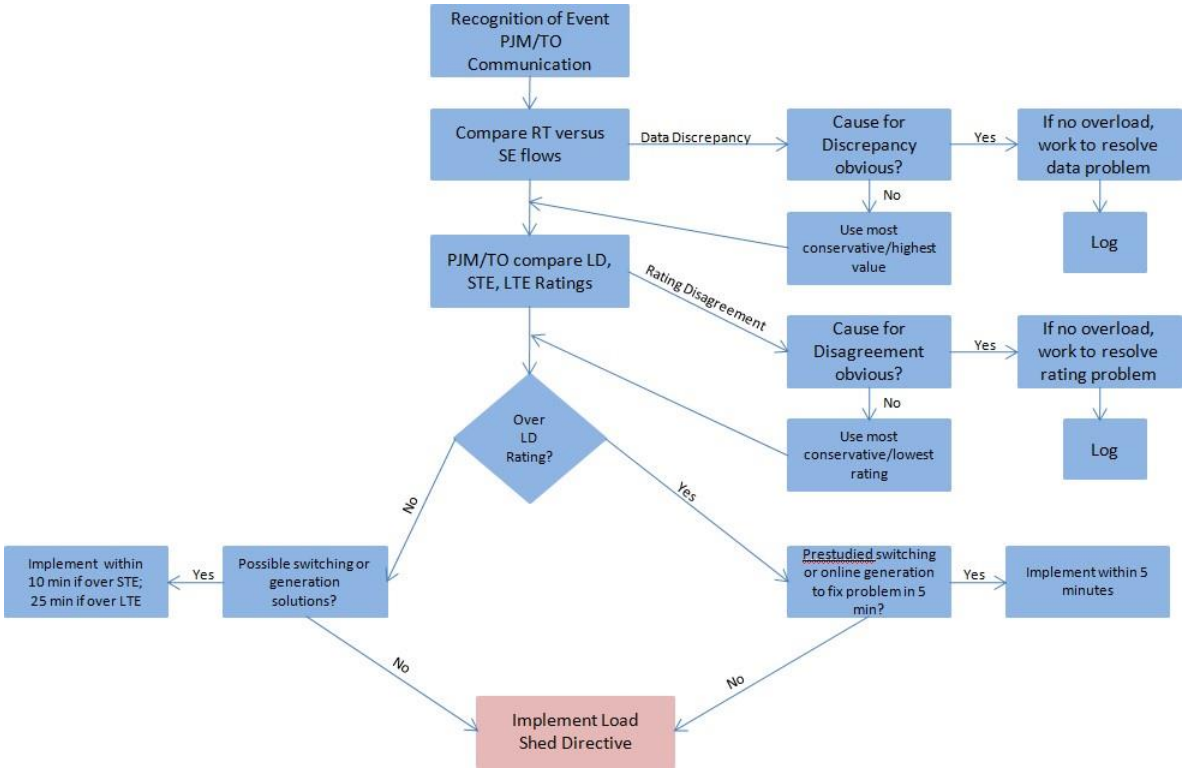
**Step 4C:** Flow exceeds LTE but not STE

- Operators may have additional time to study Switching Solutions and/or Generation Redispatch. The additional time is dependent upon the STE time based rating for the facility as documented in Manual M-03 Attachment F and posted on at this OASIS site (typically 30 mins – 2hours).
- http://www.pjm.com/~/media/etools/oasis/system-information/m03-attachment-f-ste-rating-list.ashx
- However, if flow is above the LTE rating and 5 minutes away from becoming a Violation of the STE time based rating AND if a Switching Solution and/or Generation Redispatch is not expected to alleviate the overload …Go to **STEP 5**.

**STEP 5**: PJM will initiate a Load Shed Directive to the Transmission Owner(s) immediately and without delay.

Transmission Owner may coordinate with BtMG facility interconnected to the transmission system, or through the relevant electric distribution utility, during expected prolonged emergency load dump/shed or as otherwise necessary to help mitigate a grid emergency. As BtMG facilities do not participate in the wholesale energy market, any request to operate for the purpose of helping to mitigate a wholesale market issue is on a voluntary basis at the discretion of the BtMG owner, other than the existing Non-Retail BtMG provisions. Any request to operate to mitigate a wholesale market issue will be communicated to the BtMG as a voluntary request at the discretion of the BtMG owner, other than the existing Non-Retail BtMG provisions. Refer to Manual 14D Appendix A for more information regarding BtMG.

**Load Shed Determination Flow Chart For a Facility Exceeding Rating**


Recognition of Event PJM/TO Communication
Compare RT versus SE flows
Data Discrepancy
Cause for Discrepancy obvious?
Yes
If no overload, work to resolve data problem
Log
No
Use most conservative/highest value
PJM/TO compare LD, STE, LTE Ratings
Rating Disagreement
Cause for Disagreement obvious?
Yes
If no overload, work to resolve rating problem
Log
No
Use most conservative/lowest rating
Over LD Rating?
No
Yes
Implement within 10 min if over STE; 25 min if over LTE
Yes
Possible switching or generation solutions?
Prestudied switching or online generation to fix problem in 5 min?
Yes
Implement within 5 minutes
No
No
Implement Load Shed Directive

# Section 6: Reporting Emergencies

Welcome to the *Reporting Emergencies* section of the ***PJM Manual for Emergency Operations***. In this section, you will find the following information:

- Reporting System Disturbances to the Department of Energy
- Reporting System Disturbances to NERC
- Reporting Capacity or Energy Shortages to FERC
- How PJM responds to limitations related to fuel, emissions hours, water and other consumables (see “Resource Limitation Reporting”)
- Analysis process for System Events and Disturbances

## 6.1 Reporting System Disturbances to the Department of Energy

Under certain defined conditions, PJM and/or its members are required to report the details of system disturbances to NERC and/or the Department of Energy. Per Attachment J, the reporting criteria and responsible entity for writing and submitting event reports are identified in the PJM Operating Plan.

## 6.2 Reporting System Disturbances to NERC, SERC or RFC

Under certain defined conditions, PJM is required to report the details of system disturbances to NERC. Attachment J contains the PJM Operating Plan that outlines the reporting criteria and responsible entity for writing and submitting the event reports.

## 6.3 Reporting Capacity or Energy Shortages to FERC

Whenever PJM anticipates a shortage of capacity or energy which could affect deliveries to members’ wholesale customers within the PJM Control Area, PJM is required to report such shortages to FERC. The report is to be submitted electronically to FERC via the FERC Division of Reliability’s email emergency@FERC.gov.

The report is to include the following information, at a minimum:

- Nature and projected duration of the anticipated shortage
- List of firm wholesale customers likely to be affected by the shortage
- Procedures for responding to the shortage
- Contact person at PJM for further information [Shift Supervisor and the Chief System Operator(s)]

The trigger for the report to FERC is the initiation of a Manual Load Dump Warning or Action in accordance with this Manual.

## 6.4 Resource Limitation Reporting

**Background and Intent**

PJM needs data concerning unit resource limitations for it to reliably operate the PJM RTO and its associated markets. This is especially true during periods of severe weather and/or times when there are external fuel constraints (i.e., coal strike, oil embargo). During PJM's last capacity driven load shed situation (Winter Freeze, 1994) the fuels data provided by PJM's members reduced the severity and duration of actual load curtailments.

It is the intent of this procedure to require all capacity resources to report data on known resource limitations that will impact unit run time, and affect multi-day operations planning so that in severe situations, PJM can continue to make the calls that are in the best interest of all its members. Resource limitations include limitations to primary or alternate on-site fuel, emissions, demineralized or cooling water, and other consumables. In contrast with past procedures, where PJM could have used this data to restrict the output of various generators based upon their resource limitations without financial compensation, PJM will now use the information to assist the market in providing solutions to emergency situations.

PJM's authority to require all capacity resource owners to provide these reliability based reports is found in the PJM Operating Agreement (Section 11.3 Member Responsibilities; Section 11.3.1 General; Section 1.10 Emergency, line ii) and in NERC EOP Standards.

**Seasonal and Periodic Reporting**

Prior to entering into the winter season, PJM will notify and request from all members with capacity resources, a by unit report of fuel and emissions information via an eDART based data request. Additionally, this information may be requested at other intervals as deemed necessary such as a fuel crisis (i.e., embargo, strike) or forecasted period of severe cold weather. Refer to PJM M-14D, Section 7.3.5 for additional details.

**Real-Time Reporting**

A unit is classified as a Resource Limited Unit when it is not capable at running at its maximum capacity for the next 72 hours due to any resource limitation (primary or alternate fuel, emissions, demineralized or cooling water, other consumables). Resource Limited Units should be reported to PJM through the "Resource Limitations" page of the PJM Markets Gateway system. Any Resource Limited Unit with less than 24 hours of run time remaining due to resource limitations should also update their Max Run parameter in Markets Gateway.

Natural gas-fired units that experience fuel supply/transportation restrictions are not considered Resource Limited Units due to the daily nature of their restrictions, and are excluded from this reporting. Instead, natural gas-fired units should reflect these fuel restrictions when updating their unit offer parameters within Markets Gateway, and report unplanned outages if they are unable to run.

The information on the "Resource Limitations" page is used for situational awareness and multi-day operations planning. The parameters entered on this page are not utilized in the PJM Day Ahead or Real Time Market clearing engines. Additional details about the "Resource Limitations" page of Markets Gateway can be found in the Markets Gateway User Guide.

Reporting of resource limitations is especially critical when PJM issues Conservative Operations or a Cold Weather/Hot Weather Alert.

**Maximum Emergency Qualifications**

Prior to a generation owner offering a unit as Maximum Emergency, the generation owner should take reasonable steps to maximize their remaining economic run hours. This includes actively managing fuel inventories (including fuel inventories across a portfolio of resources) and run times, procuring additional fuel and non-fuel consumables from alternate suppliers (if available) for resources with fuel limitations. For resources with environmental limitations, the generation owner should also work with the IMM to utilize the Opportunity Cost Calculator and associated Opportunity Cost Adders as indicated in Manual 15, Section 12.

If a generation owner is unable to manage a unit's remaining run hours, the unit may be offered as Maximum Emergency if the thresholds and qualifications consistent with the PJM OA, Schedule 1/Tariff, Attachment K-Appendix, section 1.10.1A are met, which states generators may only be designated as Maximum Emergency offers to the extent that the Generation Capacity Resource falls into at least one of the following categories:

1. Environmental limits- If the resource has a limit on its run hours imposed by a federal, state, or other governmental agency that will significantly limit its availability, on either a temporary or long-term basis. This includes a resource that is limited to operating only during declared PJM capacity emergencies by a governmental authority.
    a. Units that have legislatively imposed output restrictions under the Illinois Climate and Equitable Jobs Act (CEJA) which do not require PJM to declare an emergency to operate should not use Maximum Emergency to conserve hours.
    b. Units with limited hours based on environmental permits can only be placed under Maximum Emergency when:
        i The economic hours left are less than the min run time + one hour, when the law/ regulation allows the units to only run under PJM defined emergencies beyond their limits, OR
        ii The total hours left are less than 16 (CT) or 32 (CC/ST)
            1) Economic hours are run hours that do not require a PJM defined emergency to be used. Emergency hours are run hours units beyond the defined limits but require a PJM defined emergency to be used. Total hours equal economic hours plus emergency hours.
2. Fuel limits – If physical events beyond the control of the resource owner result in the temporary interruption of fuel supply and there is limited on-site fuel storage. A fuel supplier's exercise of a contractual right to interrupt supply or delivery under an interruptible service agreement shall not qualify as an event beyond the control of the resource owner.
3. Temporary emergency conditions at the unit – If temporary emergency physical conditions at the resource significantly limit its availability.
    a. An example would be if the Original Equipment Manufacturer (OEM) or insurance carrier of a unit's combustion turbines has issued a safety notice that specifies operating limitations for the units until a required upgrade can be implemented at the next outage.
    b. NOTE: These MWs must be available to PJM on demand whenever requested, otherwise this should be reported as an Outage

1. Temporary megawatt additions – If a resource can provide additional megawatts on a temporary basis by oil topping, boiler over-pressure, or similar techniques, and such megawatts are not ordinarily otherwise available.
    a. Situations for using this designation must be driven by OEM or insurance carrier operating restrictions.
    b. Scenarios that do not meet criteria for temporary MW additions:
        i Increased wear and tear or maintenance costs
        ii Power augmentation such as duct firing, steam/water injection, evaporative cooling, inlet chilling, wet compression, or peak firing unless OEM specified limitations
        iii Inability to provide temporary MWs on demand

**Maximum Emergency Reporting and Documentation**

All units that utilize Maximum Emergency should:

1. Report remaining run hours in Markets Gateway through the "Resource Limitation" page (except for temporary MW additions) and update the data at least once every 24 hours
2. For Temporary MW additions, enter information in the Operations Restriction field including the details explaining why the MWs are only available temporarily, the notification time to dispatch the additional MWs, and the duration the MWs are available and update the data at least once every 24 hours.
3. Enter an informational eDART ticket for all uses of Maximum Emergency
4. Verbally notify the PJM Generation Dispatcher for all uses of Maximum Emergency

Fuel Limited reporting: In addition to the reporting above, for fuel limited utilization of Maximum Emergency, the Generation Owner must submit documentation to PJM via FuelCostPolicyAnalysis@pjm.com within 7 business days of entering into Maximum Emergency that details the specifics of the physical event, confirmation the event is outside of the control, and the plan to restore fuel inventory and remove the unit from Maximum Emergency, including an estimated end date (i.e. quantify the temporary nature of this event), which can be no longer than 60-days from when the unit was initially placed into Maximum Emergency. If the documentation is not sufficient to confirm the criteria in PJM OA, Schedule 1/Tariff, Attachment K-Appendix, section 1.10.1A has been met, the use of Max Emergency would not be permitted and the resource would either need to be offered as economic or obtain replacement capacity which would absolve the unit from its Must Offer requirement. Similarly, if the 60-days have lapsed, the resource will need to be offered as economic or obtain replacement capacity which would absolve the unit from its Must Offer requirement.

Temporary Emergency Conditions at the Unit reporting: In addition to the reporting above, generation owners will need to submit the following within 7 business days to PJM via FuelCostPolicyAnalysis@pjm.com:

1. OEM or insurance carrier documentation showing a timeframe, MW output and reason for output limitation

Temporary MW Additions reporting: In addition to the reporting above, generation owners reporting temporary MW additions in maximum emergency will need to submit the following within 7 business days to PJM via FuelCostPolicyAnalysis@pjm.com:

1. OEM or insurance carrier documentation showing a timeframe, MW output and reason for output limitation
2. Air permit showing time restriction

**Note:**

**PJM's Use of Resource Limitation Data**

PJM uses the resource limitation data in conjunction with the other data reported to PJM to evaluate system conditions. Additionally reports derived from this information are used to lead strategy discussions among SOS members about the criticality of the situation and to determine the timing of various emergency procedures that may be used.

An invitation may also be posted to other members to attend a PJM SOS conference call to discuss the meaning of this data and how it may result in various emergency procedures.

PJM will treat as confidential the information on individual units or company data in accordance with PJM's OATT and PJM Operating Agreement. Discussions on individual units or company's resource limitation status will only occur between PJM and the generation owners who provided the data. During group discussions, PJM will only discuss what possible emergency actions are foreseen.

Unit specific Resource Limitation Information is considered proprietary and confidential, and will not be distributed amongst participants. Only aggregate information will be discussed for the sole purpose of developing reliable operating strategies during projected capacity deficient conditions.

**Operation of Resource Limited Units**

During normal conditions PJM can request companies that have units classified as resource limited, and have reached minimum levels, to bid these units in the Maximum Emergency category. When PJM declares Conservative Operations, or a Cold or Hot Weather Alert, PJM requires that companies that have units classified as resource limited, and have reached minimum levels, to bid these units in the Maximum Emergency category. This will serve to preserve these resources for the times when they are needed most. Under these conditions as summarized in the Exhibit below:

| Resource Limited Unit (Type) | Resource Limitations | | | | | PJM Member Actions |
|---|---|---|---|---|---|---|
| | On-site Fuel Only | Emissions | Cooling Water | Demin. Water | Other | |
| CT | < 72 hours | | | | | Report remaining run hours in the "Resource Limitation" page in Markets Gateway |
| | < 24 hours | | | | | Update Max Run field in Markets Gateway |
| | < 16 hours | | | | | Verbally notify PJM Master Coordinator |
| | < 16 hours | | | | | Offer as Maximum Emergency (if PJM issues Cons. Ops/Hot/Cold Weather Alert) and report as detailed in the "Maximum Emergency Reporting and Documentation" section above |
| Steam | < 240 hours (coal units only*) | | | | | Can be offered as Maximum Emergency consistent with the requirements noted below |
| | < 72 hours | | | | | Report remaining run hours in the "Resource Limitation" page in Markets Gateway |
| | < 32 hours | | | | | Verbally notify PJM Master Coordinator |
| | < 32 hours | | | | | Offer as Maximum Emergency (if PJM issues Cons. Ops/Hot/Cold Weather Alert) and report as detailed in the "Maximum Emergency Reporting and Documentation" section above |
| | < 24 hours | | | | | Update Max Run fields in Markets Gateway |

**Yellow Highlighting - Minimum Level Thresholds for Resource Limited Units**

**Gas-Only Units with Fuel Limitations:**
1) These are not considered Resource Limited Units, and should not be reported as Resource Limited in Markets Gateway.
2) These should not be placed in Max Emergency, following PJM Cons. Ops/Hot/Cold Weather Alerts, but remain Economic, unless directed otherwise by PJM.
3) Gas-Only Units with other Resource Limitations (emissions, etc) should report as indicated in the above table.

**Dual Fuel (Gas/Other) Units:**
1) These should report as Resource Limited for only on-site fuel restrictions or other Resource Limitations as indicated in the above table. They should not report natural gas fuel restrictions.
2) These may be placed in Max Emergency, following PJM Cons. Ops/Hot/Cold Weather Alerts, for only on-site fuel restrictions (when unavailable on natural gas and on-site fuel falls below Minimum Level Thresholds) or other Resource Limitations as indicated in the above table.

***Coal units with less than 240 hours remaining:**
1.) Coal units with less than 240 hours but more than 32 hours can be offered as Maximum Emergency by the generation owner unless:
a.) PJM has issued a Hot Weather Alert, Cold Weather Alert, or declares Conservative Operations, or
b.) PJM denies the use of Maximum Emergency for any reason, including but not limited to a potential thermal or voltage violation, to avoid running a CEJA limited unit with no economic hours remaining, a black start concern, tornado/hurricanes, extreme weather, GMD activity, etc.
2.) If a coal unit is offered into the Maximum Emergency state under the above conditions, it may remain in that state until one of the following is true:
a.) The generation owner elects to offer the unit as economic
b.) The remaining run hours reaches 21-days
c.) PJM has issued a Hot Weather Alert, Cold Weather Alert, or declares Conservative Operations, or
d.) PJM denies the use of Maximum Emergency for any reason, including but not limited to a potential thermal or voltage violation, to avoid running a CEJA limited unit with no economic hours remaining, a black start concern, tornado/hurricanes, extreme weather, GMD activity, etc.

### Resource Limitations Reporting

During those occasions where fuel supply emergencies have the potential to impact bulk electric system reliability or capacity adequacy, PJM will submit a DOE-417 report to DOE, NERC, and RFC and/or SERC on behalf of the appropriate PJM Member.

- CTs are removed from dispatch and placed in Maximum Emergency when their available run time due to onsite fuel inventory (e.g. Oil, Kerosene, or Diesel), emissions, or other resource limitations is less than 16 hours, unless directed otherwise by PJM Dispatch. The concept is that 16 hours is equal to four 4-hour peak load periods over a two-day period.
- Steam units are removed from dispatch to Maximum Emergency when their available run time due to onsite fuel inventory (e.g. Oil or Coal), emissions, or other resource limitations emissions, is less than 32 hours, unless directed otherwise by PJM Dispatch.

The concept is that 32 hours at rated output equals two 16-hour periods over a two-day period.

- Coal units with less than 240 hours but more than 32 hours can be offered as Maximum Emergency by the generation owner unless PJM has issued a Hot Weather Alert, Cold Weather Alert, or Conservative Operations has been issued, or if PJM denies the use of Maximum Emergency for any reason, including but not limited to a potential thermal or voltage violation, to avoid running a CEJA limited unit with no economic hours remaining, a black start concern, tornado/ hurricanes, extreme weather, GMD activity, etc.
  - If a coal unit is offered into the Maximum Emergency state under the above conditions, it may remain in that state until one of the following is true: the generation owner elects to offer the unit as economic, the remaining run hours reaches 21-days, PJM issues a Hot or Cold Weather Alert, PJM declares Conservative Operations, or PJM requests the unit be offered as economic for any reason including but not limited to a potential thermal or voltage violation to avoid running a CEJA limited unit with no economic hours remaining, a black start concern, tornado/hurricanes, extreme weather, GMD activity, etc.
- Natural gas-fired units that experience fuel supply/transportation restrictions should not be placed in Maximum Emergency. Instead, they should remain available for economics to ensure that PJM tools economically schedule the gas fired units, unless PJM Dispatch directs that they are placed in Maximum Emergency.
- Notwithstanding the above, dual fuel units that can run on either natural gas or another on-site fuel are placed in Maximum Emergency when limited by non-fuel (emissions, or other consumable) resource limitations to less than 16 hours for CTs / 32 hours for Steam. When fuel limited, they are to be placed in Maximum Emergency only when unavailable on natural gas, and their on-site fuel inventory is less than 16 hours for CTs / 32 hours for Steam.

**Note:**
Since a Cold Weather/Hot Weather Alert may only be issued on a portion of the PJM footprint, and since PJM schedules and operates the footprint as a single Balancing Authority, PJM may elect not to automatically place Resource Limited Units into the Maximum Emergency Category.

- PJM will continue to schedule system generation based upon the Two Pass methodology and generator owner's individual bids. If PJM has particular concerns over units deemed critical to current or future system conditions, then PJM will initiate individual communications with the members responsible for those units.
- For long-duration extreme events that may cause wide-scale fuel disruptions, as outlined in Section 3.5, PJM may adjust "Resource Limited Unit" reporting time-frame and minimum run time requirements to place additional Resource Limited Resources into the Maximum Emergency Category.

If PJM asks a unit to operate differently then what was accepted in the day ahead market (in order to conserve the unit's run hours due to resource limitations), then this unit would be paid

its lost opportunity cost for the accepted hours that it was not run. (Reference PJM Operating Agreement, Section 3.2.3, (e), (f)).

## 6.5 Analysis of System Events and Disturbances

The Transmission Owning members of PJM and PJM are committed to preserving the reliability of PJM monitored transmission facilities. Part of that commitment is to analyze system events or problems for the purpose of implementing corrective actions and sharing knowledge to improving operations at PJM and Transmission Owning companies. [See Attachment K.]

# Section 7: TOP Operating Plan Submission and Review (EOP-011)

Welcome to the *TOP Operating Plan Submission and Review (EOP-011)* section of the ***PJM Manual for Emergency Operations***. In this section, you will find the following information:

- A description of the process for TOPs to submit Emergency Operating Plans
- A description of the process for PJM to review the TOPs submitted Emergency Operating Plans

## 7.1 TOP EOP-011 Operating Plan Submission Process

As indicated in EOP-011 R1, all TOPs must have an RC reviewed Operating Plan to mitigate Emergencies in its TOP area. TOPs within the PJM footprint shall submit, via email, their Operating Plans to PJM for review and approval using the address: EOP-011forms@pjm.com

## 7.2 TOP EOP-011 Operating Plan Review Process

In accordance with EOP-011 R3, when PJM receives an Operating Plan submitted by a TOP to mitigate Emergencies, PJM shall review the Operating Plan regarding any reliability risks that are identified between Operating Plans. Within 30 calendar days of receipt, PJM shall:

- Review each submitted Operating Plan on the basis of compatibility and inter-dependency with the PJM (as the BA and TOP) Operating Plan.
- Review each submitted Operating Plan for coordination to avoid risk to Wide Area reliability; and
- Notify each Transmission Operator via email or phone of the results of its review, specifying any time frame for resubmittal of its Operating Plan if revisions are identified.

# Attachment A: Public Notification Statements

This attachment identifies the steps PJM's Corporate Communications will take, when PJM System Operations authorizes use of the identified weather-related capacity emergency messages, to inform member communications department staffs, the news media and the public and to coordinate emergency messages among the communications departments of members.

The attachment includes notices to member communicators and prepared draft PJM news releases.

The attachment contains baseline communications that represent the minimum that should be communicated to the public. PJM and its members should and will expand and adapt communications as they deem appropriate under the circumstances. Members will tailor their public statements and communications tactics to suit their individual needs and based upon their procedures. Each member's communications department will determine how best to respond to each emergency level.

## W1 Statement – Call for Conservation

**Purpose and Procedures:**

This statement instructs affected transmission owners to request the public to conserve electricity because of developing power supply problems. The W1 statement may be issued subsequent to a Voltage Reduction Alert and should be issued 12 to 15 hours before the effective period. When PJM System Operations orders a W1 statement, it will specify the hours and days to which the call for conservation applies.

PJM issues the W1 notice to member communications departments by email and alerts communications staff of SOS-T members via an ALL-CALL system – indicating in both cases whether the notice applies to all of PJM or a specific transmission zone(s). Then, PJM issues a news release to the news media.

## W1 Notice to Member Communicators:

Electricity supplies are tight. PJM System Operations is calling for public voluntary conservation of electricity because of the continuing *(hot / frigid)* weather.

The call for conservation applies to (all of PJM / names of PJM transmission zones) during the hours of (start and end times) on (date).

Communications departments at affected PJM members should implement their procedures for communicating the call for voluntary conservation to their customers. PJM will issue a news release shortly.

## W1 DRAFT News Release – Call for Conservation

**PJM ASKS CONSUMERS TO CONSERVE ELECTRICITY**

*(Cold / Hot)* Weather Continues to Push Electricity Use Higher

(Valley Forge, Pa. – DATE) – PJM Interconnection, the electricity grid operator for 65 million people in 13 states and the District of Columbia, has requested the public in its region to conserve electricity. The call for conservation was prompted by continuing *(hot / frigid)* weather.

The request is being made *(throughout PJM / in names of transmission zones).*

PJM is asking consumers to reduce their use of electricity, if health permits, during the hours of (*times as specified by System Operations)* on *(date).*

*(Cold Weather)*

Demand for electricity is expected to increase because of the extremely cold weather. Electricity customers can take simple electricity conservation steps such as:

- Setting thermostats lower than usual, if health permits,
- Postponing use of major electric appliances such as stoves, dishwashers and clothes dryers until other times, and
- Turning off non-essential electric lights, equipment and appliances.

*<end cold weather option>*

*(Hot Weather option)*

Demand for electricity is expected to increase as the excessive heat and humidity continue. Electricity customers can take simple electricity conservation steps such as:

- Closing curtains and blinds to keep out the sun and retain cooler air inside,
- Postponing use of major electric household appliances such as stoves, dishwashers and clothes dryers until the cooler evening hours,
- If health permits, setting air conditioner thermostats higher than usual, and
- Turning off non-essential electric appliances, equipment and lights.

*<end hot weather option>*

Conserving electricity during *(times as specified by System Operations)* on *(date)* will help ensure adequate power supplies.

PJM continues to carefully monitor the power supply conditions. It will do everything possible to keep power flowing in the region. If necessary, PJM may take additional steps, such as reducing voltage. PJM is coordinating efforts among generators, power suppliers and local utilities.

PJM is communicating about the situation with state government officials throughout the region.

*PJM Interconnection, founded in 1927, ensures the reliability of the high-voltage electric power system serving 65 million people in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia. PJM coordinates and directs the operation of the region's transmission grid, which includes over 84,236 miles of transmission lines; administers a competitive wholesale electricity market; and plans regional transmission expansion improvements to maintain grid reliability and relieve congestion. PJM's regional grid and market operations produce annual savings of $3.2 billion to $4 billion. For the latest news about PJM, visit PJM Inside Lines at insidelines.pjm.com.*

###

### W2 Statement – Voltage Reduction

**Purpose and Procedures:**

This notice is issued when a voltage reduction has been ordered. Additional, immediate electricity reductions may be needed.

PJM issues the notice to member communications departments by email and alerts communications staff of SOS-T members via an ALL-CALL system – indicating in both cases whether the notice applies to all of PJM or a specific transmission zone(s). Then, PJM issues a news release to the news media.

### W2 Notice to Member Communicators:

Because of extremely high demand for electricity, a temporary voltage reduction is in effect for *(all of PJM / names of PJM transmission zones).*

Communications departments at affected PJM members should implement their procedures for communicating about the voltage reduction to their customers. PJM will issue a news release shortly.

### W2 DRAFT News Release – Voltage Reduction

**PJM ORDERS VOLTAGE REDUCTIONS AS EXTREMELY *(HOT / COLD)* WEATHER CONTINUES**

**Public Requested to Conserve Electricity**

(Valley Forge, Pa. – DATE) – PJM Interconnection, the electricity grid operator for 65 million people in 13 states and the District of Columbia, has ordered a temporary voltage reduction to help meet the extremely high demand for electricity. The high electricity use results from the *(frigid / extremely hot)* weather conditions.

The voltage reduction and a request for consumers to reduce use of electricity are being made *(throughout PJM / in names of transmission zones).*

PJM and its members are working to ensure the area has enough electricity to meet demand as power supplies grow tight during the *(cold / hot)* weather.

A voltage reduction lowers the demand for electricity. It helps to conserve generating or transmission line capacity. Most customers generally do not notice voltage reductions.

*(Cold Weather option)*

PJM is asking consumers to reduce their use of electricity, if health permits, during the hours of (*times as specified by System Operations)* on *(date)*. Electricity customers can take simple electricity conservation steps such as:

- Setting thermostats lower than usual, if health permits,
- Postponing use of major electric appliances such as stoves, dishwashers and clothes dryers until other times, and
- Turning off non-essential electric lights, equipment and appliances.

*<end cold weather option>*

*(Hot Weather option)*

PJM is asking consumers to reduce their use of electricity, if health permits, during the hours of *(times as specified by System Operations)* on *(date).*

Electricity customers can take simple electricity conservation steps such as:

- Closing curtains and blinds to keep out the sun and retain cooler air inside,
- Postponing use of major electric household appliances such as stoves, dishwashers and clothes dryers until the cooler evening hours,
- If health permits, setting air conditioner thermostats higher than usual, and
- Turning off non-essential electric appliances, equipment and lights.

*<end hot weather option>*

PJM always takes steps first that have the least effect on most electricity customers. The steps include calling on demand response resources. These utility customers agreed in advance to eliminate or significantly reduce their use of electricity when told to do so and are paid for cutting back their electricity use. PJM will continue to monitor conditions and will request the public's assistance as necessary.

PJM is communicating about the situation with state government officials throughout the region.

*PJM Interconnection, founded in 1927, ensures the reliability of the high-voltage electric power system serving 65 million people in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia. PJM coordinates and directs the operation of the region's transmission grid, which includes over 84,236 miles of transmission lines; administers a competitive wholesale electricity market; and plans regional transmission expansion improvements to maintain grid reliability and relieve congestion. PJM's regional grid and market operations produce annual savings of $3.2 billion to $4 billion. For the latest news about PJM, visit PJM Inside Lines at insidelines.pjm.com.*

*###*

### W3 Statement – Rotating Outages

**Purpose and Procedures:**

This emergency notice is issued when rotating power outages are ordered. Additional, immediate load reductions are needed.

PJM issues the notice to member communications departments by email and alerts communications staff of SOS-T members via an ALL-CALL system – indicating in both cases whether the notice applies to all of PJM or a specific transmission zone(s). Then, PJM issues a news release to the news media.

### W3 Notice to Member Communicators:

Temporary rotating power outages are in effect. The brief rotating power outages affect *(the entire PJM region / names of transmission zones)*. PJM System Operations ordered the power outages because of extremely high demand for electricity to avoid widespread problems.

Communications departments at affected PJM members should implement their procedures for communicating to customers about the rotating outages. PJM will issue a news release shortly.

### W3 DRAFT News Release – Rotating Outages

**EXTREME ELECTRICITY DEMAND FORCES ROTATING POWER OUTAGES IN PJM**

**Grid Operator Says Voluntary Reductions in Electricity Use Urgently Needed Because of *(Cold / Hot)* Weather**

(Valley Forge, Pa. – DATE) – PJM Interconnection, the electric grid operator for 65 million people in 13 states and the District of Columbia, has directed utilities to temporarily interrupt electricity service to some customers. PJM said substantial cutbacks in electricity use are urgently needed.

The brief, temporary power outages and request for consumers to reduce use of electricity affect *(the entire PJM region / names of transmission zones)*.

The extremely *(cold / hot)* weather has pushed demand for electricity in the area beyond available supplies. The controlled power outages help prevent the failure of the entire electric power supply system in the affected areas.

*(Cold Weather option)*

"We understand the difficulty of being without electricity for any period of time during the cold weather," said Manu Asthana, PJM President and Chief Executive Officer. "That's why we first take steps that have the least effect on electric customers. However, given today's situation, we had to tell utilities to conduct controlled electricity interruptions for some customers. These short outages assist us in preserving continued operation of the power supply system."

PJM is asking consumers to reduce their use of electricity, if health permits, during the hours of *(times as specified by System Operations)* on *(date)*. Electricity customers can take simple electricity conservation steps such as:

- Setting thermostats lower than usual, if health permits,
- Postponing use of major electric appliances such as stoves, dishwashers and clothes dryers until other times, and
- Turning off non-essential electric lights, equipment and appliances.

*<end cold weather option>*

*(Hot Weather option)*

"We understand the difficulty of being without electricity for any period of time during this hot weather," said Manu Asthana, PJM President and Chief Executive Officer. "That's why we first take steps that have the least effect on electric customers. However, given today's situation, we had to tell utilities to conduct controlled electricity interruptions for some customers. These short outages assist us in preserving continued operation of the power supply system."

PJM is asking consumers to reduce their use of electricity, if health permits, during the hours of *(times as specified by System Operations)* on *(date)*.

Electricity customers can take simple electricity conservation steps such as:

- Closing curtains and blinds to keep out the sun and retain cooler air inside,
- Postponing use of major electric household appliances such as stoves, dishwashers and clothes dryers until the cooler evening hours,
- If health permits, setting air conditioner thermostats higher than usual, and
- Turning off non-essential electric appliances, equipment and lights

*<end hot weather option>*

During a rotating power outage, electric service is interrupted to some customers for a relatively short time. The outage can last 15 minutes to one hour depending on the requirements of the local utility's system. At the end of that time, service is restored to the affected customers. It is then interrupted to a different group of customers. In effect, the controlled power interruptions share limited power supplies among all customers. The procedure prevents the failure of the entire electric power supply system.

PJM will continue to monitor conditions and request the public's assistance as necessary.

PJM is communicating about the situation with state government officials throughout the region.

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### Statements for Exiting Emergency Conditions

**Purpose and Procedures:**

These notices inform member communications departments that system conditions have improved and that an emergency action has been canceled. Member communicators can appropriately shape their messages to the public and their customers. PJM would issue news releases to announce the end of these emergency procedures.

PJM issues the post-level notices first to member communications departments by email and alerts communications staff of SOS-T members via an ALL-CALL system – indicating in both cases whether the message applies to all of PJM or a specific transmission zone(s). Then, PJM issues a news release.

### Post-W1 Notice to Member Communicators:

As of *(time)*, PJM Interconnection canceled the call for conservation. PJM is no longer requesting the public to reduce electricity use because of power supply conditions.

This message applies to *(all of PJM / names of PJM transmission zones).*

### Post-W2 Notice to Member Communicators:

PJM Interconnection has canceled the voltage reduction. PJM instructed utilities to return voltages to normal levels at *(time)*.

This message applies to *(all of PJM / names of PJM transmission zones)*.

### Post-W3 Notice to Member Communicators:

PJM Interconnection has canceled the rotating outages. PJM instructed utilities to end rotating power outages at *(time).*

This message applies to *(all of PJM / names of PJM transmission zones).*

### Post-W1 DRAFT News Release for Exiting Call for Conservation

**PJM ENDS SPECIAL CALL TO CONSUMERS TO CONSERVE ELECTRICITY**

(Valley Forge, Pa. – DATE) – PJM Interconnection, the electric grid operator for 65 million people in 13 states and the District of Columbia, has ended its special request for the public to conserve electricity. The call to reduce electricity use was prompted by the *(intense-heat wave/extremely cold weather)*.

The request to reduce electricity use had applied *(throughout PJM / in names of transmission zones)*.

PJM thanked consumers for their conservation of electricity and added that wise use of energy is always prudent. PJM said conservation had been important in meeting power supply needs.

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### Post-W2 DRAFT News Release for Exiting Voltage Reduction

**PJM ENDS VOLTAGE REDUCTION**

(Valley Forge, Pa. – DATE) – PJM Interconnection, the electricity grid operator for 65 million people in 13 states and the District of Columbia, has canceled the voltage reduction it ordered. PJM had ordered utilities to reduce voltage to meet the extremely high demand for electricity during *(intense heat/frigid temperatures).* PJM also has canceled its request to consumers to reduce their use of electricity.

The voltage reduction and request for special conservation had applied to *(the entire PJM region / in names of transmission zones)*.

The voltage reduction ended at *(time)* (EDT/EST). The request to reduce the use of electricity ended at *(time)* (EDT/EST).

In addition, PJM thanked consumers for their voluntary conservation of electricity and added that wise use of energy is always prudent. PJM said conservation had been important in meeting power *PJM Interconnection, founded in 1927, ensures the reliability of the high-voltage electric power system serving 65 million people in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia. PJM coordinates and directs*

*the operation of the region's transmission grid, which includes over 84,236 miles of transmission lines; administers a competitive wholesale electricity market; and plans regional transmission expansion improvements to maintain grid reliability and relieve congestion. PJM's regional grid and market operations produce annual savings of $3.2 billion to $4 billion. For the latest news about PJM, visit PJM Inside Lines at* insidelines.pjm.com*.*

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### Post-W3 DRAFT News Release for Exiting Rotating Outages

**PJM ENDS ROTATING POWER OUTAGES**

(Valley Forge, Pa. – DATE) – PJM Interconnection, the electric grid operator for 65 million people in 13 states and the District of Columbia, has ended its order to utilities to temporarily interrupt electricity service to customers. Their electricity service should resume to normal.

Substantial cutbacks in electricity were required because extremely *(hot/cold)* weather had pushed demand for electricity beyond available supplies. The brief rotating power outages helped prevent the failure of the region's entire electric power supply system.

The rotating power outages had occurred in *(the entire PJM region / names of transmission zones)*.

"We appreciate electricity customers' patience during the rotating outages," said Manu Asthana, PJM President and Chief Executive Officer. "We understand the difficulty of being without electricity for any period of time, especially with current temperatures. These short outages helped us keep the regional power supply system in operation."

During a rotating power outage, electric service is interrupted to some customers for a relatively short time. The outage can last 15 minutes to one hour depending on the requirements of the local utility's system. At the end of that time, service is restored to the affected customers. It is then interrupted to a different group of customers. In effect, the controlled power interruptions share limited power supplies among all customers. The procedure prevents the failure of the entire electric power supply system.

The rotating power outages were ordered at *(time)* (EDT/EST) and ended at *(time)* (EDT/EST).

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## Attachment B: Teleconference Protocol Guidelines

Conference calls should be as brief as possible with only issues requiring immediate attention being discussed.

- Each committee should designate an official leader for all conference calls, typically the chairman of the committee.
- Conference calls should be conducted from a quiet location. Side conversations should be prohibited to prevent distractions during calls. Conference call participants should utilize phone muting capabilities, avoid the use of cell phones whenever possible, and avoid placing the conference call on hold.
- When conference calls are conducted as joint calls between committees, there should be a clear understanding of who the spokesperson is for each company.
- The leader should communicate an Agenda to the members prior to the call if time permits. Otherwise, at the start of the meeting, the leader should announce the Agenda and ask for additional Agenda items. It should be made clear that once the Agenda is finalized, only items on the Agenda will be discussed.
- Status information, spreadsheets, or other text to be discussed during the conference call should be e-mailed or faxed to participants prior to the call with sufficient lead time to allow for delivery and review.
- Issues not relating to the group as a whole should be handled by a separate communication between the involved parties.
- Committee members should make every attempt to enter the conference call by or prior to the specified time of the call. The start of the call should not be delayed waiting for participants to join.
- At the start of the call, the leader will initiate a roll call. At this time, it is the responsibility of the individual committee members to announce and introduce any guests that will be on the call.
- Guests should channel all comments through the committee members unless asked to address a certain issue.
- All speakers should identify themselves when speaking.
- It is the leader’s responsibility to encourage participation by all, while at the same time keeping the meeting on track.
- Silence does not necessarily indicate agreement. When voting on issues, the leader should poll each committee member. It should be predetermined how much agreement is needed on an issue for its approval.
- The meeting should be summarized by the leader highlighting all decisions, action items and priorities. The next conference, if needed, should be set up at this time.
- In crisis situations, action items resulting from the conference call should be sent to all committee members as soon as possible following the end of the call. In routine situations, minutes should be sent out by the end of the following day.

- Use muting capability when not speaking.
- Avoid cell phones, if possible.
- Do not place call on hold.

**Draft Agenda Template for Transmission calls**

Roll Call:

- Solicit additions to Peak Load Conference Call Agenda during role call

Summary of System Conditions:

- Summary of Previous Days operations (optional)
- Problem areas
- Emergency Procedures
- Current Day Operations
- Weather Projections / fronts
- Load/Capacity/Reserves
- Interchange projections
- Transmission Constraints
- Voltage Profile
- Current Emergency Procedures
- Projected Emergency Procedures
- External System Conditions
- Future Day (s) Operation Projections
- Weather Projections / fronts
- Load/Capacity/Reserves
- Transmission Constraints
- Projected Emergency Procedures
- Summary of PJM Operating Strategy
- As needed – additional tasks to be coordinated between PJM Transmission Owners and neighbors to facilitate emergency operations to include:
- Public appeals
- Resource limitations (primary or alternate fuel, emissions, demineralized or cooling water, other consumables)
- Load management
- Government requests and notifications

- Communications with other PJM operating entities, members and neighbors
- Future Conference Call Times
- Additional agenda Items

Roll Call:

- Additional Company Concerns
- Agreement with PJM Operating Strategy
- Agreement on future Conference Calls

# Attachment C: Deleted

## Attachment D: Emergency Bid Form

**Emergency Bid Form**

| | | |
|---|---|---|
| Working to Perfect the Flow of Energy | Emergency Energy Bid Form<br>**Email: emergencybid@pjm.com**<br>Voice: (610) 666 - 8809<br>Fax: (610) 666 - 4287 | For Internal Use<br>Phone:_____<br>ID:_____ |

Date:_____

Company: _____

Representative:_____

Phone: (____) _____-_____, Ext: _____

Control Area/Interface through which the power is being delivered: _____

NYPP Identifier (if applicable): _____

Full Path (including supplier, wheelers, marketers, brokers, receiver)

[1]Notification time to accept: _____

Minimum Run Time: _____

| From – To<br>HHMM-HHMM | Emergency Energy Available to Deliver (MW) | Bid Price of Energy<br>($/MWh) |
|---|---|---|
| | | |
| | | |
| | | |

**For Capacity Backed only:**

| ExSchedule ID | From – To<br>HHMM-HHMM | Capacity Backed Available to Cut (MW) | Bid Price of Energy<br>($/MWh) |
|---|---|---|---|
| | - | | |
| | - | | |
| | - | | |

[1]Minimum time required to start the energy flowing into PJM.

*Exhibit 5: Emergency Bid Form*

**Rules for submitting an Emergency Energy Bid Form:**

- Submitter must verify, by telephone, that the bid was received by PJM, otherwise the bid is invalid.
- Form must be completed fully with valid and complete path.
- No transmission is required from the PJM provider.
- Only one price per bid.
- Only one MW value per bid.
- PJM will evaluate bids based on bid price, notification time, and minimum run time.
- There are no price caps on emergency bids and they are eligible to set LMP.
- The Completed Emergency Energy Bid Form is to be submitted via email as the primary means to emergencybid@pjm.com.
- If email is not available, Emergency Energy Bid Forms may be faxed as a secondary means of submittal. The fax number is (610) 666 4287.

# Attachment E: Manual Load Dump Allocation Tables

**Winter/Summer**
**Required Manual Load Dump**
**PJM Mid-Atlantic Region**

| | | | PPL Zone | | | | PEPCO ZONE | | AE | | DPL Zone | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW | PS | PE | PPL | UGI | BC | FE-East | PEPCO | SMECO | AECO | Vineland | DPL | ODEC | DEMEC | Dover | Easton | Rockland |
| % | 17.26% | 14.89% | 12.61% | 0.35% | 11.41% | 20.90% | 9.11% | 1.38% | 4.16% | 0.27% | 4.70% | 1.43% | 0.46% | 0.27% | 0.09% | 0.70% |
| 500 | 86 | 74 | 63 | 2 | 57 | 104 | 46 | 7 | 21 | 1 | 24 | 7 | 2 | 1 | 0 | 3 |
| 1000 | 173 | 149 | 126 | 3 | 114 | 209 | 91 | 14 | 42 | 3 | 47 | 14 | 5 | 3 | 1 | 7 |
| 1500 | 259 | 223 | 189 | 5 | 171 | 313 | 137 | 21 | 62 | 4 | 71 | 21 | 7 | 4 | 1 | 10 |
| 2000 | 345 | 298 | 252 | 7 | 228 | 418 | 182 | 28 | 83 | 5 | 94 | 29 | 9 | 5 | 2 | 14 |
| 3000 | 518 | 447 | 378 | 10 | 342 | 627 | 273 | 42 | 125 | 8 | 141 | 43 | 14 | 8 | 3 | 21 |
| 4000 | 690 | 595 | 504 | 14 | 457 | 836 | 364 | 55 | 166 | 11 | 188 | 57 | 19 | 11 | 4 | 28 |
| 5000 | 863 | 744 | 631 | 17 | 571 | 1045 | 455 | 69 | 208 | 13 | 235 | 72 | 23 | 14 | 5 | 35 |

**Manual Load Dump Allocation - PJM Mid-Atlantic Region**

When issuing a manual Load Dump via All Call, the PJM Dispatcher will include the following information in the message:

- (1) Area (PJM Mid-Atlantic Region, Eastern Portion of PJM Mid-Atlantic Region, or a zone / company)
- (2) Total megawatts (refer to appropriate tables for allocation)
- (3) Allocation table to be used
- (4) Transmission Zone allocations will be handled separately based on PJM EMS capacity calculations

Allocation percentages are based on 2023 summer but applicable to both 2023 summer and 2023/2024 Winter Load conditions

*Exhibit 6: Manual Load Dump Allocation Tables*

Under capacity deficient conditions, the PJM Operating Agreement set forth in Schedule 1, Section 1.7.11 that states that:

(b) To the extent load must be shed to alleviate an Emergency in a Control Zone, the Office of the Interconnection shall, to the maximum extent practicable, direct the shedding of load within such Control Zone. The Office of the Interconnection may shed load in one Control Zone to alleviate an Emergency in another Control Zone under its control only as necessary after having first shed load to the maximum extent practical in the Control Zone experiencing the Emergency and only to the extent that PJM supports other control areas (not under its control) in those situations where load shedding would be necessary, such as to prevent isolation of facilities within the Eastern Interconnection, to prevent voltage collapse or to restore system frequency following a system collapse; *provided, however**, that the Office of the Interconnection may not order a manual load dump in a Control Zone solely to address capacity deficiencies in another Control Zone.*** This paragraph shall be implemented consistent with North American Electric Reliability Council and applicable Reliability Council Standards.

The PJM EMS load dump calculator determines which Control Zone(s) is short based on real-time.

Load, energy values from EMS and **capacity values received daily from Capacity Market Operations (Net Zone Capacity Position)**. Real-time energy values are used as a surrogate for available capacity because in a capacity shortage situation all available generation should be loaded to full capacity. Since most of the values used in the load shed calculation are real-time dynamic numbers, the calculation is performed in the PJM EMS. For load shed calculation purposes, committed Capacity Resources located in a specific Control Zone are considered to serve load in that Control Zone. ExSchedule users are able to specify that an external energy schedule is designated for a specific Control Zone. Resources that are not designated for a specific Control Zone are considered an RTO resource for load shed calculation purposes and allocated across all Control Zones according to load ratio share.

External generation operating in PJM Markets via a Dynamic Transfer (Dynamic Schedule or Pseudo-Tie) is considered an RTO resource and allocated across all Control Zones according to load ratio share. Further, during Reserve Sharing events, assistance received or provided to outside Balancing Authorities is allocated across all Control Zones according to load ratio share. Only Control Zones that are determined to be deficient are assigned a share of a load shed request initiated due to RTO capacity deficiencies. If the PJM Mid-Atlantic Region is determined to be deficient, its share is further allocated according to PJM M-13, Attachment E.

The $NetZoneCapacityPosition_{RPM}$ is determined from information in the Reliability Pricing Model (RPM).

NetZoneCapacityPositionRPM = (Final Zonal UCAP ObligationControl Zone + Final Zonal FRR ObligationControl Zone) – (RPM Committed CapacityControl Zone + FRR Committed CapacityControl Zone)

Where,

RPM Committed CapacityControl Zone = Sum of RPM commitments on all capacity resources within the control zone. Generation resource commitments are valued at the delivery year EFORd.

FRR Committed CapacityControl Zone = Sum of FRR commitments on all capacity resources within the control zone. Generation resource commitments are valued at the delivery year EFORd.

**Load Dump Allocation**

| Zone Energy Position | | | | | | | | | Zone Capacity Position | Zone Position | | Load Dump | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zone Name | + Net Zone Generation | + Load Share Ratio Gen Pseudo-Ties | + Load Share Ratio Gen Dynamic Schedules | + Active Zone Reserve Share Energy | + Net Zone LSE ExSchedules | + Load Share Ratio RTO Energy Schedules | - Net Zone Load | = Net Zone Energy Position (A) | Net Zone Capacity Position (B) | Net Zone Position (A+B) | Zone Position | Desired Load Dump | Load Dump Allocation |
| RTO | 102144 | 910 | 66 | 0 | 71 | -5351 | 97708 | 164 | 680 | 844 | | 650 | |
| Allegheny | 6654 | 59 | 4 | 0 | 0 | -347 | 6329 | 41 | 60 | 101 | EXCESS | 0 | 0 |
| COMED | 16676 | 108 | 8 | 0 | 0 | -633 | 11563 | 4595 | 2598 | 7193 | EXCESS | | 0 |
| Duquesne | 1994 | 14 | 1 | 0 | 0 | -82 | 1489 | 439 | 873 | 1312 | EXCESS | | 0 |
| Dominion | 13499 | 131 | 10 | 0 | 0 | -768 | 14015 | -1144 | -4238 | -5382 | SHORT | 0 | 348 |
| AEP | 20058 | 150 | 11 | 0 | 0 | -879 | 16048 | 3292 | -6337 | -3045 | SHORT | | 197 |
| EKPC | 964 | 16 | 1 | 0 | 71 | -91 | 1665 | -704 | -246 | -950 | SHORT | | 62 |
| First Energy | 6467 | 80 | 6 | 0 | 0 | -468 | 8547 | -2464 | 3537 | 1073 | EXCESS | 0 | 0 |
| Dayton | -21 | 21 | 2 | 0 | 0 | -124 | 2265 | -2388 | 2492 | 104 | EXCESS | | 0 |
| Mid-Atlantic | 34416 | 304 | 22 | 0 | 0 | -1788 | 32642 | 313 | -974 | -661 | SHORT | | 43 |
| Duke Energy | 1437 | 29 | 2 | 0 | 0 | -171 | 3114 | -1816 | 2915 | 1099 | EXCESS | 0 | 0 |

# Attachment F: PJM Manual Load Dump Capability

| PJM Manual Load Dump Capability | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Transmission Owner | 2022 Summer System Peak Load Est. (MW) | Maximum Manual Load Shedding Capability based on System Peak Load Estimate (MW) | Load Shed Cap (%) (Percent = #2 ÷ #1) | Overlap of Load Shedding and Under frequency Loads (MW) | Overlap of Load Shedding and Under frequency Loads (%) (Percent = #4 ÷ #2) | Manual Load Shedding if Under frequency relays have operated (MW) (MW = #2 - #4) | Manual Load Shedding if Under frequency relays have operated (%) (Percent = #6 ÷ #1) |
| DPL | 2,655 | 860 | 32.40% | 248 | 28.82% | 612 | 23.06% |
| DPL - Dover | 150 | 63 | 42.06% | 32 | 51.11% | 31 | 20.56% |
| DPL - DEMEC | 262 | 0 | 0.00% | 0 | - | 0 | 0.00% |
| DPL - Easton | 54 | 19 | 35.32% | 3 | 15.79% | 16 | 29.74% |
| DPL - ODEC | 752 | 31 | 4.12% | 14 | 44.84% | 17 | 2.28% |
| AE | 2,344 | 768 | 32.77% | 123 | 16.02% | 645 | 27.52% |
| AE - Vineland | 144 | 86 | 59.61% | 40 | 46.68% | 46 | 31.78% |
| PS | 9,543 | 1573 | 16.48% | 270 | 17.15% | 1303 | 13.65% |
| RECO | 391 | 391 | 100.00% | 151 | 38.50% | 240 | 61.50% |
| PE | 8,370 | 1275 | 15.23% | 339 | 26.59% | 936 | 11.18% |
| FE East - JC | 5,831 | 1547 | 26.53% | 0 | 0.00% | 1547 | 26.53% |
| PL | 7,024 | 6280 | 89.41% | 2515 | 40.05% | 3765 | 53.60% |
| UGI | 193 | 193 | 100.00% | 73 | 37.82% | 120 | 62.18% |
| FE East - ME | 2,934 | 851 | 29.00% | 2 | 0.19% | 849 | 28.95% |
| FE East - PN | 2,812 | 1380 | 49.08% | 139 | 10.04% | 1242 | 44.15% |
| BC | 6,414 | 2570 | 40.07% | 633 | 24.63% | 1937 | 30.20% |
| PEPCO | 5,156 | 4825 | 93.58% | 1767 | 36.62% | 3058 | 59.31% |
| PEP - SMECO | 746 | 384 | 51.47% | 144 | 37.50% | 240 | 32.17% |
| FE South | 8,097 | 1933 | 23.87% | 199 | 10.29% | 1734 | 21.42% |
| FE South-ODEC | 578 | 31 | 5.30% | 17 | 54.58% | 14 | 2.41% |
| Dom | 17,761 | 8176 | 46.03% | 2970 | 36.33% | 5206 | 29.31% |
| Dom - ODEC | 1,033 | 49 | 4.75% | 31 | 62.93% | 18 | 1.76% |
| Dom - NCEMC | 261 | 0 | 0.00% | 0 | - | 0 | 0.00% |
| Dom - NOVEC | 1,368 | 267 | 19.53% | 174 | 65.03% | 93 | 6.83% |
| AEP | 22,183 | 8598 | 38.76% | 4496 | 52.29% | 4102 | 18.49% |
| DLCO | 2,742 | 1402 | 51.13% | 455 | 32.45% | 947 | 34.54% |
| Dayton | 3,271 | 817 | 24.98% | 0 | 0.00% | 817 | 24.98% |
| FE West | 11,278 | 2636 | 23.37% | 513 | 19.46% | 2123 | 18.82% |
| CPP | 276 | 107 | 38.80% | 75 | 70.09% | 32 | 11.60% |
| Com Ed | 20,752 | 12864 | 61.99% | 3649 | 28.37% | 9215 | 44.41% |
| DEOK | 5,239 | 1201 | 22.92% | 0 | 0.00% | 1201 | 22.92% |
| EKPC | 2,091 | 1338 | 63.99% | 447 | 33.42% | 891 | 42.61% |
| OVEC | 90 | 0 | 0.00% | 0 | - | 0 | 0.00% |
| Neptune | 660 | 0 | 0.00% | 0 | - | 0 | 0.00% |
| HTP | 660 | 0 | 0.00% | 0 | - | 0 | 0.00% |

*Exhibit 7: PJM Manual Load Dump Capability*

**(Manual Load Shed Capability, excluding UFLS, refers to load that can be curtailed via SCADA within 5 minutes)**

**Note:**
Control Zone Under Frequency Load Shed (UFLS) Settings as follows:

Mid-Atlantic: 59.3, 58.9 and 58.5 Hz @ 10% increments

Western Control Zone: 59.5, 59.3, 59.1, 58.9 and 58.7 Hz @5% increments

ComEd: 59.3, 59.0 and 58.7 Hz @ 10% increments

Dominion: 59.3, 59.0 and 58.5 Hz @ 10% increments

EKPC: 59.5, 59.3, 59.1, 58.9, 58.7 and 58.5 Hz @ 5% increments.

# Attachment G: Deleted

# Attachment H: Minimum Generation Calculation – Midnight Period

| **Minimum Generation Information For:** | **Date:**_____ | **Period:**_____ |
|---|---|---|

| | | | |
|---|---|---|---|
| Minimum Generation Alert Issued | Hours | Cancelled | Hours |
| Minimum Declaration Declared | Hours | Cancelled | Hours |
| Regulation removed from Units | Hours | Cancelled | Hours |
| Lambda Signal to Zero | Hours | Cancelled | Hours |
| Reduce Emergency Reducible Generation | Hours | Cancelled | Hours |
| | | | |

| **CO** | **Western** | **Mid Atl** | **Southern** | **NI** | **TOTAL** | **REDUCIBLE ON DECLARATION** |
|---|---|---|---|---|---|---|
| | | | | | | |
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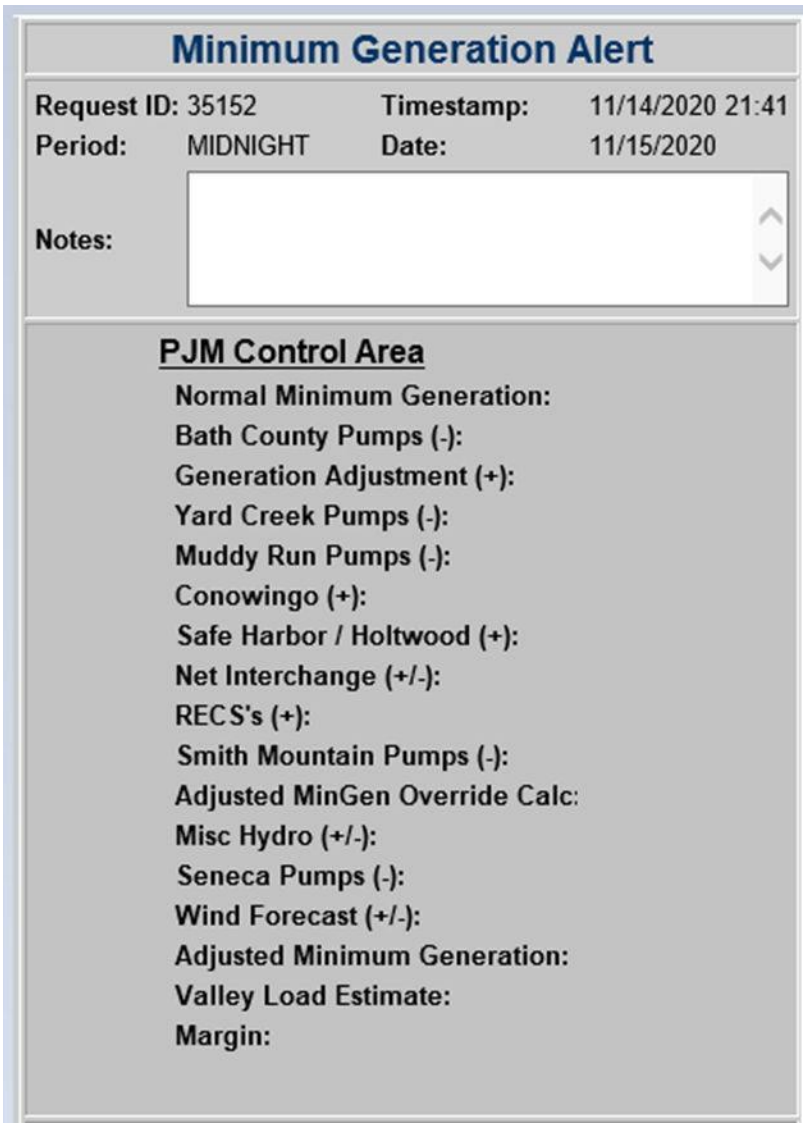
| Emergency Reducible Generation | | | | |
|---|---|---|---|---|
| Time Issued | % Reduced | MW Reduced | Key/Con MW | Time Cancelled |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| MWs Reduced on Declaration and Event | | | | | |
|---|---|---|---|---|---|
| CO | Declaration | Event | CO | Declaration | Event |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

*Exhibit 8: Minimum Generation Information*

| Minimum Generation Worksheet – Midnight Period | | | |
|---|---|---|---|
| Day of Week: | | Date: | |
| | | | |
| **Date** | | | |
| **Time** | | | |
| **Initials** | | | |
| **Normal Min Generation** | # | | |
| **Pumping Load** | - | | |
| **Hydro** | + | | |
| **Net Interchange** | + | | |
| **Dispatchable Contracts** | - | | |
| **Spot Market** | - | | |
| **R.E.C.'s** | + | | |
| **Adjusted Min Generation** | | | |
| **Valley Load Estimate** | # | | |
| **Margin** | | | |
| | | | |
| **NO Minimum Generation Alert needed** | | | |

*Exhibit 9: Minimum Generation Calculation*



**Minimum Generation Alert**

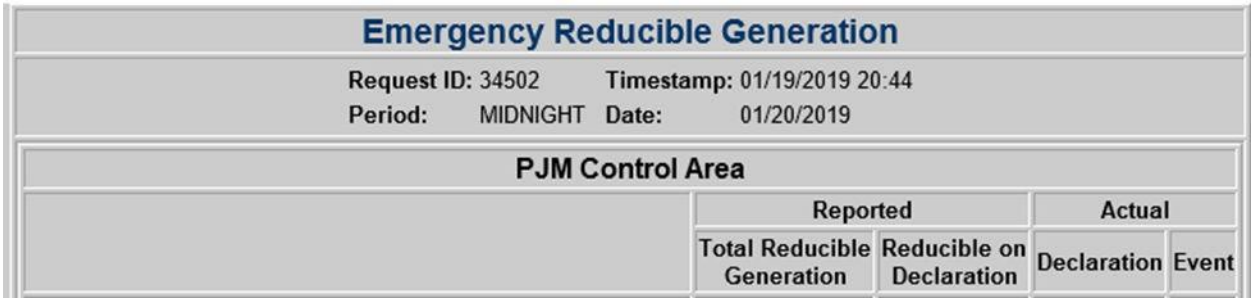
Request ID: 35152 Timestamp: 11/14/2020 21:41
Period: MIDNIGHT Date: 11/15/2020

Notes:

**PJM Control Area**

Normal Minimum Generation:
Bath County Pumps (-):
Generation Adjustment (+):
Yard Creek Pumps (-):
Muddy Run Pumps (-):
Conowingo (+):
Safe Harbor / Holtwood (+):
Net Interchange (+/-):
RECS's (+):
Smith Mountain Pumps (-):
Adjusted MinGen Override Calc:
Misc Hydro (+/-):
Seneca Pumps (-):
Wind Forecast (+/-):
Adjusted Minimum Generation:
Valley Load Estimate:
Margin:

*Exhibit 10: eDART Min Gen Calculation Worksheet*



**Emergency Reducible Generation**

Request ID: 34502 Timestamp: 01/19/2019 20:44
Period: MIDNIGHT Date: 01/20/2019

**PJM Control Area**

| | Reported | | Actual | |
|---|---|---|---|---|
| | Total Reducible Generation | Reducible on Declaration | Declaration | Event |

*Exhibit 11: eDART ERG Reporting Form*

# Attachment I: Local Post Contingency Operations Guide

**Introduction and Background**

Each PJM Transmission Owner has established local planning criteria for its system that apply to the lower voltage facilities and its associated distribution facilities. Those criteria may vary from the planning criteria that are embodied in the PJM Regional Transmission Planning Process. Part of those criteria may be to assume a level of risk of load shedding in local areas for contingencies that the Transmission Owner has determined has a low probability of occurrence.

PJM's operational practice is to respect all limits on monitored facilities over which PJM has operational control. In local contingency situations, it is common to reach a point where there are no generation redispatch options that can be employed to mitigate the contingency overloads. In those situations, PJM issues a Post-contingency Local Load Relief Warning (PCLLRW) to alert the Transmission Owner in that area that it may be necessary to shed load if the contingency occurs.

In many areas, the PCLLRWs are issued on a frequent basis when the intention of the Transmission Owner's planning criteria is to accept the risk of load shedding. Therefore, this guide is being implemented to establish a process for identifying those areas where the local planning criteria assume the load shedding risk and document those areas in this guide.

**Procedure**

- The Transmission Owner will review their system and local planning criteria and identify local areas where local planning criteria accept some level of risk, and those areas meet the following criteria:
  - Load area at risk will not exceed 100 MW.
  - Load area at risk is not served by three or more transmission lines at 345 kV or higher.
- For the areas identified in Step 1, the Transmission Owner will identify the contingency pairs that would place the area at risk, and those contingency pairs meet the following criteria:
  - The monitored element cannot be a transmission line at 230 kV or higher, unless the line is a radial feed.
- PJM Planning will review the submitted information to verify its conformance with the requirements of this guide. Planning will report its results to Operations and the Transmission Owner. If the facilities are acceptable, the contingency pairs will be entered into the table in this guide and posted as part of PJM M-3, Transmission Operations.

# Attachment J: Disturbance Reporting—US Department of Energy

**Electric Emergency Incident and Disturbance Report (United States Department of Energy, Form DOE-417) and EOP-004 Event Reporting**

**Background**

Emergency electric incidents and disturbances leading to interruptions of power could lead to disruptions of critical infrastructures such as natural gas or petroleum product pipelines, water supplies, and telecommunications systems. The national security, economic prosperity, and social well-being of the nation depends on the continuing reliability of our increasingly complex and interdependent infrastructures.

In addition to these interdependencies, the rapid evolution of information technology in the electric power industry has national security implications due to the interdependent networks of physical and information infrastructures. Information technology has changed the way the Nation's business is transacted, the way government operates, and the way government addresses national security. EOP-004 covers the critical reporting of electrical emergency incidents, disturbances or destruction that disrupts the operation of critical infrastructure in the electric power industry. DOE form DOE-417 covers additional reporting requirements such as cyber-attacks and loss of customers. Under R2 of EOP-004, Responsible Entities may submit either the Attachment 2 form included in EOP-004 or a DOE-DOE-417 form.

**Reporting Requirements**

DOE and NERC EOP-004 requirements may result in several Responsible Entities submitting a report for the same event. Specific to the PJM Operating Plan, if an event requires a report to be submitted, PJM will submit an event report. Member companies are required to provide the event information to PJM via either the Attachment 2 in EOP-004 or the DOE-417 form. Copies of the reports required for EOP-004 are to be provided to PJM six hours prior to the 24 submittal deadline to allow time for PJM to meet reporting requirements.

Members may use the Attachment 2 form in EOP-004 or the DOE form DOE-417. There may be other submittal timing requirement for the DOE-417 form. They include: either 1 hour, 6 hours, or 24hours criteria dependent. The PJM Operating Plan includes the specific timing submittal requirements.

Attachment 2 report and/or DOE-417 report must be submitted by the Entity Responsible to PJM (listed in the PJM Operating Plan table below) at the following address:

1. PJM – dispsup@pjm.com

PJM will then review and submit the report to the following organizations:

1. NERC - systemawareness@nerc.net & Operations@EISAC.com
2. DOE - doehqeoc@hq.doe.gov
3. RFC (disturbance@rfirst.org) or SERC (reporting_line_sit@list-serc1.org & SAEA@SERC1.org

When PJM submits a report, PJM will copy the affected members with the report.

A Member company may also have direct compliance responsibility to submit an DOE-417 to DOE or file an EOP-004 report, where the member is required to report an event to applicable law enforcement and government agencies per R1 of standard EOP-004 and their specific Operating Plan. Refer to the NERC website for details on filling out the report and for the most recent version of the report. For DOE-417 reporting, refer to the DOE website for details on filing and for the most recent version of the form: http://www.oe.netl.doe.gov/oe417.aspx.

| PJM Operating Plan for EOP-004 (R1 and R2) | | | | |
|---|---|---|---|---|
| **Event Type** | **Entity with Reporting Responsibility as indicated in EOP-004 or DOE-417** | **Threshold for Reporting** | **Entity responsible for providing report to PJM** | **Deadline to submit the report to regulatory organizations** |
| Damage or destruction of a Facility<br>(DOE-417 ##1 or #15) | RC, BA, TOP | Damage or destruction of a Facility within its Reliability Coordinator Area, Balancing Authority Area or Transmission Operator Area that results in action(s) to avoid a BES Emergency. | Transmission Owner supplies damage information. PJM will supply the actions taken to avoid a BES Emergency and submit the report. | Later of 24hrs or 4pm the next business day per EOP-004. 1hr or 24hrs per DOE-417 (criteria dependent). 72hrs for final DOE-417 |
| Damage or destruction of a Facility<br>(DOE-417 #1 or #10 or #16) | TO, TOP, GO, GOP, DP | Damage or destruction of its Facility that results from actual or suspected intentional human action.<br>It is not necessary to report theft unless it degrades normal operation of its Facility | Entity that owns damaged equipment | Later of 24hrs or 4pm the next business day EOP-004 1hr or 6hrs per DOE-417 (criteria dependent). 72hrs for final DOE-417 |
| Physical threats to a Facility<br>(DOE-417 #17) | TO, TOP, GO, GOP, DP | Physical threat to its Facility excluding weather or natural disaster related threats, which has the potential to degrade the normal operation of the Facility.<br>OR<br>Suspicious device or activity at a Facility. | Entity that owns the equipment threatened | Later of 24hrs or 4pm the next business day per EOP-004 and DOE-417. 72hrs for final DOE-417 |

| PJM Operating Plan for EOP-004 (R1 and R2) | | | | |
|---|---|---|---|---|
| **Event Type** | **Entity with Reporting Responsibility as indicated in EOP-004 or DOE-417** | **Threshold for Reporting** | **Entity responsible for providing report to PJM** | **Deadline to submit the report to regulatory organizations** |
| Physical threats to a BES control center<br>(DOE-417 #18) | RC, BA, TOP | Physical threat to its BES control center, excluding weather or natural disaster related threats, which has the potential to degrade the normal operation of the control center.<br>OR<br>Suspicious device or activity at a BES control center. | Entity whose control center is threatened(This applies to TO control centers as they are carrying out matrixed TOP tasks) | Later of 24hrs or 4pm the next business day per EOP-004 and DOE-417. 72hrs for final DOE-417 |
| Public appeal for load reduction resulting from a BES Emergency<br>(DOE-417 #9) | BA | Public appeal for load reduction to maintain continuity of the BES. | PJM will write and submit the report | Later of 24hrs or 4pm the next business day per EOP-004 1hr per DOE-417. 72hrs for final DOE-417 |
| System-wide voltage reduction resulting from a BES Emergency<br>(DOE-417 #8) | TOP | System wide voltage reduction of 3% or more. | PJM will write and submit the report | Later of 24hrs or 4pm the next business day per EOP-004. 1hr per DOE-417. 72hrs for final DOE-417 |
| Firm load shedding resulting from a BES Emergency<br>(DOE-417 #7) | Initiating RC, BA or TOP | Firm load shedding ≥ 100 MW (manual or automatic). | PJM will write and submit the report | Later of 24hrs or 4pm the next business day per EOP-004 1hr per DOE-417. 72hrs for final DOE-417 |

| PJM Operating Plan for EOP-004 (R1 and R2) | | | | |
|---|---|---|---|---|
| **Event Type** | **Entity with Reporting Responsibility as indicated in EOP-004 or DOE-417** | **Threshold for Reporting** | **Entity responsible for providing report to PJM** | **Deadline to submit the report to regulatory organizations** |
| | | | | |
| BES Emergency resulting in voltage deviation on a Facility<br>(DOE-417 #19) | TOP | A voltage deviation of =/> ± 10% of nominal voltage sustained for ≥ 15 continuous minutes. | PJM will write and submit the report | Later of 24hrs or 4pm the next business day per EOP-004 and DOE-417. 72hrs for final DOE-417 |
| | | | | |
| Uncontrolled loss of firm load resulting from a BES Emergency<br>(DOE-417 #6 and #20 | BA, TOP, DP | Uncontrolled loss of firm load for ≥ 15 Minutes from a single incident:<br>≥ 300 MW for entities with previous year's peak demand ≥ 3,000<br>OR<br>≥ 200 MW for all other entities | Transmission Owner(Matrixed Task) | Later of 24hrs or 4pm the next business day per EOP-004 1hr or 24 hrs per DOE-417 (criteria dependent). 72hrs for final DOE-417 |
| System separation (islanding)<br>(DOE-417 #5) | RC, BA, TOP | Each separation resulting in an island ≥ 100 MW | PJM will write and submit the report | Later of 24hrs or 4pm the next business day per EOP-004 1hr per DOE-417. 72hrs for final DOE-417 |
| Generation loss<br>(OE417 #21) | BA | Total generation loss, within one minute, of:<br>≥ 2,000 MW for entities in the Eastern or Western Interconnection | PJM will write and submit the report | Later of 24hrs or 4pm the next business day per EOP-004 and |

| PJM Operating Plan for EOP-004 (R1 and R2) | | | | |
|---|---|---|---|---|
| **Event Type** | **Entity with Reporting Responsibility as indicated in EOP-004 or DOE-417** | **Threshold for Reporting** | **Entity responsible for providing report to PJM** | **Deadline to submit the report to regulatory organizations** |
| | | | | DOE-417. 72hrs for final DOE-417 |
| Complete loss of off-site power to a nuclear generating plant (grid supply)<br>(DOE-417 #22) | TO, TOP | Complete loss of off-site power (LOOP) affecting a nuclear generating station per the Nuclear Plant Interface Requirement | Transmission Owner | Later of 24hrs or 4pm the next business day per EOP-004 and DOE-417. 72hrs for final DOE-417 |
| Transmission loss<br>(DOE-417 #23) | TOP | Unexpected loss within its area, contrary to design, of three or more BES Facilities caused by a common disturbance (excluding successful automatic reclosing). | Transmission Owner(Matrixed Task) | Later of 24hrs or 4pm the next business day per EOP-004 and DOE-417. 72hrs for final DOE-417 |
| Unplanned evacuation of its BES control center<br>(DOE-417 #24) | RC, BA, TOP | Unplanned evacuation from its BES control center facility for 30 continuous minutes or more. | Entity that evacuates their control center(This applies to TO control centers as they are carrying out matrixed TOP tasks) | Later of 24hrs or 4pm the next business day per EOP-004 and DOE-417. 72hrs for final DOE-417 |
| Complete loss of Interpersonal Communication | RC, BA, TOP | Complete loss of Interpersonal Communication and Alternative Interpersonal Communication capability | Entity that loses communications(This applies to | Later of 24hrs or 4pm the next business day per EOP-004 and |

| PJM Operating Plan for EOP-004 (R1 and R2) | | | | |
|---|---|---|---|---|
| **Event Type** | **Entity with Reporting Responsibility as indicated in EOP-004 or DOE-417** | **Threshold for Reporting** | **Entity responsible for providing report to PJM** | **Deadline to submit the report to regulatory organizations** |
| and Alternative Interpersonal Communication capability at its staffed BES control center<br>(DOE-417 #25) | | affecting its staffed BES control center for 30 continuous minutes or more. | TO control centers as they are carrying out matrixed TOP tasks) | DOE-417. 72hrs for final DOE-417 |
| Complete loss of monitoring or control capability at its staffed BES control center<br>(DOE-417 #26) | RC, BA, TOP | Complete loss of monitoring or control capability at its staffed BES control center for 30 continuous minutes or more. | Entity that loses monitoring or control (This applies to TO control centers as they are carrying out matrixed TOP tasks) | Later of 24hrs or 4pm the next business day per EOP-004 and DOE-417. 72hrs for final DOE-417 |
| DOE-417 #2 | Electric Utilities that operate as Control Area Operators and/or Reliability Authorities | Reportable Cyber Security Incident | Entity that experiences the cyber event if it impacts the BES | 1hr per DOE-417. 72hrs for final DOE-417 |
| DOE-417 #3 | Electric Utilities that operate as | Cyber event that is not a Reportable Cyber Security Incident that causes interruption of electrical system operations | Entity that experiences the cyber event if it impacts the BES | 1hr per DOE-417. 72hrs for final DOE-417 |

| PJM Operating Plan for EOP-004 (R1 and R2) | | | | |
|---|---|---|---|---|
| **Event Type** | **Entity with Reporting Responsibility as indicated in EOP-004 or DOE-417** | **Threshold for Reporting** | **Entity responsible for providing report to PJM** | **Deadline to submit the report to regulatory organizations** |
| | Control Area Operators and/or Reliability Authorities | | | |
| DOE-417 #4 | Electric Utilities that operate as Control Area Operators and/or Reliability Authorities | Complete operational failure or shut-down of the transmission and/or distribution electrical system | PJM will write and submit the report | 1hr per DOE-417. 72hrs for final DOE-417 |
| DOE-417 #11 | Electric Utilities that operate as Control Area Operators and/or Reliability Authorities | Cyber event that could potentially impact electric power system adequacy or reliability | Entity that experiences the cyber event if it could impact the BES. | 6hr per DOE-417. 72hrs for final DOE-417 |
| DOE-417 #12 | Electric Utilities that operate as Control Area Operators and/or Reliability Authorities | Loss of electric service to more than 50,000 customers for 1 hour or more | Entity that loses the customers | 6hr per DOE-417. 72hrs for final DOE-417 |

| PJM Operating Plan for EOP-004 (R1 and R2) | | | | |
|---|---|---|---|---|
| **Event Type** | **Entity with Reporting Responsibility as indicated in EOP-004 or DOE-417** | **Threshold for Reporting** | **Entity responsible for providing report to PJM** | **Deadline to submit the report to regulatory organizations** |
| DOE-417 #13 | Electric Utilities that operate as Control Area Operators and/or Reliability Authorities | Fuel supply emergencies that could impact electric power system adequacy or reliability | PJM will obtain this via Resource Limitations reported in PJM Markets Gateway | 6hr per DOE-417. 72hrs for final DOE-417 |
| Attempted Cyber Compromise DOE-417 #14 | Electric Utilities that operate as Control Area Operators and/or Reliability Authorities | Cyber Security Incident that was an attempt to compromise High or Medium Impact BES Cyber System or their associated Electronic Access Control or Monitoring Systems | Entity that experiences the cyber event if it could impact the BES | 24hrs per DOE-417. 72hrs for final DOE-417 |

*The deadlines to submit are taken directly from the EOP-004 and DOE requirements.

# Attachment K: Event Analysis Process

## PJM Event Analysis Process Document and NERC Event Analysis Process

| Contents |
|---|
| Policy Statement |
| Simplified Listing of Process Steps |
| Procedure |
| Purpose |
| Definitions |
| Scope |
| Analysis Process |
| Appendices: |
| 1. ACA Report Form |
| 2. RCA Analysis Owner Implementation Checklist |
| 3. Guidelines for Selecting and Using RCA Methods |

### Policy Statement

PJM and its members are committed to preserving the reliability of PJM monitored Bulk Electric System (BES) facilities. Part of that commitment is to analyze system events or problems for the purpose of implementing corrective actions and sharing knowledge to improving operations at PJM and Member companies.

To accomplish this they have implemented a process to provide the necessary resources to analyze events or near-miss events that have resulted in reliability concerns. These fact finding efforts work in conjunction with the NERC Event Analysis Process to identify and examine events that may impact system reliability. In many instances the EAP event categories may preclude additional investigation, allowing that due diligence will be required for events outside the scope of the EAP. Event analysis will be a collaborative effort utilizing similar tools as those listed in the PJM internal process. Teams will be comprised of PJM and member companies' representatives as needed, and may, in more severe cases, include representatives of Reliability*First* and/or NERC.

Features of the event analysis process include:

- Starting with everything on the table at the beginning of the investigation, nothing should be initially ruled out or excluded from the analysis process.
- Performing a thorough analysis of all systems, human performance, work processes, materials, environmental conditions, physical plant and management systems both individually and collectively, that contributed to the event.

- Determine if event qualifies for inclusion in the NERC Event Analysis process.
- Learning as much about the event as possible with the goal of improving the reliability of the PJM system, not as a punitive exercise.
- Accurate and thorough determination of root causes, contributing factors and corrective actions using a recognized and structured Root Cause methodology as required.
- Investigation of “near miss/good catch” events. Learning captured from “near miss/good catch” events can be just as valuable as those of actual events, identifying trends that have potential for more sever events.
- The parties most involved in the event should lead the analysis, if possible.
- Allowance for timely delivery of initial/preliminary findings to implement interim corrective actions, if necessary.
- A challenge or critical review of findings and recommended corrective actions before finalization of the analysis.
- Assurance that corrective actions are completed.
- Dissemination of findings to members or industry in general, either internally or through the NERC “lessons learned” web posting.

PJM and Members are not formally bound to participate in the Event Analysis Process and by participating, are not prevented from taking any action they determine necessary in the course of event analysis activities. This analysis process may be suspended when participating in the North American Electric Reliability Council (NERC) Event Analysis Process or when a similar analysis would cause duplication of effort or confusion.

| Step | Activity | Responsibility |
|---|---|---|
| **1** | Event Identification, Classification, NERC EAP category and Fact Finding | PJM and PJM Member Officers (or designee) |
| **2** | Determination of Analysis Action | PJM and Member through the PJM System Operations Subcommittee (Transmission) |
| **3** | Establishment of Analysis Ownership | PJM and Involved Member(s) |
| **4** | Launch of ACA or RCA Team | Analysis Owner |
| **5** | Execution of ACA or RCA | ACA/RCA Analysis Leader |
| **6** | ACA/RCA Challenge Review and Solicitation of Comments | Analysis Owner |
| **7** | Publishing of RCA and ACA reports to PJM and Transmission Owners | Analysis Owner |

| Step | Activity | Responsibility |
|---|---|---|
| | | |
| **8** | Follow-up of corrective actions/ notification of completion | Analysis Owner |
| **9** | Event Analysis Program Oversight | PJM System Operations Subcommittee (Transmission) |

## Procedure

### Purpose

The purpose of this document is to provide guidance, instruction and clarify roles and responsibilities for PJM and PJM Members to initiate and perform event analysis of operational events on PJM monitored BES facilities, including but not limited to completion of a formal Apparent Cause Analysis or Root Cause Analysis of events by PJM and/or a combination of PJM Members.

### Definitions

**Apparent Cause Analysis (ACA)** – A shorter, but still thorough, event analysis utilized for less complicated or significant events; “RCA Lite.”

**Root Cause Analysis (RCA)** –A structured, facilitated team process to identify underlying (root) causes of an incident, which resulted in an undesired outcome and produced corrective actions. An RCA process identifies and breaks down the processes and systems that contributed to the incident. It may also present actions to prevent future incidents**.**

**North America Electric Reliability Council Event Analysis Process (EAP)** - A processes for use by the industry to report, categorize, analyze, identify conclusions and recommendations and disseminate lessons learned from BES events.

**Analysis Owner** – PJM or a Transmission Owner that takes responsibility for leadership of the execution of an ACA, RCA analysis, or NERC Event Analysis Report. The Analysis Owner is responsible for establishing the analysis team, timely completion of theanalysis and acceptance of the corrective actions.

**Analysis Team Leader** – Individual designated by PJM or a Transmission Owner to provide leadership and guidance to a team of personnel executing a RCA, ACA analysis, or NERC Event Analysis Report.

**PJM System Operations Subcommittee (Transmission)** – A subcommittee of the PJM Operating Committee that provides oversight of the Event Analysis Process.

### Scope

Events intended to be included in the scope of the Event Analysis Process include events on the Bulk Electric System that result in significant reliability problems, violations of reliability criteria or standards, including near-miss/good catch situations or situations where operational conditions of the system are not well understood or explained by PJM or Member system operators. Events listed below should initiate the event investigation process.

- Event criteria that qualifies for one of the NERC Analysis Process categories.
- Violations to a NERC Operational Standards that are reportable to NERC or applicable regional compliance process.

**Examples:**

- Actual overloads which result in a reportable interconnection reliability operational limit (IROL) violation.
- Near-miss events that could have resulted in an IROL violation.
- Submittal of an event report in accordance with the NERC event reporting standard: EOP-004.
- Nuclear power plant tripping or operational problem, reported to PJM and/or the NRC where PJM and/or Member equipment did not operate as intended or within a nominal range and may have been the cause or a contributing factor.
- Events, due to their impact or severity, are attracting widespread public media coverage.
- Events involving multiple BES facility tripping, where the cause cannot be immediately explained or that may have involved personnel error.

Events intended to be excluded from the scope of the Event Analysis Process include events:

- Occurring due to weather or other acts of nature or where equipment operated as intended or within a nominal range of what is expected. (Weather-related event reports may be required by regulatory entities (NERC/FERC/RFC/SERC) to identify common issues or lessons learned.)
- Occurring on sub-transmission or distribution systems, assuming no impact on the transmission system.
- Involving generator owned and operated equipment where PJM and Transmission Owner equipment operated as intended or within a nominal range of what is expected. (This type event is not excluded from the NERC EAP and may require coordination between the transmission and generation owners to complete the necessary reporting.)
- Originating outside the transmission system where PJM and Transmission Owner equipment operated as intended or within a nominal range of what is expected.
- Where the event results in purely economic consequences and the reliability of the transmission system is not challenged or compromised.
- Where the event is limited to the complete failure of or mis-operation of a single transmission system component and otherwise transmission system equipment operated as intended or within a nominal range of what is expected and did not contribute to significant reliability problems or violations of reliability criteria or standards.

Should an event occur that challenges system reliability, and it is anticipated the event will likely end up in litigation, PJM and the member should contact their respective legal counsel to obtain legal advice about the analysis.

PJM and members may conduct their own internal event analysis for any event as required by each company's internal event analysis process.

**Analysis Process**

**Step 1** – Event Identification, Classification, NERC EAP Category and Fact Finding

PJM and Member system operators monitor system operations and identify, record and report events covered or potentially covered by the Event Analysis Process scope.

PJM and/or Members direct the preliminary gathering of facts and information as necessary to provide a succinct description of the event, its extent and consequences in preparation for a conference call briefing with PJM and involved facility owners.

**Step 2** – Determination of Analysis Action

Upon identification or notification of an event, PJM will schedule a conference call of the System Operations Subcommittee (Transmission) for the purpose of deciding if the event falls within the scope of the Event Analysis Process and to specify the level of action as outlined below:

| Level | Definition | Use when: |
|---|---|---|
| **1** | Track and Fix | • Information brought to light during the conference call adequately explains the cause of the events.<br>• Corrective actions are identified and in progress |
| **2** | Apparent Cause Analysis (ACA) | • The consequences of a repeat of a similar type event are unacceptable.<br>• The cause of the event is not clear. Further analysis is required.<br>• Corrective actions are not obvious. Further analysis is required. |
| **3** | Root Cause Investigation (RCA) | • The consequences of the event or a repeat of a similar type event are unacceptable.<br>• A pattern of repeat (or similar) events has emerged.<br>• A comprehensive, “best effort” analysis to assure identification of root causes and effective corrective actions to prevent recurrence is required. |

If the event classification results in initiation of an Apparent Cause Analysis (ACA) or a Root Cause Analysis (RCA), then proceed to **Step 3.**

**Step 3** – Establishment of Analysis Owner

PJM and Involved Member representative shall select the Analysis Owner and serve as the primary sponsor for completion of the ACA or RCA. The intent is that the Member operator with the most direct involvement in the event should take the role of Analysis Owner.

**Step 4** – Launch of Analysis Team

The Analysis Owner for an ACA shall obtain and distribute the names of PJM and involved member analysis participants and team leader.

The ACA Team Leader shall complete the analysis and report results using the ACA analysis form (Appendix1) to the PJM and involved member via conference call within 30 business days.

The Analysis Owner for a RCA shall schedule a kick-off meeting for the RCA Team that includes PJM and involved Member representatives, the Analysis Team Leader, team members and any external expert resources supporting the RCA. Appendix 2 provides a checklist as an aid for initiating the RCA.

The RCA kick-off meeting shall cover topics required to support the work of the RCA team and clarify management expectations, including: management sponsorship, resources available to the team, time commitment of participants, access to information from PJM and Member, expectations for the thoroughness of the analysis, timelines for completion of activities and confidentiality of information.

**Step 5** – Execution of RCA

The RCA Team Leader, in concert with any internal or external RCA expert resources provided, shall conduct the RCA utilizing a RCA methodology and guidelines cited in Appendix 3 or equivalent process.

Information gathered from individual interviews and documents relating to the personal performance of specific individuals involved in the event investigation shall remain confidential. Access to this information is to be limited to the analysis team and PJM and involved Member representative.

**Step 6** – RCA Challenge Review and Solicitation of Comments

Upon completion of preliminary results of the RCA, the RCA Analysis Owner and RCA Team Leader shall sponsor a RCA Challenge Review Meeting. The purpose of the Challenge Review Meeting is to provide a critical review of root cause determinations, contributing factors and proposed corrective actions. Participants in the Challenge Review Meeting shall include PJM and involved Member representative, the RCA Team Leader and Team members and other organizational entities that may be affected by the implementation of corrective actions. At the discretion of the Analysis Owner, other uninvolved members may be invited in order to provide an impartial and objective perspective to the challenge review. The Challenge Board chairperson may be the Analysis Owner or another agreed upon executive. Review and acceptance of proposed corrective actions by all affected parties should be obtained prior to the challenge meeting. Challenge board approval of conclusions and corrective actions should constitute final approval of the report unless otherwise directed by the chairperson.

**Step 7** – Publishing of Analysis to PJM and Involved Members

For RCA - Upon completion of actions resulting from the Challenge Review Meeting and preparation of a final draft report, the RCA Analysis Leader shall distribute the final draft report to the involved Member and solicit comments for a period of 30 business days. At the conclusion of the period and resolution of comments, the final report shall be distributed to PJM

and all applicable members. Both the final draft and final report shall be marked as confidential. PJM and all Members shall treat the report as confidential information.

For ACA – Upon review and approval of the analysis results by PJM and involved Member, the analysis shall be marked as confidential and distributed to PJM and all applicable members. PJM and all Members shall treat the report as confidential information.

**Step 8** – Corrective Action Follow-up and Notification of Completion

The Analysis Owner shall monitor completion of corrective actions and notify PJM and the impacted Member when completion of all corrective actions has occurred.

PJM and involved Member shall retain copies of analysis reports.

**Step 9** – Event Analysis Program Oversight

PJM shall maintain a record of events, conference calls for evaluating events for analysis action, decisions made and the status of current and ongoing RCAs or ACAs The record shall be included in the standard agenda of the PJM System Operations Subcommittee for review, evaluation and oversight by the Committee. All conditions of Code of Conduct and information confidentiality will be followed due to sensitive nature of supplied data.

**Appendix 1**

**ACA Report FORM**

**Apparent Cause Analysis (ACA) Report**

**DATE OF INCIDENT** xx/xx/xxxx

**TITLE:** The title should identify the equipment, behavior or process affected and what the incident or problem was. Also include the location of the incident.

**Report By**:

_____

Name of the Analysis Team Leader

**Approved By:**

_____

Analysis Owner

**Date Approved: xx/xx/xxxx**

**Analysis Participants:**

List additional names of team members or persons that had input into the analysis (e.g. subject matter experts, supervisors, etc.)

**Executive Summary:**

Summarize with a single length paragraph containing a brief synopsis of the event. Including significant consequences (injuries, damaged equipment, outages). Also, summarize the notable causes and corrective actions.

**Event Description**:

Identify what happened and how it was discovered. Identify procedures, activities or processes involved. If this was a repeat event identify it as such and how it differed from previous events. Parties involved should also be identified (Do not use names - use titles or positions… customers, others). Include actual and/or potential consequences.

**Operational Impacts:**

This section summarizes the operational and reliability impacts observed during the event

**ANALYSIS METHODOLOGY:**

Identify what approach, analysis, and/or resources were used to reach the cause conclusions (e.g., change analysis, barrier analysis, interviews, etc.). If there was an equipment failure, include the failure mode (i.e. how it happened).

**Causal Factors and Recommendations:**

In a brief synopsis: Identify the end result of the analysis. Record any actions, conditions or events that caused the incident. List any equipment, behavioral or procedural problems identified in the analysis. The causes should be identified by asking “why” to the point where the cause, if prevented would have prevented or mitigated the consequences of this or a similar incident.

List any corrective actions completed or planned. List an owner by name and due date for each corrective action. List the date completed for those already taken. Corrective actions must have owner acceptance before capturing them in this report.

A. Xxxxxxxxxxxxxxxxxxxx

Owner (name): nnnnnnnn Due Date: dd/dd/dddd

.

B. Xxxxxxxxxxxxxxxxxxxx

Owner (name): nnnnnnnn Due Date: dd/dd/dddd

**Appendix 2**

**RCA EVENT OWNER IMPLEMENTATION CHECKLIST**

- Confirm agreement and sponsorship of PJM and other Involved Member representative.
- Select an Analysis Leader for the RCA and brief the leader.
- Request RCA team members from PJM and any other involved Member representative.
- If the team leader does not have experience or expertise in performing a RCA, provide the team leader a qualified internal or external expert resource.

- Schedule the kick-off meeting – include sponsors, team leader & members, expert resources.
- Review and approve/amend the team charter document with PJM and involved Member representative.
- Schedule the Challenge Review Meeting.
- Distribute event analysis final report.
- Notify PJM and involved Member of completion of all corrective actions.

## Appendix 3

## GUIDELINES FOR SELECTING AND USING ROOT CAUSE ANALYSIS METHODOLOGIES

Overall Guideline: A good Root Cause Analysis should be thorough, fair and efficient.

A thorough root cause analysis will generally identify more than one root cause.

There are a wide variety of analytical methods and expert systems available to assist in performing a RCA. Thoroughly describe the methods and systems used by the team for examination by readers and reviewers.

To improve the RCA team's efficiency, use risk assessment to scale analysis efforts.

If possible, use a skilled, independent facilitator.

Use subject matter experts to provide the needed information, but use an independent facilitator and objective team members to prevent bias from controlling the direction of the investigation.

Document in detail the procedures used to do the RCA. The documentation should include details on how information was gathered, requirements for training, team membership, analytical tools, issues investigated, report format, due date, and review responsibilities.

Value and practice independence throughout the process.

Do not automatically assume that each RCA is unique. Thoroughly search historical records (inside and outside of the event or problem area) for precursors or related data, especially for establishing the context or that would establish a pattern of similar failures across the industry. Be open to generic issues.

In some cases, it may be necessary to use multiple RCA methods.

Use Root Cause Analysis methods that have a systematic repeatable methodology.

Before identifying individual faults and assigning individual responsibility, look for systemic root causes. For example: weaknesses in policies, procedures, monitoring or supervision would be systemic. For repeat occurrences, determine why the previous corrective actions did not work or consider the possible deficiencies in the corrective action program as contributors to the repeat occurrence. For repeat occurrences, determine why the previous corrective actions did not work

or consider the possible deficiencies in the corrective action program as contributors to the repeat occurrence.

Discourage the “you found it, you fix it” philosophy when it comes to the corrective action program.

Thoroughly detail and support all causes and contributors.

Maximize learning from the RCA process.

**Commonly Used RCA Analytical Methods:**

- Event and Causal Factor Analysis
- Change Analysis
- Barrier Analysis
- Task Analysis
- Five Why’s; Seven Why’s
- Problem Solving/Decision Making
- Management Oversight and Risk Tree (MORT)

**Commercially Available RCA Processes:**

- Tap Root
- REASONS
- Sigma X

Events are submitted, as applicable, to NERC via the NERC Event Analysis Process located on the NERC website at: http://www.nerc.com/pa/rrm/ea/ero_eap_documents%20dl/ero_eap_v3.1.pdf

# Attachment L: Deleted

# Attachment M: Procedure for Obtaining a Temporary Environmental Variance

During emergency conditions when load shedding is likely or imminent, it may be possible to obtain a temporary variance from environmental regulatory authorities for the purpose of allowing generators to operate and mitigate the risk of or prevent load shedding. Such a request must be reserved for times when the possibility of load shedding is imminent yet there is still time (hours) to approach regulatory contacts to explain the situation. It must be recognized that regulatory bodies will need some time to understand the situation prior to rendering a decision.

Environmental regulation is such that the generation owners are under significant pressure to remain in compliance with regulations at all times. In addition, environmental regulation tends to be local as opposed to regional or national in nature. However, based on the severity of the operating circumstances, temporary variances can sometimes be granted.

The following steps shall be followed:

- Member(s) inform PJM Dispatch of generator(s) that are either being reduced or are off-line due to environmental restrictions and their availability would make a significant contribution to alleviating the risk of load shedding in a specific area or region of PJM.
- The member company is to identify the appropriate environmental regulatory body that has jurisdiction on the generator. The generation owner will be aware of the regulations under which they operate and the possibility of obtaining a temporary variance from the appropriate regulatory authority.
- If the owner indicates that a temporary variance may be possible, PJM will assist the member company by performing the following situation assessment:
    - Operating summary – including forecasted loads and capacity for the area in question and PJM in total
    - Estimated duration for the temporary variance
    - Estimate of the probability of load shedding in the area.
- Decide with the owner who will contact the environmental regulatory authority with the request. Generally, the regulators will need to hear directly from PJM, but the generation owner maintains the relationship with the regulator.
- If the variance is granted, operate the generator to the minimum extent possible within the bounds of the variance, and conclude the variance as soon as possible.

## Attachment N: IROL Load Dump Tables

The following table is used for Transmission Owners and DPs to shed load in their zones to mitigate an IROL as described in Section 5.5:

| IROL Facility | East | Central | 5004/05 | West | AP-South | BED-BLA | AEP-DOM | CE-East | Cleveland |
|---|---|---|---|---|---|---|---|---|---|
| TO Zone | Multiplier | Multiplier | Multiplier | Multiplier | Multiplier | Multiplier | Multiplier | Multiplier | Multiplier |
| DPL | 0.14 | 0.12 | 0.30 | 0.12 | | | | | |
| DPL-Dover | 0.01 | 0.01 | 0.02 | 0.01 | | | | | |
| DPL-DEMEC | 0.01 | 0.01 | 0.03 | 0.01 | | | | | |
| DPL-Easton | 0.00 | 0.00 | 0.01 | 0.00 | | | | | |
| DPL-ODEC | 0.04 | 0.03 | 0.08 | 0.03 | | | | | |
| AE | 0.13 | 0.10 | 0.24 | 0.10 | | | | | |
| AE-Vineland | 0.01 | 0.01 | 0.01 | 0.01 | | | | | |
| PS | 0.60 | 0.48 | 0.80 | 0.46 | | | | | |
| RECO | 0.03 | 0.02 | 0.05 | 0.02 | | | | | |
| PE | 0.51 | 0.38 | 0.87 | 0.37 | | | | | |
| FE East-JC | 0.36 | 0.28 | 0.57 | 0.27 | | | | | |
| PL | | 0.39 | 0.58 | 0.31 | | | | | |
| UGI | | 0.01 | 0.01 | 0.01 | | | | | |
| FE East-ME | | 0.21 | 0.30 | 0.13 | | | | | |
| FE East-PN | | | | | | | | | |
| BC | | | 2.04 | 0.38 | 1.42 | 2.77 | 2.89 | | |
| PEP | | | | 0.60 | 0.70 | 1.41 | 1.73 | | |
| PEP-SMECO | | | | 0.08 | 0.10 | 0.21 | 0.24 | | |
| FE South | | | | | | | | | |
| FE South-ODEC | | | | | | | | | |
| DOM | | | | | 2.13 | 6.88 | 3.09 | | |
| DOM-ODEC | | | | | 0.13 | 0.43 | 0.19 | | |
| DOM-NCEMC | | | | | 0.03 | 0.11 | 0.05 | | |
| DOM-NOVEC | | | | | 0.16 | 0.51 | 0.23 | | |
| AEP-AP | | | | | | | 1.52 | | |
| AEP Total | | | | | | | | | |
| DLCO | | | | | | | | | |
| Dayton | | | | | | | | | |
| FE West | | | | | | | | | 2.66 |
| CPP | | | | | | | | | 0.03 |
| AMPT | | | | | | | | | 0.00 |
| ComEd | | | | | | | | 2.38 | |
| DEOK | | | | | | | | | |
| EKPC | | | | | | | | | |
| OVEC | | | | | | | | | |
| Neptune | | | | | | | | | |
| HTP | | | | | | | | | |
| Linden | | | | | | | | | |
| ITCI | | | | | | | | | |
| Silver Run | | | | | | | | | |
| Rock Springs | | | | | | | | | |
| DOE PORTS | | | | | | | | | |
| TransSource | | | | | | | | | |
| Wabash | | | | | | | | | |
| Napoleon | | | | | | | | | |
| Wadsworth | | | | | | | | | |

## Revision History

**Revision 88 (05/18/2023):**

- Section 2.2 - Added clarification for establishing Reliability Reserve Requirement.

**Revision 87 (05/09/2023):**

- Section 2.4.7 Removed bullet point for FE South in member actions as it is no longer needed
- Updated Attachment E: PJM EMS Load dump allocation table to reflect the new OSI EMS

**Revision 86 (11/03/2022):**

- Section 6.4 updated to reflect changes to resource limitations
- Exhibit 5: Resource Limitations Reporting updated

**Revision 85 (10/01/2022):**

- Section 2.2 Reserve Requirement updated to reflect changes to reserve requirements based on PJM Manual 11 Energy and Ancillary Services Market Operations.
- Remove reference to Day Ahead Scheduling reserve
- Remove reference to Load Forecast Error and Forced Outage Rate Components of reserve requirement
- Add language clarifying 30 minute reserve product and requirement
- Remove reference to SERC VACAR Reserve Requirement
- Update Reserve Requirement Table
- Section 2.3 clarified Advisory language to include Weather/Environmental Emergency
- Section 3.3 updated to include Cold Weather Advisory
- Section 3.3.1 Cold Weather Advisory added to address NERC Standards EOP-011, IRO-010, TOP-003
- Renumber 3.3.2 Cold Weather Alert
- Section 6.4 Seasonal and Periodic Reporting eDART based survey updated to eDART data request

**Administrative Change (5/6/2022):**

- Attachment E Winter Summer Required Manual Load Dump PJM Mid-Atlantic Region updated with the table and wording
- Attachment F exhibit 7 PJM Manual Load Dump Capability updated table
- Attachment F updated with the Note Only on tab 1 of the attached spreadsheet titled PJM UFLS (Hz)

**Revision 84 (3/23/2022)**

- Periodic Review
- Section 2.3.1 Voltage Reduction Table
  - Renamed Est. Peak Load and Est. Load Reduction columns to reflect summer values
  - Added columns with Winter values for Est. Peak and Est. Load Reduction
- Section 6.4 Resource Limitation Reporting - Changed note timeline for resource limitations Steam and CT units to be placed in Max Emergency until issue charge is completed.

**Revision 83 (1/26/2022):**

- Updated manual ownership from Rebecca Carroll to Donald Bielak
- Section 6.4 Resource Limitation Reporting – Update the Note to indicate a short-term exception for when PJM may put a unit in the Maximum Emergency category

**Revision 82 (1/1/2022)**

Section 2.2

- Updated the DASR requirement to the new 2022 values.

**Administrative Change (11/30/2021):**

- Attachment E Exhibit 1 the Eastern Portion of Mid-Atlantic Region table deleted

**Revision 81 (11/17/2021):**

Section 2.3.2 Real-Time Emergency Procedures (Warnings and Actions)

- Updated and added Note under PJM Member Actions for Step 10 (Real-time): Manual Load Dump Action to articulate expectations of Member Load shed plans

Section 5.5 Interconnection Reliability Operating Limits (IROL) Manual Load Dump Warning/ Action

- Added Note under PJM Member Actions to articulate expectations of Member Load shed plans

Attachment E: Manual Load Dump Allocation Tables

- Updated Exhibit 7: PJM Manual Load Dump Allocation Table with 2021 information
- Corrected name of Exhibit 7

Attachment F: PJM Manual Load Dump Capability

- Updated Exhibit 8: Manual Load Dump Capability with 2021 information
- Corrected name of Exhibit 8

Attachment N: IROL Load Dump Tables

- Revised table with updated information

**Revision 80 (10/20/2021):**

Section 6.4 Resource Limitation Reporting

- Updated the Operation of Resource Limited Units when PJM will request or require units to be bid in the Maximum Emergency category
- Updated Exhibit5: Resource Limitation reporting
- Added Note to indicate a short-term exception for when PJM may put a unit in the Maximum Emergency category

**Revision 79 (7/28/2021):**

Section 1.1 Policy Statements

- Added a bullet under PJM Actions to recognize that PJM may issue a Production System Change Freeze during Emergency Operations
- Added explanations for the acronyms SOS, SOS-T and SOS-J

Section 3.2 Conservative Operations

- Updated PJM and Member Actions to include participation in SOS conference calls

Section 6.4 Fuel Limitation Reporting

- Reference to OE-417 updated to DOE-417

Attachment A Public Notification Statements

- Updated SOST to SOS-T

Attachment J Disturbance Reporting - US Department of Energy

- Updates to reflect changes made by the U.S. Department of Energy (DOE) to the OE-417 Electric Emergency Incident and Disturbance Report which has been updated and renamed to DOE-417 effective June 1, 2021
    - All references to OE-417 updated to DOE-417
    - Corresponding updates to the PJM Operating Plan for EOP-004 (R1 and R2) table
        - Event Type numbering changed to reflect updated form
        - New Event Types #2 and #14 added
        - Threshold for Reporting updated for Event Type #3
        - Deadline to submit the report to regulatory organizations updated to reflect 72hrs for final DOE-417 report for all Event Types
        - Updated the incomplete Entity responsible for providing report to PJM for Event Type #4

- Removed duplicate # sign in Event Type for row 1
- Added #16 in Event Type for row 2

**Revision 78 (1/27/2021):**

Periodic Review to include the following:

Section 2.2 Reserve Requirements:

- Updated note for the amount of contingency reserves that can be made up of interruptible load from 25% to 33%

Section 2.3 Capacity Shortages:

- Modified note #3 and deleted note #5 due to the retirement of Limited DR, Extended Summer DR and Base DR

Section 3.9 Assessing Gas Infrastructure Contingency Impacts On the Electric System:

- Removed reference to pre-defined gas contingencies being identified in M03 CEII version

Section 5.2 Transmission Security Emergency Procedures:

- Modified note #3 and deleted note #5 due to the retirement of Limited DR, Extended Summer DR and Base DR

Section 5.4 Post-Contingency Local Load Relief Warning:

- Added detail to the members action section that TO dispatchers shall check the PCLLRW application to ensure that no PCLLRW status are deficient

Attachment A Public Notification Agreements:

- Updated baseline PJM information in Public Notification statements such as the amount of people in PJM's footprint, miles of transmission lines, & CEO

Attachment H:

- Updated the image for PJMs Minimum Generation Calculation Worksheet and the Emergency Reducible Generation table

Attachment J:

- Updated email information for reporting requirements for EOP-004 & OE-417 form submission requirements.

**Revision 77 (01/01/2021):**

- Section 2.2: Updated the DASR requirement to the new 2021 values.

**Administrative Change (07/16/2020):**

- Exhibit 7 and 8: Updated exhibits based on annual forecast.

- Added the following changes that were endorsed as part of version 72 but inadvertently removed from subsequent versions.
  - Section 2.3.2, Step 4: Maximum Generation Emergency Action is identified as a trigger to load Non-Retail Behind the Meter Generation.
  - Section 2.3.2, Step 7: Deploy All Resource Action is identified as a trigger to load Non-Retail Behind the Meter Generation.

**Revision 76 (03/26/2020):**

- Periodic review updated to address:
  - Section 5.4 – added reference to Manual 12, Attachment B.2

**Revision 75 (01/01/2020):**

- Section 2.2: Updated the DASR requirement to the new 2020 values

**Revision 74 (12/19/2019):**

- Attachment K: Event Analysis Program – streamlined this section and made updates to more closely align to current practice. Changed “investigation” to “analysis” throughout.
- Section 2.3.1 Advanced Notice Emergency Procedures: Alerts – Minor modification to Voltage Reduction Summary Table for PSEG to include updated load reduction estimate from voltage reduction

**Revision 73 (10/31/2019):**

- Section 3.9 Assessing Gas Infrastructure Contingency Impacts on the Electric System - Deleted the step for PJM to direct pre-contingency fuel switching from the ‘note’ and replaced with a request for the generation owner to notify PJM if any fuel risk mitigation activities will voluntarily be taken.

**Revision 72 (09/26/2019):**

- Section 2.3.2 – Real-time Emergency Procedures (Warnings and Actions) - Defined triggers to load Non-Retail Behind the Meter Generators
- Section 5.2 – Transmission Security Emergency Procedures – Defined triggers to load Non-Retail Behind the Meter Generators
- Section 5.2 – Transmission Security Emergency Procedures, Step 2 Emergency Load Reduction Action – Added missing PJM Member Actions
- Section 7.01 –TOP EOO-011 Operating Plan Submission Process – Corrected email address to EOP-001forms@pjm.com

**Administrative Change (09/26/2019):**

- Removed references to SSR in Attachments B and J

**Revision 71 (08/01/2019):**

- Updated manual ownership from Chris Pilong to Rebecca Carroll
- Resource Limitation Reporting
  - Updates to Sections 1.1, 2.3, 2.5, 3.1, 3.2, 3.3, 3.4, 3.5, 5.2, 6.4, Attachment B and removal of Attachment C: Supplementary Status Report – Resource Limitation Reporting via Markets Gateway
  - Section 3.1, 3.2, 3.3, 3.4, 6.4 – Changes for Resource Limitation Reporting for Daily Fuel Limited Gas-Fired Units

**Revision 70 (05/30/2019):**

- Gas Contingency Impacts on Reserves
  - Section 2.2 Reserve Requirements – Language to address a credible gas contingency(s) in the calculation for increasing the Day-Ahead Scheduling Reserve Requirement
  - Section 3.9 Assessing Gas Infrastructure Contingency Impacts on the Electric System – Language added to clarify the reserve market eligibility of resources impacted by a credible gas pipeline contingency(s)
- Cover to cover Periodic Review
  - Updates to Sections 1.1, 2.3, 2.5, 3.1, 3.2, 3.3, 3.4, 3.5, 5.2, 6.4, Attachment B and removal of Attachment C: Supplementary Status Report – Resource Limitation Reporting via Markets Gateway
  - Section 3.1, 3.2, 3.3, 3.4, 6.4 – Changes for Resource Limitation Reporting for Daily Fuel Limited Gas-Fired Units
  - Section 2.2 – Removed reference to SERC BAL-002 reserve policy (retired). Updated RF BAL-002 document link and naming from ‘Requirement’ to ‘Regional Criteria’.
  - Section 2.4.7 – Updated M-3 section reference section 3.7
  - Section 4.1, 4.3, 4.4, 4.5, 5.1 – Removed of mention of Supplementary Status Report (SSR) where not needed
  - Section 4.4.3 – updated link and version number to the new NERC Reliability Guideline: Generating Unit Operations During Complete Loss of Communications – Version 3
  - Section 7.1: Revised email address from dispsup@pjm.com to EOP011forms@pjm.com
  - Attachments E and F updated with 2019 summer peak data

**Revision 69 (04/01/2019)**

- Attachment J: Updated language for consistency with the new version of NERC EOP-004-4 effective 4/1/2019.

**Revision 68 (01/01/2019):**

- Section 2.2: Updated the DASR requirement to the new 2019 values.

**Administrative Change (11/12/2018):**

- Section 5.4.1 corrected grammatical errors

**Revision 67 (11/01/2018):**

- Cover to Cover Periodic Review
- Section 3.2 added “Production System Freeze Change” to Conservative Ops
- Section 3.3 corrected formatting for Day-Ahead commitment instructions
- Section 3.4 Added reference to M-11 regarding PLS schedules
- New Section 3.5 added for “Long Duration Extreme Weather”
  - Old Sections 3.5, 3.6, 3.7, and 3.8 renumbered accordingly
- Section 3.6 added language for disabling auto-reclose
- Section 4.1 deleted Exhibit 4 table
  - Former Exhibits 5 through 14 re-numbered accordingly
  - Former Exhibit 4 content regarding “Elevated Threat Alert” reformatted in section 4.1 as a list of “PJM Actions” and “PJM Member Actions”
  - Former Exhibit 4 content regarding “Imminent Threat Alerts”, “Intelligence of an impending attack on a PJM facility”, “physical attack at multiple sites”, or “Significant terrorist activity beyond the East Coast” moved to section 4.3 as a list of “PJM Actions” and “PJM Member Actions”
  - Former Exhibit 4 content regarding “Cyber event has shut down control center EMS capability” moved to section 4.4 as a list of “PJM Actions” and “PJM Member Actions”
- Section 4.2: Added language to outline communication between PJM, its members, and the E-ISAC with regards to potential cyber or physical attacks
- New section 4.3 for PJM operational procedure for physical threats
  - Created from former Exhibit 4 content regarding “Imminent Threat Alerts”, “Intelligence of an impending attack on a PJM facility”, “physical attack at multiple sites”, or “Significant terrorist activity beyond the East Coast” as a list of “PJM Actions” and “PJM Member Actions”
  - Updated “Operating Reserves” language to “30-Minute Reserves”
  - Added requirement for PJM to alert PJM’s Operations Emergency Response Team (OERT)
- New section 4.4 for PJM operational procedure for cyber threats against PJM
  - New section 4.4.1 for loss or degradation of ICCP or EMS capabilities
    - Created from former Exhibit 4 content regarding “Imminent Threat Alerts”, “Intelligence of an impending attack on a PJM facility”, “physical attack at multiple

sites", or "Significant terrorist activity beyond the East Coast" as a list of "PJM Actions" and "PJM Member Actions"

- − Updated "Operating Reserves" language to "30-Minute Reserves"
- − Added language to initiate "Manual Dispatch"

  - o New section 4.4.2 for loss of internet operational procedures
  - o New section 4.4.3 for loss of all telecommunications operational procedure

- New section 4.5 for PJM operational procedure for cyber threats against member company
- New section 4.6 for PJM operational procedure for High-Altitude Electromagnetic Pulse
- Section 5.4 General language clarifications and modifications for consistent use and spelling of terms
- Section 5.4.1 language clarifications based on internal Root Cause Analysis recommendations
- Section 6.4 added language to adjust "Resource Limited Unit" reporting time-frame and minimum run time requirements to place additional Fuel Limited Resources into the Maximum Emergency Category during long duration extreme weather events. Aligns with new section 3.5 requirements.
- Annual updates to Attachments E, F, and N

**Revision 66 (09/27/2018):**

- Section 2.3: Updated to clarify that TO may coordinate with BtMG to help on a voluntary basis with grid emergency.
- Section 5.4: Updated to clarify that TO may coordinate with BtMG to help on a voluntary basis with grid emergency. Also, PJM will include TO verified BtMG in PCLLRW tool or other as applicable
- Section 5.7: Updated to clarify that TO may coordinate with BtMG to help on a voluntary basis with grid emergency.

**Administrative Change (02/01/2018):**

- Update NERC references from EOP-004-2 to EOP-004 throughout the manual

**Revision 65 (12/22/2017):**

- Periodic review
- Section 1.3 Additional language added to the communications section to include references to communications with neighbors
- Deleted Sections 1.3.1, 1.3.2 and 1.3.3 due to redundant information being included in Manual 1.
- Section 2.2:
  - o Updated the DASR requirement to the new 2018 values.

  - Added BAL-002-2 related language to note that both generation and transmission configuration is monitored when determining the largest single contingency
- Section 2 and Section 5 updated to provide clarity regarding the emergency procedures that trigger a Performance Assessment Interval (PAI)
- Sections 2.3.2, 5.2 and 5.7 included notes to indicate which emergency procedures would trigger a Performance Assessment Interval (PAI).
- Section 3.4: Hot Weather Alert. Added language e to indicate an Alert can be issued at temps below 90-degrees during the spring and fall months depending upon impacts of generation and transmission outages that lower available capacity.
- Section 3.8: Added new section on the process for assessing and monitoring of gas infrastructure conditions. The process describes the triggers, assessment of impact to the electric system, and controlling actions.
- Revised all references to the FERC pager system to the FERC email address to be utilized for capacity deficiency notices.
- Revised all references from eLRS to DR Hub.

**Revision 64 (6/1/2017):**

- Attachments E updated with 2017/2018 Load Forecast information
- Attachments F updated with 2017/2018 Load Shed capability information

**Revision 63 (4/1/2017):**

- Introduction - Specified that M-13 is the PJM Emergency Operating Plan, as required by EOP-011
- Various updates to Sections 2 and 5 for EOP-011 compliance
  - Of note, EEA3 to be issued for Manual Load Dump Warning and Voltage Reduction Action due to new thresholds
- Creation of Section 7 TOP Operating Plan Submission and Review for EOP-011 compliance
- Modified all references to manual load shedding throughout the manual to clarify this should be implemented while minimizing overlap with automatic load shedding (EOP-011 update)
- Updated EOP-002 references to EOP-011
- Deleted Appendices 4 and 5 from Attachment K. Updated link to the NERC Event Analysis documentation.
- Updated all Load Dump references to Load Shed

**Revision 62 (2/23/2017):**

- Section 2.3.1, Voltage Reduction Summary Table updates:

- Updated FE East – PENLC and FE East – METED to reflect new consolidated MAIT TO entity as approved by 1/26/2017 FERC Order (ER17-214-001).

**Revision 61 (1/1/2017):**

- Cover to Cover Periodic Review
- General clean up and streamlining of language in the Capacity and Transmission Emergency Procedures
- Introduction: Added references to manual M-01, M-02, M-03, M-10, & M-28.
- Section 1.1: Included specific reference to PJM recalling/cancelling transmission and generation outages in the Policy
- Section 2.2: Reserve Requirements updated to reflect proper MAD reserve requirements, as well as information regarding the use of non-MAD resources to satisfy the MAD requirements if they are deliverable.
- Section 2.2: Day Ahead Schedule Reserve requirements updated for 2017
- Section 2.3.2 and 5.2: Clarified the Voltage Reduction Action definition and Manual Load Dump Action definition.
- Section 3.2: Conservative Operations expanded to cover additional scenarios as well as additional PJM Dispatch PJM Dispatch actions
- Section 3.3 and 3.4: Updated Hot and Cold Weather Alerts sections with a PJM action to recall transmission and generation outages. Included reference to M-10 for 72-hour generation maintenance outage recall language
- Section 3.4: Included reference to the Memorandum of Understanding on Natural Gas & Electric Interdependency.
- Section 5.4: Added reference to the PCLLRW tool.
- Section 5.6: Replaced NERC Policy 9 reference with IRO-006-EAST reference for TLR.
- Section 6.4: Seasonal and Periodic Fuel reporting section moved to M-14 with a clarifying note added.
- Struck references to manual M-35 (Definitions & Acronyms).
- Consistent reference to PJM ALL-CALL system throughout.
- Added bookmarks wherever “Attachment A” was referenced.
- Adjusted data retention period to align with PJM policy.
- Revisions to Attachment E for incorporating Dynamic Transfers.
- Deletion of Exhibits 5, 11, 12, 13 and 14. Renumbering of remaining exhibits

**Revision 60 (06/01/2016):**

- Cover to Cover Periodic Review
- Removed various references to Load Serving Entity (LSE) due to NERC retirement of the term and replaced them with Distribution Provider (DP) references.

- Section 2.3.1
  - Updated the Voltage Reduction Capabilities table with numerous changes based on TO capability changes and load forecast revisions.
  - Section 2.3.2 & Section 5.2
  - Added note to issue an EEA1 per EOP-002 if non-firm sales are curtailed due to emergency capacity conditions.
  - Added the term “Action” to Step 4A for consistency
  - Correctly referenced non-critical, not non-essential, station light and power.
  - Added a new Step 7: Deploy All Resources Action and renumbered subsequent “Steps” as well as updated Exhibit 1 accordingly.
- Section 3.3 Cold Weather Alert & Section 3.4 Hot Weather Alert
  - Added bullet to tie back to M-10 regarding updates to the ‘early return time’ for Planned generator outages.
- Section 3.7 GMD Operating Plan
  - Noted that TO GMD plans should be submitted via the process indicated in M-1 Attachment B
- Section 5.4
  - Updated “NOTE” to point to Section 5.7 for the Load Shed Directive process/
- Section 5.4.1
  - Added a NOTE to clarify priority for controlling the contingency overload and then running the Post Contingency Exceedance Analysis if needed.
  - Removed superfluous reference to M-03
- Section 5.5
  - Renamed ComEd interface to CE-East interface
- Section 5.7: Load Shed Procedure
  - This is a new section of the manual that was previously contained within M-03. The language was shorted for ease of use.
- Updated Attachment E with 2016 Load Dump Allocation numbers
- Updated Attachment F with 2016 Load Dump capability numbers
- Attachment G Capacity Emergency Matrix
  - Deleting this attachment. All information is already contained within Section 2.3.2.
- Corrected the revision histories for versions 53 – 58 to reflect the periodic reviews performed in system operations and reviewed through the SOS, OC, and MRC in 2015, 2014 and 2013

**Revision 59 (01/01/2016):**

- Section 2.2 updated Day Ahead Scheduling Reserve requirement for RFC effective January 1, 2016
- Section 2.3, 5.2 and Attachment C and G:
  - Renamed Maximum Emergency Generation Alerts to Maximum Generation Emergency Alerts for consistency with the Tariff
  - Renamed Maximum Emergency Generation to Maximum Generation Emergency for consistency with the Tariff
  - Updated steps 8 and 9 to include the word 'Action' in the procedure names for clarification
- Section 2.3 Voltage Reduction Action:
  - Based on member feedback, removed indication that generators connected below 230kV participate in the voltage reduction.
- Section 3.7 Geo-Magnetic Disturbances
  - Renamed to Geo-Magnetic Disturbance (GMD) Operating Plan (EOP-010-1)
  - Renamed GIC transfer limits to GMD transfer limits.
  - Created two subsections for GMD Warnings and GMD Actions
  - Renamed "Conservative Operations" to "Geomagnetic Disturbance Action"
  - Added requirement for TOs to coordinate their GMD Operating Plans with PJM.
  - Added language to strengthen compliance with EOP-010-1
- Administrative change to update all references from eMkt (retired 1/1/2016) to Markets Gateway
- Periodic Review

**Revision 58 (08/01/2015):**

- Administrative change updated references for EES to ExSchedule.
- Administrative change to convert remaining C#/H# references to W# references.
- Section 1.3.1, 1.3.2 and 1.3.3: Clarified these sections were in reference to 'unplanned' database/ICCP outages and referenced M-01 Attachment C for 'planned' outages
- Section 2.2 and 5.4: Added references to M-12 for Member actions when PJM loads 100% Synchronized Reserves and also a reference to the IRC process for reviewing reserve estimates.
- Section 2.3.2 and 5.2: Remove the term "Mandatory" from the Pre-Emergency and Emergency Load Management procedure names.
- Section 5.4: Included references the new PCLLRW eTool for issuing and responding to PCLLRWs.
- Attachment D: Revised the PJM phone number on the Emergency Bid Form
- Attachments E and F Load Shed tables updated for 6/1/2015 load forecasts

- Attachment F and N updated to include City of Rochelle load information
- Periodic Review

**Administrative Change (02/05/2015)**

- Updated Attachment N: IROL Load Dump Tables Effective Date to 01/01/2015 from 01/01/2014

**Revision 57 (01/01/2015):**

- Section 2.2 – Updated the DASR requirement to the new 2014/2015 values.
- Section 2.3:
  - Added 'Advisory' as an Emergency Procedure type
  - Added detail to the Warning, Alert and Action definitions.
  - Added a NOTE to give clarity for how unit owners received the "Unit Start Up Notification" Alert.
- Section 2.3.1 – Added the Voltage Reduction Summary table based on SOS-T Feedback
- Section 2.3.2 – Added clarity on the actions take prior to emergency procedures, included a statement about applying an Interchange Cap (based on ERPIV proposal)
- Section 2.4.1 – Added the Min Gen Advisory procedure
  - Section 3.3 & 3.4 – Cold/Hot Weather Alerts updated based on GUCC/ERPIV proposals for data entry updates and long lead commitment practices
  - Section 3.7 – Revised and updated the GMD procedure to include new monitoring stations and clarity on actions to take.
- Attachment A: Re-written, condensed & consolidated
  - Current version 4 Levels
  - Proposed version has 3 Levels, removing the Advisory level.
  - Current version has Hot and Cold discrete messaging H1-H4 & C1-C4
  - Proposed version has adjustable messaging W1-W3
- Section 5.5 and Attachment N – Removed Kammer/Belmont IROLs.
- Periodic Review

**Revision 56 (06/01/2014):**

- Section 2.2 Reserve Requirements
  - Corrected the Primary and Synchronized Reserve requirements to cover the "largest single contingency", not just the "largest unit".
- Section 2.3 Capacity Shortages and Section 5.2Transmission Security Emergencies
  - Exhibit 1 Action steps modified to reflect Pre-Emergency and Emergency Load Management

- Added language to the Maximum Emergency Generation Alert to include notice that Load Management may be required.
- Updates to Steps 1 and 2 to reflect the new categories and times.
- Noted that the minimum duration is 1-hr
- Added clarification that the official notice for CSPs to dispatch DR resources is the eLRS System. Emergency Procedures (EPs) will continue to be posted.
- The All-Call will continue to be issued but will be generic and indicate that DR has been called and that details are available on the EP website.
- Deleted Note 3 due to redundancy

- Section 2.4.8 High System Voltage
  - Revised the Black Oak SVC voltage settings based on changes in the field.
- Sections 2.3 and 5.2
  - Alerts to be issued 'in advance of the operating day', not just day ahead.
  - Revised steps under the Primary Reserve Alert, Warning and Actions to clarify that PJM does not grant environmental waivers but will work with the GO if requested/ notified.
  - Added a note to the Voltage Reduction alert to indicate staffing will be expected at stations that do not have SCADA control but are needed to implement a voltage reduction
  - Revised the Emergency Bid Form to indicate that email will be the primary means to submit the form, with fax serving as a back-up.
  - Clarified that Manual Load Shed is expected to be implemented in 5-minutes if Directed
- Section 3.3: Cold Weather Alert
  - Alerts to be issued 'in advance of the operating day', not just day ahead.
  - Changed the FE control zone names to the new naming convention
  - Added a note that PJM Dispatch will reach out to gas-fired generation owners to validate fuel supplies.
- Section 3.4: Hot Weather Alert
  - Alerts to be issued 'in advance of the operating day', not just day ahead.
  - Changed the FE control zone names to the new naming convention
  - Revised temperature triggers for a HWA for EKPC and Dominion to 93-degrees
- Section 5.4 Post Contingency Local Load Relief Warning
  - Added a step to indicate a "Load Shed Directive" message will be posted to the EP site if load shed is Directed.
- Section 5.4.1: Post-Contingency Load Dump Limit Exceedance Analysis

  - Added clarifying language to indicate pre-contingency load shed will not be directed in the case of a radial load pocket
- Attachment C
  - Eliminated Part C of the SSR for reporting of Load Response. These values will already be provided to PJM through the eLRS system by the CSPs.
- Attachment E: Manual Load Dump Allocation tables
  - Updated the Mid Atlantic Load shed table with the 2014/15 PY numbers
  - Update the FE company names
  - Eliminated the table for the Eastern portion of the Mid Atlantic
- Attachment F: Manual Load Dump Capability tables
  - Updated the Manual Load Dump capability table with the 2014/15 PY numbers
  - Update the FE company names
- Attachment G: Capacity Emergency Matrix
  - Updated the matrix with the load management changes made to sections 2.3 and 5.2
- Attachment N: IROL Load Dump Table
  - Update the FE company names
- Periodic Review

**Revision 55 (12/01/2013):**

- Section 2.2: Added a note under the reserve requirements to indicate the requirements may be raised during emergency and/or conservative operations.
- Section 2.2: Updated Load Forecasting Error metrics for 2014
- Section 2.3.2: References to ILR (interruptible load for reliability) have been removed.
- Section 2.3.2: Revised language to be consistent with M-28 changes that Emergency Energy Purchases by PJM will set LMP.
- Section 2.3.2: Revised order of emergency procedures so that Curtailment of non-essential plant and building load is curtailed as step 6, rather than step 7B: Manual Load Dump Warning.
- Section 2.3.2: Added Note 7 to reference the option to invoke CBM consistent with NERC MOD standards.
- Sections 2.3 and 2.4: Updates to Min Gen and Max Gen Alerts to include posting to the RCIS.
- Section 2.4: Added a step to set the Elroy 500kV caps to manual.
- Section 3.3 and 3.4: Cold and Hot Weather MW unavailability tables updated to include EKPC.
- Section 4: Deleted reference to CIP standards and added reference to EOP-004-2.

- Section 5.2: Revised order of emergency procedures so that Curtailment of non-essential plant and building load is curtailed as step 6, rather than step 7B: Manual Load Dump Warning.
- Section 5.4: PCLLRW language revised to indicate the PCLLRW is issued to the TO owning the equipment and that the TO is then responsible for confirming and notifying PJM that they have enough load to shed to control.
- Sections 6.1 and 6.1: Revised member reporting requirements per the requirements of EOP-004-2.
- Attachment J: Updated to include the new Operating Plan and with other event reporting changes as required by EOP-004-2.
- Attachment L: Deleted. The Transmission Emergency Alert and Security Emergency Alerts were retired by the NERC ORS
- Periodic Review

**Revision 54 (09/26/2013):**

- Removed the following from section 2.3: “NOTE: The following section on Unit Startup and Notification is not effective pending implementation of internal PJM tools and software”

**Revision 53 (06/01/2013):**

- This set of updates contains required changes for EKPC integration.
- 2013 Annual Review of M-13.
- Various grammatical and reference corrections throughout.
- Section 2.3.1: Correct reference to Attachment M, not N.
- Section 3.2: Added an unknown operating state as a potential reason to enter conservative operations.
- Section 5.4.1: Complete incomplete sentence.
- Section 5.5: Added COMED Reactive Interface to IROL list
- Attachment E: Updated with 2013 load values.
- Attachment F: Updated with 2013 load values.
- Attachment N: Add the EKPC Zone and COMED Reactive Interface.
- Update manual owner.
- Periodic Review

**Revision 52 (01/31/2013):**

- Updated Section 2.2 to remove reference to old regulation requirement. Also updated DASR requirement for 2013 values.

- Following a review of the Southwestern Blackout recommendations #13 and #23, updated Section 5.4 to include the two NOTEs regarding controlling actions for facilities exceeding their post-contingency limits.
- Following a review of the Southwestern Blackout recommendations #13 and #23, added Section 5.4.1 for a new analysis to be performed for any post-contingency flows exceeding 115% of a facility's load dump rating. (Section 5.4.1 to be effective as of 3/1/2013).
- Updated Section 5.5 and Attachment G to remove remaining references to Scarcity Pricing and add Cleveland Interface to list of IROLs.
- Updated Section 6 to reference RFC and SERC as potential RROs for notifications.

**Revision 51 (11/01/2012):**

- Section 2.2: Update regulation requirement to point to M-12
- Section 5.3 and throughout: Remove references to scarcity pricing due to shortage pricing changes. Rewrite portions of section based on shortage pricing rules.
- Section 3.3: Update Hot and Cold Weather Alert CT charts
- Section 3.7: Add new monitoring points at Libertyville and State Line.
- Section 6.2 and Attachment J: Add new NERC disturbance reporting email address.

**Revision 50 (06/28/2012):**

- Correction to load dump tables in Attachments E and F.

**Revision 49 (06/28/2012):**

- Annual Review of M-13
- Updated Attachment K to memorialize Event Investigation Process
- Reviewed Attachment N: IROL Load Dump tables – no changes required
- Attachments E & F - Updated load dump tables for 2012
- Added language to Sections 2.3 and 5.2 per the approved rules for unit startup and notification
- Changed NIPC references to DHS where applicable in Section 4
- Updated section 3.7 to include Waugh Chapel and Conastone.

**Revision 48 (04/03/2012):**

- Updated Sections 2.3.2 and 5.2 to reflect new rules for additional DR products and sub-zonal dispatch capability and to add more detail on PJM DispatchPJM Dispatch processes to identified curtailable transactions during emergencies.
- Update Section 2.4.8 to add clarity on PJM and member actions during a High Voltage Action.

- Updated Section 3.7 to add the severity level for which PJM will provide All-Call notification of an SMD.
- Update Section 5.4 to fix reference from Attachment G in M-03 to Attachment D in M-03. Also clarified language regarding post-contingency generation reductions.
- Updated Attachment C. Form for Part B of the SSR contained information regarding VCLC Alert language and also required information regarding capacity transfer between PJM and areas that are now internal.
- Updated Attachment J to include a link to the online version of the OE-417 form.

**Revision 47 (01/01/2012):**

- Updated Section 2.2 to reflect 2012 Day Ahead Scheduling Reserve requirement percentages. Also correct language regarding regulation requirement.

**Revision 46 (11/16/2011):**

- Corrections to Exhibit 3 in Section 4.1, to include missing Imminent Threat Level information.

**Revision 45 (11/16/2011):**

- Revisions performed as part of 2011 annual review of M-13.
- Updated Section 3.7 – Add clarity on the duration of an SMD event prior to taking action. Change SMD to GMD and company contacts.
- Updated Section 2.3.2 and 5.2 – Remove language stating PJM would load Maximum Emergency Generation prior to issuing a Primary Reserve Warning.
- Updated Attachment E – Clarified language on calculation of Net Zonal Capacity Position. Update screenshots of EMS load dump table.
- Updated Attachment N – Added zonal load shed percentage for AEP zone for AEP/DOM IROL. Added DEOK zone placeholder.
- Updated Attachment L – Removed references to Homeland Security Color scheme.
- Updated SSR Part G to reflect ability for PJM to request units not be placed in max emergency.
- Updates include what is needed for DEOK integration.

**Revision 44 (05/26/2011):**

- Updated tables in Attachments E and F which had errors in the previous posting of revision 43.

**Revision 43 (05/19/2011):**

- Updated Attachment N – IROL Load Dump table to reflect ATSI integration and new TRAIL line for 6/1/2011.
- Updated Attachment E

- Updated Attachment F

**Revision 42 (01/24/2011):**

- Section 2.2 – updated 2011 DASR % to 7.11%

**Revision 41 (10/1/2010):**

- Section 2.4.2 Minimum Generation Alert: Replaced existing note box to reflect revision to PJM tariff regarding Energy Resource Curtailments (Docket #ER10-1762-000).

**Revision 40 (08/13/2010):**

- Updated diagram in Exhibit 1 (Emergency Levels)
- Updated language in Load management (Section 5) to match language in Section 2
- Updated table in Attachment E
- Updated table in Attachment F
- Completed 2010 Annual Review of the EOP manual
  - Section 2 Capacity Emergencies, page 27, Step 7A (Real-Time): Voltage Reduction
  - Section 2.4.2: Minimum Generation Alert, page 32 updated text box:
  - Updated 6.1 Reporting System Disturbances to the Department of Energy, page 79
  - Updated 6.4 Fuel Limitation Reporting, page 81
  - All UDS entries changed to SCED.
  - All Scheduling Coordinator entries changed to Master Coordinator.
  - All PJM CA entries changed to PJM RTO.

**Revision 39 (01/01/2010):**

- Updated language in Load Management steps in section 2 and section 5, and Attachment G
- Updated table in Attachment F
- Updated IROL table in Attachment N

**Revision 38 (10/05/2009):**

- Updated Attachment E
- New Section 5.5 – IROL Load Dump Procedure
- New Attachment N – IROL Load Dump Table
- New High Voltage / Low Load Procedure – New Section 2.4.8
- Clarified language on Sabotage Reporting in Section 4.2
- Updated Attachment G with estimated time to implement

- Update Attachment J – EOP-004 Reporting Responsibilities

**Revision 37 (06/30/2009):**

- Updated date for 2009 Reserve Requirements
- Updated Contingency Control Notes in Section 2 for Wind
- Removed NERC and DOE reports and replaced with links to NERC standards
- Completed comprehensive annual review of the entire manual

**Revision 36 (01/30/2009):**

- Updated 2009 Reserve Requirements
- Updated Contingency Control Note – Section 5

**Revision 35 (11/07/2008):**

- Added steps and procedures for environmentally limited resources
- Updated load dump table
- Updated Operating Agreement Reference in Section 1
- Updated government notification language in Section 1

**Revision 34 (06/13/2008):**

- Section 3 and Section 6, Attachment C: Provided clarification for when Fuel Limited Gas Fired CTs should be placed into Maximum Emergency Resource Category.
- Modified Cold Weather/Hot Weather Alert to permit Emergency Procedure to be issued without Fuel Limited Resources being automatically placed into Maximum Emergency Resource Category, based on PJM Dispatch judgment.
- RPM Load Dump update
- Correct Operating Reserves
- Look at load dump table on page 127 - FE is duplicated
- Update Load Dump Table
- RFC / SERC Updated Disturbance Contacts

**Revision 33 (01/1/2008):**

- Updated language for Day Ahead Scheduling Reserves and Contingency Reserves to be effective 1/1/2008
- Draft Agenda for Conference Calls
- Additional corrections to ALM wording
- Updated OE-417 form and contacts

- Matched section 2 real-time emergency procedure language with section 5 real-time emergency procedure language

**Revision 32 (11/01/2007):**

- Corrections and clarifications to PJM Reserve Requirements notes
- Clarified issuing of NERC EEA levels
- Added note to clarify manual load shed after UFLS
- Added language for Gas Coordination for normal procedures for compliance with FERC order 698.
- Added general level for conservative operations
- Added clarifying language for Emergency Energy bids
- Added corrections to DOE reporting section.

**Revision 31 (09/28/2007):**

- Section 5: Transmission Security Emergencies: Revised definitions of Transmission Emergency Alerts and related procedures.
- Attachment J: Added latest version of Form OE-417.
- Added NERC Alert levels at Attachment M
- Updated Load Shed table in Attachment E
- Updated Annual Review language in overview
- Updated language in conservation request to add government agencies

**Revision 30 (05/24/2007):**

- Section 1: Added requirement for PJM to review manual (i.e. Emergency Operations Plan) on an annual basis in accordance with NERC and RFC standards.
- Section 2: Updated Reserve Requirements Table.

**Revision 29 (05/15/2007):**

- Attachment F: Updated to reflect PJM Manual Load Dump Capability attributes.
- Attachment J: Updated reporting requirements to U.S. Department of Energy to mirror DOE Form OE-417.
- Attachment K: Added NERC Disturbance Report form.
- Throughout: Added references to applicable NERC standards.

**Revision 28 (03/15/2007):**

- Section 2: Capacity Emergencies
  - Implement Full Emergency (Energy + Capacity) and Energy Only Option (Energy) Load Response.

  - Include Curtailment Service Providers as aggregators of Demand Resources for Full Emergency and Energy Only Option Load Response.
- Attachment G: Capacity Emergency Matrix
  - Modified to clarify Associated “Scarcity Pricing” with designated emergency procedure trigger points.
- Implement Full Emergency (Energy + Capacity) and Energy Only Option (Energy) Load Response.
- Introduction trimmed to eliminate redundant information.
- List of PJM Manuals exhibit removed, with directions given to PJM website where all the manuals can be found.
- Revision History permanently moved to the end of the manual.

**Revision 27 (09/05/2006):**

- Section 2: Capacity Emergencies
- Updated Reserve Requirements section to summarize minimum RFC requirements.
- Added NERC EEA 2 as part of Active Load Management (ALM), PJM Actions.
- Added Note 2 under Maximum Emergency Generation, PJM Actions, indicating that PJM should consider loading shared reserves prior to implementing voltage reduction.
- Added Note providing guidance as to when dispatch should consider dumping load to arrest frequency decline as part of Manual Load Dump.
- Added clarification on Light Load Emergency reductions during Minimum Generation Declaration and Event. Also added exhibits of associated eDART forms.
- Section 4: Sabotage/Terrorism Emergencies
- Added references to NERC Emergency Alert Security Levels to PJM Security Alert Levels exhibit.
- Section 5: Transmission Security Emergency
- Added section titled “Interconnection Reliability Operating Limits (IROL) Facilities,” identifying IROL facilities and providing operating guidelines.

**Revision 26 (07/26/06):**

- Section 1: Overview
- Modified Communications section to enhance coordination of ICCP link outages.
- Section 5: Transmission Security Emergency
- Modified Post-Contingency Local Load Relief Warning Section to include requirement to post on appropriate PJM web-site.

**Revision 25 (05/19/06):**

- Section 2: Capacity Emergencies

- Change “unit” references to “resource” as they apply to Demand Side Response providing Ancillary Services.
- Change “Spinning” references to “Synchronized” as they apply to Demand Side Resources providing Ancillary Services.
- Associated “Scarcity Pricing” with designated emergency procedure trigger points in section 2
- Included NERC Energy Emergency Alert 3 (EEA3) under Manual Load Dump Action.
- Added Event Investigation Process, as Attachment L.

**Revision 24 (02/22/06):**

- Revised all instances of Load Response Program and Load Reduction Program to Emergency Load Response Program.
- Revised all instances of Load Response Action to Load Reduction Action.
- Added note to Section 2, Step 4B (Real-time): Load Reduction Action.
- Revisions were made on the following pages: 33, 67, 68 and 121.

**Revision 23 (12/01/05):**

- Added Communications to Section 1, eliminated Voluntary Customer Load Curtailment and reordered Section 2, Added Inter RTO Natural Gas Coordination Procedures to Section 3, developed Section 5: Transmission Security Emergencies, modified Post Contingency Local Load Relief Warning, modified: Public/Media Notification Attachment, reordered sequence of Attachments. Included new Form OE-417 and revised instructions in Attachment J.

**Revision 22 (06/20/05):**

- Section 6: Added requirement to report anticipated capacity and energy shortages to FERC, per FERC Order No. 659, issued May 27, 2005

**Revision 21 (05/12/05):**

- Revised Attachment C: Manual Load Dump Allocation Tables.

**Revision 20 (02/04/05):**

- Revised Section 5, Post Contingency Local Load Relief Warning.

**Revision 19 (10/01/04):**

- General rearrangement of the Manual.
- Moved Sections 6 & 8 to a new manual entitled, System Restoration

**Revision 18 (04/23/04):**

- Attachment C: updated version of the Manual Load Dump Allocation Table.

**Revision 17 (03/03/04):**

- Section 3: Conservative Operation: Changed a reference to “PJM Generating Unit Reactive Capability Curve Specification and Reporting Procedures” being Attachment J in Manual 3, to being located as Attachment D in Manual 14D.
- Attachment D: PJM Manual Load Dump Capability: Added a row for AP and the Total Column has been updated.
- Added Attachment J: Teleconference Protocol Guidelines

**Revision 16 (12/11/03):**

- Section 2: Light Load Procedures: Revised to include curtailment of External Network Designated Resources. Included Local Minimum Generation Action to control localized overgeneration resulting in transmission or stability events.
- Section 3: Conservative Operations: Revised to include clarification to Heavy Load Voltage Schedule.
- Attachment C: Load Dump Allocation Tables: Relabeled table from PJM RTO to PJM. Provided note regarding PJM West Region Load Dump Allocation.

**Revision 15 (05/01/03):**

- Attachment C: Manual Load Dump Allocation Tables
- Revised allocation percentages based on 2002 Summer and 2001/02 Winter Load conditions.

**Revision 14 (04/01/03):**

- Revised Section 3: Conservative Operation. Updated to include procedures for ‘Post Contingency Local Load Relief Warning’ and to bring the PJM threat levels into alignment with Homeland Security and NERC. PJM adopted the color scheme now in use by Homeland Security.

**Revision 13 (01/01/03):**

- Revised Attachment I: Conservative Operations – Crisis Response. Updated Appendix 6: Threat Alert System and Physical Response guidelines for the Electricity Sector. Added new Appendix 7: Emergency Incident and Disturbance Report.

**Revision 12 (04/01/02):**

- Introduction: Expansion of Emergency Conditions and description of target users.
- Section 1: Overview
  - Expansion of Emergency Condition description. Inclusion of Emergency Authority.
- Section 2: Capacity Conditions
  - Defined rules regarding level to which PJM/PJM West will implement Emergency Procedures, revised PJM triggers for NERC Energy Emergency Alert notification levels., clarified delineation of duties among Generation / Transmission / LSE /

Marketer, reflected name change from Security Coordinator to Reliability Coordinator, modified exhibit 2.1 and 2.4, incorporated Load Reduction Action, and revised Action to incorporate ALM terms / restrictions.

- Section 3: Conservative Operations
  - Revised to include, 'Heavy Load Voltage Schedule Warning' and 'Crisis Response'.
- Section 8: System Restoration
  - Clarified 'PJM Operator Responsibilities During Restoration', clarified duties among Generation / Transmission / Load Serving Entities, clarified / consolidated 'PJM Assumes Control', eliminated 'Emergency Procedures', consolidated redundant material, incorporated satellite phone and PJM West.
- Attachment E: Minimum Generation Calculation for Midnight Period
  - Removed company names from form.
- Attachment G: Public/Media Notification Message
  - Revised Alert messages / examples.
- Attachment I: Crisis Response – Conservative Operations
  - Incorporated new attachment / appendices.

**Revision 11 (6/01/01):**

- Section 2: Capacity Conditions
  - Revised Light Load Procedures.
- Section 3: Conservative Operation
  - Revised to include, 'Heavy Load, Low Voltage Conditions' and 'Reporting Threats to Power System Infrastructure'.
- Section 5: Fuel Limitation Reporting
  - Complete revision and name change of section.
- Section 7: Severe Weather Conditions
  - Revised Cold Weather Alert.
- Attachment A: Supplementary Status Report
  - Revised forms.
- Attachment C: Manual Load Dump Allocation Tables
- Revised to include Summer 2001 allocations.

**Revision 10 (12/01/00):**

- Section 2: Capacity Conditions
  - Revised to include the incorporation of NERC EEA levels.
- Attachment A: Definitions and Abbreviations

- Removed Attachment A and all references. Attachment A is being developed into a new PJM Manual for ***Definitions and Abbreviations (M-35)***. All remaining attachments have been renumbered and all references have been corrected.

**Revision 09 (06/01/00):**

- Revised Attachment I: Emergency Bid Form.

**Revision 08 (04/01/00):**

- Section 2: Capacity Conditions
  - Removed all reference to Maximum Scheduled Generation.
  - Revised Exhibit 2.1: Emergency Levels, removed reference to Maximum Scheduled Generation; also revised Exhibit 2.4: Shortage Actions, removed reference to Maximum Scheduled Generation.
- Section 3: Conservative Operations
  - Removed all reference to Maximum Scheduled Generation.
- Section 5: Fuel Disruption Plans
  - Removed all reference to Maximum Scheduled Generation.
- Section 8: System Restoration
  - Added new subsection: “Guidelines for Area Interconnection and Use of External Power during System Restoration”.
- Section 9: Transmission Loading Relief
  - Removed all reference to Maximum Scheduled Generation.
  - Revised Exhibit 9.1: Initiation of NERC TLR Process, removed reference to Maximum Scheduled Generation.
- Attachment B: Supplementary Status Report
  - Removed all reference to Maximum Scheduled Generation.
  - Revised Exhibit B1: Supplementary Status Report Information Reported by Local Control Center – Page 1, removed reference to Maximum Scheduled Generation. Revised Exhibit B2: Supplementary Status Report Information Reported by Local Control Center – Page 2, removed reference to Maximum Scheduled Generation. Revised Exhibit B5: PJM Maximum Generation Report – Page 1 of 2, removed reference to Maximum Scheduled Generation. Revised Exhibit B6: PJM Maximum Generation Report – Page 2 of 2, removed reference to Maximum Scheduled Generation. Revised Exhibit B7: PJM System Status Report – Page 1 of 3, removed reference to Maximum Scheduled Generation. Revised Exhibit B8: PJM System Status Report – Page 2 of 3, removed reference to Maximum Scheduled Generation.

**Revision 07 (01/24/00):**

- Attachment B: Supplementary Status Report

- Revised all supplementary status forms.

- Attachment D: Manual Load Dump Allocation Tables
  - Revised Exhibit D.1: Manual Load Dump Allocation –PJM RTOs and revised Exhibit D.2: Manual Load Dump Allocation – Eastern PJM RTO.
- Attachment G: Restoration Forms
  - Revised all restoration forms.
- Attachment H: Public/Media Notification Messages
  - Revised and replaced previous Attachment H: Government Notification Messages.
- Attachment I: Emergency Bid Form
  - Revised Emergency Bid Form, changed ‘Bid Price of Energy’ (Mils) to ($/MWh).

**Revision 06 (06/03/99):**

- Section 9: Transmission Loading Relief
  - Added this section to describe PJM procedures for implementing NERC Transmission Loading Relief (TLR).

**Revision 05 (03/17/99):**

- Section 2: Capacity Conditions
- Added new instruction, “Three Hours Prior to Light Load Period”, and revised “Minimum Generation Emergency Declaration” and “Minimum Generation Event”.

**Revision 04 (01/10/99):**

- Attachment B: Supplementary Status Report
  - Revised Forms and Supplementary Status Report Terminology.

**Revision 04 (10/08/98):**

- Attachment G: Restoration Forms
  - Revised "PJM Composite Initial Restoration Report," "Information To Be Exchanged Between Two Companies/Areas Prior To Interconnecting" and "PJM Assumes Control."
  - Added "Company Initial Restoration Report," "PJM Composite Hourly Restoration Report," "Company Hourly Generation Restoration Report" and "Company Hourly Transmission Restoration Report."
  - Deleted "LSE Hourly Report - Generation Restoration Report 1" and LSE Hourly Report - Transmission Restoration Report 2."

**Revision 03 (06/09/98):**

- Added Attachment H: Government Notification Messages

- Added Attachment I: Emergency Bid Form

**Revision 02 (03/25/98):**

- Attachment 2: Capacity Conditions
  - Revised text.
- Section 3: Conservative Operation
  - Revised text.
- Attachment 7: Severe Weather Conditions
  - Revised text.
- Attachment B: Supplementary Status Report
  - Revised text and forms.

**Revision 01 (10/14/97):**

- Changed “Hydro Unit Pick-Up Factor” from 5% to 15% in Exhibit G: PJM Assumes Control of Attachment G: Restoration Forms.
- Deleted “attempt sales to outside” from “Minimum Generation Emergency Declaration in Section 2 “Capacity Conditions.“
- Revised “PJM Actions” under “Minimum Generation Event” in Section 2 “Capacity Conditions” to:
  - (1) PJM Dispatcher loads all remaining pumps and reduces run-of-river plant energy, where reservoir elevation and river flow allow, without spilling water or violating reservoir elevation limits.
  - (2) PJM Dispatcher reduces the PJM DispatchPJM Dispatch signal to zero.
  - (3) Cancel Spot Market Purchases bid at zero (0).
  - (4) If Transmission Constrained, follow the Guidelines for Constrained Operations
  - (5) Collect Reducible Generation Information, if not already obtained.
  - (6) Declare a Minimum Generation Event
  - (7) PJM Dispatcher requests Local Control Centers to reduce Emergency Reducible Generation (ERG), in proportion to the total amount of ERG reported.
  - (8) Attempt to sell Emergency Energy to external systems.
  - (9) In concert with the Local Control Centers, PJM Dispatcher recommends the shutdown of specific units that are not required for area protection during the current load period or the subsequent on-peak period. PJM Dispatcher recommends return times for these units.
- from:

- (1) PJM Dispatcher loads all remaining pumps and reduces run-of-river plant energy, where reservoir elevation and river flow allow, without spilling water or violating reservoir elevation limits.
- (2) PJM Dispatcher reduces the PJM Dispatch PJM Dispatch signal to zero and attempts to sell excess generation to external systems.
- (3) PJM Dispatcher requests Local Control Centers to reduce Emergency Reducible Generation (ERG), in proportion to the total amount of ERG reported.
- (4) In concert with the Local Control Centers, PJM Dispatcher recommends the shutdown of specific units that are not required for area protection during the current load period or the subsequent on-peak period. PJM Dispatcher recommends return times for these units.

**Revision 00 (04/30/97):**

This revision is a draft of the PJM Manual for ***Emergency Operations***.

- Added Supplementary Status Report Information Reported by PJM Member (Exhibit B.6, Exhibit B.7) and Supplementary Status Report Terminology to Attachment B (Supplementary Status Report).
- Added the following paragraph to the Restoration Process in Section 8 (System Restoration):
  - Nuclear units require additional consideration. Restoring customer load will normally need to be accomplished without the help of nuclear units. NRC start-up checklists do not permit hot restarts of nuclear units and their diesels are not permitted to supply auxiliary power to other generating stations. Nuclear units that are taken off line on a controlled shutdown can normally be restored to service between 24 and 48 hours following the controlled shutdown.
- Added the following item (3) to the Market Participant Actions of Implement Restoration Procedure in Section 8 (System Restoration):
  - (3) Off-site power should be restored as soon as possible to nuclear units, both units that had been operating and those that were already off line prior to the system disturbance, without regard to using these units for restoring customer load.
- Added the following paragraph to Governmental Notification & Public Appeals Procedures in Section 1 (Overview):
  - PJM will notify emergency contacts in state agencies within the PJM RTO. Specific notification of state and other agencies by PJM Members may also be required.
- Changed references to PJM Interconnection Association to PJM Interconnection, L.L.C.
- Changed references to PJM to PJM where appropriate.
- Changed references to PJM to PJM RTO where appropriate.
- Changed references to PJM IA to PJM.
- Changed references to IA to PJM.

- Changed references to Mid-Atlantic Market to PJM Interchange Energy Market.
- Changed references to Mid-Atlantic Market Operations Agreement to Operating Agreement of PJM Interconnection, L.L.C.
- Changed references to pool to control area.
- Changed references to parties to PJM Members.