




System Operating Procedures

SOP-RTMKTS.0120.0050

Implement Solar Magnetic Disturbance Remedial
Action

Effective Date: February 4, 2011
Revision No. 13

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1. Objective


The objective of this procedure is to provide a guide for operating the New England Bulk Power System during a Solar Magnetic Disturbance (SMD) and maintain the reliability of the bulk power system. This procedure documents the responsibilities of ISO New England (ISO) staff and does not in any way change the intent of Northeast Power Coordinating Council, Inc. (NPCC) C-15 Procedures for Solar Magnetic Disturbances Which Affect Electric Power Systems (NPCC C-15), but rather is intended to clarify responsibilities delegated to the ISO staff.

Additionally, this procedure directs the ISO staff on the detailed communications required in order to support its assigned responsibilities as set forth in NPCC C-15.

2. Background

Solar Magnetic Disturbance (SMD) events occur on the sun, which can ultimately affect man-made systems on earth, including power systems. A detailed description of SMD events is contained in NPCC C-15.

The NPCC Areas receive, on a continual basis, the status of solar activity and geomagnetic storm alerts from the Solar Terrestrial Dispatch (STD). The primary mechanism for notification is the STD Geomagnetic Storm Mitigation System (GSMS), an active communications software package installed in the ISO Control Room. Upon receipt of a geomagnetic storm alert from STD of level Kp 6 or higher, the GSMS automatically actuates to inform the System Operators. Although significant redundancy is incorporated in the dissemination of the solar alerts provided by the STD, in the event that all communication is lost with STD ISO shall in the interim rely on back up methods for solar forecasts and alerts issued by the governmental agencies of the United States and Canada. These are, respectively, the Space Environment Center (SEC) of the National Oceanic and Atmospheric Administration (NOAA), located in Boulder, Colorado and the Geological Survey of Canada, Department of Natural Resources Canada (NRCAN).

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3. Responsibilities

NOTE:


Any North American Electric Reliability Corporation (NERC) Certified System Operator, certified at the RC level, has the authority to take action(s) required to comply with NERC Reliability Standards.

The Solar Terrestrial Dispatch is the primary means of receiving SMD information.

1. The Operations Shift Supervisor and Senior System Operator are responsible for acknowledging receipt of and responding to SMD alerts from the GSMS.
2. In the event that conflicting data is received from a source other than the STD (i.e., SEC, NOAA, NERC or NRCAN), the Operations Shift Supervisor and Senior System Operator are responsible for using the “Submit Notifications” feature of the GSMS to automatically notify the other NPCC Areas and the STD of the activity and to resolve discrepancies.

4. Controls

- Only NERC Certified System Operators, certified at the RC level, shall be allowed to take real-time actions involving system security

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5. Instructions

5.1 Actions for Solar Terrestrial Dispatch SMD Notifications

NOTE


All time alerts issued by the STD GSMS are disseminated in Universal Time [Greenwich Mean Time (GMT)].

1. If information regarding the SMD event originated from the STD GSMS (Kp 6 or greater), the Senior System Operator should respond using the GSMS software as follows:
 - A. Click on the “Confirm Receipt”
 - B. Click on the applicable button.
 - (1) “No GIC activity has been observed yet”
 - (2) “Weak GIC activity has been observed”
 - (3) “Moderately strong GIC activity has been observed”
 - (4) “Strong GIC activity has been observed”
2. If information regarding the SMD event originated from the STD GSMS is a Kp 7 or greater, the Senior System Operator shall:
 - A. Use the Control Room Reports tool to electronically complete Attachment A – SMD Reporting
 - B. Make a log entry in the Control Room Event Logserver per SOP-RTMKTS.0125.0040 - Update Control Room Logs


NOTE

Electronic Copies of Attachment A - SMD Reporting are archived for three (3) years plus the current year.

3. When a geomagnetic storm alert from the STD predicting at least a 40% probability of activity at levels of Kp 7 or greater is received, the Operations Shift Supervisor should review the existing and planned operations for vulnerability.

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4. The Operations Shift Supervisor, after consultation with each Local Control Center (LCC), each neighboring Reliability Coordinator/ Balancing Authority (RC/BA), SMD monitoring sites and if time permits Manager, Control Room Operations or Director, Operations shall evaluate the situation and perform the following as appropriate:
 - Discontinue maintenance work and restore out of service high voltage transmission lines. Avoid taking long lines out of service
 - Maintain system voltages within acceptable operating range to protect against voltage swings
 - Review the availability of the Chester SVC and capacitor banks to respond to voltage deterioration if necessary
 - Adjust the loading on Phase II, the Cross Sound Cable and Highgate HVdc ties to be within the 40% to 90% range of nominal rating of each pole
 - Reduce the loading on inter-Area ties and on other internal critical transmission lines and interfaces to 90%, or less, of their security limits
 - Consider posturing Generators operating at their Eco Max to provide room for reserves and reactive capacity in accordance with SOP-RTMKTS.0120.0020 - Implement Capacity Remedial Action
 - Dispatch generation to manage system voltage, tie line loading and to distribute operating reserve
 - Bring equipment capable of synchronous condenser operation on line to provide reactive power reserve
 - In conjunction with personnel at those locations where SMD measurements are to be taken, ensure the monitoring equipment is in service
 - Consider the impact of tripping large shunt and series capacitor banks and static VAR compensators
5. Based on the above review, the Operations Shift Supervisor shall implement Master/Local Control Center Procedure No. 2 - Abnormal Conditions Alert (M/LCC 2) per SOP-RTMKTS.0120.0010 - Implement Operations During Abnormal Conditions.
6. Log actions taken in the Logserver per SOP-RTMKTS.0125.0040 - Update Control Room Logs.

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5.2 Actions for SMD Notifications Not Received By the Solar Terrestrial Dispatch


NOTE

If the STD GSMS is unavailable, back up methods of communicating SMD events can occur from NERC, the Space Environment Center (SEC) of the National Oceanic and Atmospheric Administration (NOAA) or the Geological Survey of Canada, Department of Natural Resources Canada (NRCAN).

NERC communications occur through the Reliability Coordinator Information System (RCIS). The SEC and NRCAN provide forecasts of geomagnetic activity to the NYISO. The NYISO subsequently disseminates this information to the each RC/BA within NPCC.

1. If SMD notifications are received from a back up method with a magnitude of Kp 7 or greater and the STD GSMS is unavailable, the Senior System Operator shall perform the following until clarifying information is received from STD:
 - A. Use the Control Room Reports tool to electronically complete Attachment A - SMD Reporting.
 - B. Make a log entry in the Logserver per SOP-RTMKTS.0125.0040 - Update Control Room Logs.
 - C. If SMD notifications predicting at least a 40% probability of activity at levels of Kp 7 occur, perform Steps 5.1.4 through 5.1.6.
2. When Geomagnetically Induced Currents (GIC) alarms are reported at the Chester SVC site, the Senior System Operator shall take the following actions:
 - A. Make an entry in the Logserver per SOP-RTMKTS.0125.0040 - Update Control Room Logs.
 - B. Report the GIC alarm using the “Submit Notifications” tab in the GSMS software using the GIC levels in the following table:

Table 1		
GIC Level	Severity	XFMR Neutral DC Current
1	Minor	5-14 Amps
2	Moderate	15-29 Amps
3	Major	30-59 Amps
4	Severe	>60 Amps

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- C. When a GIC Level 2 or above alarm is received and SMD notifications have been received with a magnitude of Kp 7 or greater, the Senior System Operator shall:
- (1) Use the Control Room Reports tool to electronically complete Attachment A - SMD Reporting.
 - (2) Make a log entry in the Logserver per SOP-RTMKTS.0125.0040 - Update Control Room Logs.

NOTE

Electronic Copies of Attachment A - SMD Reporting are archived for three (3) years plus the current year.

NOTE

If multiple GIC alarms occur during one shift at relatively the same level then logging may occur only once per shift. If multiple occurrences with increasing intensity occur during one shift, such as a level one to a level 4, each variance should be logged.


3. If conflicting information occurs between the notifications received by STD and one of the back-up methods, the Senior System Operator should report the discrepancy using the “Submit Notifications” tab in the GSMS software.

NOTE

If conflicting information occurs then determine whether to perform actions in regards to the event, which has the greater magnitude (highest Kp value) until clarified by the STD.

5.3 Communications

1. When significant action has been taken due to SMD activity of Kp-7 or greater, the Operations Shift Supervisor shall notify ISO management and staff by e-mail and/or pager using the “Control Rm Emergency Event Rpt” group e-mail listing and describe exactly what steps were taken to mitigate SMD effects as well as noting the level, duration, and related incidents (if any).
2. Activity regarding SMD \geq Kp-6 should be noted daily on the Morning Report.
3. ISO shall contact and provide notification of any Kp-7 or greater, including intensity and duration, to each LCC.

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6. Performance Measures

This procedure is deemed to be properly followed as evidenced by the following:

- Goal for Corporate performance in CPS1, CPS2 and DCS (Disturbance Control Standard) compliance met

7. References

Master Local Control Center Procedure No. 2 - Abnormal Conditions Alert (M/LCC 2)

Northeast Power Coordinating Council, Inc. Document C-15, Procedures for Solar Magnetic Disturbances Which Affect Electric Power Systems (NPCC C-15)


SOP-RTMKTS.0120.0010 - Implement Operations During Abnormal Conditions

SOP-RTMKTS.0120.0020 – Implement Capacity Remedial Action

SOP-RTMKTS.0125.0040 – Update Control Room Logs

8. Revision History

Rev. No.	Date	Reason	Contact
0	02/13/03	Initial procedure for SMD	Don Gates
1	05/6/03	Change email address	Don Gates
2	6/3/03	Revise procedure for current practice	Don Gates
3	11/16/03	Modified Controls and Performance Measures to align with ISO 9001 standards	Don Gates
4	11/21/03	Revise to coincide with new RD-09 document	Don Gates
5	02/01/05	Updated SOP for RTO terminology	Steve Weaver
6	03/29/05	Revised to incorporate the VELCO Local Control Center	Steve Weaver
7	10/14/05	Changed Attachment A sheets delivery to electronically instead of using paper	Steve Weaver
8	01/09/07	Revised to conform with NPCC C-15	Steve Weaver
9	12/20/07	Revised for NSTAR LCC and NRI	Steve Weaver
10	03/19/09	Periodic review performed	Steve Weaver

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11	04/02/09	Minor editorial changes; Corrected the title for NPCC C-15 in the Objective and References Sections; Defined acronyms for Local Control Center (LCC) & Control Areas/Balancing Authorities (CAs/BAs) Step 5.1.5 replaced Manager, Operations with Director, Operations; Step 5.2.2. defined the acronym GIC; Added new Attachments C & D	Steve Weaver
12	12/30/09	Deleted steps 5.1.2. & 5.1.3 with new Step5.1.2., 5.1.2.A, & B.; New NOTE following step 5.1.2.B; Modified step 5.1.4 6 th bullet; Added new step 5.1 6.; Modified Step 5.2.1.; replaced Step 5.2.1.A. & B. with a new sub-steps; Modified Step 5.2.1.C.; Modified step 5.2.2.; replaced sub-step 5.2.2.A with two new sub-steps 5.2.2.A & B.; Added new note following step 5.2.2.B.; replaced Steps 5.2.2.C (1)-(3) with two new sub-steps (1) & (2); Added new NOTE following step 5.2.2.C.(2)	Steve Weaver
13	02/04/11	Biennial review by procedure owner; Updated Header copyright date; Replaced Footer page numbers with Page X of Y format; Modified text in Section 3 NOTE; Modified step 5.1.1 by adding sub-steps; Step 5.1.4 replaced Control Area/Balancing Authority (CA/BA) with Reliability Coordinator/Balancing Authority (RC/BA) Modified Section 5.2 NOTE, step 5.2.2.B, and step 5.2.3; Added step 5.3.3; Section 7 added SOPs RTMKTS.0120.0020 & 0125.0040; Section 9 modified Attachment B (title changed to Retired; Attachment B was retired	Steve Weaver


9. Attachments

Attachment A - SMD Reporting

Attachment B - Retired

Attachment C - Solar Activity Reporting Form

Attachment D - Time Conversion Reference Document

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Attachment A - SMD Reporting

Received By: _____ Date: _____ Time: _____

Received From: _____

Intensity: Kp- _____ Index _____

Duration of SMD Event:

From: _____ Date _____ Hour _____

To: _____ Date _____ Hour _____

Comments: _____

Notifications:

NYISO* CONVEX REMVEC NBSO*

NSTAR


IESO* PJM* Maine Local Control Center New Hampshire Local Control Center

TransEnergie* VELCO


* Notifications not required if SMD event was received from STD GSMS

Actions Taken and Other Notifications: _____

Reported Equipment Damage: _____

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Attachment B - Retired

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Attachment C - Solar Activity Reporting Form

The predictive measure of solar activity reported by the Solar Terrestrial Dispatch is the Kp index, a scale divided into 27 zones of solar activity. A description of these zones and the relationship between the observed Kp index and typically observed GIC activity follows:

Kp Index	Solar Activity	GIC Activity
0o	Quiet	No GICs
1-		
1o		
1+		
2-		
2o		
2+		
3-		
3o		
3+		
4-		
4o		
4+		
5-	Minor Storm	Low Level GICs
5o		
5+		
6-	Major Storm	
6o		
6+		
7-	Severe Storm	Moderate GIC
7o		
7+		
8-	Very Severe Storm	Strong GICs
8o		
8+		
9-		
9o		

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Attachment D - Time Conversion Reference Document

The time reference used in the solar alerts disseminated by the Solar Terrestrial Dispatch, as well as the Department of Natural Resources Canada and the Space Environment Services, is the scientifically accepted Universal Time (UT), which is also equivalent to Greenwich Mean Time (GMT). The prevailing Eastern Time lags Universal Time / Greenwich Mean Time by five hours in the autumn and winter. The prevailing Eastern Time lags Universal Time / Greenwich Mean Time by four hours in the spring and summer. Conversion examples for the Eastern Time zone follow:

Eastern Standard Time (EST)	Universal Time (GMT)
12:00 hour	17:00 hour

Eastern Daylight Time (EDT)	Universal Time (GMT)
13:00 hour	17:00 hour