



## **Manual 12**

# **Transmission and Dispatch Operations Manual**

**Issued: March 2021**

#### **4.2.9. Operating Under Adverse Conditions**

The NYISO shall operate the NYISO secured transmission system during adverse conditions, including but not limited to peak load system conditions, thunderstorms alerts, hurricanes, tornadoes, solar magnetic flares and threat of terrorist activities, in accordance with the Reliability Rules, inclusive of LRRs and related PSC orders. Consistent with such Rules, the NYISO shall maintain reliability of the NYISO Controlled Transmission System by directing the adjustment of the Generator output levels in certain areas of the system to reduce power flows across transmission lines vulnerable to outages due to these adverse conditions, thereby reducing the likelihood of major power system disturbances.

The NYISO shall have the sole authority to declare that adverse conditions are imminent or present and invoke the appropriate operating procedure(s) affecting the NYISO Controlled Transmission System in response to those conditions. Activation of a procedure in compliance with a LRR shall involve a two step process. The TO, directly involved with such LRR, such as Storm

Watch shall advise the NYISO that adverse conditions are imminent or present and recommend to the NYISO the activation of applicable procedures in support of that rule. Consistent with the LRR, the NYISO shall declare the activation of the appropriate procedures. The TO and the NYISO shall coordinate the implementation of the applicable procedures to the extent that NYISO secured transmission system facilities are impacted. Records pertaining to the activation of such procedures and the response in accordance with those procedures shall be maintained and made available upon request.

Adjusted generation levels in response to activation of these procedures shall set the real time LBMPs. Revenue shortfalls may occur if the redispatch of the system curtails energy scheduled DayAhead and more expensive energy is dispatched subsequent to the Day-Ahead settlement. These revenue shortfalls shall be recovered through the NYISO's Scheduling, System Control, and Dispatch Service (Ancillary Service) charges.

#### **4.2.10. Adverse Operating Conditions**

##### ***NYISO Actions***

The NYISO may perform the following actions under adverse operating conditions:

1. Notify all TOs and NPCC Control Areas.
2. Reduce RTC/RTD Stability Transfer Limits and RTC/RTD Central East Voltage Transfer Limits to 90% of the Stability Transfer Limit and Central East Voltage Transfer Limits where appropriate.
3. Reduce flows on inter-area and internal NYISO secured transmission lines to a maximum of 90% of the Normal Rating.

4. Cancel in-service relay and hot line work on A-1 transmission facilities. Recommend TO cancel in-service relay and hot line work on A-2 transmission facilities.
5. Restore out-of-service A-1 transmission facilities where possible. Recommend TO restore of out-of-service A-2 transmission facilities where possible.
6. Request TOs to implement appropriate emergency procedures when a contingency occurs.

#### ***Transmission Owner Actions***

1. Implement NYISO requests to cancel in-service relay and hot line work on A-1 transmission facilities. Evaluate cancellation in-service relay and hot line work on A-2 transmission facilities.
2. Implement NYISO requests to restore out-of-service A-1 transmission facilities. Evaluate restoration of out-of-service A-2 transmission facilities.
3. Notify the NYISO of all actions taken related to this section.
4. Implement Emergency procedures, as requested by the NYISO.

#### **4.2.11. Solar Magnetic Disturbances**

##### ***Background***

The sun emits streams of charged protons and electrons known as the solar wind. The intensity of the solar wind is determined by sunspot activities (solar flares, disappearing filaments, and coronal holes). The solar wind interacts with the earth's magnetic field producing auroral currents at altitudes of 100 kilometers that follow circular paths around the earth's geomagnetic poles. These non-uniform currents then cause time-varying fluctuations in the earth's magnetic field, which in turn induce a potential difference on the surface of the earth. This Earth-Surface Potential (ESP) is measured in volts per kilometer and its magnitude and direction are functions of the change in magnetic field, earth resistivity, and geographic latitude. ESP increases with increasing latitudes and its gradient is highest on facilities having an east-west orientation. ESP is highest in igneous rock areas. The resulting ESP appears as an ideal voltage source applied between grounded neutrals of wye-connected transformers in a power system, causing Geomagnetically Induced Current (GIC) to flow between grounded neutrals via transmission lines.

During a severe Solar Magnetic Disturbance (SMD), the quasi-dc ground induced current superimposed on the normal 60 Hertz power flow can result in half-cycle saturation of the cores of grounded, wye-connected power transformers. This over-excitation may cause the following power system problems:

1. Transformer overheating resulting in premature transformer failure
2. Increased system reactive losses resulting in the depletion of MVar reserve
3. Decreased bus voltages resulting in a possible system voltage collapse

4. Increased 60 Hertz harmonics resulting in overheating and eventual tripping of static var compensators (SVCs) and shunt capacitors, protective relay misoperations, and interference with communication systems
5. Saturation of current transformers resulting in metering errors and relay misoperations
6. System voltage distortions resulting in improper operation of generator automatic voltage regulators and commutation failures in HVDC terminals and SVCs.

### **Monitoring**

The NYISO receives SMD forecasts and alerts from two agencies:

1. Electronically, via the Solar Terrestrial Dispatch Geomagnetic Storm Mitigation System (STD GSMS).
2. Space Environment Services Center (SESC) in Boulder, Colorado

An SMD forecast indicates that the condition is expected. An SMD alert indicates that the condition has occurred.

These agencies measure the disruption in the horizontal component of the earth's magnetic flux with magnetometer. The STD GSMS is kept continuously up to date by Solar Weather Specialists located at [www.spacew.com](http://www.spacew.com). SESC measures the geomagnetic activity in Boulder, Colorado. This information is quantified into A and K indices for forecasting and alerting purposes. The impact of an SMD on the power system increases with the intensity of the storm.

Information pertaining to Solar Magnetic Disturbances and the level of the disturbance will be disseminated by means of the STD GSMS. As described in NPCC Procedure C-15 or its replacement, Solar Terrestrial Dispatch (STD) using the Geomagnetic Storm Mitigation System (GSMS) is the primary mechanism for notification of SMD information to all NPCC Areas. STD will issue a Warning for forecasted Kp levels, and issue an Alert for observed Kp levels. Warnings and Alerts are issued using a Kp index based on activity. The Kp Index quantifies disturbances in the horizontal component of earth's magnetic field with an integer in the range 0-9 with 1 being calm and 5 or more indicating a geomagnetic storm. The Kp Index is derived from the maximum fluctuations of horizontal components observed on a magnetometer during a three-hour interval.

### **SMD Forecasts and Alerts**

STD through the GSMS allows for continuous updating on current Solar Magnetic Disturbance activity, as well as 24-, 48- and 72-hour predictions on SMD activity. Currently, the STD uses a Kp Index, but does not specify by level what Forecast or Alert is issued. They are issued depending on the activity seen by their satellite in regards to predicted and actual SMD activity.

The STD GSMS software classifies GIC activity at three levels:

Weak: observed GIC of 15 amps or less

Moderate: observed GIC of between 15 and 30 amps

Strong: observed GIC of greater than 30 amps

Voltage fluctuations at a transmission or generator substation can also be an indication of GIC activity.

SESC (Boulder) issues forecasts in the form of 3-Day Geomagnetic Forecast and issues alerts in the form of a three-hour "K" index that is based on the average of the last three hours of disruption in the horizontal component of the earth's magnetic flux measured in Boulder, Colorado. SESC (Boulder) transmits alerts of "K" index of K5 or above to the NYISO.

All time references in SMD Forecasts and SMD Alerts received from SESC (Boulder) are to

Universal Time (which is the same as Greenwich Mean Time), a constant scientific time reference. Eastern Standard Time lags Universal Time by 5 hours. The NYISO converts all time references to prevailing Eastern Time (Standard Time or Daylight Saving Time) as shown in [Figure 7](#).

**Figure 7: Conversion from Universal Time**

If the prevailing Eastern time is:	Then 0600 UTC (GMT) converts to:
Standard Time	0100 EST
Daylight Savings Time	0200 EDT

**NYISO Actions**

Notification to NYISO Transmission Owners will include a start time and end time (or duration) for the Warning or Alert.

These procedures will be terminated when the Warning or Alert is no longer active.

Levels up to K5, no NYISO action is required.

Level K6 Warning or Alert:

1. Notify all New York TOs

Level K7 or above Warning or Alert:

1. Notify all New York TOs
2. If significant GIC is observed or reported to NYISO by TO or NPCC Area:
  - (a) Declare the Alert State

- (b) Notify TOs to reduce normal limits on inter-area and internal NYS Power System transmission lines and transformers to a maximum of 90% of the normal rating where appropriate.
- (c) Request generators (via their TOs) to adjust machine excitation, to maintain the NYISO Controlled Transmission System voltages within acceptable operating ranges to protect against voltage swings.
- (d) Reduce RTC/RTD Stability Transfer Limits and RTC/RTD Central East Voltage Contingency Limits to 90% of the Stability Transfer Limit and Central East Voltage Contingency Limits where appropriate.
- (e) Reduce flows on inter-area and internal NYISO secured transmission lines to a maximum of 90% of the Normal Rating.

Level K9 Warning or Alert:

- Complete all actions above for Level K7 or greater Warning or Alert
- Activate Thunder Storm Alert Cases in BMS
- Cancel scheduled transmission outages and request TOs restore out of service transmission
- Review in-service work and cancel where appropriate

***Transmission Owner Actions***

TOs shall perform the following actions upon notification of an SMD Alert of a Major Storm Condition (K7-K9) or prior to the forecasted arrival of the storm upon notification of an SMD Forecast of a Major Storm Condition (K7-K9):

1. Notify generators within their areas that have a high-side wye grounded winding with terminal voltage greater than 200kV.
2. Restore out-of-service transmission facilities, where possible, and avoid taking long transmission lines out of service.
3. Review all in-service work, evaluate the impact of the loss of these facilities on the NYISO secured Transmission System, and cancel in-service work on critical facilities.
4. Monitor the MVar and voltage displays on their SCADA systems for unusual voltage and/or MVar variations.
5. Keep area substation capacitor banks in service, where possible, and evaluate the impact of the loss of transmission shunt capacitor banks.
6. Notify the NYISO of all actions taken related to this section.
7. Implement emergency procedures as requested by NYISO