New York Transco

***NYT DOCUMENT ID # TPC -0001***

## 1.0 Purpose

This document summarizes the New York Transco (NY Transco) Transmission Planning Criteria for assessing the reliability performance of the NY Transco transmission system throughout the operating and planning horizon. These Criteria shall be utilized in the design of the NY Transco transmission system and shall guide future expansion of the system. Application of these Criteria will ensure that the NY Transco transmission system is planned to maintain a consistent level of reliability. NY Transco is not a Load Serving Entity and any customers/ independent developers that will potentially be a load on the system will also need to coordinate with the electric utility in whose franchise area their facility exists for any additional requirements they may be required to comply with in order to receive delivery service.

The NY Transco Transmission System is planned in accordance with the following fundamental design principles, which are applicable to all new projects proposed by New York Transco and independent developers. Any requests to the exception of these stated principles must be evaluated from a technical perspective, and if deemed to be not a detriment to the reliability of the transmission system, it shall be memorialized and approved in writing by the VP, Capital Investments, and the Chief Engineers and/or the acting Chief of Transmission Planning. Please note that NY Transco has previously made and may continue to make investments in Transmission Projects that have been/ are proposed by other Connecting Transmission Owners, and the planning criteria utilized for those projects have met / or will meet those in effect for those Connecting Transmission Owners.

## 2.0 Transmission Planning Tools

NY Transco and/or their engineers utilize various types of power system simulation software tools for power system analysis. These software tools allow Transmission Planning Engineers to conduct steady state power flow studies (thermal and voltage), dynamic stability studies, short circuit studies, as well as various transmission system security and reliability studies. While there are several software tools utilized, the three primary software tools utilized to assess the reliability of the Transmission System are:

### *2.1) PSS®E*

Power System Simulator for Engineering (Power Transmission System Planning Software) is a Siemens program utilized for electric transmission system analysis and planning. Typical PSS/E analyses consist of steady state power flow (thermal and voltage) and dynamic stability analyses. The principal uses are to identify thermal, voltage and stability constraints and to assess solutions to these issues.

### *2.2) PowerGEM TARA*

PowerGem Transmission Adequacy & Reliability Assessment (TARA) is a software tool used to assess thermal transfer limits and to assess steady state thermal and voltage performance of the power system under N-1-1 contingency conditions.

### *2.3) ASPEN ONELINER*

ASPEN Oneliner is a software tool that allows Transmission Planning Engineers to perform Transmission System short circuit studies and to assess the adequacy of transmission circuit breaker interrupting ratings.

## 3.0 Transmission System Overview

The transmission system consists of Bulk Electric System (BES) facilities (as defined by NERC), Bulk Power System (BPS) facilities (as defined by NPCC), NYS Bulk Power System (as defined by NYSRC), and Local Transmission facilities.

### 3.1) BULK ELECTRIC SYSTEM (BES)

The Bulk Electric System (BES) definition was revised by NERC and became effective July 1, 2014. The BES definition includes bright line criteria with various enumerated inclusions and exclusions. Application of the BES definition has resulted in the NY Transco transmission systems being classified as BES. This includes transmission lines, transformers, phase angle regulators (PARs), and static and dynamic reactive power devices.

All BES elements shall be designed to meet the performance requirements specified in the applicable NERC Transmission Planning Reliability Standard (Transmission System Planning Performance Requirements; TPL-001-4).

### 3.2) BULK POWER SYSTEM (BPS)

The NPCC, which the NYISO is part of, defines the Bulk Power System as:

“The interconnected electrical systems within northeastern North America comprising generation and transmission facilities on which faults or disturbances can have a significant adverse impact outside of the local area. In this context, local areas are

determined by Council members." NPCC BPS facilities are identified based on the application of NPCC's Document A-10 "Classification of Bulk Power System Elements." This criterion is based on a performance based test for significant adverse impact.

The present NYS Bulk Power System (NYS BPS) definition is as follows:
"The portion of the bulk power system within the NYCA, generally comprising generating units 300 MW and larger; and generally comprising transmission facilities

230 kV and above. However, smaller generating units and lower voltage transmission facilities on which faults and disturbances can have a significant adverse impact outside of the local area are also part of the NYS Bulk Power System." All applicable BPS elements that are identified per NPCC A-10 shall comply with the NYSRC rules.

## 4.0 Design Principles

The New York Transco Transmission System is planned in accordance with the following fundamental design principles, which are applicable to all new projects proposed by the Company and by independent developers of generator, and/or transmission projects.

**4.1** ) Plans for the Interconnection of new generation facilities and transmission lines shall satisfy the need for adequate substation diversity recognizing that an acceptable configuration may require the relocation of existing feeders. For example, this design principle requires alternating supply and load feeders in substation design.

**4.2 )** New generation facilities and transmission lines proposing to interconnect to an existing transmission substation shall ensure that a single event (e.g., breaker failure) will not result in the outage of multiple supply sources (generation or transmission) into a transmission load area

**4.3 )** New generation facilities and transmission lines proposing to interconnect to an existing transmission substation shall ensure that a loss of any single feeder will not result in the outage of multiple bus sections.

**4.4 )** New generation facilities and transmission lines proposing to interconnect to anexisting transmission substation shall do so in a manner consistent with the design basis established by New York Transco for that substation, i.e., ring bus, double ring bus, or breaker-and-a-half. The new interconnection shall not compromise the basic design concepts inherent in these configurations. For example, transmission feeders or generation shall not be connected to the syn buses of a breaker-and-a- half configuration. Additionally, a new project shall not interfere from the ultimate design basis of the substation from being achieved. This provision may be waived for generators under 20MVA in aggregate and connecting to the NY Transco system at voltage levels below 200kV. In these cases, half-

breaker stations may beacceptable so long as all other criteria in the design principles section can be met including all protection requirements. The acceptance of these not standard interconnections is at the sole discretion of NY Transco

**4.5 )** New generation facilities and transmission lines proposing to interconnect to an existing transmission feeder shall require the construction of a new substation with theappropriate breaker configuration at the point of interconnection to maintain system reliability. In the case where the existing transmission feeder is one of multiple feeders with common terminals, then all such transmission feeders shall be incorporated intothe design of the new substation to prevent the interconnection from causing an imbalance in the distribution of power on the two parallel feeders.

**4.6 )** Interconnection plans for new generation facilities and transmission lines shall be designed to ensure system reliability, and as such shall comply with basic substation reliability design. For example, interconnection plans will avoid overhead crossings of other feeders and associated substation bus sections, provide adequate separation and when necessary independent routing of underground feeders, and provide separation of control and relay protection wiring.

**4.7 )** New York Transco shall not be obligated to supply or absorb reactive power for entities interconnecting transmission systems (new or modified interconnections) with New York Transco's Transmission System. Such entities shall supply the additional reactive power requirements attributable to such interconnection to ensure reactive power neutrality at the point of interconnection to the New York Transco Transmission System. This requirement is applicable under normal system conditions (i.e., when all design facilities are in service), as well as steady-state conditions occurring after design criteria contingencies described in the New York State Reliability Council (NYSRC) *Reliability Rules & Compliance Manual for Planning and Operating the New York State Power System*.

**4.8 )** New non-synchronous generation facilities shall be designed to meet 0.85 lagging power factor at 0.95 pu voltage, and 0.95 leading power at 1.05 pu voltage, for N-0 and N-1 conditions.

**4.9 )** All equipment on the Transmission System, including but not limited to circuit breakers, bus work, disconnect switches, and structural supports, shall withstand the mechanical forces associated with postulated fault currents and at a minimum the station design basis.

**4.10 )** The harmonic voltage or current distortion created by any interconnecting facility must not exceed the fundamental 60 Hz voltage or current waveform limits as identified in IEEE standard 519.

**4.11 )** New generation facilities and transmission lines proposing to interconnect to an existing transmission feeder or substation shall require the new interconnection to be evaluated for Sub Synchronous Resonance (SSR) and Electromagnetic Transients Program (EMTP) impacts.

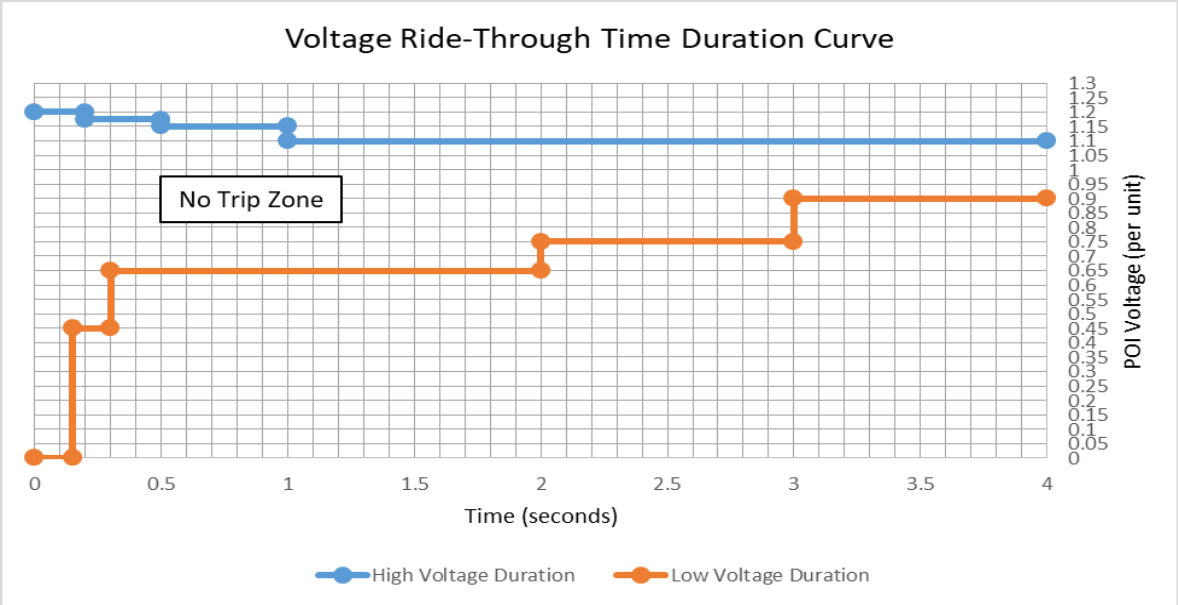
**4.12 ) RESERVED FOR FUTURE USE**

**4.13 )** In addition to transmission planning criteria enumerated in this document, all new projects, whether generation or transmission, must be designed to conform with and adhere to all applicable NERC, NPCC, NYSRC Reliability Rules including NYSRC Local Reliability Rules, as well as applicable New York Transco specifications, procedures and guidelines.

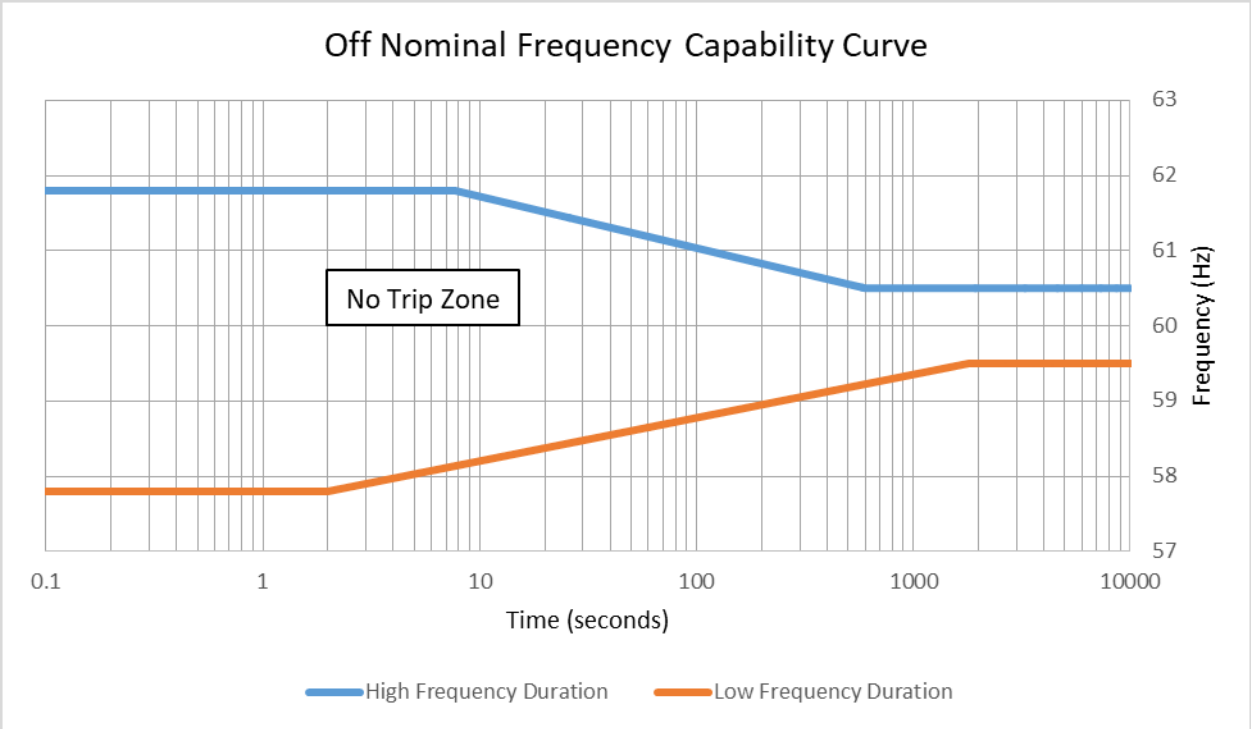
**4.14 ) RESERVED FOR FUTURE USE**

**4.15 )** Inverter-Based generation resources which are interconnected to New York Transco's Transmission System shall continue to inject current at the Point of Interconnection inside the "No Trip" zone of the frequency and voltage ride through curves of NERC Standard PRC-024 Attachment 1 and NPCC Regional Standard PRC-006-NPCC Figure 2. (For an illustration of the "No Trip Zone" as presented in the NERC Std. PRC-024 in effect at time of writing of this Planning Criteria document, please see Graph 1 and Graph 2 below. For an illustration of the NPCC Thresholds for Setting Underfrequency Trip Protection for Generators, please see Graph 3 below. Please note that any future interconnection proposals will need to comply with the then current version of NERC Standards, including PRC-024, as may be amended by NERC from time to time and NPCC Standards and Criteria, including PRC-006-NPCC, as may be amended by NPCC from time to time.)

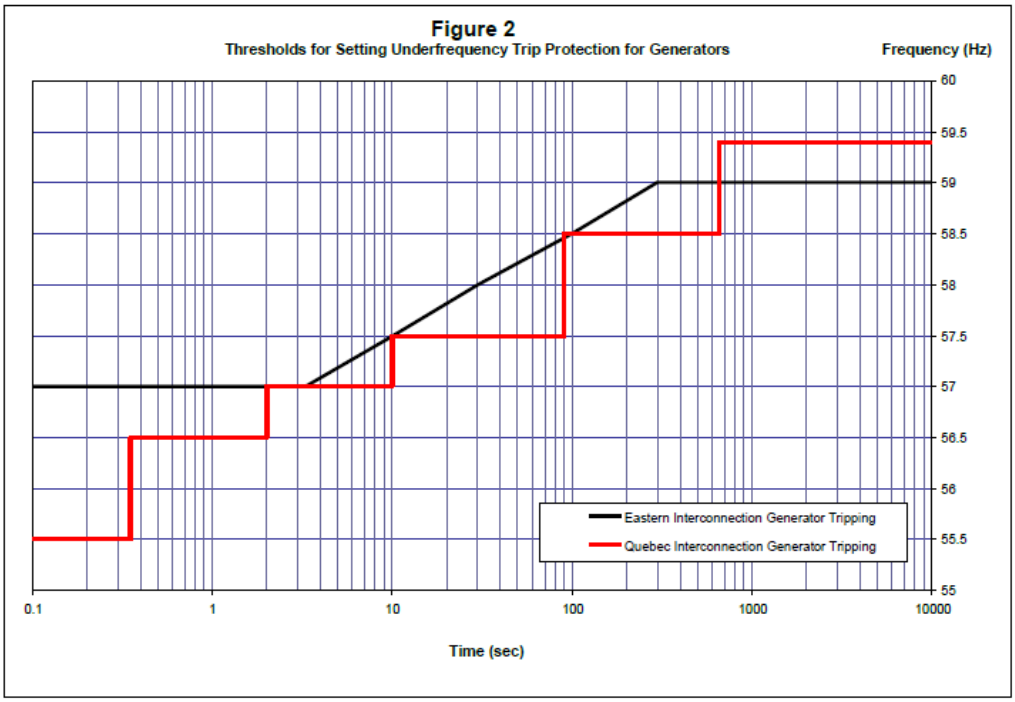
*Graph 1: NERC Standard PRC-024 Voltage Ride-Through Requirements*



*Graph 2: NERC Standard PRC-024 Frequency Ride-Through Requirements*




*Graph 3: NPCC Standard PRC-006-NPCC Underfrequency Trip Protection for Generators*




**4.16)** Inverter-Based generation resources shall support voltage regulation and voltage stability at the Point of Interconnection and as such shall have the capability to

operate in automatic voltage control at all times. The automatic voltage control shallbe continuously acting to control reactive power injection across all expected planning conditions. Inverter- Based generation resources shall follow NYISO's Default Generator Voltage Schedule.

Inverter-Based generation resources shall be designed to meet 0.85 lagging power factor at 0.95 pu voltage and 0.95 leading power at 1.05 pu voltage, for N-0 and N-1 conditions at all active power outputs down to 0 MW at the Point of Interconnection.

**4.17)** Inverter based resources shall not utilize momentary cessation unless it is identified in an interconnection study as being necessary by the NYISO or other Affected Transmission Owners as being necessary to maintain acceptable system performance. If momentary cessation s deemed necessary, NY Transco will approve acceptable settings on a case-by-case basis.

**4.18)** Inverter based generation resources shall provide primary frequency response (active power-frequency control), implemented at either the inverter-level or at the plant-level, and deliver that primary frequency response to the grid when in an operating condition that would allow for a response. The control shall have an adjustable proportional droop characteristic with a default value of 5 percent. If a deadband is used, it shall be a non-step deadband not to exceed +/- 0.036 Hz. If hysteresis is used in the deadband, it shall not exceed +/- 0.005 Hz on either side of the deadband. Hysteresis shall not be used if frequency measurement resolution is not sufficient to accurately measure this frequency.

**4.19)** Battery Energy Storage Systems (BESS), and Pumped Storage facilities shallbe considered as a generator rather than a load. However, when evaluating system impacts these types of facilities will be evaluated for impacts caused while acting as both a generator and a load

**4.20)** Special Protection Systems (SPS) / Remedial Action Schemes (RAS) typically are control schemes that control (e.g., trip, runback) a power system element in response to an adverse system condition other than the isolation of faulted Element(s). Under Frequency Load Shedding (UFLS) systems and Overload schemes are not considered SPSs or RASs. The use of SPSs or RASs on any portion of New York Transco's system, generally, is not allowed. SPSs and RASs would be considered **only** as a temporary mitigation measure and only while facilities are being constructed for the long-term correction of any adverse system condition(s).

# 5.0 Performance Principles

## 5.1) Performance Criteria

The performance criteria of the New York Transco Transmission System requires the evaluation of voltage, thermal, stability, transient, and short circuit performance of the system with all facilities in service, as well as under the contingency conditions described in the following sections.

While transfer limits across the transmission *interface*s defined by the *NYISO* are not, by themselves, measures of *reliability*, there is potential for adverse *reliability* impacts to occur if transfer limits are degraded from their existing levels as the result of the addition of a new generator or transmission facility. The *NYSRC* Reliability Rules do not require that transfer limits be maintained at specific levels. However, in its processes to review the impacts of any proposed transmission or *generation* project, the *NYISO* should give due consideration to the possible *reliability* impacts that may result if the proposed project results in diminished *transfer capability*, per NPCC criteria.

Accordingly, the transfer limits assessment is the responsibility of the New York Independent System Operator (NYISO), and it is performed as a critical part of the NYISO process to ensure transmission system reliability, with the participation of all New York Control Area (NYCA) market participants, including New York Transco.

## 5.2) System Design

New York Transco transmission assets are designed to First contingency design which meansthat the New York Transco Transmission System is planned to withstand, at peak design demand, the more severe of independent Scenarios A, B or C, as described below:

**Scenario A**
The most severe of design criteria contingencies of Category P1, P2, P4, P5, and P7 in accordance with Table 1 of the NERC Standard TPL-001 *Transmission System Planning Performance Requirements* (N-1). NY Transco evaluates these contingencies in the time immediately following a contingency event, in which only dynamic devices (generators, STATCOMS, SVCs, etc.) have had time to respond to the new system conditions. Operator actions or automatic equipment operations that occur after a time delay are not considered.

**Scenario B**
The most severe of design criteria contingencies of Category I *Single Event*, Contingency events 1 through 9, in accordance with Table B-1 of the NYSRC Reliability Rules (N-1/-0).

**Scenario C**
The most severe of design criteria contingencies of Category P3 and P6 in accordance with Table 1 of the NERC Standard TPL-001 *Transmission System Planning Performance Requirements* (N-1-1). NY Transco evaluates these contingencies allowing all system adjustments following the first contingency, and allowing only dynamic devices to respond following the second contingency. Following the first contingency, system redispatch is applied in accordance with subsystem and monitored element files provided by NYISO to secure those facilities defined by NYISO (typically those facilities on the A-1 List). Where non-BPS overloads could be resolved by securing the system, redispatch between the first and second contingencies may be considered in accordance with the NYISO Manual 15 (Emergency Operations).

Under Normal System conditions thermal or voltage limits shall not be exceeded (N-0).

For Scenario A testing, applicable post-contingency thermal, voltage and stability limits shall

not be exceeded (N-1).

For Scenario B testing, applicable post-contingency thermal, voltage and stability limits shall not be exceeded. In addition, the system must be able to be returned to within its normal state limits using all available operating reserves and system controls (N-1/-0).

For Scenario C testing, applicable post-contingency thermal, voltage and stability limits shall not be exceeded

### 5.3) Voltage Assessment

Voltages must satisfy both steady-state and post-contingency limits, as follows:
Minimum: 328 kV < **345** kV system < Maximum: 362 kV
Minimum: 219 kV < **230** kV system < Maximum: 242 kV
Minimum: 131 kV < **138** kV system < Maximum: 145 kV
Minimum: 109 kV < **115** kV system < Maximum: 121 kV

Voltages on systems below 200kV may be allowed to have a limit of 0.90 pu post contingencyfollowing operation of dynamic devices (e.g., generators, STATCOMS, SVCs) and prior toautomatic equipment operations (e.g., LTCs and automatic switching of shunt compensation).

The change in voltage ("delta V") following a contingency must be less than 0.05 per unit for facilities operated at 200 kV and above and must be less than 0.10 per unit for facilities operated below 200 kV.

### 5.4) Thermal Assessment

**5.4.1)** The New York Transco thermal planning criteria, expressed in ampere carryingcapacity, consider three thermal categories. These are:

- Normal (operating) rating
- Long-Term Emergency (LTE) rating
- Short-Term Emergency (STE) rating

**5.4.2)** The post-contingency loading of any overhead facility or inter-utility tie must not exceed its LTE rating.

**5.4.3)** In observance of NYSRC Reliability Rules**,** the post-contingency loading of any underground cable can exceed its LTE rating, but not its STE rating, following:

- Loss of generation – provided that ten (10) minute operating reserve and/or phase angle regulation is available to reduce the loading to its LTE rating and not cause any other facility to be loaded beyond its LTE rating; and
- Loss of transmission – provided that phase angle regulation is available to reduce the loading to its LTE rating and not cause any other facility to be loaded beyond its LTE

rating.

## 5.5) Stability Assessment

Unit and system stability shall be maintained during and following the more severe of independent scenarios A and B as identified in Section 4.1, with due regard to reclosing (inaccordance with NPCC Criteria).

New York Transco's transient voltage recovery (TVR) criterion requires voltage to recoverabove 0.9 per unit within five seconds after a fault has cleared.

## 5.6) Transient Assessment

As changes occur in the topography of the New York Transco transmission infrastructure, appropriate analysis shall be conducted to ensure that electrical equipment (e.g., circuit breakers, transformers, series and shunt compensation devices) are protected against transient overvoltage and harmful resonance conditions caused by switching operations and/or potential contingency events

## 5.7) Short Circuit Assessment

The New York Transco Transmission System shall be planned such that, when all generation and all transmission lines are in service, fault duty levels do not exceed the ratedinterrupting capability of breakers at the substations. Determination of fault duty levels shall be made with due regard to fault current limiting series reactor operating protocols.

## 5.8) Extreme Contingency Assessment

Extreme contingency assessment recognizes that the Transmission System can be subjected to events that exceed, in severity, the normal planning criteria. This assessment is conducted to determine the nature and potential extent of widespread system disturbances from such events and to identify measures that will be utilized, where appropriate, to reduce the frequency of occurrence of such events, or to mitigate the consequences that are indicated as a result of testing for such contingencies. Analytical studies shall be performed to determine the effect of the Extreme Contingency.

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**REVISION HISTORY**

| REV # | DATE | Revision(s) | Preparer | Approver |
|---|---|---|---|---|
| A | 4-17-20 | First DRAFT issued for comment | JPB | |
| 0 | 8-21-20 | ORIGINAL ISSUE | JPB | PH |
| 1 | 3-11-21 | Format updates, inverter requirements | JPB | PH |
| | | | | |