Transmission System Reliability Standards

SYSPLAN-01

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I. EXECUTIVE SUMMARY

These Eversource transmission system reliability standards describe how to conduct transmission system planning assessments and develops transmission solutions for the Eversource transmission system. These transmission system reliability standards also describe how Eversource coordinates with the Independent System Operator - New England (ISO-NE) in the development of near-term and long-term transmission system plans through the regional New England Planning Advisory Committee (PAC).

II. SCOPE AND APPLICABILITY

These Eversource transmission system reliability standards define the minimum design criteria to assure the reliability of the Eversource transmission system through coordination of system planning and design. This reliability standard applies to the Eversource transmission system when performing assessments of Eversource transmission system facilities. It is acceptable under these reliability standards to enhance and expand the design of the Eversource transmission system if a higher level of system reliability is desirable for a local area.

The ISO-NE is designated by the Federal Energy Regulatory Commission (FERC) as the Planning Authority (PA) in accordance with the North American Electric Reliability Corporation (NERC) statutory requirements. NERC and the Northeast Power Coordinating Council (NPCC) also have transmission system design criteria which also apply to portions of the New England transmission system including the Eversource transmission system. ISO-NE is responsible for transmission system planning for all New England and performs its transmission system planning responsibilities utilizing the ISO-NE reliability standards.

III. REFERENCE DOCUMENTS

The transmission system evaluations described in this reliability standard are focused on ensuring that reliable and efficient transmission solutions are developed as they apply to the thermal, short circuit, voltage and stability (dynamic) needs of the New England transmission system. The Eversource transmission system is tested and designed for compliance with the transmission planning documents of NERC, NPCC and ISO-NE.

NERC Reliability Standards

Eversource is registered with NPCC as a responsible entity performing the Transmission Planning (TP) function in the NERC Functional Model. Based upon registration with NPCC/NERC as a TP, Eversource is obligated to comply with the NERC “TPL” (Transmission Planning) Reliability Standard. The NERC TPL reliability standard applies to the parts of the Eversource transmission system that are designated as Bulk Electric System (BES) elements. NERC in their capacity as the Electric Reliability Organization (ERO) for the United States, establishes minimum reliability criteria for the BES that all Transmission Owners must comply with. The NERC TPL reliability standard is the minimum acceptable standards for planning the transmission system.

1. TPL -001-4, "Transmission System Planning Performance Requirements"
2. FAC-013-2, "Assessment of Transfer Capability for the Near-Term Transmission Planning Horizon"
3. NUC-001-3, "Nuclear Plant Interface Coordination Reliability Standard"
4. PRC-012-2 Remedial Action Schemes

NPCC Documents

Eversource is a member of NPCC and as such, is obligated under the NPCC By-Laws to comply with NPCC specific criteria given in the Directories, Criteria, Guides and Procedures. The transmission system reliability standards developed by NPCC apply to the Eversource transmission system facilities classified as BPS (Bulk Power System) per the requirements of NPCC Criteria A-10.

1. Regional Reliability Reference Directory #1, "Design and Operation of the Bulk Power System"
2. Regional Reliability Reference Directory #4, "Bulk Power System Protection Criteria"
3. Regional Reliability Reference Directory #7, "Special Protection Systems"
4. Criteria A-10, "Classification of Bulk Power System Elements"

ISO-NE Documents

ISO-NE is the Planning Authority for the New England region and as such has been delegated authority over the design and planning of the New England transmission system.

ISO-NE in their capacity as a Reliability Coordinator, Balancing Authority, Transmission Operator, Planning Coordinator and Regional Transmission Organization (RTO) must comply with both NERC and NPCC criteria. The ISO-NE reliability standards must comply with both NERC and NPCC criteria. Eversource as a member of NEPOOL has endorsed the ISO-NE Transmission Operating Agreement (TOA) and therefore, must comply with ISO-NE planning procedures and reliability standards.

1. ISO-NE Planning Procedure No. 3, Reliability Standards for the New England Area Pool Transmission Facilities.
2. ISO-NE Tariff #3, Transmission, Markets and Services Tariff, Section I.3.9: Review of Market Participant's Proposed Plans.
3. The New England Transmission Operating Agreement Section 2.06: Review of Transmission Plans and Section 3.09(a) and (b) Planning and Expansion.
4. ISO-NE Open Access Transmission Tariff, Section II.48: Regional System Planning Process.
5. ISO-NE Planning Procedures (PP) PP5, PP5-1, PP5-3, PP5-5 and PP9.
6. ISO/TO Transmission Planning Coordination Matrix.
7. ISO-NE Transmission Operating Guides applicable to the Eversource Transmission System.
8. ISO-NE Transmission Planning Guide.

IV. PROCEDURE

The Eversource transmission system shall be designed with sufficient transmission capacity to serve area loads for design contingency events. The contingency events shall be applied to transmission elements and generating resources to examine the potential for the inability to meet

the performance criteria as defined in this procedure on the Eversource transmission system. The design of the Eversource transmission system shall assume power flow conditions with utilizing transfers, loads, and resource conditions that reasonably stress the system. Conditions required for the design of the transmission system can be classified as: N-0: All-facilities-in, N-1: All-facilities-in followed by a contingency, and N-1-1: Scenarios that have a contingency following an initial contingency. After removal of the single element from service, system adjustments are made in preparation for the next contingency in accordance with ISO-NE rules and procedures.

V. SERVICE EXPECTATIONS

Compliance with the Eversource transmission reliability standards ensures the reliability and efficiency of the Eversource transmission system to meet regulatory requirements through the coordination of system planning, design and operation in accordance with good electric utility practice. There may be circumstances that may expose customers to the increased possibility of more frequent and/or more extensive transmission outages. It may not always be possible to achieve the designed level of reliability due to delays in siting and permitting new facilities, construction delays, load growth that exceeds predicted levels or delays due to actions taken by others beyond the control of Eversource.

The local area system (A local area system is defined as an electrically confined or radial portion of the system. The geographic size and number of system elements contained will vary based on system characteristics. A local area may be relatively large geographically with relatively few buses in a sparse system, or be relatively small geographically with a relatively large number of buses in a densely networked system.) must be designed to withstand representative contingencies as listed in Table 1 (N-1) and Table 2 (N-1-1). The local area systems shall be designed for a level of reliability such that the loss of a major portion of the system, or the unintentional separation of any portion of the system, will not result from reasonably foreseeable contingencies. The local area systems shall be designed with sufficient transmission capability to integrate area loads with sufficient generation to provide a reliable supply. Simulations of these contingencies must include assessment of the potential for widespread cascading outages due to voltage collapse, instability or thermal overloads. In applying these reliability standards, loss of customer load may occur following certain multiple contingencies. The temporary loss of small portions of the transmission system may be tolerated if the reliability of the overall bulk power system is not jeopardized.

VI. NUCLEAR PLANT INTERFACE

Analyses of New England transmission system contingencies may include assessment of the potential for the inability to meet the Nuclear Plant Interface Requirements (NPIRs). The NPIRs for each nuclear plant generator subject to dispatch by ISO-NE are documented in the Attachment to Master/Local Control Center Procedure No. 1 - Nuclear Plant Transmission Operations (M/LCC 1) applicable to that nuclear plant generator. The loss of minor portions of the transmission system may be tolerated provided the reliability of the overall interconnected transmission system is not jeopardized and the NPIRs are met.

VII. REMEDIAL ACTION SCHEMES

A Remedial Action Scheme (RAS) or also referred to as a Special Protection Scheme (SPS) may be used in the design of the bulk power system and local area systems. The requirements of an

RAS are defined in NERC PRC-012 and NPCC Regional Reliability Reference Directory #7 - Special Protection System. A set of guidelines for application of a RAS on the ISO-NE system is contained in the ISO-NE Special Protection Systems Application Guidelines (ISO-NE Planning Procedure No. 5-5, "PP5-5"). A RAS may be used to provide protection for infrequent contingencies, or for temporary conditions that may exist as the result of project delays, unusual combinations of system demand and equipment outages or availability, or specific equipment maintenance outages. The decision to employ a RAS should consider the complexity of the scheme and the consequences of correct or incorrect operation as well as its benefits. All RASs proposed for use on the bulk power system and the local area systems must be reviewed and/or approved by ISO-NE and NPCC.

The use of a RAS shall be on a limited and temporary basis. The use of a RAS could be necessary if new transmission facilities are delayed for reasons beyond the control of Eversource. The use of a RAS is not to ensure compliance with these Eversource long-term transmission system reliability standards for the Eversource transmission system.

It is acceptable for Eversource to use a RAS to enhance and achieve a desired level of regional transfer capability across the New England transmission system under the approval of ISO-NE and NPCC.

VIII. EVERSOURCE TRANSMISSION REQUIREMENTS

Table 1: N-1			
Initial Condition	**Contingency Event**	**Performance Requirement**	
		Steady-State	**Stability**
All Facilities-In	No Contingency	Eversource transmission system shall have equipment loadings within normal limits. Eversource transmission system voltages shall be within normal limits. All NPIRs shall be met.	The system shall remain in a state of equilibrium.
	Permanent three phase fault with normal fault clearing on a: • Generator • Transmission Circuit • Transformer • Bus Section • Shunt Device	Eversource transmission system shall have equipment loadings within applicable emergency limits for the system conditions that exist following the contingency. Eversource transmission system voltages shall be within applicable emergency limits for the system conditions that exist following the contingency. All NPIRs shall be met following contingencies.	The system shall remain stable. Cascading and uncontrollable islanding that result in the loss or unintentional separation of major portions of the Eversource transmission system shall not occur. All modeled units and transmission facilities, such as HVDC, FACTs devices, etc. shall remain damped in accordance with the criterion specified in ISO-NE PP3 Appendix C. Transient voltage criteria as specified in ISO-NE PP3, Appendix D shall be met.
	Simultaneous permanent phase-to-ground faults on different phases of each of two adjacent transmission circuits on a multiple circuit tower with normal fault clearing.		
	Permanent phase-to-ground fault with a breaker failure on a: • Generator • Transmission Circuit • Transformer • Bus Section • Shunt Device		
	Circuit Breaker open without a fault		
	Simultaneous loss of both poles of a DC bipolar facility without an AC fault		
	The failure of a circuit breaker to operate when initiated by a Type I SPS following: • Breaker opening without a fault • Permanent phase-to-ground fault with normal fault clearing on any: o Transmission Circuit o Transformer o Bus Section o Shunt device o Generator		

Table 2: N-1-1			
Initial Condition	**Contingency Event**	**Performance Requirement**	
		Steady-State	**Stability**
Single element out of service • Generator • Transmission Circuit • Transformer • HVDC Pole • Shunt Device • Series Device	Permanent three phase fault with normal fault clearing on a: • Generator • Transmission Circuit • Transformer • Shunt Device	Eversource transmission system shall have equipment loadings within applicable limits pre-contingency and for the system conditions that exist following the contingency. Eversource transmission system voltages shall be within applicable limits for pre-disturbance conditions and for the system conditions that exist following the contingency. All NPIRs shall be met following contingencies.	The system shall remain stable. Cascading and uncontrollable islanding that result in the loss or unintentional separation of major portions of the Eversource transmission system shall not occur. All modeled units and transmission facilities, such as HVDC, FACTs devices, etc. shall remain damped in accordance with the criterion specified in ISO-NE PP3 Appendix C. Transient voltage criteria as specified in ISO-NE PP3, Appendix D shall be met.
	Circuit breaker open without a fault		
	Permanent phase-to-ground fault on a HVDC Pole		
	Loss of bipolar DC line		
	Permanent phase -to-ground with breaker failure on a: • Generator • Transmission Circuit • Transformer • Bus section • Shunt Device		
	Simultaneous permanent phase -to-ground faults on different phases of each of two adjacent transmission circuits on a multiple circuit tower with normal fault clearing.		