Exhibit A

Proposed Reliability Standard

A. Introduction

1. **Title:** Automatic Underfrequency Load Shedding

2. **Number:** PRC-006-NPCC-2

3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.

4. **Applicability:**

   4.1. Functional Entities:

   4.1.1. Generator Owner

   4.1.2. Planning Coordinator

   4.1.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators

   4.1.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators

5. **Effective Date:** See Implementation Plan.

B. Requirements and Measures

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent-wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or

(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning

Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or (3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

- **12.1** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.
- **12.2** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that

is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

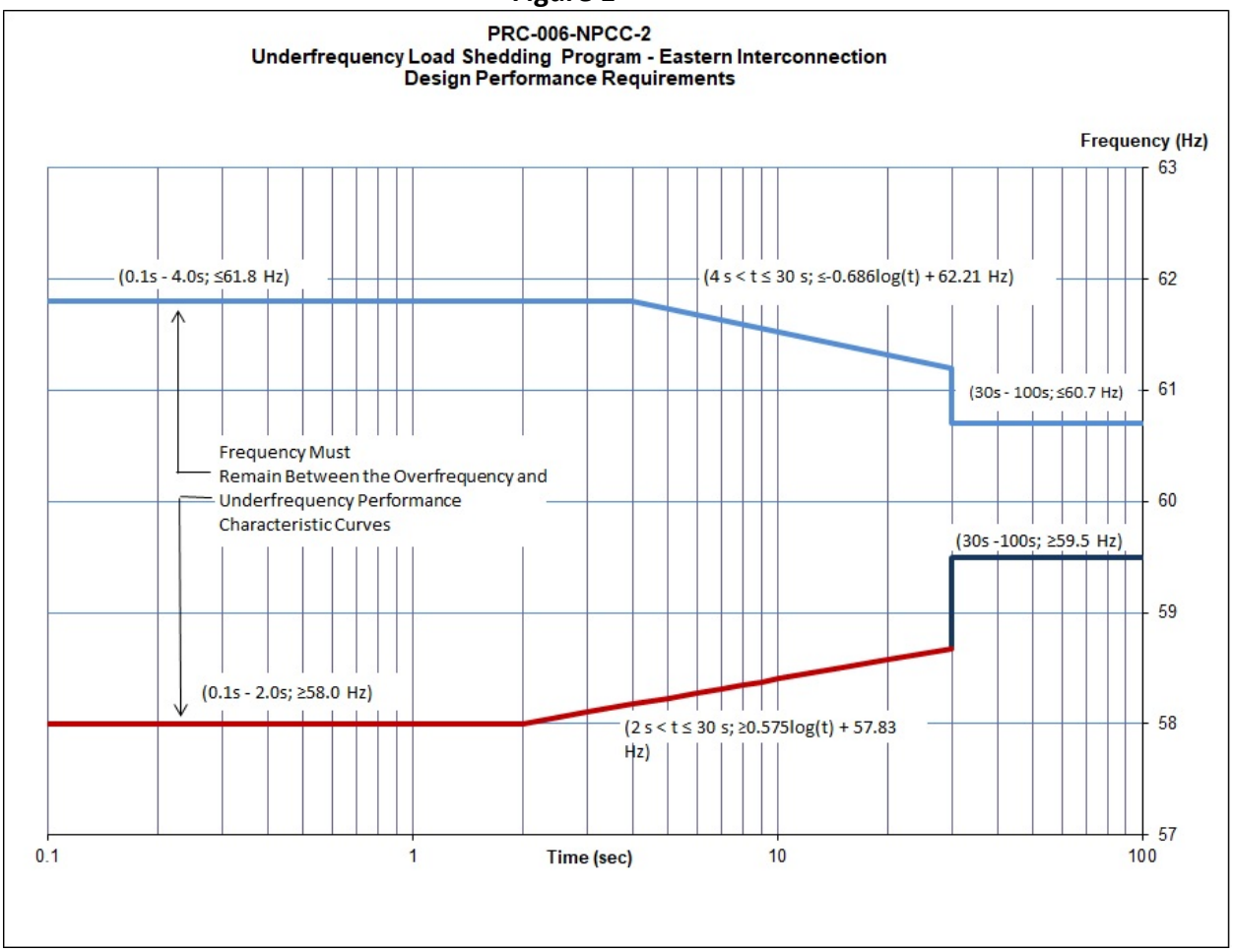
16.1 Set the underfrequency protection to operate at a frequency setting that is as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

Figure 1

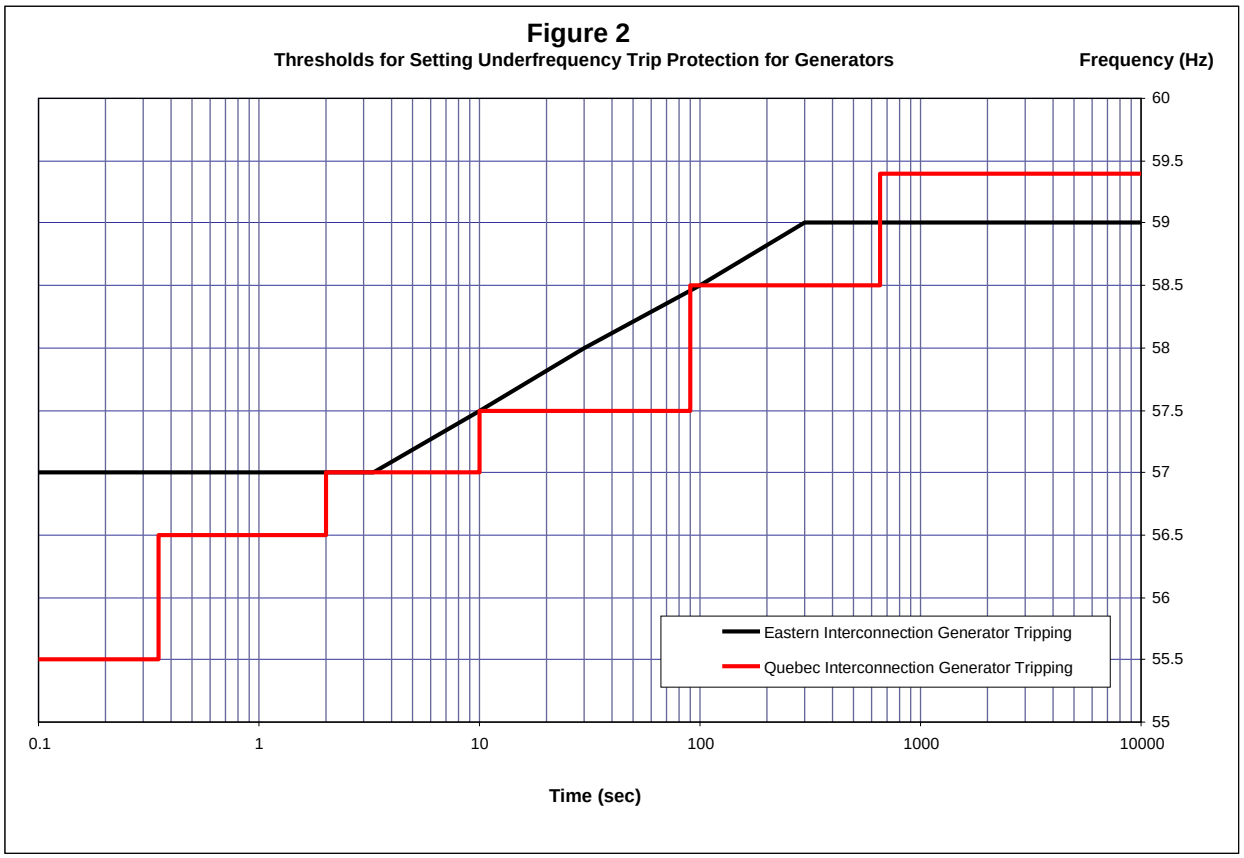


Curve Data:

Overfrequency Requirements		**Source**
t ≤ 4 s	f = 61.8 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
4 s < t ≤ 30 s	f = -0.686log(t) + 62.21 Hz	
t > 30 s	f = 60.7 Hz	

Underfrequency Requirements		**Source**
t ≤ 2 s	f = 58.0 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
2 s < t ≤ 30 s	f = 0.575log(t) + 57.83 Hz	
t > 30 s	f = 59.5 Hz	NERC PRC-006-NPCC (Regional Standard on UFLS)

Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority:

Northeast Power Coordinating Council

1.2. Evidence Retention:

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 2, 3, 4, 5, 8, and 9.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 6, and 7.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 15.

The Generator Owner shall keep evidence for three calendar years for Measures 10, 11, 12, 13, and 16.

1.3. Compliance Monitoring and Enforcement Program:

Compliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of Load required to be shed at each stage	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load required to be shed at each stage m	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of Load required to be shed at each stage.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required to be shed at each stage
R4.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60

	Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	calendar days of permissible time for each item.
R5.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8.	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with

	less than 100% but more than (and including) 95% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.
R9.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10.	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.
R12.	N/A	N/A	The Generator Owner with a new generating unit, or an existing	The Generator Owner with a new generating unit, or an existing generator increasing its net

			generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13.	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14.	N/A	N/A	N/A	The Planning Coordinator did not apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15.	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16.	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1 OR	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

		Coordinator as specified in Requirement R16, Part 16.3.	Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	

D. Regional Variances

None.

E. Associated Documents

Technical Rationale

Version History

Version	Date	Action	Change Tracking
1	2-9-2012	Adopted by Board of Trustees	
2	6-23-2015	RSAR Submitted	
2	11-5-2019	Adopted by the NERC Board of Trustees	

Standard Attachments

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in

addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment C

UFLS Table 1: Eastern Interconnection Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	28 – 50	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Rationale Box:

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.

PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.

Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from

tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

A. Introduction

~~2.1~~1. **Title:** **Automatic Underfrequency Load Shedding**

~~2.2~~2. **Number:** PRC-006-NPCC-2~~1~~

~~2.3~~3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document~~To provide a regional reliability standard that ensures the development of an effective automatic underfrequency load shedding (UFLS) program in order to preserve the security and integrity of the bulk power system during declining system frequency events in coordination with the NERC UFLS reliability standard characteristics~~.

~~2.4~~4. **Applicability:**

~~a.~~4.1. Generator Owner

~~b.~~4.2. Planning Coordinator

~~c.~~4.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators~~Distribution Provider~~

~~d.~~4.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators~~Transmission Owner~~

~~2.5~~5. **Effective Date:**

See Implementation Plan~~For the Eastern Interconnection & Québec Interconnection portions of NPCC excluding the Independent Electricity System Operator (IESO) Planning Coordinator area of NPCC in Ontario, Canada:~~

~~The effective date for Requirements R1, R2, R3, R4, R5, R6, and R7 is the first day of the first calendar quarter following applicable regulatory approval but no earlier than January 1, 2016 The effective date for Requirements R8 through R23 is the first day of the first calendar quarter two years following applicable governmental and regulatory approval.~~

~~For the Independent Electricity System Operator (IESO) Planning Coordinator's area of NPCC in Ontario, Canada:~~

~~All requirements are effective the first day of the first calendar quarter following applicable governmental and regulatory approval but no earlier than April 1, 2017~~.

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B. Requirements and Measures

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or

~~1.~~ The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the

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corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or
(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or
(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

~~**R1** Each Planning Coordinator shall establish requirements for entities aggregating their UFLS programs for each anticipated island and requirements for compensatory load shedding based on islanding criteria (required by the NERC PRC Standard on UFLS). [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]~~

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

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M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

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R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

12.1 Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.

12.2 Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

~~**R2. Each Planning Coordinator shall, within 30 days of completion of its system studies required by the NERC PRC Standard on UFLS, identify to the Regional Entity the generation facilities within its Planning Coordinator Area necessary to support the UFLS program performance characteristics. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]**~~

~~**R3. Each Planning Coordinator shall provide to the Transmission Owner, Distribution Provider, and Generator Owner within 30 days upon written request the requirements for entities aggregating the UFLS programs and requirements for compensatory load shedding program**~~

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~~derived from each Planning Coordinator's system studies as determined by Requirement R1. [Violation Risk Factor: Low] [Time Horizon: Long Term Planning]~~

~~R4 Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program reflecting normal operating conditions excluding outages for its Facilities based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3, or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island identified in Requirement R1 and acting as a single entity, provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load, based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3.~~
~~[Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

~~R5 Each Distribution Provider or Transmission Owner that must arm its load to trip on underfrequency in order to meet its requirements as specified and by doing so exceeds the tolerances and/or deviates from the number of stages and frequency set points of the UFLS program as specified in the tables contained in Requirement R4 above, as applicable depending on its total peak net Load shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

~~5.1 Inform its Planning Coordinator of the need to exceed the stated tolerances or the number of stages as shown in UFLS Attachment C, Table 1 if applicable and~~

~~5.2 Provide its Planning Coordinator with a technical study that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.~~

~~5.3 Inform its Planning Coordinator of the need to exceed the stated tolerances of UFLS Attachment C, Table 2 or Table 3, and in the case of Attachment C, Table 2 only, the need to deviate from providing two stages of UFLS, if applicable, and~~

~~5.4 Provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.~~

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R6. Each Distribution Provider and Transmission Owner in the Québec Interconnection portion of NPCC shall implement an automatic UFLS program for its Facilities based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4 or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island, identified in Requirement R1, an aggregated automatic UFLS program that sheds Load based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R7. Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with the following minimum time delay:

7.1 Eastern Interconnection – 100 ms

7.2 Québec Interconnection – 200 ms

[Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R8. Each Planning Coordinator shall develop and review once per calendar year settings for inhibit thresholds (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]

R9. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 days of the initial determination of those inhibit thresholds and within 30 days of any changes to those thresholds. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]

R10. Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings based on the notification provided by the Planning Coordinator in accordance with Requirement R9. [Violation Risk Factor: High] [Time Horizon: Operations Planning]

R11. Each Distribution Provider and Transmission Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with R9. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

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R12. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage coincident with their integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would be opened by the UFLS relays. [Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]

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R13. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, below the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, except as otherwise exempted in Requirements R16 and R19. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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R14. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay to its Planning Coordinator within 45 days of the Planning Coordinator's request. [Violation Risk Factor: High] [Time Horizon: Operations Planning]

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R15. Each Generator Owner with a new generating unit, scheduled to be in service on or after the effective date of this Standard, or an existing generator increasing its net capability by greater than 10% shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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15.1 Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 1.

15.2 Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1.

R16. Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard that have underfrequency

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protections set to trip above the appropriate curve in Figure 1 shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

16.1 Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

16.2 Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

16.3 Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping.

R17 Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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R18 Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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R19. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 1, based on their licensing design basis, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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19.1 Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8Hz.

19.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

19.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

~~R20 The Planning Coordinator shall update its UFLS program database as specified by the NERC PRC Standard on UFLS. This database shall include the following information: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]~~

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~~20.1 For each UFLS relay, including those used for compensatory load shedding, the amount and location of load shed at peak, the corresponding frequency threshold and time delay settings.~~

~~20.2 The buses at which the Load is modeled in the NPCC library power flow case.~~

~~20.3 A list of all generating units that may be tripped for underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, including the frequency trip threshold and time delay for each protection system.~~

~~20.4 The location and amount of additional elements to be switched for voltage control that are coordinated with UFLS program tripping.~~

~~20.5 A list of all UFLS relay inhibit functions along with the corresponding settings and locations of these relays.~~

~~R21 Each Planning Coordinator shall notify each Distribution Provider, Transmission Owner, and Generator Owner within its Planning Coordinator area of changes to load distribution needed to satisfy UFLS program performance characteristics as specified by the NERC PRC Standard on UFLS.[Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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~~R22 Each Distribution Provider, Transmission Owner and Generator Owner shall implement the load distribution changes based on the notification provided by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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~~R23 Each Distribution Provider, Transmission Owner and Generator Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]~~

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M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

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M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

16.1 Set the underfrequency protection to operate at a frequency setting that is as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

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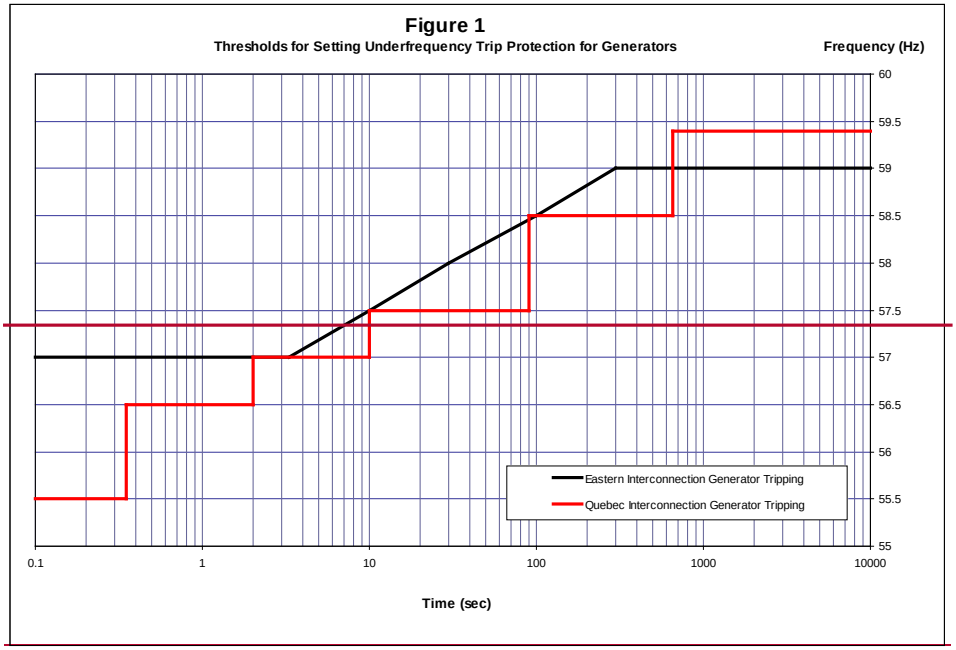

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Figure 1

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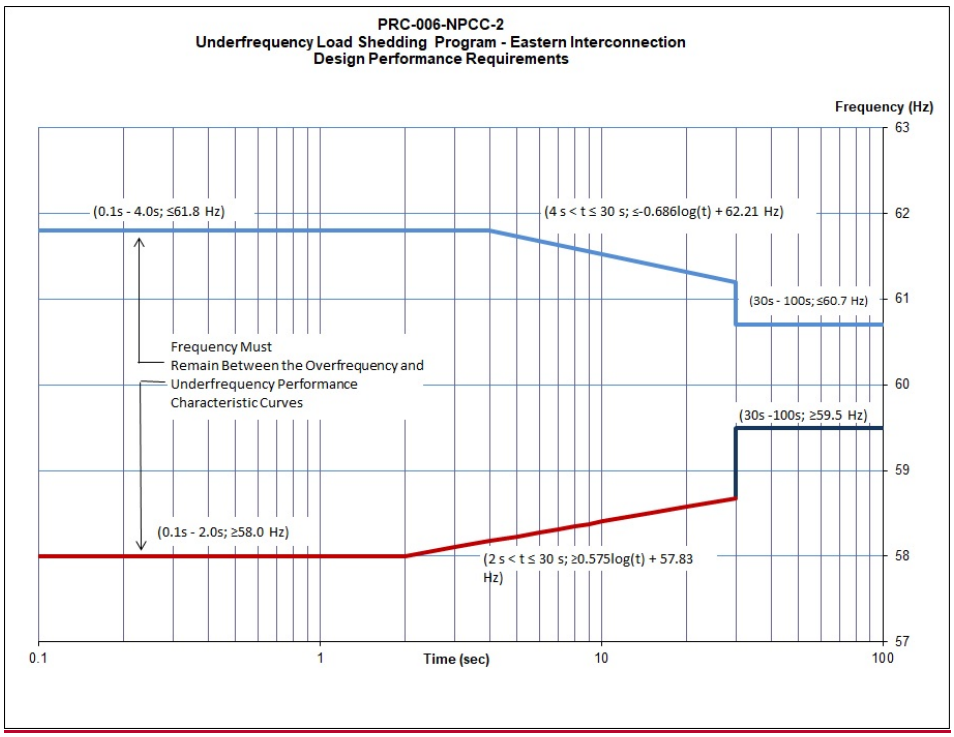

NERC PRC-006 Overfrequency Requirements (Continent-Wide Standard on UFLS)
NERC PRC-006 Underfrequency Requirements (Continent-Wide Standard on UFLS) - out to 30 seconds only
NERC PRC-006-NPCC Underfrequency Requirements (Regional Standard on UFLS)- more stringent than Content-Wide Standard from 30 - 100 seconds

Curve Data:

Overfrequency Requirements		Source
t ≤ 4 s	f = 61.8 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
4 s < t ≤ 30 s	f = -0.686log(t) + 62.21 Hz	
t > 30 s	f = 60.7 Hz	

Underfrequency Requirements		Source
t ≤ 2 s	f = 58.0 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
2 s < t ≤ 30 s	f = 0.575log(t) + 57.83 Hz	
t > 30 s	f = 59.5 Hz	NERC PRC-006-NPCC (Regional Standard on UFLS)

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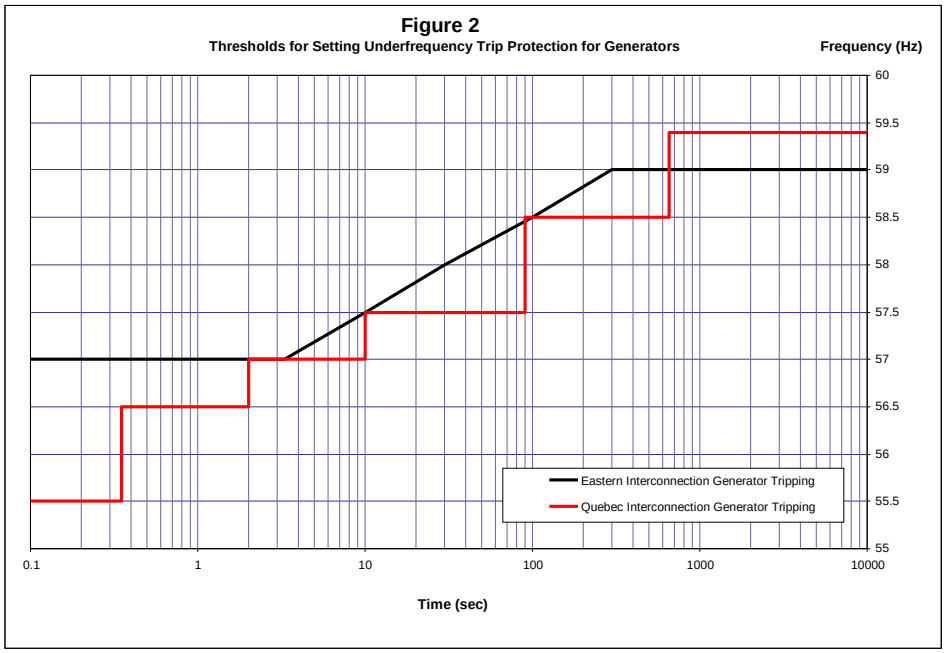
Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



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Measures

M1 Each Planning Coordinator shall have evidence such as reports, system studies and/or real time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

M3 Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.

M4 Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped, and the corresponding frequency thresholds, on those circuits included in its UFLS program to achieve the individual and cumulative percentages identified in Requirement R4. (Attachment C Tables 1-3).

M5 Each Distribution Provider or Transmission Owner shall have evidence such as reports, analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.

M6 Each Distribution Provider and Transmission Owner in the Québec Interconnection shall have evidence such as documentation or reports containing the location and amount of load to be tripped and the corresponding frequency thresholds on those circuits included in its UFLS program to achieve the load values identified in Table 4 of Requirement R6. (Attachment C Table 4).

M7 Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum time delay, in accordance with Requirement R7.

M8 Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R8.

M9 Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

M10 Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets or other documentation that demonstrates that it meets Requirement R10.

M11 Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R11.

M12 Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program coincident with the integrated hourly peak of the previous year that demonstrates that it meets Requirement R12.

M13 Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R13.

M14 Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R14.

M15 Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R15.

M16 Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with

Requirement R13 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R16.

M17 Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such as emails, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R17.

M18 Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as emails, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R18.

M19 Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in Figure 1 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R19.

M20 Each Planning Coordinator shall provide evidence such as spreadsheets, system studies, or other documentation that demonstrates that it meets the requirements of Requirement R20.

M21 Each Planning Coordinator shall provide evidence such as emails, memorandum or other dated documentation that it meets Requirement R21.

M22 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as reports, spreadsheets or other documentation that demonstrates that it meets Requirement R22.

M23 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates it meets Requirement 23.

C. Compliance

1.11. Compliance Monitoring Process

a.1.1. Compliance Enforcement Authority

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Northeast Power Coordinating CouncilPCC Compliance Committee

a. **Compliance Monitoring Period and Reset Time Frame**

Not Applicable

b.1.2. DataEvidence Retention

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 24, 35, 46, 57, 810, and 119, and 12.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 3, 86, and 79, 20, and 21.

The Planning Coordinator in Ontario, Quebec, and the Maritime Provinces shall keep evidence for three calendar years for Measure 17.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 185, 22, and 23.

The Generator Owner shall keep evidence for three calendar years for Measures 103, 114, 125, 136, and 169.

c.1.3. Compliance Monitoring and Assessment Processes

ComSelf-Certifications.

Spot Checking.

Compliance Audits.

Self-Reporting.

Compliance Violation Investigations.

Complaints.pliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

d. Additional Compliance Information

None.

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~~1.2~~ Violation Severity Levels

~~iremen t~~R#	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the

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	amount of Load required to be shed at each stage	the required amount of Load required to be shed at each stage m	the required amount of Load required to be shed at each stage.	required amount of Load required to be shed at each stage
R4.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60 calendar days of permissible time for each item.
R5.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.

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R6.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8.	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.

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R9.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10.	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75

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	45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	calendar days of the Planning Coordinator's request.
R12.	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13.	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.

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R14.	N/A	N/A	N/A	The Planning Coordinator did not apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15.	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16.	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator as specified in Requirement R16, Part 16.3.	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1 OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

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Standard Attachments

PRC-006-NPCC-1 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate~~The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 1. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all islands identified in Requirement R1 in which the unit may operate~~.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit~~The Planning Coordinator shall identify, compile and maintain an updated list of all existing non-nuclear generating units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1. The list shall include the following information for each unit~~:

   ~~1.~~1.1 Generator name and generating capacity
   ~~2.~~1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
   ~~3.~~1.3 Physical and electrical location of the unit

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~~4.~~1.4 All islands within which the unit may operate, as identified in Requirement R1

~~5.~~2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

~~1.~~2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding~~Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator in Requirement R1 within which the generator may operate to provide compensatory load shedding~~.

~~2.~~2.2 In Ontario and in the Maritime provinces, ~~T~~the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~.~~.

~~3.~~2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2~~The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1~~.

~~1.~~2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~The amount of compensatory load shedding shall be equivalent~~

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~~(±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~.

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PRC-006-NPCC-1 Attachment B

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Compensatory Load Shedding Criteria for ISO-NE and NYISO:

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The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements~~The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 1 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements~~:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit~~The Generator Owner shall identify and compile a list of all existing non-nuclear generating units in service prior to the effective date of this standard that has underfrequency protection set to trip above the appropriate curve in Figure 1. The list shall include the following information associated with each unit~~:

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   ~~1.~~1.1 Generator name and generating capacity
   ~~2.~~1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
   ~~3.~~1.3 Physical and electrical location of the unit

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4.1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

5.2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

1.2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standardIn cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 1, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standardIn cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 1, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

3.2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

4.2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip The compensatory load shedding shall be provided at the UFLS program stage with the frequency

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~~threshold setting at or closest to but above the frequency at which the subject generator will trip~~.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~.

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PRC-006-NPCC-1 Attachment C

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UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW or more of peak net Load shall implement a UFLS program with the following attributes:

Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5
59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 – 3	1. – 31.5

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UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW or more and less than 100 MW of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

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UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW or more and less than 50 MW of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	28-50	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

UFLS Table 4: Quebec Interconnection

	Rate	Frequency (Hz)	MW at peak (*Load must be fixed at all times when above 60% of peak load..)	Mvar at peak	Total Nominal Operating Time (s)[2]
Threshold Stage 1	——	58.5	1000*	1000	0.30
Threshold Stage 2	——	58.0	800*	800	0.30
Threshold Stage 3	——	57.5	800	800	0.30
Threshold Stage 4	——	57.0	800	800	0.30
Threshold Stage 5 (anti-stall)	——	59.0	500	500	20.0
Slope Stage 1	-0.3 Hz/s	58.5	400	400	0.30
Slope Stage 2	-0.4 Hz/s	59.8	800*	800	0.30
Slope Stage 3	-0.6 Hz/s	59.8	800*	800	0.30
Slope Stage 4	-0.9 Hz/s	59.8	800	800	0.30

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load

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2. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communications time, and the rated breaker interrupting time. The underfrequency relay operating time shall be measured from the time when the frequency passes through the frequency threshold set point.

			Operating Time (s)[2]		
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal	Load Shed at Stage as % of	Cumulative Load Shed as

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

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			Operating Time (s)[1]	TO or DP Load	% of TO or DP Load
1	59.5	0.10	0.30	28 – 50	28 – 50

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1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

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Rationale Box:

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.

PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.

Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed

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voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

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Exhibit B

Implementation Plan

NPCC, Inc.
NORTHEAST POWER COORDINATING COUNCIL, INC.
1040 AVE. OF THE AMERICAS, NEW YORK, NY 10018 (212) 840-1070 FAX (212) 302-2782

Implementation Plan

Regional Reliability Standard PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Applicable Standard(s)

- PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Requested Retirement(s)

- PRC-006-NPCC-1 – Automatic Underfrequency Load Shedding

Applicable Entities

- Generator Owners
- Planning Coordinators
- Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.
- Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

Background

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. To determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. To determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Review Attachment C in PRC-006-NPCC-1 to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. Review and revise Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

Effective Date

All requirements with the exception of R3 will be enforceable on the first day of the first calendar quarter following the applicable governmental and regulatory approvals.

R3 will be enforceable on the first day of the first calendar quarter 12 months following the applicable governmental and regulatory approvals.

Retirement Date

The NPCC Regional Reliability Standard PRC-006-NPCC-1 shall be retired immediately prior to the Effective Date of PRC-006-NPCC-2.

Exhibit D

Summary of Development History and Complete Record of Development

Summary of Development History

Summary of Development History

The development record for proposed NPCC Regional Reliability Standard PRC-006-NPCC-2 is summarized below.

I. Overview of the Standard Drafting Team

When evaluating a proposed Reliability Standard, the Commission is expected to give "due weight" to the technical expertise of the ERO.[1] The technical expertise of the ERO is derived from the acceptance of qualified candidates for the Standard Drafting Team ("SDT") pursuant to Step 2.2 of the NPCC Regional Standard Processes Manual.[2] For this project, the SDT consisted of industry experts, all with a diverse set of experiences. A roster of the Standard Drafting Team members is included in **Exhibit E**.

II. Standard Development History

A. Standard Authorization Request Development

On March 31, 2015, NPCC received a Regional Standard Authorization Request ("RSAR") to review "regional reliability standard PRC-006-NPCC-1 for potential revisions or retirements made necessary by NERC's PRC-006-1/PRC-006-2 Automatic Underfrequency Load Shedding and PRC-024-1/PRC-024-2 Generator Frequency and Voltage Protective Relay Settings standards."[3] On June 26, 2015, the Regional Standards Committee accepted the RSAR and authorized posting the RSAR, thereby starting the project to develop proposed Regional Reliability Standard PRC-006-NPCC-2.

B. First Posting - Comment Period

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1 Section 215(d)(2) of the Federal Power Act; 16 U.S.C. § 824o(d)(2) (2018).

2 The NPCC Regional Standard Processes Manual is available at https://www.npcc.org/Standards/Regional%20Standards%20General/NPCC%20Regional%20%20Standard%20Processes%20Manual_FERC_Approved_version_1_20141223.pdf.

3 See Exhibit D.

On September 1, 2017, NPCC posted proposed Regional Reliability Standard PRC-006-NPCC-2 and a proposed implementation plan for a 45-day comment period, from September 1 through October 16, 2017.[4] Based on the comments received, the standard drafting team decided to make substantive revisions to the proposed Regional Reliability Standard. Therefore, the proposed Regional Reliability Standard was posted for an additional comment period.

C. Second Posting – Comment Period

On April 16, 2018, NPCC posted proposed Regional Reliability Standard PRC-006-NPCC-2 and a proposed implementation plan for a 45-day comment period, from April 16, 2018 through May 31, 2018. Based on the comments received, the standard drafting team decided to make substantive revisions to the proposed Regional Reliability Standard. Therefore, the proposed Regional Reliability Standard was posted for an additional comment period.

D. Third Posting – Comment Period

On August 10, 2018, NPCC posted proposed Regional Reliability Standard PRC-006-NPCC-2 and a proposed implementation plan for a 45-day comment period, from August 10, 2018 to September 25, 2018. Based on the comments received, the standard drafting team decided to make substantive revisions to the proposed Regional Reliability Standard.

E. Final Ballot and NPCC Board of Directors Approval

Proposed Regional Reliability Standard PRC-006-NPCC-2 was posted for a 30-day pre-ballot review and a subsequent 10-day ballot period through midnight December 22, 2018. Due to a lack of quorum by the end of the ballot period, on January 9, 2019, NPCC issued a notification that it was extending the ballot period until quorum was satisfied. On February 15,

[4] Materials for this posting and subsequent postings are on the NPCC project page, *available at* https://www.npcc.org/Standards/SitePages/DevStandardDetail.aspx?DevDocumentId=122.

2019, NPCC announced that the ballot for proposed Regional Reliability Standard PRC-006-NPCC-2 and associated documents reached quorum at 80.95% of the total registered NPCC General and Full Members Representatives, and receiving support from 76% of the voters. On May 1, 2019, the NPCC Board of Directors approved the proposed Regional Reliability Standard. On August 6, 2019, NPCC was notified of an errata and applied its Regional Standards Development Process to address it.[5] On September 5, 2019, the NPCC Board of Directors approved the correction of the errata to the proposed Regional Reliability Standard.

F. Board of Trustees Adoption

NERC posted proposed Regional Reliability Standard PRC-006-NPCC-2 for a 45 day public comment period from May 8, 2019 to June 21, 2019. The NERC Board of Trustees adopted proposed Regional Reliability Standard PRC-006-NPCC-2 on November 5, 2019.[6]

[5] The errata was in Figure 1 of the proposed Regional Reliability Standard. In the version of the proposed Regional Reliability Standard that the NPCC Board of Directors approved on May 1, 2019, a performance curve had an incorrect mathematical expression to describe it. Instead of "(0.1s - 1.1s; ≥58.0 Hz)", the mathematical expression should have read "(0.1s - 2.0s; ≥58.10 Hz)".

[6] NERC, *November 2019 Board of Trustees Agenda Package*, Agenda Item 5.c (PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding), *available at* https://www.nerc.com/gov/bot/Agenda%20highlights%20and%20Mintues%202013/Board_Open_Meeting_Agenda_Package_November_5_2019.pdf.

Complete Record of Development

Regional Standard:
PRC-006-NPCC

Automatic Underfrequency Load Shedding
Current Status:
Regional BOD Approved

View Supporting Documents

Approval & Implementation

Date	Action
09/05/19	Region BOD Approval

Ballot Period 11/12/2018 through 2/10/2019

Date	Action	
02/10/19	Ballot Period Ended 57	View Ballot Results
12/12/18	Other Ballot Supporting Document posted publicly 56	View Document
12/12/18	Other Ballot Supporting Document posted publicly 55	View Document
12/12/18	Membership Ballot Document posted publicly 54	View Document
12/12/18	Membership Ballot Document posted publicly 53	View Document
12/12/18	Membership Ballot Document posted publicly 52	View Document
12/12/18	Membership Ballot Document posted publicly 51	View Document
12/12/18	Membership Ballot Document posted publicly 50	View Document
12/12/18	Ballot Period Started	View Ballot Submissions
11/12/18	Pre-Ballot Review Document posted publicly 49	View Document
11/12/18	Pre-Ballot Review Document posted publicly 48	View Document
11/12/18	Pre-Ballot Review Document posted publicly 47	View Document
11/12/18	Pre-Ballot Review Document posted publicly 46	View Document
11/12/18	Pre-Ballot Review Document posted publicly 45	View Document
11/12/18	Pre-Ballot Review Document posted publicly 44	View Document
11/12/18	RSC Posts for Pre-Ballot Review	

Comment Period 8/10/2018 through 9/24/2018

Date	Action	
11/02/18	Comments Response Document posted publicly 43	View Document
11/02/18	Comments Response Document posted publicly 42	View Document
11/02/18	Comments Response Document posted publicly 41	View Document
11/02/18	Comments Response Document posted publicly 40	View Document
11/02/18	Comments Response Document posted publicly 39	View Document
09/25/18	Comment Period Ended	

08/10/18	Comments Template Document posted publicly 38	View Document
08/10/18	Draft Standard Document (Redline) posted publicly 37	View Document
08/10/18	Draft Standard Document (Redline) posted publicly 36	View Document
08/10/18	Implementation Plan posted publicly 35	View Document
08/10/18	Draft Standard Document posted publicly 34	View Document
08/10/18	Comment Period Started 33	View Comments
08/10/18	Comment Period Announcement posted publicly 32	View Document

Comment Period 4/16/2018 through 5/31/2018

Date	Action	
08/09/18	Comments Response Document posted publicly 31	View Document
07/24/18	Comments Response Document posted publicly 30	View Document
07/24/18	Comments Response Document posted publicly 29	View Document
07/24/18	Comments Response Document posted publicly 28	View Document
07/24/18	Comments Response Document posted publicly 27	View Document
07/24/18	Comments Response Document posted publicly 26	View Document
07/24/18	Comments Response Document posted publicly 25	View Document
06/01/18	Comment Period Ended	
05/01/18	Draft Standard Document (Redline) posted publicly 24	View Document
04/16/18	Draft Standard Document posted publicly 23	View Document
04/16/18	Comment Period Started 22	View Comments
04/16/18	Other Commenting Supporting Document posted publicly 21	View Document
04/16/18	Implementation Plan posted publicly 20	View Document
04/16/18	Draft Standard Document (Redline) posted publicly 19	View Document
04/16/18	Comments Template Document posted publicly 18	View Document
04/16/18	Comment Period Announcement posted publicly 17	View Document

Comment Period 9/1/2017 through 10/16/2017

Date	Action	
01/30/18	Comments Response Document posted publicly 16	View Document
01/30/18	Comments Response Document posted publicly 15	View Document
01/30/18	Comments Response Document posted publicly 14	View Document
01/30/18	Comments Response Document posted publicly 13	View Document
01/30/18	Comments Response Document posted publicly 12	View Document
01/30/18	Comments Response Document posted publicly 11	View Document
01/30/18	Comments Response Document posted publicly 10	View Document

01/30/18	Comments Response Document posted publicly 9	View Document
01/30/18	Comments Response Document posted publicly 8	View Document
10/16/17	Comment Period Ended	
09/01/17	Comment Period Announcement posted publicly 7	View Document
09/01/17	Comment Period Started 6	View Comments
09/01/17	Implementation Plan posted publicly 5	View Document
09/01/17	Draft Standard Document (Redline) posted publicly 4	View Document
09/01/17	Draft Standard Document posted publicly 3	View Document
09/01/17	Comments Response Document posted publicly 2	View Document

Project Initiation / Drafting Team Formation

Date	Action	
06/26/15	RSC Accepts	
06/26/15	RSAR Document posted publicly 1	View Document

Northeast Power Coordinating Council (NPCC)

PRC-006-NPCC-2	Automatic Underfrequency Load Shedding	Standards in Development	05/08/10 - 06/21/2019	Info 63 PRC-006-NPCC-2 Clean 62 Summary of Changes 61 Implementation Plan 60 Submit Comments Unofficial Comment Form (Word) 59 Comments Received 58

Information in a Regional Standard Authorization Request (RSAR)

The tables below identify information to be submitted in a Regional Standard Authorization Request to the NPCC Regional Standards Process Manager, NPCCstandard@npcc.org . The NPCC Regional Standards Process Manager shall be responsible for implementing and maintaining this form as needed to support the information requirements of the standards process.

Regional Standard Authorization Request Form

Title of Proposed Standard:	PRC-006-NPCC-2
Request Date:	03-31-2015

RSAR Requester Information

Name: Brian Robinson		**RSAR Type (Check box for one of these selections.)**	
Company:	NPCC	☐	New Standard
Telephone: 802-241-1400		☒	Revision to Existing Standard
Fax:	(866) 214-8632	☐	Withdrawal of Existing Standard
Email:	Brian.Robinson@utilitysvcs.com	☐	Urgent Action

Purpose (Describe the purpose of the proposed standard – what the standard will achieve in support of reliability.**)**

The purpose of the proposed RSAR is to review regional reliability standard PRC-006-NPCC-1 for potential revisions or retirements made necessary by NERC's PRC-006-1/PRC-006-2 Automatic Underfrequency Load Shedding and PRC-024-1/PRC-024-2 Generator Frequency and Voltage Protective Relay Settings standards.

PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.

PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard.

Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.

PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

Retiring PRC-006-NPCC-1 is to be considered if it is determined that it can be retired without sacrificing the ability to develop an effective underfrequency load shedding program.

Industry Need (Provide a detailed statement justifying the need for the proposed standard, along with any supporting documentation**.)**

To enhance efficiencies and cost effectiveness, it must be determined if PRC-006-NPCC-1 requirements can be revised or retired to address the new NERC BES definition, Paragraph 81, and eliminate redundancy leading to double jeopardy with PRC-006-1/PRC-006-2 and PRC-024-1/PRC-024-2 requirements without sacrificing the ability to develop an effective underfrequency load shedding program.

Brief Description: (Describe the proposed standard in sufficient detail to clearly define the scope in a manner that can be easily understood by others.**)**

The requirements in PRC-006-NPCC-1 will be reviewed individually for revision or deletion with respect to the new NERC BES definition, and Paragraph 81. In addition, PRC-006-NPCC-1 will be reviewed against NERC's PRC-006-1/PRC-006-2 and PRC-024-1/PRC-024-2 2-2. PRC-006-1/PRC-006-2 mandates the establishment of design and documentation requirements for automatic underfrequency load shedding (UFLS) programs. PRC-024-1/PRC-024-2 mandate that Generator Owners set their generator protective relays such that generating units remain connected during defined frequency and voltage excursions. These "umbrellas" encompasses the relevant requirements in PRC-006-NPCC-1. However, the relevant requirements in each of the standards are to be compared and the requirements of PRC-006-NPCC-1, if so determined, are revised or deleted to eliminate redundancy and the

concomitant double jeopardy. The review will also ensure that NERC Rules of Procedure, Section 312. Regional Reliability Standards, bullet 1that reads "Regional Entities may propose Regional Reliability Standards that set more stringent reliability requirements than the NERC Reliability Standard or cover matters not covered by an existing NERC Reliability Standard." will govern.

PRC-006-1/PRC-006-2 specifies in Requirement R4 that "Each Planning Coordinator shall conduct and document a UFLS design assessment at least once every five years…" Revision to Attachment C of PRC-006-NPCC-1 needs to be considered to address the circumstance surrounding a design assessment that does not meet the performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.

Revise Table 4 Attachment C to reflect the modified Quebec UFLS program parameters as recommended in the 2013 NPCC UFLS Adequacy Assessment and review the applicability of Requirements R4 and R5 as they pertain to the Quebec Interconnection.

Additionally, as identified by SS38 there are aspects of the performance requirements in NERC PRC-006-1 that are slightly more relaxed than the criteria in Directory#12 and these more stringent attributes of the NPCC criteria were not incorporated into the regional standard.

Specifically, the NPCC criteria in Directory#12 (Sections 5.1.1 and 5.1.2) state that (1) frequency decline is arrested at no less than 58.0 Hz for the portions of NPCC in the Eastern Interconnection, and 56.0 Hz for the portion of NPCC in the Quebec Interconnection (2) frequency should not remain below 59.5Hz for more than 30 seconds and should not remain below 58.5 Hz. for more than 10 seconds. Review the need to include the performance criteria presently in Directory#12 into PRC-006-NPCC-02, or whether the performance criteria included in PRC-006-1/PRC-006-2 is sufficient.

Interpretations of PRC-006-NPCC-1 to be considered to clarify PRC-006-NPCC-2.

The review will include an assessment of the need to include language to address dispersed generation resources.

PRC-006-NPCC-2 should be made to conform to the NERC Results Based Standard format.

After this review is completed, it will be determined if PRC-006-NPCC-1 should be revised, or retired.

Reliability Functions

The Standard will Apply to the Following Functions (Check all applicable boxes.)

☐	Reliability Coordinator	The entity that is the highest level of authority who is responsible for the reliable operation of the Bulk Electric System, has the Wide Area view of the Bulk Electric System, and has the operating tools, processes and procedures, including the authority to prevent or mitigate emergency operating situations in both next-day analysis and real-time operations. The Reliability Coordinator has the purview that is broad enough to enable the calculation of Interconnection Reliability Operating Limits, which may be based on the operating parameters of transmission systems beyond any Transmission Operator's vision.
☐	Balancing Authority	The responsible entity that integrates resource plans ahead of time, maintains load-interchange-generation balance within a Balancing Authority Area, and supports Interconnection frequency in real time.
☐	Interchange Authority	Authorizes valid and balanced Interchange Schedules.
☒	Planning Coordinator	The responsible entity that coordinates and integrates transmission facility and service plans, resource plans, and protection systems.
☐	Transmission Service Provider	The entity that administers the transmission tariff and provides Transmission Service to Transmission Customers under applicable transmission service agreements.
☒	Transmission Owner	The entity that owns and maintains transmission facilities.
☐	Transmission Operator	The entity responsible for the reliability of its "local" transmission system, and that operates or directs the operations of the transmission facilities.
☐	Transmission Planner	The entity that develops a long-term (generally one year and beyond) plan for the reliability (adequacy) of the interconnected bulk electric transmission systems within its portion of the Planning Authority Area.
☐	Resource Planner	The entity that develops a long-term (generally one year and beyond) plan for the resource adequacy of specific loads (customer demand and energy requirements) within a Planning Authority Area.
☐	Generator Operator	The entity that operates generating unit(s) and performs the functions of supplying energy and Interconnected Operations Services.
☒	Generator Owner	Entity that owns and maintains generating units.
☐	Purchasing-Selling Entity	The entity that purchases or sells, and takes title to, energy, capacity, and Interconnected Operations Services. Purchasing-Selling Entities may be affiliated or unaffiliated merchants and may or may not own generating facilities.
☒	Distribution Provider	Provides and operates the "wires" between the transmission system and the customer.

☐	Load-Serving Entity	Secures energy and transmission service (and related Interconnected Operations Services) to serve the electrical demand and energy requirements of its end-use customers.

Reliability and Market Interface Principles

Applicable Reliability Principles *(Check all boxes that apply.)*	
☒	1. Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards.
☒	2. The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
☒	3. Information necessary for the planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the systems reliably.
☒	4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained, and implemented.
☒	5. Facilities for communication, monitoring, and control shall be provided, used, and maintained for the reliability of interconnected bulk power systems.
☐	6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions.
☒	7. The security of the interconnected bulk power systems shall be assessed, monitored, and maintained on a wide-area basis.
Does the proposed Standard comply with all of the following Market Interface Principles? *(Select 'yes' or 'no' from the drop-down box.)*	
Recognizing that reliability is an Common Attribute of a robust North American economy:	
1. A reliability standard shall not give any market participant an unfair competitive advantage.Yes	
2. A reliability standard shall neither mandate nor prohibit any specific market structure. Yes	
3. A reliability standard shall not preclude market solutions to achieving compliance with that standard. Yes	
4. A reliability standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards. Yes	

Detailed Description (Provide enough detail so that an independent entity familiar with the industry could draft a standard based on this description.)

Review and compare regional standard PRC-006-NPCC-1with continent-wide standards PRC-006-1/PRC-006-2 and PRC-024-1/PRC-024-2 to determine if revisions are necessary, or retirement of PRC-006-NPCC-01 possible.

Determine the necessity for including wording to address dispersed generation resources.

Consider incorporating more stringent aspects of Directory#12 in order to facilitate future retirement of Directory#12.

Related Standards

Standard No.	Explanation
PRC-006-1/PRC-006-2	NERC Automatic Underfrequency Load shedding
PRC-024-1/PRC-024-2	NERC Generator Frequency and Voltage Protective Relay Settings

Related SARs or RSARs

SAR ID	Explanation

NPCC, Inc.
NORTHEAST POWER COORDINATING COUNCIL, INC.
1040 AVE. OF THE AMERICAS, NEW YORK, NY 10018 (212) 840-1070 FAX (212) 302-2782

PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from September 1, 2017 through October 16, 2017.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

NPCC, Inc.

NORTHEAST POWER COORDINATING COUNCIL, INC.
1040 AVE. OF THE AMERICAS, NEW YORK, NY 10018 (212) 840-1070 FAX (212) 302-2782

1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

7. Provide any additional comments for the drafting team to consider, if desired.

Comments:

A. Introduction

1. Title: **Automatic Underfrequency Load Shedding**

2. Number: PRC-006-NPCC-2

3. Purpose: The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Standard establishes more stringent and specific NPCC UFLS program requirements to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.

4. Applicability:

4.1. Generator Owner

4.2. Planning Coordinator

4.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

4.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

5. Effective Date:

The first day of the first calendar quarter following applicable governmental and regulatory approvals.

B. Requirements

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Note that Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program having performance characteristics that prevents the frequency from remaining below 59.5 Hz for greater than 30 seconds in accordance with Figure 1. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC PRC Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 days of receipt of a request. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Planning Coordinator shall, within 30 days of completion of its UFLS system studies, identify to the Regional Entity all non-BES generation facilities, within its Planning Coordinator Area, that must not trip above the appropriate generator underfrequency trip threshold curve in Figure 2 in order to support acceptable UFLS program performance. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M3. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.

R4. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each island identified per the NERC PRC Standard on UFLS. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

4.1. The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times and load shedding amounts specified in Attachment C, Tables 1 through 3.

4.2. Alternatively, the program can be implemented collectively by multiple Distribution Providers or Transmission Owners with less than 100 MW of individual peak net Load, as long they reside in the same UFLS Island identified by the Planning Coordinator per R2. These multiple Distribution Providers or Transmission owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3.

M4. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R4. (Attachment C Tables 1-3).

R5. Each Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program, shall notify its Planning Coordinator within 30 days, and: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

5.1. Each Distribution Provider or Transmission Owner applicable to Attachment C, Table 1, within 90 calendar days of informing of its Planning Coordinator that

tolerances cannot be met, determine if tolerances can be met through adjustments and notify the Planning Coordinator of the determination and;

5.1.1. If adjustments are possible, make the adjustments within 180 calendar days after determining that adjustments are possible and notify the Planning Coordinator when complete, or;

5.1.2. If adjustments are not possible then provide its Planning Coordinator with a technical study within 180 calendar days that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.

5.2. Each Distribution Provider or Transmission Owner applicable to Attachment C, Table 2 or Table 3, within 90 calendar days after informing the Planning Coordinator, determine if tolerances can be met through adjustments and notify the Planning Coordinator of the determination, and;

5.2.1. If adjustments are possible, within 90 calendar days make the adjustments of determining that adjustments are possible and notify the Planning Coordinator when complete, or;

5.2.2. If adjustments are not possible, then within 90 calendar days provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

5.3. Each Distribution Provider or Transmission Owner in the Quebec Interconnection, within 90 calendar days after informing the Planning Coordinator, determine if tolerances can be met through adjustments and notify the Planning Coordinator of the determination, and;

5.3.1. If adjustments are possible, within 180 calendar days make the adjustments of determining that adjustments are possible and notify the Planning Coordinator when complete, or;

5.3.2. If adjustments are not possible, then within 90 calendar days provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with the UFLS program.

M5. Each Distribution Provider or Transmission Owner shall have evidence such as reports, analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.

Rationale for Requirement R6: Operation of underfrequency relays results directly in load being shed, interrupting service to customers. The security of underfrequency relays against misoperation is therefore paramount. The 100 ms minimum time delay specified in R6 serves to prevent premature activation of these relays during short-lived transient frequency excursions that may occur on a localized basis in the absence

of a serious system event wherein UFLS would be appropriate. This intentional delay helps to ensure that the relays activate only for frequency excursions that are due to actual system events that require automatic UFLS to reestablish the balance of generation to load.

R6. Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with a 100 ms minimum time delay. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M6. Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum time delay, in accordance with Requirement R6.

R7. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M7. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R7.

R8. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 days of any changes to those thresholds. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*

M8. Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R8.

R9. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R8 shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M9. Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

R10. Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings provided by the Planning Coordinator in accordance with Requirement R8 and based on the Planning Coordinator approved implementation plan in accordance with R9. *[Violation Risk Factor: High] [Time Horizon: Operations Planning]*

M10. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R10.

Rationale for Requirement R11: It is recognized that, ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard universally, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. This being said, entities are required by R11 to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R11. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load projected to be shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would disconnect load if triggered by the UFLS relays. If there is no local metering of the load through said switches, the load may be calculated from measurements made at the nearest available metering. (e.g., upstream metering on the distribution feeder that supplies the load to be shed). *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M11. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R11.

R12. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted in Requirements R15 and R18. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M12. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R12.

R13. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay to its Planning Coordinator within 45 days of the Planning Coordinator's request. *[Violation Risk Factor: High] [Time Horizon: Operations Planning]*

M13. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R13.

R14. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

14.1. Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.

14.2. Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 2.

M14. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R14.

R15. Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard, as documented in accordance with Attachments A or B, that have underfrequency protections set to trip above the appropriate curve in Figure 2 shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

15.1. Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

15.2. Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

15.3. Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M15. Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with Requirement R13 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R15.

R16. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R15.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M16. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such as emails, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R16.

R17. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R15.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M17. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as emails, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R17.

R18. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2, based on their licensing design basis, shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- **18.1.** Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.
- **18.2.** Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.
- **18.3.** Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M18. Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R18.

Figure 1
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz
Design Performance Requirements

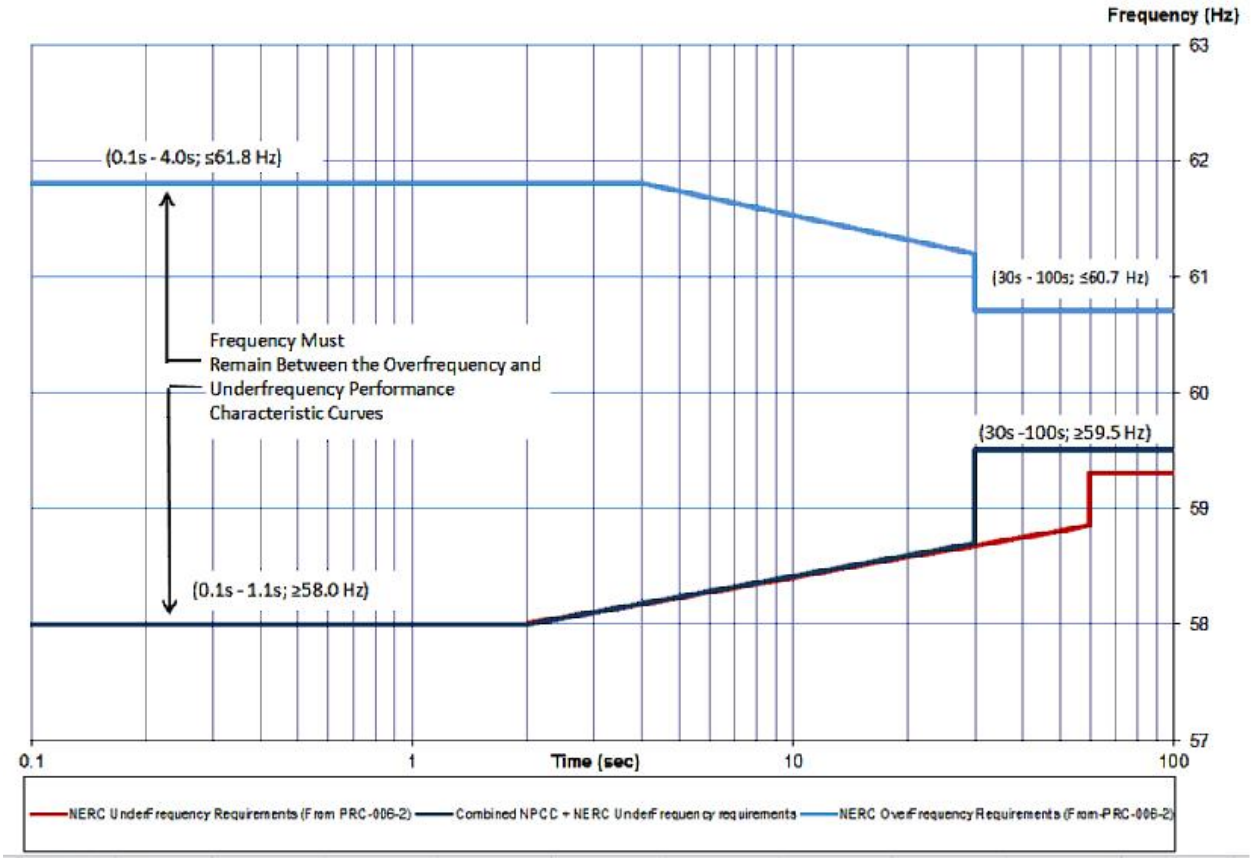
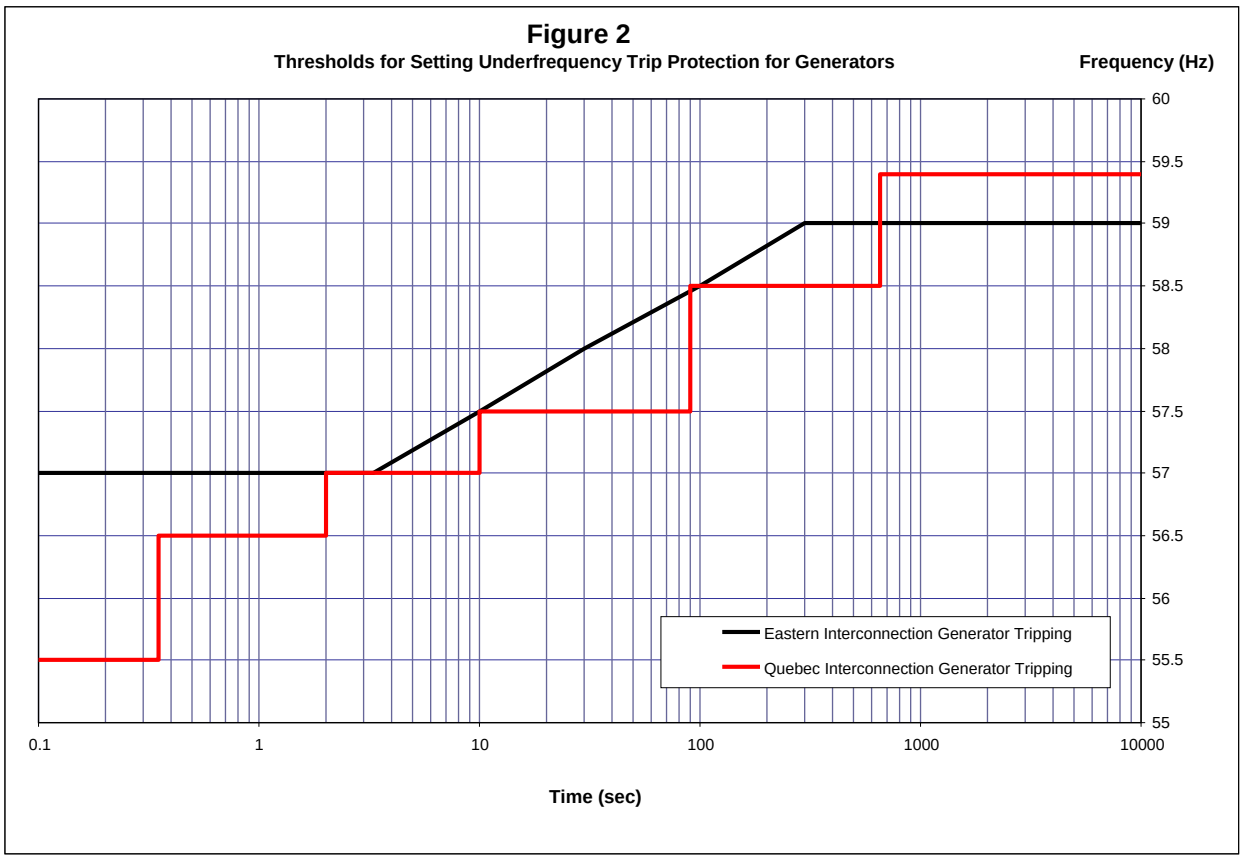


Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority

NPCC Compliance Committee

1.2. Compliance Monitoring Period and Reset Time Frame

Not Applicable

1.3. Data Retention

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 4, 5, 6,7,10, 11, and 12.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 3, 8, 9, 20, and 21.

The Planning Coordinator in Ontario, Quebec, and the Maritime Provinces shall keep evidence for three calendar years for Measure 17.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 18, 22, and 23.

The Generator Owner shall keep evidence for three calendar years for Measures 13, 14, 15, 16, and 19.

1.4. Compliance Monitoring and Assessment Processes

Self -Certifications.

Spot Checking.

Compliance Audits.

Self- Reporting.

Compliance Violation Investigations.

Complaints.

1.5. Additional Compliance Information

None.

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units, in their Planning Coordinator area, in service prior to the effective date of Version 1 of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

    2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest

frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-1 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units in service prior to the effective date of Version 1 of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution

Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-1 Attachment C

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:

Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5
59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 – 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	28-50	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Guidelines and Technical Basis:

Standard PRC-006-2, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.

PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.

Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria

Generator dynamic modeling (MOD-027-1 - Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions) or system modeling (if variations in system response are detected under MOD-033 - Steady-State and Dynamic System Model Validation)

A. Introduction

1. **Title:** **Automatic Underfrequency Load Shedding**

2. **Number:** PRC-006-NPCC-~~2~~1

3. **Purpose:** ~~To provide a regional reliability standard that ensures the development of an effective automatic underfrequency load shedding (UFLS) program in order to preserve the security and integrity of the bulk power system during declining system frequency events in coordination with the NERC UFLS reliability standard characteristics.~~ The NPCC Automatic Underfrequency Load Shedding (UFLS) regional S~~s~~tandard establishes more stringent and specific NPCC UFLS program requirements to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.

4. **Applicability:**

   4.1. Generator Owner

   4.2. Planning Coordinator

   ~~4.2.~~ Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

   4.3.

   4.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

~~4.3. Distribution Provider~~

~~4.4. Transmission Owner~~

5. **Effective Date:**

   ~~For the Eastern Interconnection & Québec Interconnection portions of NPCC excluding the Independent Electricity System Operator (IESO) Planning Coordinator area of NPCC in Ontario, Canada:~~

   ~~The effective date for Requirements R1, R2, R3, R4, R5, R6, and R7 is the first day of the first calendar quarter following applicable regulatory approval but no earlier than January 1, 2016 The effective date for Requirements R8 through R23 is the first day of the first calendar quarter two years following applicable governmental and regulatory approval.~~

   ~~For the Independent Electricity System Operator (IESO) Planning Coordinator's area of NPCC in Ontario, Canada:~~

   ~~All requirements are effective t~~The first day of the first calendar quarter following applicable governmental and regulatory approvals. ~~but no earlier than April 1, 2017.~~

B. Requirements

~~R1~~ R1 ~~NPCC Under frequency Load Shedding Program - More Stringent Criteria~~

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Should the Applicability List re-ordered to list:
4.1 Planning Coordinator
4.2 Distribution Provider
4.3 Transmission Owner
4.4 Generation Owner
The current NERC guidance regarding the applicability ordering.

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Thought standards now need an Implementation Plan and should say "See Implementation Plan"

~~The NPCC underfrequency Criteria are in addition to, or more stringent or more specific than the NERC PRC Standard on UFLS, or any Regional Reliability standard requirements.~~

~~The intent of the NPCC automatic Under frequency Load Shedding program is to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.~~

Commented [DML4]: Dan to move to "purpose" section

~~Each Planning Coordinator shall design a UFLS program that meets the following performance characteristics in simulations of underfrequency conditions resulting from an imbalance scenario, where an imbalance = [(load – actual generation output) / (load)], of up to 25 percent within the identified island(s).~~

Rationale for Requirement R1: ~~Attachment 1~~Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern ~~I~~interconnection portion of NPCC. Note that ~~Attachment 1~~Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

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R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program having performance characteristics that prevents the frequency from remaining below 59.5 Hz for greater than 30 seconds in accordance with Figure 1.

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~~*R1.1 Frequency decline is arrested at no less than 58.0 Hz for the portions of NPCC in the Eastern Interconnection.*~~

~~*R1.2 Frequency does not remain below 58.5 Hz for greater than 10 seconds, and does not remain below 59.5 Hz for greater than 30 seconds.*~~

~~*[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*~~

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M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

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~~Attachment 1 of this document shows the NPCC underfrequency criteria for the eastern interconnection portion of NPCC. Note that Attachment 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS. The Section below need to be move to Rationale Box:~~

~~"Attachment 1 of this document shows the NPCC underfrequency criteria for the eastern interconnection portion of NPCC. Note that Attachment 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS."~~

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R2. ~~-~~Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC PRC Standard on UFLS, ~~-~~ to Distribution ~~p~~Providers, Generator Owners, and

Transmission O~~o~~wners within 30 days of receipt of a ~~of a~~ request. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M2. ~~—~~Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

~~**Do not change language of existing R2 but it becomes:**~~

~~**R3.** Each Planning Coordinator shall, within 30 days of completion of its system studies required by the NERC PRC Standard on UFLS, identify to the Regional Entity the generation facilities within its Planning Coordinator Area necessary to support the UFLS program performance characteristics. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]~~

~~**Rationale for Requirement R3:** Demonstrate to the Regional Entity, via system studies, that the UFLS program will not meet performance requirements if all non-BES generators identified in R3.1 trip above underfrequency trip threshold curve in Figure 1~~

R3. ~~-~~ ~~—~~Each Planning Coordinator shall, within 30 days of completion of its UFLS system studies, identify to the Regional Entity all non-BES generation facilities, within its Planning Coordinator Area, that must not trip above the appropriate generator underfrequency trip threshold curve in Figure 2 in order to support acceptable UFLS program performance.

~~*R3.2 Demonstrate to the Regional Entity, via system studies, that the UFLS program will not meet performance requirements if all non-BES generators identified in R3.1 trip above underfrequency trip threshold curve in Figure 1.*~~

[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]

M3. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.

~~Each Planning Coordinator shall provide to the Transmission Owner, Distribution Provider, and Generator Owner within 30 days upon written request the requirements for entities aggregating the UFLS programs and requirements for compensatory load shedding program derived from each Planning Coordinator's system studies as determined by Requirement R1. [Violation Risk Factor: Low] [Time Horizon: Long Term Planning]~~

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R4. ~~-~~Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each island identified per the NERC PRC Standard on UFLS. ~~*for its Facilities*~~ *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

4.1. The UFLS program shall be implemented~~-~~ by each Distribution Provider and Transmission Owner according ~~based~~ to~~on~~ the frequency thresholds, ~~total~~ nominal operating times and load shedding amounts specified in Attachment C, Tables 1 through 3.~~,~~

4.2. Alternatively, the program can be implemented ~~or shall~~ collectively ~~implement , by mutual agreement~~ by ~~with~~ multiple ~~one or more~~ Distribution Providers or~~and~~ Transmission Owners with less than 100 MW of individual peak net Load, as long they reside in the same UFLS Island identified by the Planning Coordinator per R2. ~~within the same island per identified in, Requirement R1,~~ These multiple Distribution Providers or Transmission owners~~and~~, via mutual agreement, shall act~~ing~~ as a single entity to~~,~~ provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to~~, based on~~ the frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3.

~~**4.3.** Whether implemented collectively or individually, the automatic UFLS program shall be implemented on an island basis. Each Distribution Provider and Transmission Owner shall provide the required loadshedding amounts and frequency thresholds specified in the Attachment C, Tables 1 through 3, within each island identified in R2.~~

M4. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program ~~to achieve the individual and cumulative percentages~~ identified in Requirement R4. (Attachment C Tables 1-3). ~~[Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

~~**R5.**~~

~~If a Distribution Provider or Transmission Owner cannot meet the tolerances and/or number of stages and frequency set points specified in Attachment C, Tables 1 through 3, such Distribution Provider or Transmission Owner shall: .~~

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~~Each Distribution Provider or Transmission Owner that must arm its load to trip on underfrequency in order to meet its requirements as specified and by doing so exceeds the tolerances and/or deviates from the number of stages and frequency set points of the UFLS program as specified in the tables contained in Requirement R4 above, as applicable depending on its total peak net Load shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*~~

~~**5.1.** Inform its Planning Coordinator of the need to exceed the stated tolerances or the number of stages as shown in UFLS Attachment C, Table 1 if applicable and~~**~~5.1.1.~~** ~~and~~;**~~5.1.2.~~**

~~**5.2.** Provide its Planning Coordinator with a technical study that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.~~.1

~~**5.3.** Inform its Planning Coordinator of the need to exceed the stated tolerances of UFLS Attachment C, Table 2 or Table 3, and in the case of Attachment C, Table 2 only, the need to deviate from providing two stages of UFLS, if applicable, and~~**~~5.3.1.~~**

~~**5.4.** Provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.~~.1

~~**M5.** Each Distribution Provider or Transmission Owner shall have evidence such as reports, analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.~~

~~**Rationale for Requirement R6:** Operation of underfrequency relays results directly in load being shed, interrupting service to customers. The security of underfrequency relays against misoperation is therefore paramount. The 100 ms minimum time delay specified in R6 serves to prevent premature activation of these relays during short-lived transient frequency excursions that may occur on a localized basis in the absence of a serious system event wherein UFLS would be appropriate. This intentional delay helps to ensure that the relays activate only for frequency excursions that are due to actual system events that require automatic UFLS to reestablish the balance of generation to load.~~

R5. Each Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program, shall notify its

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Planning Coordinator within 30 days, and: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

5.1. Each Distribution Provider or Transmission Owner applicable to Attachment C, Table 1, within 90 calendar days of informing of its Planning Coordinator that tolerances cannot be met, determine if tolerances can be met through adjustments and notify the Planning Coordinator of the determination and;

5.1.1. If adjustments are possible, make the adjustments within 180 calendar days after determining that adjustments are possible and notify the Planning Coordinator when complete, or;

5.1.2. If adjustments are not possible then provide its Planning Coordinator with a technical study within 180 calendar days that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.

5.2. Each Distribution Provider or Transmission Owner applicable to Attachment C, Table 2 or Table 3, within 90 calendar days after informing the Planning Coordinator, determine if tolerances can be met through adjustments and notify the Planning Coordinator of the determination, and;

5.2.1. If adjustments are possible, within 90 calendar days make the adjustments of determining that adjustments are possible and notify the Planning Coordinator when complete, or;

5.2.2. If adjustments are not possible, then within 90 calendar days provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

5.3. Each Distribution Provider or Transmission Owner in the Quebec Interconnection, within 90 calendar days after informing the Planning Coordinator, determine if tolerances can be met through adjustments and notify the Planning Coordinator of the determination, and;

5.3.1. If adjustments are possible, within 180 calendar days make the adjustments of determining that adjustments are possible and notify the Planning Coordinator when complete, or;

5.3.2. If adjustments are not possible, then within 90 calendar days provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with the UFLS program.

M5. Each Distribution Provider or Transmission Owner shall have evidence such as reports, analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.

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Rationale for Requirement R6: Operation of underfrequency relays results directly in load being shed, interrupting service to customers. The security of underfrequency relays against misoperation is therefore paramount. The 100 ms minimum time delay specified in R6 serves to prevent premature activation of these relays during short-lived transient frequency excursions that may occur on a localized basis in the absence of a serious system event wherein UFLS would be appropriate. This intentional delay helps to ensure that the relays activate only for frequency excursions that are due to actual system events that require automatic UFLS to reestablish the balance of generation to load.

~~**R6** Each Distribution Provider and Transmission Owner in the Québec Interconnection portion of NPCC shall implement an automatic UFLS program for its Facilities based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4 or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island, identified in Requirement R1, an aggregated automatic UFLS program that sheds Load based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

R6.~~7~~ ~~—~~Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with a 100 ms~~with the following~~ minimum time delay.~~:~~

~~7.1 Eastern Interconnection 100 ms~~

~~*7.2 Québec Interconnection 200 ms*~~

[Violation Risk Factor: High] [Time Horizon: Long Term Planning]

M6. ~~—~~Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum time delay, in accordance with Requirement R6.

~~Each Distribution Provider and Transmission Owner in the Québec Interconnection shall have evidence such as documentation or reports containing the location and amount of load to be tripped and the corresponding frequency thresholds on those circuits included in its UFLS program to achieve the load values identified in Table 4 of Requirement R6. (Attachment C Table 4). **Rationale Box:** Operation of underfrequency relays results directly in load being shed, interrupting service to customers. The security of underfrequency relays against misoperation is therefore paramount. The 100 ms minimum time delay specified in R6 serves to prevent premature activation of these relays during short-lived transient frequency excursions that may occur on a localized basis in the absence of a serious system event wherein UFLS would be appropriate. This intentional delay helps to ensure that the relays activate only for frequency excursions that are due to actual system events that require automatic UFLS to reestablish the balance of generation to load.~~

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R7.~~8~~ –Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program.~~Each Planning Coordinator shall develop and review once per calendar year settings for inhibit thresholds (such as but not limited to voltage, current and time) of UFLS relays to be utilized within its region's UFLS program.~~ *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M~~8~~7. — Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R~~8~~7.

R8.~~9~~ Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds ~~within 30 days of the initial determination of those inhibit thresholds and~~ within 30 days of any changes to those thresholds. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*

M8. Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R8.

R9.~~10~~ Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R8 shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M9. Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

R~~10~~. –Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings ~~based on the notification~~ provided by the Planning Coordinator in accordance with Requirement R~~8~~9. and based on the Planning Coordinator approved implementation plan in accordance with R9. *[Violation Risk Factor: High] [Time Horizon: Operations Planning]*

M10. — Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R10.

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Commented [RS9]: National Grid: Suggest to remove "…of the initial determination of those inhibit thresholds and…" My guess is that all the PC's have made their initial determinations and we only need to consider any changes to those thresholds.

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Commented [RS10]: National Grid: Suggestion to re-word. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R8 shall, develop and submit an implementation plan within 90 days of the request…

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Rationale for Requirement R11: It is recognized that, ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard universally, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. This being said, entities are required by R11 to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

~~(The original R9 was swapped with R10)*****~~

~~**R11.** Each Distribution Provider and Transmission Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with R9. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]~~

R-11. –Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load ~~that would have been~~projected to be shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would ~~be opened~~disconnect load if triggered by the UFLS relays. If there is no local metering of the load through said switches, the load may be calculated from measurements made at the nearest available metering. –(e.g., upstream metering on the distribution feeder that supplies the load to be shed). *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M12~~1~~1. –Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program ~~coincident with the integrated hourly peak of the previous year that~~to demonstrate~~s~~ that it meets Requirement R12~~1~~1.

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Commented [RS11]: National Grid: Suggest to shorten. A technical writer may be able to help with this and eliminate words as "on the other hand."

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~~**R12.** Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage coincident with their integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would be opened by the UFLS relays. [Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]~~

~~RATIONALE BOX:~~

~~It is recognized that, ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard universally, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. This being said, entities are required by R12 to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.~~

R1~~2~~2. ~~3~~ ~~—~~Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in ~~Figure 1~~Figure 2, except as otherwise exempted in Requirements R1~~6~~5 and R1~~9~~8. ~~–~~*[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M12. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R12.

R1~~3~~3. ~~4~~ ~~—————~~Each Generator Owner shall transmit the generator underfrequency trip setting and time delay to its Planning Coordinator within 45 days of the Planning Coordinator's request. *[Violation Risk Factor: High] [Time Horizon: Operations Planning]*

M13. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R13.

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R1~~4~~. ~~5~~ Each Generator Owner with a new generating unit, ~~scheduled to be in service on or after the effective date of this Standard,~~ or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

1~~4~~.1. Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in ~~Figure 1~~Figure 2.

1~~4~~.2. Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in ~~Figure 1~~Figure 2.

M14. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R14.

R1~~5~~. ~~6~~ Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard, as documented in accordance with Attachments A or B, that have underfrequency protections set to trip above the appropriate curve in ~~Figure 1~~Figure 2 shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

1~~5~~.1. Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

1~~5~~.2. Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

1~~5~~.3. Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.~~.~~

M1~~6~~5. Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with Requirement R13 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R1~~6~~5.

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Commented [DML13]: Guy to tightening up standard so that existing units that do meet curve, cant file to not meet curve. Add dates to attachment A and B and remove from R15.

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R1~~7~~6. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R1~~6~~5.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1~~7~~6. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such as emails, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R1~~7~~6.

R17. ~~8~~ Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R1~~5~~6.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1~~8~~7. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as emails, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R1~~8~~7.

R18. ~~9~~ Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in ~~Figure 1~~Figure 2, based on their licensing design basis, shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

1~~8~~9.1. Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

1~~9~~8.2. Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

1~~8~~9.3. Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M1~~9~~8. Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in ~~Figure 1~~Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R1~~8~~9.

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R. 20 M19.20 Each Planning Coordinator shall provide evidence such as spreadsheets, system studies, or other documentation that demonstrates that it meets the requirements of Requirement R2019.

. TThe Planning Coordinator shall update its UFLS program database parameters as specified by the NERC PRC Standard on UFLS. This database shall include the following information: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

20.1 For each UFLS relay, including those used for compensatory load shedding, the amount and location of load shed at peak, the corresponding frequency threshold and time delay settings.

20..2 The buses at which the Load is modeled in the NPCC library power flow case.

20..3 A list of all generating units that may be tripped for underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, including the frequency trip threshold and time delay for each protection system.

20..4 The location and amount of additional elements to be switched for voltage control that are coordinated with UFLS program tripping.

20..5 A list of all UFLS relay inhibit functions along with the corresponding settings and locations of these relays.

M20. Each Planning Coordinator shall provide evidence such as spreadsheets, system studies, or other documentation that demonstrates that it meets the additional UFLS program database parameters of Requirement R20.

R21 Each Planning Coordinator shall notify each Distribution Provider, Transmission Owner, and Generator Owner within its Planning Coordinator area of changes to load distribution needed to satisfy UFLS program performance characteristics as specified by the

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~~NERC PRC Standard on UFLS.[Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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~~**R22** Each Distribution Provider, Transmission Owner and Generator Owner shall implement the load distribution changes based on the notification provided by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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~~**R23** Each Distribution Provider, Transmission Owner and Generator Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]~~

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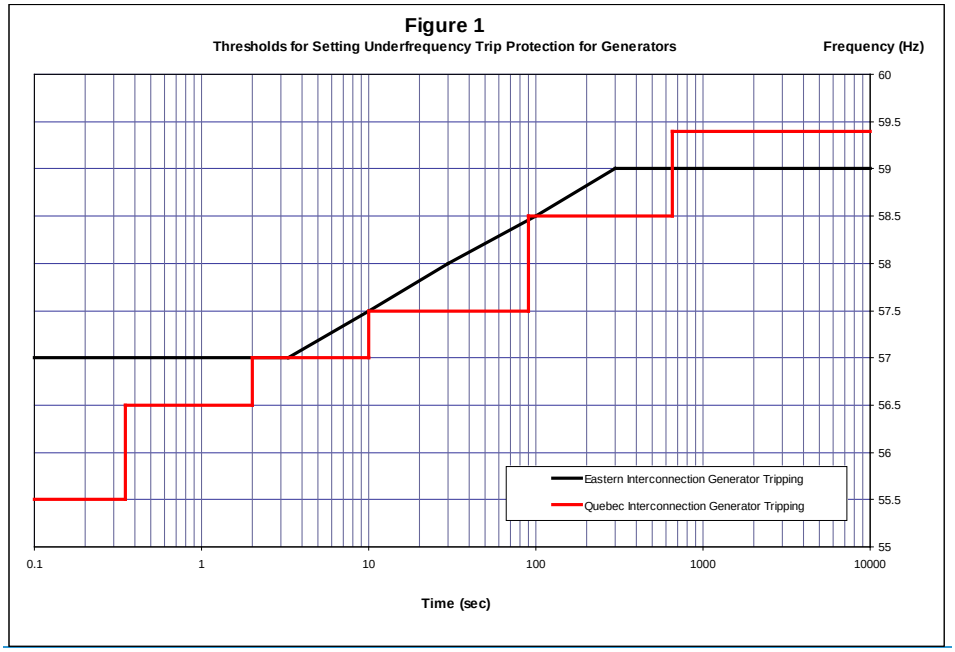
Figure 1


Thresholds for Setting Underfrequency Trip Protection for Generators
Frequency (Hz)
60
59.5
59
58.5
58
57.5
57
56.5
56
55.5
55
0.1
1
10
100
1000
10000
Time (sec)
Eastern Interconnection Generator Tripping
Quebec Interconnection Generator Tripping

~~Attachment 1~~Figure 1
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz Design Performance Requirements

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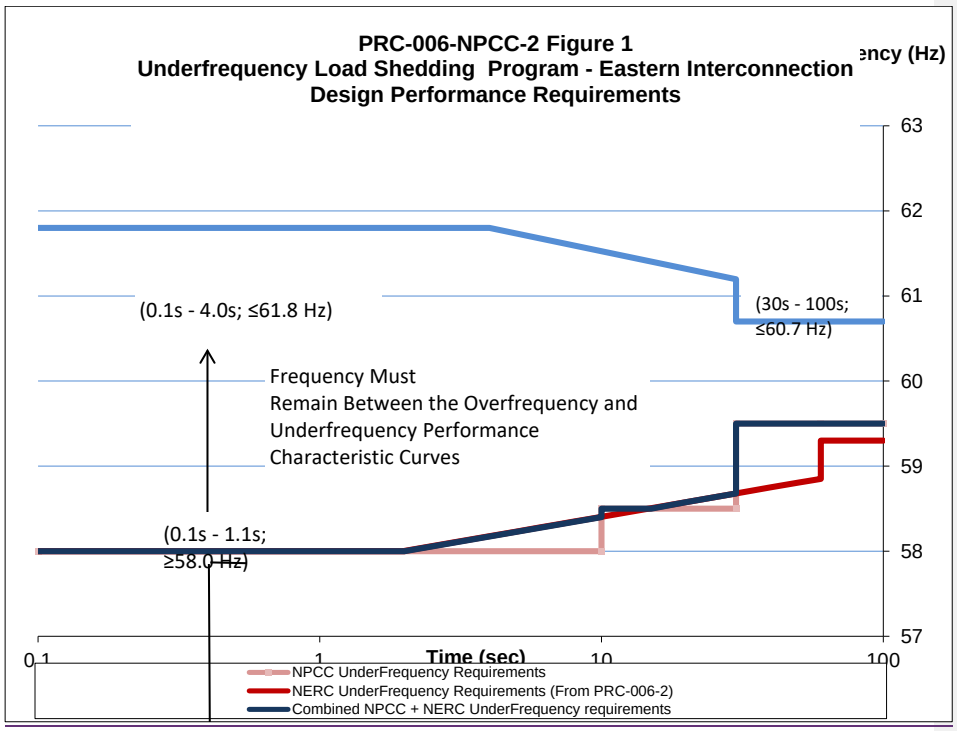
PRC-006-NPCC-2 Figure 1
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
ency (Hz)
63
62
61
60
59
58
57
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must Remain Between the Overfrequency and Underfrequency Performance Characteristic Curves
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
10
100
Time (sec)
NPCC UnderFrequency Requirements
NERC UnderFrequency Requirements (From PRC-006-2)
Combined NPCC + NERC UnderFrequency requirements

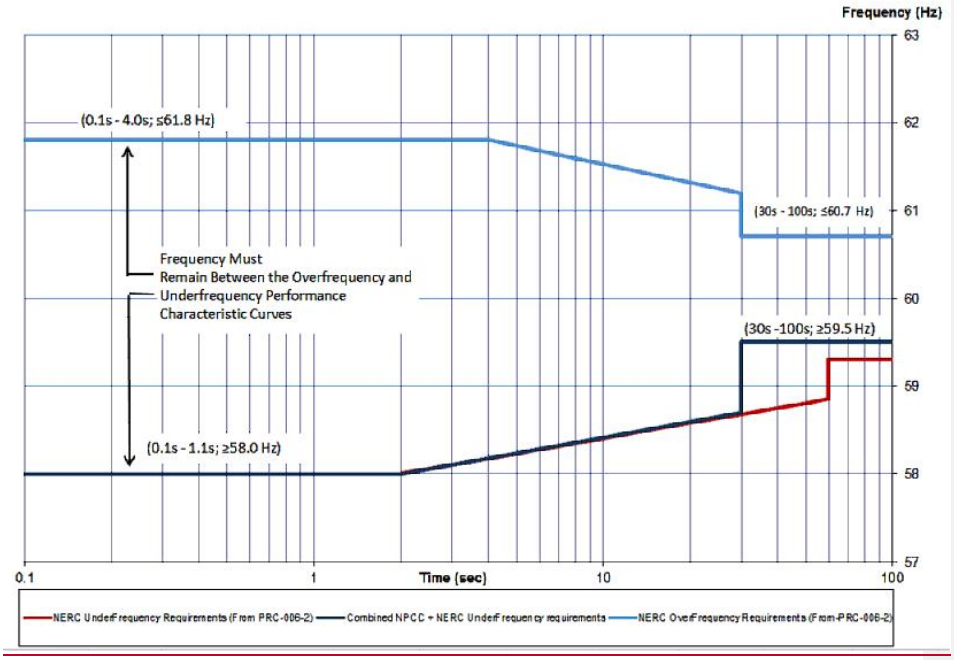

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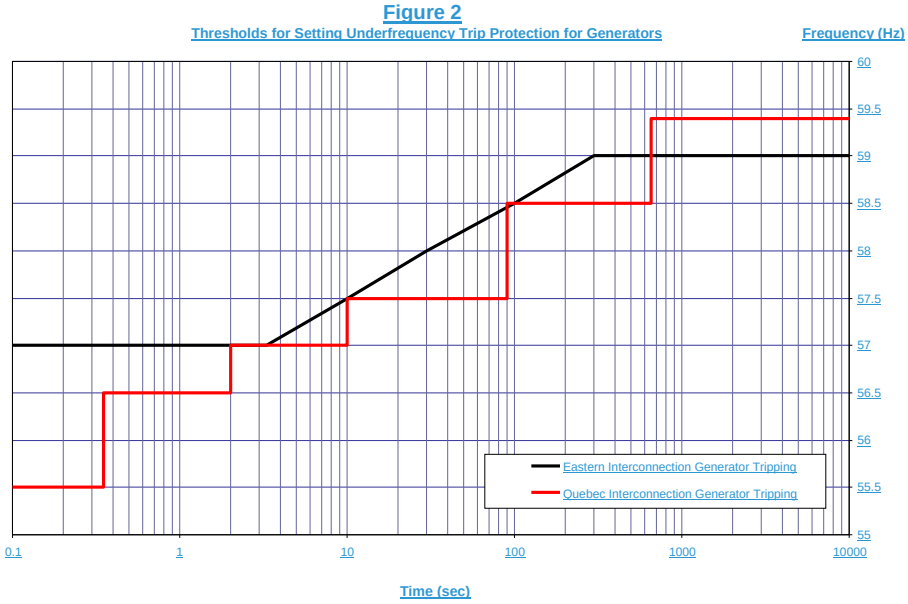
Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators

Figure 2

Thresholds for Setting Underfrequency Trip Protection for Generators



~~C.~~ Measures

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~~**M1.** Each Planning Coordinator shall have evidence such as reports, system studies and/or real time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.~~

~~**M2.** Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.~~

~~**M3.** Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.~~

~~**M4.** Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped, and the corresponding frequency thresholds, on those circuits included in its UFLS program to achieve the individual and cumulative percentages identified in Requirement R4. (Attachment C Tables 1-3).~~

M5 Each Distribution Provider or Transmission Owner shall have evidence such as reports, analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.

M6 Each Distribution Provider and Transmission Owner in the Québec Interconnection shall have evidence such as documentation or reports containing the location and amount of load to be tripped and the corresponding frequency thresholds on those circuits included in its UFLS program to achieve the load values identified in Table 4 of Requirement R6. (Attachment C Table 4).

M7 Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum time delay, in accordance with Requirement R7.

M8 Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R8.

M9 Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

M10 Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets or other documentation that demonstrates that it meets Requirement R10.

M11 Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R11.

M12 Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program coincident with the integrated hourly peak of the previous year that demonstrates that it meets Requirement R12.

M13 Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R13.

M14 Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R14.

M15 Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R15.

M16 Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with Requirement R13 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R16.

M17 Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such as emails, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R17.

M18 Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as emails, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R18.

M19 Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in Figure 1 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R19.

M20 Each Planning Coordinator shall provide evidence such as spreadsheets, system studies, or other documentation that demonstrates that it meets the requirements of Requirement R20.

M21 Each Planning Coordinator shall provide evidence such as emails, memorandum or other dated documentation that it meets Requirement R21.

M22 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as reports, spreadsheets or other documentation that demonstrates that it meets Requirement R22.

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~~**M23** Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates it meets Requirement 23.~~

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~~D.~~C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority

NPCC Compliance Committee

1.2. Compliance Monitoring Period and Reset Time Frame

Not Applicable

1.3. Data Retention

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 4, 5, 6,7,10, 11, and 12.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 3, 8, 9, 20, and 21.

The Planning Coordinator in Ontario, Quebec, and the Maritime Provinces shall keep evidence for three calendar years for Measure 17.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 18, 22, and 23.

The Generator Owner shall keep evidence for three calendar years for Measures 13, 14, 15, 16, and 19.

1.4. Compliance Monitoring and Assessment Processes

Self -Certifications.

Spot Checking.

Compliance Audits.

Self- Reporting.

Compliance Violation Investigations.

Complaints.

1.5. Additional Compliance Information

None.

PRC-006-NPCC-~~1~~2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in ~~Figure 1~~Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is ~~-~~provided in all UFLS islands ~~identified in Requirement R1~~ in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain ~~an updated~~ a list of all existing non-nuclear generating units, in their Planning Coordinator area, in service prior to the effective date of ~~the~~Version 1 of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate generating units, if any, ~~effective date of this standard~~ that have their underfrequency protections set to trip above the appropriate curve in ~~Figure 1~~Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in ~~Figure 1~~Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate~~, as identified in Requirement R1~~

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator ~~in Requirement R1~~ within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, ~~T~~the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~.~~.

2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in ~~Figure 1~~Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in ~~Figure 1~~Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in ~~Figure 1~~Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-1 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate ~~-~~curve in ~~Figure 1~~Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify~~, and~~ compile, and maintain a list of all of its existing non-nuclear generating units in service prior to the effective date of Version 1 of the regional ~~is s~~Standard (April, 2017 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, that ~~has~~ have their underfrequency protections set to trip above the appropriate curve in ~~Figure 1~~Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in ~~Figure 1~~Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in ~~Figure 1~~Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in ~~Figure 1~~Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-1 Attachment C

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:

Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5
59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 ~~2~~ – 3	~~29.5~~ 29.5 – 31.5

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak ~~-~~net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

1. ~~1.~~ The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

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UFLS Table 3: Eastern Interconnection Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:				
UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	28-50	28-50

1. ~~1.~~ The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

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~~UFLS Table 4: Quebec Interconnection~~

Commented [DML19]: Quebec want this out of standard

	~~Rate~~	~~Frequency (Hz)~~	~~MW at peak (*Load must be fixed at all times when above 60% of peak load..)~~	~~Mvar at peak~~	~~Total Nominal Operating Time (s)~~ [2]
~~Threshold Stage 1~~	~~——~~	~~58.5~~	~~1000*~~	~~1000~~	~~0.30~~
~~Threshold Stage 2~~	~~——~~	~~58.0~~	~~800*~~	~~800~~	~~0.30~~
~~Threshold Stage 3~~	~~——~~	~~57.5~~	~~800~~	~~800~~	~~0.30~~
~~Threshold Stage 4~~	~~——~~	~~57.0~~	~~800~~	~~800~~	~~0.30~~
~~Threshold Stage 5 (anti-stall)~~	~~——~~	~~59.0~~	~~500~~	~~500~~	~~20.0~~
~~Slope Stage 1~~	~~-0.3 Hz/s~~	~~58.5~~	~~400~~	~~400~~	~~0.30~~
~~Slope Stage 2~~	~~-0.4 Hz/s~~	~~59.8~~	~~800*~~	~~800~~	~~0.30~~
~~Slope Stage 3~~	~~-0.6 Hz/s~~	~~59.8~~	~~800*~~	~~800~~	~~0.30~~
~~Slope Stage 4~~	~~-0.9 Hz/s~~	~~59.8~~	~~800~~	~~800~~	~~0.30~~

~~2. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communications time, and the rated breaker interrupting time. The underfrequency relay operating time shall be measured from the time when the frequency passes through the frequency threshold set point.~~

Guidelines and Technical Basis:

~~Guidelines and Technical Basis~~

Standard PRC-006-2, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.

PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.

Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria

Generator dynamic modeling (MOD-027-1 - Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions) or system modeling (if variations in system response are detected under MOD-033 - Steady-State and Dynamic System Model Validation)

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Implementation Plan

Regional Reliability Standard PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Applicable Standard(s)

- PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Requested Retirement(s)

- PRC-006-NPCC-1 – Automatic Underfrequency Load Shedding

Applicable Entities

- Generator Owner
- Planning Coordinator
- Distribution Provider that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.
- Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

Background

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the

applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

Effective Date

The first day of the first calendar quarter 6 months following applicable governmental and regulatory approvals.

Retirement Date

Regional Reliability Standard PRC-006-NPCC-1 shall be retired immediately prior to the effective date of PRC-006-NPCC-2.

NYISO Comments

Regional Standard PRC-006-NPCC-02

October 16, 2017

The NYISO submits the following comments on the proposed Regional Standard for the drafting team's consideration:

With regards to R3

Each Planning Coordinator shall, within 30 days of completion of its UFLS system studies, identify to the Regional Entity all non-BES generation facilities, within its Planning Coordinator Area, that must not trip above the appropriate generator underfrequency trip threshold curve in Figure 2 in order to support acceptable UFLS program performance.

- It is not clear what is considered to be non-BES generation facilities:
    - Is it limited to generation that is modeled?
    - How should DER, behind the meter or load/netted generation be addressed?
    - What is the criteria for determining what Non-BES generation is not allowed to trip
- What is the role of the Regional Entity, once this information is provided?
- Who will have the obligation/authority to inform any identified non-BES generators that they must adhere to the appropriate trip threshold?

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from September 1, 2017 through October 16, 2017.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments:

PSEG offers the following comments to inform the instant drafting team of PSEG's concerns with the proposed standard and to memorialize our position for future consideration.

a) Generator Compensatory Load Shedding:

PRC-006-NPCC-02 requirement R15 part 3 (R15.3) as proposed would retain PRC-006-NPCC-01's requirement R16.3 for compensatory load shedding by Generators in U.S. portions of NPCC. However, like PRC-006-NPCC-01, PRC-006-NPCC-02 also does not include an accompanying requirement in the revised standard that requires a distribution or transmission entity to make appropriate load (i.e. "within the UFLS island identified by the Planning Coordinator in Requirement R2") available to the Generator to shed. And there also are no applicable Tariffs etc., or other NERC or NPCC standards that require distribution or transmission entities to make any load available to Generators for this purpose. Consequently, a requirement for Generator compensatory load shedding in U.S. portions of NPCC is now and potentially would remain non-implementable for GOs.PRC-006-NPCC-02 requirement R15 part 3 (R15.3) and should therefore be removed from the proposed standard.

b) Generator Underfrequency Trip Protection Settings

The revised standard retains PRC-006-NPCC-01's Figure 1 generator underfrequency trip protection settings threshold curve, as PRC-006-NPCC-02 Figure 2. PSEG does not believe retention of that curve or inclusion of another PRC-006-NPCC-specific Generator UF settings curve in PRC-006-NPCC-2 are necessary. All UFLS plans of NERC Registered Entities to whom NERC reliability standard PRC-006-2 is, PRC-006-NPCC-01 is and PRC-006-NPCC-02 would be applicable, must already now meet the design performance requirements identified in Attachment 1 of PRC-006-2. PRC-006-2 Attachment 1 includes and illustrates that the least-demanding/potentially damaging (the 'Eastern Interconnection') generator underfrequency trip protection settings threshold curve for generating units, directed and required by NERC reliability standard PRC-024-2 (see Attachment 1 of PRC-024-2), coordinates with the UFLS plan performance requirements set out in PRC-006-2. And that curve (Attachment 1 of PRC-024-2) would coordinate with the UFLS plan

performance requirements that would be set out in PRC-006-NPCC-2 as now proposed (see PRC-006-NPCC-02 Figure 1). All of the curves in Attachment 1 of PRC-024-2, including the 'Eastern Interconnection' curve, are considered adequate generator UF and OF performance by NERC and FERC by virtue of being in NERC- and FERC- approved reliability standard PRC-024-2. If PRC-006-NPCC-02 is to retain PRC-006-NPCC-02 Figure 2, or another PRC-006-NPCC-specific Generator UF settings curve, PSEG recommends additional technical justification for doing so.

Generator underfrequency trip protection settings that will be directed and required by PRC-006-NPCC-2 requirement R12 (i.e. that Generators meet the curve presented in PRC-006-NPCC-02 Figure 2) also directly impact the burden and costs Generators now or could in future (new units; unit uprate modifications) bear to meet other requirements in the standard: R14; R15; R17 without a commensurate reliability benefit. Generators' additional burdens and costs to meet these other requirements should be better supported by additional technical justification explaining why PRC-006-NPCC-02's Figure 2 curve, or any other generator UF settings curve that might alternatively be proposed, is required for PRC-006-NPCC-2, over adoption of (direct or implicit) and reliance upon the 'Eastern Interconnection' curve in Attachment 1 of PRC-024-2.

c) Applicability to Non-BES Generators

PRC-006-NPCC-02 requirement R3 appears designed to result in NPCC requiring otherwise non-BES (i.e. not NERC registered) Generators, or Generators' otherwise non-BES generating units, to comply with the standard's under-frequency ride-through requirements. The result would be that, where it could otherwise be needed to save an island, load shedding beyond that directed in Tables 1 to 3 in Attachment C of the proposed standard would be avoided, at these Generators' risk (NERC compliance) and expense. PSEG does not support this. The NERC registration criteria have been developed to generally ensure that entities needed to ensure BES reliability via the NERC reliability standards are registered and thereby in the scope of those standards. Similarly, the BES Definition was developed to generally ensure that facilities and equipment needed to ensure BES reliability via the NERC reliability standards, are designated as part of the BES and thereby in the scope of those standards. PSEG recommends additional technical and legal justification explaining why the Generators indicated in R3 ("non-BES generation facilities") need to be registered and become subject to the standard's under-frequency ride-through requirements, versus developing and implementing alternatives options such as requiring implementation of additional load shedding.

d) Adequacy of Required DP and TO Load Shedding

Requirements R4 and R5 direct how much load DPs and TOs must shed, at what frequency thresholds. However, neither of these requirements, nor any others in PRC-006-NPCC-02, address or identify what additional action these DPs and TOs, PCs subject to PRC-006-NPCC-02 R1, or any other entities are required to take in the event that the amount of load

shed required by R4 and R5 (i.e. load shed schedule listed in PRC-006-NPCC-02 Attachment C) would not produce UFLS program performance meeting PRC-006-NPCC-02 Figure 1. PSEG recommends clarification of what additional actions would be required, and by whom.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Effective date indicated in Section 5 is not consistent with date indicated in Implementation plan document. PSEG suggests that Section 5 refer to or direct the same schedule as the Implementation Plan.

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: As noted in our comments in response to Question 1, PSEG disagrees with compensatory load shedding requirements. PSEG reiterates that PRC-006-NPCC-02 requirement R15 part 3 (R15.3) should be removed from the proposed standard.

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

Following on our comments provided in response to Question 1, PSEG does not find requirement R12 cost-effective because it requires Generators to meet a generator underfrequency trip protection settings threshold curve (PRC-006-NPCC-02 Figure 2) which exceeds what is necessary i.e. beyond what is needed for NPCC entities' UFLS program performance to produce BES frequency outcomes that will conform to PRC-006-NPCC-02 Figure 1 limits. Without any commensurate improvement in BES reliability, this increases costs to Generators. For example, new generators' UF provisions/protections, replicating standard designs that otherwise meet others' UF requirements outside of NPCC, may require review and potential modification from standard design. PSEG recommends that the 'Eastern Interconnection' curve in Attachment 1 of PRC-024-2 be adopted for PRC-006-NPCC-02, to replace PRC-006-NPCC-02 Figure 2. This would be accomplished implicitly by removing PRC-006-NPCC-02 R12 in its entirety from PRC-006-NPCC-02, since Generators already must comply with PRC-024-2. It could also be done explicitly by replacing the current PRC-006-NPCC-02 Figure 2 with: (i) a copy of the 'Eastern Interconnection' curve in Attachment 1 of PRC-024-2; or (ii) explicit reference to that curve in PRC-006-NPCC-02; or (iii) incorporating the curve into PRC-006-NPCC-02 Figure 1 (as PRC-006-NPCC-02 Figure 1 has done with the BES System Frequency element of Attachment 1 of PRC-006-2, and Attachment 1 of PRC-006-2 itself has done with the 'Eastern Interconnection' curve in Attachment 1 of PRC-024-2).

On the basis of our comments in response to Question 1, PSEG does not find requirement R3 cost-effective because it could impose significant additional risks and costs on otherwise non-BES Generators, or Generators' otherwise non-BES generating units, to the benefit (avoided additional costs) to other already-NERC-registered BES entities (DPs, TOs) who could implement one or more alternative solutions (e.g.: additional load shed capability; strengthened transmission capability).

7. Provide any additional comments for the drafting team to consider, if desired.

Comments:

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from September 1, 2017 through October 16, 2017.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: This draft version of NPCC Regional Standard PRC-006-NPCC-2 'Automatic Underfrequency Load Shedding' includes instances of unclear language, exposing risks of alternative interpretations; see questions and proposed changes under item #7 below for details.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Please consider changing language under Effective Dates to state: "See Implementation Plan." Please consider changing the effective date to read as the first day of the first calendar quarter 12 months following applicable governmental and regulatory approvals. The change from 6 months to 12 months will provide additional time that may be needed to accommodate automatic UFLS changes that may need to be made on an island basis, for each identified island. Changes involving automatic UFLS are generally made on an annual schedule.

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☒

No ☐

Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: See #7 below.

7. Provide any additional comments for the drafting team to consider, if desired.

Comments: Below please find our general questions and proposed (editorial) changes:

- Should the word island (as in UFLS Island) be capitalized throughout this document, since it is a defined term in the NPCC Glossary of Terms? The term island' is sometimes written with a lower case "i" and sometimes with a capital "I", please review to ensure consistency in standard.

- Suggesting changing reference to NERC PRC-006-2 from 'generic' version (i.e., NERC PRC Standard on UFLS) to a more formal language e.g., NERC Reliability Standard PRC-006.

- Please review lay-out, in particular related to spacing between Requirements and Measures.

- Applicability. Please consider revision Sections 4.3 (Distribution Providers) and 4.4 (transmission Owners) to the terminology of 'UFLS entities' as used in NERC Reliability Standard PRC-006-2.

- R3. How can non-BES generation facilities become part of a requirement? If so, should there be lower thresholds for non-BES generation? Since Requirement R3 as presently written is only a reporting requirement, it seems reasonable to consider this requirement as a candidate for deletion per Paragraph 81 (i.e., providing little protection to the reliable operations of the BES).

- R4. Please ensure consistency in language of sub-Requirements R4.1 and R4.2., where R4.1 uses a shall (strong) language and R4.2 seems to allow for an exception ('Alternatively'), where the present language seems to expose a significant risk of alternative interpretations. It is our interpretation that the 'shall' language requires compliance with the requirement in 4.1 during all conditions, and the alternative in 4.2 never seems to become applicable as a requirement.

- R4. Consider re-instating language "for its Facilities based on frequency thresholds", as used in PRC-006-NPCC-01, to clarify meaning of which outages are referred to in 4.1. F urther, does the requirement to exclude outages only refer to outages within each identified island?

- R5. The language in sub-requirements 5.1.1., etc. lack clarity and could be misinterpreted. Suggesting adding comma signs, where appropriate, to make requirement R5 clearer and more precise. In 5.1.1. consider adding a comma sign after "… after determining that adjustments are possible".

- R5. The language in 5.2.1. and 5.3.1. to "make the adjustments of determining that adjustments are possible" is unclear if it refers to having the adjustments made or only determining if the adjustments are possible; also missing a comma sign (for readability) as noted above for 5.1.1.

- R5. The term "bulk power system" seems to refer to NPCC BPS definition, but this is not clear.

- R5. The number of days in the different sub-requirements varies between 90 and 180 days. Is this variation for the different sub-requirements intentional? If so, what is the rationale? Also, 90 days to make necessary adjustments (if that is the correct interpretation) seems very short.

- R8. The word 'those' should either be removed or explained (what it refers to).

- R9. Suggest to move 'for approval by the Planning Coordinator' to before 'within 90 days'.

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- R10. Are there any time requirements related to implementation of the inhibit thresholds?

- Rationale for R11. Please explain or delete the word ‘universally’, used in this rationale box.

- R11. Should the time 15 months, be written as 15 calendar months (for improved clarity)?

- R11. Delete the last sentence “If there is no local metering of the load through said switches, the load may be calculated from measurements made at the nearest available metering. (e.g., upstream metering on the distribution feeder that supplies the load to be shed).” Since it is not drafted as a requirement. This text could be moved to the rationale box, if appropriate.

- The last paragraph in the Guidelines and Technical Basis section seems to be unfinished.

- RE:

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments:

Suggest changing 'the NERC PRC standard on UFLS' to 'the NERC Standard PRC-006' in **the Rationale Box for R1, R2 and R4 and Attachment A.**

The timeframe identified in **R 5.1.1** would be applicable only if there were a limited number of setting changes that could be performed on *existing* relays with UFLS capability.
Recommend changing to:

"If adjustments are possible *utilizing existing UFLS relays*, …"

For **R 5.1.2** Will the Planning Coordinator be maintaining detailed UFLS base cases for immediate use when DP/TO has a need to perform a technical study?
Recommend a 1-1/2 year Technical Study duration based on developing detailed scope for approval, developing base cases for the analysis, performing the analysis, review of results by PC, performing any requested sensitivity/other analysis, review and approval of the final study report.

For **R 5.1.2:** Need to address the impact if the Technical Study does identify a significant adverse impact. The additional steps and associated timeline to address the existing out of tolerance/adverse impact need to be defined.

The DP/TO will need to develop an implementation plan which would be challenging to do in the proposed 180 days. Eversource recommends a two-year implementation period based on engineering the project, attaining capital funding for the Project, ordering equipment, performing scheduling requirements, and construction of the project.

If a new or redefined Island is determined in your area that is the result of a new UFLS study performed by the Planning Coordinator or NPCC, how would your Company comply with Compliance Reporting by Island?

A new island(s) or modified Island boundary can create significant effort, construction time, and cost, to be Compliant on an Island basis. This issue should be addressed in detail. The magnitude of the required load shift could be significant. If a DP/TO does not have the capability to add additional UFLS to an Island by simply activating UFLS on **existing** station relays, the DP/TO must identify new stations/circuits and develop Projects to add the capability.

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If a DP/TO is out of tolerance with island balancing only (entity as a whole meets the PRC-006-NPCC UFLS Requirements), can an additional alternative be introduced to hold off on adjustments / technical studies until completion of a NPCC/SS-38 UFLS Assessment Study that is planned to occur in the near term?
(This is currently what Eversource Eastern Mass is doing since the NPCC/SS-38 UFLS Assessment Study is being advanced and the analysis may redefine islands. Eversource Eastern Mass is at a point where finding additional load shed opportunities in the New England Island will be labor intensive and costly. Eversource Eastern Mass does not want to pursue significant changes that may not be necessary. Developing independent study cases and pursuing a separate technical study that would be done in parallel with a Regional Study would not make sense.)

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments:
Section 5 states that the effective date is 'The first day of the first calendar quarter following applicable governmental and regulatory approvals' but the **Implementation Plan** states that 'The first day of the first calendar quarter 6 months following applicable governmental and regulatory approvals.' So not sure which effective date the SDT is proposing.

However, even if the effective date is at least 6 months, we are concerned with non-compliance due to the possibility of significant UFLS Program change requirements and the amount of time required to develop, fund and implement/construct a change Project.
For many this may not be an issue, but if a TO/DP needs to make significant changes to be compliant by Island, they would not meet this requirement on the effective date.

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

Yes ☒

No ☐

Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

   Comments:

In reference to **R2,** "PC to Provide UFLS Island Boundaries…": The requirement for an entity's UFLS Program attributes to be compliant by Island rather than entity-wide can potentially create costly modifications/changes to a TO/DPs UFLS Program that can take significant time, resources, and dollars to implement. The criteria and severity of contingencies used in defining Islands should consider the potential impact resulting from the Island defining process.

7. Provide any additional comments for the drafting team to consider, if desired.

   Comments:

Regarding Compensatory Load Shedding, we agree with the revisions of 15.3 as well as to Attachment B. Consider adding the following to the end of 2.1 of Attachment B to ensure GOs properly communicate changes to the DP/TO.

'The GO shall communicate any required changes for Compensatory Load Shedding to the DP or TO (or within 90 days of implementing the change).'

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from September 1, 2017 through October 16, 2017.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments:

We believe there is a potential misalignment between the design performance requirement in the NERC continent-wide standard PRC-006-2 and in the proposed regional standard PRC-006-2-NPCC-2 and the existing NPCC Directory #12. The NERC continent-wide standard requires that the under-frequency performance characteristic (Requirement R3, Part 3.10) remains between 59.3 Hz and 60.7 Hz after 60 seconds (60 s / 59.3 Hz & 60 s / 60.7 Hz). Both the regional standard and the directory have the under-frequency performance requirement remain above 59.5 Hz after 30 seconds (30 s / 59.5 Hz).

Planning Coordinators that are not part of NPC region design their UFLS program according to the NERC continent-wide standard and use the 60 s / 59.3 Hz performance characteristic. Planning Coordinators in the NPCC region design their UFLS program using the 30 s / 59.5 Hz performance characteristic.

There may be instances where portions of Planning Coordinators in the NPCC region may form islands with portions of systems outside of the NPCC's footprint. This may pose a potential non-compliance with their own performance characteristic of 30 s / 59.5 Hz.

Given that there is no technical justification for the existing NPCC performance characteristic of 30 s / 59.5 Hz, we propose that the regional standard and/or directory (depending on whether the regional or the directory is retired) be aligned with the continent-wide standard's performance characteristic of 60 s / 59.3 Hz. Since the NPCC performance characteristic is more stringent than that of the continent-wide standard, there should be no impact on the current UFLS program for the Eastern Interconnection. An aligned performance characteristic is not expected to result in non-compliance for the NPCC Planning Coordinators.

Furthermore, we propose that, in lieu of revising the regional standard to align with the performance characteristic contained in continent-wide standard and retiring the directory, to align the NPCC Directory #12 with the continent-wide standard and retire the regional standard. We find that using the NPCC process for developing/revising/approving criteria would be less onerous for the alignment than the NERC standard development process (i.e., limited to NPCC members as opposed to the greater NERC industry stakeholders needed to build consensus).

Our proposal to retire the regional standard is consistent with the objective of revising selected NERC standards to remove the "fill-in-the-blank" requirements that were established at earlier versions of the NERC standards. Now that the NERC PRC-006-2 has been developed, with Regional Variance for Quebec (and WECC), and in effect, we do not see any value of maintaining this regional standard. The more stringent and/or more specific requirements, if desired to be retained, should be stipulated in a Directory.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

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5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

   Comments: See Comments for Question 1.

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

   Comments:

7. Provide any additional comments for the drafting team to consider, if desired.

We submit the following comments for your consideration:

R1: See Comments for Question 1.

R2: We see this as an administrative requirement that does not address any reliability need. It would be sufficient for the Planning Coordinators to notify the applicable UFLS entities of the UFLS program.

R3: Similar with R2, we see this as an administrative requirement as it is not clear what reliability need this requirement is meant to address.

R11: This requirement is a duplication of R8 of PRC-006-2. We propose to have R11 removed.

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from September 1, 2017 through October 16, 2017.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Based on the regional standard PRC-006-NPCC-2 the UFLS will be initiated earlier when compared to the continent wide standard PRC-006-3 to prevent frequency collapsing on any potential island created as result of Grid disturbances. When referencing the performance characteristic requirements, a higher frequency requirement for the same time duration is better for grid reliability.
OPG believes that an analysis of potential islands survivability must be performed for all the potential islands that do not belongs entirely to NPCC region and will contain generators from entities that do not have to comply with the proposed performance characteristic requirements of the regional standard PRC-006-2-NPCC-2. In these case of a newly created island the UFLS associated with the portion of the island contained in the NPCC region would be the first to shed load in an attempt to prevent the decline in frequency due to more stringent PRC-006-NPCC-2 performance characteristic requirements (30 s / 59.5 Hz vs. 60 s / 59.3 Hz as required by PRC-006-3). While frequency will be the same in the entire island the load shedding contained only to NPCC region can potentially affect the island dynamic and steady state stability due to power swings and circuits overload.
This would not be an issue if dynamic UFLS can be achieved/implemented or exceptions allowed for specific islands (where dual interactive regulatory requirements are present) for survivability purposed.
The above analysis is no longer required if the discrepancy between regional and continent wide standard is eliminated by using the same performance characteristic requirements; it does however no longer justifies from this point of view the existence of a regional standard and perhaps the case for regional variance is more justified (i.e. when establishing the compensatory load shedding per attachment A/B)
If the NPCC Directory #12 UFLS requirements are perfectly aligned with the NPCC continent-wide standard, then there is no increase in grid reliability and no justification for existence. The regional standards are justified if they increase the grid reliability through more stringent, justified, requirements or when dealing with technical constraints by minimizing the compliance effort without affecting grid reliability.

In order to justify more stringent regional standard requirements the SDT should revalidate the initial technical justification for the more stringent performance characteristics (i.e. revalidate NPCC UFLS assessment for the current grid composition in terms of different representative generator manufacturers in service and compilation of capabilities/ride through for generators).

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: OPG has requested previously the Standard Drafting Team to ensure that the obligations stemming from requirement R15 part 15.3 are clearly removed from the compliance obligation of the Generator Owner, since in Ontario the Planning Coordinator is responsible for establishing the compensatory load shedding requirements. This is only captured in PRC-006-NPCC-2 attachment A and because of differences between Ontario, Quebec, Maritime Provinces and the ISO-NE, NYISO we have two different entities having regulatory obligations for the same requirement R15. OPG is of the opinion that the wording used on the latest draft standard revision of R15 is still confusing and recommends the following changes:

R15. Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard, that have underfrequency protections set to trip above the appropriate curve in Figure 2 shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

…

> **15.3. T**he responsible entity, as documented in accordance with Attachments A or B, shall have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping that is within the UFLS Island identified by the Planning Coordinator in Requirement R2.

This will result only in part 15.3 creating compliance obligation for different entities similar to variances.

OPG also recommend to make the following changes to the requirement "15.3 **T**he responsible entity, as documented in accordance with Attachments A or B, shall have compensatory load shedding, as provided by a Distribution Provider, Underfrequency Load Shedding (UFLS)-only Distribution Provider (DP) or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2."

SDT should include the newly approved FERC registration category, "Underfrequency Load Shedding (UFLS)-only Distribution Provider (DP)" in the revision of the standard PRC-006-NPCC-2 Automatic Underfrequency Load Shedding, to bring PRC-006-NPCC-02 standard in line with the newly registered functional categories as per Project 2017-07 Standards Alignment with Registration.

Now that we also have newly registered UFLS-only DP entity, can SDT comment on following the same NERC compliance obligation approach per PRC-006-3, which requires UFLS entity to provide load shedding as determined by the Planning Coordinator(s)?
"R9. Each UFLS entity shall provide automatic tripping of Load in accordance with the UFLS program design and schedule for implementation, including any Corrective Action Plan, as determined by its Planning Coordinator(s) in each Planning Coordinator area in which it owns assets. [VRF: High][Time Horizon: Long-term Planning]"

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

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Comments: Directory 12 Automatic Underfrequency Load Shedding Program has requirements pertaining to the following:

- Automatic Underfrequency Load Shedding
- Underfrequency trip settings of the protective relaying

The requirements pertaining to Automatic Underfrequency Load Shedding are translated into PRC-006-NPCC-02 which is the regional standard for Automatic Underfrequency Load Shedding.

OPG is of the opinion that Directory 12 should not be retired before a regional standard is prepared (i.e. PRC-024-NPCC-01) or regional variance is included via revision of the PRC-024-2 for translation of Underfrequency trip settings of the protective relaying, contained in D12.

The following are the NPCC Directory #12 – Under frequency Protection Requirements that should be translated to a new regional standard or variance before D12 retirement.

"5.4 Generator Under frequency Protection Requirements

Generators shall not be tripped for under-frequency conditions in the area above the curve in Figure 1, except as provided for in Sections 5.4.1 and 5.4.2.

5.4.1 It is recognized that, in special cases, requirements may dictate generator trip in the region above the curve. In those cases, the Generator Owner shall so notify its Balancing Authority and shall ensure through alternate arrangements, that automatic **load shedding** additional to the amount set out in Section 5.2 and in Section 5.3, equivalent (+/- 5%) to the amount of **generation** to be tripped, is provided. Such cases shall be reviewed by the Task Force on Coordination of Operation

5.4.2 Generator Owners shall not increase the under frequency trip settings or make other modifications to the existing exempt generators (that trip above the curve in Figure 1) that may cause these generators to, directly or indirectly, trip at a higher frequency."

Additionally these Under Frequency Protection Requirements should be adequately designed and coordinated with the Balancing Authorities (i.e. IESO for Ontario) and the NERC PRC-024 existing requirement, to eliminate potential gaps.

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: All the requirements associated with the Underfrequency Trip Settings associated and the Figure 2 of the PRC-006-NPCC-2 Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators should be deleted from this regional standard and adequately addressed/included in a newly develop regional standard PRC-024-NPCC-01, or revision of PRC-024-2 to include regional variance

7. Provide any additional comments for the drafting team to consider, if desired.

Comments:
OPG is of the opinion that although included in the Standard PRC-006-NPCC-1 Automatic Underfrequency Load Shedding, the requirements for the Frequency Settings of the Protective Relaying is better suited in a new regional standard PRC-024-NPCC-01 or a newly revised PRC-024-3 that includes the required regional variance.

If the decision is taken to proceed with the development of a new regional standard then coordination between regulators is required to eliminate potential gaps between the currently applicable regulatory compliance requirements with respect to Generator Frequency Protective Relay Settings:

- NERC Standard PRC-024-2 — Generator Frequency and Voltage Protective Relay Settings
- IESO Market Rules - Chapter 4 - Grid Connection Requirements – Appendix 4.2 – Generation Facility Requirements
- Market Manual 2: Market Administration Part 2.20: Performance Validation - 3. Generator Requirements
- NPCC Regional Reliability Reference Directory # 12 - Under frequency Load Shedding Program Requirements

All these regulatory requirements should be coordinated to eliminate the potential for inadvertent noncompliance. Although this requires a lot of effort and can be met with resistance the better the effort put in the development of coordinated standards by different regulators on the same technical issue, the higher Grid Reliability end result and the least potential for inadvertent noncompliance due to misunderstandings.

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from September 1, 2017 through October 16, 2017.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: While in general agreement with the changes; the proposed text should be modified for clarity and enforceability.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Consider allowing the flexibility to adopt immediately or adopt when the next annual load review is carried out to address any changes that may only be incorporated during the next review.

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Specify that the requirement applies to only BES generators either in this requirement or in the applicability section.

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: Note that this requirement does not impact NB Power generation.

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: R3: Suggest rewording R3 such that the PC will provide data to RE within 30 days of request from the RE, where the data to be based on the most recent study. Also, for clarity, identify the requirement(s) that define acceptable UFLS program performance.

The RE does not (to my knowledge) have a formal process for such data submission and is not consistent in acknowledging such data submissions.

R5: Limiting mutual agreements to smaller entities could result in the unnecessary installation of UFLS devices to meet load shedding thresholds.

7. Provide any additional comments for the drafting team to consider, if desired.

Comments:

Part 4, Applicability: Similar to PRC-006-2, the applicability of TO and DP should include text to clarify that UFLS program as established by the Planning Coordinator.

Assuming the intent is to only include BES generators the applicability should clearly specify otherwise the standard could be considered as applicable to all generation facilities owned by a generation owner regardless if a BES facility or not. Another option is to replace “generator” with “BES generator” in the relevant requirements.

Requirement 1: I would expect that this requirement is met through application of the UFLS tables in standard attachment. If the tables in the attachment do not meet this requirement how does the PC reconcile this requirement with the load shedding tables?

Requirement 3: Suggest rewording R3 such that the PC will provide the information to the RE within 30 days of request from the RE, where the information supplied to the RE is based on the most recent study as required by PRC-006-2 R4.

For clarity please identify the requirement(s) that define acceptable UFLS program performance either in this standard or PRC-006-2

It is not clear on how the PC determines if a non-BES unit results in unacceptable UFLS performance. Would the UFLS performance be based on a single generator misoperation or multiple simultaneous misoperations?

Requirement 4: The general reference "the NERC PRC Standard on UFLS" should include the standard number and the requirement for clarity.

To be more flexible, why limit mutual agreements to small entities but allow any entity to participate in a mutual agreement though conditional on PC approval. Allowing more flexibility could help resolve the scenario in R5 in some situations.

Requirement 5: Propose wording "…within 30 days <u>of discovery</u>" .

For R 5.1.2, I am concerned with the DP or TO carrying out a technical study to determine if there is no significant impact on the bulk power system.

Requirement 6: If this requirement is not a critical component of the UFLS, and is simply there to prevent load loss on significant frequency swings, recommend moving this requirement to the guidance section.

Requirement 7: Please define or describe "inhibit thresholds".

Requirement 11: Why are we limiting the approach in determining peak load values for a given load? Approach should be broadened to allow for other reasonable methods. Also question the situation where a meter data is unavailable. Another approach could also allow for monthly meter readings reconciled with system peak. So recommend that "…or monthly meter reading values reconciled with system hourly peak values. Also recommend broad wording allowing other approaches that provide a reasonable calculation of a load's peak load.

Requirement 12: The curve is not the same as off normal frequency capability curve PRC-024 attachment 1 (Eastern Interconnection). To avoid uncertainty with generator owners that have met compliance with PRC-024 a note could be added in this requirement identifying the more stringent generator UFLS curve. In addition, the drafting team may consider a regional

variance on PRC-024 adding the new curve for generation or referencing applicable portions of this regional standard.

R15.1 This sub-requirement would be more flexible if "plant design and licensing limitations" was replaced with "plant design or licensing limitations" (replaced and with or) to address those situations were licensing may not be effected though the plant design is.

Guidelines and Technical Basis: I agree with the approach taken. I assume that there are no compliance implications on the factors that could initiate a new assessment. Do you agree?

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from September 1, 2017 through October 16, 2017.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

   Comments: If the R5.1 technical study shows that there are significant adverse impacts on the system, then the standard doesn't provide guidance on next steps. In Figure 1, for clarity, move the label for the "combined NERC – NPCC curve" to the far left in the legend and make it plainly the "NPCC Underfrequency Curve"

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

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5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: Absolutely. We agree with the retirement of any NPCC Directories

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

7. Provide any additional comments for the drafting team to consider, if desired.

Comments: M9 – needs to be changed for applicability of R9 to DPs and TOs; In several places, the term calendar days is used and in others simply days. Use one notation for consistency; In the Guidelines and Technical Basis section the final sentence “Generator dynamic modeling (MOD-027-1…)” should be made into a bullet.

Regional Standard: **PRC-006-NPCC**
Automatic Underfrequency Load Shedding
Comment Period (9/1/2017 - 10/16/2017)

	Date	Organization	
	10/16/2017	PSEG Fossil LLC	View Attachment
	10/16/2017	New York Independent System Operator	View Attachment
	10/16/2017	Ontario Power Generation Inc.	View Attachment
	10/16/2017	New Brunswick Power Corporation	View Attachment
	10/16/2017		View Attachment
	10/13/2017	National Grid	View Attachment
	10/13/2017		
Comments: R4: R4 states, "The automatic UFLS program shall be implemented on an island basis for each island identified per the NERC PRC Standard on UFLS" but the individual TO/DP will not have visibility or control for identified islands. The islands may span a different area than the TO/DP service area. The individual TO/DP will not be able to demonstrate compliance on an island basis; the individual TO/DP is limited to demonstrating compliance for its service area which may nor may not align with the island. The requirement should be clarified to state that it applies to only the portion of the island the TO/DP has control over. R11: Can the drafting team address the following two questions: What is the purpose of R11? and What is the quantitative benefit of collecting and sharing this information? If the purpose and/or benefit is not quantitative why not remove R11 altogether from the standard? Under the current version of PRC-006-NPCC, the TP (or DP) provides historical data on load that would have been shed if the UFLS Program had operated at the actual peak from prior year. The phrase "that would have been" shed is being replaced with "projected to be" shed. Under the proposed language, the TP (or DP) is required to provide a projection of the amount of load that will be shed, at the projected peak load conditions, if ULFS Program is actually triggered. This is already addressed by PRC-006-2 R8. However the second sentence of the requirement does not align because it refers to the actual net load from the previous year. The "that would have been" language in the first sentence should be retained, if the purpose and/or benefit is quantitative. Otherwise, R11 should be removed from the standard. General comment: For Attachment C, Table 1, Footnote 1, include the following additional sentence: "This total operating time may include a maximum deviation, for any load, limited to ±50 milliseconds." Rationale for Comment: Relay and circuit breaker operating times are rarely precisely repeatable. Thus it is not practicable to expect zero deviation of a specified time-operating interval. This is probably the reason why NPCC Directory #12 Req. 5.2.1 which refers to the same operating time requirement, included the maximum deviation allowance in its own Footnote (1). Note this comment does not pertain to any changes brought about by the current revision, but to a deficiency in the previous version. This -2 revision is an opportunity to correct the deficiency.			
	10/13/2017	ISO-New England, Inc.	View Attachment
	09/28/2017	Independent Electricity System Operator	View Attachment

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September 1, 2017

Subject: Posting for Open Process Review of *PRC-006-NPCC-2 Automatic Underfrequency Load Shedding.*

The clean and redlined versions of the revised NPCC Regional Standard PRC-006-NPCC-2 *Automatic Underfrequency Load Shedding*, have been posted on the NPCC Website for a 45-day comment period through October 16, 2017, along with a proposed Implementation Plan.

This initial draft has been developed in accordance with the NPCC Regional Standard Process Manual (RSPM) and within the scope of NPCC Regional Standard Authorization Request, which was accepted by the NPCC Regional Standard Committee (RSC). The revisions are also presented as mandated by the NERC Rules of Procedure. This initial draft does not include the Violation Severity Levels, which will be developed for the next posting period.

Among the proposed changes included in the initial draft version of the Standard are:

- Modifications to Figures #1 and #2 in the Standard
- Added a Guidelines and Technical Basis section (NERC may request us to create a separate document for this section and post it with the standard subsequent to approvals)
- Incorporated certain Criteria attributes from Directory #12 Automatic UFLS Program Requirements which will facilitate the retirement of Directory #12
- Additional clarification of requirement language
- Proposed retirements of some of the Requirements that are redundant to the PRC-006-2 Continent-wide NERC standard

Also posted is a set of questions developed by the Regional Standard Drafting Team to solicit comments on the draft standard and associated draft Implementation Plan for the Regional Standard. Included in these questions is one on cost effectiveness of the requirements.

Comments on the posted materials may be submitted through the NPCC Open Process Portal, which may be accessed through:
https://www.npcc.org/Standards/SitePages/DevStandardDetail.aspx?DevDocumentId=122
Subsequent to consideration of comments and revision, the standard is tentatively scheduled to be posted for a second comment period in the first quarter of 2018 and then for a 30-day pre-ballot review and 10-day ballot period following the conclusion of the review period.

Please contact me with any questions regarding this Standard.

Thank you.

Ruida Shu
Northeast Power Coordinating Council, Inc.
Senior Engineer, Reliability Standards and Criteria
Main: 212-840-1070
Direct: 917-934-7976
Fax: 212-302-2782
Email: rshu@npcc.org

R4:
R4 states, “The automatic UFLS program shall be implemented on an island basis for each island identified per the NERC PRC Standard on UFLS” but the individual TO/DP will not have visibility or control for identified islands. The islands may span a different area than the TO/DP service area. The individual TO/DP will not be able to demonstrate compliance on an island basis; the individual TO/DP is limited to demonstrating compliance for its service area which may nor may not align with the island. The requirement should be clarified to state that it applies to only the portion of the island the TO/DP has control over.

Drafting Team Response:
The Planning Coordinator is the responsible entity to determine UFLS program requirements on an island basis.
The Transmission Owner and Distribution Provider are responsible to implement the appropriate amount of load-shedding in accordance with Attachment C for each island in its service area.

R11:
Can the drafting team address the following two questions: What is the purpose of R11? and What is the quantitative benefit of collecting and sharing this information? If the purpose and/or benefit is not quantitative why not remove R11 altogether from the standard?
Under the current version of PRC-006-NPCC, the TP (or DP) provides historical data on load that would have been shed if the UFLS Program had operated at the actual peak from prior year. The phrase “that would have been” shed is being replaced with “projected to be” shed. Under the proposed language, the TP (or DP) is required to provide a projection of the amount of load that will be shed, at the projected peak load conditions, if ULFS Program is actually triggered. This is already addressed by PRC-006-2 R8. However, the second sentence of the requirement does not align because it refers to the actual net load from the previous year. The “that would have been” language in the first sentence should be retained, if the purpose and/or benefit is quantitative. Otherwise, R11 should be removed from the standard.

Drafting Team Response:
The drafting team decided to make modifications to requirement language of R11.

General comment:
For Attachment C, Table 1, Footnote 1, include the following additional sentence:
“This total operating time may include a maximum deviation, for any load, limited to ±50 milliseconds.”
Rationale for Comment: Relay and circuit breaker operating times are rarely precisely repeatable. Thus, it is not practicable to expect zero deviation of a specified time-operating interval. This is probably the reason why NPCC Directory #12 Req. 5.2.1 which refers to the same operating time requirement, included the maximum deviation allowance in its own Footnote (1).

Note this comment does not pertain to any changes brought about by the current revision, but to a deficiency in the previous version. This “-2” revision is an opportunity to correct the deficiency.

Drafting Team Response:
Action Item:
The drafting team will discuss the 300 ms total nominal operating time at a later time.

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments:
Suggest changing 'the NERC PRC standard on UFLS' to 'the NERC Standard PRC-006' in **the Rationale Box for R1, R2 and R4 and Attachment A.**

The timeframe identified in **R 5.1.1** would be applicable only if there were a limited number of setting changes that could be performed on *existing* relays with UFLS capability.
Recommend changing to:
"If adjustments are possible *utilizing existing UFLS relays*, …"

For **R 5.1.2** Will the Planning Coordinator be maintaining detailed UFLS base cases for immediate use when DP/TO has a need to perform a technical study?
Recommend a 1-1/2 year Technical Study duration based on developing detailed scope for approval, developing base cases for the analysis, performing the analysis, review of results by PC, performing any requested sensitivity/other analysis, review and approval of the final study report.

For **R 5.1.2:** Need to address the impact if the Technical Study does identify a significant adverse impact. The additional steps and associated timeline to address the existing out of tolerance/adverse impact need to be defined.

The DP/TO will need to develop an implementation plan which would be challenging to do in the proposed 180 days. Eversource recommends a two-year implementation period based on engineering the project, attaining capital funding for the Project, ordering equipment, performing scheduling requirements, and construction of the project.

If a new or redefined Island is determined in your area that is the result of a new UFLS study performed by the Planning Coordinator or NPCC, how would your Company comply with Compliance Reporting by Island?

A new island(s) or modified Island boundary can create significant effort, construction time, and cost, to be Compliant on an Island basis. This issue should be addressed in detail. The magnitude of the required load shift could be significant. If a DP/TO does not have the capability to add

additional UFLS to an Island by simply activating UFLS on **existing** station relays, the DP/TO must identify new stations/circuits and develop Projects to add the capability.

If a DP/TO is out of tolerance with island balancing only (entity as a whole meets the PRC-006-NPCC UFLS Requirements), can an additional alternative be introduced to hold off on adjustments / technical studies until completion of a NPCC/SS-38 UFLS Assessment Study that is planned to occur in the near term?
(This is currently what Eversource Eastern Mass is doing since the NPCC/SS-38 UFLS Assessment Study is being advanced and the analysis may redefine islands. Eversource Eastern Mass is at a point where finding additional load shed opportunities in the New England Island will be labor intensive and costly. Eversource Eastern Mass does not want to pursue significant changes that may not be necessary. Developing independent study cases and pursuing a separate technical study that would be done in parallel with a Regional Study would not make sense.)

Drafting Team Response:
In general specifics in regards to the NERC Standard numbers are avoided due to the possibility of changes to the standard due to retirements or other standards superseding the existing standard. In additional to clarification we will refer to the NERC standard references as continent wide.
The drafting team does not agree with adding the language “utilizing existing UFLS relays” to requirement 5, because it is not in the interest of reliability.
After reviewing all the comments for requirement 5 of the standard, the drafting team decided to provide a rationale box to clarify the standard.
In regards to the new or modified islands per the study of SS38, it is covered by the requirement 3 and requirement 15 in the continent-wide standard.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments:
Section 5 states that the effective date is ‘The first day of the first calendar quarter following applicable governmental and regulatory approvals’ but the **Implementation Plan** states that ‘The first day of the first calendar quarter 6 months following applicable governmental and regulatory approvals.’ So not sure which effective date the SDT is proposing.

However, even if the effective date is at least 6 months, we are concerned with non-compliance due to the possibility of significant UFLS Program change requirements and the amount of time required to develop, fund and implement/construct a change Project.
For many this may not be an issue, but if a TO/DP needs to make significant changes to be compliant by Island, they would not meet this requirement on the effective date.

Drafting Team Response:
The drafting team changed the language in section 5 to Refer to Implementation Plan".
In the Implementation Plan drafting team increased the implementation period to 12 months for R4 and keeping the remainder requirements to the first day of the first calendar quarter following the applicable governmental and regulatory approvals.

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

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Comments:

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

In reference to **R2,** "PC to Provide UFLS Island Boundaries…": The requirement for an entity's UFLS Program attributes to be compliant by Island rather than entity-wide can potentially create costly modifications/changes to a TO/DPs UFLS Program that can take significant time, resources, and dollars to implement. The criteria and severity of contingencies used in defining Islands should consider the potential impact resulting from the Island defining process.

Drafting Team Response:

The criteria and severity of contingencies used in defining Islands is beyond the scope of this standard (PRC-006-NPCC-2). Criteria for determining islands is in part defined in the continent –wide standard on UFLS in requirements R1 and R2 of PRC-006-3. The criteria and severity of contingencies used to define Islands is at the discretion of the PC conducting the study to identify islands. As a general comment however, the goal of the island identification analysis is to identify coherent generation groups that define where and how the islands are formed. Identification of these coherent generation groups may require the simulation of beyond extreme contingencies (i.e. simulation of normal and extreme contingencies may not be adequate to identify these coherent generation groups).

7. Provide any additional comments for the drafting team to consider, if desired.

Comments:

Regarding Compensatory Load Shedding, we agree with the revisions of 15.3 as well as to Attachment B. Consider adding the following to the end of 2.1 of Attachment B to ensure GOs properly communicate changes to the DP/TO.

'The GO shall communicate any required changes for Compensatory Load Shedding to the DP or TO (or within 90 days of implementing the change).'

Drafting Team Response:

Thank you for your comments.

The drafting team believes the current R15 addresses the concern.

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from September 1, 2017 through October 16, 2017.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments:

We believe there is a potential misalignment between the design performance requirement in the NERC continent-wide standard PRC-006-2 and in the proposed regional standard PRC-006-2-NPCC-2 and the existing NPCC Directory #12. The NERC continent-wide standard requires that the under-frequency performance characteristic (Requirement R3, Part 3.10) remains between 59.3 Hz and 60.7 Hz after 60 seconds (60 s / 59.3 Hz & 60 s / 60.7 Hz). Both the regional standard and the directory have the under-frequency performance requirement remain above 59.5 Hz after 30 seconds (30 s / 59.5 Hz).

Planning Coordinators that are not part of NPC region design their UFLS program according to the NERC continent-wide standard and use the 60 s / 59.3 Hz performance characteristic. Planning Coordinators in the NPCC region design their UFLS program using the 30 s / 59.5 Hz performance characteristic.

There may be instances where portions of Planning Coordinators in the NPCC region may form islands with portions of systems outside of the NPCC's footprint. This may pose a potential non-compliance with their own performance characteristic of 30 s / 59.5 Hz.

Given that there is no technical justification for the existing NPCC performance characteristic of 30 s / 59.5 Hz, we propose that the regional standard and/or directory (depending on whether the regional or the directory is retired) be aligned with the continent-wide standard's performance characteristic of 60 s / 59.3 Hz. Since the NPCC performance characteristic is more stringent than that of the continent-wide standard, there should be no impact on the current UFLS program for the Eastern Interconnection. An aligned performance characteristic is not expected to result in non-compliance for the NPCC Planning Coordinators.

Furthermore, we propose that, in lieu of revising the regional standard to align with the performance characteristic contained in continent-wide standard and retiring the directory, to align the NPCC Directory #12 with the continent-wide standard and retire the regional standard. We find that using the NPCC process for developing/revising/approving criteria would be less onerous for the alignment than the NERC standard development process (i.e., limited to NPCC members as opposed to the greater NERC industry stakeholders needed to build consensus).

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Our proposal to retire the regional standard is consistent with the objective of revising selected NERC standards to remove the "fill-in-the-blank" requirements that were established at earlier versions of the NERC standards. Now that the NERC PRC-006-2 has been developed, with Regional Variance for Quebec (and WECC), and in effect, we do not see any value of maintaining this regional standard. The more stringent and/or more specific requirements, if desired to be retained, should be stipulated in a Directory.

Drafting Team Response:
Thank you for your comments.

NPCC's Regional UFLS standard has been developed to meet the performance obligations deemed necessary within the NPCC footprint. Currently, Directory 12, PRC-006-NPCC-1 and PRC-006-3 have a slight miss-alignment in performance characteristics of the programs. The SDT has endeavored to alleviate this issue with the inclusion of "Figure 1: PRC-006-NPCC-2 Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz Design Performance Requirements" which aligned the performance curves of PRC-006-3 and PRC-006-NPCC-2. While the NPCC performance obligations continue to be more stringent, they are in alignment with the continent-wide performance obligations.

The SDT is currently not aware of any instances of islanding which includes portions both within and outside of NPCC. It is the SDT position that all portions of NPCC are to be planned and programs implemented to meet the performance of the Figure 1 program specifications.

The SDT discussed the best course of action in deciding to retire Directory 12 in lieu of PRC-006-NPCC and has decided that retirement of Directory 12 and enhancement of PRC-006-NPCC is the most appropriate course of action. Directories within NPCC are only applicable to Full Members of NPCC. This is a limited set of entities as compared to those applicable to the NERC Reliability Standards. To meet the performance obligations as outlined in the standard broad applicability, as required by the Regional Standard, is required.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: See Comments for Question 1.

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

7. Provide any additional comments for the drafting team to consider, if desired.

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We submit the following comments for your consideration:

R1: See Comments for Question 1.

R2: We see this as an administrative requirement that does not address any reliability need. It would be sufficient for the Planning Coordinators to notify the applicable UFLS entities of the UFLS program.

R3: Similar with R2, we see this as an administrative requirement as it is not clear what reliability need this requirement is meant to address.

R11: This requirement is a duplication of R8 of PRC-006-2. We propose to have R11 removed.

Drafting Team Response:
Thank you for your comments, the drafting team decided that R2 is necessary to ensure the island boundaries are clearly identified for the purposes of entities that may wish to aggregate their load or for compensatory load shedding purposes.
R3 is still under development.
R11 has more specifics in regards to the data and it ensures the PCs are all seeking consistent information regarding load that is measured and part of the UFLS program.

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from September 1, 2017 through October 16, 2017.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

   Comments: If the R5.1 technical study shows that there are significant adverse impacts on the system, then the standard doesn't provide guidance on next steps. In Figure 1, for clarity, move the label for the "combined NERC – NPCC curve" to the far left in the legend and make it plainly the "NPCC Underfrequency Curve"

   Drafting Team Response:
   The drafting team will provide additional guidance on R5.1 with the rationale box as well as modified the bottom legend of Figure 1 to reflect the comment.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☒

No ☐

Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: Absolutely. We agree with the retirement of any NPCC Directories

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

7. Provide any additional comments for the drafting team to consider, if desired.

Comments: M9 – needs to be changed for applicability of R9 to DPs and TOs; In several places, the term calendar days is used and in others simply days. Use one notation for consistency; In the Guidelines and Technical Basis section the final sentence "Generator dynamic modeling (MOD-027-1…)" should be made into a bullet.

Drafting Team Response:
The drafting team accepts these comments and will make changes accordingly.

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3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: This draft version of NPCC Regional Standard PRC-006-NPCC-2 'Automatic Underfrequency Load Shedding' includes instances of unclear language, exposing risks of alternative interpretations; see questions and proposed changes under item #7 below for details.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Please consider changing language under Effective Dates to state: "See Implementation Plan." Please consider changing the effective date to read as the first day of the first calendar quarter 12 months following applicable governmental and regulatory approvals. The change from 6 months to 12 months will provide additional time that may be needed to accommodate automatic UFLS changes that may need to be made on an island basis, for each identified island. Changes involving automatic UFLS are generally made on an annual schedule.

Drafting Team Response:
The drafting team changed the language in section 5 to Refer to Implementation Plan".
In the Implementation Plan drafting team increased the implementation period to 12 months for R4 and keeping the remainder requirements to the first day of the first calendar quarter following the applicable governmental and regulatory approvals.

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

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4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

Yes ☒

No ☐

Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

Yes ☒

No ☐

Comments:

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: See #7 below.

7. Provide any additional comments for the drafting team to consider, if desired.

Comments: Below please find our general questions and proposed (editorial) changes:

- Should the word island (as in UFLS Island) be capitalized throughout this document, since it is a defined term in the NPCC Glossary of Terms? The term island' is sometimes written with a lower case "i" and sometimes with a capital "I", please review to ensure consistency in standard.

- Suggesting changing reference to NERC PRC-006-2 from 'generic' version (i.e., NERC PRC Standard on UFLS) to a more formal language e.g., NERC Reliability Standard PRC-006.

- Please review lay-out, in particular related to spacing between Requirements and Measures.

- Applicability. Please consider revision Sections 4.3 (Distribution Providers) and 4.4 (transmission Owners) to the terminology of 'UFLS entities' as used in NERC Reliability Standard PRC-006-2.

- R3. How can non-BES generation facilities become part of a requirement? If so, should there be lower thresholds for non-BES generation? Since Requirement R3 as presently written is only a reporting requirement, it seems reasonable to consider this requirement as a candidate for deletion per Paragraph 81 (i.e., providing little protection to the reliable operations of the BES).

- R4. Please ensure consistency in language of sub-Requirements R4.1 and R4.2., where R4.1 uses a shall (strong) language and R4.2 seems to allow for an exception ('Alternatively'), where the present language seems to expose a significant risk of alternative interpretations. It is our interpretation that the 'shall' language requires compliance with the requirement in 4.1 during all conditions, and the alternative in 4.2 never seems to become applicable as a requirement.

- R4. Consider re-instating language "for its Facilities based on frequency thresholds", as used in PRC-006-NPCC-01, to clarify meaning of which outages are referred to in 4.1. F urther, does the requirement to exclude outages only refer to outages within each identified island?

- R5. The language in sub-requirements 5.1.1., etc. lack clarity and could be misinterpreted. Suggesting adding comma signs, where appropriate, to make requirement R5 clearer and more precise. In 5.1.1. consider adding a comma sign after "… after determining that adjustments are possible".

- R5. The language in 5.2.1. and 5.3.1. to "make the adjustments of determining that adjustments are possible" is unclear if it refers to having the adjustments made or only determining if the adjustments are possible; also missing a comma sign (for readability) as noted above for 5.1.1.

- R5. The term "bulk power system" seems to refer to NPCC BPS definition, but this is not clear.

- R5. The number of days in the different sub-requirements varies between 90 and 180 days. Is this variation for the different sub-requirements intentional? If so, what is the rationale? Also, 90 days to make necessary adjustments (if that is the correct interpretation) seems very short.

- R8. The word 'those' should either be removed or explained (what it refers to).

- R9. Suggest to move 'for approval by the Planning Coordinator' to before 'within 90 days'.

- R10. Are there any time requirements related to implementation of the inhibit thresholds?

- Rationale for R11. Please explain or delete the word 'universally', used in this rationale box.

- R11. Should the time 15 months, be written as 15 calendar months (for improved clarity)?

- R11. Delete the last sentence "If there is no local metering of the load through said switches, the load may be calculated from measurements made at the nearest available metering. (e.g., upstream metering on the distribution feeder that supplies the load to be shed)." Since it is not drafted as a requirement. This text could be moved to the rationale box, if appropriate.

- The last paragraph in the Guidelines and Technical Basis section seems to be unfinished.

- RE:

Drafting Team Response:
The drafting team accepted the comments on changing "Islands" to "islands" and will made updates to the documents accordingly.

For the sake of clarity, the drafting team will adopt the following reference throughout the document: "NERC continent-wide UFLS standard".

The drafting team will do a quality review of the entire document and make necessary layout changes.

Section 4.3: Thank you for your comment. The drafting team decided the existing language is sufficient and provides clarity.

R3 response: Non-BES generation facilities, although not subject to NERC requirements, could be material to the performance to the UFLS program.
The requirement is directed to Planning Coordinator and supports regional UFLS study efforts for reliability purposes.

R4 response: The drafting team reviewed the language and the team agreed that the existing language is sufficiently clear and consistent. Use of the word "shall" does appear in both 4.1 and 4.2.

R5 response: The drafting team agrees with the comment and modified bulk power system to BES since it is a NERC standard that focus on the NPCC region.
The drafting team agrees with the comment and modified 5.2.1 to 180 days. For 5.2.2 and 5.3.2, since they are different analysis compared to 5.1.2 thus 90 days is suggested by the drafting team.

R8 response: The drafting team accepted the comments and made modifications to the requirement language accordingly.

R9 response: The drafting team accepted the comments and made modifications to the requirement language accordingly.

R10 response: Thank you for your comments, please refer to the Implementation Plan in accordance with R9.

R11 response: The drafting team accepted the comments and made modifications to the requirement language accordingly.

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Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

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2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: While in general agreement with the changes; the proposed text should be modified for clarity and enforceability.

Drafting Team Response:
Standard is under revision.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Consider allowing the flexibility to adopt immediately or adopt when the next annual load review is carried out to address any changes that may only be incorporated during the next review.

Drafting Team Response:
Standard is under revision.

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Specify that the requirement applies to only BES generators either in this requirement or in the applicability section.

Drafting Team Response:
R15.3 is applicable to the BES generator that specify by your registration.

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

Yes ☒

No ☐

Comments: Note that this requirement does not impact NB Power generation.

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

Yes ☒

No ☐

Comments:

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: R3: Suggest rewording R3 such that the PC will provide data to RE within 30 days of request from the RE, where the data to be based on the most recent study. Also, for clarity, identify the requirement(s) that define acceptable UFLS program performance.

The RE does not (to my knowledge) have a formal process for such data submission and is not consistent in acknowledging such data submissions.

R5: Limiting mutual agreements to smaller entities could result in the unnecessary installation of UFLS devices to meet load shedding thresholds.

Drafting Team Response:
The drafting team made modification to the R3 language and will develop a comment question to ask the ISOs on this requirement in the next comment period.
For R5 please see the response provided by the drafting team in Question 7.

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7. Provide any additional comments for the drafting team to consider, if desired.

Comments:

Part 4, Applicability: Similar to PRC-006-2, the applicability of TO and DP should include text to clarify that UFLS program as established by the Planning Coordinator.

Assuming the intent is to only include BES generators the applicability should clearly specify otherwise the standard could be considered as applicable to all generation facilities owned by a generation owner regardless if a BES facility or not. Another option is to replace "generator" with "BES generator" in the relevant requirements.

Requirement 1: I would expect that this requirement is met through application of the UFLS tables in standard attachment. If the tables in the attachment do not meet this requirement how does the PC reconcile this requirement with the load shedding tables?

Requirement 3: Suggest rewording R3 such that the PC will provide the information to the RE within 30 days of request from the RE, where the information supplied to the RE is based on the most recent study as required by PRC-006-2 R4.

For clarity please identify the requirement(s) that define acceptable UFLS program performance either in this standard or PRC-006-2

It is not clear on how the PC determines if a non-BES unit results in unacceptable UFLS performance. Would the UFLS performance be based on a single generator misoperation or multiple simultaneous misoperations?

Requirement 4: The general reference "the NERC PRC Standard on UFLS" should include the standard number and the requirement for clarity.

To be more flexible, why limit mutual agreements to small entities but allow any entity to participate in a mutual agreement though conditional on PC approval. Allowing more flexibility could help resolve the scenario in R5 in some situations.

Requirement 5: Propose wording "…within 30 days <u>of discovery</u>" .

For R 5.1.2, I am concerned with the DP or TO carrying out a technical study to determine if there is no significant impact on the bulk power system.

Requirement 6: If this requirement is not a critical component of the UFLS, and is simply there to prevent load loss on significant frequency swings, recommend moving this requirement to the guidance section.

Requirement 7: Please define or describe "inhibit thresholds".

Requirement 11: Why are we limiting the approach in determining peak load values for a given load? Approach should be broadened to allow for other reasonable methods. Also question the situation where a meter data is unavailable. Another approach could also allow for monthly meter readings reconciled with system peak. So recommend that "…or monthly meter reading values reconciled with system hourly peak values. Also recommend broad wording allowing other approaches that provide a reasonable calculation of a load's peak load.

Requirement 12: The curve is not the same as off normal frequency capability curve PRC-024 attachment 1 (Eastern Interconnection). To avoid uncertainty with generator owners that have met compliance with PRC-024 a note could be added in this requirement identifying the more stringent generator UFLS curve. In addition, the drafting team may consider a regional variance on PRC-024 adding the new curve for generation or referencing applicable portions of this regional standard.

R15.1 This sub-requirement would be more flexible if "plant design and licensing limitations" was replaced with "plant design or licensing limitations" (replaced and with or) to address those situations were licensing may not be effected though the plant design is.

Guidelines and Technical Basis: I agree with the approach taken. I assume that there are no compliance implications on the factors that could initiate a new assessment. Do you agree?

Drafting Team Response:
For part 4, drafting team accepted the comment and made modifications to the applicability section of the standard.

The drafting team considered the applicability for the Generator is clear and concise. Thank you for your comment.

The purpose of R1 is to establish performance criteria with Figure 1, this performance can be met using table 1. If in the future, the performance criteria cannot be met using table 1, then the PRC-006-NPCC-02 UFLS Regional Standard will need to be revised.

Thank you for your comment, the drafting team reviewed R3 and made a modification to specify "acceptable" as being in accordance with PRC-006 standard requirements.
For R3, it will be up to the Planning Coordinator to determine its methodology in regards to non-BES units.

In response to R4, in general specifics in regards to the NERC Standard numbers are avoided due to the possibility of changes to the standard due to retirements or other standards superseding the existing standard.
The drafting team made modifications to R4 in regards to the mutual agreements.

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For R5, the drafting team made modification to the requirement language.
The drafting team expects the Distribution Provider and Transmission Owner to perform the analysis or to retain a consultant if necessary.

For R6, the drafting team reviewed the comments and decided the requirement is necessary for the reliability services to the customers.

For R7, the drafting team will develop a rationale box to define inhibit threshold.
Action Item: Dean Latulipe will develop a rationale box to define inhibit threshold.

For R11, the drafting team made modifications to the requirement language.

For R12, the drafting team decided to add a note to clarify the differences between the Regional UFLS standard vs PRC-024 in regards to the Figure 2.
At this time the drafting team decided it is impractical to pursue a NPCC regional variance.

For R15.1, the drafting team accepted the comment and made modification to the language.

The intent for Guidelines and Technical Basis is to provide additional guidance to the standard, it is not intended to be audited.

NYISO Comments
Regional Standard PRC-006-NPCC-02
October 16, 2017

The NYISO submits the following comments on the proposed Regional Standard for the drafting team's consideration:
With regards to R3
Each Planning Coordinator shall, within 30 days of completion of its UFLS system studies, identify to the Regional Entity all non-BES generation facilities, within its Planning Coordinator Area, that must not trip above the appropriate generator underfrequency trip threshold curve in Figure 2 in order to support acceptable UFLS program performance.

- It is not clear what is considered to be non-BES generation facilities:
  - Is it limited to generation that is modeled?
  - How should DER, behind the meter or load/netted generation be addressed?
  - What is the criteria for determining what Non-BES generation is not allowed to trip
- What is the role of the Regional Entity, once this information is provided?
- Who will have the obligation/authority to inform any identified non-BES generators that they must adhere to the appropriate trip threshold?

Drafting Team Response:
The drafting team is considering removing or clarifying R3 and will draft a comment question for the ISOs in the next comment period.

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Based on the regional standard PRC-006-NPCC-2 the UFLS will be initiated earlier when compared to the continent wide standard PRC-006-3 to prevent frequency collapsing on any potential island created as result of Grid disturbances. When referencing the performance characteristic requirements, a higher frequency requirement for the same time duration is better for grid reliability.
OPG believes that an analysis of potential islands survivability must be performed for all the potential islands that do not belongs entirely to NPCC region and will contain generators from entities that do not have to comply with the proposed performance characteristic requirements of the regional standard PRC-006-2-NPCC-2. In these case of a newly created island the UFLS associated with the portion of the island contained in the NPCC region would be the first to shed load in an attempt to prevent the decline in frequency due to more stringent PRC-006-NPCC-2 performance characteristic requirements (30 s / 59.5 Hz vs. 60 s / 59.3 Hz as required by PRC-006-3). While frequency will be the same in the entire island the load shedding contained only to NPCC region can potentially affect the island dynamic and steady state stability due to power swings and circuits overload.
This would not be an issue if dynamic UFLS can be achieved/implemented or exceptions allowed for specific islands (where dual interactive regulatory requirements are present) for survivability purposed.
The above analysis is no longer required if the discrepancy between regional and continent wide standard is eliminated by using the same performance characteristic requirements; it does however no longer justifies from this point of view the existence of a regional standard and perhaps the case for regional variance is more justified (i.e. when establishing the compensatory load shedding per attachment A/B)
If the NPCC Directory #12 UFLS requirements are perfectly aligned with the NPCC continent-wide standard, then there is no increase in grid reliability and no justification for existence. The regional standards are justified if they increase the grid reliability through more stringent, justified, requirements or when dealing with technical constraints by minimizing the compliance effort without affecting grid reliability.

In order to justify more stringent regional standard requirements the SDT should revalidate the initial technical justification for the more stringent performance characteristics (i.e. revalidate NPCC UFLS assessment for the current grid composition in terms of different representative generator manufacturers in service and compilation of capabilities/ride through for generators).

Drafting Team Response:

It is true that PRC-006-NPCC-2 has more stringent performance requirements than PRC-006-3 for time frames greater than 30 seconds. Directory 12 does also.

It is not necessarily true that UFLS relays located in the NPCC region, would be the first to trip in an island that straddles portions of NPCC and another NERC Region. Which UFLS relays trip first would depend on the underfrequency trip settings of UFLS relays inside NPCC, compared to the trip settings of UFLS relays in the neighboring region. Also, the associated time delays of the UFLS relays will influence which relays trip first. The question of whether any mismatch is UFLS relay trip times between Regions will cause the island to go unstable would be answered by the simulations conducted to determine if the island meets underfrequency load shedding performance requirements. If the island goes unstable, and collapses, then the island would not meet UFLS performance requirements (either PRC-006-3 or PRC-006-NPCC-2). In this case, the UFLS program in either portion of the island, or both, would need to be modified such that the island meets the performance requirements.

Simulations for the island would still be required, even if the performance requirements of PRC-006-3 and PRC-006-NPCC-2 were the same.

The drafting team disagrees, and maintains that PRC-006-NPCC-2 has more stringent performance requirements than PRC-006-3 for time frames greater than 30 seconds. The drafting team has no justification for lessening this stringency.

The drafting team did investigate this, and found no justification for lessening the stringency of the PRC-006-NPCC-2 performance requirements.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

   Comments: OPG has requested previously the Standard Drafting Team to ensure that the obligations stemming from requirement R15 part 15.3 are clearly removed from the compliance

obligation of the Generator Owner, since in Ontario the Planning Coordinator is responsible for establishing the compensatory load shedding requirements. This is only captured in PRC-006-NPCC-2 attachment A and because of differences between Ontario, Quebec, Maritime Provinces and the ISO-NE, NYISO we have two different entities having regulatory obligations for the same requirement R15. OPG is of the opinion that the wording used on the latest draft standard revision of R15 is still confusing and recommends the following changes:

R15. Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard, that have underfrequency protections set to trip above the appropriate curve in Figure 2 shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

…

> **15.3. T**he responsible entity, as documented in accordance with Attachments A or B, shall have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping that is within the UFLS Island identified by the Planning Coordinator in Requirement R2.

This will result only in part 15.3 creating compliance obligation for different entities similar to variances.

OPG also recommend to make the following changes to the requirement "15.3 **T**he responsible entity, as documented in accordance with Attachments A or B, shall have compensatory load shedding, as provided by a Distribution Provider, Underfrequency Load Shedding (UFLS)-only Distribution Provider (DP) or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2."

SDT should include the newly approved FERC registration category, "Underfrequency Load Shedding (UFLS)-only Distribution Provider (DP)" in the revision of the standard PRC-006-NPCC-2 Automatic Underfrequency Load Shedding, to bring PRC-006-NPCC-02 standard in line with the newly registered functional categories as per Project 2017-07 Standards Alignment with Registration.

Now that we also have newly registered UFLS-only DP entity, can SDT comment on following the same NERC compliance obligation approach per PRC-006-3, which requires UFLS entity to provide load shedding as determined by the Planning Coordinator(s)?
"R9. Each UFLS entity shall provide automatic tripping of Load in accordance with the UFLS program design and schedule for implementation, including any Corrective Action Plan, as determined by its Planning Coordinator(s) in each Planning Coordinator area in which it owns assets. [VRF: High][Time Horizon: Long-term Planning]"

Drafting Team Response:

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The drafting team has revised requirement 15 for better consistency between compliance obligations in R15.3 and Attachments A and B.

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Directory 12 Automatic Underfrequency Load Shedding Program has requirements pertaining to the following:

- Automatic Underfrequency Load Shedding
- Underfrequency trip settings of the protective relaying

The requirements pertaining to Automatic Underfrequency Load Shedding are translated into PRC-006-NPCC-02 which is the regional standard for Automatic Underfrequency Load Shedding.

OPG is of the opinion that Directory 12 should not be retired before a regional standard is prepared (i.e. PRC-024-NPCC-01) or regional variance is included via revision of the PRC-024-2 for translation of Underfrequency trip settings of the protective relaying, contained in D12.

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The following are the NPCC Directory #12 – Under frequency Protection Requirements that should be translated to a new regional standard or variance before D12 retirement.

"5.4 Generator Under frequency Protection Requirements

Generators shall not be tripped for under-frequency conditions in the area above the curve in Figure 1, except as provided for in Sections 5.4.1 and 5.4.2.

5.4.1 It is recognized that, in special cases, requirements may dictate generator trip in the region above the curve. In those cases, the Generator Owner shall so notify its Balancing Authority and shall ensure through alternate arrangements, that automatic **load shedding** additional to the amount set out in Section 5.2 and in Section 5.3, equivalent (+/- 5%) to the amount of **generation** to be tripped, is provided. Such cases shall be reviewed by the Task Force on Coordination of Operation

5.4.2 Generator Owners shall not increase the under frequency trip settings or make other modifications to the existing exempt generators (that trip above the curve in Figure 1) that may cause these generators to, directly or indirectly, trip at a higher frequency."

Additionally these Under Frequency Protection Requirements should be adequately designed and coordinated with the Balancing Authorities (i.e. IESO for Ontario) and the NERC PRC-024 existing requirement, to eliminate potential gaps.

Drafting Team Response:
Underfrequency trip setting requirements for generators are already in Figure 1 of PRC-006-NPCC-01. The drafting team merely re-numbered this Figure to #2 in PRC-006-NPCC-02. So no changes to this requirement are proposed for PRC-006-NPCC-02.

The conditions under which the generator underfrequency protection requirements apply to are already in PRC-006-NPCC-01 and were not changed for PRC-006-NPCC-02.

NERC BES Generators have to comply with NERC PRC-024 as well.

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: All the requirements associated with the Underfrequency Trip Settings associated and the Figure 2 of the PRC-006-NPCC-2 Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators should be deleted from this regional standard and adequately addressed/included in a newly develop regional standard PRC-024-NPCC-01, or revision of PRC-024-2 to include regional variance

Drafting Team Response:
The drafting team believes that it is better to leave the Thresholds for Setting Underfrequency Trip Protection for Generators in PRC-006-NPCC-2 on account of the fact that the low frequency withstand capability of generation is a critical parameter in the development and operation of any underfrequency load shedding program. The drafting team does not have justification for reducing the margin and reliability.

7. Provide any additional comments for the drafting team to consider, if desired.

Comments:
OPG is of the opinion that although included in the Standard PRC-006-NPCC-1 Automatic Underfrequency Load Shedding, the requirements for the Frequency Settings of the Protective Relaying is better suited in a new regional standard PRC-024-NPCC-01 or a newly revised PRC-024-3 that includes the required regional variance.

If the decision is taken to proceed with the development of a new regional standard then coordination between regulators is required to eliminate potential gaps between the currently applicable regulatory compliance requirements with respect to Generator Frequency Protective Relay Settings:

- NERC Standard PRC-024-2 — Generator Frequency and Voltage Protective Relay Settings
- IESO Market Rules - Chapter 4 - Grid Connection Requirements – Appendix 4.2 – Generation Facility Requirements
- Market Manual 2: Market Administration Part 2.20: Performance Validation - 3. Generator Requirements
- NPCC Regional Reliability Reference Directory # 12 - Under frequency Load Shedding Program Requirements

All these regulatory requirements should be coordinated to eliminate the potential for inadvertent noncompliance. Although this requires a lot of effort and can be met with resistance the better the effort put in the development of coordinated standards by different regulators on the same technical issue, the higher Grid Reliability end result and the least potential for inadvertent noncompliance due to misunderstandings.

Drafting Team Response:
The drafting team believes that it is better to leave the Thresholds for Setting Underfrequency Trip Protection for Generators in PRC-006-NPCC-2 on account of the fact that the low

frequency withstand capability of generation is a critical parameter in the development and operation of any underfrequency load shedding program.

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from September 1, 2017 through October 16, 2017.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments:

PSEG offers the following comments to inform the instant drafting team of PSEG's concerns with the proposed standard and to memorialize our position for future consideration.

a) Generator Compensatory Load Shedding:

PRC-006-NPCC-02 requirement R15 part 3 (R15.3) as proposed would retain PRC-006-NPCC-01's requirement R16.3 for compensatory load shedding by Generators in U.S. portions of NPCC. However, like PRC-006-NPCC-01, PRC-006-NPCC-02 also does not include an accompanying requirement in the revised standard that requires a distribution or transmission entity to make appropriate load (i.e. "within the UFLS island identified by the Planning Coordinator in Requirement R2") available to the Generator to shed. And there also are no applicable Tariffs etc., or other NERC or NPCC standards that require distribution or transmission entities to make any load available to Generators for this purpose. Consequently, a requirement for Generator compensatory load shedding in U.S. portions of NPCC is now and potentially would remain non-implementable for GOs.PRC-006-NPCC-02 requirement R15 part 3 (R15.3) and should therefore be removed from the proposed standard.

b) Generator Underfrequency Trip Protection Settings

The revised standard retains PRC-006-NPCC-01's Figure 1 generator underfrequency trip protection settings threshold curve, as PRC-006-NPCC-02 Figure 2. PSEG does not believe retention of that curve or inclusion of another PRC-006-NPCC-specific Generator UF settings curve in PRC-006-NPCC-2 are necessary. All UFLS plans of NERC Registered Entities to whom NERC reliability standard PRC-006-2 is, PRC-006-NPCC-01 is and PRC-006-NPCC-02 would be applicable, must already now meet the design performance requirements identified in Attachment 1 of PRC-006-2. PRC-006-2 Attachment 1 includes and illustrates that the least-demanding/potentially damaging (the 'Eastern Interconnection') generator underfrequency trip protection settings threshold curve for generating units, directed and required by NERC reliability standard PRC-024-2 (see Attachment 1 of PRC-024-2), coordinates with the UFLS plan performance requirements set out in PRC-006-2. And that curve (Attachment 1 of PRC-024-2) would coordinate with the UFLS plan

performance requirements that would be set out in PRC-006-NPCC-2 as now proposed (see PRC-006-NPCC-02 Figure 1). All of the curves in Attachment 1 of PRC-024-2, including the 'Eastern Interconnection' curve, are considered adequate generator UF and OF performance by NERC and FERC by virtue of being in NERC- and FERC- approved reliability standard PRC-024-2. If PRC-006-NPCC-02 is to retain PRC-006-NPCC-02 Figure 2, or another PRC-006-NPCC-specific Generator UF settings curve, PSEG recommends additional technical justification for doing so.

Generator underfrequency trip protection settings that will be directed and required by PRC-006-NPCC-2 requirement R12 (i.e. that Generators meet the curve presented in PRC-006-NPCC-02 Figure 2) also directly impact the burden and costs Generators now or could in future (new units; unit uprate modifications) bear to meet other requirements in the standard: R14; R15; R17 without a commensurate reliability benefit. Generators' additional burdens and costs to meet these other requirements should be better supported by additional technical justification explaining why PRC-006-NPCC-02's Figure 2 curve, or any other generator UF settings curve that might alternatively be proposed, is required for PRC-006-NPCC-2, over adoption of (direct or implicit) and reliance upon the 'Eastern Interconnection' curve in Attachment 1 of PRC-024-2.

c) Applicability to Non-BES Generators

PRC-006-NPCC-02 requirement R3 appears designed to result in NPCC requiring otherwise non-BES (i.e. not NERC registered) Generators, or Generators' otherwise non-BES generating units, to comply with the standard's under-frequency ride-through requirements. The result would be that, where it could otherwise be needed to save an island, load shedding beyond that directed in Tables 1 to 3 in Attachment C of the proposed standard would be avoided, at these Generators' risk (NERC compliance) and expense. PSEG does not support this. The NERC registration criteria have been developed to generally ensure that entities needed to ensure BES reliability via the NERC reliability standards are registered and thereby in the scope of those standards. Similarly, the BES Definition was developed to generally ensure that facilities and equipment needed to ensure BES reliability via the NERC reliability standards, are designated as part of the BES and thereby in the scope of those standards. PSEG recommends additional technical and legal justification explaining why the Generators indicated in R3 ("non-BES generation facilities") need to be registered and become subject to the standard's under-frequency ride-through requirements, versus developing and implementing alternatives options such as requiring implementation of additional load shedding.

d) Adequacy of Required DP and TO Load Shedding

Requirements R4 and R5 direct how much load DPs and TOs must shed, at what frequency thresholds. However, neither of these requirements, nor any others in PRC-006-NPCC-02, address or identify what additional action these DPs and TOs, PCs subject to PRC-006-NPCC-02 R1, or any other entities are required to take in the event that the amount of load

shed required by R4 and R5 (i.e. load shed schedule listed in PRC-006-NPCC-02 Attachment C) would not produce UFLS program performance meeting PRC-006-NPCC-02 Figure 1. PSEG recommends clarification of what additional actions would be required, and by whom.

Drafting Team Response:
a) The settings are in place in order for the UFLS program to work. Those units identified have already secure their compensatory load shedding. This allow the generator not able to meet the performance curve due to design constraint and ability to meet the curve to secure load shedding as an alternate need. New or upgraded units following the effective date of the version 1 of this standard are not permitted to utilize compensatory load shedding provisions therefore this requirement is not applicable to units that's not already secured compensatory load shedding.

b) The drafting team has reviewed and discussed this requirement extensively and have concluded the fact that meeting the performance characteristics identified in Figure 2 is necessary for reliability.

c) Pending

d) That situation is already covered by R15 in the continent wide standard (PRC-006-3). If the planning coordinator determines that the UFLS program does not meet the performance characteristics shall develop a Corrective Action Plan and a schedule for implementation by the UFLS entities.

2. Do you agree with the proposed revisions to Section 5 of the document on Effective Date? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Effective date indicated in Section 5 is not consistent with date indicated in Implementation plan document. PSEG suggests that Section 5 refer to or direct the same schedule as the Implementation Plan.

Drafting Team Response:
The drafting team accepted the comments and made updates accordingly.

3. Do you agree with the proposed revisions to Requirement 15.3 on compensatory load shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: As noted in our comments in response to Question 1, PSEG disagrees with compensatory load shedding requirements. PSEG reiterates that PRC-006-NPCC-02 requirement R15 part 3 (R15.3) should be removed from the proposed standard.

Drafting Team Response:
Please refer to the drafting team response in question #1.

4. Do you agree with the drafting team on their proposal to keep Requirement 18 (old Requirement 19) as is? If not, please explain why and include any suggestions.

Yes ☒

No ☐

Comments:

5. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

6. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

Following on our comments provided in response to Question 1, PSEG does not find requirement R12 cost-effective because it requires Generators to meet a generator underfrequency trip protection settings threshold curve (PRC-006-NPCC-02 Figure 2) which exceeds what is necessary i.e. beyond what is needed for NPCC entities' UFLS program performance to produce BES frequency outcomes that will conform to PRC-006-NPCC-02 Figure 1 limits. Without any commensurate improvement in BES reliability, this increases costs to Generators. For example, new generators' UF provisions/protections, replicating standard designs that otherwise meet others' UF requirements outside of NPCC, may require review and potential modification from standard design. PSEG recommends that the 'Eastern Interconnection' curve in Attachment 1 of PRC-024-2 be adopted for PRC-006-NPCC-02, to replace PRC-006-NPCC-02 Figure 2. This would be accomplished implicitly by removing PRC-006-NPCC-02 R12 in its entirety from PRC-006-NPCC-02, since Generators already must comply with PRC-024-2. It could also be done explicitly by replacing the current PRC-006-NPCC-02 Figure 2 with: (i) a copy of the 'Eastern Interconnection' curve in Attachment 1 of PRC-024-2; or (ii) explicit reference to that curve in PRC-006-NPCC-02; or (iii) incorporating the curve into PRC-006-NPCC-02 Figure 1 (as PRC-006-NPCC-02 Figure 1 has done with the BES System Frequency element of Attachment 1 of PRC-006-2, and Attachment 1 of PRC-006-2 itself has done with the 'Eastern Interconnection' curve in Attachment 1 of PRC-024-2).

On the basis of our comments in response to Question 1, PSEG does not find requirement R3 cost-effective because it could impose significant additional risks and costs on otherwise non-BES Generators, or Generators' otherwise non-BES generating units, to the benefit (avoided additional costs) to other already-NERC-registered BES entities (DPs, TOs) who could implement one or more alternative solutions (e.g.: additional load shed capability; strengthened transmission capability).

Drafting Team Response:
For reliability purposes, the drafting team decided to retain the existing generator low frequency requirement.

7. Provide any additional comments for the drafting team to consider, if desired.

Comments:

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April 16, 2018

Subject: Posting for Open Process Review of *PRC-006-NPCC-2 Automatic Underfrequency Load Shedding.*

The clean and redlined versions of the revised NPCC Regional Standard PRC-006-NPCC-2 *Automatic Underfrequency Load Shedding*, have been posted on the NPCC Website for a 45-day comment period through May 31, 2018, along with a proposed Implementation Plan and Mapping document.

This draft has been developed in accordance with the NPCC Regional Standard Process Manual (RSPM) and within the scope of an NPCC Regional Standard Authorization Request, which was accepted by the NPCC Regional Standard Committee (RSC). The revisions are also presented as mandated by the NERC Rules of Procedure.

Among the proposed changes included in the updated draft version of the Standard are:

- Modifications to Figures #1 and #2 in the Standard
- Added a Guidelines and Technical Basis section (NERC may request us to create a separate document for this section and post it with the standard subsequent to approvals)
- Incorporated certain Criteria attributes from Directory #12 Automatic UFLS Program Requirements which will facilitate the retirement of Directory #12
- Additional clarification of requirement language
- Proposed retirements of some of the Requirements that are redundant to the PRC-006-2 Continent-wide NERC standard

Also posted is a set of questions developed by the Regional Standard Drafting Team to solicit comments on the draft standard and associated draft Implementation Plan for the Regional Standard. Included in these questions is one on cost effectiveness of the requirements.

Comments on the posted materials may be submitted through the NPCC Open Process Portal, which may be accessed through:
https://www.npcc.org/Standards/SitePages/DevStandardDetail.aspx?DevDocumentId=122
Depending on comments received and if no revisions are deemed necessary by the Standard Drafting Team, the standard is tentatively scheduled to be posted for a 30-day pre-ballot review and 10-day ballot period towards third quarter of 2018.

Please contact me with any questions regarding this Standard.

Thank you.

Ruida Shu
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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from April 16, 2018 through May 31, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

Comments:

A. Introduction

1. **Title:** **Automatic Underfrequency Load Shedding**

2. **Number:** PRC-006-NPCC-2

3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Standard establishes more stringent and specific NPCC UFLS program requirements to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.

4. **Applicability:**

   4.1. Generator Owner

   4.2. Planning Coordinator

   4.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program as established by the Planning Coordinators.

   4.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program as established by the Planning Coordinators.

5. **Effective Date:**

   ~~The first day of the first calendar quarter following applicable governmental and regulatory approvals.~~ Reference to Implementation Plan.

B. Requirements

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Note that Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program having performance characteristics that prevents the frequency from ~~m~~ remaining below 59.5 Hz for greater than 30 seconds in accordance with Figure 1. *[Violation Risk Factor: ~~Medium~~High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC PRC Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 ~~days~~calendar days of receipt of a request. *[Violation Risk Facto ~~r:~~ ~~Medium~~Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that ~~-~~demonstrates that it meets requirement R2.

R3. Each Planning Coordinator shall, within 30 ~~days~~calendar days of completion of its UFLS system studies, identify to the Regional Entity all non-BES generation facilities, within its Planning Coordinator Area, that must not trip above the appropriate generator underfrequency trip threshold curve in Figure 2 in order to support ~~acceptable~~ UFLS program performance requirements. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M3. ~~—~~Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.

R4. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each island identified per the NERC PRC Standard on UFLS. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

4.1. The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times and load shedding amounts specified in Attachment C, Tables 1 through 3 or,

~~.~~

4.2. ~~Alternatively, t~~The program ~~can~~ shall be implemented collectively by multiple Distribution Providers or Transmission Owners ~~with less than 100 MW of individual peak net Load~~, as long as they reside in the same UFLS Island identified by the Planning Coordinator per R2. These multiple Distribution Providers or Transmission O~~o~~wners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3.

M4. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R4. (Attachment C Tables 1-3).

R5. ~~Each Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program, shall notify its Planning Coordinator within 30 days, and: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*~~

~~**5.1.** Each Distribution Provider or Transmission Owner applicable to Attachment C, Table 1, within 90 calendar days of informing of its Planning Coordinator that tolerances cannot be met, determine if tolerances can be met through adjustments and notify the Planning Coordinator of the determination and;~~

~~**5.1.1.** If adjustments are possible, make the adjustments within 180 calendar days after determining that adjustments are possible and notify the Planning Coordinator when complete, or;~~

~~**5.1.2.** If adjustments are not possible then provide its Planning Coordinator with a technical study within 180 calendar days that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.~~

~~**5.2.** Each Distribution Provider or Transmission Owner applicable to Attachment C, Table 2 or Table 3, within 90 calendar days after informing the Planning Coordinator, determine if tolerances can be met through adjustments and notify the Planning Coordinator of the determination, and;~~

~~**5.2.1.** If adjustments are possible, within 90 calendar days make the adjustments of determining that adjustments are possible and notify the Planning Coordinator when complete, or;~~

~~**5.2.2.** If adjustments are not possible, then within 90 calendar days provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.~~

~~**5.3.** Each Distribution Provider or Transmission Owner in the Quebec Interconnection, within 90 calendar days after informing the Planning Coordinator, determine if tolerances can be met through adjustments and notify the Planning Coordinator of the determination, and;~~

~~**5.3.1.** If adjustments are possible, within 180 calendar days make the adjustments of determining that adjustments are possible and notify the Planning Coordinator when complete, or;~~

~~**5.3.2.** If adjustments are not possible, then within 90 calendar days provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with the UFLS program.~~Each Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

5.1. Notify its Planning Coordinator within 30 calendar days of recognition.

5.2. Within the following 90 calendar days, determine if tolerances can be met through adjustments and notify the Planning Coordinator.

5.3. If adjustments are possible, make the adjustments within 180 calendar days after determining that adjustments are possible, and notify the Planning Coordinator when complete, or,

5.4. If adjustments are not possible then:

5.4.1. Each Distribution Provider or Transmission Owner subject to Attachment C, Table 1, shall within 180 calendar days, provide its Planning Coordinator with a technical study that demonstrates that the Distribution Provider's or Transmission Owner's specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the BES, or

5.4.2. Each Distribution Provider or Transmission Owner subject to Attachment C, Table 2 or Table 3, or in the Quebec Interconnection, shall within 90 calendar days, provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with the UFLS program.

M5. Each Distribution Provider or Transmission Owner shall have evidence such as reports ~~,~~ analysis, system studies and dated documentation that demonstrates that it meets ~~-~~Requirement R5.

Rationale for Requirement R6: Operation of underfrequency relays results directly in load being shed, interrupting service to customers. The security of underfrequency relays against misoperation is therefore paramount. The 100 ms minimum time delay specified in R6 serves to prevent premature activation of these relays during short-lived transient frequency excursions that may occur on a localized basis in the absence of a serious system event wherein UFLS would be appropriate. This intentional delay helps to ensure that the relays activate only for frequency excursions that are due to actual system events that require automatic UFLS to reestablish the balance of generation to load.

R6. Each Distribution Provider and Transmission Owner shall set each underfrequency relay ~~-~~that is part of its region's UFLS program with a 100 ms minimum time delay. *[Violation ~~-~~Risk Factor: ~~High~~Medium] [Time Horizon: Long Term Planning]*

M6. Each Distribution Provider and Transmission Owner shall have evidence such as ~~-dd~~ocumentation or reports that their underfrequency relays have been set with the minimum ~~-~~time delay, in accordance with Requirement R6.

Rationale for Requirement R7: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an Underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the Underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance

criteria.

R7. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M7. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R7.

R8. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 ~~days~~calendar days of any changes ~~to those thresholds~~. *[Violation Risk Factor: ~~Medium~~Lower] [Time Horizon: Operations Planning]*

M8. Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R8.

R9. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R8 shall develop and submit an implementation plan for approval by the Planning Coordinator within 90 ~~days~~calendar days of the request from the Planning Coordinator ~~for approval by the Planning Coordinator~~. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M9. ~~Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9~~Each Distribution Provider and Transmission Owner shall provide evidence such as ~~test reports, data sheets or other~~ letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

R10. Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings provided by the Planning Coordinator in accordance with Requirement R8 and based on the Planning Coordinator approved implementation plan in accordance with R9. *[Violation Risk Factor: High] [Time Horizon: Operations Planning]*

M10. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R10.

Rationale for Requirement R11: It is recognized that, ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard ~~universally~~, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holi~~days~~days), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-

areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. This being said, entities are required by R11 to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R11. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load ~~projected to be~~that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating ~~actual metered~~ Load through the switches that would disconnect load if triggered by the UFLS relays. ~~If there is no local metering of the load through said switches, the load may be calculated from measurements made at the nearest available metering. (e.g., upstream metering on the distribution feeder that supplies the load to be shed).~~ *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M11. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R11.

R12. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted in Requirements R15 and R18. *[Violation Risk Factor: ~~High~~Medium] [Time Horizon: Long Term Planning]*

M12. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R12.

R13. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay ~~to its Planning Coordinator~~ within 45 ~~days~~calendar days of the Planning Coordinator's request. *[Violation Risk Factor: ~~High~~Lower] [Time Horizon: Operations Planning]*

M13. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R13.

R14. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: ~~High~~Medium] [Time Horizon: Long Term Planning]*

14.1. Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.

14.2. Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 2.

M14. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R14.

R15. For existing non-nuclear units in service prior to the effective date of this standard, as documented in accordance with Attachments A or B, that have underfrequency protections set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: ~~High~~Medium] [Time Horizon: Long Term Planning]

15.1. Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

15.2. Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

15.3. Each Planning Coordinator in Ontario, Québec and the Maritime Provinces in accordance with Attachment A and each Generator Owner in the New-England States and in New York State in accordance with Attachment B shall arrange for compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

~~Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard, as documented in accordance with Attachments A or B, that have underfrequency protections set to trip above the appropriate curve in Figure 2 shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*~~

~~**15.1.** Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.~~

~~**15.2.** Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.~~

~~**15.3.** Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to~~

~~early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.~~

M15. Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with Requirement R12~~3~~ shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R15.

R16. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R15.3 for generating units in its respective NPCC area. *[Violation Risk Factor: ~~High~~Medium] [Time Horizon: Long Term Planning]*

M16. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such as ~~emails~~reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R16.

R17. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R15.3 for generating units in its respective NPCC area. *[Violation Risk Factor: ~~High~~Medium] [Time Horizon: Long Term Planning]*

M17. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as ~~emails~~reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R17.

R18. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2, based on their licensing design basis, shall: *[Violation Risk Factor: ~~High~~Medium] [Time Horizon: Long Term Planning]*

18.1. Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

18.2. Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

18.3. Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M18. Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R18.

Figure 1
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz
Design Performance Requirements

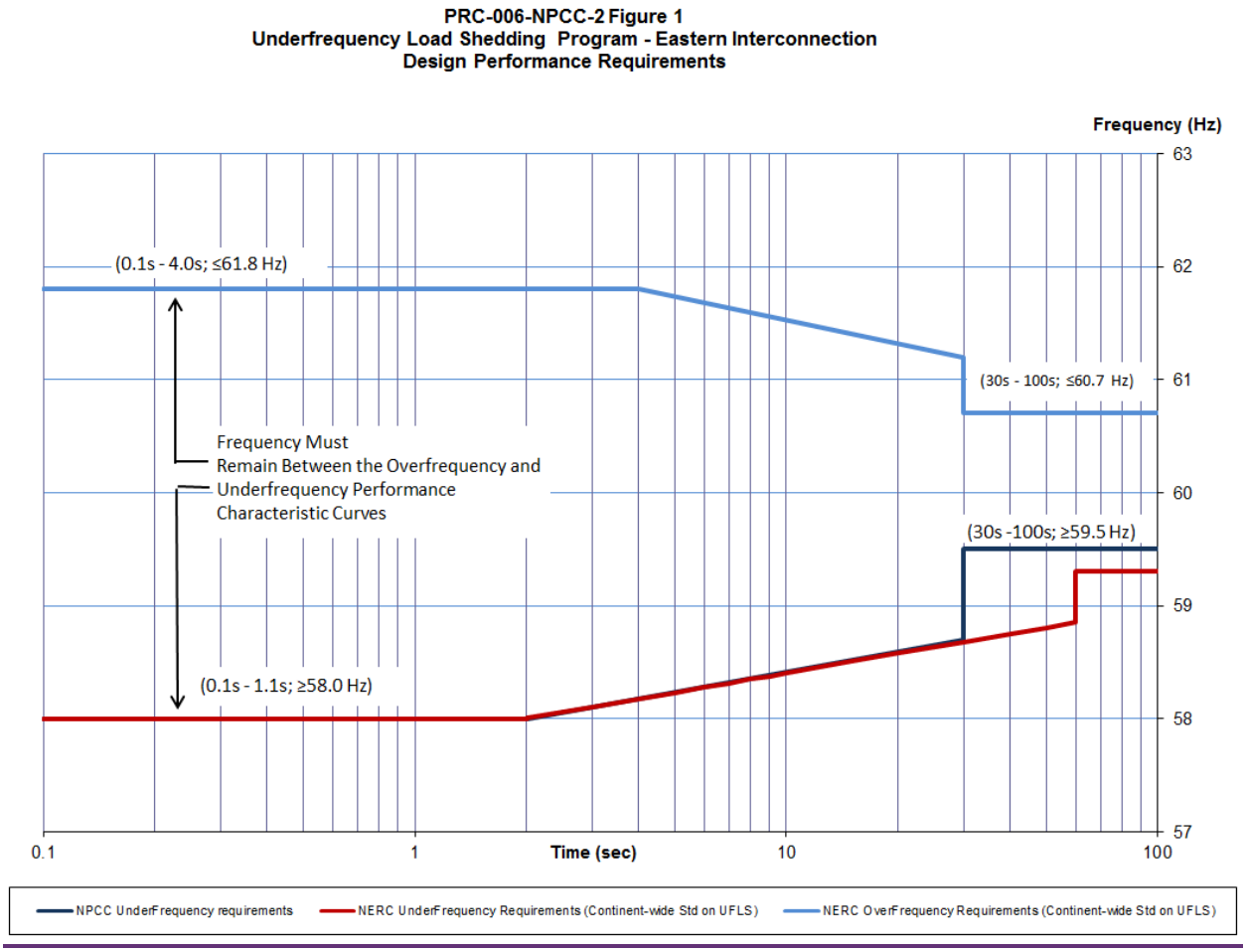
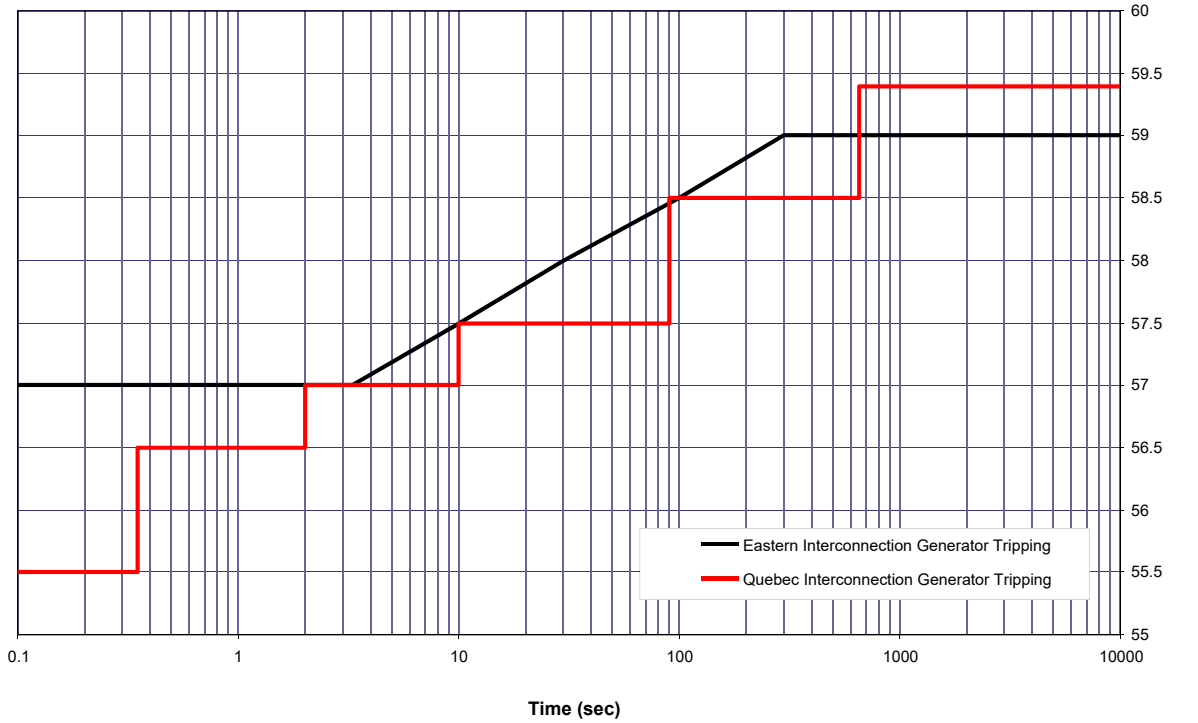


Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators

Figure 2

Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority

NPCC Compliance Committee

1.2. Compliance Monitoring Period and Reset Time Frame

Not Applicable

1.3. Data Retention

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 4, 5, 6,7,10, 11, and 12.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 3, 8, 9, 20, and 21.

The Planning Coordinator in Ontario, Quebec, and the Maritime Provinces shall keep evidence for three calendar years for Measure 17.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 18, 22, and 23.

The Generator Owner shall keep evidence for three calendar years for Measures 13, 14, 15, 16, and 19.

1.4. Compliance Monitoring and Assessment Processes

Self -Certifications.

Spot Checking.

Compliance Audits.

Self- Reporting.

Compliance Violation Investigations.

Complaints.

1.5. Additional Compliance Information

None.

2. Violation Severity Levels

Requirement	Lower VSL	Moderate VSL	High VSL	
R1	N/A	**N/A**	N/A	The F to des havin

				chara frequ 59.5 H 1.
R2	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The P to pro bound NERC within a requ
R3	The Planning Coordinator identified to the Regional Entity all non-BES ~~the~~ generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order ~~necessary~~ to support ~~the~~ UFLS program performance requirements, but did so more than 30 calendar days ~~but less than 41~~ and up to and including 40 days after completion of the system studies.	The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program performance requirements, but did so more than 40 days but less than calendar days but less than and including 50 days after completion of the system studies.	The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program performance requirements,, but did so more than 50 calendar days but less than and including 60 days after completion of the system studies.	The P identi facilit Coord trip a gener thresh the U requi the R calen the sy OR The P identi facilit Coord trip a gener thresh to sup perfo
R4				The D Trans imple progr speci Part 4
R5	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations ir Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations ir Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	The D Trans meet numb set po Progr items 60 ca time f

R6	The Distribution Provider or Transmission Owner set less than 100% but more than (and including) 95% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.	The Distribution Provider or Transmission Owner set less than 95% but more than (and including) 90% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.	The Distribution Provider or Transmission Owner set less than 90% but more than (and including) 85% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.	The D Trans than 8 relays UFLS minim
R7	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The P devel for in once less th regio
R8	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar daysbut less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar daysbut less than and including 60 calendar days of any changes.	The P to pro Owne withi area t thresh calen
R9	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The D Trans devel imple ~~than~~w the re
R10	implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85 % of UFLS relays.	The D Trans imple thresh the Pl accor Coord imple than
R11	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The D Trans provi Coord the ac have relays descr within last u

		months since last update.		
R12	N/A	N/A	N/A	The G each trip re below under settin Figur exem
R13	The Generator Owner transmitted the generator underfrequency trip setting and time delay ~~to its Planning Coordinator~~ more than 45 calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay ~~to its Planning Coordinator~~ more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay ~~to its Planning Coordinator~~ more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	The G transm under time d days Coord
R14	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not: fulfill the obligation of Requirement R14; Part 14.1 OR Did not fulfill the obligation of Requirement R14, Part 14.2.	The G new g existi net ca 10%, oblig Part 1
R15	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.as specified in Requirement R15, Part 15.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirment 15, Part 15.1	The F Ontar Marit Gene Engla State comp speci Part 1
R16	N/A	N/A	N/A	The F not ap descr deter shedd
R17	N/A	N/A	N/A	The G Distri Trans apply

				in Att the co that is
R18	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator as specified in Requirement R18, Part 18.3.	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R18; Part 18.1 OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R18, Part 18.2.	The G fulfill Requ Part 1

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units, in their Planning Coordinator area, in service prior to the effective date of Version 1 of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays

1.3 Physical and electrical location of the unit
1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

   2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

   2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

   2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

   2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

   In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-1 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units in service prior to the effective date of Version 1 of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

   2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

   2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

   2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

   2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

   2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

   In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-1 Attachment C

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:

Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5
59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 – 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	28-50	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Guidelines and Technical Basis:

Standard PRC-006-32, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.

PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.

Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
-
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling ~~(MOD-027-1 - Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions) or system modeling (if variations in system response are detected under MOD-033 - Steady-State and Dynamic System Model Validation)~~

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Implementation Plan

Regional Reliability Standard PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Applicable Standard(s)

- PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Requested Retirement(s)

- PRC-006-NPCC-1 – Automatic Underfrequency Load Shedding

Applicable Entities

- Generator Owners
- Planning Coordinators
- Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.
- Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

Background

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. To determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. To determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Review Attachment C in PRC-006-NPCC-1 to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. Review and revise Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

Effective Date

All requirements with the exception of R4 will be enforceable on the first day of the first calendar quarter following the applicable governmental and regulatory approvals.

R4 will be enforceable on the first day of the first calendar quarter 12 months following the applicable governmental and regulatory approvals.

Retirement Date

The NPCC Regional Reliability Standard PRC-006-NPCC-1 shall be retired immediately prior to the Effective Date of PRC-006-NPCC-2.

Mapping Document

Draft NPCC Regional Automatic Underfrequency Load Shedding Standard PRC-006-NPCC-2

NPCC's regional standard PRC-006-NPCC-2 "Automatic Underfrequency Load Shedding" (UFLS) was effective in the US in July 2015. The standard is currently under revision to align with the continent-wide PRC-006-2 UFLS standard which became effective on October 2015. The draft of PRC-006-NPCC-2 removes duplicity with the continent wide standard and adds specificity to allow retirement of the NPCC UFLS Directory #12 containing more stringent UFLS performance criteria and harmonizes the requirements and criteria of all these documents.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
PRC-006-NPCC-1 **R1** Each Planning Coordinator shall establish requirements for entities aggregating their UFLS programs for each anticipated island and requirements for compensatory load shedding based on islanding criteria (required by the NERC PRC Standard on UFLS). [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R2**. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC PRC Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]* **R4.** Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall	The purpose of R1 in PRC-006-NPCC-1 was to ensure entities that aggregate their load understand what the UFLS island boundaries are and establish criteria for compensatory load shedding. The revised R2, R4, and R15 clearly address this in the proposed PRC-006-NPCC-2.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each island identified per the NERC PRC Standard on UFLS. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* **4.1.** The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times and load shedding amounts specified in Attachment C, Tables 1 through 3 or. **4.2.** The program shall be implemented collectively by multiple Distribution Providers or Transmission Owners , as long as they reside in the same UFLS Island identified by the Planning Coordinator per R2. These multiple Distribution Providers or Transmission Owners, via mutual	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3. **R15.** For existing non-nuclear units in service prior to the effective date of this standard, as documented in accordance with Attachments A or B, that have underfrequency protections set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning*]* **15.1.** Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	15.2. Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator. **15.3.** Each Planning Coordinator in Ontario, Québec and the Maritime Provinces in accordance with Attachment A and each Generator Owner in the New-England States and in New York State in accordance with Attachment B shall arrange for compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	Planning Coordinator in Requirement R2.	
PRC-006-NPCC-1 **R2** Each Planning Coordinator shall, within 30 days of completion of its system studies required by the NERC PRC Standard on UFLS, identify to the Regional Entity the generation facilities within its Planning Coordinator Area necessary to support the UFLS program performance characteristics. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R3.** Each Planning Coordinator shall, within 30 calendar days of completion of its UFLS system studies, identify to the Regional Entity all non-BES generation facilities, within its Planning Coordinator Area, that must not trip above the appropriate generator underfrequency trip threshold curve in Figure 2 in order to support UFLS program performance requirements. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*	The original intent of R2 in Version 2 was to ensure that the non-BES units necessary to support UFLS system performance were subject to the standard with notification going to NPCC to ensure they were registered as being "material" per Appendix 5B of the NERC Rules of Procedure. Also clarity was added that these generating units must not trip above the appropriate generator underfrequency trip threshold curve in Figure 1. This was previously implicit in the Version 1 of the standard and NPCC will continue to have the PC identify these units and pursue their registration.
PRC-006-NPCC-1 **R3** Each Planning Coordinator shall provide to the Transmission Owner, Distribution Provider, and Generator Owner within 30	**PRC-006-NPCC-2** **R2**. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC PRC Standard on UFLS, to	The reliability intent of Version 1 R3 was to ensure that the entities aggregating load were aware of the island boundaries. This is covered in draft R2 of the proposed revision to the standard. Requirements regarding

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
days upon written request the requirements for entities aggregating the UFLS programs and requirements for compensatory load shedding program derived from each Planning Coordinator's system studies as determined by Requirement R1. [Violation Risk Factor: Low] [Time Horizon: Long Term Planning]	Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]* **R15.** For existing non-nuclear units in service prior to the effective date of this standard, as documented in accordance with Attachments A or B, that have underfrequency protections set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning*]* **15.1.** Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations. **15.2.** Each Generator Owner shall transmit the existing underfrequency settings and any changes to the	compensatory load shedding have been clarified and are covered through draft R15.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	underfrequency settings along with the technical basis for the settings to the Planning Coordinator. **15.3.** Each Planning Coordinator in Ontario, Québec and the Maritime Provinces in accordance with Attachment A and each Generator Owner in the New-England States and in New York State in accordance with Attachment B shall arrange for compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.	
PRC-006-NPCC-1 **R4** Each Distribution Provider and Transmission Owner in the Eastern	**PRC-006-NPCC-2** **R4.** Each Distribution Provider and Transmission Owner in the Eastern	Added clarity and separated the requirement into parts.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
Interconnection portion of NPCC shall implement an automatic UFLS program reflecting normal operating conditions excluding outages for its Facilities based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3, or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island identified in Requirement R1 and acting as a single entity, provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load, based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3. [Violation Risk Factor: High] [Time Horizon: Long Term Planning	Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each island identified per the NERC PRC Standard on UFLS. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* **4.1.** The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times and load shedding amounts specified in Attachment C, Tables 1 through 3 or. **4.2.** The program shall be implemented collectively by multiple Distribution Providers or Transmission Owners , as long as they reside in the same UFLS Island identified by the Planning	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	Coordinator per R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3.	
PRC-006-NPCC-1 **R5** Each Distribution Provider or Transmission Owner that must arm its load to trip on underfrequency in order to meet its requirements as specified and by doing so exceeds the tolerances and/or deviates from the number of stages and frequency set points of the UFLS program as specified in the tables contained in Requirement R4 above, as applicable depending on its total peak net Load shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R5.** Each Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning*]* **5.1.** Notify its Planning Coordinator within 30 calendar days of recognition. **5.2.** Within the following 90 calendar days, determine if tolerances can be met	Clarifications are proposed in the proposed Version 2. Subrequirements have been revised and separated out, timeframes have been added.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
5.1 Inform its Planning Coordinator of the need to exceed the stated tolerances or the number of stages as shown in UFLS Attachment C, Table 1 if applicable and **5.2** Provide its Planning Coordinator with a technical study that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system. **5.3** Inform its Planning Coordinator of the need to exceed the stated tolerances of UFLS Attachment C, Table 2 or Table 3, and in the case of Attachment C, Table 2 only, the need to deviate from providing two stages of UFLS, if applicable, and **5.4** Provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.	through adjustments and notify the Planning Coordinator. **5.3.** If adjustments are possible, make the adjustments within 180 calendar days after determining that adjustments are possible, and notify the Planning Coordinator when complete, or, **5.4.** If adjustments are not possible then: **5.4.1.** Each Distribution Provider or Transmission Owner subject to Attachment C, Table 1, shall within 180 calendar days, provide its Planning Coordinator with a technical study that demonstrates that the Distribution Provider's or Transmission Owner's specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the BES, or **5.4.2.** Each Distribution Provider or Transmission Owner subject to Attachment C, Table 2 or Table 3, or in the Quebec Interconnection, shall within 90 calendar days, provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	available that would allow the Distribution Provider or Transmission Owner to comply with the UFLS program.	
PRC-006-NPCC-1 **R6** Each Distribution Provider and Transmission Owner in the Québec Interconnection portion of NPCC shall implement an automatic UFLS program for its Facilities based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4 or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island, identified in Requirement R1, an aggregated automatic UFLS program that sheds Load based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]		The drafting team agreed to retire the requirement.
PRC-006-NPCC-1	**PRC-006-NPCC-2**	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
R7 Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with the following minimum time delay: 7.1 Eastern Interconnection – 100 ms 7.2 Québec Interconnection – 200 ms [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**R6.** Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with a 100 ms minimum time delay. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*	Elimnated Hydro Quebec Interconnection minimum time delay of 200ms.
PRC-006-NPCC-1 **R8** Each Planning Coordinator shall develop and review once per calendar year settings for inhibit thresholds (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R7.** Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*	Periodicty of develop and review settings has been increased from once per calendar year to once per five calendar years. This coincides with the the periodicity of UFLS studies. Having a yearly "develop and review" without taking any further action is strictly administrative and does nothing for reliability (P-81 type of issue).
NPCC-006-NPCC-1	**NPCC-006-NPCC-2**	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
R9 Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 days of the initial determination of those inhibit thresholds and within 30 days of any changes to those thresholds. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]	**R8.** Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*	Clarified the language.
NPCC-006-NPCC-1 **R10** Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings based on the notification provided by the Planning Coordinator in accordance with Requirement R9. [Violation Risk Factor: High] [Time Horizon: Operations Planning]	**NPCC-006-NPCC-2** **R10.** Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings provided by the Planning Coordinator in accordance with Requirement R8 and based on the Planning Coordinator approved implementation plan in accordance with R9. *[Violation Risk Factor: High] [Time Horizon: Operations Planning]*	Same - with changes to requirement numbers referenced only. Added clarification for Planning Coordinator developes implementation plan.
NPCC-006-NPCC-1 **R11** Each Distribution Provider and Transmission Owner shall develop and submit	**PRC-006-NPCC-2** **R9.** Each Distribution Provider and Transmission Owner that receives a	Language clarifications and changes to requirement numbers referenced.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with R9. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]	notification pursuant to Requirement R8 shall develop and submit an implementation plan for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*	
PRC-006-NPCC-1 **R12** Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage coincident with their integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would be opened by the UFLS relays. [Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R11.** Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. *[Violation Risk Factor: Lower]*	Added language that allows calculation of load from nearest available metering rather than actual metering. The requirement as it exists is placing undo burden to install metering when it can be accurately calculated as a cost effective alternative.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	[Time Horizon: Long Term Planning]	
PRC-006-NPCC-1 **R13** Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, below the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, except as otherwise exempted in Requirements R16 and R19. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R12.** Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted in Requirements R15 and R18. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*	Clarification was made that the Underfrequency trip relay must to be set to operate "on or below" the appropriate curve. In Version 1 it currently states below and questions arose whether settings on the curve were considered in compliance.
NPCC-006-NPCC-1 **R14** Each Generator Owner shall transmit the generator underfrequency trip setting and time delay to its Planning Coordinator within 45 days of the Planning Coordinator's request. [Violation Risk Factor: High] [Time Horizon: Operations Planning]	**PRC-006-NPCC-2** **R13.** Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*	No Change from Version 1 only requirement numbering
PRC-006-NPCC-1	**PRC-006-NPCC-2**	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
R15 Each Generator Owner with a new generating unit, scheduled to be in service on or after the effective date of this Standard, or an existing generator increasing its net capability by greater than 10% shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning] **15.1** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 1. **15.2** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1.	**R14.** Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]* **14.1.** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2. **14.2.** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip	Removed language pertaining to the Version 1 of the standard regarding on or after the effective date. Version 1 has been in place and transition/implementation concerns need not be addressed in this requirement.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	protection settings threshold curve in Figure 2.	
PRC-006-NPCC-1 **R16** Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1 shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning] **16.1** Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations. **16.2** Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator. **16.3** Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to	**PRC-006-NPCC-2** **R15.** For existing non-nuclear units in service prior to the effective date of this standard, as documented in accordance with Attachments A or B, that have underfrequency protections set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning*]* **15.1.** Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations. **15.2**. Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical	Addition made to R15.3 to clarify that any compensatory load shedding must be in the island the generating unit resides in.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
compensate for the loss of their generator due to early tripping.	basis for the settings to the Planning Coordinator. **15.3.** Each Planning Coordinator in Ontario, Québec and the Maritime Provinces in accordance with Attachment A and each Generator Owner in the New-England States and in New York State in accordance with Attachment B shall arrange for compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.	
PRC-006-NPCC-1 **R17** Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement	**PRC-006-NPCC-2** **R16.** Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is	Same – numbering of requirements changing

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	required in Requirement R15.3 for generating units in its respective NPCC area. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*	
PRC-006-NPCC-1 **R18** Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R17.** Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R15.3 for generating units in its respective NPCC area. *[Violation Risk Factor: Medium][Time Horizon: Long Term Planning]*	Same – numbering of requirements changing
PRC-006-NPCC-1 **R19** Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 1, based on their licensing design basis, shall: [Violation Risk	**PRC-006-NPCC-2** **R18.** Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2, based on their licensing design basis, shall: *[Violation*	Same – numbering of requirements changing and Figure reference update

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
Factor: High] [Time Horizon: Long Term Planning] **19.1** Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8Hz. **19.2** Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz. **19.3** Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.	*Risk Factor: Medium] [Time Horizon: Long Term Planning]* **18.1.** Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz. **18.2.** Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz. **18.3.** Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.	
PRC-006-NPCC-1 **R20** The Planning Coordinator shall update its UFLS program database as specified by the NERC PRC Standard on UFLS. This database shall include the following information:	**PRC-006-2 (Existing in force continent-wide standard)** **R6.** Each Planning Coordinator shall maintain a UFLS database containing data	The drafting team decided to remove requirement 19 and 20 because they are covered by the continent-wide PRC-006-2 requirement 6.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
[Violation Risk Factor: Lower] [Time Horizon: Operations Planning] **20.1** For each UFLS relay, including those used for compensatory load shedding, the amount and location of load shed at peak, the corresponding frequency threshold and time delay settings. **20.2** The buses at which the Load is modeled in the NPCC library power flow case. **20.3** A list of all generating units that may be tripped for underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, including the frequency trip threshold and time delay for each protection system. **20.4** The location and amount of additional elements to be switched for voltage control that are coordinated with UFLS program tripping. **20.5** A list of all UFLS relay inhibit functions along with the corresponding settings and locations of these relays.	necessary to model its UFLS program for use in event analyses and assessment of the UFLS program at least once each calendar year, with no more than 15 months between maintenance activities. [VRF: Lower][Time Horizon: Long-term Planning]	The requirement 19 and 20 language will be transferred over to new guideline document.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
PRC-006-NPCC-1 **R21** Each Planning Coordinator shall notify each Distribution Provider, Transmission Owner, and Generator Owner within its Planning Coordinator area of changes to load distribution needed to satisfy UFLS program performance characteristics as specified by the NERC PRC Standard on UFLS.[Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-2 (Existing in force continent-wide standard)** **R3.** Each Planning Coordinator shall develop a UFLS program, including notification of and a schedule for implementation by UFLS entities within its area, that meets the following performance characteristics in simulations of underfrequency conditions resulting from an imbalance scenario, where an imbalance = [(load — actual generation output) / (load)], of up to 25 percent within the identified island(s). [VRF: High][Time Horizon: Long-term Planning] **3.1.** Frequency shall remain above the Underfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and	PRC-006-NPCC-1 R21 is now redundant with the NERC continent wide standard R3. This requirement, R21 is proposed for retirement under the P-81 criteria.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	3.2. Frequency shall remain below the Overfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and **3.3.** Volts per Hz (V/Hz) shall not exceed 1.18 per unit for longer than two seconds cumulatively per simulated event, and shall not exceed 1.10 per unit for longer than 45 seconds cumulatively per simulated event at each generator bus and generator step-up transformer high-side bus associated with each of the following: • Individual generating units greater than 20 MVA (gross nameplate rating) directly connected to the BES • Generating plants/facilities greater than 75 MVA (gross	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	aggregate nameplate rating) directly connected to the BES • Facilities consisting of one or more units connected to the BES at a common bus with total generation above 75 MVA gross nameplate rating.	
PRC-006-NPCC-1 **R22** Each Distribution Provider, Transmission Owner and Generator Owner shall implement the load distribution changes based on the notification provided by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-2 (Existing in force continent-wide standard)** **R9.** Each UFLS entity shall provide automatic tripping of Load in accordance with the UFLS program design and schedule for implementation, including any Corrective Action Plan, as determined by its Planning Coordinator(s) in each Planning Coordinator area in which it owns assets. [VRF: High][Time Horizon: Long-term Planning]	PRC-006-NPCC-1 R22 is now redundant with the NERC continent wide standard R9 and this requirement, R22 is proposed for retirement under the P-81 criteria.
PRC-006-NPCC-1 **R23** Each Distribution Provider, Transmission Owner and Generator Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning	**PRC-006-2 (Existing in force continent-wide standard)** **R3.** Each Planning Coordinator shall develop a UFLS program, including notification of and a schedule for implementation by	PRC-006-NPCC-1 states an implemention plan for changes needs to be submitted to the PC for their approval within 90 days of the request. However in R22 of the regional standard it states that the changes shall be implemented based on the PC's notification.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
Coordinator in accordance with Requirement R21. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]	UFLS entities within its area, that meets the following performance characteristics in simulations of underfrequency conditions resulting from an imbalance scenario, where an imbalance = [(load — actual generation output) / (load)], of up to 25 percent within the identified island(s). [VRF: High][Time Horizon: Long-term Planning] **3.1.** Frequency shall remain above the Underfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and **3.2.** Frequency shall remain below the Overfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state	We believe this is fully covered in R3 and an additional implementation plan beyond the PC's plan, which includes the notification and schedule for the UFLS entities to follow is now unnecessary in the regional standard. We are recommending that R23 in the regional standard be retired.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	condition between 59.3 Hz and 60.7 Hz is reached, and **3.3.** Volts per Hz (V/Hz) shall not exceed 1.18 per unit for longer than two seconds cumulatively per simulated event, and shall not exceed 1.10 per unit for longer than 45 seconds cumulatively per simulated event at each generator bus and generator step-up transformer high-side bus associated with each of the following: • Individual generating units greater than 20 MVA (gross nameplate rating) directly connected to the BES • Generating plants/facilities greater than 75 MVA (gross aggregate nameplate rating) directly connected to the BES Facilities consisting of one or more units connected to the BES at a common bus with	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	total generation above 75 MVA gross nameplate rating.	

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from April 13, 2018 through May 29, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No **X**

Comments: We would like to reiterate a previous comment that we submitted concerning the difference between the design performance requirement in the NERC continent-wide standard PRC-006-2 and what is included in the proposed regional standard PRC-006-2-NPCC-2 and in the existing NPCC Directory #12.

The NERC continent-wide standard requires that the system frequency be restored to between 59.3 Hz and 60.7 Hz in 60 seconds (60 s / 59.3 Hz & 60 s / 60.7 Hz), following an imbalance that results in an under-frequency (Requirement R3, Part 3.10). However, both the regional standard and the directory require the frequency to be restored to above 59.5 Hz in 30 seconds (30 s / 59.5 Hz).

Based on our experiences with the August 2003 Blackout and based on the UFLS assessment completed by the SS-38 Working Group, Ontario could form islands with portions of the power system that are not part of NPCC region. Given this and since there is no technical justification for the existing NPCC performance characteristic of 30 s / 59.5 Hz, we believe the regional standard should be aligned with the continent-wide standard's performance characteristic of 60 s / 59.3 Hz. This would eliminate any potential non-compliance risks that Ontario may face as a result of having two different performance criteria apply to the same island.

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes **X**

   No ☐

Comments: With respect to Sub-requirement 5.4.1., we are not certain that a Distribution Provider or Transmission Owner will have the required data and capability to perform the technical study to assess whether their specific deviations from the UFLS requirements will have a significant adverse impact on the BES. The required data and capability to perform these types of BES assessments are usually found with the Planning Coordinator.

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

Yes **X**

No ☐

Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes **X**

   No ☐

   Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

   Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

   Comments:

We are unable to find the rationale for changing the VRF from a HIGH to a MEDIUM for various requirements (e.g. R12, R15-R18) addressing compensatory load shedding requirements for generators that are set to trip above the applicable curves in Figure 2. Without knowing the rationale, we do not support such changes since failing to shed load to compensate for the additional loss of the tripped generation can lead to total collapse of the island. We recommend the drafting team reconsider the reliability impact and reinstate these VRFs to HIGH, or provide the technical justification for such changes.

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: National Grid recommends that a technical writer review PRC-006-NPCC-2 for possible improvements. Please ensure that all aspects of the regional standard conform with the most recent NERC standards format.

Specific Comments:

Consider changing the Purpose to state: "To establish consistent and coordinated requirements for the design, implementation, and analysis of automatic underfrequency load shedding (UFLS) programs among all NPCC Region applicable entities."

Consider changing the Applicability to state:

4.1 Planning Coordinators

4.2 UFLS entities shall mean all entities that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators. Such entities may include one or more of the following:

4.2.1 Transmission Owners

4.2.2 Distribution Providers

4.2.3 UFLS-Only Distribution Providers

4.3 Generator Owners

This proposed applicability change will also be reflected in multiple requirements by replacing Transmission Owners and Distribution Providers with UFLS entities.

Consider changing the Effective Date to state: "See Implementation Plan."

Consider changing references for this standard from "NERC PRC Standard on UFLS" to "the continent-wide PRC-006 standard."

Consider changing from "greater than 30 seconds" to "more than 30 seconds" in Requirement R1.

Consider consistent use of the comma. (e.g., missing in M1, R4.1, R4.2, etc.)

Correct font type for “R4” in Requirement R4.

Please insert “for it Facilities” after the word ‘outage’ in requirement R4, to clarify type of outages.

Consider changing capitalized “Island” to be lower case “island.” Island is not a NERC Glossary Term. Please see requirement R4.2.

Consider improvements to the readability of sub-requirements, which are combined with ‘and’ or ‘or’ statements. Separate sub-requirements / alternatives in ‘and’ or ‘or’ statements by use of semicolons, e.g., before the term “or” between R4.1 and R4.2.

Consider deleting “at least” in “at least once per five calendar years” in Requirement R7.

Consider changing capitalized “Underfrequency” to be lower case “underfrequency” in the Rationale box for Requirement R7. Underfrequency is not a NERC Glossary defined term.

Consider revising R8 by changing the word “applicable” to “allowable”. As presently written it appears as if the Planning Coordinator is responsible to develop (specific) settings for inhibit thresholds.

Correct lay-out (break) in Requirement R13.

Consider ensuring the Compliance section of the standard is in conformance with other NERC reliability standards. We suggest changing the Compliance Enforcement Authority to be NPCC as the Regional Entity, instead of the NPCC Compliance Committee.

Consider removing the Guidelines and Technical Basis section in accordance with the NERC Technical Rationale Transition Plan. A separate document may be required.

Consider adding a Version History section.

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: Consider consistent use of terms “technical study” as used in R5.4.1 and “system studies” as used in Requirement R3, M1, M5, and M7. Are these terms referring to the same or different studies?

Consider improvements to the readability of sub-requirements, which are combined with 'and' or 'or' statements. Separate sub-requirements / alternatives in 'and' or 'or' statements by use of semicolons, e.g., before the term "or" between R5.3 and R5.4, as well as between R5.4 and R5.4.2.

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

   Comments: National Grid recommends dividing R15.3 into two sub-requirements.

Recommended change:

15.3. Each Planning Coordinator in Ontario, Québec and the Maritime Provinces in accordance with Attachment A shall arrange for compensatory load shedding, as provided by a UFLS entity that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

15.4. Each Generator Owner in the New-England States and in New York State in accordance with Attachment B shall arrange for compensatory load shedding, as provided by a UFLS entity that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

Requirement R17 would also need to be revised to reference R15.4.

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative

language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

Comments:

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

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2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from April 16, 2018 through May 31, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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Comments by Consolidated Edison Co. of New York

1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: Con Edison agrees with the proposed revisions as posted. However, Con Edison believes that, per the Guidelines and Technical Basis section in PRC-006-NPCC-2, "significant variations" exist that impact the BES and mandate that an updated UFLS assessment be conducted. The "significant variation" is the inability of generation to ride through high frequency events. This issue has been highlighted by a NERC Industry Advisory, Turbine Combustor Lean Blowout, issued June 26, 2008.

Con Edison recommends that a new UFLS assessment be conducted due to reliability concerns of turbine-generator governor controls and the NPCC Under Frequency Load Shedding Study results as discussed in this submittal.

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: See comments in section 6. The 1% UFLS tolerance specified in Attachment C may not provide any additional benefit to the success of an UFLS system.

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: The lack of test performance standards provides no guarantee that turbine-generators will remain synchronized to the system during a low frequency event. NPCC should develop a more stringent requirement to test turbine-generators in a manner that verifies the

ability to ride through low frequency conditions, as well as high frequency conditions. This testing is being developed worldwide. For example, National Grid in the United Kingdom has Grid Code CO5 that verifies equipment performance and has developed frequency response markets to provide performance incentives. Equipment testing is the only means of verifying performance, and if this cannot be done, then assumptions on reliability of turbine-generators should be more conservative.

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

   Comments:

An UFLS Standard is cost effective if it successfully islands a service area. On November 4th, 2006, Europe experienced an UFLS event and avoided a grid shutdown. The event resulted in the European breaking up into 3 large grids. Post event, the grids were synchronized back together in 39 minutes. Only a small percentage of customers were shutdown with minimal economic impact on the European economy.

In the United States, the opposite occurred in 2003. A cascading outage initiated in the Midwest caused the northeast portion of the Eastern Interconnection to isolate. The last line of defense was the UFLS system, and it failed. The subsequent blackout caused a $6B economic impact per the DOE. By implementing governor testing standards and improved UFLS studies, the potential for a system wide blackout can be avoided. The money invested in this system is cost effective as was seen in Europe in 2006.

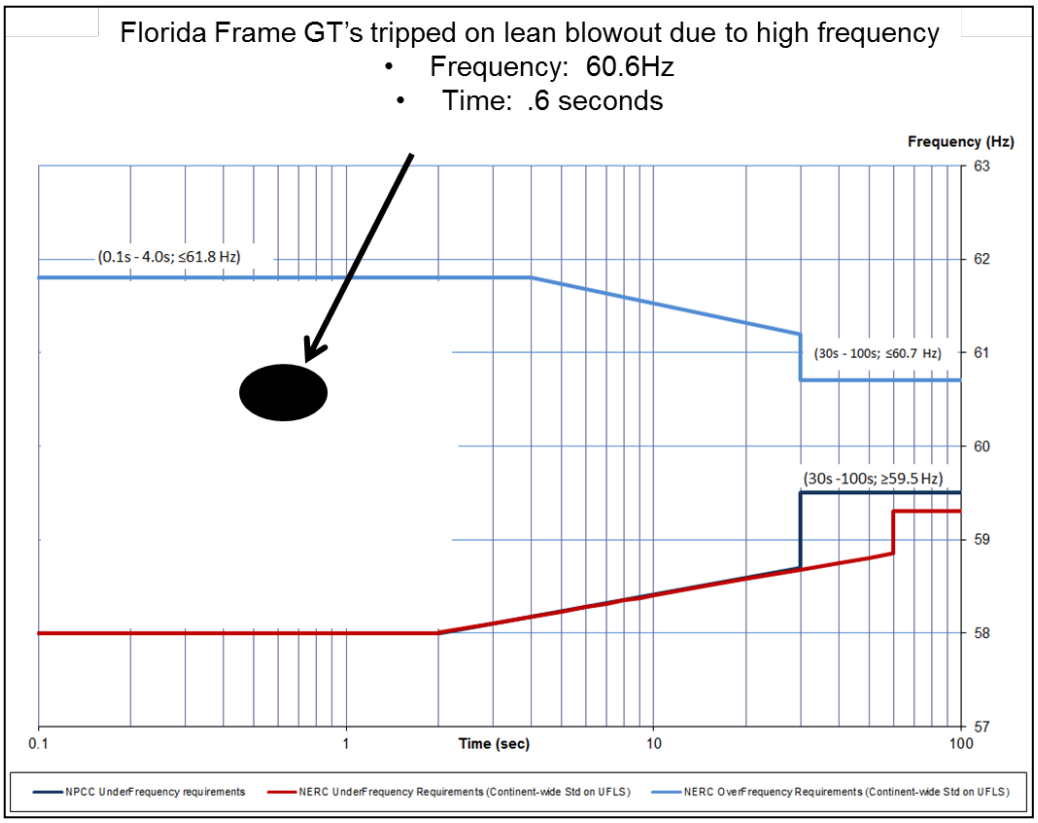
6. Provide any additional comments for the drafting team to consider, if desired.

   Comments: Con Edison respectively adds the following comments.

(1) Requirement 1 references Figure 1 in PRC-006-NPCC. While this figure is based on the NERC Standard from PRC-006, it is unrealistic. NPCC should develop a more stringent requirement based on the documented performance of the governor during off frequency conditions. Note that PRC-024 applies to protection relays, not governor controls. If the governor controls reduce the fuel to cause flameout, or the steam turbine controls increase the steam pressure to cause a drum level trip prior to the relay setting, then the relay setting has minimal value except to protect the plant. If the governor controls work properly, successful UFLS event is possible.

The figure below shows the response of large frame gas turbines during the 2/26/2008 FRCC System Disturbance. Per the FRCC report, the frequency excursion of 60.6 Hz resulted in numerous lean blowouts of gas turbines. The NPCC Under Frequency Load Shedding Study assumes gas turbines will operate reliably at 61.8Hz (1.2 Hz higher than observed in the Florida event), which is unrealistic. Studies should include the loss of generation at high frequencies, or limit the UFLS peak frequencies to a lower frequency.

Presently, large frame gas turbines-generators are base load generation commonly used in combined cycle power plants. The loss of these combined cycle plants will result in a system collapse and blackout. NPCC should develop more stringent governor test requirements to support the performance requirements based on Figure 1. It is recommended that advice from the original equipment manufacturers will provide benefits; especially on the subject testing and modeling of governors in dynamic load flows.



(2) PRC-006-NPCC Attachment C, Table 1 provides frequency thresholds, total operating time, and percent load shed. The load shed tolerances may not be ideal for different distribution system designs. All distribution systems consist of radial, loop and network designs. Mandating a tolerance of 1% (7.5%-6.5%) may be appropriate for radial and loop distribution systems because of the small customer load supply from single or two area station supplies.

However, a 1% tolerance for network systems is much more challenging since the customer load supply requires multiple area station supplies (greater than 2). For example, if a service area has a 10,000MW peak load, with an average network size of 150MW; it is challenging to meet the 100MW tolerance (1% of peak).

DP's and TO's with network designs may have to change UFLS set points annually to meet the 1% tolerance. More important, critical networks (high density populations, hospitals, transportations hubs) may have to be included in the UFLS program merely to meet a compliance target requiring a 1% tolerance.

The design basis for a 1% tolerance was the results of an SS38 study in which island frequencies exceeded 61.8Hz. Since this high frequency is unrealistic as discussed above, the 1% tolerance should be re-evaluated. More flexible tolerances should be applied to accommodate different distribution systems. For example, the design change can include system studies with more frequency thresholds and smaller load shedding blocks.

3) Lastly, the Data Retention section C.1.3 needs to be updated to reflect the changes in this latest revision. For example, R7 and M7 apply to Planning Coordinators, but in the Data Retention section M7 is assigned to DP and TO.

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Background Information

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3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: See question 2 comments

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: R5.3 Presently states, "If adjustments are possible, make the adjustments within 180 calendar days…"

Recommend drafting group address in wording direction on if adjustments are possible but it will take longer than 180 days implement. What steps to take? Develop Implementation Plan with PC? (This would be for the case where changes/"adjustments" are not just an existing relay setting change, but may require installation of new relays where the time to implement will be longer than 180 days (Project funding, design, purchase equipment, installation, testing, etc).

R5.4 presently states, "If adjustments are not possible then:" ……within 180 days provide its PC with a technical study that demonstrates the deviations from the requirements will not have a significant adverse impact on the BES.

Recommend drafting group address in wording: Steps if technical study demonstrates the deviations from the requirements will have a significant adverse impact on the BES.

Should the TO then refer to R15 of the NERC Continent Wide PRC-006-3 Standard, and develop a Corrective Action Plan and a schedule for implementation with the PC?

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: No comment

6. Provide any additional comments for the drafting team to consider, if desired.

Comments: Proposed Implementation Plan Eversource comment to be provided for this comment period: My understanding from discussions with the group during the review of comments in October 2017, is that, If new UFLS Performance analysis identified significant changes are required to a TO/DP's UFLS Program (that will take longer than 12 months to implement), the TO/DP will develop a Implementation Plan with the PC. The Implementation Plan would fall under R15 of the continent-wide PRC-006 standard. During the review of comments discussion in October, it was said drafting team will clarify this in 5.1.2, but 5.1.2 is no longer exists.

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2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from April 16, 2018 through May 31, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

NPCC, Inc.

NORTHEAST POWER COORDINATING COUNCIL, INC.
1040 AVE. OF THE AMERICAS, NEW YORK, NY 10018 (212) 840-1070 FAX (212) 302-2782

1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: We have a concern with R3 because we are unsure of the rationale for the requirement. Further, identifying which non-BES generators are critical for supporting the frequency performance of an island in a non-discriminatory manner could be extremely difficult, especially since non-BES generators tend to be smaller and potentially more numerous. We recommend deleting this requirement. ISO New England requires non-BES generation to meet underfrequency tripping requirements (or the procurement of compensatory load shedding, if needed) through its tariff and operating procedures.

For R11, we suggest deleting the "or calculating" from the current language to make it read:

For R11, we suggest removing the "or calculating" wording in the requirement or adding "if measured data is unavailable then calculated data may be used". Also, the rational for the requirement doesn't seem quite right or it may be difficult to put into practice since different islands may have peaks that occur at different times.

"Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring ~~or calculating~~ Load through the switches that would disconnect load if triggered by the UFLS relays. [Violation Risk Factor: Lower]

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: For the wording in Requirement 5, we recommend changing as follows: "Each Distribution Provider or Transmission Owner that ~~cannot~~ does not meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program, shall:"

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☒

   No

Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

Comments:

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from April 16, 2018 through May 31, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

NPCC, Inc.
NORTHEAST POWER COORDINATING COUNCIL, INC.
1040 AVE. OF THE AMERICAS, NEW YORK, NY 10018 (212) 840-1070 FAX (212) 302-2782

1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: While agreeing with the overall proposed revisions there are still some changes recommended by OPG via the answers to questions number 2, 4 and 6.

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: OPG is of the opinion that some distribution providers with assigned compliance obligations as per R5 part 5.4 may not have the capability, nor the access to the required information to perform a study to demonstrate that the specific deviations from the UFLS requirements will not have a significant adverse impact on the BES. This exercise is more suitable for the respective Transmission Planner and/or the Reliability Coordinator.

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: OPG is satisfied with R15 final revision, in accordance with the comments previously provided for additional clarity with respect to the responsible entity for compensatory load shedding.
Additional revisions of R15 may be required to incorporate the newly proposed revision for R18, once accepted by the SDT.

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: OPG is of the opinion that Directory 12 requirements pertaining to the underfrequency trip settings of the protective relaying are better suited in a regional standard (i.e. new PRC-024-NPCC-01) or in a regional variance of the standard PRC-024-2 — Generator Frequency and Voltage Protective Relay Settings, and merely suggest SAR initiation.

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: It appears that for the existing BES the traditional UFLS based only on frequency thresholds is cost effective for now. It may be possible that with the changes in the mix of generating resources and grid evolution, in the future this method will no longer be sufficient/reliable for emergency operating conditions and therefore new protective schemes, based on frequency derivative, must be developed/implemented. Furthermore these type of protections can possibly be dynamically adapted to grid configurations (i.e. coupled with wide-area phasor measurements to limit or prevent the system from severe disturbances or even collapses due to delayed response and over shedding).

6. Provide any additional comments for the drafting team to consider, if desired.

Comments: OPG has the following comments:

- **Auxiliary power supplies** located at the nuclear generating plants, driven by **non-nuclear prime mover**, that are connected to the grid only for the duration of testing, should be considered non-nuclear units and should be subject to compliance with the obligations spelled out in requirement # R15 (non-nuclear)

- Existing Nuclear Generators that cannot satisfy the condition of maximum 57.8 Hz imposed by R18 Part 18.1, due to extenuating equipment limitation circumstances, design and licensing limitations, **shall set the underfrequency protection to operate at the lowest frequency allowed by the existing limitation factors**, and communicate the settings and technical basis to the Planning Coordinator

- The standard should also be revised to include requirements for arrangements of adequate compensatory load shedding, as per Attachment A or B, for the loss of nuclear generator(s) due to early tripping that is within the UFLS island identified by the PC in R2. **Note** This requirements is now missing

OPG believes the reasoning is obvious and is available to provide additional information/justification if required.

OPG proposed language for R18 is as follows:

R18. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2, based on their licensing design basis, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

18.1. Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

18.2. Each Generator Owner of existing nuclear generating plants that cannot satisfy the condition of maximum 57.8 Hz imposed by 18.1, due to extenuating circumstances such as equipment limitations or design and licensing limitations, shall set the underfrequency protection to operate at the lowest frequency allowed by the existing limiting factor. Auxiliary power supplies located at the nuclear generating plants, driven by non-nuclear prime mover, that are connected to the grid only for the duration of testing, are considered non-nuclear units and are subject to compliance with the obligations spelled out in requirement # R15.

18.3. Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

18.4. Transmit the initial frequency trip setting, any subsequent changes to the setting, and the technical basis for the settings to the Planning Coordinator.

18.5 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces in accordance with Attachment A and each Generator Owner in the New-England States and in New York State in accordance with Attachment B shall arrange for compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2

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Regional Standard: **PRC-006-NPCC**

Automatic Underfrequency Load Shedding

Comment Period (4/16/2018 - 5/31/2018)

	Date	Organization	
	05/31/2018	Ontario Power Generation Inc.	View Attachment
	05/31/2018	ISO-New England, Inc.	View Attachment
	05/31/2018	Eversource Energy	View Attachment
	05/30/2018	Consolidated Edison Company of New York, Inc.	View Attachment
	05/30/2018	National Grid	View Attachment
	05/29/2018	Independent Electricity System Operator	View Attachment
	05/29/2018		View Attachment
	05/16/2018	Liberty Utilities (Granite State Electric), LLC	

Comments: We recommend a change in the existing standard due to potential issues we have observed in meeting the requirements in the past. Because of the site of the Granite States load it has been difficult to stay within the threshold. We request that the drafting team consider a tolerance band of 5 to 10 MW for table 1. The current tolerance is too low for entities that have load between 100 to 95. As an example, under table 2 an entity with 50 MW of load must shed in between 7 to 12.5 MW of load, which results in a tolerance band of 5.5 MW. An entity with 100 MW of load must shed 14 to 25 MW of load, which results in a tolerance band of 11 MW. An entity with 101 MW of load fall under table 1. They must shed between 6.6 MW to 7.6 MW with a tolerance band of 1 MW. A tolerance band of 1 MW is way too tight. Below I provide a table that shows loads at 50 MW increments to demonstrate the tolerance band. Table 1 (> 100 MW) Table 2 (50 to 100 MW) 0.065 0.075 0.14 0.25 Load MW Tolerance 50 7 12.5 5.50 101 6.57 7.58 1.01 14.14 25.25 11.11 150 9.75 11.25 1.50 21 37.5 16.50 200 13.00 15.00 2.00 28 50 22.00 250 16.25 18.75 2.50 35 62.5 27.50 300 19.50 22.50 3.00 42 75 33.00 350 22.75 26.25 3.50 49 87.5 38.50 400 26.00 30.00 4.00 56 100 44.00 450 29.25 33.75 4.50 63 112.5 49.50 500 32.50 37.50 5.00 70 125 55.00 550 35.75 41.25 5.50 77 137.5 60.50 600 39.00 45.00 6.00 84 150 66.00 650 42.25 48.75 6.50 91 162.5 71.50 700 45.50 52.50 7.00 98 175 77.00 750 48.75 56.25 7.50 105 187.5 82.50 800 52.00 60.00 8.00 112 200 88.00 850 55.25 63.75 8.50 119 212.5 93.50 900 58.50 67.50 9.00 126 225 99.00 950 61.75 71.25 9.50 133 237.5 104.50 1000 65.00 75.00 10.00 140 250 110.00 1050 68.25 78.75 10.50 147 262.5 115.50 1100 71.50 82.50 11.00 154 275 121.00 1150 74.75 86.25 11.50 161 287.5 126.50 1200 78.00 90.00 12.00 168 300 132.00 1250 81.25 93.75 12.50 175 312.5 137.50 1300 84.50 97.50 13.00 182 325 143.00 1350 87.75 101.25 13.50 189 337.5 148.50 1400 91.00 105.00 14.00 196 350 154.00 1450 94.25 108.75 14.50 203 362.5 159.50 1500 97.50 112.50 15.00 210 375 165.00 In addition, the drafting team may consider clarifying foot note 2 to identify where peak net load is to be measured. Is it the peak net load as seen by distribution provider or by transmission owner (highside or lowside of transformer)? The changes to section 4.2 implies that DPs and TO's must coordinate their plan such that the entire plan meets the criteria identified in attachment C. The rational for this change is not clear to me and therefore we are not sure that we agree with the drafting team.

A. Introduction

1. **Title:** **Automatic Underfrequency Load Shedding**

2. **Number:** PRC-006-NPCC-2

3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Standard establishes more stringent and specific NPCC UFLS program requirements to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.

4. **Applicability:**

   4.1. Generator Owner

   4.2. Planning Coordinator

   4.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program as established by the Planning Coordinators.

   4.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program as established by the Planning Coordinators.

5. **Effective Date:**

   Reference to Implementation Plan.

B. Requirements

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Note that Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program having performance characteristics that prevents the frequency from remaining below 59.5 Hz for greater than 30 seconds in accordance with Figure 1. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC PRC Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Facto Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Planning Coordinator shall, within 30 calendar days of completion of its UFLS system studies, identify to the Regional Entity all non-BES generation facilities, within its Planning Coordinator Area, that must not trip above the appropriate generator underfrequency trip threshold curve in Figure 2 in order to support UFLS program performance requirements. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M3. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.

R4. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each island identified per the NERC PRC Standard on UFLS. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

4.1. The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times and load shedding amounts specified in Attachment C, Tables 1 through 3 or,

4.2. The program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS Island identified by the Planning Coordinator per R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3.

M4. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R4. (Attachment C Tables 1-3).

R5. Each Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

5.1. Notify its Planning Coordinator within 30 calendar days of recognition.
5.2. Within the following 90 calendar days, determine if tolerances can be met through adjustments and notify the Planning Coordinator.
5.3. If adjustments are possible, make the adjustments within 180 calendar days after determining that adjustments are possible, and notify the Planning Coordinator when complete, or,
5.4. If adjustments are not possible then:

5.4.1. Each Distribution Provider or Transmission Owner subject to Attachment C, Table 1, shall within 180 calendar days, provide its Planning Coordinator with a technical study that demonstrates that the Distribution Provider's or Transmission Owner's specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the BES, or

5.4.2. Each Distribution Provider or Transmission Owner subject to Attachment C, Table 2 or Table 3, or in the Quebec Interconnection, shall within 90 calendar days, provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with the UFLS program.

M5. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.

Rationale for Requirement R6: Operation of underfrequency relays results directly in load being shed, interrupting service to customers. The security of underfrequency relays against misoperation is therefore paramount. The 100 ms minimum time delay specified in R6 serves to prevent premature activation of these relays during short-lived transient frequency excursions that may occur on a localized basis in the absence of a serious system event wherein UFLS would be appropriate. This intentional delay helps to ensure that the relays activate only for frequency excursions that are due to actual system events that require automatic UFLS to reestablish the balance of generation to load.

R6. Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with a 100 ms minimum time delay. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M6. Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum time delay, in accordance with Requirement R6.

Rationale for Requirement R7: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an Underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the Underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to

operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R7. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M7. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R7.

R8. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M8. Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R8.

R9. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R8 shall develop and submit an implementation plan for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

R10. Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings provided by the Planning Coordinator in accordance with Requirement R8 and based on the Planning Coordinator approved implementation plan in accordance with R9. *[Violation Risk Factor: High] [Time Horizon: Operations Planning]*

M10. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R10.

Rationale for Requirement R11: It is recognized that, ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program,

on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. This being said, entities are required by R11 to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R11. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M11. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R11.

R12. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted in Requirements R15 and R18. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M12. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R12.

R13. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request.
[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

M13. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R13.

R14. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

14.1. Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.

14.2. Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 2.

M14. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R14.

R15. For existing non-nuclear units in service prior to the effective date of this standard, as documented in accordance with Attachments A or B, that have underfrequency protections set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]

15.1. Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

15.2. Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

15.3. Each Planning Coordinator in Ontario, Québec and the Maritime Provinces in accordance with Attachment A and each Generator Owner in the New-England States and in New York State in accordance with Attachment B shall arrange for compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M15. Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with Requirement R12shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R15.

R16. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R15.3 for generating units in its respective NPCC area. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M16. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such asreports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R16.

R17. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement

R15.3 for generating units in its respective NPCC area. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M17. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R17.

R18. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2, based on their licensing design basis, shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

- **18.1.** Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.
- **18.2.** Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.
- **18.3.** Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M18. Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R18.

Figure 1
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz
Design Performance Requirements

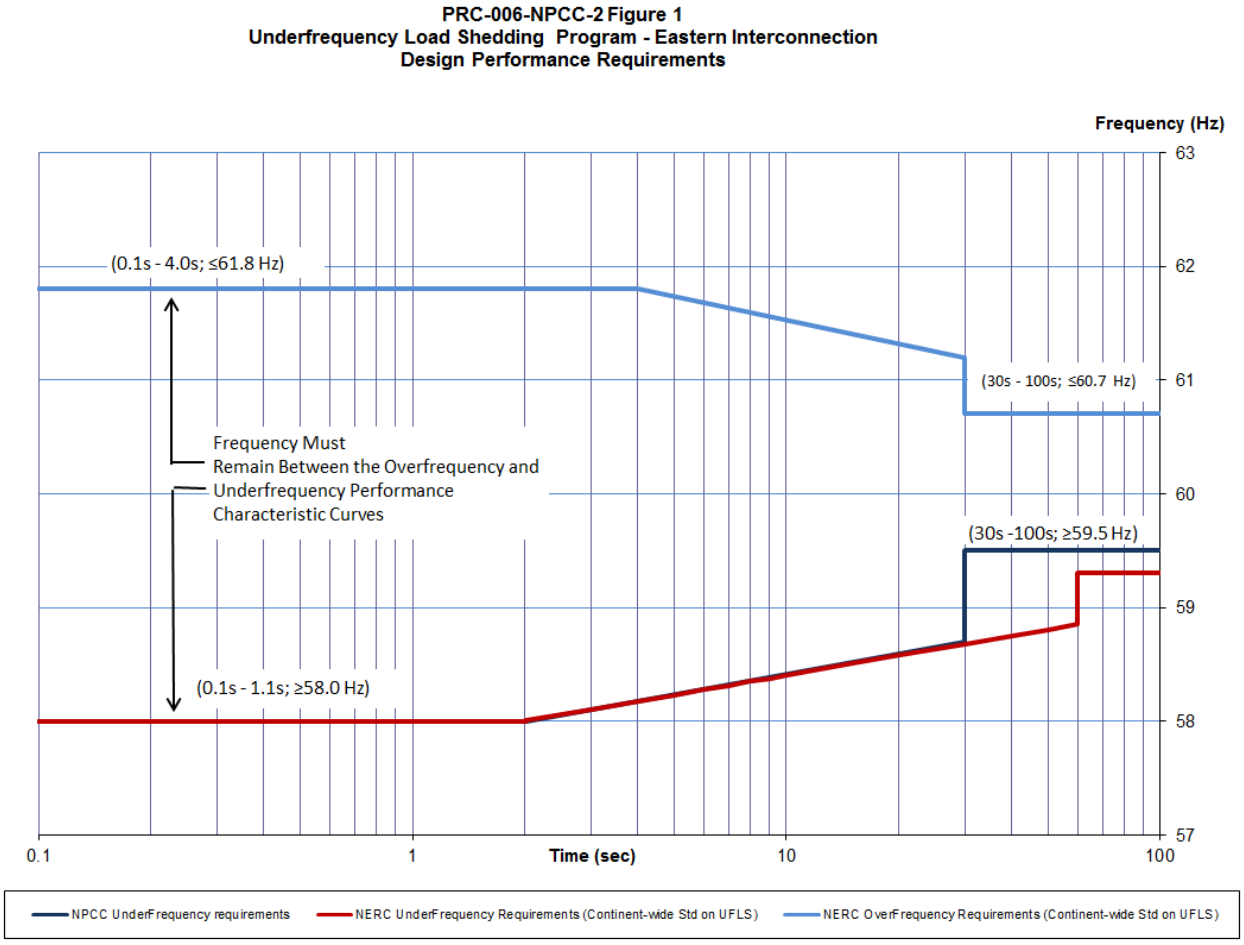
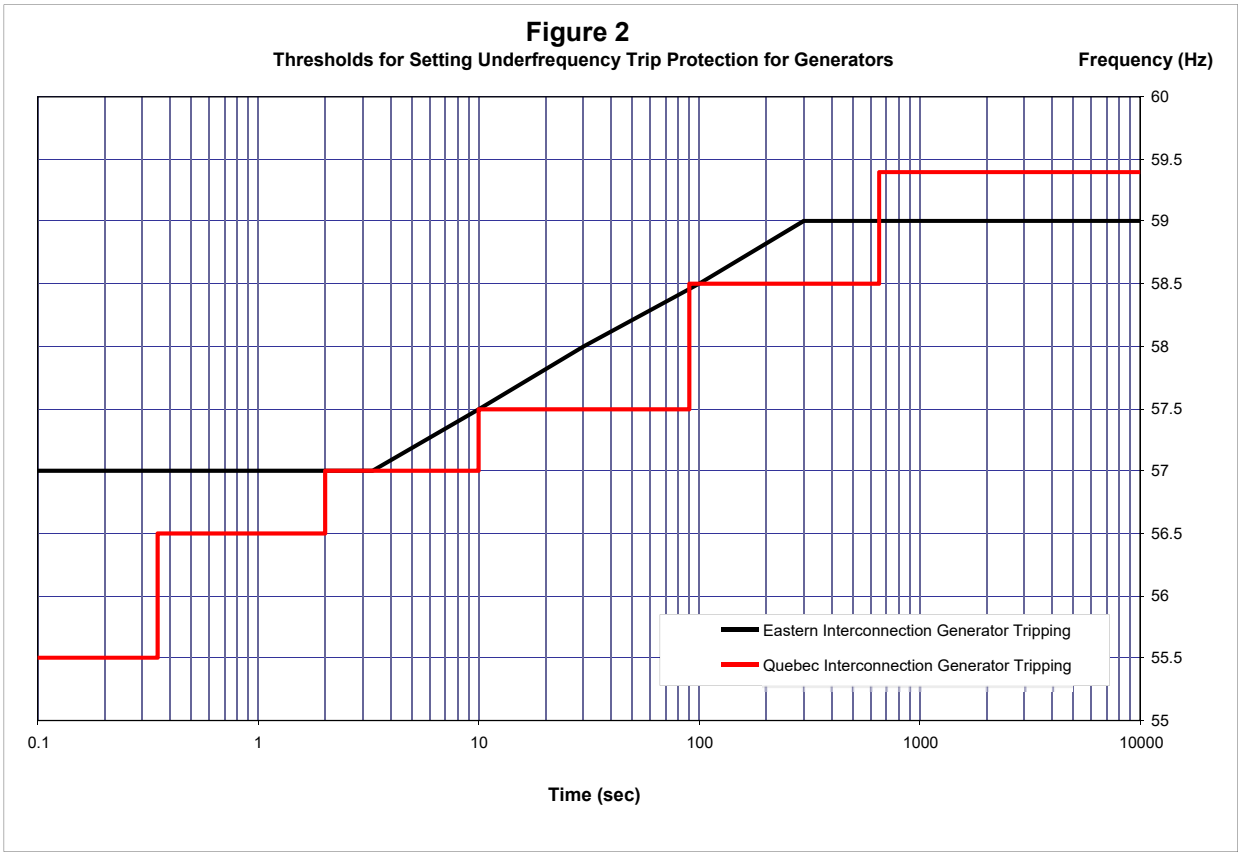


Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority

NPCC Compliance Committee

1.2. Compliance Monitoring Period and Reset Time Frame

Not Applicable

1.3. Data Retention

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 4, 5, 6,7,10, 11, and 12.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 3, 8, 9, 20, and 21.

The Planning Coordinator in Ontario, Quebec, and the Maritime Provinces shall keep evidence for three calendar years for Measure 17.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 18, 22, and 23.

The Generator Owner shall keep evidence for three calendar years for Measures 13, 14, 15, 16, and 19.

1.4. Compliance Monitoring and Assessment Processes

Self -Certifications.

Spot Checking.

Compliance Audits.

Self- Reporting.

Compliance Violation Investigations.

Complaints.

1.5. Additional Compliance Information

None.

2. Violation Severity Levels

Requirement	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	N/A	**N/A**	N/A	The Plannning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS. within 60 calendar days following a request.
R3	The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support UFLS program performance requirements, but did so more than 30 calendar daysand up to and including 40 days after completion of the system studies.	The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program performance requirements, but did so more than 40 days but less than calendar days but less than and including 50 days after completion of the system studies.	The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program performance requirements,, but did so more than 50 calendar days but less than and including 60 days after completion of the system studies.	The Planning Coordinator identified all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program performance requirements, but failed to inform the Regional Entity within 60 calendar days after completion of the system studies. OR The Planning Coordinator did not identify the BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to supportUFLS program performance requirements.

R4				The Distribution Provider or Transmission Owner failed to implement the automatic UFLS program on an island basis as specified by Requirement R4, Part 4.1 or Part 4.2.
R5	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations ir Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations ir Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60 calendar days of permissible time for each item.
R6	The Distribution Provider or Transmission Owner set less than 100% but more than (and including) 95% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.	The Distribution Provider or Transmission Owner set less than 95% but more than (and including) 90% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.	The Distribution Provider or Transmission Owner set less than 90% but more than (and including) 85% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.	The Distribution Provider or Transmission Owner set less than 85% ot its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.
R7	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.

R8	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar daysbut less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar daysbut less than and including 60 calendar days of any changes.	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R9	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R10	implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85 % of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85 % of UFLS relays.
R11	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.

	(and including) 16 calendar months since last update.	(and including)17 calendar months since last update.	(and including)18 calendar months since last update.	
R12	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R13	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.
R14	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not: fulfill the obligation of Requirement R14; Part 14.1 OR Did not fulfill the obligation of Requirement R14, Part 14.2.	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R15, Part 15.1 and Part 15.2.
R15	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner in the New-England States and in New York State failed to arrange for

		the Planning Coordinator.as specified in Requirement R15, Part 15.2.	in Requirment 15, Part 15.1	compensatory load shedding as specified in Requirement R15, Part 15.3.
R16	N/A	N/A	N/A	The Planning Coordinator did not apply the methodology described in Attachment A to determine the compensatory load shedding that is required.
R17	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the methodology described in Attachment B to determine the compensatory load shedding that is required.
R18	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator as specified in Requirement R18, Part 18.3.	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R18; Part 18.1 OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R18, Part 18.2.	The Generator Owner did not fulfill the obligations of Requirement R18, Part 18.1 and Part 18.2.

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units, in their Planning Coordinator area, in service prior to the effective date of Version 1 of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

    2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest

frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-1 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units in service prior to the effective date of Version 1 of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution

Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-1 Attachment C

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:

Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5
59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 – 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:				
UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	28-50	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Guidelines and Technical Basis:

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.
PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.
Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

A. Introduction

1. **Title:** **Automatic Underfrequency Load Shedding**

2. **Number:** PRC-006-NPCC-1

3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Standard establishes more stringent and specific NPCC UFLS program requirements to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document~~To provide a regional reliability standard that ensures the development of an effective automatic underfrequency load shedding (UFLS) program in order to preserve the security and integrity of the bulk power system during declining system frequency events in coordination with the NERC UFLS reliability standard characteristics~~.

4. **Applicability:**

   4.1. Generator Owner

   4.2. Planning Coordinator

   4.3. Distribution Provider that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program as established by the Planning Coordinators.

   4.4. Transmission Owner that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program as established by the Planning Coordinators.

5. **Effective Date:**

Reference to Implementation Plan ~~For the Eastern Interconnection & Québec Interconnection portions of NPCC excluding the Independent Electricity System Operator (IESO) Planning Coordinator area of NPCC in Ontario, Canada:~~

> ~~The effective date for Requirements R1, R2, R3, R4, R5, R6, and R7 is the first day of the first calendar quarter following applicable regulatory approval but no earlier than January 1, 2016 The effective date for Requirements R8 through R23 is the first day of the first calendar quarter two years following applicable governmental and regulatory approval.~~

~~For the Independent Electricity System Operator (IESO) Planning Coordinator's area of NPCC in Ontario, Canada:~~

> ~~All requirements are effective the first day of the first calendar quarter following applicable governmental and regulatory approval but no earlier than April 1, 2017~~.

B. Requirements

Rationale for Requirement R1: Figure 1 of this document shows the NPCC

~~Adopted by Board of Trustees: February 9, 2012~~

underfrequency criteria for the Eastern Interconnection portion of NPCC. Note that Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program having performance characteristics that prevents the frequency from remaining below 59.5 Hz for greater than 30 seconds in accordance with Figure 1. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1~~ **R1** Each Planning Coordinator shall establish requirements for entities aggregating their UFLS programs for each anticipated island and requirements for compensatory load shedding based on islanding criteria (required by the NERC PRC Standard on UFLS). [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]~~

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC PRC Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

~~**R2** Each Planning Coordinator shall, within 30 days of completion of its system studies required by the NERC PRC Standard on UFLS, identify to the Regional Entity the generation facilities within its Planning Coordinator Area necessary to support the UFLS program performance characteristics. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]~~

R3. Each Planning Coordinator shall, within 30 calendar days of completion of its UFLS system studies, identify to the Regional Entity all non-BES generation facilities, within its Planning Coordinator Area, that must not trip above the appropriate generator underfrequency trip threshold curve in Figure 2 in order to support UFLS program performance requirements. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M3. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3

R4. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for

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each island identified per the NERC PRC Standard on UFLS. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

4.1. The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times and load shedding amounts specified in Attachment C, Tables 1 through 3 or,

4.2. The program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS Island identified by the Planning Coordinator per R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3

~~**R3** Each Planning Coordinator shall provide to the Transmission Owner, Distribution Provider, and Generator Owner within 30 days upon written request the requirements for entities aggregating the UFLS programs and requirements for compensatory load shedding program derived from each Planning Coordinator's system studies as determined by Requirement R1. [Violation Risk Factor: Low] [Time Horizon: Long Term Planning]~~

M4. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R4. (Attachment C Tables 1-3).~~**R4** Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program reflecting normal operating conditions excluding outages for its Facilities based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3, or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island identified in Requirement R1 and acting as a single entity, provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load, based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3.
[Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

R5. Each Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

5.1. Notify its Planning Coordinator within 30 calendar days of recognition.
5.2. Within the following 90 calendar days, determine if tolerances can be met through adjustments and notify the Planning Coordinator.

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5.3. If adjustments are possible, make the adjustments within 180 calendar days after determining that adjustments are possible, and notify the Planning Coordinator when complete, or,

5.4. If adjustments are not possible then:

5.4.1. Each Distribution Provider or Transmission Owner subject to Attachment C, Table 1, shall within 180 calendar days, provide its Planning Coordinator with a technical study that demonstrates that the Distribution Provider's or Transmission Owner's specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the BES, or

5.4.2. Each Distribution Provider or Transmission Owner subject to Attachment C, Table 2 or Table 3, or in the Quebec Interconnection, shall within 90 calendar days, provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with the UFLS program.

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M5. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.

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~~**R5** Each Distribution Provider or Transmission Owner that must arm its load to trip on underfrequency in order to meet its requirements as specified and by doing so exceeds the tolerances and/or deviates from the number of stages and frequency set points of the UFLS program as specified in the tables contained in Requirement R4 above, as applicable depending on its total peak net Load shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

Rationale for Requirement R6: Operation of underfrequency relays results directly in load being shed, interrupting service to customers. The security of underfrequency relays against misoperation is therefore paramount. The 100 ms minimum time delay specified in R6 serves to prevent premature activation of these relays during short-lived transient frequency excursions that may occur on a localized basis in the absence of a serious system event wherein UFLS would be appropriate. This intentional delay helps to ensure that the relays activate only for frequency excursions that are due to actual system events that require automatic UFLS to reestablish the balance of generation to load.

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R6. Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with a 100 ms minimum time delay. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning].*

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M6. Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum

time delay, in accordance with Requirement R6.~~5.1 Inform its Planning Coordinator of the need to exceed the stated tolerances or the number of stages as shown in UFLS Attachment C, Table 1 if applicable and~~

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~~5.2 Provide its Planning Coordinator with a technical study that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.~~

~~5.3 Inform its Planning Coordinator of the need to exceed the stated tolerances of UFLS Attachment C, Table 2 or Table 3, and in the case of Attachment C, Table 2 only, the need to deviate from providing two stages of UFLS, if applicable, and~~

~~5.4 Provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.~~

~~**R6** Each Distribution Provider and Transmission Owner in the Québec Interconnection portion of NPCC shall implement an automatic UFLS program for its Facilities based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4 or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island, identified in Requirement R1, an aggregated automatic UFLS program that sheds Load based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

Rationale for Requirement R7: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an Underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the Underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable

networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R7. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M7. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R7.

R8. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M8. Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R8.

R9. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R8 shall develop and submit an implementation plan for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

~~**R7** Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with the following minimum time delay:~~

~~7.1 Eastern Interconnection – 100 ms~~

~~7.2 Québec Interconnection – 200 ms~~

~~[Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

~~**R8** Each Planning Coordinator shall develop and review once per calendar year settings for inhibit thresholds (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]~~

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~~**R9** Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 days of the initial determination of those inhibit thresholds and within 30 days of any changes to those thresholds. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]~~

R10. Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings provided by the Planning Coordinator in accordance with Requirement R8 and based on the Planning Coordinator approved implementation plan in accordance with R9. *[Violation Risk Factor: High] [Time Horizon: Operations Planning]*

M10. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R10.

~~**R10** Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings based on the notification provided by the Planning Coordinator in accordance with Requirement R9. [Violation Risk Factor: High] [Time Horizon: Operations Planning]~~

Rationale for Requirement R11: It is recognized that, ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. This being said, entities are required by R11 to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R11. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. *[Violation Risk Factor: Lower]*

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[Time Horizon: Long Term Planning] ~~**R11** Each Distribution Provider and Transmission Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with R9. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]~~

M11. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R11.

R12. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted in Requirements R15 and R18. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M12. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R12.

R13. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

~~**R12** Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage coincident with their integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would be opened by the UFLS relays. [Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]~~

M13. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R13.

R14. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

14.1. Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.

14.2. Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 2.~~**R13** Each Generator Owner shall set each generator underfrequency trip relay, if so equipped,~~

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below the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, except as otherwise exempted in Requirements R16 and R19. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R14 Each Generator Owner shall transmit the generator underfrequency trip setting and time delay to its Planning Coordinator within 45 days of the Planning Coordinator's request. [Violation Risk Factor: High] [Time Horizon: Operations Planning]

M14. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R14.

R15. For existing non-nuclear units in service prior to the effective date of this standard, as documented in accordance with Attachments A or B, that have underfrequency protections set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]

15.1. Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

15.2. Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

15.3. Each Planning Coordinator in Ontario, Québec and the Maritime Provinces in accordance with Attachment A and each Generator Owner in the New-England States and in New York State in accordance with Attachment B shall arrange for compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2

M15. Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with Requirement R12shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R15.**R15** Each Generator Owner with a new generating unit, scheduled to be in service on or after the effective date of this Standard, or an existing generator increasing its net capability by greater than 10% shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

15.1 Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 1.

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~~15.2 Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1.~~

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~~**R16** Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1 shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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~~16.1 Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.~~

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~~16.2 Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.~~

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~~16.3 Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping.~~

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~~**R17** Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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R16. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R15.3 for generating units in its respective NPCC area. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M16. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such asreports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R16.

R17. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R15.3 for generating units in its respective NPCC area. *[Violation Risk Factor: Medium]*

[Time Horizon: Long Term Planning]

M17. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R17.

R18. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2, based on their licensing design basis, shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

18.1. Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

18.2. Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

18.3. Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M18. Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R18.

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~~**R18** Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

~~**R19** Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 1, based on their licensing design basis, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

~~19.1 Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8Hz.~~

~~19.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.~~

19.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

R20 The Planning Coordinator shall update its UFLS program database as specified by the NERC PRC Standard on UFLS. This database shall include the following information: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

20.1 For each UFLS relay, including those used for compensatory load shedding, the amount and location of load shed at peak, the corresponding frequency threshold and time delay settings.

20.2 The buses at which the Load is modeled in the NPCC library power flow case.

20.3 A list of all generating units that may be tripped for underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, including the frequency trip threshold and time delay for each protection system.

20.4 The location and amount of additional elements to be switched for voltage control that are coordinated with UFLS program tripping.

20.5 A list of all UFLS relay inhibit functions along with the corresponding settings and locations of these relays.

R21 Each Planning Coordinator shall notify each Distribution Provider, Transmission Owner, and Generator Owner within its Planning Coordinator area of changes to load distribution needed to satisfy UFLS program performance characteristics as specified by the NERC PRC Standard on UFLS.[Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R22 Each Distribution Provider, Transmission Owner and Generator Owner shall implement the load distribution changes based on the notification provided by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R23 Each Distribution Provider, Transmission Owner and Generator Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

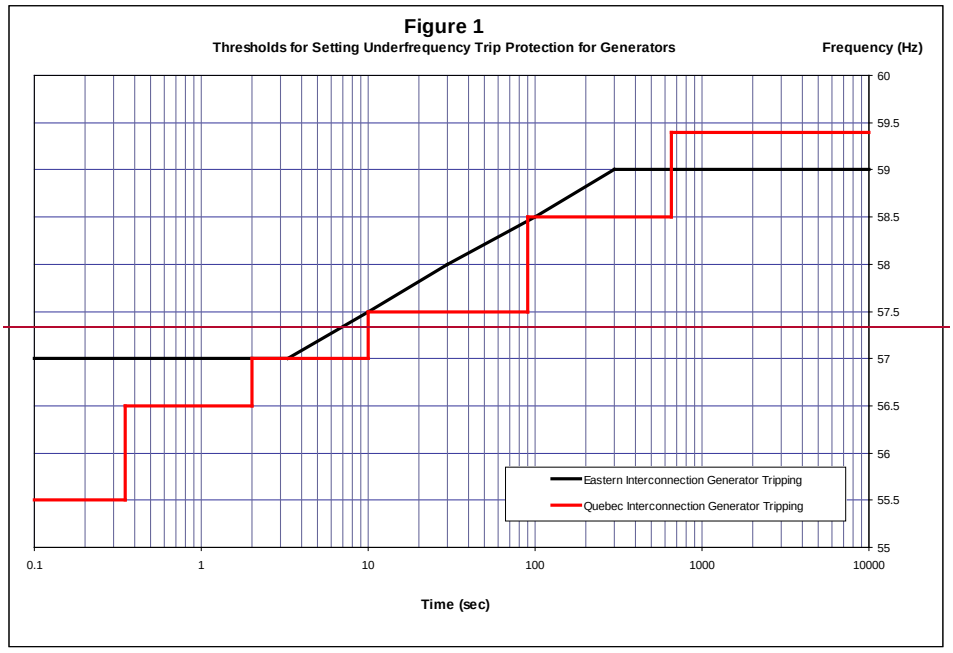

Figure 1
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz
Design Performance Requirements

PRC-006-NPCC-2 Figure 1
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements

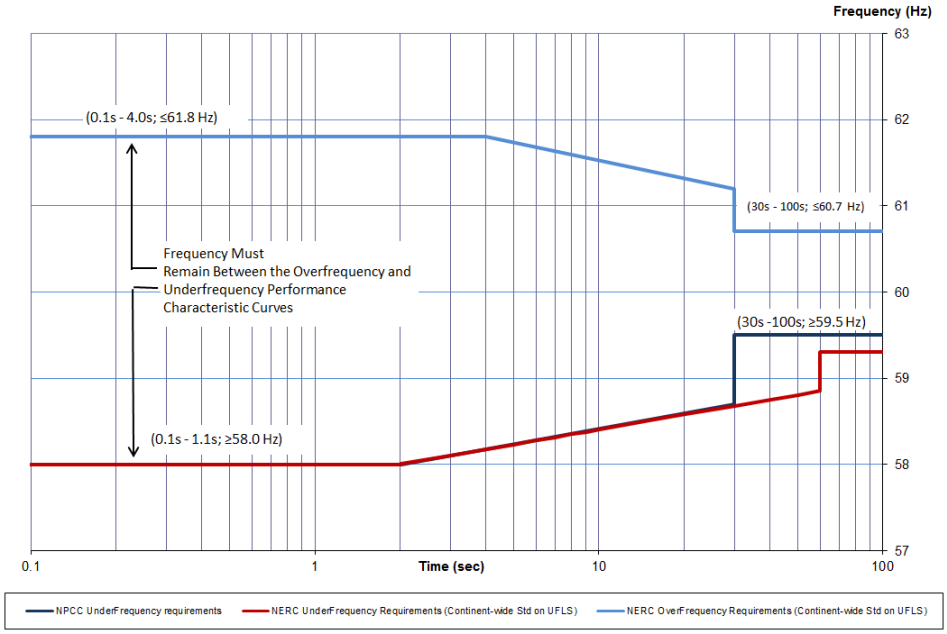

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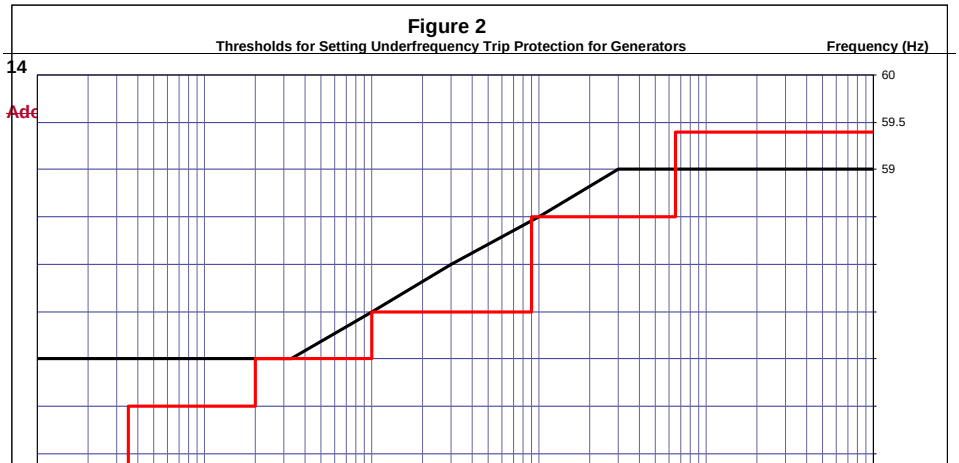
Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



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~~C. Measures~~

M1 Each Planning Coordinator shall have evidence such as reports, system studies and/or real time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

M3 Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.

M4 Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped, and the corresponding frequency thresholds, on those circuits included in its UFLS program to achieve the individual and cumulative percentages identified in Requirement R4. (Attachment C Tables 1-3).

M5 Each Distribution Provider or Transmission Owner shall have evidence such as reports, analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.

M6 Each Distribution Provider and Transmission Owner in the Québec Interconnection shall have evidence such as documentation or reports containing the location and amount of load to be tripped and the corresponding frequency thresholds on those circuits included in its UFLS program to achieve the load values identified in Table 4 of Requirement R6. (Attachment C Table 4).

M7 Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum time delay, in accordance with Requirement R7.

M8 Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R8.

M9 Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

M10 Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets or other documentation that demonstrates that it meets Requirement R10.

M11 Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R11.

M12 Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program coincident with the integrated hourly peak of the previous year that demonstrates that it meets Requirement R12.

M13 Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R13.

M14 Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R14.

M15 Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R15.

M16 Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with Requirement R13 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R16.

M17 Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such as emails, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R17.

M18 Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as emails, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R18.

M19 Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in Figure 1 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R19.

M20 Each Planning Coordinator shall provide evidence such as spreadsheets, system studies, or other documentation that demonstrates that it meets the requirements of Requirement R20.

M21 Each Planning Coordinator shall provide evidence such as emails, memorandum or other dated documentation that it meets Requirement R21.

M22 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as reports, spreadsheets or other documentation that demonstrates that it meets Requirement R22.

M23 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates it meets Requirement 23.

D.C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority

NPCC Compliance Committee

1.2. Compliance Monitoring Period and Reset Time Frame

Not Applicable

1.3. Data Retention

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 4, 5, 6,7,10, 11, and 12.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 3, 8, 9, 20, and 21.

The Planning Coordinator in Ontario, Quebec, and the Maritime Provinces shall keep evidence for three calendar years for Measure 17.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 18, 22, and 23.

The Generator Owner shall keep evidence for three calendar years for Measures 13, 14, 15, 16, and 19.

1.4. Compliance Monitoring and Assessment Processes

Self -Certifications.

Spot Checking.

Compliance Audits.

Self- Reporting.

Compliance Violation Investigations.

Complaints.

1.5. Additional Compliance Information

None.

2. Violation Severity Levels

Requirement	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	N/A	N/A	N/A	The Plannning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS. within 60 calendar days following a request.
R3	The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support	The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program performance	The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program	The Planning Coordinator identified all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program performance requirements, but failed to inform the Regional

	UFLS program performance requirements, but did so more than 30 calendar daysand up to and including 40 days after completion of the system studies.	requirements, but did so more than 40 days but less than calendar days but less than and including 50 days after completion of the system studies.	performance requirements,, but did so more than 50 calendar days but less than and including 60 days after completion of the system studies.	Entity within 60 calendar days after completion of the system studies. OR The Planning Coordinator did not identify the BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to supportUFLS program performance requirements.
R4				The Distribution Provider or Transmission Owner failed to implement the automatic UFLS program on an island basis as specified by Requirement R4, Part 4.1 or Part 4.2.
R5	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations ir Requirement R5, Parts %.1 through Part 5.4 but exceeded the	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations ir Requirement R5, Parts %.1 through Part 5.4 but exceeded the	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible time frame for one or more	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60 calendar days of permissible time for each

	permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	item.
R6	The Distribution Provider or Transmission Owner set less than 100% but more than (and including) 95% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.	The Distribution Provider or Transmission Owner set less than 95% but more than (and including) 90% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.	The Distribution Provider or Transmission Owner set less than 90% but more than (and including) 85% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.	The Distribution Provider or Transmission Owner set less than 85% ot its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.
R7	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R8	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning

	area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	applicable inhibit thresholds more than 40 calendar daysbut less than and including 50 calendar days of any changes.	area the applicable inhibit thresholds more than 50 calendar daysbut less than and including 60 calendar days of any changes.	Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R9	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R10	implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85 % of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85 % of UFLS relays.
R11	The Distribution Provider or Transmission Owner	The Distribution Provider or Transmission Owner	The Distribution Provider or Transmission Owner	The Distribution Provider or Transmission Owner failed to provide

	provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R12	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R13	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.

	Coordinator's request.	Coordinator's request.	Planning Coordinator's request.	
R14	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not: fulfill the obligation of Requirement R14; Part 14.1 OR Did not fulfill the obligation of Requirement R14, Part 14.2.	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R15, Part 15.1 and Part 15.2.
R15	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.as specified in Requirement R15, Part 15.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirment 15, Part 15.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner in the New-England States and in New York State failed to arrange for compensatory load shedding as specified in Requirement R15, Part 15.3.
R16	N/A	N/A	N/A	The Planning Coordinator did not apply the methodology described in Attachment A to determine the

				compensatory load shedding that is required.
R17	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the methodology described in Attachment B to determine the compensatory load shedding that is required.
R18	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator as specified in Requirement R18, Part 18.3.	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R18; Part 18.1 OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R18, Part 18.2.	The Generator Owner did not fulfill the obligations of Requirement R18, Part 18.1 and Part 18.2.

PRC-006-NPCC-1 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 1. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all islands identified in Requirement R1 in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements:

1. The Planning Coordinator shall identify, compile and maintain an updated list of all existing non-nuclear generating units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate, as identified in Requirement R1

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator in Requirement R1 within which the generator may operate to provide compensatory load shedding.

    2.2 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4..

    2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1 during an underfrequency event. If the highest

frequency at which the subject generator will trip above the appropriate curve in Figure 1 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-1 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 1 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify and compile a list of all existing non-nuclear generating units in service prior to the effective date of this standard that has underfrequency protection set to trip above the appropriate curve in Figure 1. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 1, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 1, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

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PRC-006-NPCC-1 Attachment C

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW or more of peak net Load shall implement a UFLS program with the following attributes:

Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5
59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 – 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW or more and less than 100 MW of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

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1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW or more of peak net Load shall implement a UFLS program with the following attributes:

Frequency Threshold (Hz)	Total Nominal Operating Time (s)[2]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5
59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 – 3	29.5 – 31.5

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UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW or more and less than 100 MW of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

~~UFLS Table 3: Eastern Interconnection~~

~~Distribution Providers and Transmission Owners with 25 MW or more and less than 50 MW of peak net Load shall implement a UFLS program with the following attributes:~~

~~UFLS Stage~~	~~Frequency Threshold (Hz)~~	~~Total Nominal Operating Time (s)[1]~~	~~Load Shed at Stage as % of TO or DP Load~~	~~Cumulative Load Shed as % of TO or DP Load~~
~~1~~	~~59.5~~	~~0.30~~	~~28-50~~	~~28-50~~

~~1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.~~

UFLS Table 4: Quebec Interconnection

	Rate	Frequency (Hz)	MW at peak (*Load must be fixed at all times when above 60% of peak load..)	Mvar at peak	Total Nominal Operating Time (s) [2]
Threshold Stage 1	——	58.5	1000*	1000	0.30
Threshold Stage 2	——	58.0	800*	800	0.30
Threshold Stage 3	——	57.5	800	800	0.30
Threshold Stage 4	——	57.0	800	800	0.30
Threshold Stage 5 (anti-stall)	——	59.0	500	500	20.0
Slope Stage 1	-0.3 Hz/s	58.5	400	400	0.30
Slope Stage 2	-0.4 Hz/s	59.8	800*	800	0.30
Slope Stage 3	-0.6 Hz/s	59.8	800*	800	0.30
Slope Stage 4	-0.9 Hz/s	59.8	800	800	0.30

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Guidelines and Technical Basis:

2. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communications time, and the rated breaker interrupting time. The underfrequency relay operating time shall be measured from the time when the frequency passes through the frequency threshold set point.

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.

PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.

Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from April 16, 2018 through May 31, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: See question 2 comments

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: R5.3 Presently states, "If adjustments are possible, make the adjustments within 180 calendar days…"

Recommend drafting group address in wording direction on if adjustments are possible but it will take longer than 180 days implement. What steps to take? Develop Implementation Plan with PC? (This would be for the case where changes/"adjustments" are not just an existing relay setting change, but may require installation of new relays where the time to implement will be longer than 180 days (Project funding, design, purchase equipment, installation, testing, etc).

R5.4 presently states, "If adjustments are not possible then:" ……within 180 days provide its PC with a technical study that demonstrates the deviations from the requirements will not have a significant adverse impact on the BES.

Recommend drafting group address in wording: Steps if technical study demonstrates the deviations from the requirements will have a significant adverse impact on the BES.

Should the TO then refer to R15 of the NERC Continent Wide PRC-006-3 Standard, and develop a Corrective Action Plan and a schedule for implementation with the PC?

Drafting Team Response:
The drafting team made modifications to the Requirement 5 according to the comment.

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☒

No ☐

Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: No comment

6. Provide any additional comments for the drafting team to consider, if desired.

Comments: Proposed Implementation Plan Eversource comment to be provided for this comment period: My understanding from discussions with the group during the review of comments in October 2017, is that, If new UFLS Performance analysis identified significant changes are required to a TO/DP's UFLS Program (that will take longer than 12 months to implement), the TO/DP will develop a Implementation Plan with the PC. The Implementation Plan would fall under R15 of the continent-wide PRC-006 standard. During the review of comments discussion in October, it was said drafting team will clarify this in 5.1.2, but 5.1.2 is no longer exists.

Drafting Team Response:
The drafting team made modifications to the Requirement 5 according to the comment.

We recommend a change in the existing standard due to potential issues we have observed in meeting the requirements in the past. Because of the site of the Granite States load it has been difficult to stay within the threshold. We request that the drafting team consider a tolerance band of 5 to 10 MW for table 1. The current tolerance is too low for entities that have load between 100 to 95. As an example, under table 2 an entity with 50 MW of load must shed in between 7 to 12.5 MW of load, which results in a tolerance band of 5.5 MW. An entity with 100 MW of load must shed 14 to 25 MW of load, which results in a tolerance band of 11 MW. An entity with 101 MW of load fall under table 1. They must shed between 6.6 MW to 7.6 MW with a tolerance band of 1 MW. A tolerance band of 1 MW is way too tight. Below I provide a table that shows loads at 50 MW increments to demonstrate the tolerance band.

	Table 1 (> 100 MW)				Table 2 (50 to 100 MW)		
	0.065	0.075			0.14	0.25	
Load MW			Tolerance				
50					7	12.5	5.50
101	6.57	7.58	1.01		14.14	25.25	11.11
150	9.75	11.25	1.50		21	37.5	16.50
200	13.00	15.00	2.00		28	50	22.00
250	16.25	18.75	2.50		35	62.5	27.50
300	19.50	22.50	3.00		42	75	33.00
350	22.75	26.25	3.50		49	87.5	38.50
400	26.00	30.00	4.00		56	100	44.00
450	29.25	33.75	4.50		63	112.5	49.50
500	32.50	37.50	5.00		70	125	55.00
550	35.75	41.25	5.50		77	137.5	60.50
600	39.00	45.00	6.00		84	150	66.00
650	42.25	48.75	6.50		91	162.5	71.50
700	45.50	52.50	7.00		98	175	77.00
750	48.75	56.25	7.50		105	187.5	82.50
800	52.00	60.00	8.00		112	200	88.00

850	55.25	63.75	8.50		119	212.5	93.50
900	58.50	67.50	9.00		126	225	99.00
950	61.75	71.25	9.50		133	237.5	104.50
1000	65.00	75.00	10.00		140	250	110.00
1050	68.25	78.75	10.50		147	262.5	115.50
1100	71.50	82.50	11.00		154	275	121.00
1150	74.75	86.25	11.50		161	287.5	126.50
1200	78.00	90.00	12.00		168	300	132.00
1250	81.25	93.75	12.50		175	312.5	137.50
1300	84.50	97.50	13.00		182	325	143.00
1350	87.75	101.25	13.50		189	337.5	148.50
1400	91.00	105.00	14.00		196	350	154.00
1450	94.25	108.75	14.50		203	362.5	159.50

In addition, the drafting team may consider clarifying foot note 2 to identify where peak net load is to be measured. Is it the peak net load as seen by distribution provider or by transmission owner (high side or low side of transformer)?

The changes to section 4.2 implies that DPs and TO's must coordinate their plan such that the entire plan meets the criteria identified in attachment C. The rational for this change is not clear to me and therefore we are not sure that we agree with the drafting team.

Drafting Team Response:
Thank you for your comments, the drafting team made modifications to Requirement 5 where an entity can develop and implement a Corrective Action Plan that is mutually agreed upon with the Planning Coordinator.
The drafting team believes that in order to make modifications to Table 1, 2 and 3 additional technical justification is required.
The drafting team believes that the footnote #2 is sufficient enough for entities to determine where they calculate or measure the load.
The drafting team believes that the current requirement 4.2 allows more flexibility to different size utilities to aggregate their UFLS if they choose.

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from April 13, 2018 through May 29, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No **X**

Comments: We would like to reiterate a previous comment that we submitted concerning the difference between the design performance requirement in the NERC continent-wide standard PRC-006-2 and what is included in the proposed regional standard PRC-006-2-NPCC-2 and in the existing NPCC Directory #12.

The NERC continent-wide standard requires that the system frequency be restored to between 59.3 Hz and 60.7 Hz in 60 seconds (60 s / 59.3 Hz & 60 s / 60.7 Hz), following an imbalance that results in an under-frequency (Requirement R3, Part 3.10). However, both the regional standard and the directory require the frequency to be restored to above 59.5 Hz in 30 seconds (30 s / 59.5 Hz).

Based on our experiences with the August 2003 Blackout and based on the UFLS assessment completed by the SS-38 Working Group, Ontario could form islands with portions of the power system that are not part of NPCC region. Given this and since there is no technical justification for the existing NPCC performance characteristic of 30 s / 59.5 Hz, we believe the regional standard should be aligned with the continent-wide standard's performance characteristic of 60 s / 59.3 Hz. This would eliminate any potential non-compliance risks that Ontario may face as a result of having two different performance criteria apply to the same island.

Drafting Team Response:
The drafting team changed the language of Requirement 1 to make 59.5Hz requirement only applicable to islands wholly within the NPCC Region.

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes **X**

   No ☐

Comments: With respect to Sub-requirement 5.4.1., we are not certain that a Distribution Provider or Transmission Owner will have the required data and capability to perform the technical study to assess whether their specific deviations from the UFLS requirements will have a significant adverse impact on the BES. The required data and capability to perform these types of BES assessments are usually found with the Planning Coordinator.

Drafting Team Response:
The drafting team believes there are enough technical consultants available to perform necessary study for the TO or DP and PC will readily provide data for such study so the requirement need not be modified. The PC, TP or RC could also serve as technical consultants to perform the necessary studies.

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes **X**

   No ☐

   Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes **X**

   No ☐

   Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

   Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

   Comments:

We are unable to find the rationale for changing the VRF from a HIGH to a MEDIUM for various requirements (e.g. R12, R15-R18) addressing compensatory load shedding requirements

for generators that are set to trip above the applicable curves in Figure 2. Without knowing the rationale, we do not support such changes since failing to shed load to compensate for the additional loss of the tripped generation can lead to total collapse of the island. We recommend the drafting team reconsider the reliability impact and reinstate these VRFs to HIGH, or provide the technical justification for such changes.

Drafting Team Response:
The drafting team agreed with the comment and made VRF modifications to Requirement 12, 15-18.

NPCC, Inc.
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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from April 16, 2018 through May 31, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

NPCC, Inc.

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: We have a concern with R3 because we are unsure of the rationale for the requirement. Further, identifying which non-BES generators are critical for supporting the frequency performance of an island in a non-discriminatory manner could be extremely difficult, especially since non-BES generators tend to be smaller and potentially more numerous. We recommend deleting this requirement. ISO New England requires non-BES generation to meet underfrequency tripping requirements (or the procurement of compensatory load shedding, if needed) through its tariff and operating procedures.

For R11, we suggest deleting the "or calculating" from the current language to make it read:

For R11, we suggest removing the "or calculating" wording in the requirement or adding "if measured data is unavailable then calculated data may be used". Also, the rational for the requirement doesn't seem quite right or it may be difficult to put into practice since different islands may have peaks that occur at different times.

"Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring ~~or calculating~~ Load through the switches that would disconnect load if triggered by the UFLS relays. [Violation Risk Factor: Lower]

Drafting Team Response:
For Requirement 3, the drafting team decided to remove the requirement since there are mechanisms in place for PC to collect the data (Tariffs etc.) and it does not create a reliability gap because the performance characteristics UFLS program must still be met.
For Requirement 11, the drafting team accepted the comment and made modifications to the requirement language accordingly.

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: For the wording in Requirement 5, we recommend changing as follows: "Each Distribution Provider or Transmission Owner that ~~cannot~~ does not meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program, shall:"

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☒

   No

Comments:

Drafting Team Response:
The drafting team made modifications to the requirement according to the comment.

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative

language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

Comments:

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from April 16, 2018 through May 31, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: While agreeing with the overall proposed revisions there are still some changes recommended by OPG via the answers to questions number 2, 4 and 6.

Drafting Team Response:
Thank you for your comment.

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: OPG is of the opinion that some distribution providers with assigned compliance obligations as per R5 part 5.4 may not have the capability, nor the access to the required information to perform a study to demonstrate that the specific deviations from the UFLS requirements will not have a significant adverse impact on the BES. This exercise is more suitable for the respective Transmission Planner and/or the Reliability Coordinator.

Drafting Team Response:
The drafting team believes there are enough technical consultants available to perform necessary study for the TO or DP and PC will readily provide data for such study so the requirement need not be modified. The PC, TP or RC could also serve as technical consultants to perform the necessary studies.

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: OPG is satisfied with R15 final revision, in accordance with the comments previously provided for additional clarity with respect to the responsible entity for compensatory load shedding.
Additional revisions of R15 may be required to incorporate the newly proposed revision for R18, once accepted by the SDT.

Drafting Team Response:
Thank you for your comment, please see response to question 6.

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: OPG is of the opinion that Directory 12 requirements pertaining to the underfrequency trip settings of the protective relaying are better suited in a regional standard (i.e. new PRC-024-NPCC-01) or in a regional variance of the standard PRC-024-2 — Generator Frequency and Voltage Protective Relay Settings, and merely suggest SAR initiation.

Drafting Team Response:
Thank you for your comment. The drafting team would recommend you submit a SAR during the NERC Periodic Review.

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: It appears that for the existing BES the traditional UFLS based only on frequency thresholds is cost effective for now. It may be possible that with the changes in the mix of generating resources and grid evolution, in the future this method will no longer be sufficient/reliable for emergency operating conditions and therefore new protective schemes, based on frequency derivative, must be developed/implemented. Furthermore these type of protections can possibly be dynamically adapted to grid configurations (i.e. coupled with wide-area phasor measurements to limit or prevent the system from severe disturbances or even collapses due to delayed response and over shedding).

Drafting Team Response:
Thank you for your comment.

6. Provide any additional comments for the drafting team to consider, if desired.

Comments: OPG has the following comments:

- **Auxiliary power supplies** located at the nuclear generating plants, driven by **non-nuclear prime mover**, that are connected to the grid only for the duration of testing, should be considered non-nuclear units and should be subject to compliance with the obligations spelled out in requirement # R15 (non-nuclear)

- Existing Nuclear Generators that cannot satisfy the condition of maximum 57.8 Hz imposed by R18 Part 18.1, due to extenuating equipment limitation circumstances, design and licensing limitations, **shall set the underfrequency protection to operate at the lowest frequency allowed by the existing limitation factors**, and communicate the settings and technical basis to the Planning Coordinator

- The standard should also be revised to include requirements for arrangements of adequate compensatory load shedding, as per Attachment A or B, for the loss of nuclear generator(s) due to early tripping that is within the UFLS island identified by the PC in R2. **Note** This requirements is now missing

OPG believes the reasoning is obvious and is available to provide additional information/justification if required.

OPG proposed language for R18 is as follows:

R18. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2, based on their licensing design basis, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

18.1. Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

18.2. Each Generator Owner of existing nuclear generating plants that cannot satisfy the condition of maximum 57.8 Hz imposed by 18.1, due to extenuating circumstances such as equipment limitations or design and licensing limitations, shall set the underfrequency protection to operate at the lowest frequency allowed by the existing limiting factor. Auxiliary power supplies located at the nuclear generating plants, driven by non-nuclear prime mover, that are connected to the

grid only for the duration of testing, are considered non-nuclear units and are subject to compliance with the obligations spelled out in requirement # R15.

18.3. Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

18.4. Transmit the initial frequency trip setting, any subsequent changes to the setting, and the technical basis for the settings to the Planning Coordinator.

18.5 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces in accordance with Attachment A and each Generator Owner in the New-England States and in New York State in accordance with Attachment B shall arrange for compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2

Drafting Team Response:
Thank you for your comments. The drafting team recognize the importance of protecting nuclear generation however does not agree to have compensatory load shedding. The SDT believes that the proposed change requested by the comment has a potential adverse reliability impact. The SDT believes more information is needed to determine if this is a broader issue. The commenter believes that there is currently no non-compliance however, going forward there could be a scenario that may restrict utilization of nuclear assets. Sufficient justification was not provided so the SDT decided not make the change at this time.

1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: National Grid recommends that a technical writer review PRC-006-NPCC-2 for possible improvements. Please ensure that all aspects of the regional standard conform with the most recent NERC standards format.

Specific Comments:

Consider changing the Purpose to state: "To establish consistent and coordinated requirements for the design, implementation, and analysis of automatic underfrequency load shedding (UFLS) programs among all NPCC Region applicable entities."

Consider changing the Applicability to state:

4.1 Planning Coordinators

4.2 UFLS entities shall mean all entities that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators. Such entities may include one or more of the following:

4.2.1 Transmission Owners

4.2.2 Distribution Providers

4.2.3 UFLS-Only Distribution Providers

4.3 Generator Owners

This proposed applicability change will also be reflected in multiple requirements by replacing Transmission Owners and Distribution Providers with UFLS entities.

Consider changing the Effective Date to state: "See Implementation Plan."

Consider changing references for this standard from "NERC PRC Standard on UFLS" to "the continent-wide PRC-006 standard."

Consider changing from "greater than 30 seconds" to "more than 30 seconds" in Requirement R1.

Consider consistent use of the comma. (e.g., missing in M1, R4.1, R4.2, etc.)

Correct font type for “R4” in Requirement R4.

Please insert “for it Facilities” after the word ‘outage’ in requirement R4, to clarify type of outages.

Consider changing capitalized “Island” to be lower case “island.” Island is not a NERC Glossary Term. Please see requirement R4.2.

Consider improvements to the readability of sub-requirements, which are combined with ‘and’ or ‘or’ statements. Separate sub-requirements / alternatives in ‘and’ or ‘or’ statements by use of semicolons, e.g., before the term “or” between R4.1 and R4.2.

Consider deleting “at least” in “at least once per five calendar years” in Requirement R7.

Consider changing capitalized “Underfrequency” to be lower case “underfrequency” in the Rationale box for Requirement R7. Underfrequency is not a NERC Glossary defined term.

Consider revising R8 by changing the word “applicable” to “allowable”. As presently written it appears as if the Planning Coordinator is responsible to develop (specific) settings for inhibit thresholds.

Correct lay-out (break) in Requirement R13.

Consider ensuring the Compliance section of the standard is in conformance with other NERC reliability standards. We suggest changing the Compliance Enforcement Authority to be NPCC as the Regional Entity, instead of the NPCC Compliance Committee.

Consider removing the Guidelines and Technical Basis section in accordance with the NERC Technical Rationale Transition Plan. A separate document may be required.

Consider adding a Version History section.

Drafting Team Response:
Thank you for your comments but the drafting team slightly modified the Purpose language. The quality review will be done prior to the next posting.

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: Consider consistent use of terms “technical study” as used in R5.4.1 and “system studies” as used in Requirement R3, M1, M5, and M7. Are these terms referring to the same or different studies?

Consider improvements to the readability of sub-requirements, which are combined with 'and' or 'or' statements. Separate sub-requirements / alternatives in 'and' or 'or' statements by use of semicolons, e.g., before the term "or" between R5.3 and R5.4, as well as between R5.4 and R5.4.2.

Drafting Team Response:
Thank you for your comments. The quality review will be done prior to the next posting.

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

   Comments: National Grid recommends dividing R15.3 into two sub-requirements.

Recommended change:

15.3. Each Planning Coordinator in Ontario, Québec and the Maritime Provinces in accordance with Attachment A shall arrange for compensatory load shedding, as provided by a UFLS entity that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

15.4. Each Generator Owner in the New-England States and in New York State in accordance with Attachment B shall arrange for compensatory load shedding, as provided by a UFLS entity that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

Requirement R17 would also need to be revised to reference R15.4.

Drafting Team Response:
Thank you for your comments, the drafting team decided to keep the requirement as it is.

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative

language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

Comments:

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from April 16, 2018 through May 31, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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Comments by Consolidated Edison Co. of New York

1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: Con Edison agrees with the proposed revisions as posted. However, Con Edison believes that, per the Guidelines and Technical Basis section in PRC-006-NPCC-2, "significant variations" exist that impact the BES and mandate that an updated UFLS assessment be conducted. The "significant variation" is the inability of generation to ride through high frequency events. This issue has been highlighted by a NERC Industry Advisory, Turbine Combustor Lean Blowout, issued June 26, 2008.

Con Edison recommends that a new UFLS assessment be conducted due to reliability concerns of turbine-generator governor controls and the NPCC Under Frequency Load Shedding Study results as discussed in this submittal.

Drafting Team Response:
The concern is dully noted and it has been transferred to the appropriate NPCC groups.

2. Do you agree with the proposed revisions to Requirement 5? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: See comments in section 6. The 1% UFLS tolerance specified in Attachment C may not provide any additional benefit to the success of an UFLS system.

3. Do you agree with the proposed revisions to Requirement 15? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: The lack of test performance standards provides no guarantee that turbine-generators will remain synchronized to the system during a low frequency event. NPCC should develop a more stringent requirement to test turbine-generators in a manner that verifies the ability to ride through low frequency conditions, as well as high frequency conditions. This testing is being developed worldwide. For example, National Grid in the United Kingdom has Grid Code CO5 that verifies equipment performance and has developed frequency response markets to provide performance incentives. Equipment testing is the only means of verifying performance, and if this cannot be done, then assumptions on reliability of turbine-generators should be more conservative.

Drafting Team Response:
The drafting team recognizes the importance of the issue however the drafting team recommend Con Edison submit a SAR to NERC to the appropriate standard. PRC-006-NPCC-2 is consistent with PRC-024-2 NERC standard.

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

   Comments:

An UFLS Standard is cost effective if it successfully islands a service area. On November 4th, 2006, Europe experienced an UFLS event and avoided a grid shutdown. The event resulted in the European breaking up into 3 large grids. Post event, the grids were synchronized back together in 39 minutes. Only a small percentage of customers were shutdown with minimal economic impact on the European economy.

In the United States, the opposite occurred in 2003. A cascading outage initiated in the Midwest caused the northeast portion of the Eastern Interconnection to isolate. The last line of defense was the UFLS system, and it failed. The subsequent blackout caused a $6B economic impact per the DOE. By implementing governor testing standards and improved UFLS studies, the

potential for a system wide blackout can be avoided. The money invested in this system is cost effective as was seen in Europe in 2006.

Drafting Team Response:
Thank you for your comment.

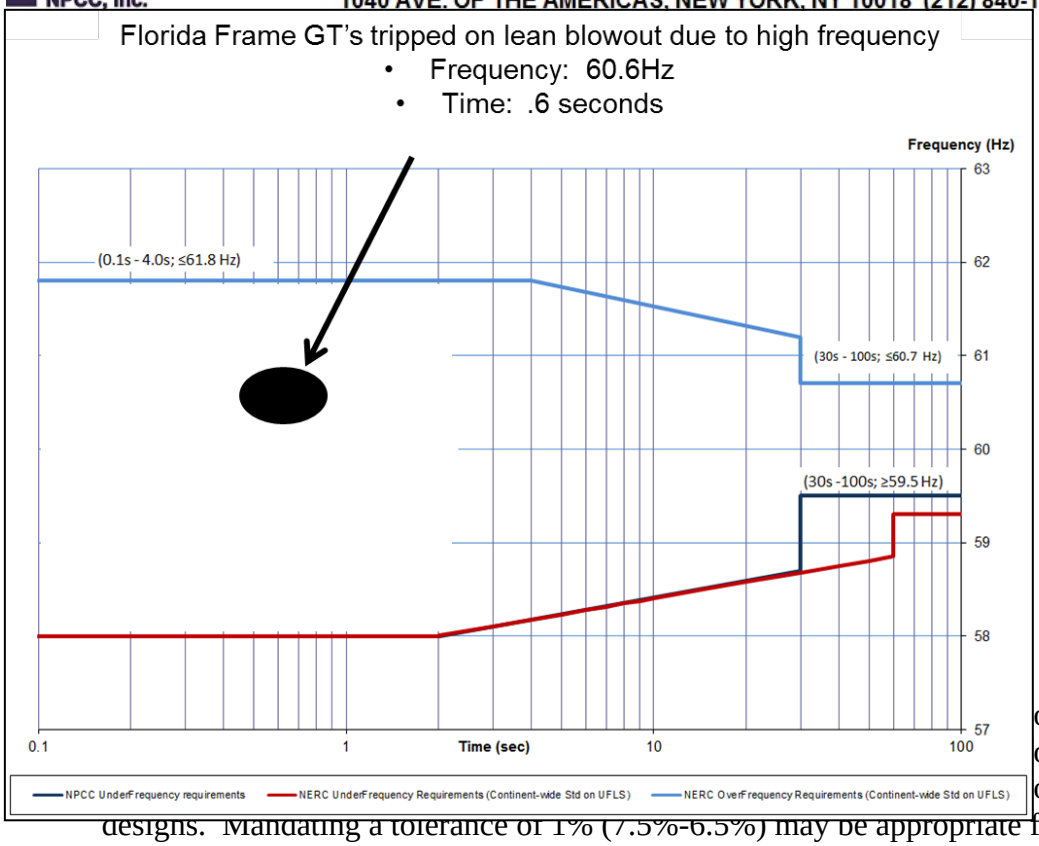
6. Provide any additional comments for the drafting team to consider, if desired.

Comments: Con Edison respectively adds the following comments.

(1) Requirement 1 references Figure 1 in PRC-006-NPCC. While this figure is based on the NERC Standard from PRC-006, it is unrealistic. NPCC should develop a more stringent requirement based on the documented performance of the governor during off frequency conditions. Note that PRC-024 applies to protection relays, not governor controls. If the governor controls reduce the fuel to cause flameout, or the steam turbine controls increase the steam pressure to cause a drum level trip prior to the relay setting, then the relay setting has minimal value except to protect the plant. If the governor controls work properly, successful UFLS event is possible.

The figure below shows the response of large frame gas turbines during the 2/26/2008 FRCC System Disturbance. Per the FRCC report, the frequency excursion of 60.6 Hz resulted in numerous lean blowouts of gas turbines. The NPCC Under Frequency Load Shedding Study assumes gas turbines will operate reliably at 61.8Hz (1.2 Hz higher than observed in the Florida event), which is unrealistic. Studies should include the loss of generation at high frequencies, or limit the UFLS peak frequencies to a lower frequency.

Presently, large frame gas turbines-generators are base load generation commonly used in combined cycle power plants. The loss of these combined cycle plants will result in a system collapse and blackout. NPCC should develop more stringent governor test requirements to support the performance requirements based on Figure 1. It is recommended that advice from the original equipment manufacturers will provide benefits; especially on the subject testing and modeling of governors in dynamic load flows.



otal operating or different op and network designs. Mandating a tolerance of 1% (7.5%-6.5%) may be appropriate for radial and loop distribution systems because of the small customer load supply from single or two area station supplies.

However, a 1% tolerance for network systems is much more challenging since the customer load supply requires multiple area station supplies (greater than 2). For example, if a service area has a 10,000MW peak load, with an average network size of 150MW; it is challenging to meet the 100MW tolerance (1% of peak).

DP's and TO's with network designs may have to change UFLS set points annually to meet the 1% tolerance. More important, critical networks (high density populations, hospitals, transportations hubs) may have to be included in the UFLS program merely to meet a compliance target requiring a 1% tolerance.

The design basis for a 1% tolerance was the results of an SS38 study in which island frequencies exceeded 61.8Hz. Since this high frequency is unrealistic as discussed above, the 1% tolerance should be re-evaluated. More flexible tolerances should be applied to accommodate different distribution systems. For example, the design change can include system studies with more frequency thresholds and smaller load shedding blocks.

3) Lastly, the Data Retention section C.1.3 needs to be updated to reflect the changes in this latest revision. For example, R7 and M7 apply to Planning Coordinators, but in the Data Retention section M7 is assigned to DP and TO.

Drafting Team Response:
Thank you for your comment.
The drafting team made appropriate changes to the standard based on the comments.

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August 10, 2018

Subject: Posting for Open Process Review of *PRC-006-NPCC-2 Automatic Underfrequency Load Shedding.*

The clean and redlined versions of the revised NPCC Regional Standard PRC-006-NPCC-2 *Automatic Underfrequency Load Shedding*, have been posted on the NPCC Website for a 45-day comment period through September 25, 2018, along with a proposed Implementation Plan.

This draft has been developed in accordance with the NPCC Regional Standard Process Manual (RSPM) and within the scope of an NPCC Regional Standard Authorization Request, which was accepted by the NPCC Regional Standard Committee (RSC). The revisions are also presented as mandated by the NERC Rules of Procedure.

Among the proposed changes included in the updated draft version of the Standard are:

- Modifications to Figures #1 and #2 in the Standard
- Added a Guidelines and Technical Basis section (NERC may request us to create a separate document for this section and post it with the standard subsequent to approvals)
- Incorporated certain Criteria attributes from Directory #12 Automatic UFLS Program Requirements which will facilitate the retirement of Directory #12
- Additional clarification of requirement language
- Proposed retirements of some of the Requirements that are redundant to the PRC-006-2 Continent-wide NERC standard

Also posted is a set of questions developed by the Regional Standard Drafting Team to solicit comments on the draft standard and associated draft Implementation Plan for the Regional Standard. Included in these questions is one on cost effectiveness of the requirements.

Comments on the posted materials may be submitted through the NPCC Open Process Portal, which may be accessed through:
https://www.npcc.org/Standards/SitePages/DevStandardDetail.aspx?DevDocumentId=122
Depending on comments received and if no revisions are deemed necessary by the Standard Drafting Team, the standard is tentatively scheduled to be posted for a 30-day pre-ballot review and 10-day ballot period towards fourth quarter of 2018.

Please contact me with any questions regarding this Standard.

Thank you.

Ruida Shu
Northeast Power Coordinating Council, Inc.
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NPCC, Inc.
NORTHEAST POWER COORDINATING COUNCIL, INC.
1040 AVE. OF THE AMERICAS, NEW YORK, NY 10018 (212) 840-1070 FAX (212) 302-2782

PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from August 10, 2018 through September 25, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes **X**

   No ☐

Comments:

2. Do you agree with the proposed revisions to Requirement 4? If not, please explain why and include any suggestions.

   Yes **X**

   No ☐

Comments:

3. Do you agree with the proposed revisions to Requirement 16? If not, please explain why and include any suggestions.

   Yes **X**

   No ☐

Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes **X**

   No ☐

Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

Comments:

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

2. Do you agree with the proposed revisions to Requirement 4? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments: We believe that the language could be enhanced by adding some wording as follows to clarify that a determination has been made:

Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that determines that it does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec…

Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and

3. Do you agree with the proposed revisions to Requirement 16? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

Comments: We suggest providing the curve definitions for Figure 1 (these are included in the continent wide version and should make it easier for entities to determine if they are meeting the curves). We also suggest deleting the red line showing the NERC underfrequency requirements (continent wide standard on UFLS) since entities within NPCC must meet the NPCC performance.

There is a typographical error in Attachment B, PRC-006-NPCC-1 was effective July 1, 2015. Revise to:

The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (~~April, 2017~~ July 1, 2015 PRC-006-NPCC-1).

For Attachment B, 2.1 and 2.2, compensatory load shedding must be in both the same and smallest island as the generator (for example, there may be a unit that's in the NE and CT islands. We would need to make sure that the compensatory load shedding was in the CT island., revise as follows:

2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the

appropriate amount of compensatory load to be shed within the smallest island as identified by the Planning Coordinator in Requirement R1 of this standard that contains the generator.

2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island as identified by the Planning Coordinator in Requirement R1 of this standard that contains the generator.

Regional Standard: **PRC-006-NPCC**
Automatic Underfrequency Load Shedding
Comment Period (8/10/2018 - 9/24/2018)

	Date	Organization	
	09/24/2018	ISO-New England, Inc.	View Attachment
	09/19/2018	Independent Electricity System Operator	View Attachment
	09/06/2018	Talen Energy Supply, LLC	

Comments: The Fig. 2 disturbance ride-through requirements greatly exceed those of the continent-wide standard (PRC-024-2) as well as the damage prevention limits set by many turbine OEMs. PRC-024 grandfathers units that cannot meet its ride-out criteria, but PRC-006-NPCC-2 does so (in R13) only for units that were in service prior to July 1, 2015. R12 consequently is likely to preclude ever uprating our NPCC-area plants by 10% or more. This restriction is not new; it exists in R15 of the current version of the standard (PRC-006-NPCC-1), but we believe that this circumstance does not prevent us from using the present opportunity to request removal of this requirement, particularly since turbine OEM limits are not the only issue causing the standard to be impractical. The disturbance magnitudes in Fig. 2 are extreme, making it impossible to ensure that units will not suffer indirect trips (e.g. CTG flame-out, steam drum level high/low), especially since such frequency excursions are likely to be accompanied by upsets to voltage and (due to governor action) MW output. Limits on frequency relay settings are easy to implement, but, "shall not trip," requirements can lead to unsolvable frequency-vs-other cause quandaries. R13 of PRC-006-NPCC-2 is also a concern, in that GOs with Fig. 2 conflicts for existing units in the ISO-NE and NYISO areas must, " arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2." The term, "arrange for" seems to imply that there exists a market for compensatory load shedding (there is none) or that ISOs will cooperate in this respect (the standard does not appear to require them to do so). Once again this is an existing problem, in R16 of PRC-006-NPCC-1, not something new for Rev. 2 of the standard. R16 of PRC-006-NPCC-2 (R19 of PRC-006-NPCC-1) is unreasonable as well, in that the allowance for OEM restrictions is cut off at 57.8 Hz. Units that can't run this low are evidently forced to retire or to set their relays in a fashion contradicting good engineering practice (i.e. allowing equipment to be damaged).

	08/24/2018	Vermont Transco	View Attachment

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

2. Do you agree with the proposed revisions to Requirement 4? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

3. Do you agree with the proposed revisions to Requirement 16? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: For the sake of clarity consider the following language, which spells out what we want: "Set the underfrequency protection to operate at a frequency setting that is as low as possible in accordance with the plant design"

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

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5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: The requirements are cost-effective as written

6. Provide any additional comments for the drafting team to consider, if desired.

Comments: The purpose paragraph notes that the standard establishes more stringent program requirements. It is unclear what we are comparing against. Are we comparing this standard against Directory 12, the NERC PRC-006-3 standard, the previous NPCC PRC-006-NPCC-01? Consider clarifying the purpose with something like:

"The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes specific NPCC UFLS program requirements that are more stringent than those of prior NPCC standards to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document."

Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard is adopted by the NERC Board of Trustees (Board).

Description of Current Draft

Completed Actions	Date
Regional Standards Committee approved Regional Standard Authorization Request (RSAR) for posting	June 23, 2015

Anticipated Actions	Date
1st 45-day Formal Comment Period	September 1, 2017 - October 18, 2017
2nd 45-day Formal Comment Period	April 16, 2018 – June 1, 2018
30-day Pre-ballot Period	
10-day ballot Period	
Board adoption	

Upon Board adoption, the rationale boxes will be moved to the Supplemental Material Section.

A. Introduction

1. **Title:** Automatic Underfrequency Load Shedding

2. **Number:** PRC-006-NPCC-2

3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.

4. **Applicability:**

   4.1. Functional Entities:

   4.1.1. Generator Owner

   4.1.2. Planning Coordinator

   4.1.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators

   4.1.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators

5. **Effective Date:** See Implementation Plan.

B. Requirements and Measures

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or

(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or (3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its

Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

12.1 Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.

12.2 Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

16.1 Set the underfrequency protection to operate at as a low frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

Figure 1
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz
Design Performance Requirements

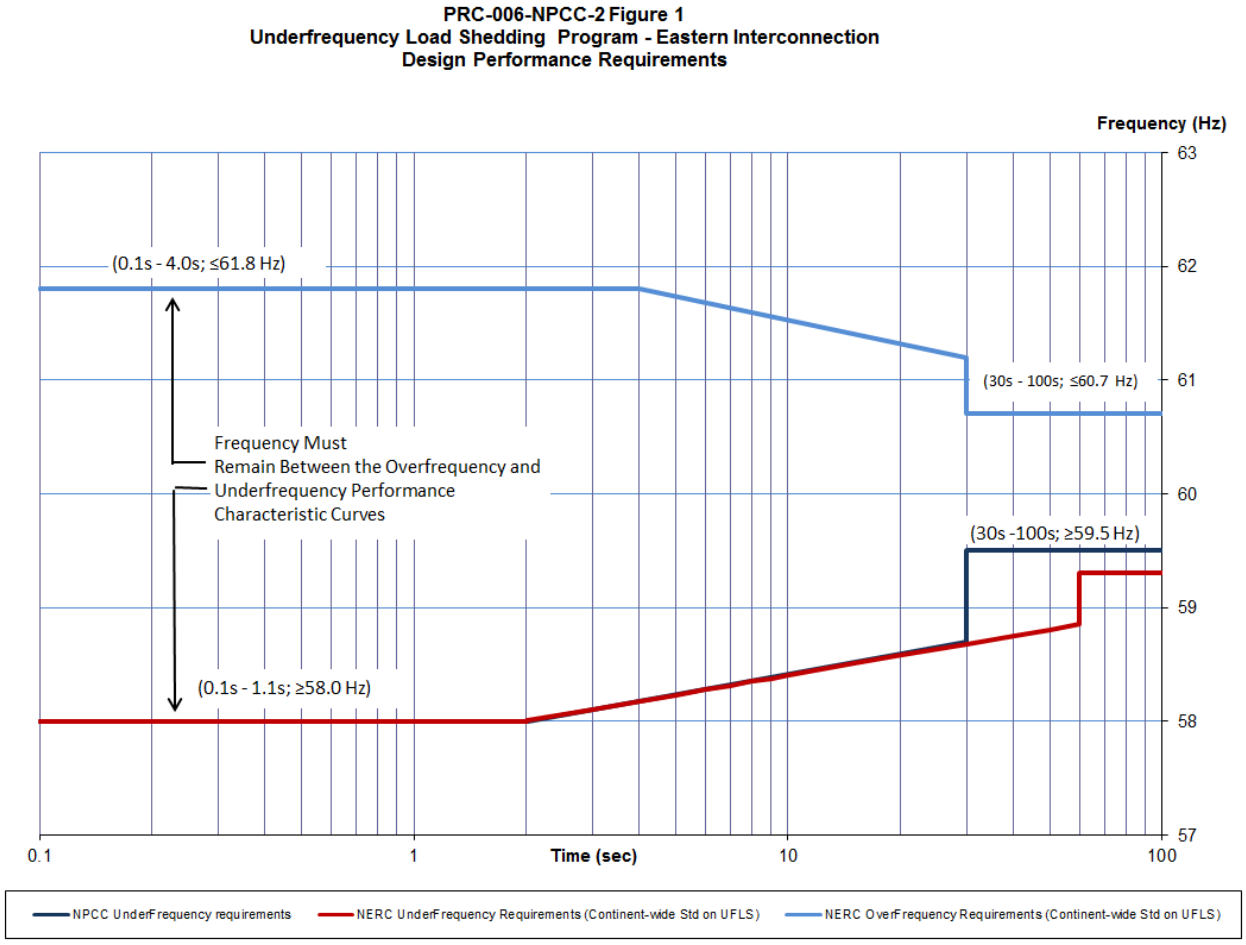
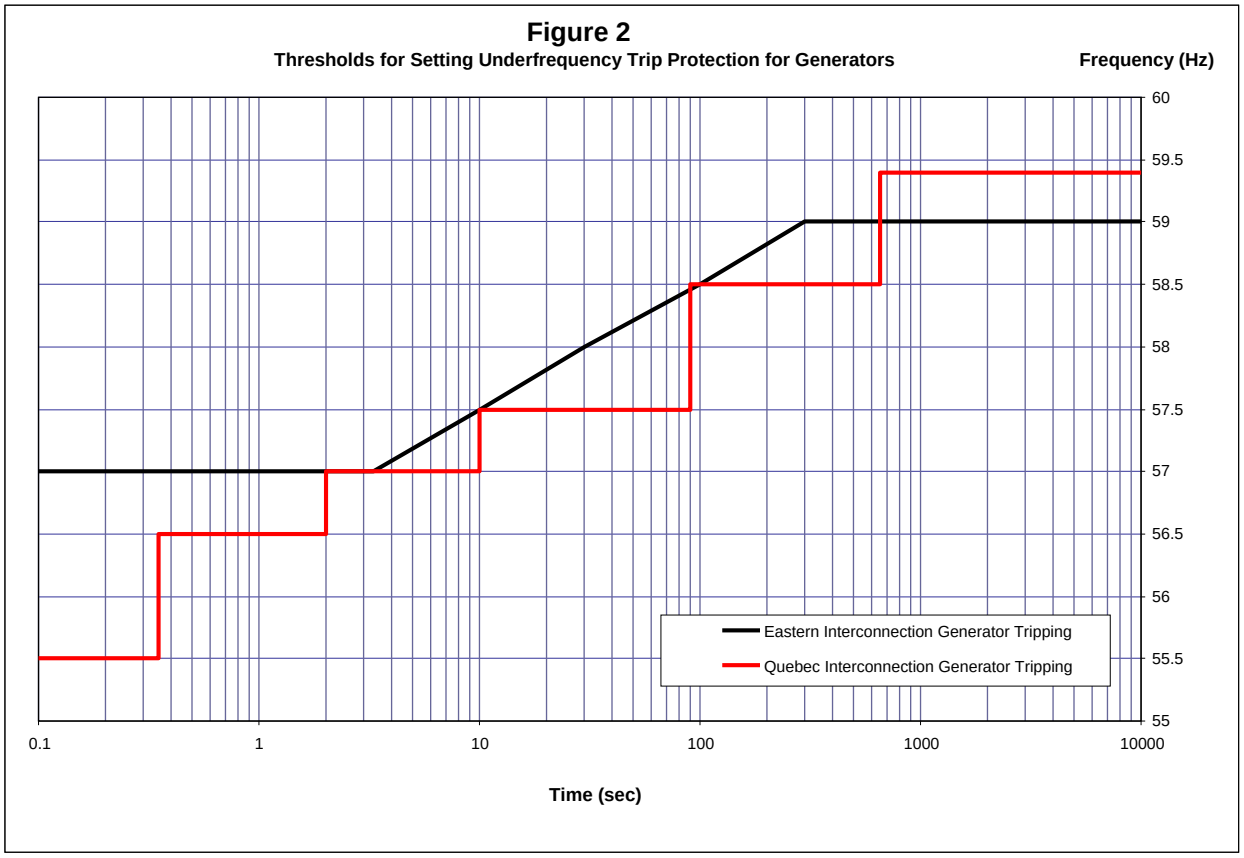


Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority:

Northeast Power Coordinating Council

1.2. Evidence Retention:

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 2, 3, 4, 5, 8, and 9.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 6, and 7.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 15.

The Generator Owner shall keep evidence for three calendar years for Measures 10, 11, 12, 13, and 16.

1.3. Compliance Monitoring and Enforcement Program:

Compliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of Load required to be shed at each stage	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load required to be shed at each stage m	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of Load required to be shed at each stage.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required to be shed at each stage
R4.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60

	Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	calendar days of permissible time for each item.
R5.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8.	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with

	less than 100% but more than (and including) 95% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.
R9.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10.	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.
R12.	N/A	N/A	The Generator Owner with a new generating unit, or an existing	The Generator Owner with a new generating unit, or an existing generator increasing its net

			generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13.	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14.	N/A	N/A	N/A	The Planning Coordinator did not apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15.	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16.	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1 OR	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

		Coordinator as specified in Requirement R16, Part 16.3.	Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	

D. Regional Variances

None.

E. Associated Documents

Technical Rationale

Version History

Version	Date	Action	Change Tracking
1	2-9-2012	Adopted by Board of Trustees	
2	6-23-2015	RSAR Submitted	

Standard Attachments

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in

addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment C

UFLS Table 1: Eastern Interconnection Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	28 – 50	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Rationale Box:

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.
PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.
Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

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Implementation Plan

Regional Reliability Standard PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Applicable Standard(s)

- PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Requested Retirement(s)

- PRC-006-NPCC-1 – Automatic Underfrequency Load Shedding

Applicable Entities

- Generator Owners
- Planning Coordinators
- Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.
- Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

Background

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. To determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. To determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Review Attachment C in PRC-006-NPCC-1 to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. Review and revise Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

Effective Date

All requirements with the exception of R3 will be enforceable on the first day of the first calendar quarter following the applicable governmental and regulatory approvals.

R3 will be enforceable on the first day of the first calendar quarter 12 months following the applicable governmental and regulatory approvals.

Retirement Date

The NPCC Regional Reliability Standard PRC-006-NPCC-1 shall be retired immediately prior to the Effective Date of PRC-006-NPCC-2.

A. Introduction

1. **Title:** **Automatic Underfrequency Load Shedding**

2. **Number:** PRC-006-NPCC-2

3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.

4. **Applicability:**

   4.1. Generator Owner

   4.2. Planning Coordinator

   4.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program as established by the Planning Coordinators.

   4.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program as established by the Planning Coordinators.

5. **Effective Date:**

   ~~Reference to~~See Implementation Plan.

B. Requirements

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. ~~Note that~~ Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for ~~greater~~ more than 30 seconds in accordance with Figure 1. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor*

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- *Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

~~**R3.** Each Planning Coordinator shall, within 30 calendar days of completion of its UFLS system studies, identify to the Regional Entity all non-BES generation facilities, within its Planning Coordinator Area, that must not trip above the appropriate generator underfrequency trip threshold curve in Figure 2 in order to support UFLS program performance requirements. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*~~

~~**M3.** Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.~~

R34. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each island identified per the NERC continent wide PRC-006 Standard on UFLS as follows:~~.~~ *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

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- **34.1.** The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times and load shedding amounts specified in Attachment C, Tables 1 through 3; or~~,~~

- **34.2.** The program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS i~~I~~sland identified by the Planning Coordinator per R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time and load shedding amounts specified in Attachment C, Tables 1~~ through~~ 3.

M34. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R34. (Attachment C Tables 1-3).

R54. ~~Each Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program, shall~~Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec

Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall ~~Nn~~otify its Planning Coordinator within 30 calendar days ~~and shall~~: ~~notify its Planning Coordinator within the following 30 calendar days of identification and shall:~~ [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

- Within 30 calendar days, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or

(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or

(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

~~Notify its Planning Coordinator within 30 calendar days~~
~~Within the following 180 calendar days from notification of the Planning Coordinator, develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator; or~~

~~Within the following 180 calendar days from notification to the Planning Coordinator, provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters, and shall demonstrate coordination with UFLS programs of all adjoining entities residing within the same island(s) identified by the Planning Coordinator in R2. ,The technical study shall also demonstrate coordination and coordination with other UFLS programs of adjoining Planning Coordinators.~~

~~of recognition~~

~~5.1. Within the following 180 calendar days of the identification, develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with the Planning Coordinator, and implement the Corrective Action Plan; or.~~

~~5.2. Within the following 90 calendar days, determine if tolerances can be met through adjustments and notify the Planning Coordinator~~Within the following 180 calendar days of the

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~~identification, provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. This technical study shall be coordinated with UFLS programs of adjoining entities, and shall be acceptable to the Planning Coordinator.~~

~~**5.3.** If adjustments are possible, make the adjustments within 180 calendar days after determining that adjustments are possible, and notify the Planning Coordinator when complete, or,~~

~~**5.4.** If adjustments are not possible then:~~

~~**5.4.1.** Each Distribution Provider or Transmission Owner subject to Attachment C, Table 1, shall within 180 calendar days, provide its Planning Coordinator with a technical study that demonstrates that the Distribution Provider's or Transmission Owner's specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the BES, or~~

~~**5.4.2.** Each Distribution Provider or Transmission Owner subject to Attachment C, Table 2 or Table 3, or in the Quebec Interconnection, shall within 90 calendar days, provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with the UFLS program.~~

M~~5~~4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R~~4~~5.

> ~~**Rationale for Requirement R6:** Operation of underfrequency relays results directly in load being shed, interrupting service to customers. The security of underfrequency relays against misoperation is therefore paramount. The 100 ms minimum time delay specified in R6 serves to prevent premature activation of these relays during short-lived transient frequency excursions that may occur on a localized basis in the absence of a serious system event wherein UFLS would be appropriate. This intentional delay helps to ensure that the relays activate only for frequency excursions that are due to actual system events that require automatic UFLS to reestablish the balance of generation to load.~~

~~**R6.** Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with a 100 ms minimum time delay. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*~~

~~**M6.** Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum time delay, in accordance with Requirement R6.~~

> **Rationale for Requirement R~~7~~5:** An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay

operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an uUnderfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the uUnderfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5~~7~~. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5~~7~~. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5~~7~~.

R6~~8~~. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6~~8~~. Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R6~~8~~.

R7~~9~~. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6~~8~~ shall develop and submit an implementation plan with respect to inhibit threshold for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7~~9~~. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7~~9~~.

R8~~10~~. Each Distribution Provider and Transmission Owner shall implement the inhibit threshold ~~settings~~ provided by the Planning Coordinator in accordance with Requirement R6~~8~~ and based on the Planning Coordinator approved implementation plan in accordance with R7~~9~~.
[Violation Risk Factor: High] [Time Horizon: Operations Planning]

M8~~10~~. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8~~10~~.

Rationale for Requirement R9~~11~~: ~~It is recognized that, i~~Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. This being said, entities are required by R11 to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9~~11~~. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower]*
[Time Horizon: Long Term Planning]

M9~~11~~. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the ~~frequency set point, the~~ net amount of load shed and the percentage of its

peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9~~11~~.

R10~~2~~. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted in Requirements R13~~5~~ and R16~~8~~. *[Violation Risk Factor: ~~Medium~~High] [Time Horizon: Long Term Planning]*

M10~~2~~. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10~~2~~.

R11~~3~~. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11~~3~~. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11~~3~~.

R12~~4~~. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

~~R~~12.1 ~~12~~4.1. Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.

~~R~~12.2. ~~12~~4.2. Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 2.

M12~~4~~. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12~~4~~.

R13~~5~~. For existing non-nuclear units in service prior to ~~the effective date~~July 1, 2015 ~~of this standard, as documented in accordance with Attachments A or B,~~ that have underfrequency protections

set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: ~~Medium~~High] [Time Horizon: Long Term Planning]

~~R~~1~~3~~5.1. Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

~~R~~1~~3~~5.2. Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

~~R~~1~~3~~5.3. Each Planning Coordinator in Ontario, Québec and the Maritime Provinces ~~in accordance with Attachment A and each Generator Owner in the New England States and in New York State in accordance with Attachment B~~ shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

~~R~~13.4. Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

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M1~~3~~5. Each Generator Owner with existing non-nuclear units in service prior to ~~the effective date of this Standard~~July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 ~~2~~shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R1~~5~~3.

R1~~4~~6. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R1~~3~~5.3 for generating units in its respective NPCC area. *[Violation Risk Factor: ~~Medium~~High] [Time Horizon: Long Term Planning]*

M1~~4~~6. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R1~~4~~6.

R1~~5~~7. Each Generator Owner, Distribution Provider or Transmission Owner within the ~~Planning Coordinator area of ISO-NE~~ISO-NE Planning Coordinator area and in ~~or the New York~~NY-ISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R1~~3~~5.~~4~~3 for generating units in its respective NPCC area. *[Violation Risk Factor: ~~Medium~~High]*
[Time Horizon: Long Term Planning]

M1~~5~~7. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the ~~New York~~NY-ISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R1~~5~~7.

R1~~6~~8. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2~~,~~ based on their licensing design basis, shall: *[Violation Risk Factor: ~~Medium~~High] [Time Horizon: Long Term Planning]*

16.1 Set the underfrequency protection to operate at as a low frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

~~**R16.1** Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.~~

~~**R16.2** Each Generator Owner of existing nuclear non-boiling water generating plants that cannot satisfy the condition of maximum 57.8 Hz imposed by R16.1., due to extenuating circumstances such as equipment limitations or design and licensing limitations, shall set the underfrequency protection to operate at the lowest frequency allowed by the existing limiting factor. Auxiliary power supplies located at the nuclear generating plants, driven by non-nuclear prime movers, that are connected to the grid only for the duration of testing, are considered non-nuclear units and are subject to compliance with the obligations spelled out in requirement R13.~~

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~~**R16.3** Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.~~

~~**R16.4** Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.~~

~~**168.1.** Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.~~

~~**168.2.** Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.~~

~~**168.3.** Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.~~

M168. Each Generator Owner of nuclear units that have ~~have been specifically identified by NPCC as having~~ generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R168.

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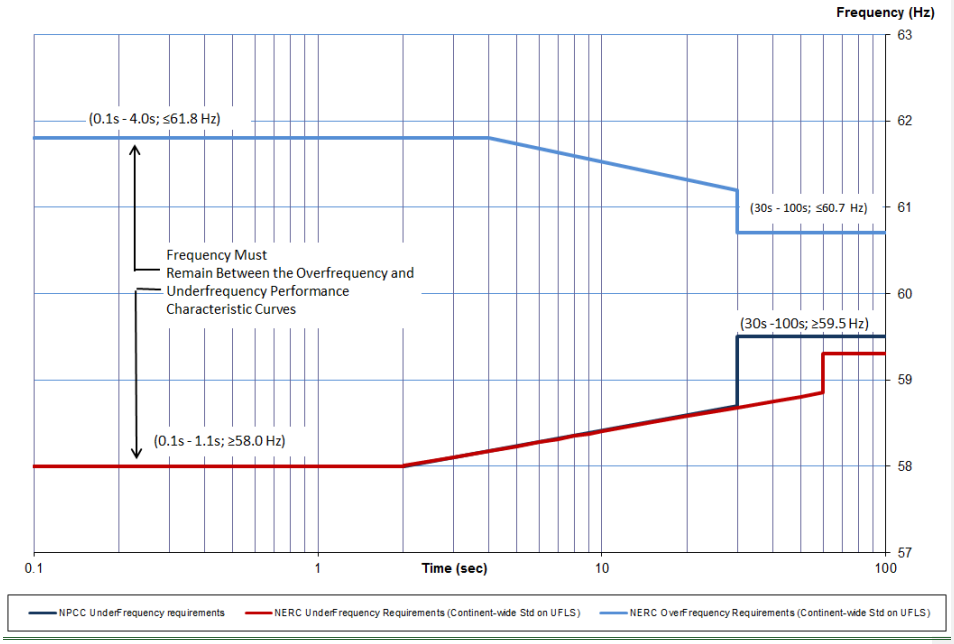
Figure 1
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz
Design Performance Requirements

PRC-006-NPCC-2 Figure 1
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements



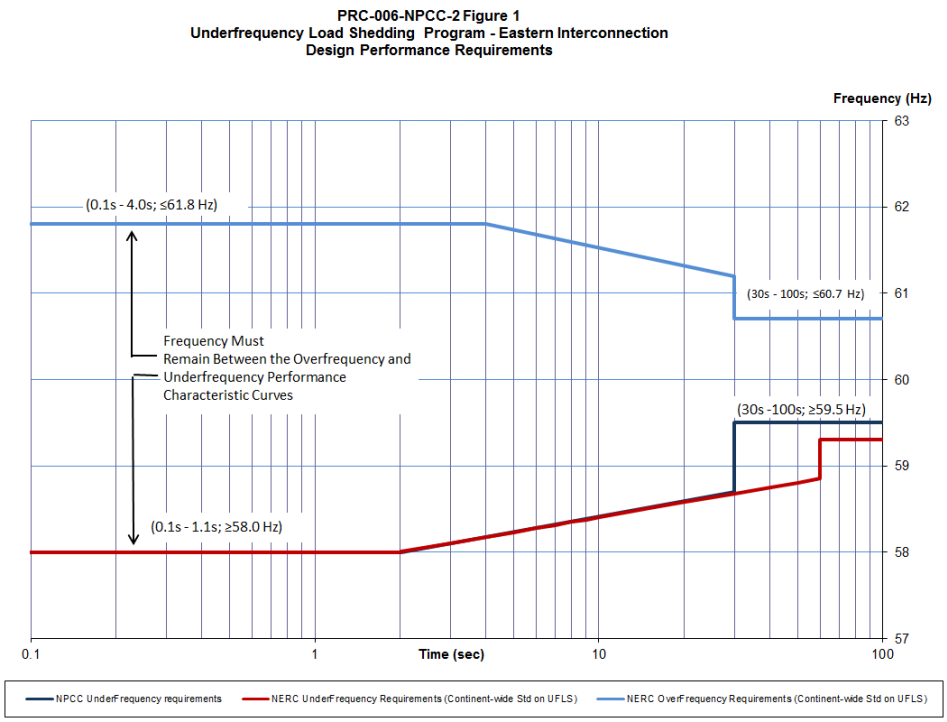
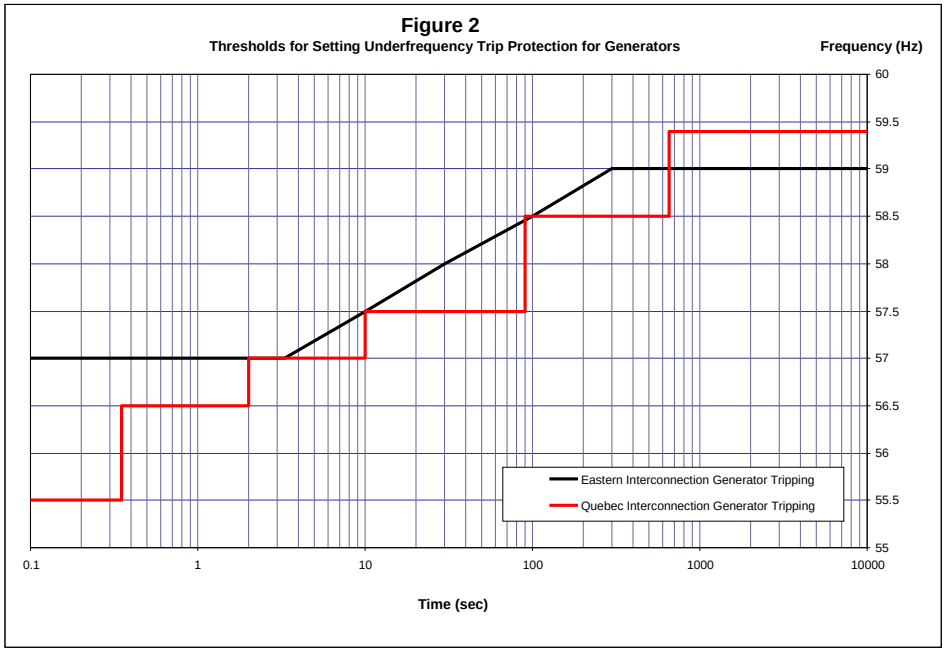


Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators

Figure 2



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority

Northeast Power Coordinating Council~~PCC Compliance Committee~~

~~**1.2. Compliance Monitoring Period and Reset Time Frame**~~

~~Not Applicable~~

~~1.3.~~1.2. ~~Data~~Evidence ~~-~~Retention

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 2~~4~~, 3~~5~~, ~~4~~6, ~~5~~7, 8~~10~~, and 9~~11, and 12~~.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, ~~3, 6~~8, and 7~~9, 20, and 21~~.

~~The Planning Coordinator in Ontario, Quebec, and the Maritime Provinces shall keep evidence for three calendar years for Measure 17.~~

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 1~~18, 22, and 23~~5.

The Generator Owner shall keep evidence for three calendar years for Measures 1~~0~~3, 1~~1~~4, 1~~5~~2, 1~~3~~6, and 1~~6~~9.

~~1.4.~~1.3. Compliance Monitoring and Assessment Processes

Compliance Audit~~Self-Certifications.~~

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints~~Spot Checking.~~

~~Compliance Audits.~~

~~Self-Reporting.~~

~~Compliance Violation Investigations.~~

~~Complaints.~~

~~**1.5. Additional Compliance Information**~~

~~None.~~

2. Violation Severity Levels

Requirement	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	N/A	**N/A**	N/A	The Plannning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2	The Planning ~~The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.~~Coordinator provided island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.~~The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.~~	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.~~The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.~~	The Planning Coordinator~~ failed to provide its UFLS~~ island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS. within 60 calendar days following a request.~~The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC PRC Standard on UFLS. within 60 calendar days following a request.~~

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~~R3~~	~~The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support UFLS program performance requirements, but did so more than 30 calendar daysand up to and including 40 days after completion of the system studies.~~	~~The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program performance requirements, but did so more than 40 days but less than calendar days but less than and including 50 days after completion of the system studies.~~	~~The Planning Coordinator identified to the Regional Entity all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program performance requirements,, but did so more than 50 calendar days but less than and including 60 days after completion of the system studies.~~	~~The Planning Coordinator identified all non-BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to support the UFLS program performance requirements, but failed to inform the Regional Entity within 60 calendar days after completion of the system studies.~~ ~~OR~~ ~~The Planning Coordinator did not identify the BES generation facilities within its Planning Coordinator Area that must not trip above the appropriate generator underfrequency trip threshold curve in order to supportUFLS program performance requirements.~~	
R~~3~~4	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of Load required to be shed at each stage	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load required to be shed at each stage m	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of Load required to be shed at each stage.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required to be shed at each stage~~The Distribution Provider or Transmission Owner failed to implement the automatic UFLS program on an island basis as specified by Requirement R4, Part 4.1 or Part 4.2.~~	**Formatted:** Font: (Default) Times New Roman **Formatted:** Font: (Default) Times New Roman **Formatted:** Font: (Default) Times New Roman **Formatted:** Font: (Default) Times New Roman
R~~4~~5	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or	The Distribution Provider or Transmission Owner that cannot meet the	The Distribution Provider or Transmission Owner that cannot meet the	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or	**Formatted:** Font: (Default) Times New Roman **Formatted:** Font: (Default) Times New Roman **Formatted:** Font: (Default) Times New Roman

	number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.~~The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations ir Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.~~	tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days. ~~The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations ir Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.~~	tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days. ~~The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.~~	number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60 calendar days of permissible time for each item. ~~The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60 calendar days of permissible time for each item.~~
~~**R6**~~	~~The Distribution Provider or Transmission Owner set less than 100% but more than (and including) 95% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.~~	~~The Distribution Provider or Transmission Owner set less than 95% but more than (and including) 90% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.~~	~~The Distribution Provider or Transmission Owner set less than 90% but more than (and including) 85% of its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.~~	~~The Distribution Provider or Transmission Owner set less than 85% ot its underfrequency relays that are part of its region's UFLS program with a 100 ms minimum time delay.~~
R5~~7~~	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its

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	including) 95% of relays within its region's UFLS program.~~The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.~~	95% but more than (and including) 90% of relays within its region's UFLS program.~~The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.~~	than (and including) 85% of relays within its region's UFLS program.~~The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.~~	region's UFLS program.~~The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.~~
R6~~8~~	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.~~The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.~~	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.~~The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar daysbut less than and including 50 calendar days of any changes.~~	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.~~The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar daysbut less than and including 60 calendar days of any changes.~~	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes ~~The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes~~
R7~~9~~	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.~~The Distribution Provider or Transmission Owner developed and submitted its implementation plan~~	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.~~The Distribution Provider or Transmission Owner developed and~~	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.~~The Distribution Provider or Transmission~~	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request. ~~The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan~~

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	~~more than 90 calendar days and up to and including 100 calendar days following the request.~~	~~submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.~~	~~Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.~~	~~within 120 days following the request.~~
R~~8~~10	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.~~implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.~~	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.~~The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.~~	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.~~The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85 % of UFLS relays.~~	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.~~The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85 % of UFLS relays.~~
R~~9~~11	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.~~The~~	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.~~The Distribution Provider or Transmission~~

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	~~Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.~~	calendar months since last update.~~The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.~~	calendar months since last update.~~The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.~~	~~Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.~~
R10~~2~~	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted. ~~The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.~~
R11~~3~~	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.~~The Generator~~

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	request.~~The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.~~	Coordinator's request.~~The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.~~	Planning Coordinator's request.~~The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.~~	~~Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.~~
R1~~2~~4	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.~~The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%:~~ ~~Did not: fulfill the obligation of Requirement R14; Part 14.1~~ ~~OR~~ ~~Did not fulfill the obligation of Requirement R14, Part 14.2.~~	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2. ~~The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R15, Part 15.1 and Part 15.2.~~
R1~~3~~5	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed

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		the Planning Coordinatoras specified in Requirement R13, Part 13.2.~~The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.as specified in Requirement R15, Part 15.2.~~	in Requirement 13, Part 13.1 ~~The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirment 15, Part 15.1~~	to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.~~The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner in the New England States and in New York State failed to arrange for compensatory load shedding as specified in Requirement R15, Part 15.3.~~
R1~~6~~	N/A	N/A	N/A	The Planning Coordinator did not apply the criteria described in Attachment A to determine the compensatory load shedding that is required.~~The Planning Coordinator did not apply the methodology described in Attachment A to determine the compensatory load shedding that is required.~~
R1~~7~~	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.~~The Generator Owner, Distribution Provider, or Transmission Owner did not apply the methodology described in Attachment B to determine the compensatory load shedding that is required.~~
R1~~8~~	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the	The Generator Owner: Failed to set the underfrequency protection as specified	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

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		settings to the Planning Coordinator as specified in Requirement R16, Part 16.3.~~The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator as specified in Requirement R18, Part 18.3.~~	in Requirement R16; Part 16.1 OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.~~The Generator Owner:~~ ~~Failed to set the underfrequency protection as specified in Requirement R18; Part 18.1~~ ~~OR~~ ~~Failed to set the frequency trip setting upper tolerance as specified in Requirement R18, Part 18.2.~~	~~The Generator Owner did not fulfill the obligations of Requirement R18, Part 18.1 and Part 18.2.~~

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate, as identified in Requirement R1

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

    2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

    2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

~~The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.~~

~~The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:~~

~~1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units, in their Planning Coordinator area, in service prior to the effective date of Version 1 of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:~~

~~1.1 Generator name and generating capacity~~
~~1.2 Underfrequency protection trip settings, including frequency trip set points and time delays~~
~~1.3 Physical and electrical location of the unit~~
~~1.4 All islands within which the unit may operate~~

~~2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:~~

~~2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.~~

~~2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.~~

~~2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest~~

~~frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.~~

~~2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.~~

~~In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.~~

PRC-006-NPCC-1 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

~~The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:~~

~~1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units in service prior to the effective date of Version 1 of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:~~

~~1.1 Generator name and generating capacity~~
~~1.2 Underfrequency protection trip settings, including frequency trip set points and time delays~~
~~1.3 Physical and electrical location of the unit~~
~~1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.~~

~~2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:~~

~~2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to~~

be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment C

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	28 – 50	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

PRC-006-NPCC-1 Attachment C

UFLS Table 1: Eastern Interconnection Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:			
Frequency Threshold (Hz)	Total Nominal Operating Time (s)[2]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 – 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	28-50	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

~~Guidelines and Technical Basis:~~

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~~Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.~~

~~PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.~~

~~Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:~~

- ~~Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.~~
- ~~Unforeseen islanding event~~
- ~~Real and reactive load distribution (including changes to location of compensatory load shedding)~~
- ~~Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances~~
- ~~Load characteristics in particular frequency responsive load~~
- ~~Automatic load restoration~~
- ~~Generation geographical distribution~~

~~• Generator trip settings~~

~~• Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria~~

~~• Generator dynamic modeling~~

~~• Dynamic VAR device modeling~~

~~HVDC dynamic modeling~~**Rationale Box:**

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Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.

PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.

Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

A. Introduction

~~2.1~~1. Title: **Automatic Underfrequency Load Shedding**

~~2.2~~2. Number: PRC-006-NPCC-2~~1~~

~~2.3~~**3. Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document~~To provide a regional reliability standard that ensures the development of an effective automatic underfrequency load shedding (UFLS) program in order to preserve the security and integrity of the bulk power system during declining system frequency events in coordination with the NERC UFLS reliability standard characteristics~~.

~~2.4~~4. Applicability:

~~a.~~**4.1.** Generator Owner

~~b.~~**4.2.** Planning Coordinator

~~c.~~**4.3.** Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators~~Distribution Provider~~

~~d.~~**4.4.** Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators~~Transmission Owner~~

~~2.5~~5. Effective Date:

See Implementation Plan ~~For the Eastern Interconnection & Québec Interconnection portions of NPCC excluding the Independent Electricity System Operator (IESO) Planning Coordinator area of NPCC in Ontario, Canada:~~

~~The effective date for Requirements R1, R2, R3, R4, R5, R6, and R7 is the first day of the first calendar quarter following applicable regulatory approval but no earlier than January 1, 2016 The effective date for Requirements R8 through R23 is the first day of the first calendar quarter two years following applicable governmental and regulatory approval.~~

~~For the Independent Electricity System Operator (IESO) Planning Coordinator's area of NPCC in Ontario, Canada:~~

~~All requirements are effective the first day of the first calendar quarter following applicable governmental and regulatory approval but no earlier than April 1, 2017~~.

B. Requirements

Rationale for Requirement R1: Figure 1 of this document shows the NPCC

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~~Adopted by Board of Trustees: February 9, 2012~~

underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

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R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or
(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or
(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

~~**R1** Each Planning Coordinator shall establish requirements for entities aggregating their UFLS programs for each anticipated island and requirements for compensatory load shedding based on islanding criteria (required by the NERC PRC Standard on UFLS). [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]~~

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are

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coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of

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the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*,

12.1 Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.

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12.2 Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

~~**R2 Each Planning Coordinator shall, within 30 days of completion of its system studies required by the NERC PRC Standard on UFLS, identify to the Regional Entity the generation facilities within its Planning Coordinator Area necessary to support the UFLS program performance characteristics. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]**~~

~~**R3 Each Planning Coordinator shall provide to the Transmission Owner, Distribution Provider, and Generator Owner within 30 days upon written request the requirements for entities aggregating the UFLS programs and requirements for compensatory load shedding program derived from each Planning Coordinator's system studies as determined by Requirement R1. [Violation Risk Factor: Low] [Time Horizon: Long Term Planning]**~~

~~**R4 Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program reflecting normal operating conditions excluding outages for its Facilities based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3, or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island identified in Requirement R1 and acting as a single entity, provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load, based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3.**~~
~~**[Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

~~**R5 Each Distribution Provider or Transmission Owner that must arm its load to trip on underfrequency in order to meet its requirements as specified and by doing so exceeds the tolerances and/or deviates from the number of stages and frequency set points of the UFLS program as specified in the tables contained in Requirement R4 above, as applicable depending on its total peak net Load shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

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5.1 Inform its Planning Coordinator of the need to exceed the stated tolerances or the number of stages as shown in UFLS Attachment C, Table 1 if applicable and

5.2 Provide its Planning Coordinator with a technical study that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.

5.3 Inform its Planning Coordinator of the need to exceed the stated tolerances of UFLS Attachment C, Table 2 or Table 3, and in the case of Attachment C, Table 2 only, the need to deviate from providing two stages of UFLS, if applicable, and

5.4 Provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

R6. Each Distribution Provider and Transmission Owner in the Québec Interconnection portion of NPCC shall implement an automatic UFLS program for its Facilities based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4 or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island, identified in Requirement R1, an aggregated automatic UFLS program that sheds Load based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R7. Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with the following minimum time delay:

7.1 Eastern Interconnection – 100 ms

7.2 Québec Interconnection – 200 ms

[Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R8. Each Planning Coordinator shall develop and review once per calendar year settings for inhibit thresholds (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]

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R9 Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 days of the initial determination of those inhibit thresholds and within 30 days of any changes to those thresholds. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]

R10 Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings based on the notification provided by the Planning Coordinator in accordance with Requirement R9. [Violation Risk Factor: High] [Time Horizon: Operations Planning]

R11 Each Distribution Provider and Transmission Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with R9. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

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R12 Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage coincident with their integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would be opened by the UFLS relays. [Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]

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R13 Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, below the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, except as otherwise exempted in Requirements R16 and R19. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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R14 Each Generator Owner shall transmit the generator underfrequency trip setting and time delay to its Planning Coordinator within 45 days of the Planning Coordinator's request. [Violation Risk Factor: High] [Time Horizon: Operations Planning]

R15 Each Generator Owner with a new generating unit, scheduled to be in service on or after the effective date of this Standard, or an existing generator increasing its net capability by greater than 10% shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

15.1 Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 1.

15.2 Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1.

R16 Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1 shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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16.1 Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

16.2 Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

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16.3 Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping.

R17 Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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R18 Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R16.3 for

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~~generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

~~R19. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 1, based on their licensing design basis, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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~~19.1 Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8Hz.~~

~~19.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.~~

~~19.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.~~

~~R20 The Planning Coordinator shall update its UFLS program database as specified by the NERC PRC Standard on UFLS. This database shall include the following information: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]~~

~~20.1 For each UFLS relay, including those used for compensatory load shedding, the amount and location of load shed at peak, the corresponding frequency threshold and time delay settings.~~

~~20.2 The buses at which the Load is modeled in the NPCC library power flow case.~~

~~20.3 A list of all generating units that may be tripped for underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, including the frequency trip threshold and time delay for each protection system.~~

~~20.4 The location and amount of additional elements to be switched for voltage control that are coordinated with UFLS program tripping.~~

~~20.5 A list of all UFLS relay inhibit functions along with the corresponding settings and locations of these relays.~~

~~**R21. Each Planning Coordinator shall notify each Distribution Provider, Transmission Owner, and Generator Owner within its Planning Coordinator area of changes to load distribution needed to satisfy UFLS program performance characteristics as specified by the NERC PRC Standard on UFLS.[Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

~~**R22. Each Distribution Provider, Transmission Owner and Generator Owner shall implement the load distribution changes based on the notification provided by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

~~**R23. Each Distribution Provider, Transmission Owner and Generator Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]**~~

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

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16.1 Set the underfrequency protection to operate at as a low frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

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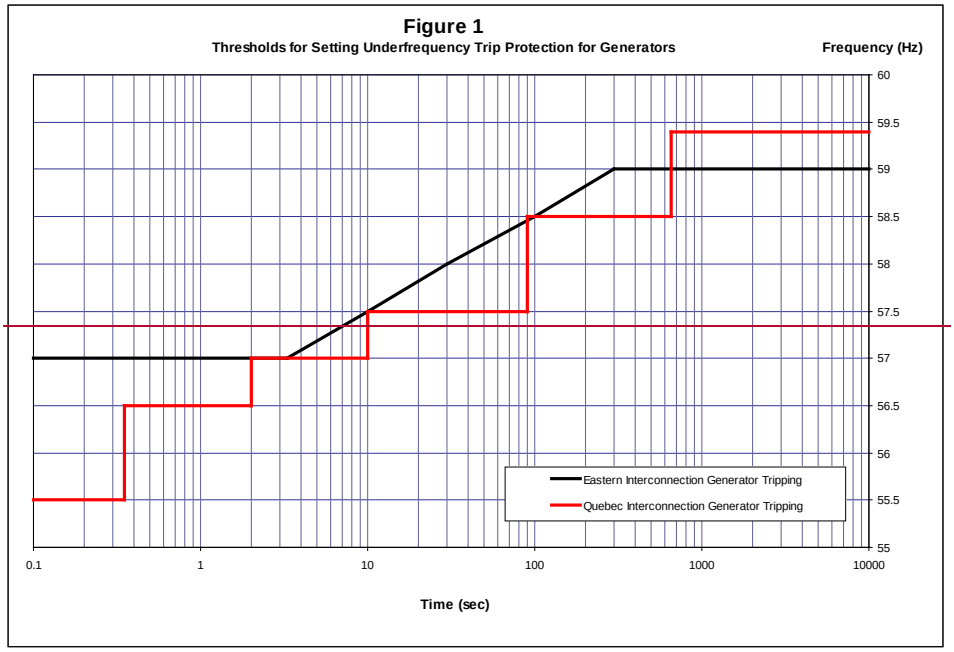

Figure 1
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz Design Performance Requirements

PRC-006-NPCC-2 Figure 1
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements

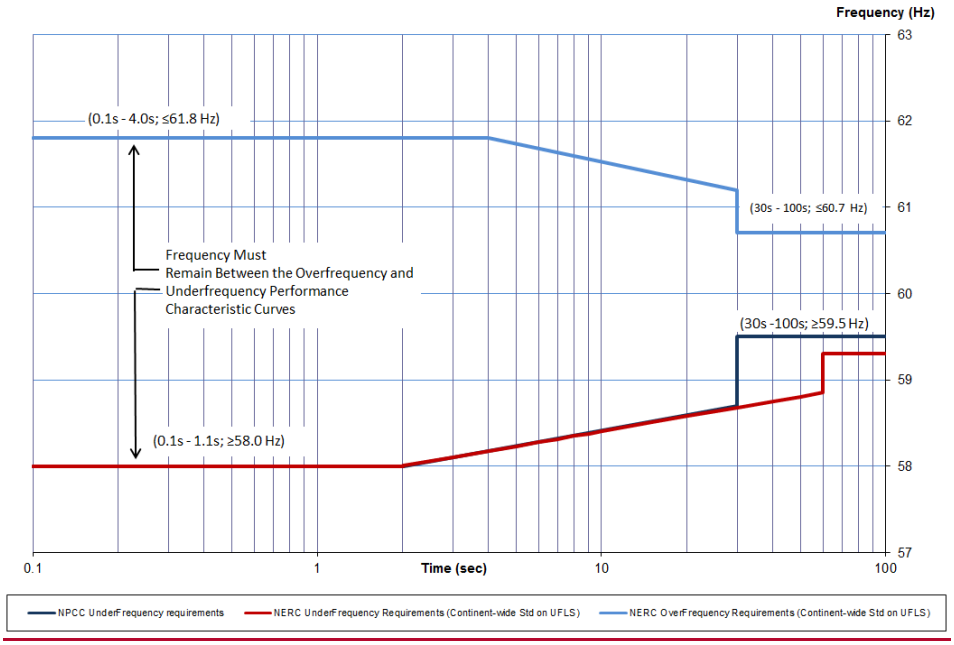

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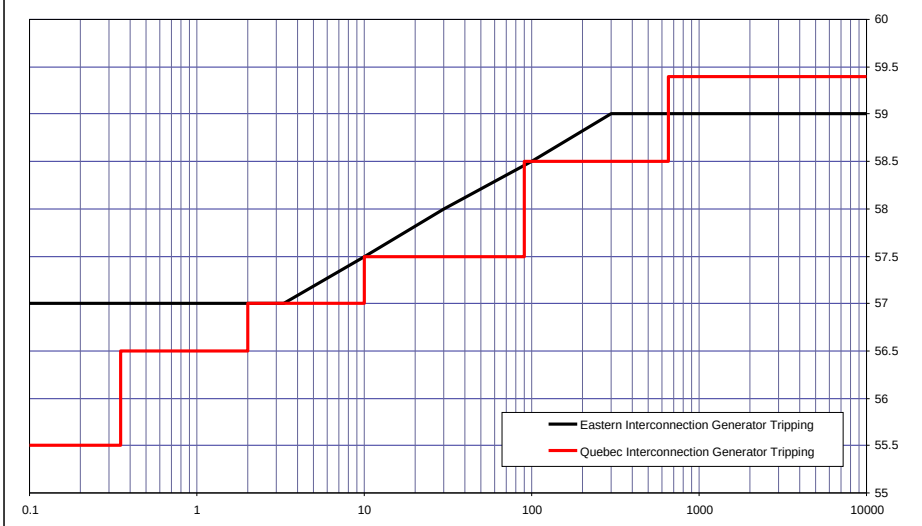
Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators

Figure 2



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C. Measures

M1 Each Planning Coordinator shall have evidence such as reports, system studies and/or real time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

M3 Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.

M4 Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped, and the corresponding frequency thresholds, on those circuits included in its UFLS program to achieve the individual and cumulative percentages identified in Requirement R4. (Attachment C Tables 1-3).

M5 Each Distribution Provider or Transmission Owner shall have evidence such as reports, analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.

M6 Each Distribution Provider and Transmission Owner in the Québec Interconnection shall have evidence such as documentation or reports containing the location and amount of load to be tripped and the corresponding frequency thresholds on those circuits included in its UFLS program to achieve the load values identified in Table 4 of Requirement R6. (Attachment C Table 4).

M7 Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum time delay, in accordance with Requirement R7.

M8 Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R8.

M9 Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

M10 Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets or other documentation that demonstrates that it meets Requirement R10.

M11 Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R11.

M12 Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program coincident with the integrated hourly peak of the previous year that demonstrates that it meets Requirement R12.

M13 Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R13.

M14 Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R14.

M15 Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R15.

M16 Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with Requirement R13 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R16.

M17 Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such as emails, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R17.

M18 Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as emails, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R18.

M19 Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in Figure 1 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R19.

M20 Each Planning Coordinator shall provide evidence such as spreadsheets, system studies, or other documentation that demonstrates that it meets the requirements of Requirement R20.

M21 Each Planning Coordinator shall provide evidence such as emails, memorandum or other dated documentation that it meets Requirement R21.

M22 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as reports, spreadsheets or other documentation that demonstrates that it meets Requirement R22.

M23 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates it meets Requirement 23.

D.C. Compliance

1.11. Compliance Monitoring Process

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a.1.1. Compliance Enforcement Authority

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Northeast Power Coordinating CouncilPCC Compliance Committee

a. **Compliance Monitoring Period and Reset Time Frame**

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Not Applicable

b.1.2. DataEvidence Retention

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 24, 35, 46, 57, 810, and 119, and 12.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 3, 86, and 79, 20, and 21.

The Planning Coordinator in Ontario, Quebec, and the Maritime Provinces shall keep evidence for three calendar years for Measure 17.

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The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 1~~8~~5~~, 22, and 23~~.

The Generator Owner shall keep evidence for three calendar years for Measures 10~~3~~, 11~~4~~, 12~~5~~, 13~~6~~, and 16~~9~~.

~~c.~~1.3.Compliance Monitoring and Assessment Processes

Com~~Self-Certifications.~~

~~Spot Checking.~~

~~Compliance Audits.~~

~~Self-Reporting.~~

~~Compliance Violation Investigations.~~

~~Complaints.~~pliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

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~~**d. Additional Compliance Information**~~

~~None.~~

~~1.2~~1. Violation Severity Levels

Requirement	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required

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	Load required to be shed at each stage	required to be shed at each stage m	Load required to be shed at each stage.	to be shed at each stage
R4	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60 calendar days of permissible time for each item.
R5	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6	The Planning Coordinator provided to a Transmission	The Planning Coordinator provided to a Transmission Owner	The Planning Coordinator provided to a Transmission	The Planning Coordinator failed to provide to a

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	Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.

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R9	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days

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	days and less than (and including) 55 calendar days of the Planning Coordinator's request.	days and less than (and including) 65 calendar days of the Planning Coordinator's request.	days and less than (and including) 75 calendar days of the Planning Coordinator's request.	of the Planning Coordinator's request.
R12	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14	N/A	N/A	N/A	The Planning Coordinator did not

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				apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator as specified in Requirement R16, Part 16.3.	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1 OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

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PRC-006-NPCC-1 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate~~The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 1. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all islands identified in Requirement R1 in which the unit may operate~~.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit~~The Planning Coordinator shall identify, compile and maintain an updated list of all existing non-nuclear generating units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1. The list shall include the following information for each unit~~:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate, as identified in Requirement R1

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

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2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding~~Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator in Requirement R1 within which the generator may operate to provide compensatory load shedding~~.

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2.2 In Ontario and in the Maritime provinces, ~~T~~the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~.~~.

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2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2~~The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1~~.

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2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~.

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In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability

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of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~.

PRC-006-NPCC-1 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements~~The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 1 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements~~:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (April, 2017 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit~~The Generator Owner shall identify and compile a list of all existing non-nuclear generating units in service prior to the effective date of this standard that has underfrequency protection set to trip above the appropriate curve in Figure 1. The list shall include the following information associated with each unit~~:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 1, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall

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arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 1, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~.

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2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip ~~The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip~~.

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2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~.

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In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~.

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PRC-006-NPCC-1 Attachment C

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UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW or more of peak net Load shall implement a UFLS program with the following attributes:

Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5
59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 – 3	– 31.5

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UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW or more and less than 100 MW of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

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UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW or more and less than 50 MW of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	28 50	28 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

~~UFLS Table 4: Quebec Interconnection~~

	~~Rate~~	~~Frequency (Hz)~~	~~MW at peak (*Load must be fixed at all times when above 60% of peak load..)~~	~~Mvar at peak~~	~~Total Nominal Operating Time (s)~~ [2]
~~Threshold Stage 1~~	~~——~~	~~58.5~~	~~1000*~~	~~1000~~	~~0.30~~
~~Threshold Stage 2~~	~~——~~	~~58.0~~	~~800*~~	~~800~~	~~0.30~~
~~Threshold Stage 3~~	~~——~~	~~57.5~~	~~800~~	~~800~~	~~0.30~~
~~Threshold Stage 4~~	~~——~~	~~57.0~~	~~800~~	~~800~~	~~0.30~~
~~Threshold Stage 5 (anti-stall)~~	~~——~~	~~59.0~~	~~500~~	~~500~~	~~20.0~~
~~Slope Stage 1~~	~~-0.3 Hz/s~~	~~58.5~~	~~400~~	~~400~~	~~0.30~~
~~Slope Stage 2~~	~~-0.4 Hz/s~~	~~59.8~~	~~800*~~	~~800~~	~~0.30~~
~~Slope Stage 3~~	~~-0.6 Hz/s~~	~~59.8~~	~~800*~~	~~800~~	~~0.30~~
~~Slope Stage 4~~	~~-0.9 Hz/s~~	~~59.8~~	~~800~~	~~800~~	~~0.30~~

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold	Minimum Relay Time	Total Nominal	Load Shed at Stage as % of	Cumulative Load Shed as

~~2. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communications time, and the rated breaker interrupting time. The underfrequency relay operating time shall be measured from the time when the frequency passes through the frequency threshold set point.~~

	(Hz)	Delay (s)	Operating Time (s)[2]	TO or DP Load	% of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

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1	59.5	0.10	0.30	28 – 50	28 – 50

Rationale Box:

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Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.
PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.
Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling

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PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Comment Form

Background Information

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. PRC-006-NPCC-1 is to be reviewed to determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. PRC-006-NPCC-1 is to be reviewed in order to determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Attachment C in PRC-006-NPCC-1 is to be reviewed to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. PRC-006-NPCC-1 is to be reviewed in order to update Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

The comment period is open from August 10, 2018 through September 25, 2018.
Please submit your comments using this form and upload it to the NPCC website or provide your responses directly:
PRC-006-NPCC-02 Automatic Underfrequency Load Shedding

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1. Do you agree with the proposed revisions to the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

2. Do you agree with the proposed revisions to Requirement 4? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

3. Do you agree with the proposed revisions to Requirement 16? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

Comments:

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   Yes ☐

   No ☒

Comments:

2. Do you agree with the proposed revisions to Requirement 4? If not, please explain why and include any suggestions.

   Yes ☐

   No ☒

Comments: Additional modifications are needed. The requirement states that that an entity that does not meet the UFLS program parameters to develop a mutually agreeable CAP with the Planning Coordinator within 30 days but does not identify from what start date the 30 days kicks off from. There are no other requirements that either specify a requirement for notification or a due date.

If the drafting team is going to resolve the issue that an entity cannot meet the plan due to too narrow of range, then there must be a timeframe for identifying when a validation has to occur.

There either needs to be a requirement that specifies a date when they want UFLS plan validations or they need to give a date when the UFLS entities need to re-evaluate.

In addition, 30 day turn is also narrow and we prefer 90 days.

Drafting Team Responses:
The SDT accepted the comments and made the necessary modification to the requirement.
The NERC defined glossary term for Corrective Action Plan includes a timeline for corrective actions.
Requirement 9 requires TO and DP annual provide documentation with no more than 15 calendar month between updates to its Planning Coordinator.

3. Do you agree with the proposed revisions to Requirement 16? If not, please explain why and include any suggestions.

Yes ☐

No ☐

Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☐

   No ☐

Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments:

6. Provide any additional comments for the drafting team to consider, if desired.

Comments:

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   Yes **X**

   No ☐

Comments:

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   Yes **X**

   No ☐

Comments:

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   Yes **X**

   No ☐

Comments:

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   Yes **X**

   No ☐

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Comments:

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Comments:

Drafting Team Responses:
Thank you for your support and comments.

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   Yes ☒

   No ☐

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   Yes ☒

   No ☐

   Comments: We believe that the language could be enhanced by adding some wording as follows to clarify that a determination has been made:

Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that determines that it does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec…

Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and

Drafting Team Responses:
The SDT accepted the comments and made the necessary modification to the requirement.

3. Do you agree with the proposed revisions to Requirement 16? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

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Comments: We suggest providing the curve definitions for Figure 1 (these are included in the continent wide version and should make it easier for entities to determine if they are meeting the curves). We also suggest deleting the red line showing the NERC underfrequency requirements (continent wide standard on UFLS) since entities within NPCC must meet the NPCC performance.

There is a typographical error in Attachment B, PRC-006-NPCC-1 was effective July 1, 2015. Revise to:

The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (~~April, 2017~~ July 1, 2015 PRC-006-NPCC-1).

For Attachment B, 2.1 and 2.2, compensatory load shedding must be in both the same and smallest island as the generator (for example, there may be a unit that's in the NE and CT islands. We would need to make sure that the compensatory load shedding was in the CT island., revise as follows:

2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island as identified by the Planning Coordinator in Requirement R1 of this standard that contains the generator.

2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island as identified by the Planning Coordinator in Requirement R1 of this standard that contains the generator.

Drafting Team Responses:
The SDT accepted the comments and made the necessary modification to Figure 1.
The SDT accepted the comments and made the necessary date change to the Attachment A and B.
The SDT accepted the comments and made the necessary modifications to the Attachment B.

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   Yes ☒

   No ☐

   Comments:

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   No ☐

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Drafting Team Responses:
The SDT accepted the comments and made the necessary modification to the requirement.

3. Do you agree with the proposed revisions to Requirement 16? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

   Comments:

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

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2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island as identified by the Planning Coordinator in Requirement R1 of this standard that contains the generator.

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   Yes ☒

   No ☐

Comments:

2. Do you agree with the proposed revisions to Requirement 4? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

3. Do you agree with the proposed revisions to Requirement 16? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments: For the sake of clarity consider the following language, which spells out what we want: "Set the underfrequency protection to operate at a frequency setting that is as low as possible in accordance with the plant design"

Drafting Team Response:
The SDT accepted the comments and made the necessary modification to the requirement.

4. Do you agree with the drafting team proposal to retire Directory 12 Automatic Underfrequency Load Shedding Program? If not, please explain why and include any suggestions.

   Yes ☒

   No ☐

Comments:

5. Are each of the draft requirements, as written, cost effective or is there a more cost-effective alternative to meeting the reliability objective. If so, please provide alternative language for the particular requirement(s), along with any technical supporting information demonstrating that the reliability objective would still be met.

Comments: The requirements are cost-effective as written

Drafting Team Response:
Thank you for your comment.

6. Provide any additional comments for the drafting team to consider, if desired.

Comments: The purpose paragraph notes that the standard establishes more stringent program requirements. It is unclear what we are comparing against. Are we comparing this standard against Directory 12, the NERC PRC-006-3 standard, the previous NPCC PRC-006-NPCC-01? Consider clarifying the purpose with something like:

> "The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes specific NPCC UFLS program requirements that are more stringent than those of prior NPCC standards to ensure that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document."

Drafting Team Responses:
The SDT accepted the comments and made the necessary modification to the purpose statement.

Mapping Document

Draft NPCC Regional Automatic Underfrequency Load Shedding Standard
PRC-006-NPCC-2

NPCC's regional standard PRC-006-NPCC-2 "Automatic Underfrequency Load Shedding" (UFLS) was effective in the US in July 2015. The standard is currently under revision to align with the continent-wide PRC-006-2 UFLS standard which became effective on October 2015. The draft of PRC-006-NPCC-2 removes duplicity with the continent wide standard and adds specificity to allow retirement of the NPCC UFLS Directory #12 containing more stringent UFLS performance criteria and harmonizes the requirements and criteria of all these documents.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
PRC-006-NPCC-1 **R1** Each Planning Coordinator shall establish requirements for entities aggregating their UFLS programs for each anticipated island and requirements for compensatory load shedding based on islanding criteria (required by the NERC PRC Standard on UFLS). [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R2**. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]* **R3.** Each Distribution Provider and Transmission Owner in the Eastern	The purpose of R1 in PRC-006-NPCC-1 was to ensure entities that aggregate their load understand what the UFLS island boundaries are and establish criteria for compensatory load shedding. The revised R2, R3, and R13 clearly address this in the proposed PRC-006-NPCC-2.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* • The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or • The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3. **R13.** For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning*]* **13.1.** Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	the plant design and licensing limitations. **13.2.** Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator. **13.3.** Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	13.4. Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.	
PRC-006-NPCC-1 **R2** Each Planning Coordinator shall, within 30 days of completion of its system studies required by the NERC PRC Standard on UFLS, identify to the Regional Entity the generation facilities within its Planning Coordinator Area	**PRC-006-NPCC-2** **R1.** Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance	The original R2 is redundant and it is being covered by the new R1, R2 and R3.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
necessary to support the UFLS program performance characteristics. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]	characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* **R2**. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]* **R3.** Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	the NERC continent wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* • The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or • The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3	
PRC-006-NPCC-1 **R3** Each Planning Coordinator shall provide to the Transmission Owner, Distribution Provider, and Generator Owner within 30 days upon written request the requirements for entities aggregating the UFLS programs and requirements for compensatory load shedding program derived from each Planning Coordinator's system studies as determined by Requirement R1. [Violation Risk Factor: Low] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R2**. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]* **R13.** For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure	The reliability intent of Version 1 R3 was to ensure that the entities aggregating load were aware of the island boundaries. This is covered in draft R2 of the proposed revision to the standard. Requirements regarding compensatory load shedding have been clarified and are covered through draft R13.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	2: [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning*]* **13.1.** Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations. **13.2.** Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator. **13.3.** Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2. **13.4.** Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.	
PRC-006-NPCC-1 **R4** Each Distribution Provider and Transmission Owner in the Eastern	**PRC-006-NPCC-2** **R4.** Each Distribution Provider or Transmission Owner in the Eastern	Added clarity and combined with the original R4 and R5 into one requirement.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
Interconnection portion of NPCC shall implement an automatic UFLS program reflecting normal operating conditions excluding outages for its Facilities based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3, or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island identified in Requirement R1 and acting as a single entity, provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load, based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3. [Violation Risk Factor: High] [Time Horizon: Long Term Planning	Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* • Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and • Within the following 180 calendar days from notification of the Planning Coordinator, (1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or (2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or (3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
PRC-006-NPCC-1 **R5** Each Distribution Provider or Transmission Owner that must arm its load to trip on underfrequency in order to meet its requirements as specified and by doing so exceeds the tolerances and/or deviates from the number of stages and frequency set points of the UFLS program as specified in the tables contained in Requirement R4 above, as applicable depending on its total peak net Load shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning] **5.1** Inform its Planning Coordinator of the need to exceed the stated tolerances or the number of stages as shown in UFLS Attachment C, Table 1 if applicable and **5.2** Provide its Planning Coordinator with a technical study that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.	**PRC-006-NPCC-2** **R4.** Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* • Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and • Within the following 180 calendar days from notification of the Planning Coordinator, (1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or	Added clarity and combined with the original R4 and R5 into one requirement.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
5.3 Inform its Planning Coordinator of the need to exceed the stated tolerances of UFLS Attachment C, Table 2 or Table 3, and in the case of Attachment C, Table 2 only, the need to deviate from providing two stages of UFLS, if applicable, and **5.4** Provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.	(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or (3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3	
PRC-006-NPCC-1 **R6** Each Distribution Provider and Transmission Owner in the Québec Interconnection portion of NPCC shall implement an automatic UFLS program for its Facilities based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4 or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island, identified in Requirement R1, an aggregated automatic UFLS program that sheds Load based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]		The drafting team agreed to retire the requirement because it is redundant to the Quebec Variance section of the PRC-006-3 NERC standard.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
PRC-006-NPCC-1 **R7** Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with the following minimum time delay: 7.1 Eastern Interconnection – 100 ms 7.2 Québec Interconnection – 200 ms [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2**	The drafting team agreed to retire the requirement because the time delay is added into Attachment C tables.
PRC-006-NPCC-1 **R8** Each Planning Coordinator shall develop and review once per calendar year settings for inhibit thresholds (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R5.** Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*	Periodicty of develop and review settings has been increased from once per calendar year to once per five calendar years. This coincides with the the periodicity of UFLS studies. Having a yearly "develop and review" without taking any further action is strictly administrative and does nothing for reliability (P-81 type of issue).

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
NPCC-006-NPCC-1 **R9** Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 days of the initial determination of those inhibit thresholds and within 30 days of any changes to those thresholds. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]	**NPCC-006-NPCC-2** **R6.** Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*	Clarified the language.
NPCC-006-NPCC-1 **R10** Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings based on the notification provided by the Planning Coordinator in accordance with Requirement R9. [Violation Risk Factor: High] [Time Horizon: Operations Planning]	**NPCC-006-NPCC-2** **R8.** Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operations Planning]*	Only made changes to requirement numbers referenced only. Added clarification for Planning Coordinator developes implementation plan.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
NPCC-006-NPCC-1 **R11** Each Distribution Provider and Transmission Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with R9. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]	**PRC-006-NPCC-2** **R7.** Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*	Language clarifications and changes to requirement numbers referenced.
PRC-006-NPCC-1 **R12** Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage coincident with their integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would be opened by the UFLS relays.	**PRC-006-NPCC-2** **R9.** Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by	Added language that allows calculation of load from nearest available metering rather than actual metering. The requirement as it exists is placing undo burden to install metering when it can be accurately calculated as a cost effective alternative.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]	measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*	
PRC-006-NPCC-1 **R13** Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, below the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, except as otherwise exempted in Requirements R16 and R19. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R10.** Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*	Clarification was made that the Underfrequency trip relay must to be set to operate "on or below" the appropriate curve. In Version 1 it currently states below and questions arose whether settings on the curve were considered in compliance.
NPCC-006-NPCC-1 **R14** Each Generator Owner shall transmit the generator underfrequency trip setting and time delay to its Planning Coordinator within 45 days of the Planning Coordinator's request.	**PRC-006-NPCC-2** **R11.** Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk*	No Change from Version 1 only requirement numbering

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
[Violation Risk Factor: High] [Time Horizon: Operations Planning]	*Factor: Lower] [Time Horizon: Operations Planning]*	
PRC-006-NPCC-1 **R15** Each Generator Owner with a new generating unit, scheduled to be in service on or after the effective date of this Standard, or an existing generator increasing its net capability by greater than 10% shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning] **15.1** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 1. **15.2** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip	**PRC-006-NPCC-2** **R12.** Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]* **12.1.** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2. **12.2.** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the	Removed language pertaining to the Version 1 of the standard regarding on or after the effective date. Version 1 has been in place and transition/implementation concerns need not be addressed in this requirement.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
protection settings threshold curve in Figure 1.	generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.	
PRC-006-NPCC-1 **R16** Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1 shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning] **16.1** Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations. **16.2** Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.	**PRC-006-NPCC-2** **R13.** For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: High] [Time Horizon: Long Term Planning*]* **13.1.** Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations. **13.2**. Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical	Addition made to R13.3 and R13.4 which is the approved requirement R16 to clarify that any compensatory load shedding must be in the island the generating unit resides in.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
16.3 Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping.	basis for the settings to the Planning Coordinator. **13.3.** Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2. **13.4.** Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.	
PRC-006-NPCC-1 **R17** Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R14.** Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*	Only made changes to the requirement number.
PRC-006-NPCC-1 **R18** Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in	**PRC-006-NPCC-2** **R15.** Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that is	Only made changes to the requirement number.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High][Time Horizon: Long Term Planning]*	
PRC-006-NPCC-1 **R19** Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 1, based on their licensing design basis, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning] **19.1** Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8Hz. **19.2** Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz. **19.3** Transmit the initial frequency trip setting and any changes to the setting and the	**PRC-006-NPCC-2** **R16.** Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* **16.1.** Set the underfrequency protection to operate at a frequency as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz. **16.2.** Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.	Only made changes to the requirement number and Figure reference update.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
technical basis for the settings to the Planning Coordinator.	**16.3.** Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.	
PRC-006-NPCC-1 **R20** The Planning Coordinator shall update its UFLS program database as specified by the NERC PRC Standard on UFLS. This database shall include the following information: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning] **20.1** For each UFLS relay, including those used for compensatory load shedding, the amount and location of load shed at peak, the corresponding frequency threshold and time delay settings. **20.2** The buses at which the Load is modeled in the NPCC library power flow case. **20.3** A list of all generating units that may be tripped for underfrequency conditions above the appropriate generator underfrequency	**PRC-006-2 (Existing in force continent-wide standard)** **R6.** Each Planning Coordinator shall maintain a UFLS database containing data necessary to model its UFLS program for use in event analyses and assessment of the UFLS program at least once each calendar year, with no more than 15 months between maintenance activities. [VRF: Lower][Time Horizon: Long-term Planning]	The drafting team decided to remove requirement 19 and 20 because they are covered by the continent-wide PRC-006-2 requirement 6. The requirement 19 and 20 language will be transferred over to new guideline document.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
trip protection settings threshold curve in Figure 1, including the frequency trip threshold and time delay for each protection system. **20.4** The location and amount of additional elements to be switched for voltage control that are coordinated with UFLS program tripping. **20.5** A list of all UFLS relay inhibit functions along with the corresponding settings and locations of these relays.		
PRC-006-NPCC-1 **R21** Each Planning Coordinator shall notify each Distribution Provider, Transmission Owner, and Generator Owner within its Planning Coordinator area of changes to load distribution needed to satisfy UFLS program performance characteristics as specified by the NERC PRC Standard on UFLS.[Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-2 (Existing in force continent-wide standard)** **R3.** Each Planning Coordinator shall develop a UFLS program, including notification of and a schedule for implementation by UFLS entities within its area, that meets the following performance characteristics in simulations of underfrequency conditions resulting from an imbalance scenario, where an imbalance =	PRC-006-NPCC-1 R21 is now redundant with the NERC continent wide standard R3. This requirement, R21 is proposed for retirement under the P-81 criteria.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	[(load — actual generation output) / (load)], of up to 25 percent within the identified island(s). [VRF: High][Time Horizon: Long-term Planning] **3.1.** Frequency shall remain above the Underfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and **3.2.** Frequency shall remain below the Overfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and **3.3.** Volts per Hz (V/Hz) shall not exceed 1.18 per unit for longer than two seconds cumulatively per simulated event, and shall not exceed 1.10 per unit for longer	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	than 45 seconds cumulatively per simulated event at each generator bus and generator step-up transformer high-side bus associated with each of the following: • Individual generating units greater than 20 MVA (gross nameplate rating) directly connected to the BES • Generating plants/facilities greater than 75 MVA (gross aggregate nameplate rating) directly connected to the BES • Facilities consisting of one or more units connected to the BES at a common bus with total generation above 75 MVA gross nameplate rating.	
PRC-006-NPCC-1 **R22** Each Distribution Provider, Transmission Owner and Generator Owner shall implement the load distribution changes based on the	**PRC-006-2 (Existing in force continent-wide standard)** **R9.** Each UFLS entity shall provide automatic tripping of Load in accordance with the	PRC-006-NPCC-1 R22 is now redundant with the NERC continent wide standard R9 and this requirement, R22 is proposed for retirement under the P-81 criteria.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
notification provided by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	UFLS program design and schedule for implementation, including any Corrective Action Plan, as determined by its Planning Coordinator(s) in each Planning Coordinator area in which it owns assets. [VRF: High][Time Horizon: Long-term Planning]	
PRC-006-NPCC-1 **R23** Each Distribution Provider, Transmission Owner and Generator Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]	**PRC-006-2 (Existing in force continent-wide standard)** **R3.** Each Planning Coordinator shall develop a UFLS program, including notification of and a schedule for implementation by UFLS entities within its area, that meets the following performance characteristics in simulations of underfrequency conditions resulting from an imbalance scenario, where an imbalance = [(load — actual generation output) / (load)], of up to 25 percent within the identified island(s). [VRF: High][Time Horizon: Long-term Planning]	PRC-006-NPCC-1 states an implemention plan for changes needs to be submitted to the PC for their approval within 90 days of the request. However in R22 of the regional standard it states that the changes shall be implemented based on the PC's notification. We believe this is fully covered in R3 and an additional implementation plan beyond the PC's plan, which includes the notification and schedule for the UFLS entities to follow is now unnecessary in the regional standard. We are recommending that R23 in the regional standard be retired.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	3.1. Frequency shall remain above the Underfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and **3.2.** Frequency shall remain below the Overfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and **3.3.** Volts per Hz (V/Hz) shall not exceed 1.18 per unit for longer than two seconds cumulatively per simulated event, and shall not exceed 1.10 per unit for longer than 45 seconds cumulatively per simulated event at each generator bus and generator step-up transformer high-side bus	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	associated with each of the following: • Individual generating units greater than 20 MVA (gross nameplate rating) directly connected to the BES • Generating plants/facilities greater than 75 MVA (gross aggregate nameplate rating) directly connected to the BES Facilities consisting of one or more units connected to the BES at a common bus with total generation above 75 MVA gross nameplate rating.	

A. Introduction

~~2.1~~1. **Title:** **Automatic Underfrequency Load Shedding**

~~2.2~~2. **Number:** PRC-006-NPCC-2~~1~~

~~2.3~~3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document~~To provide a regional reliability standard that ensures the development of an effective automatic underfrequency load shedding (UFLS) program in order to preserve the security and integrity of the bulk power system during declining system frequency events in coordination with the NERC UFLS reliability standard characteristics~~.

~~2.4~~4. **Applicability:**

~~a.~~4.1. Generator Owner

~~b.~~4.2. Planning Coordinator

~~c.~~4.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators~~Distribution Provider~~

~~d.~~4.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators~~Transmission Owner~~

~~2.5~~5. **Effective Date:**

See Implementation Plan ~~For the Eastern Interconnection & Québec Interconnection portions of NPCC excluding the Independent Electricity System Operator (IESO) Planning Coordinator area of NPCC in Ontario, Canada:~~

~~The effective date for Requirements R1, R2, R3, R4, R5, R6, and R7 is the first day of the first calendar quarter following applicable regulatory approval but no earlier than January 1, 2016 The effective date for Requirements R8 through R23 is the first day of the first calendar quarter two years following applicable governmental and regulatory approval.~~

~~For the Independent Electricity System Operator (IESO) Planning Coordinator's area of NPCC in Ontario, Canada:~~

~~All requirements are effective the first day of the first calendar quarter following applicable governmental and regulatory approval but no earlier than April 1, 2017~~.

B. Requirements

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~~Adopted by Board of Trustees: February 9, 2012~~

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

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R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or
(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or
(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

~~**R1** Each Planning Coordinator shall establish requirements for entities aggregating their UFLS programs for each anticipated island and requirements for compensatory load shedding based on islanding criteria (required by the NERC PRC Standard on UFLS). [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]~~

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and

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the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the

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various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*,

12.1 Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.

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12.2 Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

~~**R2 Each Planning Coordinator shall, within 30 days of completion of its system studies required by the NERC PRC Standard on UFLS, identify to the Regional Entity the generation facilities within its Planning Coordinator Area necessary to support the UFLS program performance characteristics. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]**~~

~~**R3 Each Planning Coordinator shall provide to the Transmission Owner, Distribution Provider, and Generator Owner within 30 days upon written request the requirements for entities aggregating the UFLS programs and requirements for compensatory load shedding program derived from each Planning Coordinator's system studies as determined by Requirement R1. [Violation Risk Factor: Low] [Time Horizon: Long Term Planning]**~~

~~**R4 Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program reflecting normal operating conditions excluding outages for its Facilities based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3, or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island identified in Requirement R1 and acting as a single entity, provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load, based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3.**~~
~~**[Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

~~**R5 Each Distribution Provider or Transmission Owner that must arm its load to trip on underfrequency in order to meet its requirements as specified and by doing so exceeds the tolerances and/or deviates from the number of stages and frequency set points of the UFLS program as specified in the tables contained in Requirement R4 above, as applicable depending on its total peak net Load shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

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5.1 Inform its Planning Coordinator of the need to exceed the stated tolerances or the number of stages as shown in UFLS Attachment C, Table 1 if applicable and

5.2 Provide its Planning Coordinator with a technical study that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.

5.3 Inform its Planning Coordinator of the need to exceed the stated tolerances of UFLS Attachment C, Table 2 or Table 3, and in the case of Attachment C, Table 2 only, the need to deviate from providing two stages of UFLS, if applicable, and

5.4 Provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

R6. Each Distribution Provider and Transmission Owner in the Québec Interconnection portion of NPCC shall implement an automatic UFLS program for its Facilities based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4 or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island, identified in Requirement R1, an aggregated automatic UFLS program that sheds Load based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R7. Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with the following minimum time delay:

7.1 Eastern Interconnection – 100 ms

7.2 Québec Interconnection – 200 ms

[Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R8. Each Planning Coordinator shall develop and review once per calendar year settings for inhibit thresholds (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]

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~~R9 Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 days of the initial determination of those inhibit thresholds and within 30 days of any changes to those thresholds. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]~~

~~R10 Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings based on the notification provided by the Planning Coordinator in accordance with Requirement R9. [Violation Risk Factor: High] [Time Horizon: Operations Planning]~~

~~R11 Each Distribution Provider and Transmission Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with R9. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]~~

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~~R12 Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage coincident with their integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would be opened by the UFLS relays. [Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]~~

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~~R13 Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, below the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, except as otherwise exempted in Requirements R16 and R19. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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~~R14 Each Generator Owner shall transmit the generator underfrequency trip setting and time delay to its Planning Coordinator within 45 days of the Planning Coordinator's request. [Violation Risk Factor: High] [Time Horizon: Operations Planning]~~

R15 Each Generator Owner with a new generating unit, scheduled to be in service on or after the effective date of this Standard, or an existing generator increasing its net capability by greater than 10% shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

15.1 Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 1.

15.2 Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1.

R16 Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1 shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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16.1 Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

16.2 Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

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16.3 Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping.

R17 Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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R18 Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R16.3 for

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~~generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

~~R19. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 1, based on their licensing design basis, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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~~19.1 Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8Hz.~~

~~19.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.~~

~~19.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.~~

~~R20 The Planning Coordinator shall update its UFLS program database as specified by the NERC PRC Standard on UFLS. This database shall include the following information: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]~~

~~20.1 For each UFLS relay, including those used for compensatory load shedding, the amount and location of load shed at peak, the corresponding frequency threshold and time delay settings.~~

~~20.2 The buses at which the Load is modeled in the NPCC library power flow case.~~

~~20.3 A list of all generating units that may be tripped for underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, including the frequency trip threshold and time delay for each protection system.~~

~~20.4 The location and amount of additional elements to be switched for voltage control that are coordinated with UFLS program tripping.~~

~~20.5 A list of all UFLS relay inhibit functions along with the corresponding settings and locations of these relays.~~

~~**R21. Each Planning Coordinator shall notify each Distribution Provider, Transmission Owner, and Generator Owner within its Planning Coordinator area of changes to load distribution needed to satisfy UFLS program performance characteristics as specified by the NERC PRC Standard on UFLS.[Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

~~**R22. Each Distribution Provider, Transmission Owner and Generator Owner shall implement the load distribution changes based on the notification provided by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

~~**R23. Each Distribution Provider, Transmission Owner and Generator Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]**~~

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

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13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

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16.1 Set the underfrequency protection to operate at a frequency setting that is as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

Figure 1

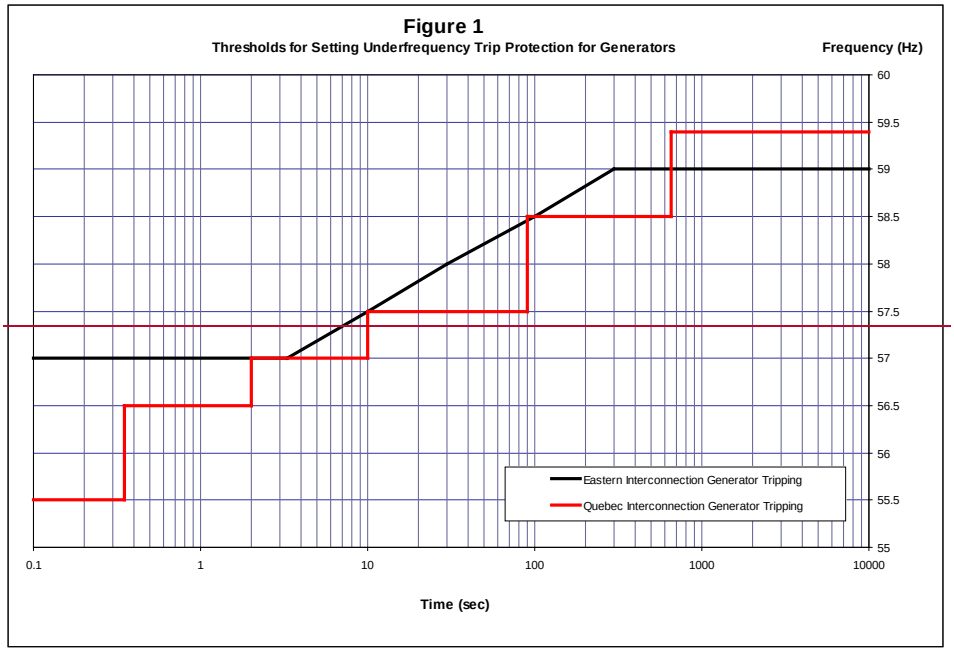

Figure 1

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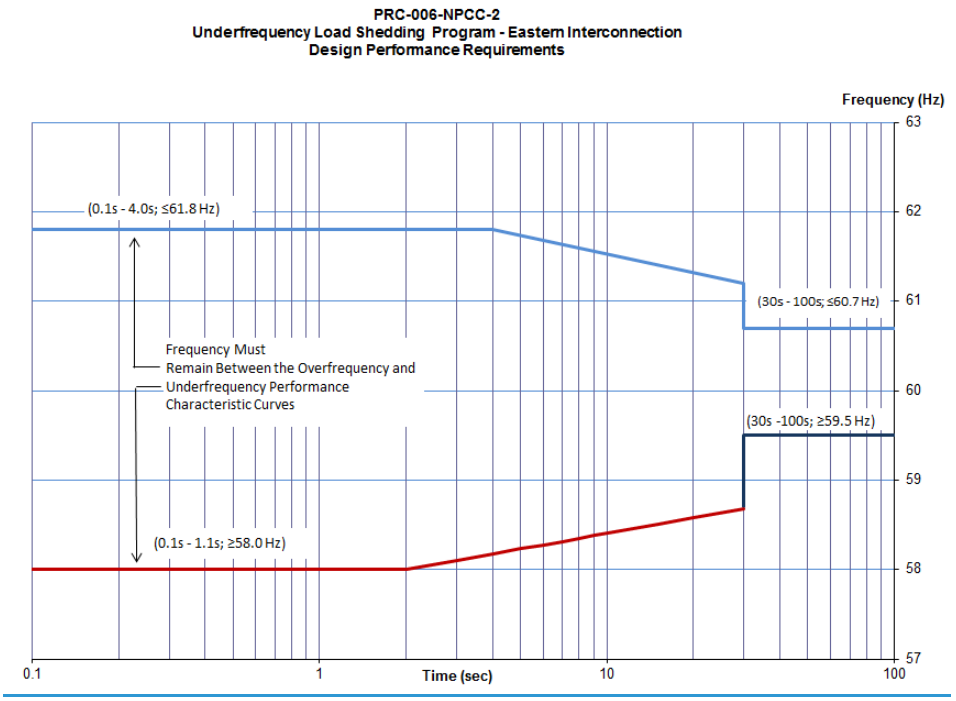

NERC PRC-006 Overfrequency Requirements (Continent-Wide Standard on UFLS)
NERC PRC-006 Underfrequency Requirements (Continent-Wide Standard on UFLS) - out to 30 seconds only
NERC PRC-006-NPCC Underfrequency Requirements (Regional Standard on UFLS)- more stringent than Content-Wide Standard from 30 - 100 seconds

Curve Data:

Overfrequency Requirements		Source
t ≤ 4 s	f = 61.8 Hz	~~NERC PRC-006 (Continent-Wide Standard on UFLS)~~
4 s < t ≤ 30 s	f = -0.686log(t) + 62.21 Hz	
t > 30 s	f = 60.7 Hz	

Underfrequency Requirements		Source
t ≤ 2 s	f = 58.0 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
2 s < t ≤ 30 s	f = 0.575log(t) + 57.83 Hz	
t > 30 s	f = 59.5 Hz	NERC PRC-006-NPCC (Regional Standard on UFLS)

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PRC-006-NPCC-2 Figure 1
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements

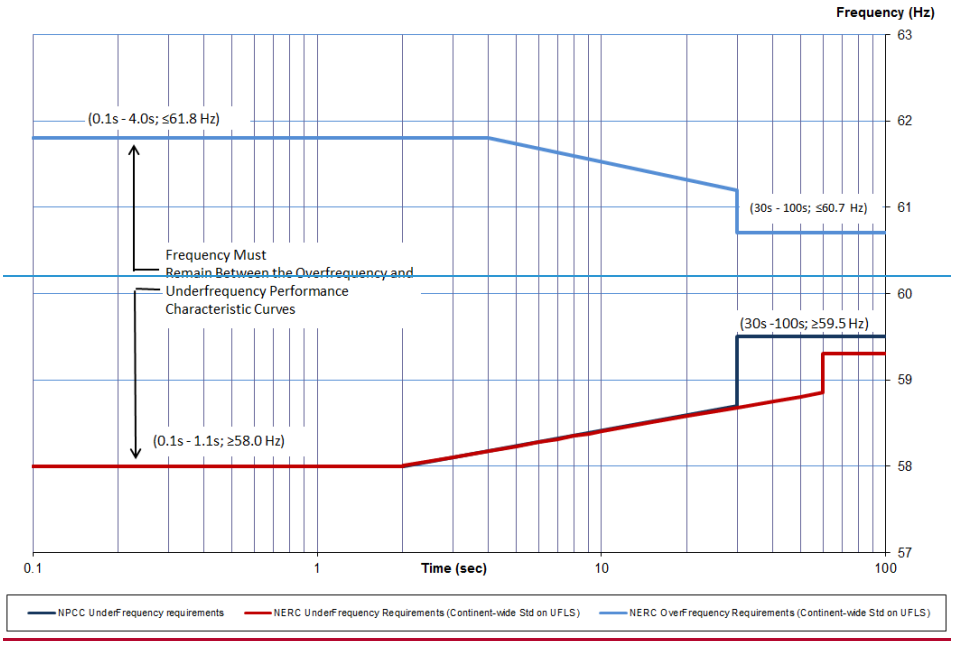

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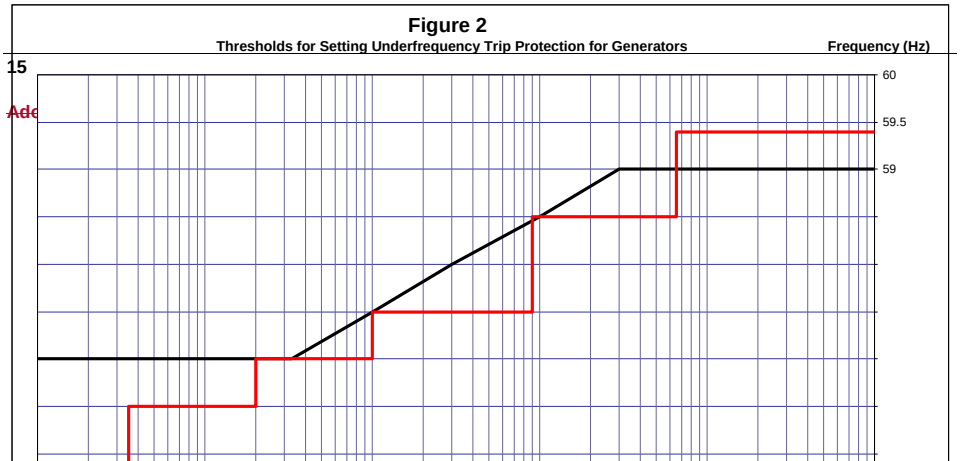
Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



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~~C. Measures~~

M1 Each Planning Coordinator shall have evidence such as reports, system studies and/or real time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

M3 Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.

M4 Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped, and the corresponding frequency thresholds, on those circuits included in its UFLS program to achieve the individual and cumulative percentages identified in Requirement R4. (Attachment C Tables 1-3).

M5 Each Distribution Provider or Transmission Owner shall have evidence such as reports, analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.

M6 Each Distribution Provider and Transmission Owner in the Québec Interconnection shall have evidence such as documentation or reports containing the location and amount of load to be tripped and the corresponding frequency thresholds on those circuits included in its UFLS program to achieve the load values identified in Table 4 of Requirement R6. (Attachment C Table 4).

M7 Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum time delay, in accordance with Requirement R7.

M8 Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R8.

M9 Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

M10 Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets or other documentation that demonstrates that it meets Requirement R10.

M11 Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R11.

M12 Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program coincident with the integrated hourly peak of the previous year that demonstrates that it meets Requirement R12.

M13 Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R13.

M14 Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R14.

M15 Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R15.

M16 Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with Requirement R13 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R16.

M17 Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such as emails, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R17.

M18 Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as emails, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R18.

M19 Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in Figure 1 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R19.

M20 Each Planning Coordinator shall provide evidence such as spreadsheets, system studies, or other documentation that demonstrates that it meets the requirements of Requirement R20.

M21 Each Planning Coordinator shall provide evidence such as emails, memorandum or other dated documentation that it meets Requirement R21.

M22 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as reports, spreadsheets or other documentation that demonstrates that it meets Requirement R22.

M23 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates it meets Requirement 23.

D.C. Compliance

1.11. Compliance Monitoring Process

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a.1.1. Compliance Enforcement Authority

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Northeast Power Coordinating CouncilPCC Compliance Committee

a. **Compliance Monitoring Period and Reset Time Frame**

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Not Applicable

b.1.2. DataEvidence Retention

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 24, 35, 46, 57, 810, and 119, and 12.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 3, 86, and 79, 20, and 21.

The Planning Coordinator in Ontario, Quebec, and the Maritime Provinces shall keep evidence for three calendar years for Measure 17.

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The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 1~~8~~5~~, 22, and 23~~.

The Generator Owner shall keep evidence for three calendar years for Measures 1~~0~~3, 1~~1~~4, 1~~2~~5, 1~~3~~6, and 1~~6~~9.

~~c.~~1.3.Compliance Monitoring and Assessment Processes

Com~~Self-Certifications.~~

~~Spot Checking.~~

~~Compliance Audits.~~

~~Self-Reporting.~~

~~Compliance Violation Investigations.~~

~~Complaints.~~pliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

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~~**d. Additional Compliance Information**~~

~~None.~~

~~1.2~~1. Violation Severity Levels

Requirement	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required

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	Load required to be shed at each stage	required to be shed at each stage m	Load required to be shed at each stage.	to be shed at each stage
R4	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60 calendar days of permissible time for each item.
R5	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6	The Planning Coordinator provided to a Transmission	The Planning Coordinator provided to a Transmission Owner	The Planning Coordinator provided to a Transmission	The Planning Coordinator failed to provide to a

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	Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.

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R9	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days

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	days and less than (and including) 55 calendar days of the Planning Coordinator's request.	days and less than (and including) 65 calendar days of the Planning Coordinator's request.	days and less than (and including) 75 calendar days of the Planning Coordinator's request.	of the Planning Coordinator's request.
R12	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14	N/A	N/A	N/A	The Planning Coordinator did not

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				apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator as specified in Requirement R16, Part 16.3.	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1 OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

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PRC-006-NPCC-1 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate~~The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 1. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all islands identified in Requirement R1 in which the unit may operate~~.

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The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit~~The Planning Coordinator shall identify, compile and maintain an updated list of all existing non-nuclear generating units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1. The list shall include the following information for each unit~~:

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   1.1 Generator name and generating capacity
   1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
   1.3 Physical and electrical location of the unit
   1.4 All islands within which the unit may operate, as identified in Requirement R1

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2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

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2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding~~Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator in Requirement R1 within which the generator may operate to provide compensatory load shedding~~.

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2.2 In Ontario and in the Maritime provinces, ~~T~~the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~.~~.

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2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2~~The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1~~.

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2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~.

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In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability

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of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~.

PRC-006-NPCC-1 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements~~The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 1 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements~~:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit~~The Generator Owner shall identify and compile a list of all existing non-nuclear generating units in service prior to the effective date of this standard that has underfrequency protection set to trip above the appropriate curve in Figure 1. The list shall include the following information associated with each unit~~:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 1, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~.

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2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 1, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip ~~The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip~~.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two~~

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~~calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~.

PRC-006-NPCC-1 Attachment C

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UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW or more of peak net Load shall implement a UFLS program with the following attributes:

Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5
59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 – 3	– 31.5

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UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW or more and less than 100 MW of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

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UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW or more and less than 50 MW of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	28 50	28 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

~~UFLS Table 4: Quebec Interconnection~~

	~~Rate~~	~~Frequency (Hz)~~	~~MW at peak (*Load must be fixed at all times when above 60% of peak load..)~~	~~Mvar at peak~~	~~Total Nominal Operating Time (s)~~ [2]
~~Threshold Stage 1~~	~~——~~	~~58.5~~	~~1000*~~	~~1000~~	~~0.30~~
~~Threshold Stage 2~~	~~——~~	~~58.0~~	~~800*~~	~~800~~	~~0.30~~
~~Threshold Stage 3~~	~~——~~	~~57.5~~	~~800~~	~~800~~	~~0.30~~
~~Threshold Stage 4~~	~~——~~	~~57.0~~	~~800~~	~~800~~	~~0.30~~
~~Threshold Stage 5 (anti-stall)~~	~~——~~	~~59.0~~	~~500~~	~~500~~	~~20.0~~
~~Slope Stage 1~~	~~-0.3 Hz/s~~	~~58.5~~	~~400~~	~~400~~	~~0.30~~
~~Slope Stage 2~~	~~-0.4 Hz/s~~	~~59.8~~	~~800*~~	~~800~~	~~0.30~~
~~Slope Stage 3~~	~~-0.6 Hz/s~~	~~59.8~~	~~800*~~	~~800~~	~~0.30~~
~~Slope Stage 4~~	~~-0.9 Hz/s~~	~~59.8~~	~~800~~	~~800~~	~~0.30~~

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold	Minimum Relay Time	Total Nominal	Load Shed at Stage as % of	Cumulative Load Shed as

~~2. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communications time, and the rated breaker interrupting time. The underfrequency relay operating time shall be measured from the time when the frequency passes through the frequency threshold set point.~~

	(Hz)	Delay (s)	Operating Time (s)[2]	TO or DP Load	% of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

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1	59.5	0.10	0.30	28 – 50	28 – 50

Rationale Box:

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Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.

PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.

Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling

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Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard is adopted by the NERC Board of Trustees (Board).

Description of Current Draft

Completed Actions	Date
Regional Standards Committee approved Regional Standard Authorization Request (RSAR) for posting	June 23, 2015

Anticipated Actions	Date
1st 45-day Formal Comment Period	September 1, 2017 - October 18, 2017
2nd 45-day Formal Comment Period	April 16, 2018 – June 1, 2018
30-day Pre-ballot Period	
10-day ballot Period	
Board adoption	

Upon Board adoption, the rationale boxes will be moved to the Supplemental Material Section.

A. Introduction

1. **Title:** Automatic Underfrequency Load Shedding

2. **Number:** PRC-006-NPCC-2

3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.

4. **Applicability:**

   4.1. Functional Entities:

   4.1.1. Generator Owner

   4.1.2. Planning Coordinator

   4.1.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators

   4.1.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators

5. **Effective Date:** See Implementation Plan.

B. Requirements and Measures

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent-wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or
(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or
(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

- **12.1** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.
- **12.2** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that

is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

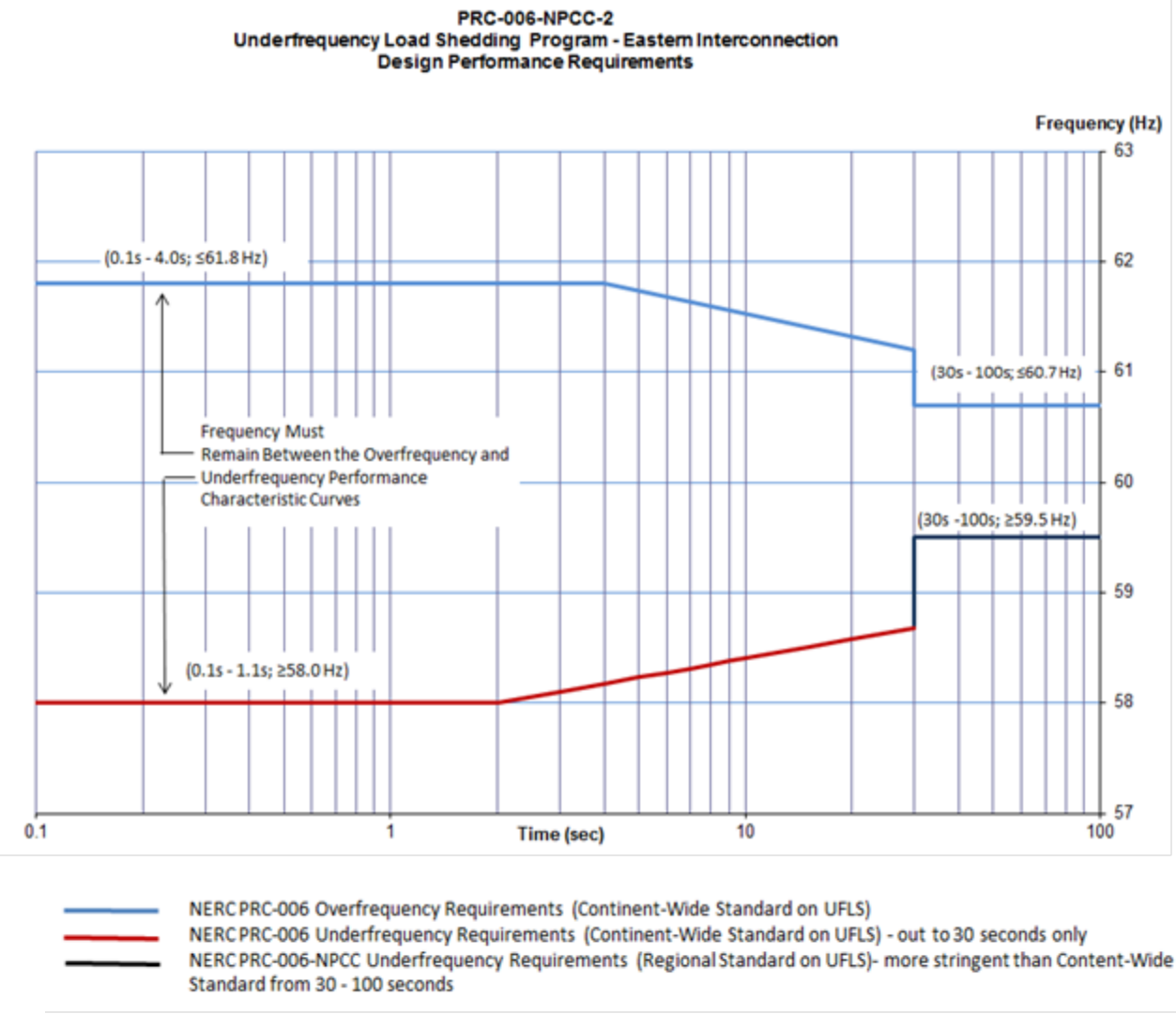
16.1 Set the underfrequency protection to operate at a frequency setting that is as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

Figure 1

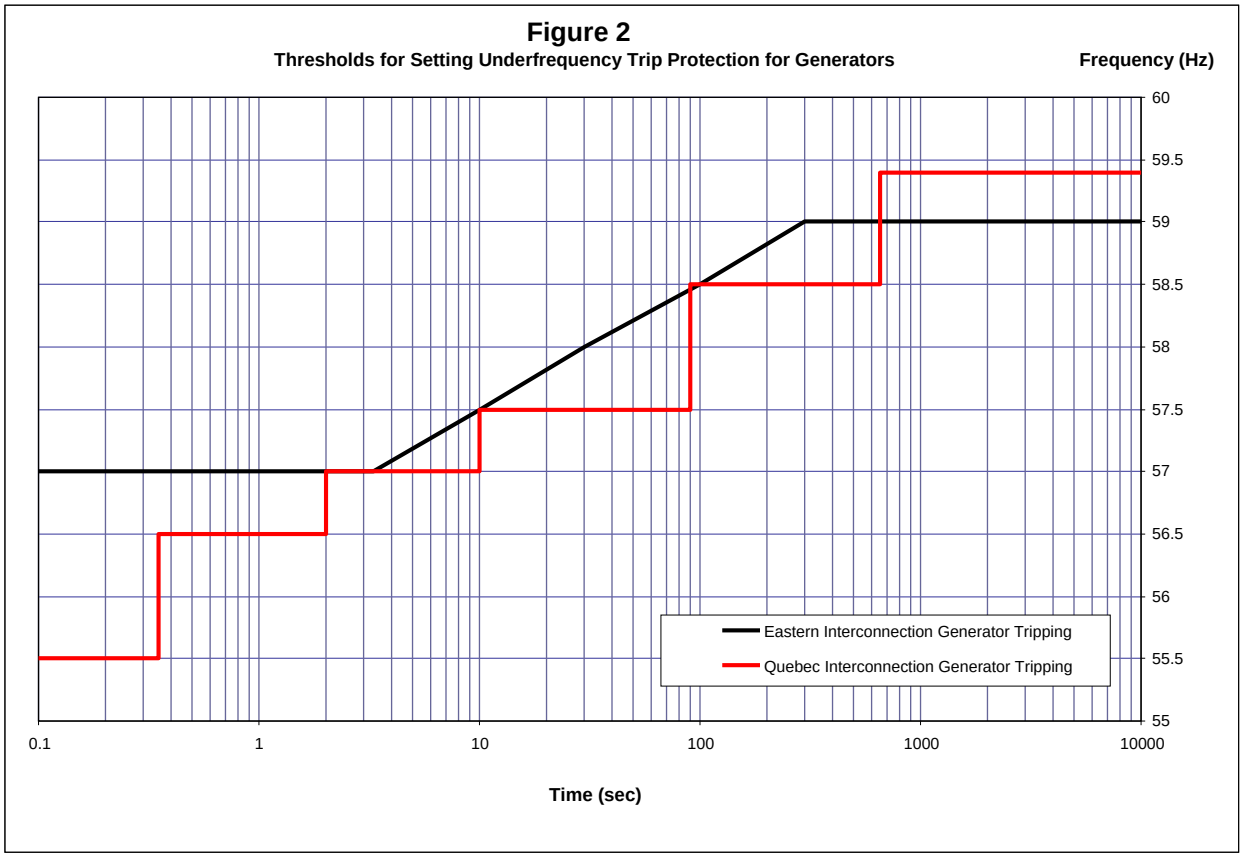


Curve Data:

Overfrequency Requirements		**Source**
t ≤ 4 s	f = 61.8 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
4 s < t ≤ 30 s	f = -0.686log(t) + 62.21 Hz	
t > 30 s	f = 60.7 Hz	

Underfrequency Requirements		**Source**
t ≤ 2 s	f = 58.0 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
2 s < t ≤ 30 s	f = 0.575log(t) + 57.83 Hz	
t > 30 s	f = 59.5 Hz	NERC PRC-006-NPCC (Regional Standard on UFLS)

Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority:

Northeast Power Coordinating Council

1.2. Evidence Retention:

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 2, 3, 4, 5, 8, and 9.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 6, and 7.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 15.

The Generator Owner shall keep evidence for three calendar years for Measures 10, 11, 12, 13, and 16.

1.3. Compliance Monitoring and Enforcement Program:

Compliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of Load required to be shed at each stage	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load required to be shed at each stage m	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of Load required to be shed at each stage.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required to be shed at each stage
R4.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60

	Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	calendar days of permissible time for each item.
R5.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8.	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with

	less than 100% but more than (and including) 95% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.
R9.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10.	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.
R12.	N/A	N/A	The Generator Owner with a new generating unit, or an existing	The Generator Owner with a new generating unit, or an existing generator increasing its net

			generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13.	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14.	N/A	N/A	N/A	The Planning Coordinator did not apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15.	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16.	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1 OR	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

		Coordinator as specified in Requirement R16, Part 16.3.	Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	

D. Regional Variances

None.

E. Associated Documents

Technical Rationale

Version History

Version	Date	Action	Change Tracking
1	2-9-2012	Adopted by Board of Trustees	
2	6-23-2015	RSAR Submitted	

Standard Attachments

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in

addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment C

UFLS Table 1: Eastern Interconnection Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	28 – 50	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Rationale Box:

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.
PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.
Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard is adopted by the NERC Board of Trustees (Board).

Description of Current Draft

Completed Actions	Date
Regional Standards Committee approved Regional Standard Authorization Request (RSAR) for posting	June 23, 2015

Anticipated Actions	Date
1st 45-day Formal Comment Period	September 1, 2017 - October 18, 2017
2nd 45-day Formal Comment Period	April 16, 2018 – June 1, 2018
30-day Pre-ballot Period	
10-day ballot Period	
Board adoption	

Upon Board adoption, the rationale boxes will be moved to the Supplemental Material Section.

A. Introduction

1. **Title:** Automatic Underfrequency Load Shedding
2. **Number:** PRC-006-NPCC-2
3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.
4. **Applicability:**
   - **4.1. Functional Entities:**
     - **4.1.1.** Generator Owner
     - **4.1.2.** Planning Coordinator
     - **4.1.3.** Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators
     - **4.1.4.** Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators
5. **Effective Date:** See Implementation Plan.

B. Requirements and Measures

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent-wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or
(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or
(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

- **12.1** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.
- **12.2** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that

is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

16.1 Set the underfrequency protection to operate at ~~as~~ a ~~low~~ frequency setting that is as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

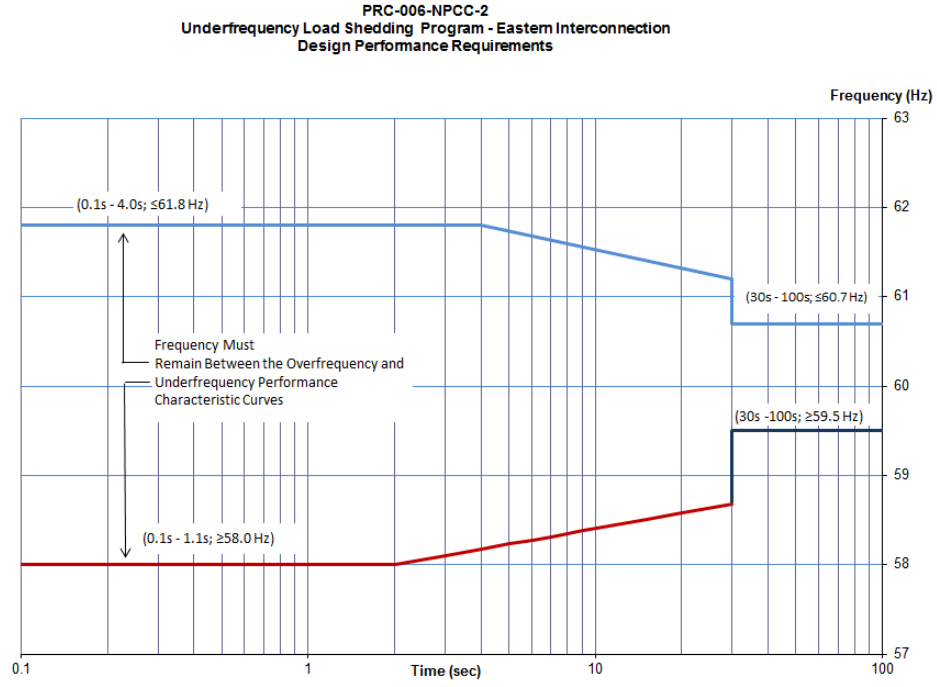
M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

Figure 1

~~PRC-006-NPCC-2~~

~~Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz~~

~~Design Performance Requirements~~



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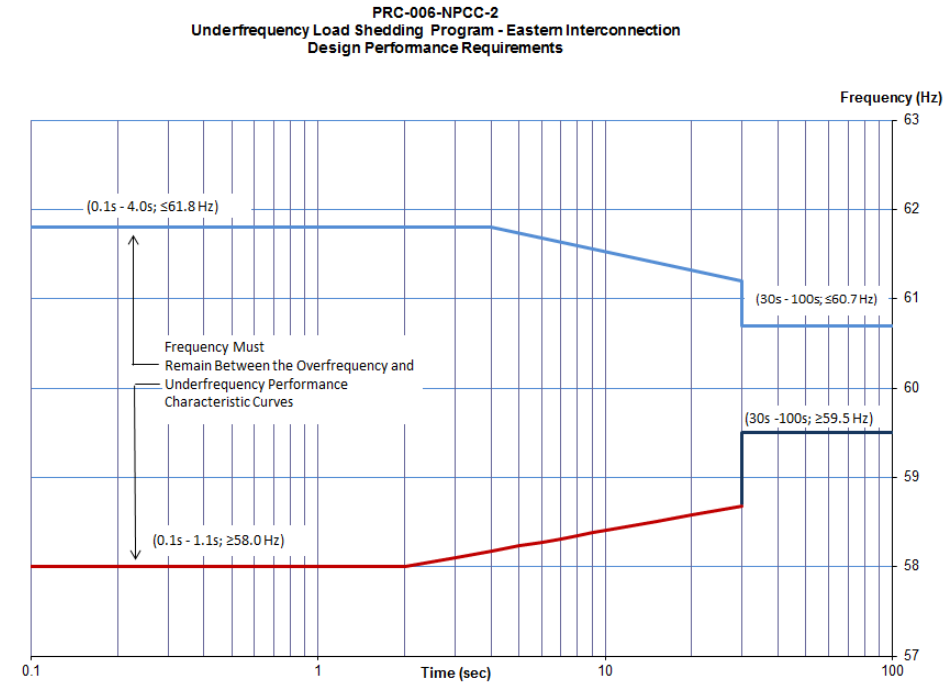
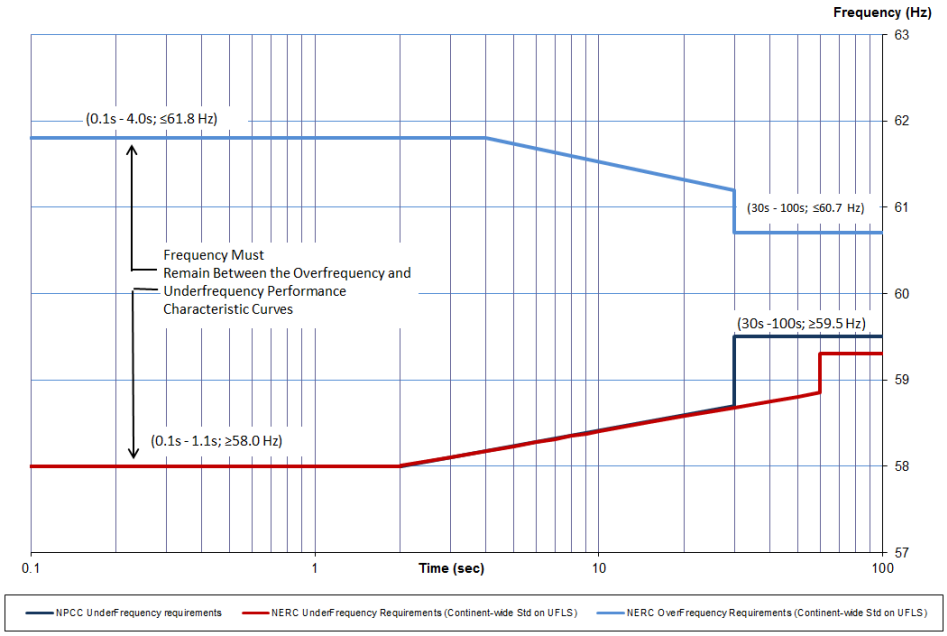
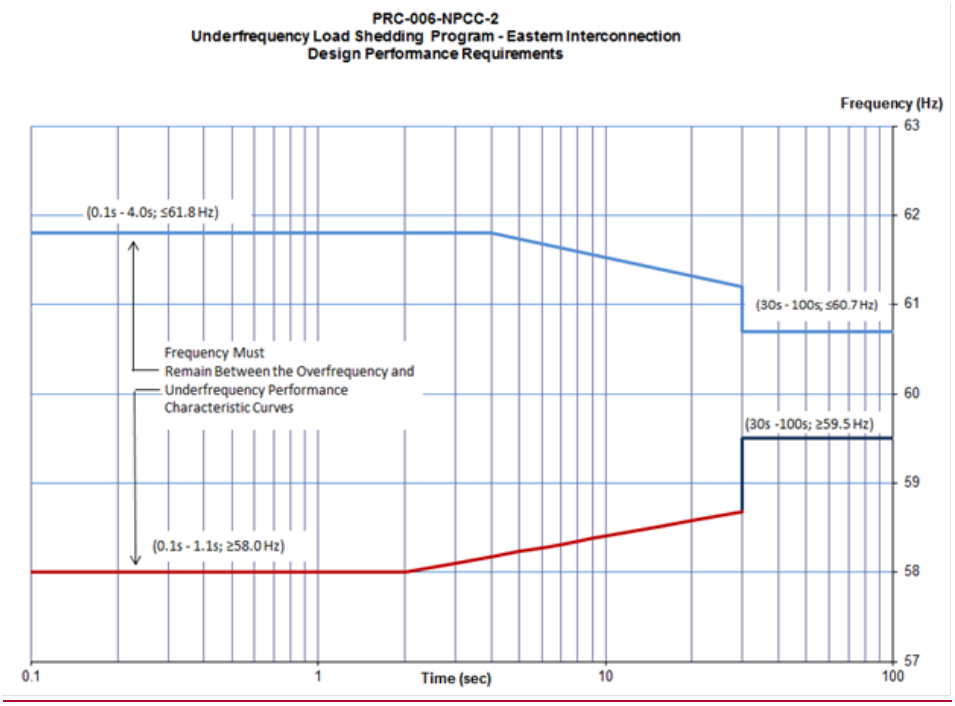

PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
Frequency (Hz)
63
62
61
60
59
58
57
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
10
100
Time (sec)

PRC-006-NPCC-2 Figure 1
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements




PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
Frequency (Hz)
63
62
61
60
59
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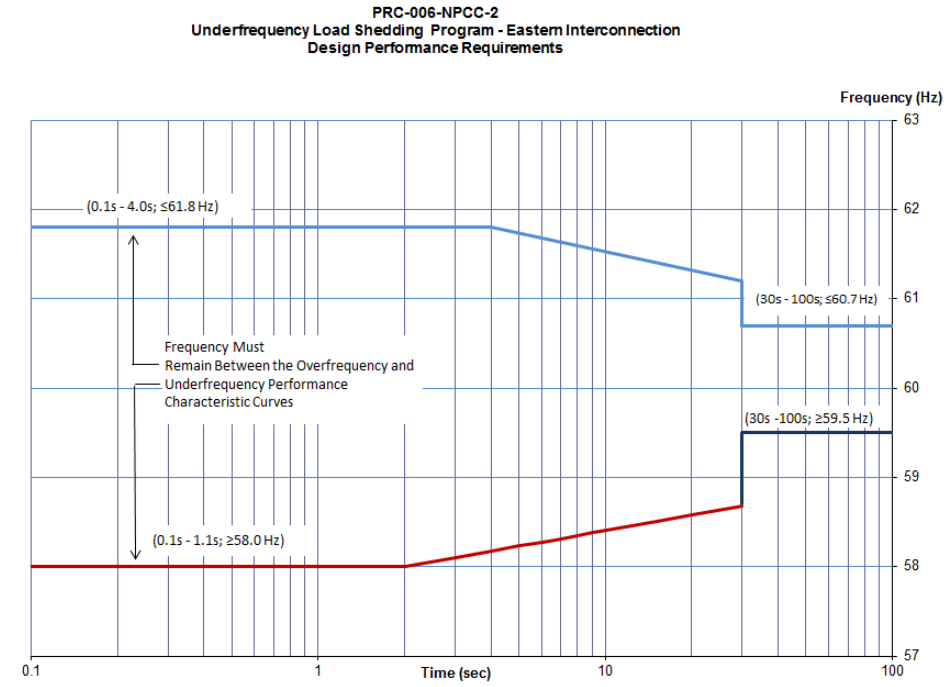
57
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
Time (sec)
10
100


PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
Frequency (Hz)
63
62
61
60
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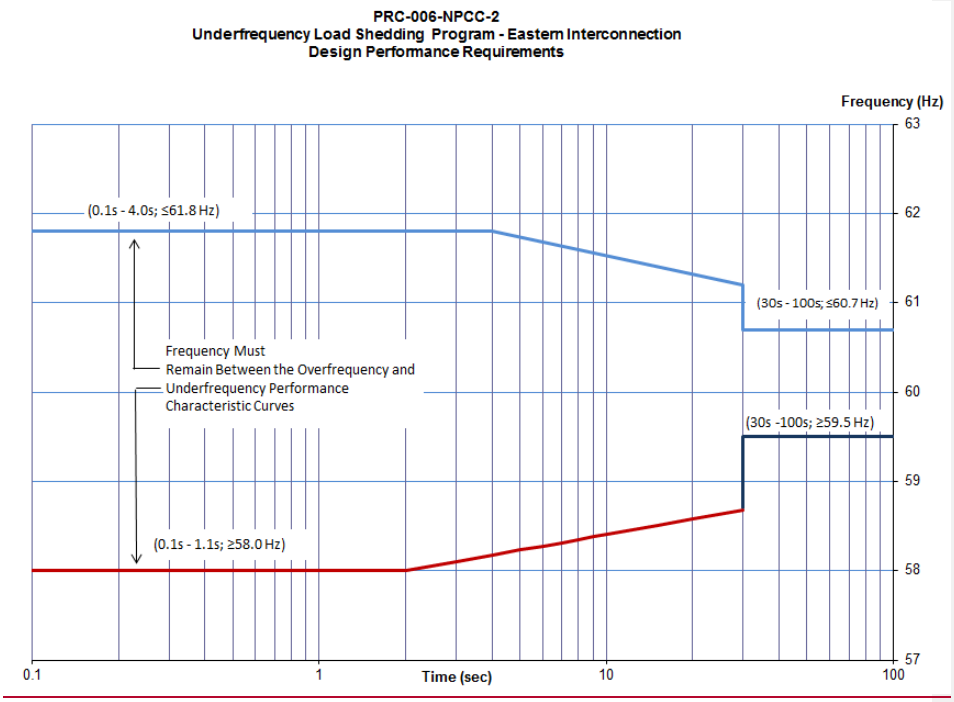
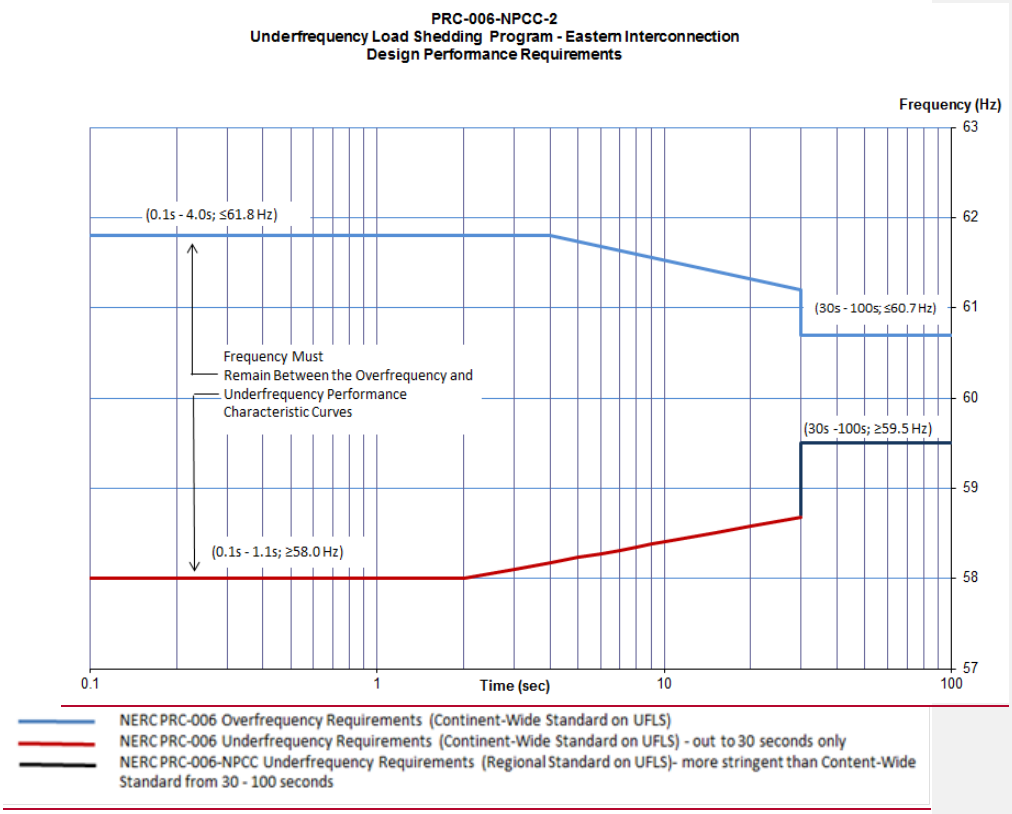
58
57
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
10
100
Time (sec)


PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
Frequency (Hz)
63
62
61
60
59
58
57
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
10
100
Time (sec)



Curve Data:

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Overfrequency Requirements		Source
t ≤ 4 s	f = 61.8 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
4 s < t ≤ 30 s	f = -0.686log(t) + 62.21 Hz	
t > 30 s	f = 60.7 Hz	

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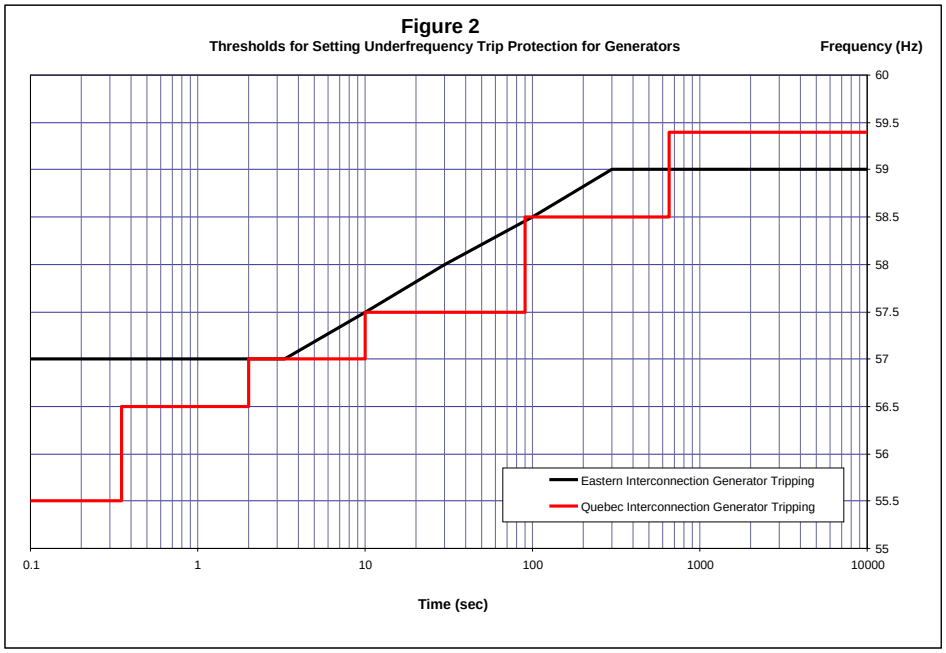
Underfrequency Requirements		Source
t ≤ 2 s	f = 58.0 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
2 s < t ≤ 30 s	f = 0.575log(t) + 57.83 Hz	
t > 30 s	f = 59.5 Hz	NERC PRC-006-NPCC (Regional Standard on UFLS)

Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority:
Northeast Power Coordinating Council

1.2. Evidence Retention:

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 2, 3, 4, 5, 8, and 9.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 6, and 7.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 15.

The Generator Owner shall keep evidence for three calendar years for Measures 10, 11, 12, 13, and 16.

1.3. Compliance Monitoring and Enforcement Program:

Compliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of Load required to be shed at each stage	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load required to be shed at each stage m	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of Load required to be shed at each stage.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required to be shed at each stage
R4.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items

	Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	in Requirement 5 within 60 calendar days of permissible time for each item.
R5.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8.	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning

	approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.	Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.
R9.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10.	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.

R12.	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13.	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14.	N/A	N/A	N/A	The Planning Coordinator did not apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15.	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16.	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

		the settings to the Planning Coordinator as specified in Requirement R16, Part 16.3.	OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	

D. Regional Variances

None.

E. Associated Documents

Technical Rationale

Version History

Version	Date	Action	Change Tracking
1	2-9-2012	Adopted by Board of Trustees	
2	6-23-2015	RSAR Submitted	

Standard Attachments

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (~~April~~July 1, 2015~~7~~ PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in

addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (~~April~~July 1, 201~~57~~ PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment C

UFLS Table 1: Eastern Interconnection Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	28 – 50	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Rationale Box:

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.
PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.
Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

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Implementation Plan

Regional Reliability Standard PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Applicable Standard(s)

- PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Requested Retirement(s)

- PRC-006-NPCC-1 – Automatic Underfrequency Load Shedding

Applicable Entities

- Generator Owners
- Planning Coordinators
- Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.
- Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

Background

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. To determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. To determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Review Attachment C in PRC-006-NPCC-1 to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. Review and revise Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

Effective Date

All requirements with the exception of R3 will be enforceable on the first day of the first calendar quarter following the applicable governmental and regulatory approvals.

R3 will be enforceable on the first day of the first calendar quarter 12 months following the applicable governmental and regulatory approvals.

Retirement Date

The NPCC Regional Reliability Standard PRC-006-NPCC-1 shall be retired immediately prior to the Effective Date of PRC-006-NPCC-2.

Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard is adopted by the NERC Board of Trustees (Board).

Description of Current Draft

Completed Actions	Date
Regional Standards Committee approved Regional Standard Authorization Request (RSAR) for posting	June 23, 2015

Anticipated Actions	Date
1st 45-day Formal Comment Period	September 1, 2017 - October 18, 2017
2nd 45-day Formal Comment Period	April 16, 2018 – June 1, 2018
30-day Pre-ballot Period	
10-day ballot Period	
Board adoption	

Upon Board adoption, the rationale boxes will be moved to the Supplemental Material Section.

A. Introduction

1. **Title:** Automatic Underfrequency Load Shedding
2. **Number:** PRC-006-NPCC-2
3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.
4. **Applicability:**
   - **4.1. Functional Entities:**
     - **4.1.1.** Generator Owner
     - **4.1.2.** Planning Coordinator
     - **4.1.3.** Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators
     - **4.1.4.** Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators
5. **Effective Date:** See Implementation Plan.

B. Requirements and Measures

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent-wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or
(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or
(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

- **12.1** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.
- **12.2** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that

is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

16.1 Set the underfrequency protection to operate at ~~as~~ a ~~low~~ frequency setting that is as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

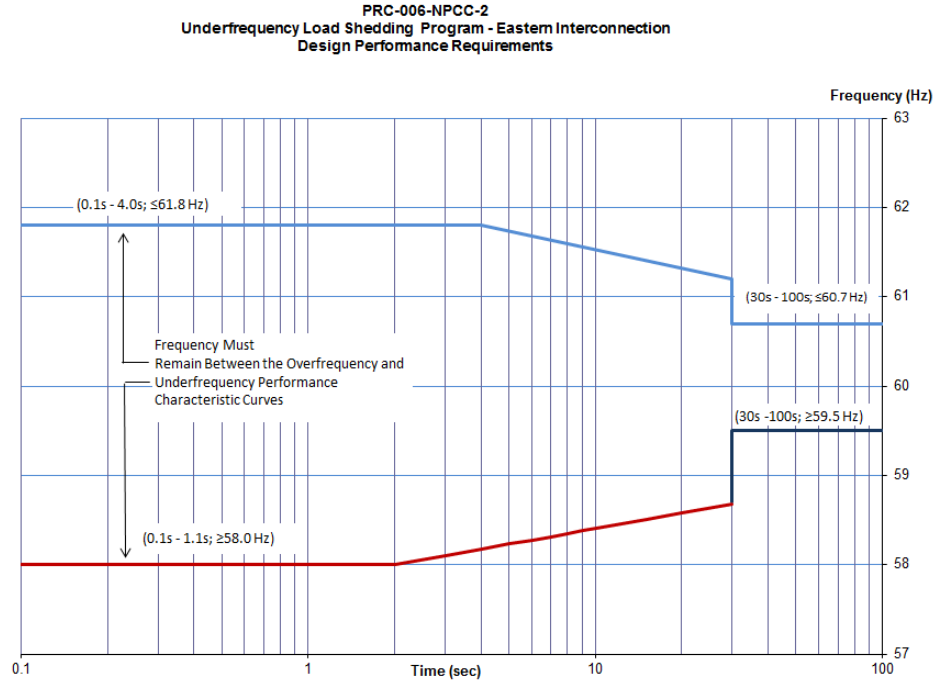
M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

Figure 1

~~PRC-006-NPCC-2~~

~~Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz~~

~~Design Performance Requirements~~



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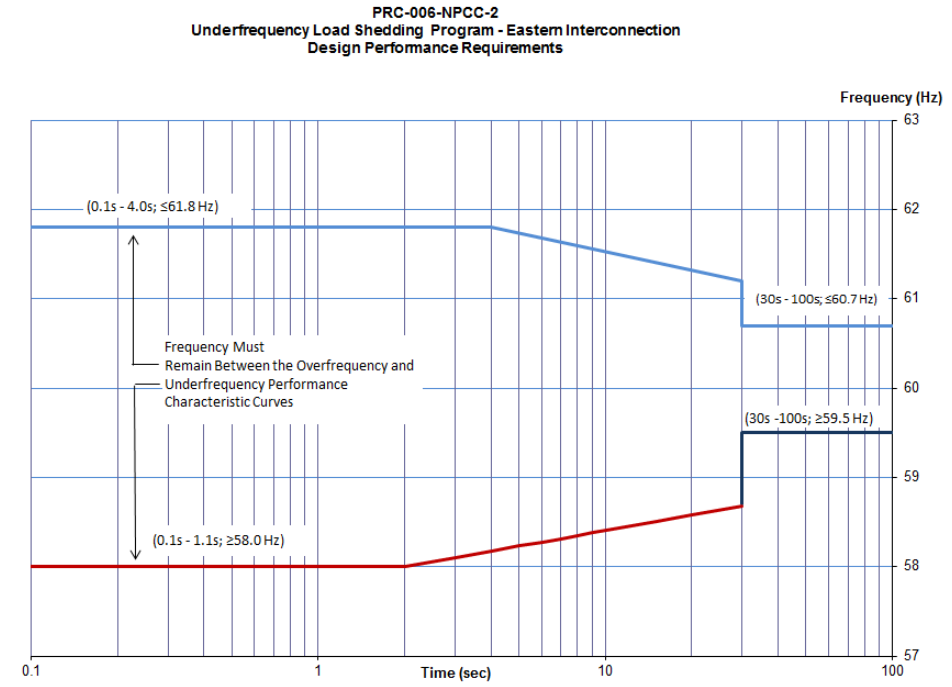
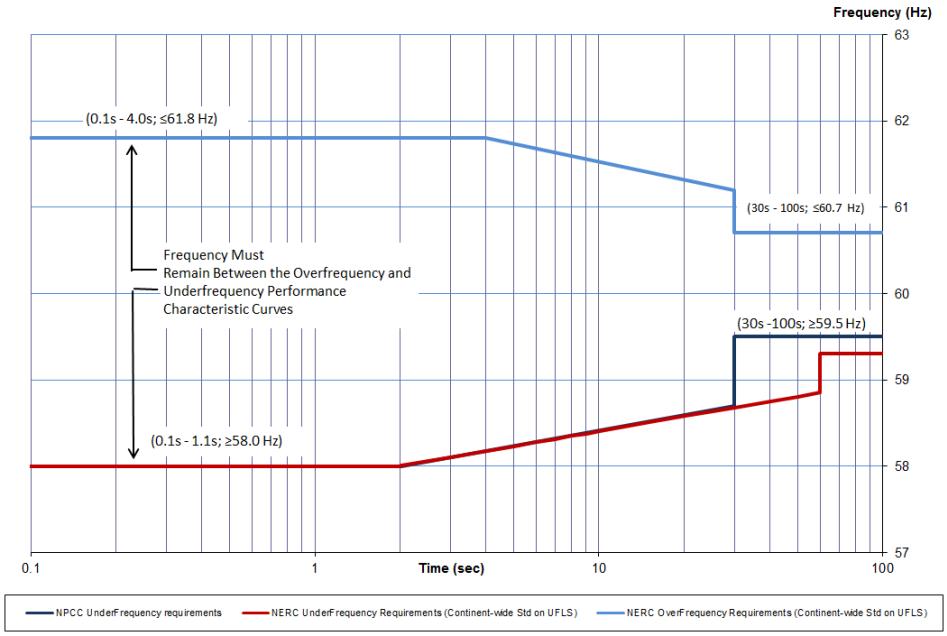
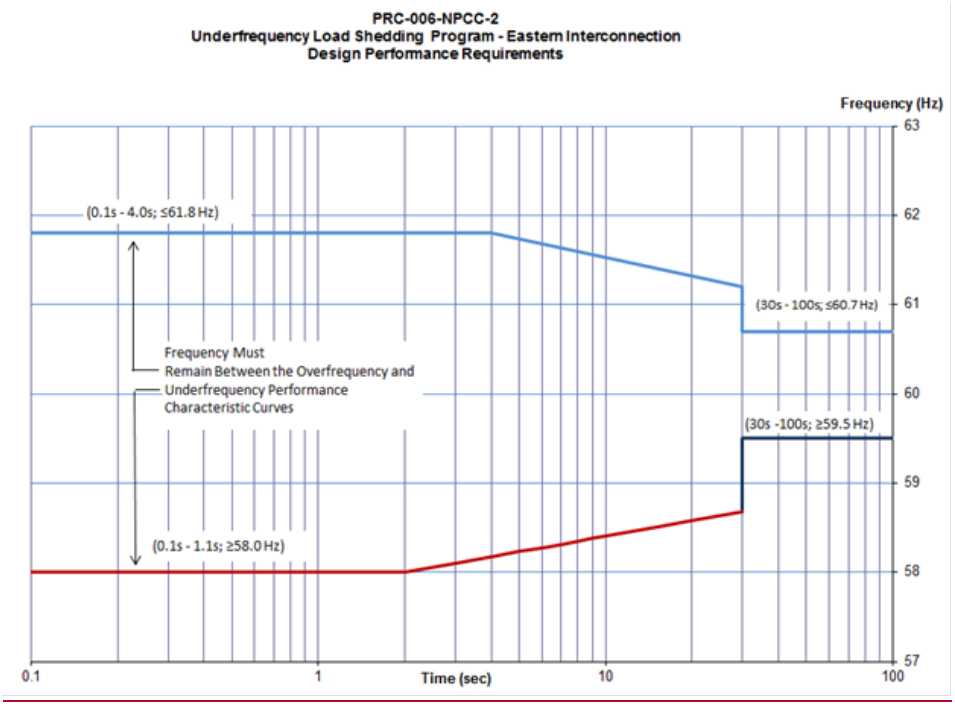

PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
Frequency (Hz)
63
62
61
60
59
58
57
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
10
100
Time (sec)

PRC-006-NPCC-2 Figure 1
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements

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(30s - 100s; ≤60.7 Hz)
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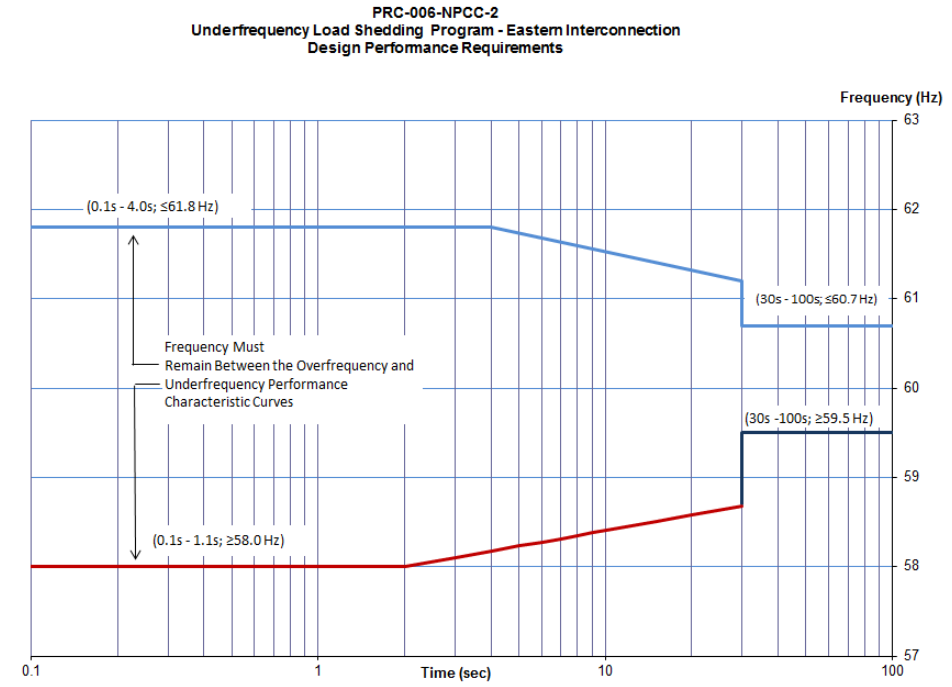
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
Time (sec)
10
100


PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
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Characteristic Curves
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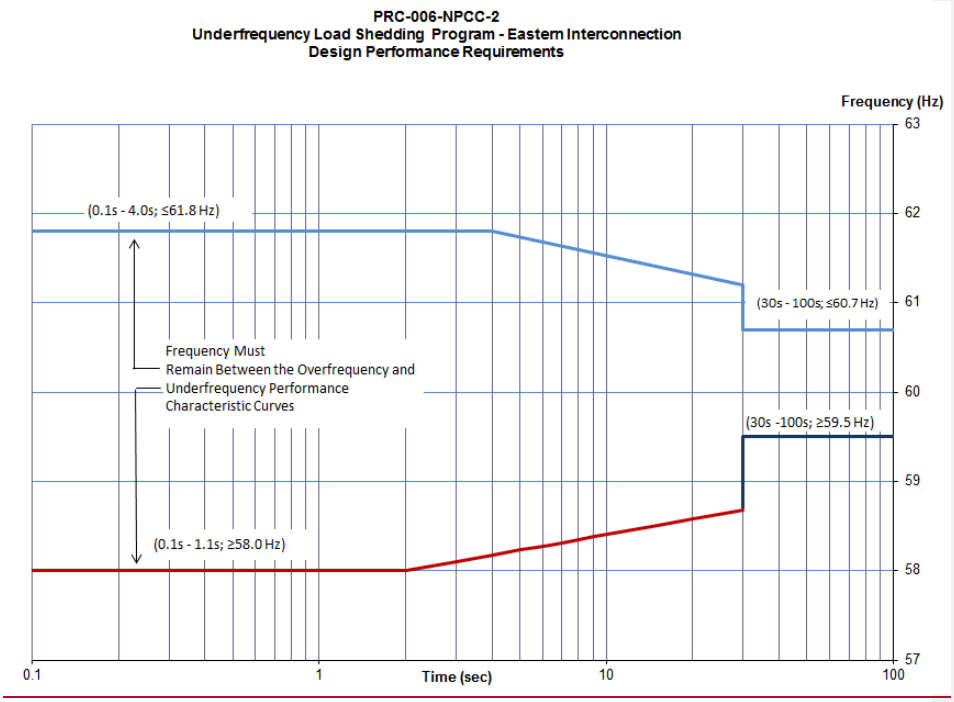
1
10
100
Time (sec)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Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
Frequency (Hz)
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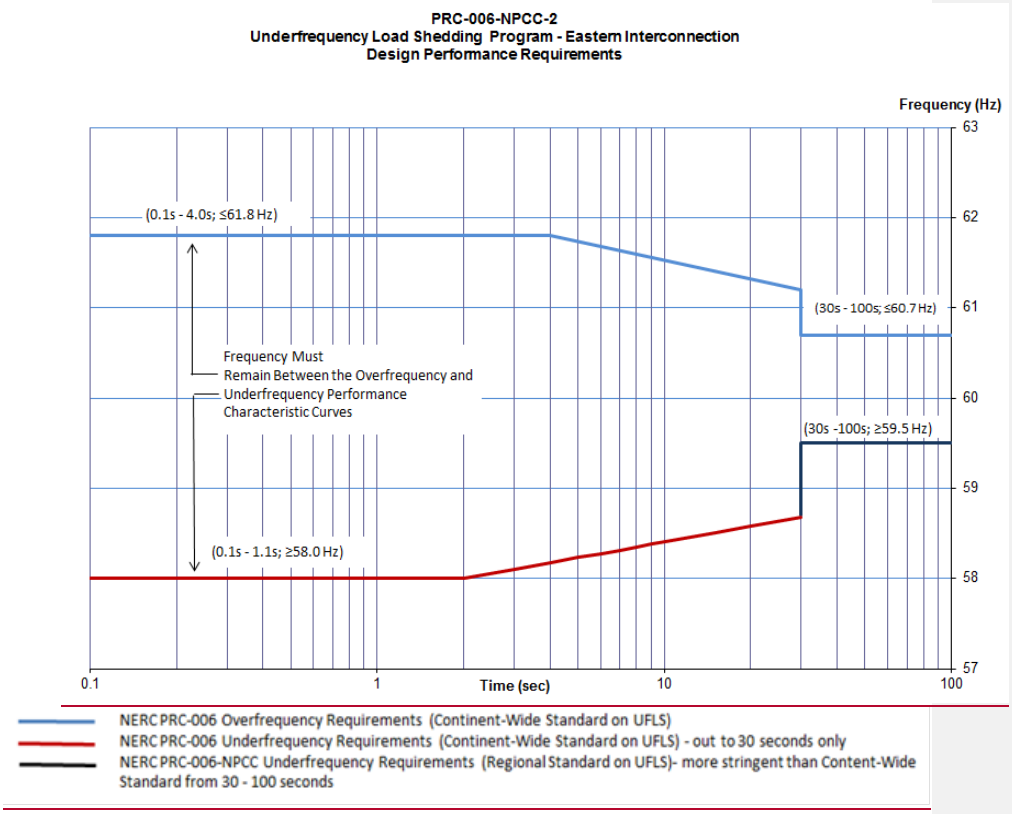
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
10
100
Time (sec)



Curve Data:

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Overfrequency Requirements		Source
t ≤ 4 s	f = 61.8 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
4 s < t ≤ 30 s	f = -0.686log(t) + 62.21 Hz	
t > 30 s	f = 60.7 Hz	

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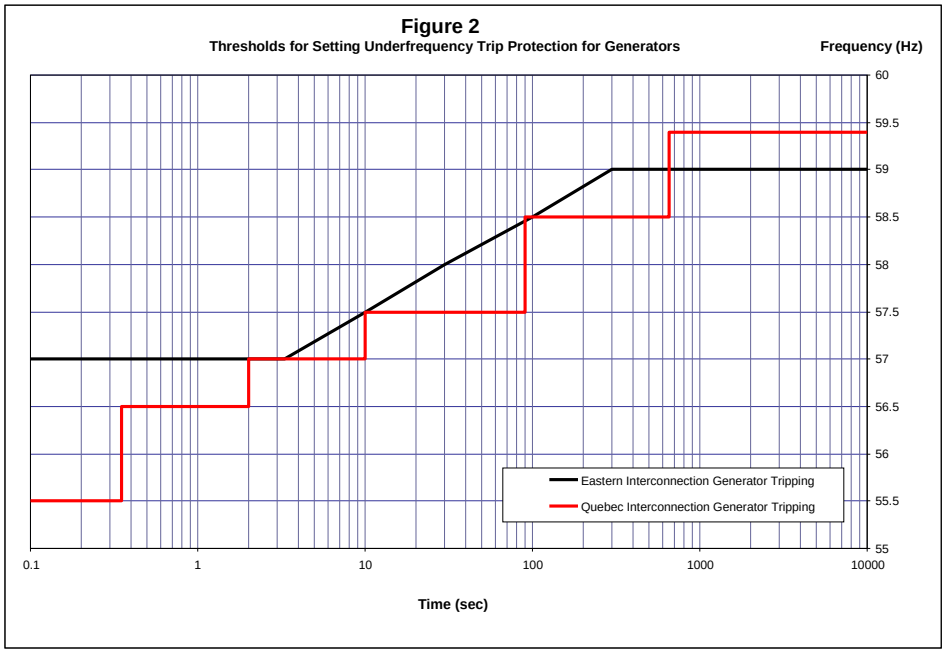
Underfrequency Requirements		Source
t ≤ 2 s	f = 58.0 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
2 s < t ≤ 30 s	f = 0.575log(t) + 57.83 Hz	
t > 30 s	f = 59.5 Hz	NERC PRC-006-NPCC (Regional Standard on UFLS)

Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority:
Northeast Power Coordinating Council

1.2. Evidence Retention:

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 2, 3, 4, 5, 8, and 9.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 6, and 7.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 15.

The Generator Owner shall keep evidence for three calendar years for Measures 10, 11, 12, 13, and 16.

1.3. Compliance Monitoring and Enforcement Program:

Compliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of Load required to be shed at each stage	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load required to be shed at each stage m	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of Load required to be shed at each stage.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required to be shed at each stage
R4.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items

	Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	in Requirement 5 within 60 calendar days of permissible time for each item.
R5.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8.	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning

	approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.	Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.
R9.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10.	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.

R12.	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13.	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14.	N/A	N/A	N/A	The Planning Coordinator did not apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15.	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16.	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

		the settings to the Planning Coordinator as specified in Requirement R16, Part 16.3.	OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	

D. Regional Variances

None.

E. Associated Documents

Technical Rationale

Version History

Version	Date	Action	Change Tracking
1	2-9-2012	Adopted by Board of Trustees	
2	6-23-2015	RSAR Submitted	

Standard Attachments

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (~~April~~July 1, 2015~~7~~ PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in

addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (~~April~~July 1, 201~~57~~ PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment C

UFLS Table 1: Eastern Interconnection Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	28 – 50	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Rationale Box:

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.
PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.
Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

Consolidated Edison Company
of New York, Inc.
4 Irving Place
New York NY 10003-0987

November 2, 2018

VIA EMAIL

Regional Standards Committee (RSC)
NPCC
rscmembers@npcc.org

Subject: PRC-006-NPCC-02 Automatic Underfrequency Load Shedding – Approval to Post for Pre-Ballot and Ballot Period

Dear RSC Members:

The PRC-006-NPCC-2 Automatic Underfrequency Load Shedding Regional Standard has been posted for three 45-day comment periods. The drafting team has responded to every comment from all three periods. NPCC's Manager of Reliability Standards has posted all comment responses onto the NPCC website. The next step, in accordance with the NPCC Regional Standard Processes Manual, is to obtain the RSC's approval to post for a 30-day pre-ballot review period and a subsequent 10-day ballot period. If you have not already done so, please email your approval to Mr. Ruida Shu so he can post the documents for pre-ballot and ballot period.

I'd like to take this opportunity to commend all the members of the Standard Drafting Team, and those who supported them, for their perseverance through the arduous task of re-writing this Regional Standard over the course of the past two years and five months. Their dedication was essential to accomplish the team's mission.

If you have any questions, please don't hesitate to contact me.

Regards

Dan Taft
Chief Engineer – Control Systems Engineering Department
Chair – NPCC PRC-006-NPCC-2 Standard Drafting Team

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A. Introduction

~~2.1~~1. **Title:** **Automatic Underfrequency Load Shedding**

~~2.2~~2. **Number:** PRC-006-NPCC-2~~1~~

~~2.3~~3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document~~To provide a regional reliability standard that ensures the development of an effective automatic underfrequency load shedding (UFLS) program in order to preserve the security and integrity of the bulk power system during declining system frequency events in coordination with the NERC UFLS reliability standard characteristics~~.

~~2.4~~4. **Applicability:**

~~a.~~4.1. Generator Owner

~~b.~~4.2. Planning Coordinator

~~c.~~4.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators~~Distribution Provider~~

~~d.~~4.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators~~Transmission Owner~~

~~2.5~~5. **Effective Date:**

See Implementation Plan ~~For the Eastern Interconnection & Québec Interconnection portions of NPCC excluding the Independent Electricity System Operator (IESO) Planning Coordinator area of NPCC in Ontario, Canada:~~

~~The effective date for Requirements R1, R2, R3, R4, R5, R6, and R7 is the first day of the first calendar quarter following applicable regulatory approval but no earlier than January 1, 2016 The effective date for Requirements R8 through R23 is the first day of the first calendar quarter two years following applicable governmental and regulatory approval.~~

~~For the Independent Electricity System Operator (IESO) Planning Coordinator's area of NPCC in Ontario, Canada:~~

~~All requirements are effective the first day of the first calendar quarter following applicable governmental and regulatory approval but no earlier than April 1, 2017~~.

B. Requirements

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~~Adopted by Board of Trustees: February 9, 2012~~

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

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R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or
(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or
(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

~~**R1** Each Planning Coordinator shall establish requirements for entities aggregating their UFLS programs for each anticipated island and requirements for compensatory load shedding based on islanding criteria (required by the NERC PRC Standard on UFLS). [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]~~

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and

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the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the

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various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*,

12.1 Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.

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12.2 Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

~~**R2 Each Planning Coordinator shall, within 30 days of completion of its system studies required by the NERC PRC Standard on UFLS, identify to the Regional Entity the generation facilities within its Planning Coordinator Area necessary to support the UFLS program performance characteristics. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]**~~

~~**R3 Each Planning Coordinator shall provide to the Transmission Owner, Distribution Provider, and Generator Owner within 30 days upon written request the requirements for entities aggregating the UFLS programs and requirements for compensatory load shedding program derived from each Planning Coordinator's system studies as determined by Requirement R1. [Violation Risk Factor: Low] [Time Horizon: Long Term Planning]**~~

~~**R4 Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program reflecting normal operating conditions excluding outages for its Facilities based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3, or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island identified in Requirement R1 and acting as a single entity, provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load, based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3.**~~
~~**[Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

~~**R5 Each Distribution Provider or Transmission Owner that must arm its load to trip on underfrequency in order to meet its requirements as specified and by doing so exceeds the tolerances and/or deviates from the number of stages and frequency set points of the UFLS program as specified in the tables contained in Requirement R4 above, as applicable depending on its total peak net Load shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

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5.1 Inform its Planning Coordinator of the need to exceed the stated tolerances or the number of stages as shown in UFLS Attachment C, Table 1 if applicable and

5.2 Provide its Planning Coordinator with a technical study that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.

5.3 Inform its Planning Coordinator of the need to exceed the stated tolerances of UFLS Attachment C, Table 2 or Table 3, and in the case of Attachment C, Table 2 only, the need to deviate from providing two stages of UFLS, if applicable, and

5.4 Provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

R6. Each Distribution Provider and Transmission Owner in the Québec Interconnection portion of NPCC shall implement an automatic UFLS program for its Facilities based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4 or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island, identified in Requirement R1, an aggregated automatic UFLS program that sheds Load based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R7. Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with the following minimum time delay:

7.1 Eastern Interconnection – 100 ms

7.2 Québec Interconnection – 200 ms

[Violation Risk Factor: High] [Time Horizon: Long Term Planning]

R8. Each Planning Coordinator shall develop and review once per calendar year settings for inhibit thresholds (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]

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~~R9 Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 days of the initial determination of those inhibit thresholds and within 30 days of any changes to those thresholds. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]~~

~~R10 Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings based on the notification provided by the Planning Coordinator in accordance with Requirement R9. [Violation Risk Factor: High] [Time Horizon: Operations Planning]~~

~~R11 Each Distribution Provider and Transmission Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with R9. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]~~

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~~R12 Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage coincident with their integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would be opened by the UFLS relays. [Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]~~

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~~R13 Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, below the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, except as otherwise exempted in Requirements R16 and R19. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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~~R14 Each Generator Owner shall transmit the generator underfrequency trip setting and time delay to its Planning Coordinator within 45 days of the Planning Coordinator's request. [Violation Risk Factor: High] [Time Horizon: Operations Planning]~~

R15 Each Generator Owner with a new generating unit, scheduled to be in service on or after the effective date of this Standard, or an existing generator increasing its net capability by greater than 10% shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

15.1 Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 1.

15.2 Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1.

R16 Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1 shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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16.1 Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

16.2 Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

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16.3 Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping.

R17 Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

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R18 Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R16.3 for

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~~generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

~~R19. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 1, based on their licensing design basis, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning]~~

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~~19.1 Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8Hz.~~

~~19.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.~~

~~19.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.~~

~~R20 The Planning Coordinator shall update its UFLS program database as specified by the NERC PRC Standard on UFLS. This database shall include the following information: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]~~

~~20.1 For each UFLS relay, including those used for compensatory load shedding, the amount and location of load shed at peak, the corresponding frequency threshold and time delay settings.~~

~~20.2 The buses at which the Load is modeled in the NPCC library power flow case.~~

~~20.3 A list of all generating units that may be tripped for underfrequency conditions above the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, including the frequency trip threshold and time delay for each protection system.~~

~~20.4 The location and amount of additional elements to be switched for voltage control that are coordinated with UFLS program tripping.~~

~~20.5 A list of all UFLS relay inhibit functions along with the corresponding settings and locations of these relays.~~

~~**R21. Each Planning Coordinator shall notify each Distribution Provider, Transmission Owner, and Generator Owner within its Planning Coordinator area of changes to load distribution needed to satisfy UFLS program performance characteristics as specified by the NERC PRC Standard on UFLS.[Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

~~**R22. Each Distribution Provider, Transmission Owner and Generator Owner shall implement the load distribution changes based on the notification provided by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]**~~

~~**R23. Each Distribution Provider, Transmission Owner and Generator Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]**~~

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

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13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

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16.1 Set the underfrequency protection to operate at a frequency setting that is as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

Figure 1

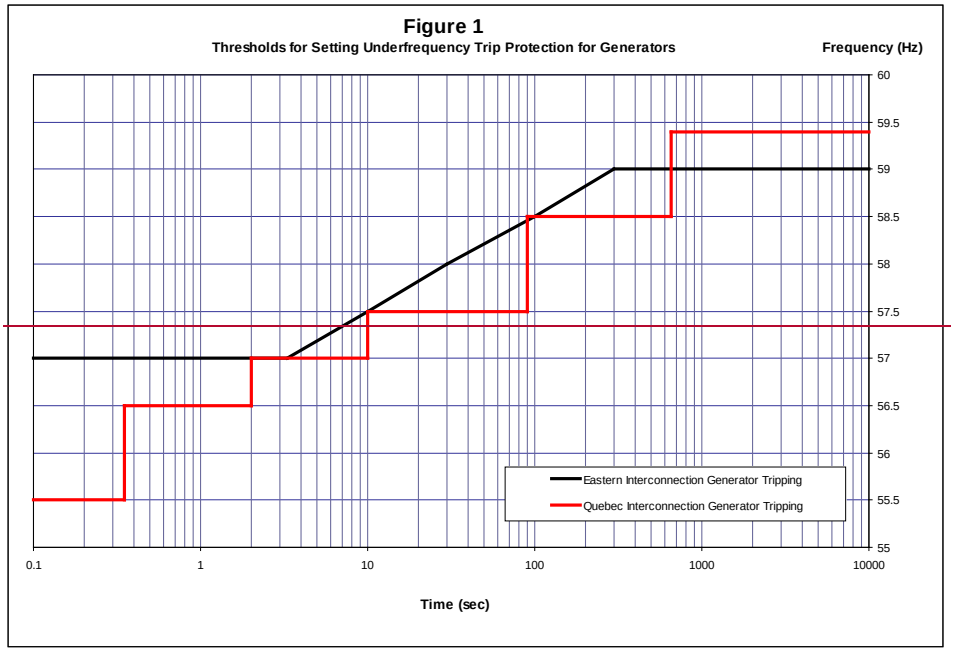

Figure 1

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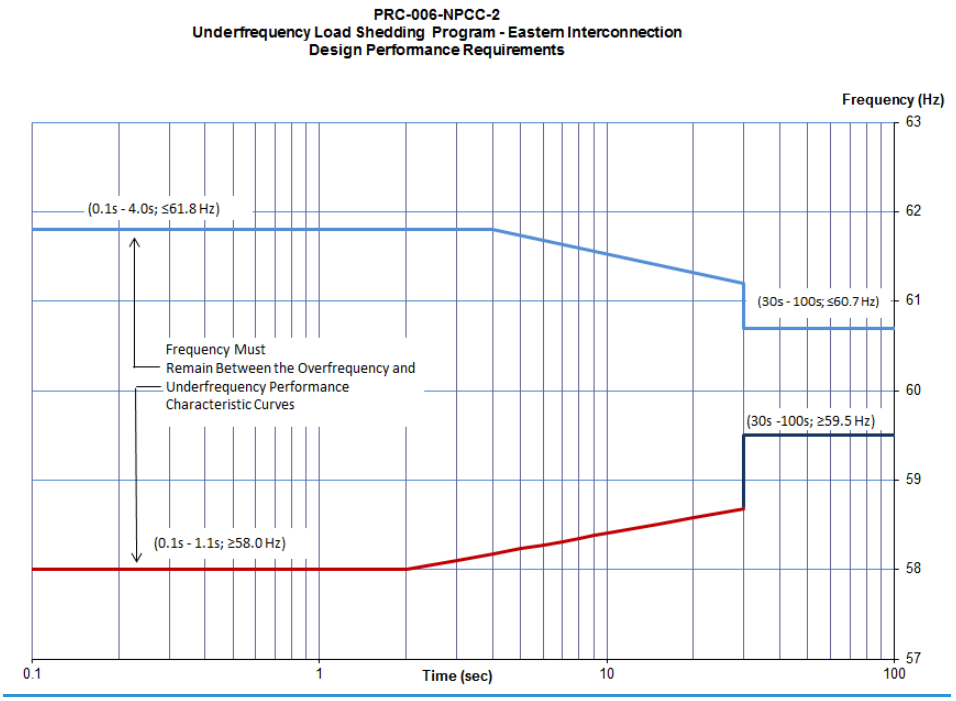

NERC PRC-006 Overfrequency Requirements (Continent-Wide Standard on UFLS)
NERC PRC-006 Underfrequency Requirements (Continent-Wide Standard on UFLS) - out to 30 seconds only
NERC PRC-006-NPCC Underfrequency Requirements (Regional Standard on UFLS)- more stringent than Content-Wide Standard from 30 - 100 seconds

Curve Data:

Overfrequency Requirements		Source
t ≤ 4 s	f = 61.8 Hz	~~NERC PRC-006 (Continent-Wide Standard on UFLS)~~
4 s < t ≤ 30 s	f = -0.686log(t) + 62.21 Hz	
t > 30 s	f = 60.7 Hz	

Underfrequency Requirements		Source
t ≤ 2 s	f = 58.0 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
2 s < t ≤ 30 s	f = 0.575log(t) + 57.83 Hz	
t > 30 s	f = 59.5 Hz	NERC PRC-006-NPCC (Regional Standard on UFLS)

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PRC-006-NPCC-2 Figure 1
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements

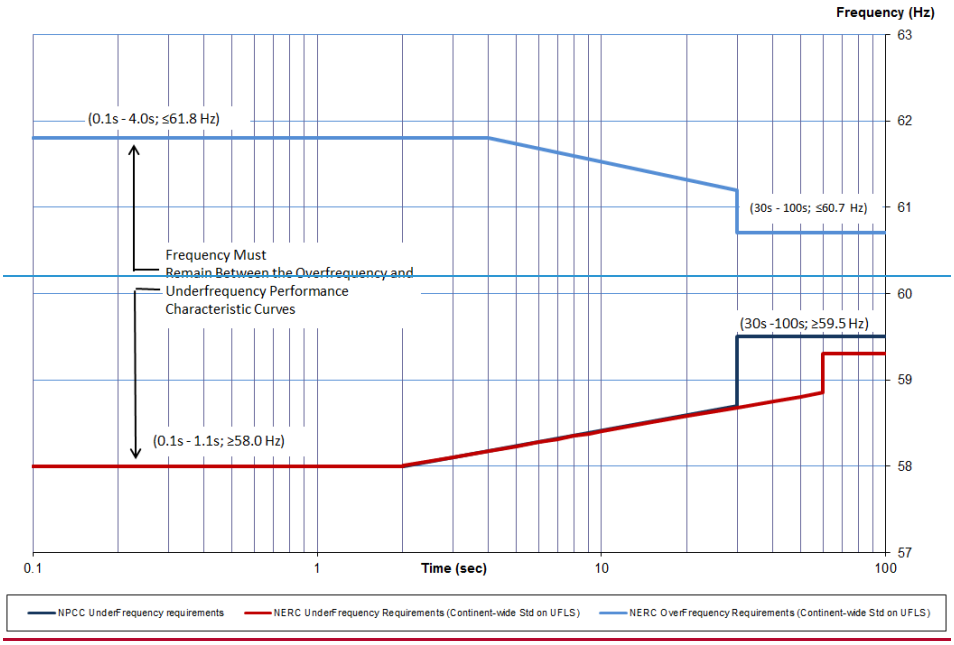

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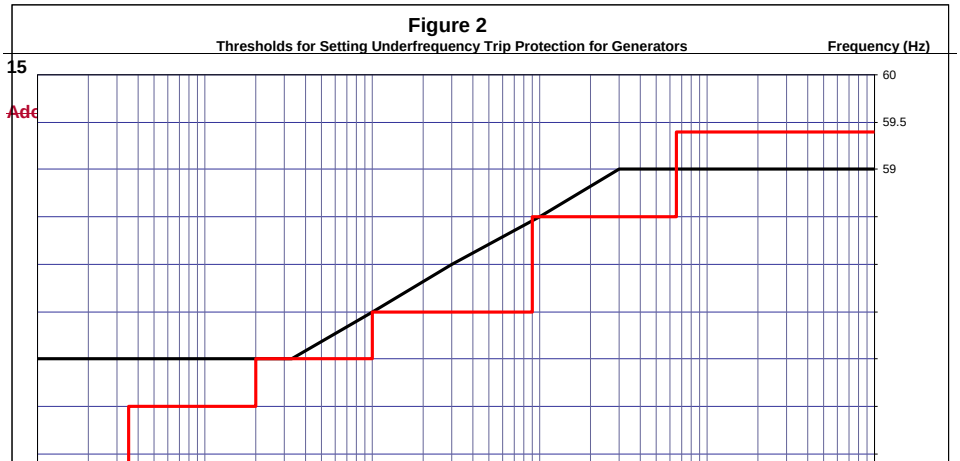
Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



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~~C. Measures~~

M1 Each Planning Coordinator shall have evidence such as reports, system studies and/or real time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

M3 Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets Requirement R3.

M4 Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped, and the corresponding frequency thresholds, on those circuits included in its UFLS program to achieve the individual and cumulative percentages identified in Requirement R4. (Attachment C Tables 1-3).

M5 Each Distribution Provider or Transmission Owner shall have evidence such as reports, analysis, system studies and dated documentation that demonstrates that it meets Requirement R5.

M6 Each Distribution Provider and Transmission Owner in the Québec Interconnection shall have evidence such as documentation or reports containing the location and amount of load to be tripped and the corresponding frequency thresholds on those circuits included in its UFLS program to achieve the load values identified in Table 4 of Requirement R6. (Attachment C Table 4).

M7 Each Distribution Provider and Transmission Owner shall have evidence such as documentation or reports that their underfrequency relays have been set with the minimum time delay, in accordance with Requirement R7.

M8 Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R8.

M9 Each Planning Coordinator shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R9.

M10 Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets or other documentation that demonstrates that it meets Requirement R10.

M11 Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R11.

M12 Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the frequency set point, the net amount of load shed and the percentage of its peak load at each stage of its UFLS program coincident with the integrated hourly peak of the previous year that demonstrates that it meets Requirement R12.

M13 Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R13.

M14 Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R14.

M15 Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R15.

M16 Each Generator Owner with existing non-nuclear units in service prior to the effective date of this Standard which have underfrequency tripping that is not compliant with Requirement R13 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R16.

M17 Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall provide evidence such as emails, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R17.

M18 Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall provide evidence such as emails, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R18.

M19 Each Generator Owner of nuclear units that have been specifically identified by NPCC as having generator trip settings above the generator trip curve in Figure 1 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R19.

M20 Each Planning Coordinator shall provide evidence such as spreadsheets, system studies, or other documentation that demonstrates that it meets the requirements of Requirement R20.

M21 Each Planning Coordinator shall provide evidence such as emails, memorandum or other dated documentation that it meets Requirement R21.

M22 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as reports, spreadsheets or other documentation that demonstrates that it meets Requirement R22.

M23 Each Distribution Provider, Transmission Owner and Generator Owner shall provide evidence such as letters, emails or other dated documentation that demonstrates it meets Requirement 23.

D.C. Compliance

1.11. Compliance Monitoring Process

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a.1.1. Compliance Enforcement Authority

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Northeast Power Coordinating CouncilPCC Compliance Committee

a. **Compliance Monitoring Period and Reset Time Frame**

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Not Applicable

b.1.2. DataEvidence Retention

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 24, 35, 46, 57, 810, and 119, and 12.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 3, 86, and 79, 20, and 21.

The Planning Coordinator in Ontario, Quebec, and the Maritime Provinces shall keep evidence for three calendar years for Measure 17.

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The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 1~~8~~5~~, 22, and 23~~.

The Generator Owner shall keep evidence for three calendar years for Measures 1~~0~~3, 1~~1~~4, 1~~2~~5, 1~~3~~6, and 1~~6~~9.

~~c.~~1.3.Compliance Monitoring and Assessment Processes

Com~~Self-Certifications.~~

~~Spot Checking.~~

~~Compliance Audits.~~

~~Self-Reporting.~~

~~Compliance Violation Investigations.~~

~~Complaints.~~pliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

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~~**d. Additional Compliance Information**~~

~~None.~~

~~1.2~~1. Violation Severity Levels

Requirement	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required

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	Load required to be shed at each stage	required to be shed at each stage m	Load required to be shed at each stage.	to be shed at each stage
R4	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60 calendar days of permissible time for each item.
R5	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6	The Planning Coordinator provided to a Transmission	The Planning Coordinator provided to a Transmission Owner	The Planning Coordinator provided to a Transmission	The Planning Coordinator failed to provide to a

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	Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.

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R9	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days

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	days and less than (and including) 55 calendar days of the Planning Coordinator's request.	days and less than (and including) 65 calendar days of the Planning Coordinator's request.	days and less than (and including) 75 calendar days of the Planning Coordinator's request.	of the Planning Coordinator's request.
R12	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14	N/A	N/A	N/A	The Planning Coordinator did not

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				apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator as specified in Requirement R16, Part 16.3.	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1 OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

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PRC-006-NPCC-1 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate~~The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 1. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all islands identified in Requirement R1 in which the unit may operate~~.

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The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit~~The Planning Coordinator shall identify, compile and maintain an updated list of all existing non-nuclear generating units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1. The list shall include the following information for each unit~~:

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   1.1 Generator name and generating capacity
   1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
   1.3 Physical and electrical location of the unit
   1.4 All islands within which the unit may operate, as identified in Requirement R1

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2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

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2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding~~Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator in Requirement R1 within which the generator may operate to provide compensatory load shedding~~.

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2.2 In Ontario and in the Maritime provinces, ~~T~~the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~.~~.

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2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2~~The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 1~~.

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2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~.

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In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability

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of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~.

PRC-006-NPCC-1 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements~~The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 1 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements~~:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit~~The Generator Owner shall identify and compile a list of all existing non-nuclear generating units in service prior to the effective date of this standard that has underfrequency protection set to trip above the appropriate curve in Figure 1. The list shall include the following information associated with each unit~~:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 1, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~.

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2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 1, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the smallest island identified by the Planning Coordinator in Requirement R1 of this standard~~.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4~~.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip ~~The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip~~.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system~~.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two~~

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~~calendar years, plus expected station loads to be transferred to the system upon loss of the facility~~.

PRC-006-NPCC-1 Attachment C

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UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW or more of peak net Load shall implement a UFLS program with the following attributes:

Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
59.5	0.30	6.5 – 7.5	6.5 – 7.5
59.3	0.30	6.5 – 7.5	13.5 – 14.5
59.1	0.30	6.5 – 7.5	20.5 – 21.5
58.9	0.30	6.5 – 7.5	27.5 – 28.5
59.5	10.0	2 – 3	– 31.5

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UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW or more and less than 100 MW of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time(s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	14-25	14-25
2	59.1	0.30	14-25	28-50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

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UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW or more and less than 50 MW of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.30	28 50	28 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

~~UFLS Table 4: Quebec Interconnection~~

	~~Rate~~	~~Frequency (Hz)~~	~~MW at peak (*Load must be fixed at all times when above 60% of peak load..)~~	~~Mvar at peak~~	~~Total Nominal Operating Time (s)~~ [2]
~~Threshold Stage 1~~	~~——~~	~~58.5~~	~~1000*~~	~~1000~~	~~0.30~~
~~Threshold Stage 2~~	~~——~~	~~58.0~~	~~800*~~	~~800~~	~~0.30~~
~~Threshold Stage 3~~	~~——~~	~~57.5~~	~~800~~	~~800~~	~~0.30~~
~~Threshold Stage 4~~	~~——~~	~~57.0~~	~~800~~	~~800~~	~~0.30~~
~~Threshold Stage 5 (anti-stall)~~	~~——~~	~~59.0~~	~~500~~	~~500~~	~~20.0~~
~~Slope Stage 1~~	~~-0.3 Hz/s~~	~~58.5~~	~~400~~	~~400~~	~~0.30~~
~~Slope Stage 2~~	~~-0.4 Hz/s~~	~~59.8~~	~~800*~~	~~800~~	~~0.30~~
~~Slope Stage 3~~	~~-0.6 Hz/s~~	~~59.8~~	~~800*~~	~~800~~	~~0.30~~
~~Slope Stage 4~~	~~-0.9 Hz/s~~	~~59.8~~	~~800~~	~~800~~	~~0.30~~

UFLS Table 1: Eastern Interconnection

Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold	Minimum Relay Time	Total Nominal	Load Shed at Stage as % of	Cumulative Load Shed as

~~2. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communications time, and the rated breaker interrupting time. The underfrequency relay operating time shall be measured from the time when the frequency passes through the frequency threshold set point.~~

	(Hz)	Delay (s)	Operating Time (s)[2]	TO or DP Load	% of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection

Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

UFLS Table 3: Eastern Interconnection

Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:

UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.

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1	59.5	0.10	0.30	28 – 50	28 – 50

Rationale Box:

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Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.

PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.

Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling

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Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard is adopted by the NERC Board of Trustees (Board).

Description of Current Draft

Completed Actions	Date
Regional Standards Committee approved Regional Standard Authorization Request (RSAR) for posting	June 23, 2015

Anticipated Actions	Date
1st 45-day Formal Comment Period	September 1, 2017 - October 18, 2017
2nd 45-day Formal Comment Period	April 16, 2018 – June 1, 2018
30-day Pre-ballot Period	
10-day ballot Period	
Board adoption	

Upon Board adoption, the rationale boxes will be moved to the Supplemental Material Section.

A. Introduction

1. **Title:** Automatic Underfrequency Load Shedding

2. **Number:** PRC-006-NPCC-2

3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.

4. **Applicability:**

   4.1. Functional Entities:

   4.1.1. Generator Owner

   4.1.2. Planning Coordinator

   4.1.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators

   4.1.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators

5. **Effective Date:** See Implementation Plan.

B. Requirements and Measures

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent-wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or
(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or
(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

- **12.1** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.
- **12.2** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that

is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

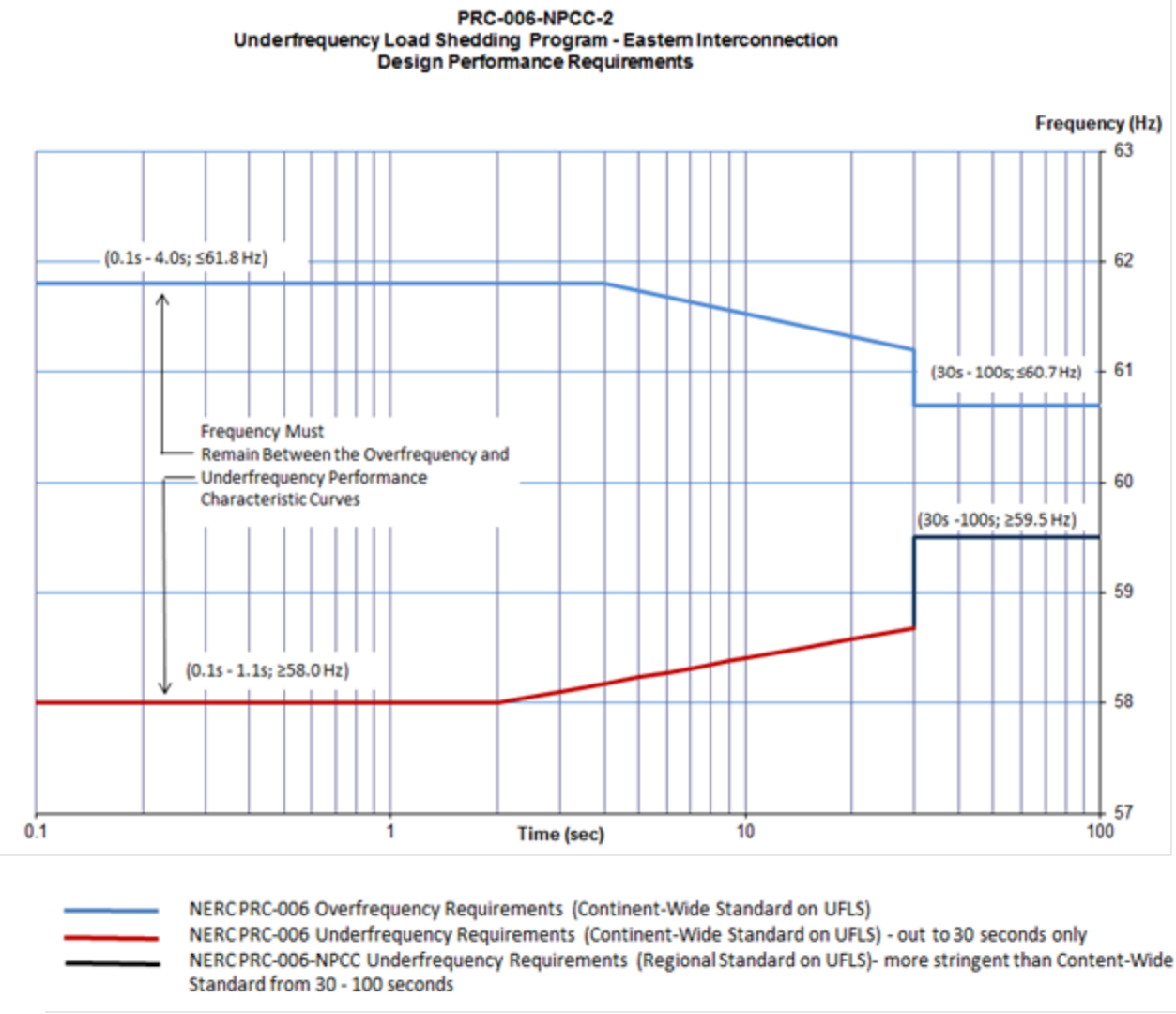
16.1 Set the underfrequency protection to operate at a frequency setting that is as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

Figure 1

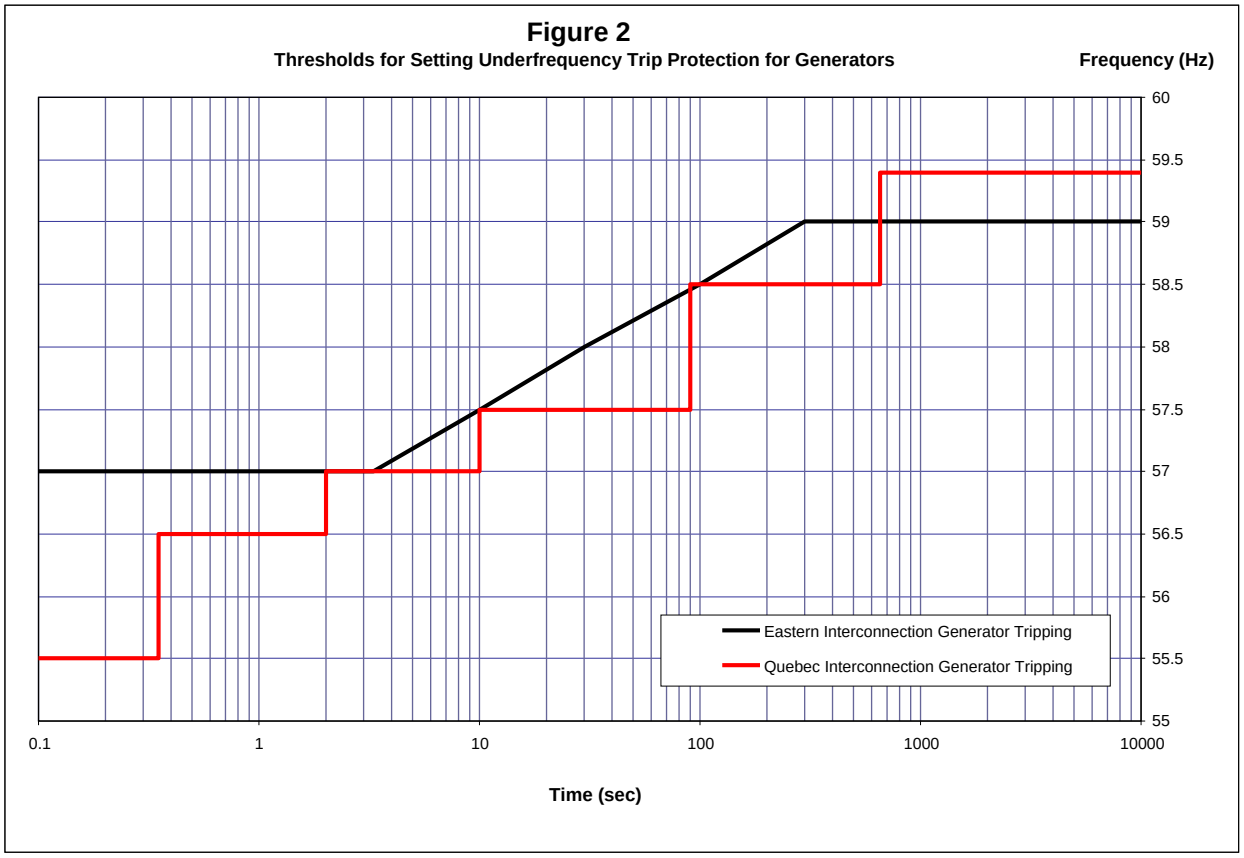


Curve Data:

Overfrequency Requirements		**Source**
t ≤ 4 s	f = 61.8 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
4 s < t ≤ 30 s	f = -0.686log(t) + 62.21 Hz	
t > 30 s	f = 60.7 Hz	

Underfrequency Requirements		**Source**
t ≤ 2 s	f = 58.0 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
2 s < t ≤ 30 s	f = 0.575log(t) + 57.83 Hz	
t > 30 s	f = 59.5 Hz	NERC PRC-006-NPCC (Regional Standard on UFLS)

Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority:

Northeast Power Coordinating Council

1.2. Evidence Retention:

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 2, 3, 4, 5, 8, and 9.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 6, and 7.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 15.

The Generator Owner shall keep evidence for three calendar years for Measures 10, 11, 12, 13, and 16.

1.3. Compliance Monitoring and Enforcement Program:

Compliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of Load required to be shed at each stage	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load required to be shed at each stage m	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of Load required to be shed at each stage.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required to be shed at each stage
R4.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60

	Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	calendar days of permissible time for each item.
R5.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8.	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with

	less than 100% but more than (and including) 95% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.
R9.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10.	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.
R12.	N/A	N/A	The Generator Owner with a new generating unit, or an existing	The Generator Owner with a new generating unit, or an existing generator increasing its net

			generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13.	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14.	N/A	N/A	N/A	The Planning Coordinator did not apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15.	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16.	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1 OR	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

		Coordinator as specified in Requirement R16, Part 16.3.	Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	

D. Regional Variances

None.

E. Associated Documents

Technical Rationale

Version History

Version	Date	Action	Change Tracking
1	2-9-2012	Adopted by Board of Trustees	
2	6-23-2015	RSAR Submitted	

Standard Attachments

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in

addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment C

UFLS Table 1: Eastern Interconnection Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	28 – 50	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Rationale Box:

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.
PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.
Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard is adopted by the NERC Board of Trustees (Board).

Description of Current Draft

Completed Actions	Date
Regional Standards Committee approved Regional Standard Authorization Request (RSAR) for posting	June 23, 2015

Anticipated Actions	Date
1st 45-day Formal Comment Period	September 1, 2017 - October 18, 2017
2nd 45-day Formal Comment Period	April 16, 2018 – June 1, 2018
30-day Pre-ballot Period	
10-day ballot Period	
Board adoption	

Upon Board adoption, the rationale boxes will be moved to the Supplemental Material Section.

A. Introduction

1. **Title:** Automatic Underfrequency Load Shedding
2. **Number:** PRC-006-NPCC-2
3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.
4. **Applicability:**
   - **4.1. Functional Entities:**
     - **4.1.1.** Generator Owner
     - **4.1.2.** Planning Coordinator
     - **4.1.3.** Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators
     - **4.1.4.** Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators
5. **Effective Date:** See Implementation Plan.

B. Requirements and Measures

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent-wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or
(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or
(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

- **12.1** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.
- **12.2** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that

is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

16.1 Set the underfrequency protection to operate at ~~as~~ a ~~low~~ frequency setting that is as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

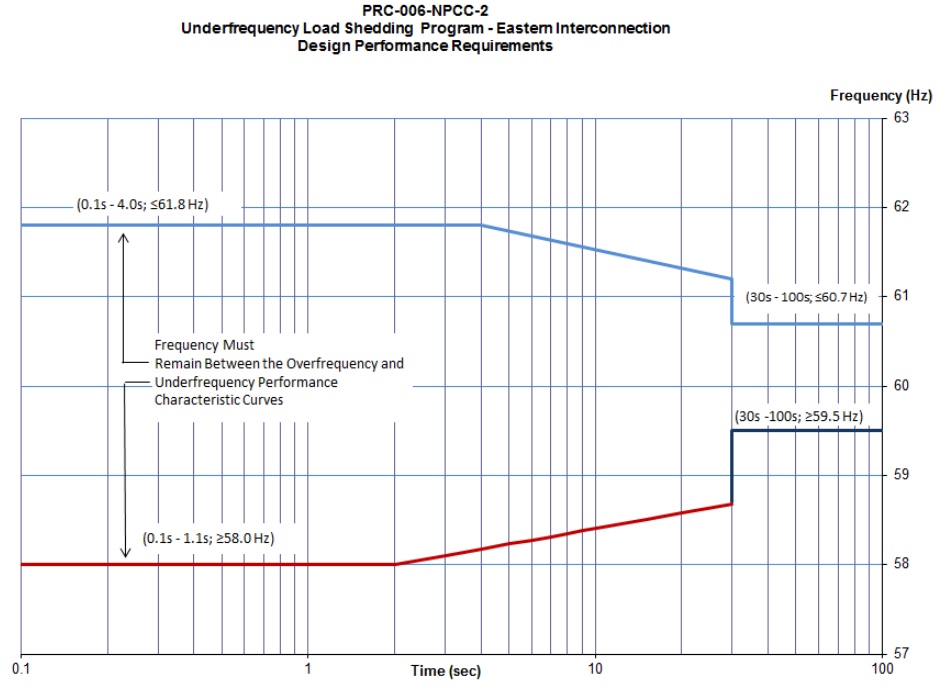
M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

Figure 1

~~PRC-006-NPCC-2~~

~~Underfrequency Load Shedding Program – Eastern Interconnection Frequency Hz~~

~~Design Performance Requirements~~



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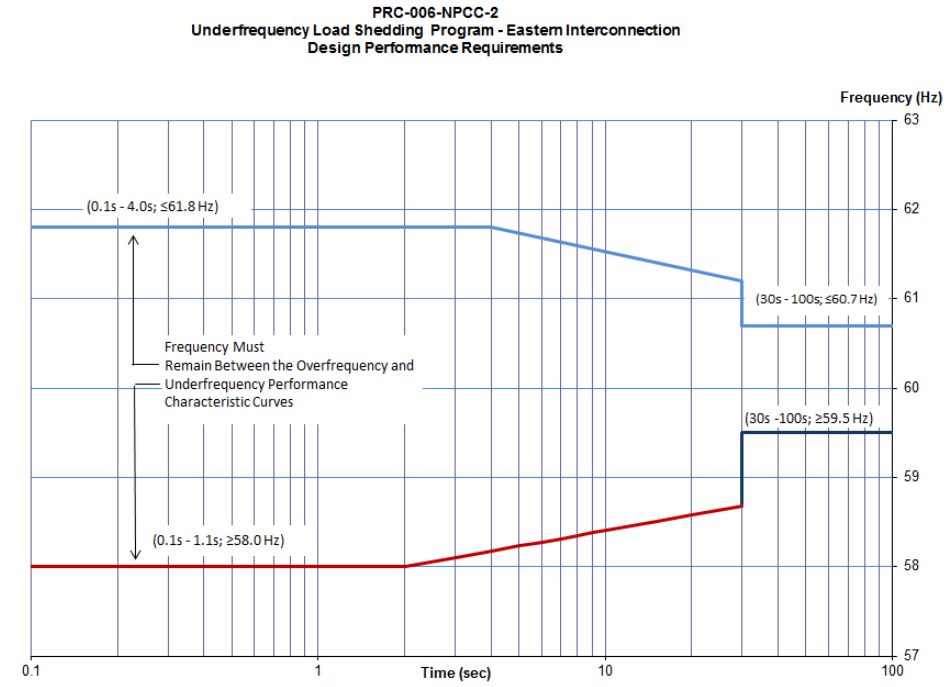
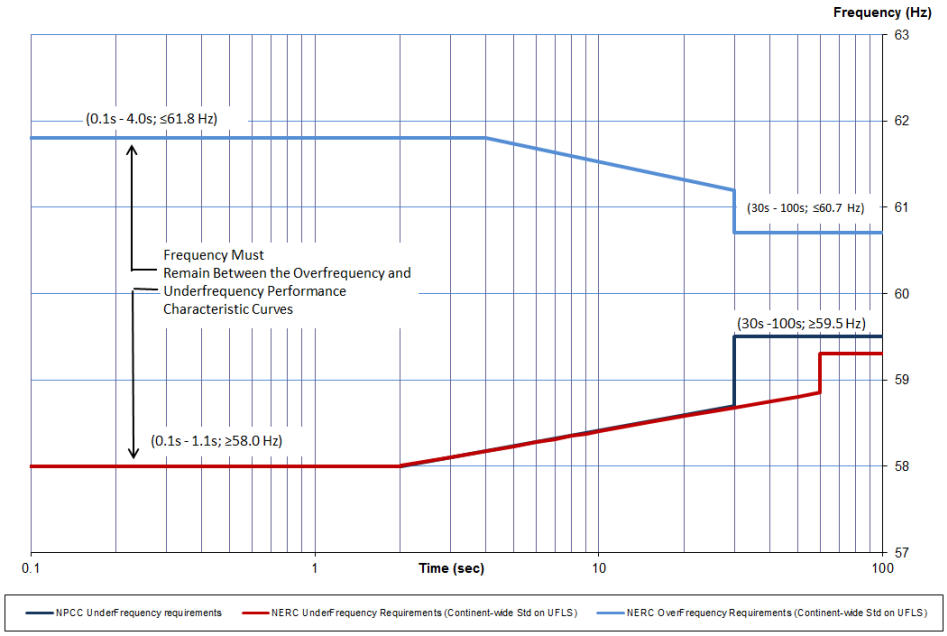
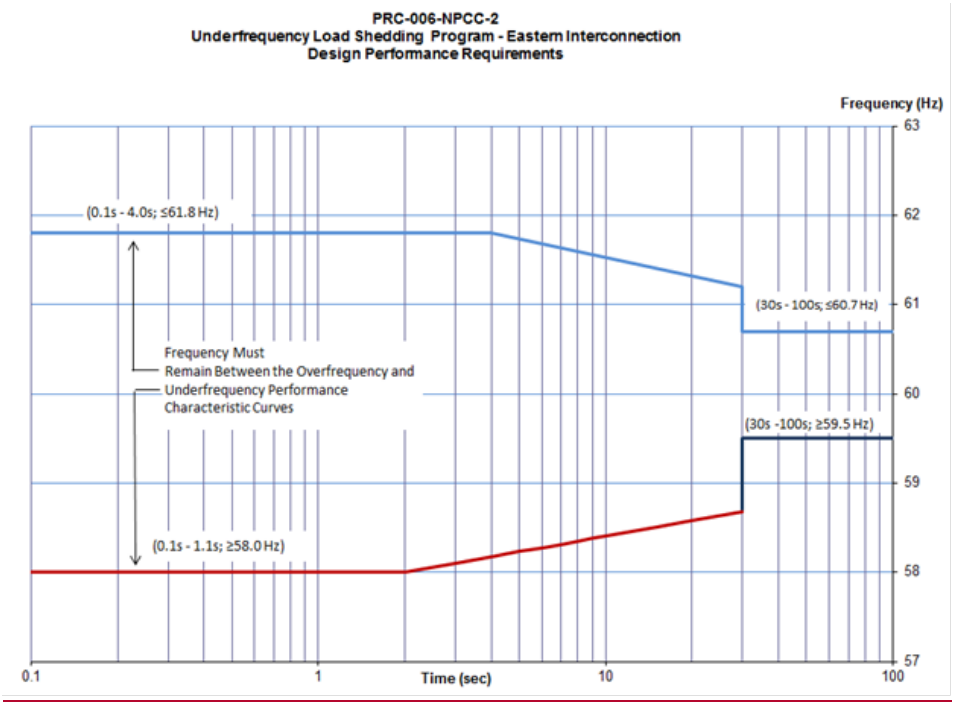
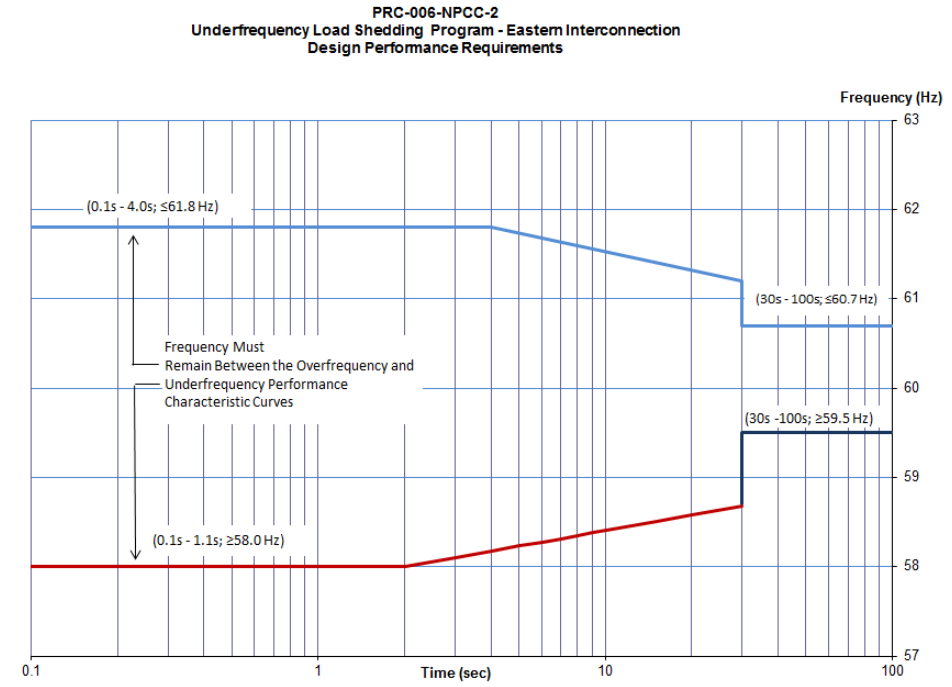

PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
Frequency (Hz)
63
62
61
60
59
58
57
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
10
100
Time (sec)

PRC-006-NPCC-2 Figure 1
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements




PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
Frequency (Hz)
63
62
61
60
59
58
57
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
Time (sec)
10
100


PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
Frequency (Hz)
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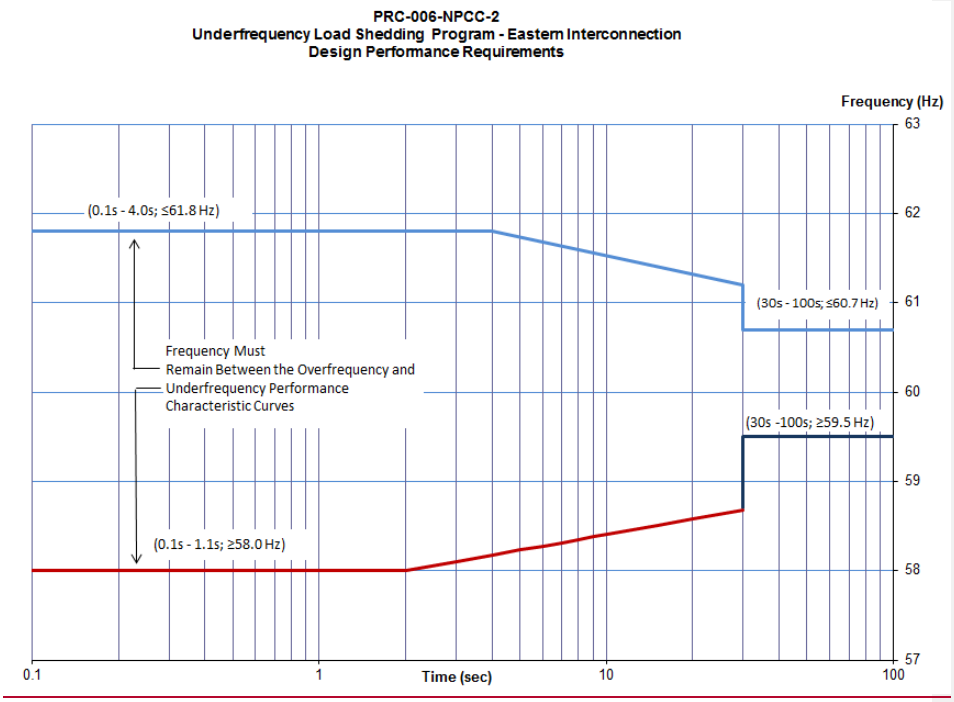
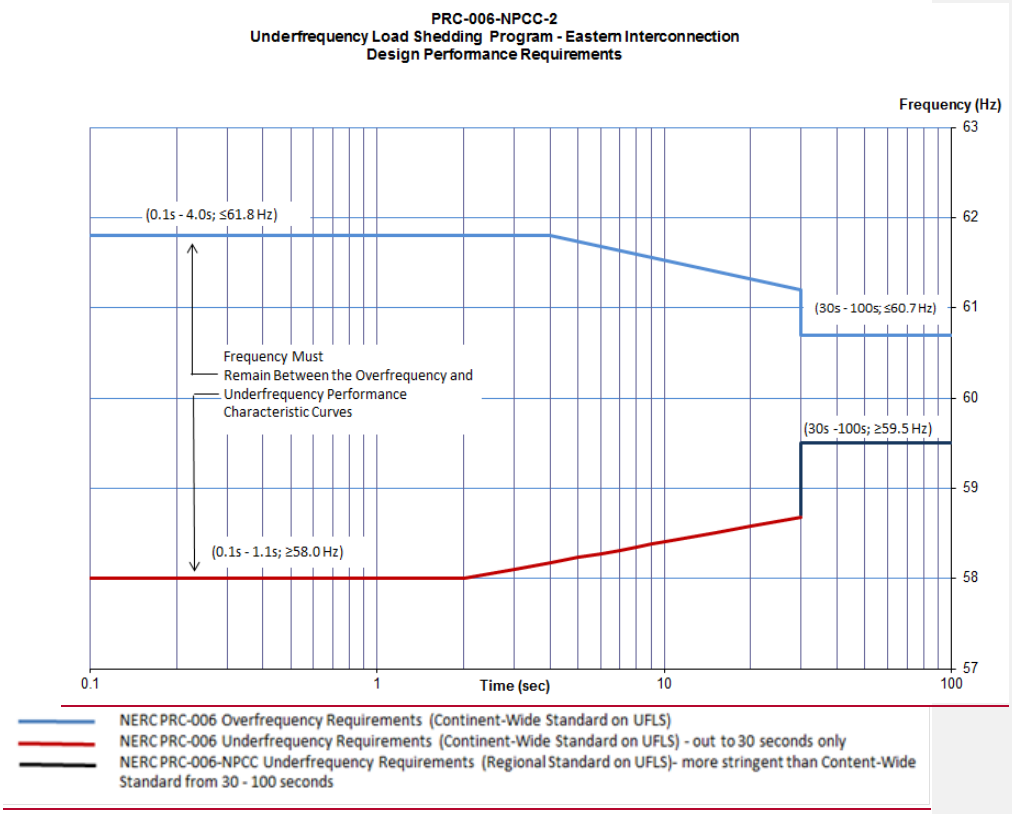
62
61
60
59
58
57
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
10
100
Time (sec)


PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements
Frequency (Hz)
63
62
61
60
59
58
57
(0.1s - 4.0s; ≤61.8 Hz)
(30s - 100s; ≤60.7 Hz)
Frequency Must
Remain Between the Overfrequency and
Underfrequency Performance
Characteristic Curves
(30s -100s; ≥59.5 Hz)
(0.1s - 1.1s; ≥58.0 Hz)
0.1
1
10
100
Time (sec)



Curve Data:

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Overfrequency Requirements		Source
t ≤ 4 s	f = 61.8 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
4 s < t ≤ 30 s	f = -0.686log(t) + 62.21 Hz	
t > 30 s	f = 60.7 Hz	

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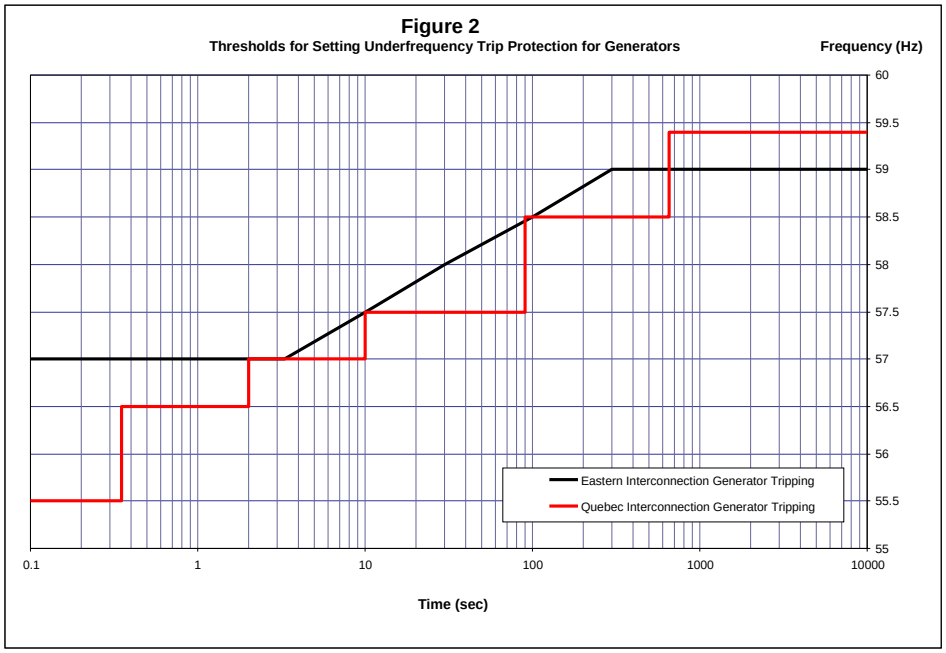
Underfrequency Requirements		Source
t ≤ 2 s	f = 58.0 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
2 s < t ≤ 30 s	f = 0.575log(t) + 57.83 Hz	
t > 30 s	f = 59.5 Hz	NERC PRC-006-NPCC (Regional Standard on UFLS)

Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority:
Northeast Power Coordinating Council

1.2. Evidence Retention:

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 2, 3, 4, 5, 8, and 9.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 6, and 7.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 15.

The Generator Owner shall keep evidence for three calendar years for Measures 10, 11, 12, 13, and 16.

1.3. Compliance Monitoring and Enforcement Program:

Compliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC ~~continent wide~~continent-wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of Load required to be shed at each stage	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load required to be shed at each stage m	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of Load required to be shed at each stage.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required to be shed at each stage
R4.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items

	Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	Program fulfilled its obligations for Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	but exceeded the permissible time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	in Requirement 5 within 60 calendar days of permissible time for each item.
R5.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8.	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning

	approved implementation plan for less than 100% but more than (and including) 95% of UFLS relays.	Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	Coordinator in accordance with the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.
R9.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10.	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.

R12.	N/A	N/A	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	The Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13.	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14.	N/A	N/A	N/A	The Planning Coordinator did not apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15.	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16.	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

		the settings to the Planning Coordinator as specified in Requirement R16, Part 16.3.	OR Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	

D. Regional Variances

None.

E. Associated Documents

Technical Rationale

Version History

Version	Date	Action	Change Tracking
1	2-9-2012	Adopted by Board of Trustees	
2	6-23-2015	RSAR Submitted	

Standard Attachments

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (~~April~~July 1, 2015~~7~~ PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in

addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (~~April~~July 1, 201~~57~~ PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment C

UFLS Table 1: Eastern Interconnection Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	28 – 50	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Rationale Box:

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.
PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.
Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

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Implementation Plan

Regional Reliability Standard PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Applicable Standard(s)

- PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Requested Retirement(s)

- PRC-006-NPCC-1 – Automatic Underfrequency Load Shedding

Applicable Entities

- Generator Owners
- Planning Coordinators
- Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.
- Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

Background

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. To determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. To determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Review Attachment C in PRC-006-NPCC-1 to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. Review and revise Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

Effective Date

All requirements with the exception of R3 will be enforceable on the first day of the first calendar quarter following the applicable governmental and regulatory approvals.

R3 will be enforceable on the first day of the first calendar quarter 12 months following the applicable governmental and regulatory approvals.

Retirement Date

The NPCC Regional Reliability Standard PRC-006-NPCC-1 shall be retired immediately prior to the Effective Date of PRC-006-NPCC-2.

Mapping Document

Draft NPCC Regional Automatic Underfrequency Load Shedding Standard
PRC-006-NPCC-2

NPCC's regional standard PRC-006-NPCC-2 "Automatic Underfrequency Load Shedding" (UFLS) was effective in the US in July 2015. The standard is currently under revision to align with the continent-wide PRC-006-2 UFLS standard which became effective on October 2015. The draft of PRC-006-NPCC-2 removes duplicity with the continent wide standard and adds specificity to allow retirement of the NPCC UFLS Directory #12 containing more stringent UFLS performance criteria and harmonizes the requirements and criteria of all these documents.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
PRC-006-NPCC-1 **R1** Each Planning Coordinator shall establish requirements for entities aggregating their UFLS programs for each anticipated island and requirements for compensatory load shedding based on islanding criteria (required by the NERC PRC Standard on UFLS). [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R2**. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]* **R3.** Each Distribution Provider and Transmission Owner in the Eastern	The purpose of R1 in PRC-006-NPCC-1 was to ensure entities that aggregate their load understand what the UFLS island boundaries are and establish criteria for compensatory load shedding. The revised R2, R3, and R13 clearly address this in the proposed PRC-006-NPCC-2.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* • The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or • The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3. **R13.** For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning*]* **13.1.** Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	the plant design and licensing limitations. **13.2.** Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator. **13.3.** Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	13.4. Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.	
PRC-006-NPCC-1 **R2** Each Planning Coordinator shall, within 30 days of completion of its system studies required by the NERC PRC Standard on UFLS, identify to the Regional Entity the generation facilities within its Planning Coordinator Area	**PRC-006-NPCC-2** **R1.** Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance	The original R2 is redundant and it is being covered by the new R1, R2 and R3.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
necessary to support the UFLS program performance characteristics. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]	characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* **R2**. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]* **R3.** Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	the NERC continent wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* • The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or • The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3	
PRC-006-NPCC-1 **R3** Each Planning Coordinator shall provide to the Transmission Owner, Distribution Provider, and Generator Owner within 30 days upon written request the requirements for entities aggregating the UFLS programs and requirements for compensatory load shedding program derived from each Planning Coordinator's system studies as determined by Requirement R1. [Violation Risk Factor: Low] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R2**. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]* **R13.** For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure	The reliability intent of Version 1 R3 was to ensure that the entities aggregating load were aware of the island boundaries. This is covered in draft R2 of the proposed revision to the standard. Requirements regarding compensatory load shedding have been clarified and are covered through draft R13.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	2: [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning*]* **13.1.** Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations. **13.2.** Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator. **13.3.** Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2. **13.4.** Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.	
PRC-006-NPCC-1 **R4** Each Distribution Provider and Transmission Owner in the Eastern	**PRC-006-NPCC-2** **R4.** Each Distribution Provider or Transmission Owner in the Eastern	Added clarity and combined with the original R4 and R5 into one requirement.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
Interconnection portion of NPCC shall implement an automatic UFLS program reflecting normal operating conditions excluding outages for its Facilities based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3, or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island identified in Requirement R1 and acting as a single entity, provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load, based on frequency thresholds, total nominal operating time and amounts specified in Attachment C, Tables 1 through 3. [Violation Risk Factor: High] [Time Horizon: Long Term Planning	Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* • Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and • Within the following 180 calendar days from notification of the Planning Coordinator, (1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or (2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or (3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
PRC-006-NPCC-1 **R5** Each Distribution Provider or Transmission Owner that must arm its load to trip on underfrequency in order to meet its requirements as specified and by doing so exceeds the tolerances and/or deviates from the number of stages and frequency set points of the UFLS program as specified in the tables contained in Requirement R4 above, as applicable depending on its total peak net Load shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning] **5.1** Inform its Planning Coordinator of the need to exceed the stated tolerances or the number of stages as shown in UFLS Attachment C, Table 1 if applicable and **5.2** Provide its Planning Coordinator with a technical study that demonstrates that the Distribution Providers or Transmission Owners specific deviations from the requirements of UFLS Attachment C, Table 1 will not have a significant adverse impact on the bulk power system.	**PRC-006-NPCC-2** **R4.** Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* • Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and • Within the following 180 calendar days from notification of the Planning Coordinator, (1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or	Added clarity and combined with the original R4 and R5 into one requirement.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
5.3 Inform its Planning Coordinator of the need to exceed the stated tolerances of UFLS Attachment C, Table 2 or Table 3, and in the case of Attachment C, Table 2 only, the need to deviate from providing two stages of UFLS, if applicable, and **5.4** Provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.	(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or (3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3	
PRC-006-NPCC-1 **R6** Each Distribution Provider and Transmission Owner in the Québec Interconnection portion of NPCC shall implement an automatic UFLS program for its Facilities based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4 or shall collectively implement by mutual agreement with one or more Distribution Providers and Transmission Owners within the same island, identified in Requirement R1, an aggregated automatic UFLS program that sheds Load based on the frequency thresholds, slopes, total nominal operating time and amounts specified in Attachment C, Table 4. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]		The drafting team agreed to retire the requirement because it is redundant to the Quebec Variance section of the PRC-006-3 NERC standard.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
PRC-006-NPCC-1 **R7** Each Distribution Provider and Transmission Owner shall set each underfrequency relay that is part of its region's UFLS program with the following minimum time delay: 7.1 Eastern Interconnection – 100 ms 7.2 Québec Interconnection – 200 ms [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2**	The drafting team agreed to retire the requirement because the time delay is added into Attachment C tables.
PRC-006-NPCC-1 **R8** Each Planning Coordinator shall develop and review once per calendar year settings for inhibit thresholds (such as but not limited to voltage, current and time) to be utilized within its region's UFLS program. [Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R5.** Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*	Periodicty of develop and review settings has been increased from once per calendar year to once per five calendar years. This coincides with the the periodicity of UFLS studies. Having a yearly "develop and review" without taking any further action is strictly administrative and does nothing for reliability (P-81 type of issue).

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
NPCC-006-NPCC-1 **R9** Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 days of the initial determination of those inhibit thresholds and within 30 days of any changes to those thresholds. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]	**NPCC-006-NPCC-2** **R6.** Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*	Clarified the language.
NPCC-006-NPCC-1 **R10** Each Distribution Provider and Transmission Owner shall implement the inhibit threshold settings based on the notification provided by the Planning Coordinator in accordance with Requirement R9. [Violation Risk Factor: High] [Time Horizon: Operations Planning]	**NPCC-006-NPCC-2** **R8.** Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operations Planning]*	Only made changes to requirement numbers referenced only. Added clarification for Planning Coordinator developes implementation plan.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
NPCC-006-NPCC-1 **R11** Each Distribution Provider and Transmission Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with R9. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]	**PRC-006-NPCC-2** **R7.** Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*	Language clarifications and changes to requirement numbers referenced.
PRC-006-NPCC-1 **R12** Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage coincident with their integrated hourly peak net Load during the previous year, as determined by measuring actual metered Load through the switches that would be opened by the UFLS relays.	**PRC-006-NPCC-2** **R9.** Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by	Added language that allows calculation of load from nearest available metering rather than actual metering. The requirement as it exists is placing undo burden to install metering when it can be accurately calculated as a cost effective alternative.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]	measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*	
PRC-006-NPCC-1 **R13** Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, below the appropriate generator underfrequency trip protection settings threshold curve in Figure 1, except as otherwise exempted in Requirements R16 and R19. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R10.** Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*	Clarification was made that the Underfrequency trip relay must to be set to operate "on or below" the appropriate curve. In Version 1 it currently states below and questions arose whether settings on the curve were considered in compliance.
NPCC-006-NPCC-1 **R14** Each Generator Owner shall transmit the generator underfrequency trip setting and time delay to its Planning Coordinator within 45 days of the Planning Coordinator's request.	**PRC-006-NPCC-2** **R11.** Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk*	No Change from Version 1 only requirement numbering

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
[Violation Risk Factor: High] [Time Horizon: Operations Planning]	*Factor: Lower] [Time Horizon: Operations Planning]*	
PRC-006-NPCC-1 **R15** Each Generator Owner with a new generating unit, scheduled to be in service on or after the effective date of this Standard, or an existing generator increasing its net capability by greater than 10% shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning] **15.1** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 1. **15.2** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip	**PRC-006-NPCC-2** **R12.** Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]* **12.1.** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2. **12.2.** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the	Removed language pertaining to the Version 1 of the standard regarding on or after the effective date. Version 1 has been in place and transition/implementation concerns need not be addressed in this requirement.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
protection settings threshold curve in Figure 1.	generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.	
PRC-006-NPCC-1 **R16** Each Generator Owner of existing non-nuclear units in service prior to the effective date of this standard that have underfrequency protections set to trip above the appropriate curve in Figure 1 shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning] **16.1** Set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations. **16.2** Transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.	**PRC-006-NPCC-2** **R13.** For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: [Violation Risk Factor: High] [Time Horizon: Long Term Planning*]* **13.1.** Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations. **13.2**. Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical	Addition made to R13.3 and R13.4 which is the approved requirement R16 to clarify that any compensatory load shedding must be in the island the generating unit resides in.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
16.3 Have compensatory load shedding, as provided by a Distribution Provider or Transmission Owner that is adequate to compensate for the loss of their generator due to early tripping.	basis for the settings to the Planning Coordinator. **13.3.** Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2. **13.4.** Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.	
PRC-006-NPCC-1 **R17** Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-NPCC-2** **R14.** Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*	Only made changes to the requirement number.
PRC-006-NPCC-1 **R18** Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the New York ISO shall apply the criteria described in Attachment B to determine the compensatory load shedding that is required in Requirement R16.3 for generating units in	**PRC-006-NPCC-2** **R15.** Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that is	Only made changes to the requirement number.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
its respective NPCC area. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High][Time Horizon: Long Term Planning]*	
PRC-006-NPCC-1 **R19** Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 1, based on their licensing design basis, shall: [Violation Risk Factor: High] [Time Horizon: Long Term Planning] **19.1** Set the underfrequency protection to operate at as low a frequency as possible in accordance with the plant design and licensing limitations but not greater than 57.8Hz. **19.2** Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz. **19.3** Transmit the initial frequency trip setting and any changes to the setting and the	**PRC-006-NPCC-2** **R16.** Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]* **16.1.** Set the underfrequency protection to operate at a frequency as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz. **16.2.** Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.	Only made changes to the requirement number and Figure reference update.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
technical basis for the settings to the Planning Coordinator.	**16.3.** Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.	
PRC-006-NPCC-1 **R20** The Planning Coordinator shall update its UFLS program database as specified by the NERC PRC Standard on UFLS. This database shall include the following information: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning] **20.1** For each UFLS relay, including those used for compensatory load shedding, the amount and location of load shed at peak, the corresponding frequency threshold and time delay settings. **20.2** The buses at which the Load is modeled in the NPCC library power flow case. **20.3** A list of all generating units that may be tripped for underfrequency conditions above the appropriate generator underfrequency	**PRC-006-2 (Existing in force continent-wide standard)** **R6.** Each Planning Coordinator shall maintain a UFLS database containing data necessary to model its UFLS program for use in event analyses and assessment of the UFLS program at least once each calendar year, with no more than 15 months between maintenance activities. [VRF: Lower][Time Horizon: Long-term Planning]	The drafting team decided to remove requirement 19 and 20 because they are covered by the continent-wide PRC-006-2 requirement 6. The requirement 19 and 20 language will be transferred over to new guideline document.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
trip protection settings threshold curve in Figure 1, including the frequency trip threshold and time delay for each protection system. **20.4** The location and amount of additional elements to be switched for voltage control that are coordinated with UFLS program tripping. **20.5** A list of all UFLS relay inhibit functions along with the corresponding settings and locations of these relays.		
PRC-006-NPCC-1 **R21** Each Planning Coordinator shall notify each Distribution Provider, Transmission Owner, and Generator Owner within its Planning Coordinator area of changes to load distribution needed to satisfy UFLS program performance characteristics as specified by the NERC PRC Standard on UFLS.[Violation Risk Factor: High] [Time Horizon: Long Term Planning]	**PRC-006-2 (Existing in force continent-wide standard)** **R3.** Each Planning Coordinator shall develop a UFLS program, including notification of and a schedule for implementation by UFLS entities within its area, that meets the following performance characteristics in simulations of underfrequency conditions resulting from an imbalance scenario, where an imbalance =	PRC-006-NPCC-1 R21 is now redundant with the NERC continent wide standard R3. This requirement, R21 is proposed for retirement under the P-81 criteria.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	[(load — actual generation output) / (load)], of up to 25 percent within the identified island(s). [VRF: High][Time Horizon: Long-term Planning] **3.1.** Frequency shall remain above the Underfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and **3.2.** Frequency shall remain below the Overfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and **3.3.** Volts per Hz (V/Hz) shall not exceed 1.18 per unit for longer than two seconds cumulatively per simulated event, and shall not exceed 1.10 per unit for longer	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	than 45 seconds cumulatively per simulated event at each generator bus and generator step-up transformer high-side bus associated with each of the following: • Individual generating units greater than 20 MVA (gross nameplate rating) directly connected to the BES • Generating plants/facilities greater than 75 MVA (gross aggregate nameplate rating) directly connected to the BES • Facilities consisting of one or more units connected to the BES at a common bus with total generation above 75 MVA gross nameplate rating.	
PRC-006-NPCC-1 **R22** Each Distribution Provider, Transmission Owner and Generator Owner shall implement the load distribution changes based on the	**PRC-006-2 (Existing in force continent-wide standard)** **R9.** Each UFLS entity shall provide automatic tripping of Load in accordance with the	PRC-006-NPCC-1 R22 is now redundant with the NERC continent wide standard R9 and this requirement, R22 is proposed for retirement under the P-81 criteria.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
notification provided by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]	UFLS program design and schedule for implementation, including any Corrective Action Plan, as determined by its Planning Coordinator(s) in each Planning Coordinator area in which it owns assets. [VRF: High][Time Horizon: Long-term Planning]	
PRC-006-NPCC-1 **R23** Each Distribution Provider, Transmission Owner and Generator Owner shall develop and submit an implementation plan within 90 days of the request from the Planning Coordinator for approval by the Planning Coordinator in accordance with Requirement R21. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]	**PRC-006-2 (Existing in force continent-wide standard)** **R3.** Each Planning Coordinator shall develop a UFLS program, including notification of and a schedule for implementation by UFLS entities within its area, that meets the following performance characteristics in simulations of underfrequency conditions resulting from an imbalance scenario, where an imbalance = [(load — actual generation output) / (load)], of up to 25 percent within the identified island(s). [VRF: High][Time Horizon: Long-term Planning]	PRC-006-NPCC-1 states an implemention plan for changes needs to be submitted to the PC for their approval within 90 days of the request. However in R22 of the regional standard it states that the changes shall be implemented based on the PC's notification. We believe this is fully covered in R3 and an additional implementation plan beyond the PC's plan, which includes the notification and schedule for the UFLS entities to follow is now unnecessary in the regional standard. We are recommending that R23 in the regional standard be retired.

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	3.1. Frequency shall remain above the Underfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and **3.2.** Frequency shall remain below the Overfrequency Performance Characteristic curve in PRC-006-2 - Attachment 1, either for 60 seconds or until a steady-state condition between 59.3 Hz and 60.7 Hz is reached, and **3.3.** Volts per Hz (V/Hz) shall not exceed 1.18 per unit for longer than two seconds cumulatively per simulated event, and shall not exceed 1.10 per unit for longer than 45 seconds cumulatively per simulated event at each generator bus and generator step-up transformer high-side bus	

Standard: PRC-006-NPCC-2		
Requirement in Approved Standard	**Translation to New Standard or Other Action**	**Description and Change Justification**
	associated with each of the following: • Individual generating units greater than 20 MVA (gross nameplate rating) directly connected to the BES • Generating plants/facilities greater than 75 MVA (gross aggregate nameplate rating) directly connected to the BES Facilities consisting of one or more units connected to the BES at a common bus with total generation above 75 MVA gross nameplate rating.	

Consolidated Edison Company
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4 Irving Place
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November 2, 2018

VIA EMAIL

Regional Standards Committee (RSC)
NPCC
rscmembers@npcc.org

Subject: PRC-006-NPCC-02 Automatic Underfrequency Load Shedding – Approval to Post for Pre-Ballot and Ballot Period

Dear RSC Members:

The PRC-006-NPCC-2 Automatic Underfrequency Load Shedding Regional Standard has been posted for three 45-day comment periods. The drafting team has responded to every comment from all three periods. NPCC's Manager of Reliability Standards has posted all comment responses onto the NPCC website. The next step, in accordance with the NPCC Regional Standard Processes Manual, is to obtain the RSC's approval to post for a 30-day pre-ballot review period and a subsequent 10-day ballot period. If you have not already done so, please email your approval to Mr. Ruida Shu so he can post the documents for pre-ballot and ballot period.

I'd like to take this opportunity to commend all the members of the Standard Drafting Team, and those who supported them, for their perseverance through the arduous task of re-writing this Regional Standard over the course of the past two years and five months. Their dedication was essential to accomplish the team's mission.

If you have any questions, please don't hesitate to contact me.

Regards

Dan Taft
Chief Engineer – Control Systems Engineering Department
Chair – NPCC PRC-006-NPCC-2 Standard Drafting Team

(212) 460 – 4536
taftd@coned.com

Consolidated Edison Company
of New York, Inc.
4 Irving Place
New York NY 10003-0987

October 30, 2018

VIA EMAIL

Guy V. Zito
Assistant Vice-President Standards
NPCC
gzito@npcc.org

Subject: PRC-006-NPCC-02 Automatic Underfrequency Load Shedding – CEAP

Dear Mr. Zito,

Following the review and revision of draft PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Regional Standard, in accordance with the NPCC Regional Standard Processes Manual, the next step in the process towards adoption would normally be to determine if it is necessary to implement the Cost-Effective Analysis Process (CEAP). Considering the drafting team only clarified the requirement language within the standard, removed redundant requirements with the Continent-wide UFLS Standard, and did not make any revisions that could potentially incur additional costs, I propose to waive the formal CEAP on behalf of the PRC-006-NPCC-02 Automatic Underfrequency Load Shedding Standard drafting team. Additionally, the Standard drafting team did post a cost effectiveness question to allow the industry to propose any cost-effective alternatives during the third posting for comment period. The industry did not provide any alternatives. If you have any questions, please contact me.

Regards

Dan Taft
Chief Engineer – Control Systems Engineering Department
Chair – NPCC PRC-006-NPCC-2 Standard Drafting Team

(212) 460 – 4536
taftd@coned.com

	1. Determine Quorum				2. Vote/Ballot Recording		
NPCC Registered Members		**In Attendance**	**By Proxy**		**Affirmative**	**Negative**	**Abstain**
		(denote w/ 1)	(denote w/ 1)		(denote w/ 1)	(denote w/ 1)	(denote w/ 1)
Sector 1, Transmission Owners	**17**	**17**	**0**		**17**	**0**	**0**
Central Hudson Gas and Electric Corporation	1	1			1		
Central Maine Power Company	1	1			1		
Consolidated Edison Company of New York, Inc.	1	1			1		
Emera Maine	1	1			1		
Eversource Energy	1	1			1		
Hydro One Inc	1	1			1		
Hydro-Quebec TransEnergie	1	1			1		
Long Island Power Authority	1	1			1		
National Grid	1	1			1		
New Hampshire Transmission, LLC	1	1			1		
New York Power Authority	1	1			1		
New York State Electric & Gas Corporation	1	1			1		
Nova Scotia Power Inc.	1	1			1		
Orange and Rockland Utilities Inc	1	1			1		
Rochester Gas & Electric Corporation	1	1			1		
The United Illuminating Company	1	1			1		
Vermont Transco	1	1			1		

		1. Determine Quorum			2. Vote/Ballot Recording		
NPCC Registered Members		**In Attendance**	**By Proxy**		**Affirmative**	**Negative**	**Abstain**
		(denote w/ 1)	(denote w/ 1)		(denote w/ 1)	(denote w/ 1)	(denote w/ 1)
Sector 2, Reliability Coordinators	**5**	**5**	**0**		**5**	**0**	**0**
Hydro-Quebec TransEnergie	1	1			1		
Independent Electricity System Operator	1	1			1		
ISO-New England, Inc.	1	1			1		
New Brunswick Power Corporation	1	1			1		
New York Independent System Operator	1	1			1		

	1. Determine Quorum			2. Vote/Ballot Recording		
NPCC Registered Members		**In Attendance**	**By Proxy**	**Affirmative**	**Negative**	**Abstain**
		(denote w/ 1)	(denote w/ 1)	(denote w/ 1)	(denote w/ 1)	(denote w/ 1)
Sector 3, TDUs, Dist. And LSE	**21**	**17**	**2**	**19**	**0**	**0**
Braintree Electric Light Department	1	1		1		
Consolidated Edison Company of New York, Inc.	1	1		1		
Eversource Energy	1	1		1		
Groton Electric Light	1	1		1		
Hingham Municipal Lighting Plant	1	1		1		
Hydro One Inc	1		1	1		
Hydro Quebec Distribution	1		1	1		
Ipswich Municipal Light Department	1	1		1		
Long Island Power Authority	1	1		1		
Marblehead Municipal Light Department	1	1		1		
National Grid USA	1	1		1		
New Brunswick Power Corporation	1	1		1		
New York Power Authority	1	1		1		
Orange and Rockland Utilities, Inc	1	1		1		
Princeton Municipal Light Department	1					
Shrewsbury Electric & Cable Operations	1	1		1		
Sterling Municipal Light Department	1	1		1		
Toronto Hydro Electric System Ltd.	1	1		1		
Vermont Electric Cooperative, Inc.	1					
Wakefield Municipal Gas and Light Department	1	1		1		
Westfield Gas & Electric	1	1		1		

	1. Determine Quorum				2. Vote/Ballot Recording		
NPCC Registered Members		**In Attendance**	**By Proxy**		**Affirmative**	**Negative**	**Abstain**
		(denote w/ 1)	(denote w/ 1)		(denote w/ 1)	(denote w/ 1)	(denote w/ 1)
Sector 4, Generator Owners	**20**	**16**	**0**		**10**	**4**	**2**
Bruce Power L.P.	1						
Consolidated Edison Company of New York, Inc.	1	1			1		
Covanta Energy	1	1				1	
Dominion Resources, Inc.	1	1			1		
Eastern Generation LLC	1	1					1
Entergy Nuclear Northeast, Inc	1	1			1		
Exelon Generation Company, LLC	1						
First Wind Operations & Maintenance	1						
Long Island Power Authority	1						
Massachusetts Municipal Wholesale Electric Company	1	1			1		
New York Power Authority	1	1			1		
NextEra Energy Resources, LLC	1	1			1		
NRG Energy Inc.	1	1			1		
Nova Scotia Power Inc.	1	1					1
Ontario Power Generation Inc.	1	1			1		
PSEG Fossil LLC	1	1				1	
Talen Energy Supply, LLC	1	1				1	
TransCanada	1	1			1		
Vistra Energy Corp	1	1			1		
Wheelabrator Westchester LP	1	1				1	

		1. Determine Quorum			2. Vote/Ballot Recording		
NPCC Registered Members		**In Attendance**	**By Proxy**		**Affirmative**	**Negative**	**Abstain**
		(denote w/ 1)	(denote w/ 1)		(denote w/ 1)	(denote w/ 1)	(denote w/ 1)
Sector 5, Marketers, Brokers, Aggragators	**12**	**9**	**0**		**8**	**0**	**1**
Brookfield Power Corporation	1	1			1		
Consolidated Edison Company of New York, Inc.	1	1			1		
Consolidated Edison Energy/Development	1						
HQ Energy Marketing Inc.	1	1			1		
H.Q. Energy Services (U.S.) Inc.	1	1			1		
Long Island Power Authority	1	1			1		
Massachusetts Municipal Wholesale Electric Company	1	1			1		
Nalcor Energy	1						
New York Power Authority	1	1			1		
Nexus Energy Inc.	1	1					1
Shell Energy North America	1						
Utility Services Inc.	1	1			1		

		1. Determine Quorum			2. Vote/Ballot Recording		
NPCC Registered Members		**In Attendance**	**By Proxy**		**Affirmative**	**Negative**	**Abstain**
		(denote w/ 1)	(denote w/ 1)		(denote w/ 1)	(denote w/ 1)	(denote w/ 1)
Sector 6, State and Provincial Reg. and Govt. Au	**5**	**3**	**0**		**3**	**0**	**0**
Long Island Power Authority	1	1			1		
Maine Public Utilities Commission	1	1			1		
New Hampshire Public Utilities Commission	1						
New York Power Authority	1	1			1		
New York State Department of Public Service	1						

		1. Determine Quorum			2. Vote/Ballot Recording		
NPCC Registered Members		**In Attendance**	**By Proxy**		**Affirmative**	**Negative**	**Abstain**
		(denote w/ 1)	(denote w/ 1)		(denote w/ 1)	(denote w/ 1)	(denote w/ 1)
Sector 7, Sub Regional Rel. Councils, REs and Others	**25**	**16**	**0**		**14**	**0**	**2**
4g Technologies, LP	1						
Abloy Security, Inc.	1	1			1		
AESI Acumen Engineered Solutions Internaiontal Inc.	1	1			1		
Ascendant Energy Solutions, Inc.	1						
Casimir Systemics LLC	1	1			1		
Ciufo & Cooperberg Consulting Inc.	1	1			1		
DataCapable, Inc.	1						
David Kiguel	1	1			1		
ERLPhase Power Technologies	1	1			1		
GDS Associateds, Inc.	1	1			1		
Genieall	1						
International Business Machines Corporation	1						
Ironhouse Inc.	1						
McCoy Power Consultants, Inc.	1	1			1		
Network & Security Technologies, Inc.	1	1					1
New Power Technologies, Inc	1						
New York State Reliability Council, LLC	1	1			1		
Oxbow-Sherman Energy, LLC	1	1			1		
PLM, Inc.	1	1			1		
Preti, Flaherty, Beliveau, and Pachios, LLP.	1	1					1
Proven Compliance Solutions, Inc.	1	1			1		
SGC Engineering, LLC	1	1			1		
Sund Technologies, LLC	1						
TRC Solutions	1	1			1		
VIASYN, Inc.	1						

Determine Electronic Quorum

Sector	Sector Name	Total Registered	In Attendance	By Proxy	Total Represented	Sector % Attending
1	**Transmission Owners**	17	17	0	17	1.00
2	**Reliability Coordinators**	5	5	0	5	1.00
3	**TDUs, Dist. And LSE**	21	17	2	19	0.90
4	**Generator Owners**	20	16	0	16	0.80
5	**Marketers, Brokers, Aggragators**	12	9	0	9	0.75
6	**Customers- large and small**	5	3	0	3	0.60
7	**State and Provincial Reg. and Govt. Authorities**	25	16	0	16	0.64
		105	83	2	85	

Electronic Vote Quorum= at least 2/3 of the Total Registered

Quorum Present? **YES**

Determine if Motion or Item Passes

Sector	Sector Name	Total Registered	Sector % Attending	Affirmative # of Votes	Affirmative Fraction	Negative # of Votes	Negative Fraction	Abstain # of Votes	Votes Cast Total (-Abstentions)	Sector has Voted(1-Y, 0-N)
1	**Transmission Owners**	17	1.00	17	1.000	0	0.000	0	17	1
2	**Reliability Coordinators**	5	1.00	5	1.000	0	0.000	0	5	1
3	**TDUs, Dist. And LSE**	21	0.90	19	1.000	0	0.000	0	19	1
4	**Generator Owners**	20	0.80	10	0.714	4	0.286	2	14	1
5	**Marketers, Brokers, Aggragators**	12	0.75	8	1.000	0	0.000	1	8	1
6	**Customers- large and small**	5	0.60	3	1.000	0	0.000	0	3	1
7	**State and Provincial Reg. and Govt. Authorities**	25	0.64	14	1.000	0	0.000	2	14	1
	Totals	105		76	6.714	4	0.286	5	80	7

Sum of Affirmative/Number of Sectors that Voted MUST BE AT LEAST 2/3 to pass 0.959

Did MOTION PASS? PASS

Comment Report

Project Name:	Regional Reliability Standard (NPCC) | PRC-006-NPCC-2
Comment Period Start Date:	5/8/2019
Comment Period End Date:	6/21/2019
Associated Ballots:	

There were 1 sets of responses, including comments from approximately 1 different people from approximately 1 companies representing 1 of the Industry Segments as shown in the table on the following pages.

Questions

1. Do you agree the development of PRC-006-NPCC-2 met the "Open" criteria as outlined above? If "No", please explain in the comment area below:

2. Do you agree the development of PRC-006-NPCC-2 met the "Inclusive" criteria as outlined above? If "No", please explain in the comment area below:

3. Do you agree the development of PRC-006-NPCC-2 met the "Balanced" criteria as outlined above? If "No", please explain in the comment area below:

4. Do you agree the development of PRC-006-NPCC-2 met the "Due Process" criteria as outlined above? If "No", please explain in the comment area below:

5. Do you agree the development of PRC-006-NPCC-2 met the "Transparent" criteria as outlined above? If "No", please explain in the comment area below:

Organization Name	Name	Segment(s)	Region	Group Name	Group Member Name	Group Member Organization	Group Member Segment(s)	Group Member Region

1. Do you agree the development of PRC-006-NPCC-2 met the “Open” criteria as outlined above? If “No”, please explain in the comment area below:	
Leonard Kula - Independent Electricity System Operator - 2	
Answer	Yes
Document Name	
Comment	
N/A	
Likes 0	
Dislikes 0	
Response	

2. Do you agree the development of PRC-006-NPCC-2 met the “Inclusive” criteria as outlined above? If “No”, please explain in the comment area below:	
Leonard Kula - Independent Electricity System Operator - 2	
Answer	Yes
Document Name	
Comment	
N/A	
Likes 0	
Dislikes 0	
Response	

3. Do you agree the development of PRC-006-NPCC-2 met the “Balanced” criteria as outlined above? If “No”, please explain in the comment area below:	
Leonard Kula - Independent Electricity System Operator - 2	
Answer	Yes
Document Name	
Comment	
N/A	
Likes 0	
Dislikes 0	
Response	

4. Do you agree the development of PRC-006-NPCC-2 met the “Due Process” criteria as outlined above? If “No”, please explain in the comment area below:	
Leonard Kula - Independent Electricity System Operator - 2	
Answer	Yes
Document Name	
Comment	
N/A	
Likes 0	
Dislikes 0	
Response	

5. Do you agree the development of PRC-006-NPCC-2 met the “Transparent” criteria as outlined above? If “No”, please explain in the comment area below:
Leonard Kula - Independent Electricity System Operator - 2

Answer	Yes
Document Name	
Comment	
N/A	
Likes 0	
Dislikes 0	
Response	

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Unofficial Comment Form

Regional Reliability Standard | PRC-006-NPCC-2

DO NOT use this form for submitting comments. Use the electronic form to submit comments on Regional Reliability Standard **PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding.** The form must be submitted by **8 p.m. Eastern, Friday, June 21, 2019.**

Documents and information about this project are available on the NPCC's Standards In Development page. If you have questions, contact Senior Reliability Standards Analyst, Nasheema Santos (via email) or at (404) 446-2564.

Background Information

The NPCC drafting team reviewed Regional Reliability Standard PRC-006-NPCC-1 and made the following changes:

1. Remove redundancies with the most recent of the Continent-wide NERC Standard, PRC-006-3. Some of the redundancies removed from the Regional Standard PRC-006-NPCC-2 are those related to:
   - The Québec Interconnection portion of NPCC shall implement an automatic UFLS program in accordance with Attachment C Table 4;
   - Requirements for a UFLS Database;
   - Notification of changes to load distribution needed to satisfy UFLS program performance characteristics; and
   - Development of an implementation plan when changes to load distribution are needed.
2. Ensure that UFLS island boundaries, once identified, are provided upon request, to affected entities.
3. Minimum time UFLS relay time delay added to Attachment C tables and removed as a separate requirement.
4. Added the ability for a TO or DP to calculate net load shed for UFLS if direct metering is not available.
5. A number of minor clarifications were made to the standard such as requiring the Underfrequency trip relay must to be set to operate "on or below" the appropriate curve. In Version 1 it currently states below and questions arose whether settings on the curve were considered in compliance.
6. Clarification that any compensatory load shedding for non-conformance with the Underfrequency trip specification for generation (in service prior to July 1, 2015) must be within the same island as the generator resides.

NERC Criteria for Developing or Modifying a Regional Reliability Standard

Regional Reliability Standard shall be: (1) a regional reliability standard that is more stringent than the continent-wide reliability standard, including a regional standard that addresses matters that the continent-wide reliability standard does not; or (2) a regional reliability standard that is necessitated by a physical difference in the bulk power system. Regional reliability standards shall provide for as much uniformity as possible with reliability standards across the interconnected bulk power system of the North American continent. Regional reliability standards, when approved by FERC and applicable authorities in Mexico and Canada, shall be made part of the body of NERC reliability standards and shall be enforced upon all applicable bulk power system owners, operators, and users within the applicable area, regardless of membership in the region.

The approval process for a regional reliability standard requires NERC to publicly notice and request comment on the proposed standard. Comments shall be permitted only on the following criteria (technical aspects of the standard are vetted through the regional standards development process):

Open — Regional reliability standards shall provide that any person or entity that is directly and materially affected by the reliability of the bulk power system within the regional entity shall be able to participate in the development and approval of reliability standards. There shall be no undue financial barriers to participation. Participation shall not be conditional upon membership in the regional entity, a regional entity or any organization, and shall not be unreasonably restricted on the basis of technical qualifications or other such requirements.

Inclusive — Regional reliability standards shall provide that any person with a direct and material interest has a right to participate by expressing an opinion and its basis, having that position considered, and appealing through an established appeals process, if adversely affected.

Balanced — Regional reliability standards shall have a balance of interests and shall not be dominated by any two-interest categories and no single-interest category shall be able to defeat a matter.

Due Process — Regional reliability standards shall provide for reasonable notice and opportunity for public comment. At a minimum, the standard shall include public notice of the intent to develop a standard, a public comment period on the proposed standard, due consideration of those public comments, and a ballot of interested stakeholders.

Transparent — All actions material to the development of regional reliability standards shall be transparent. All standards development meetings shall be open and publicly noticed on the regional entity's Web site.

Review the revised Regional Reliability Standard and answer the following questions.

1. Do you agree the development of PRC-006-NPCC-2 met the "Open" criteria as outlined above? If "No", please explain in the comment area below:

   ☐ Yes
   ☐ No
   Comments:

2. Do you agree the development of PRC-006-NPCC-2 met the "Inclusive" criteria as outlined above? If "No", please explain in the comment area below:

   ☐ Yes
   ☐ No
   Comments:

3. Do you agree the development of PRC-006-NPCC-2 met the "Balanced" criteria as outlined above? If "No", please explain in the comment area below:

   ☐ Yes
   ☐ No
   Comments:

4. Do you agree the development of PRC-006-NPCC-2 met the "Due Process" criteria as outlined above? If "No", please explain in the comment area below:

   ☐ Yes
   ☐ No
   Comments:

5. Do you agree the development of PRC-006-NPCC-2 met the "Transparent" criteria as outlined above? If "No", please explain in the comment area below:

   ☐ Yes
   ☐ No
   Comments:

NPCC, Inc.
NORTHEAST POWER COORDINATING COUNCIL, INC.
1040 AVE. OF THE AMERICAS, NEW YORK, NY 10018 (212) 840-1070 FAX (212) 302-2782

Implementation Plan

Regional Reliability Standard PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Applicable Standard(s)

- PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding

Requested Retirement(s)

- PRC-006-NPCC-1 – Automatic Underfrequency Load Shedding

Applicable Entities

- Generator Owners
- Planning Coordinators
- Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.
- Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program.

Background

The revisions to the PRC-006-NPCC-1 Automatic Underfrequency Load Shedding have been developed to address the following concerns.

1. To determine if the applicability of the standard needs to be revised in accordance with Project 2014-01 Dispersed Generation Resources.
2. To determine if the performance requirements as contained in the criteria of NPCC Directory#12 Sections 5.1.1 and 5.1.2 should be explicitly included in the requirements of the Regional Standard and potential retirement of Directory 12 Automatic Underfrequency Load Shedding Program.
3. Review Attachment C in PRC-006-NPCC-1 to address the implications of the design assessment, in accordance with Requirement R4 of PRC-006-1/PRC-006-2, of not meeting the program performance characteristics as identified in Requirement R3 of PRC-006-1/PRC-006-2.
4. Review and revise Table 4 in Attachment C in accordance with the 2013 NPCC UFLS Adequacy Assessment. Additionally, the applicability of Requirements R4 and R5 will be reviewed to consider that Hydro Quebec is not part of the Eastern Interconnection.

Effective Date

All requirements with the exception of R3 will be enforceable on the first day of the first calendar quarter following the applicable governmental and regulatory approvals.

R3 will be enforceable on the first day of the first calendar quarter 12 months following the applicable governmental and regulatory approvals.

Retirement Date

The NPCC Regional Reliability Standard PRC-006-NPCC-1 shall be retired immediately prior to the Effective Date of PRC-006-NPCC-2.

Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard is adopted by the NERC Board of Trustees (Board).

Description of Current Draft

Completed Actions	Date
Regional Standards Committee approved Regional Standard Authorization Request (RSAR) for posting	June 23, 2015

Anticipated Actions	Date
1st 45-day Formal Comment Period	September 1, 2017 - October 18, 2017
2nd 45-day Formal Comment Period	April 16, 2018 – June 1, 2018
3rd 45-day Formal Comment Period	August 10, 2018- September 24, 2018
30-day Pre-ballot Period	November 12, 2018- December 12, 2018
10-day ballot Period (Extended to achieve quorum)	December 12, 2018- February 10, 2019
NPCC Board of Directors Approval	May 1, 2019
NERC Board adoption	

Upon Board adoption, the rationale boxes will be moved to the Supplemental Material Section.

A. Introduction

1. **Title:** Automatic Underfrequency Load Shedding

2. **Number:** PRC-006-NPCC-2

3. **Purpose:** The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.

4. **Applicability:**

   4.1. Functional Entities:

   4.1.1. Generator Owner

   4.1.2. Planning Coordinator

   4.1.3. Distribution Providers that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators

   4.1.4. Transmission Owners that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators

5. **Effective Date:** See Implementation Plan.

B. Requirements and Measures

Rationale for Requirement R1: Figure 1 of this document shows the NPCC underfrequency criteria for the Eastern Interconnection portion of NPCC. Figure 1 also shows the NERC criteria as defined in the NERC PRC Standard on UFLS.

R1. Each Planning Coordinator in the Eastern Interconnection portion of NPCC shall design an UFLS program, pertaining to islands wholly within the NPCC Region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds in accordance with Figure 1 *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M1. Each Planning Coordinator shall have evidence such as reports, system studies and/or real-time power flow data captured from actual system events and other dated documentation that demonstrates it meets Requirement R1.

R2. Each Planning Coordinator shall provide UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS, to Distribution Providers, Generator Owners, and Transmission Owners within 30 calendar days of receipt of a request. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M2. Each Planning Coordinator shall have evidence such as dated documentation that demonstrates that it meets requirement R2.

R3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall implement an automatic UFLS program, reflecting normal operating conditions, excluding outages. The automatic UFLS program shall be implemented on an island basis for each identified island per the NERC continent-wide PRC-006 Standard on UFLS as follows: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- The UFLS program shall be implemented by each Distribution Provider and Transmission Owner according to the frequency thresholds, nominal operating times, and load shedding amounts specified in Attachment C, Tables 1-3; or
- The UFLS program shall be implemented collectively by multiple Distribution Providers or Transmission Owners, as long as they reside in the same UFLS island identified by the Planning Coordinator per Requirement R2. These multiple Distribution Providers or Transmission Owners, via mutual agreement, shall act as a single entity to provide an aggregated automatic UFLS program that sheds their coincident peak aggregated net Load according to the frequency thresholds, total nominal operating time, and load shedding amounts specified in Attachment C, Tables 1-3.

M3. Each Distribution Provider and Transmission Owner in the Eastern Interconnection portion of NPCC shall have evidence such as documentation or reports containing the location and amount of load to be tripped in their respective areas, and the corresponding frequency thresholds, on those circuits included in its UFLS program identified in Requirement R3. (Attachment C, Tables 1-3).

R4. Each Distribution Provider or Transmission Owner in the Eastern Interconnection portion of NPCC that does not meet the UFLS program parameters specified in Attachment C, Table 1-3, and each Distribution Provider or Transmission Owner in the Quebec Interconnection that does not meet the UFLS program parameters specified by its Planning Coordinator shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

- Within 30 calendar days of determining that it does not meet the specified parameters, notify its Planning Coordinator that it does not meet the UFLS program parameters; and
- Within the following 180 calendar days from notification of the Planning Coordinator,

(1) develop a Corrective Action Plan and a schedule for implementation that is mutually agreed upon with its Planning Coordinator or
(2) provide its Planning Coordinator with a technical study that demonstrates that the deviations from the program parameters will not result in failure of UFLS performance criteria being met for any island. The technical study must be acceptable to the Planning Coordinator prior to implementing deviations from program parameters and shall demonstrate coordination with UFLS programs of all entities residing within the same island(s) identified by the Planning Coordinator in Requirement R2. The technical study shall also demonstrate coordination with other UFLS programs of adjoining Planning Coordinators, or
(3) provide its Planning Coordinator with an analysis demonstrating that no alternative load shedding solution is available that would allow the Distribution Provider or Transmission Owner to comply with UFLS Attachment C Table 2 or Attachment C Table 3.

M4. Each Distribution Provider or Transmission Owner shall have evidence such as reports analysis, system studies and dated documentation that demonstrates that it meets Requirement R4.

Rationale for Requirement R5: An inhibit function provides supervisory control over a UFLS relay. For example, an undervoltage inhibit feature prevents UFLS relay operation if the sensed voltage decreases below an adjustable setting. An undervoltage inhibit function is intended to prevent operation of a UFLS relay when the transmission supply is lost to distribution station feeding many induction motors. Following loss of the transmission supply, motors may support the voltage while the motors coast down in speed. The motors coasting down (ringing down) will look like an underfrequency event to the relay. The inhibit setting is set to a voltage above which the motor load is expected to sustain. This prevents the underfrequency relay from tripping and locking out distribution feeder breakers supplying the motor load, between the time the transmission supply line trips and the time when the line recloses to restore the load. Voltages sustained by motors that are coasting down (e.g. 0.70 pu) are typically much lower than voltages at which the UFLS relays are required to operate to meet UFLS performance criteria. However, motor loads supplied by cable networks typically have higher ring down voltages because of cable charging. Therefore, care must be taken so that the voltage inhibit setting is not higher than the voltage at which UFLS relays are required to operate to meet UFLS performance criteria.

R5. Each Planning Coordinator shall develop and review settings for inhibit thresholds at least once per five calendar years (such as, but not limited to, voltage, current and time) to be utilized within its region's UFLS program. *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

M5. Each Planning Coordinator shall have evidence such as reports, system studies or analysis that demonstrates that it meets Requirement R5.

R6. Each Planning Coordinator shall provide each Transmission Owner and Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 30 calendar days of any changes. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M6. Each Planning Coordinator shall provide evidence such as letters, emails or other dated documentation that demonstrates that it meets Requirement R6.

R7. Each Distribution Provider and Transmission Owner that receives a notification pursuant to Requirement R6 shall develop and submit an implementation plan with respect to inhibit thresholds for approval by the Planning Coordinator within 90 calendar days of the request from the Planning Coordinator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M7. Each Distribution Provider and Transmission Owner shall provide evidence such as letters, emails, or other dated documentation that demonstrates that it meets Requirement R7.

R8. Each Distribution Provider and Transmission Owner shall implement the inhibit thresholds provided by the Planning Coordinator in accordance with Requirement R6 and based on the Planning Coordinator approved implementation plan in accordance with R7. *[Violation Risk Factor: High] [Time Horizon: Operation Planning]*

M8. Each Distribution Provider and Transmission Owner shall provide evidence such as test reports, data sheets, completed work orders, or other documentation that demonstrates that it meets Requirement R8.

Rationale for Requirement R9: Ideally, the amount of load to be shed in each stage of the UFLS program for every entity should perfectly match that prescribed in this Standard, for all phases of the load cycle, i.e., seasonal (summer vs. winter), weekly (weekday vs. weekend vs. holidays), daily (morning, noon, and night), etc. for all of the identified islands. Practically, however, this is obviously not possible because the load cycles of the various areas and sub-areas within any given island do not perfectly track the load cycle of the overall island. The UFLS program, on the other hand, is designed based on peak conditions for the overall island. The percentages of actual load shedding that would occur for any conditions other than peak, therefore, can only approximate that prescribed in the Standard. To that end, Requirement R11 requires entities to document measured loads in the UFLS program coincident with their own annual peak, whether or not that peak occurs at the same time or in the same season as the peak of the identified island in which their load resides. Using individual entity peaks vs. overall island peaks provides a consistent approach for accounting purposes among the very entities that are responsible for designing and maintaining their UFLS programs.

R9. Each Transmission Owner and Distribution Provider shall annually provide documentation, with no more than 15 calendar months between updates, to its Planning Coordinator of the actual net Load that would have been shed by the UFLS relays at each UFLS stage. The actual net Load shall be coincident with the entity's integrated hourly peak net Load during the previous year, as determined by measuring or calculating Load through the switches that would disconnect load if triggered by the UFLS relays. If measured data is unavailable then calculated data may be used. *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*

M9. Each Distribution Provider and Transmission Owner shall provide evidence such as reports, spreadsheets or other dated documentation submitted to its Planning Coordinator that indicates the net amount of load shed and the percentage of its peak load at each stage of its UFLS program to demonstrate that it meets Requirement R9.

R10. Each Generator Owner shall set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection setting threshold curve in Figure 2, except as otherwise exempted in Requirements R13 and R16. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M10. Each Generator Owner shall provide evidence such as reports, data sheets, spreadsheets or other documentation that demonstrates that it meets Requirement R10.

R11. Each Generator Owner shall transmit the generator underfrequency trip setting and time delay within 45 calendar days of the Planning Coordinator's request. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

M11. Each Generator Owner shall provide evidence such as emails, letters or other dated documentation that demonstrates that it meets Requirement R11.

R12. Each Generator Owner with a new generating unit, or an existing generator increasing its net capability by greater than 10% shall: *[Violation Risk Factor: Medium] [Time Horizon: Long Term Planning]*

- **12.1** Design measures to prevent the generating unit from tripping directly or indirectly for underfrequency conditions above the appropriate generator tripping threshold curve in Figure 2.
- **12.2** Design auxiliary system(s) or devices used for the control and protection of auxiliary system(s), necessary for the generating unit operation such that they will not trip the generating unit during underfrequency conditions above the appropriate generator underfrequency trip protection setting threshold curve in Figure 2.

M12. Each Generator Owner shall provide evidence such as reports, data sheets, specifications, memorandum or other documentation that demonstrates that it meets Requirement R12.

R13. For existing non-nuclear units in service prior to July 1, 2015, that have underfrequency protections set to trip above the appropriate curve in Figure 2: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

13.1 Each Generator Owner shall set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations.

13.2 Each Generator Owner shall transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinator.

13.3 Each Planning Coordinator in Ontario, Québec and the Maritime Provinces shall arrange for compensatory load shedding, in accordance with Attachment A and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

13.4 Each Generator Owner in the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator area shall arrange for compensatory load shedding, in accordance with Attachment B and as provided by a Distribution Provider or Transmission Owner, that is adequate to compensate for the loss of generator(s) due to early tripping that is within the UFLS island identified by the Planning Coordinator in Requirement R2.

M13. Each Generator Owner with existing non-nuclear units in service prior to July 1, 2015 which have underfrequency tripping that is not compliant with Requirement R10 shall provide evidence such as reports, spreadsheets, memorandum or dated documentation demonstrating that it meets Requirement R13.

R14. Each Planning Coordinator in Ontario, Quebec and the Maritime provinces shall apply the criteria described in Attachment A to determine the compensatory load shedding that is required in Requirement R13.3 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M14. Each Planning Coordinator in Ontario, Quebec and Maritime provinces shall provide evidence such as reports, memorandum or other documentation that demonstrates that it followed the methodology described in Attachment A and meets Requirement R14.

R15. Each Generator Owner, Distribution Provider or Transmission Owner within the ISO-NE Planning Coordinator area and in NYISO Planning Coordinator Area shall apply the criteria described in Attachment B to determine the compensatory load shedding that

is required in Requirement R13.4 for generating units in its respective NPCC area. *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

M15. Each Generator Owner, Distribution Provider or Transmission Owner within the Planning Coordinator area of ISO-NE or the NYISO shall provide evidence such as reports, memorandum, or other documentation that demonstrates that it followed the methodology described in Attachment B and meets Requirement R15.

R16. Each Generator Owner of existing nuclear generating plants with units that have underfrequency relay threshold settings above the Eastern Interconnection generator tripping curve in Figure 2 based on their licensing design shall: *[Violation Risk Factor: High] [Time Horizon: Long Term Planning]*

16.1 Set the underfrequency protection to operate at a frequency setting that is as low as possible in accordance with the plant design and licensing limitations but not greater than 57.8 Hz.

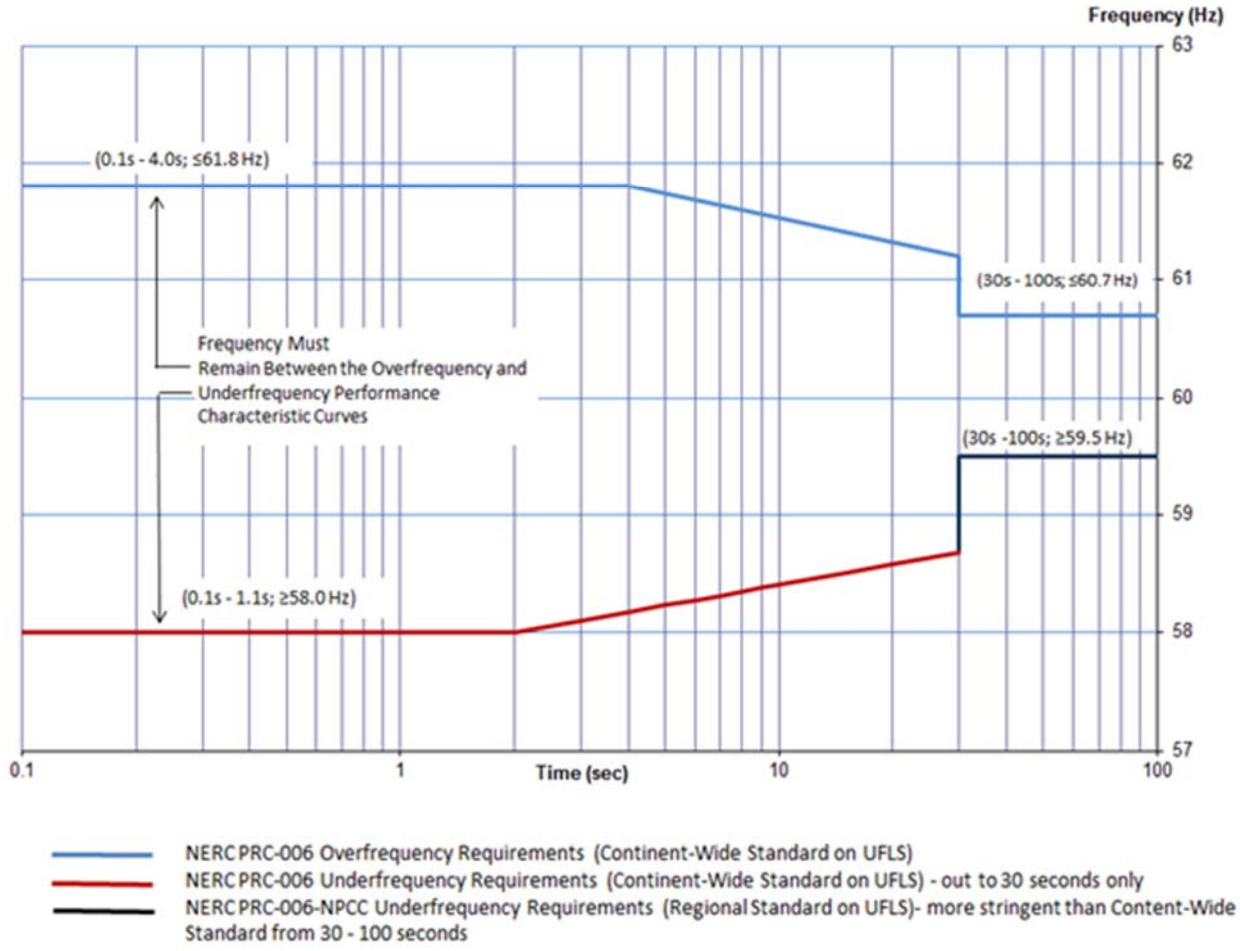
16.2 Set the frequency trip setting upper tolerance to no greater than + 0.1 Hz.

16.3 Transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning Coordinator.

M16. Each Generator Owner of nuclear units that have generator trip settings above the generator trip curve in Figure 2 shall provide evidence such as letters, reports and dated documentation that demonstrates that it meets Requirement R16.

Figure 1

PRC-006-NPCC-2
Underfrequency Load Shedding Program - Eastern Interconnection
Design Performance Requirements

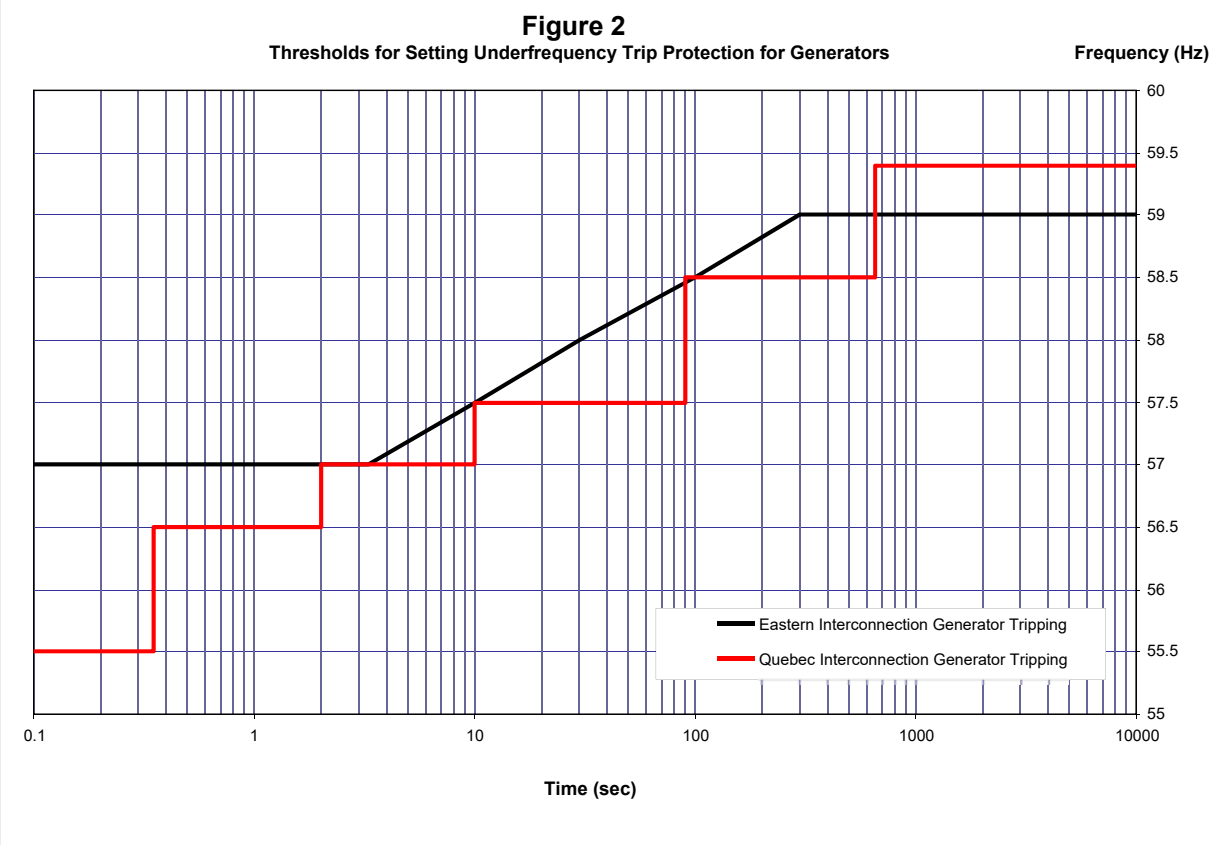


Curve Data:

Overfrequency Requirements		**Source**
t ≤ 4 s	f = 61.8 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
4 s < t ≤ 30 s	f = -0.686log(t) + 62.21 Hz	
t > 30 s	f = 60.7 Hz	

Underfrequency Requirements		**Source**
t ≤ 2 s	f = 58.0 Hz	NERC PRC-006 (Continent-Wide Standard on UFLS)
2 s < t ≤ 30 s	f = 0.575log(t) + 57.83 Hz	
t > 30 s	f = 59.5 Hz	NERC PRC-006-NPCC (Regional Standard on UFLS)

Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority:

Northeast Power Coordinating Council

1.2. Evidence Retention:

The Distribution Provider and Transmission Owner shall keep evidences for three calendar years for Measures 2, 3, 4, 5, 8, and 9.

The Planning Coordinator shall keep evidence for three calendar years for Measures 1, 2, 5, 6, and 7.

The Distribution Provider, Transmission Owner, and Generator Owner shall keep evidences for three calendar years for Measures 15.

The Generator Owner shall keep evidence for three calendar years for Measures 10, 11, 12, 13, and 16.

1.3. Compliance Monitoring and Enforcement Program:

Compliance Audit

Self-Certification

Spot Checking

Compliance Violation Investigation

Self-Reporting

Complaints

Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	N/A	N/A	N/A	The Planning Coordinator failed to design an UFLS program having performance characteristics that prevent frequency from remaining below 59.5 Hz in accordance with Figure 1.
R2.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 30 calendar days and up to and including 40 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 40 calendar days but less than and including 50 days following a request.	The Planning Coordinator provided its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS but did so more than 50 calendar days but less than and including 60 days following a request.	The Planning Coordinator failed to provide its UFLS island boundaries, as identified per the NERC continent-wide PRC-006 Standard on UFLS. within 60 calendar days following a request.
R3.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20% or less of the relays identified as included in the UFLS program, or amount of load tripped is within 10% deviation from the required amount of Load required to be shed at each stage	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 20%-40% of the relays identified as included in the UFLS program, or amount of load tripped is within 20% deviation from the required amount of Load required to be shed at each stage m	The Distribution Provider or Transmission Owner failed to apply appropriate settings on 40%-60% of the relays identified as included in the UFLS program, or amount of load tripped is within 30% deviation from the required amount of Load required to be shed at each stage.	The Distribution Provider or Transmission Owner failed to apply appropriate settings on > 60% of the relays identified as included in the UFLS program, or amount of load tripped has a > 30% deviation from the required amount of Load required to be shed at each stage
R4.	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations for	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program fulfilled its obligations but exceeded the permissible	The Distribution Provider or Transmission Owner that cannot meet the tolerances and/or number of stages and frequency set points specified in the UFLS Program failed to meet all of items in Requirement 5 within 60

	Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items by a period of up to 10 calendar days but less than or equal to 20 calendar days.	Requirement R5, Parts %.1 through Part 5.4 but exceeded the permissible time frame for one or more of the 4 items within a time greater than 20 calendar days but less than or equal to 30 calendar days.	time frame for one or more of the 4 items within a time greater than 30 calendar days but less than or equal to 60 calendar days.	calendar days of permissible time for each item.
R5.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 100% but more than (and including) 95% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 95% but more than (and including) 90% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 90% but more than (and including) 85% of relays within its region's UFLS program.	The Planning Coordinator developed or reviewed settings for inhibit thresholds at least once per five calendar years, for less than 85% of relays within its region's UFLS program.
R6.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 30 calendar days and up to and including 40 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 40 calendar days but less than and including 50 calendar days of any changes.	The Planning Coordinator provided to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds more than 50 calendar days but less than and including 60 calendar days of any changes.	The Planning Coordinator failed to provide to a Transmission Owner or Distribution Provider within its Planning Coordinator area the applicable inhibit thresholds within 60 calendar days after any changes
R7.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 90 calendar days and up to and including 100 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 100 calendar days and up to and including 110 calendar days following the request.	The Distribution Provider or Transmission Owner developed and submitted its implementation plan more than 110 calendar days and up to and including 120 calendar days following the request.	The Distribution Provider or Transmission Owner failed to develop and submit its implementation plan within 120 days following the request.
R8.	Implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with the Planning Coordinator approved implementation plan for	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with	The Distribution Provider or Transmission Owner implemented the inhibit threshold settings provided by the Planning Coordinator in accordance with

	less than 100% but more than (and including) 95% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 95% but more than (and including) 90% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 90% but more than (and including) 85% of UFLS relays.	the Planning Coordinator approved implementation plan for less than 85% of UFLS relays.
R9.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 15 calendar months but less than (and including) 16 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 16 calendar months but less than (and including)17 calendar months since last update.	The Distribution Provider or Transmission Owner provided to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 more than 17 calendar months but less than (and including)18 calendar months since last update.	The Distribution Provider or Transmission Owner failed to provide to its Planning Coordinator documentation of the actual net Load that would have been shed by the UFLS relays at each UFLS stage as described in Requirement R11 within 18 calendar months since last update.
R10.	N/A	N/A	N/A	The Generator Owner did not set each generator underfrequency trip relay, if so equipped, on or below the appropriate generator underfrequency trip protection settings threshold curve in Figure 2, except as otherwise exempted.
R11.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 45calendar days and less than (and including) 55 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 55 calendar days and less than (and including) 65 calendar days of the Planning Coordinator's request.	The Generator Owner transmitted the generator underfrequency trip setting and time delay more than 65 calendar days and less than (and including) 75 calendar days of the Planning Coordinator's request.	The Generator Owner failed to transmit the generator underfrequency trip setting and time delay within 75 calendar days of the Planning Coordinator's request.
R12.	N/A	N/A	The Generator Owner with a new generating unit, or an existing	The Generator Owner with a new generating unit, or an existing generator increasing its net

			generator increasing its net capability by greater than 10%: Did not fulfill the obligation of Requirement R12; Part 12.1 OR Did not fulfill the obligation of Requirement R12, Part 12.2.	capability by greater than 10%, did not fulfill the obligations of Requirement R12, Part 12.1 and Part 12.2.
R13.	N/A	The Generator Owner failed to transmit the existing underfrequency settings and any changes to the underfrequency settings along with the technical basis for the settings to the Planning Coordinatoras specified in Requirement R13, Part 13.2.	The Generator Owner failed to set the underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations a specified in Requirement 13, Part 13.1	The Planning Coordinator in Ontario, Québec and the Maritime Provinces or the Generator Owner within the ISO-NE and in NYISO Planning Coordinator areas failed to arrange for compensatory load shedding as specified in Requirement R13, Part 13.3.
R14.	N/A	N/A	N/A	The Planning Coordinator did not apply the criteria described in Attachment A to determine the compensatory load shedding that is required.
R15.	N/A	N/A	N/A	The Generator Owner, Distribution Provider, or Transmission Owner did not apply the criteria described in Attachment B to determine the compensatory load shedding that is required.
R16.	N/A	The Generator Owner failed to transmit the initial frequency trip setting and any changes to the setting and the technical basis for the settings to the Planning	The Generator Owner: Failed to set the underfrequency protection as specified in Requirement R16; Part 16.1 OR	The Generator Owner did not fulfill the obligations of Requirement R16, Part 16.1 and Part 16.2.

		Coordinator as specified in Requirement R16, Part 16.3.	Failed to set the frequency trip setting upper tolerance as specified in Requirement R16, Part 16.2.	

D. Regional Variances

None.

E. Associated Documents

Technical Rationale

Version History

Version	Date	Action	Change Tracking
1	2-9-2012	Adopted by Board of Trustees	
2	6-23-2015	RSAR Submitted	

Standard Attachments

PRC-006-NPCC-2 Attachment A

Compensatory Load Shedding Criteria for Ontario, Quebec, and the Maritime Provinces:

The Planning Coordinator in Ontario, Quebec and the Maritime provinces is responsible for establishing the compensatory load shedding requirements for all existing non-nuclear units in its NPCC area with underfrequency protections set to trip above the appropriate curve in Figure 2. In addition, it is the Planning Coordinator's responsibility to communicate these requirements to the appropriate Distribution Provider or Transmission Owner and to ensure that adequate compensatory load shedding is provided in all UFLS islands in which the unit may operate.

The methodology below provides a set of criteria for the Planning Coordinator to follow for determining compensatory load shedding requirements as part of its UFLS Assessment based on the NERC PRC Standard on UFLS:

1. The Planning Coordinator shall identify, compile and maintain a list of all existing non-nuclear generating units in their Planning Coordinator area that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate generating units, if any, that have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information for each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 All islands within which the unit may operate

2. For each generating unit identified in (1) above, the Planning Coordinator shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 Arrange for a Distribution Provider or Transmission Owner that owns UFLS relays within the island(s) identified by the Planning Coordinator within which the generator may operate to provide compensatory load shedding.

    2.2 In Ontario and in the Maritime provinces, the compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in

addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.3 The compensatory load shedding shall be provided at the UFLS program stage (or threshold stage for Quebec) with a frequency threshold setting that corresponds to the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 during an underfrequency event. If the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2 does not correspond to a specific UFLS program stage threshold setting, the compensatory load shedding shall be provided at the UFLS program stage with a frequency threshold setting that is higher than the highest frequency at which the subject generator will trip above the appropriate curve in Figure 2.

2.4 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment B

Compensatory Load Shedding Criteria for ISO-NE and NYISO:

The Generator Owner in the New England states or New York State are responsible for establishing a compensatory load shedding program for all existing non-nuclear units with underfrequency protection set to trip above the appropriate curve in Figure 2 of this standard. The Generator Owner shall follow the methodology below to determine compensatory load shedding requirements:

1. The Generator Owner shall identify, compile, and maintain a list of all of its existing non-nuclear generating units that were in service prior to the effective date of the regional Standard (July 1, 2015 PRC-006-NPCC-1). The list must indicate the Generator Owner's generating units, if any, which have their underfrequency protections set to trip above the appropriate curve in Figure 2. Generating Units not appearing on the list as of the effective date of Version 1 of the regional standard, as shown above, must have their Underfrequency protections set to trip on or below the appropriate curve in Figure 2. The list shall include the following information associated with each unit:

    1.1 Generator name and generating capacity
    1.2 Underfrequency protection trip settings, including frequency trip set points and time delays
    1.3 Physical and electrical location of the unit
    1.4 Smallest island within which the unit may operate as identified by the Planning Coordinator in Requirement R1 of this Standard.

2. For each generating unit identified in (1) above, the Generator Owner shall establish the requirements for compensatory load shedding based on criteria outlined below:

    2.1 In cases where a Distribution Provider or Transmission Owner has coordinated protection settings with the Generator Owner to cause the generator to trip above the appropriate curve in Figure 2, the Distribution Provider or Transmission Owner is responsible to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

    2.2 In cases where a Generator Owner has a generator that cannot physically meet the set points defined by the appropriate curve in Figure 2, the Generator Owner shall arrange for a Distribution Provider or Transmission Owner to provide the appropriate amount of compensatory load to be shed within the same and smallest island identified by the Planning Coordinator in Requirement R1 of this standard.

2.3 The compensatory load shedding that is provided by the Distribution Provider or Transmission Owner shall be in addition to the amount that the Distribution Provider or Transmission Owner is required to shed as specified in Requirement R4.

2.4 The compensatory load shedding shall be provided at the UFLS program stage with the frequency threshold setting at or closest to but above the frequency at which the subject generator will trip.

2.5 The amount of compensatory load shedding shall be equivalent (±5%) to the average net generator megawatt output for the prior two calendar years, as specified by the Planning Coordinator, plus expected station loads to be transferred to the system upon loss of the facility. The net generation output should only include those hours when the unit was a net generator to the electric system.

In the specific instance of a generating unit that has been interconnected to the electric system for less than two calendar years, the amount of compensatory load shedding shall be equivalent (±5%) to the maximum claimed seasonal capability of the generator over two calendar years, plus expected station loads to be transferred to the system upon loss of the facility.

PRC-006-NPCC-2 Attachment C

UFLS Table 1: Eastern Interconnection Distribution Providers and Transmission Owners with 100 MW[2] or more of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	6.5 – 7.5	6.5 – 7.5
2	59.3	0.10	0.30	6.5 – 7.5	13.5 – 14.5
3	59.1	0.10	0.30	6.5 – 7.5	20.5 – 21.5
4	58.9	0.10	0.30	6.5 – 7.5	27.5 – 28.5
5	59.5	0.10	10.0	2 - 3	29.5 – 31.5

UFLS Table 2: Eastern Interconnection Distribution Providers and Transmission Owners with 50 MW[2] or more and less than 100 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	14 – 25	14 – 25
2	59.1	0.10	0.30	14 – 25	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

UFLS Table 3: Eastern Interconnection Distribution Providers and Transmission Owners with 25 MW[2] or more and less than 50 MW[2] of peak net Load shall implement a UFLS program with the following attributes:					
UFLS Stage	Frequency Threshold (Hz)	Minimum Relay Time Delay (s)	Total Nominal Operating Time (s)[1]	Load Shed at Stage as % of TO or DP Load	Cumulative Load Shed as % of TO or DP Load
1	59.5	0.10	0.30	28 – 50	28 – 50

1. The total nominal operating time includes the underfrequency relay operating time plus any interposing auxiliary relay operating times, communication times, and the rated breaker interrupting time. The underfrequency relay operating time is measured from the time when frequency passes through the frequency threshold setpoint, using a test rate of frequency decay of 0.2 Hz per second. If the relay operating time is dependent on the rate of frequency decay, the underfrequency relay operating time and any subsequent testing of the UFLS relays shall utilize a test rate of linear frequency decay of 0.2 Hz per second.
2. Peak net load shall be calculated as an average of the peak net load from the previous 3 years, excluding the current year.

Rationale Box:

Standard PRC-006-3, R4 requires the Planning Coordinator to conduct a UFLS assessment at least once every five years. However, aside from a UFLS islanding event, it does not prescribe other factors or events which could warrant a new UFLS assessment in less than the five years time-frame.
PRC-006-NPCC-01 contained requirements if changes to load distribution impacted UFLS program performance (R21) but did not consider many other factors. The drafting team recommends retiring these requirements (R21, R22, R23) and replacing them with the following guidance.
Significant variations in the following factors could require a Planning Coordinator to conduct a new assessment:

- Changes to the BES that could modify the creation of islands or the severity of events such as new transmission topologies, revised protection schemes or new or revised RAS.
- Unforeseen islanding event
- Real and reactive load distribution (including changes to location of compensatory load shedding)
- Transmission Owner or Distribution Provider's inability to implement the UFLS program within the stated tolerances
- Load characteristics in particular frequency responsive load
- Automatic load restoration
- Generation geographical distribution
- Generator trip settings
- Generation mix in particular non-BES generation that may not be subject to frequency ride-through criteria
- Generator dynamic modeling
- Dynamic VAR device modeling
- HVDC dynamic modeling

NPCC, Inc.

NORTHEAST POWER COORDINATING COUNCIL, INC.
1040 AVE. OF THE AMERICAS, NEW YORK, NY 10018 (212) 840-1070 FAX (212) 302-2782

Date: May 2, 2019

To: Mr. Howard Gugel
Vice President of Engineering and Standards

From: Mr. Guy V. Zito
Assistant Vice President – Standards
Chair, Regional Standards Committee

Subject: NPCC Regional Standard, PRC-006-NPCC-02 "Automatic Underfrequency Load Shedding" for NERC BOT Consideration and Adoption

In this transmittal, please find a clean version of the subject Regional Standard and the proposed Implementation Plan. This represents a revision to the existing FERC approved PRC-006-NPCC-1 Regional Standard and was completed in accordance with the FERC approved NPCC Regional Standard Processes Manual by a drafting team of NPCC subject matter experts who perform, or are involved with analysis of, the UFLS studies in the Region.

The Standard was posted for three industry comment periods and a pre-ballot review. A ballot was then conducted which closed at 23:59 PM on February 10th, 2019 achieving a 96% approval with 81% quorum.

On May 1, 2019 the NPCC Board of Directors approved, PRC-006-NPCC-02. A full developmental record for the standard, including a mapping document detailing changes from the existing FERC approved version of the standard requirements to this revised version, may be found at:

NPCC Automatic Underfrequency Load Shedding Regional Standard Development Page

A summary of the revisions to the previous version of the standard is as follows:

1) Remove redundancies with the most recent of the Continent-wide NERC Standard, PRC-006-3. Some of the redundancies removed from the Regional Standard PRC-006-NPCC-2 are those related to:
   - The Québec Interconnection portion of NPCC shall implement an automatic UFLS program in accordance with Attachment C Table 4
   - Requirements for a UFLS Database
   - Notification of changes to load distribution needed to satisfy UFLS program performance characteristics
   - Development of an implementation plan when changes to load distribution are needed

2) Ensure that UFLS island boundaries, once identified, are provided upon request, to affected entities.
3) Minimum time UFLS relay time delay added to Attachment C tables and removed as a separate requirement
4) Added the ability for a TO or DP to calculate net load shed for UFLS if direct metering is not available
5) A number of minor clarifications were made to the standard such as requiring the Underfrequency trip relay must to be set to operate "on or below" the appropriate curve. In Version 1 it currently states below and questions arose whether settings on the curve were considered in compliance.
6) Clarification that any compensatory load shedding for non-conformance with the Underfrequency trip specification for generation (in service prior to July 1, 2015) must be within the same island as the generator resides.

NPCC hereby requests that the NPCC Regional Standard PRC-006-NPCC-02, "*Automatic Underfrequency Load Shedding* the PRC-006-NPCC-2 be submitted to the NERC Board of Trustees for their consideration and adoption at their August 15, 2019 meeting.

Please contact me if you have further questions or need additional information.

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Updated
Regional Reliability Standards Announcement

Northeast Power Coordinating Council
PRC-006-NPCC-2

Comment Period Open through June 21, 2019

Now Available

The Northeast Power Coordinating Council, Inc. (NPCC) requested that NERC post Regional Reliability Standard **PRC-006-NPCC-2 – Automatic Underfrequency Load Shedding** for industry review and comment in accordance with the NERC Rules of Procedure.

Background

The NPCC drafting team reviewed Regional Reliability Standard PRC-006-NPCC-1. The revisions made to PRC-006-NPCC-1 can be found in the Summary of Changes.

Commenting

Use the Standards Balloting and Commenting System (SBS) to submit comments. If you experience any difficulties using the electronic form, contact Nasheema Santos. The form must be submitted by **8 p.m. Eastern, Friday, June 21, 2019.** An unofficial Word version of the comment form is posted on the Regional Reliability Standards Under Development page.

Regional Reliability Standards Development Process

Section 300 of **NERC's Rules of Procedures of the Electric Reliability Organization** governs the regional reliability standards development process. Although the technical aspects of this Regional Reliability Standard have been vetted through NPCC's Regional Standards development process, the final approval process for a Regional Reliability Standard requires NERC publicly to notice and request comment on the criteria outlined in the unofficial comment form.

Documents and information about this project are available on the NPCC's Standards In Development page.

For more information or assistance, contact Senior Reliability Standards Analyst, Nasheema Santos (via email) or at (404) 446-2564.

North American Electric Reliability Corporation
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Exhibit E

Standard Drafting Team Roster

DRAFTING TEAM--RSAR PRC-006-NPCC-02

	Self-Nominations	
1	Dan Taft	Consolidated Edison Company of New York
2	Jonathan Appelbaum (Resigned from United Illuminating)	The United Illuminating Company
3	Tim Kucey (Resigned from drafting team)	PSEG Fossil LLC
4	Vincent Morissette	Hydro-Québec TransÉnergie
5	Dean Latulipe	National Grid
6	Brian Robinson--**RSAR Requester**	Utility Services, Inc.
7	Hamid Hamadani	Hydro One Networks, Inc.
8	Daniel Kidney	NPCC Compliance Staff
9	Ruida Shu	NPCC Standards Staff

Exhibit F

Violation Risk Factor and Violation Severity Level Justification

Exhibit F

Violation Risk Factor and Violation Severity Level Justification

The modifications in proposed Regional Reliability Standard PRC-006-NPCC-2 are extensive and best understood by reviewing the Summary of Changes and the NPCC mapping document, both in Exhibit D. These modifications have resulted in some changes to the Violation Risk Factors (VRFs) and Violation Severity Levels (VSLs) as compared to the current version of the Regional Reliability Standard PRC-006-NPCC-1. The Standard Drafting Team (SDT) considered the NERC Criteria for VRFs and the FERC Guidelines for VRFs and the NERC Criteria for VSLs and the FERC Order of VSLs when developing the VRFs and VSLs for the proposed Regional Reliability Standard.

1. **PRC-006-NPCC-2 Requirement R1.** Proposed Requirement R1 replaces in part currently effective PRC-006-NPCC-1 Requirement R2, the substance of which is now addressed by proposed Requirements R1, R2, and R3.

   VRF Justification: The justification for the VRF is provided in the table below.

VRF Justifications for PRC-006-NPCC-2 Requirement R1	
Proposed VRF	**High**
VRF Discussion	A VRF of "High" is being proposed for this Requirement. A VRF of "High" is appropriate because the proposed Requirement is associated with the design of an UFLS program pertaining to islands within the NPCC region, having performance characteristics that prevents the frequency from remaining below 59.5 Hz for more than 30 seconds. If violated, this Requirement in the planning timeframe could, under emergency, abnormal, or restorative conditions anticipated by the preparations,

VRF Justifications for PRC-006-NPCC-2 Requirement R1	
	directly cause or contribute to Bulk Electric System instability, separation, or a cascading sequence of failures, place the Bulk Electric System at an unacceptable risk of instability, separation, or cascading failures, or could hinder restoration to a normal condition.
FERC VRF Guideline 1 Consistency with Blackout Report	Emergency operations, protection systems and their coordination, system modeling and data exchange, and clearer criteria for operationally critical facilities
FERC VRF Guideline 2 Consistency within a Reliability Standard	Not applicable. There are no sub-Requirement VRFs in the Regional Reliability Standard.
FERC VRF Guideline 3 Consistency among Reliability Standards	The proposed VRF is consistent with other FERC-approved VRFs in different Reliability Standards that address similar reliability goals. Specifically, the proposed VRF of "High" is consistent with the VRF of "High" in PRC-006-3 Requirement R3, which requires the development of a UFLS program.
FERC VRF Guideline 4 Consistency with NERC Definition of VRFs	The team relied on NERC's definition of a high risk requirement.
FERC VRF Guideline 5 Treatment of Requirements that comingle more than one obligation	Not applicable. The Requirement does not comingle a higher risk reliability objective with a lower risk reliability objective.

VSL Justification: The justification for the VSL is provided in the table below.

VSL Justifications for PRC-006-NPCC-2 Requirement R1	
FERC VSL Guideline 1 Violation Severity Level assignments should not have the unintended consequence of lowering the current level of compliance	The proposed Requirement is new and has a single VSL of "Severe." Therefore, the proposed VSLs do not have the unintended consequence of lowering the level of compliance.

VSL Justifications for PRC-006-NPCC-2 Requirement R1	
FERC VSL Guideline 2 Violation Severity Level assignments should ensure uniformity and consistency in the determination of penalties Guideline 2a: A violation of a "binary" type requirement must be a "Severe" VSL Guideline 2b: Do not use ambiguous terms to describe noncompliant performance	The proposed VSL is "Severe" as required for a "binary" type requirement and does not use any ambiguous terminology, thereby supporting uniformity and consistency in the determination of similar penalties for similar violations.
FERC VSL Guideline 3 Violation Severity Level assignment should be consistent with the corresponding Requirement	The proposed VSLs use the same terminology as used in the associated Requirement and are, therefore, consistent with the Requirement.
FERC VSL Guideline 4 Violation Severity Level assignment should be based on a single violation, not a cumulative number of violations	Each VSL is based on a single violation and not cumulative violations.

2. **PRC-006-NPCC-2 Requirement R2.** Proposed Requirement R2 carries forward currently effective PRC-006-NPCC-1 Requirement R3 largely unchanged, keeping the requirement to provide information about UFLS island boundaries to affected entities while moving the requirements regarding compensator load shedding to proposed Requirement R13. Aspects of currently effective PRC-006-NPCC-1 Requirements R1 and R2 were incorporated into proposed Requirement R2 as well.

   VRF Justification: The justification for the VRF is in the table below.

VRF Justifications for PRC-006-NPCC-2 Requirement R2	
Proposed VRF	**Lower**
VRF Discussion	A VRF of "Lower" is being proposed for this Requirement. A VRF of "Lower" is appropriate because the proposed Requirement is administrative in nature and is associated with providing UFLS island boundaries to relevant entities within 30 calendar days

VRF Justifications for PRC-006-NPCC-2 Requirement R2	
	of receipt of a request. If violated, this Requirement in the planning timeframe would not, under the emergency, abnormal, or restorative conditions anticipated by the preparations, be expected to adversely affect the electrical state or capability of the Bulk Electric System, or the ability to effectively monitor, control, or restore the Bulk Electric System.
FERC VRF Guideline 1 Consistency with Blackout Report	Emergency operations, protection systems and their coordination, system modeling and data exchange, and clearer criteria for operationally critical facilities
FERC VRF Guideline 2 Consistency within a Reliability Standard	Not applicable. There are no sub-Requirement VRFs in the Regional Reliability Standard.
FERC VRF Guideline 3 Consistency among Reliability Standards	The proposed VRF is consistent with other FERC-approved VRFs in different Reliability Standards that address similar reliability goals. Specifically, the proposed VRF of "Lower" is consistent with the VRF of "Lower" in PRC-006-3 Requirement R7, which requires relevant entities to provide information to other entities within 30 calendar days of a request.
FERC VRF Guideline 4 Consistency with NERC Definition of VRFs	The team relied on NERC's definition of a lower risk requirement.
FERC VRF Guideline 5 Treatment of Requirements that comingle more than one obligation	Not applicable. The Requirement does not comingle a higher risk reliability objective with a lower risk reliability objective.

VSL Justification: The VSLs did not substantively change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard. Only minor revisions were made.

3. **PRC-006-NPCC-2 Requirement R3.** Proposed Requirement R3 replaces in part currently effective PRC-006-NPCC-1 Requirement R1, the substance of which is now addressed by the proposed Requirements R2, R3, and R13, and also replaces in part the currently effective PRC-006-NPCC-1 Requirement R2, the substance of which is now addressed by the proposed Requirements R1, R2, and R3.

VRF Justification: The justification for the VRF is in the table below.

VRF Justifications for PRC-006-NPCC-2 Requirement R3	
Proposed VRF	**High**
VRF Discussion	A VRF of "High" is being proposed for this Requirement. A VRF of "High" is appropriate because the proposed Requirement is associated with implementation of an automatic UFLS program on an island basis. If violated, this Requirement in the planning timeframe could, under emergency, abnormal, or restorative conditions anticipated by the preparations, directly cause or contribute to Bulk Electric System instability, separation, or a cascading sequence of failures, place the Bulk Electric System at an unacceptable risk of instability, separation, or cascading failures, or could hinder restoration to a normal condition.
FERC VRF Guideline 1 Consistency with Blackout Report	Emergency operations, protection systems and their coordination, system modeling and data exchange, and clearer criteria for operationally critical facilities
FERC VRF Guideline 2 Consistency within a Reliability Standard	Not applicable. There are no sub-Requirement VRFs in the Regional Reliability Standard.
FERC VRF Guideline 3 Consistency among Reliability Standards	The proposed VRF is consistent with other FERC-approved VRFs in different Reliability Standards that address similar reliability goals. Specifically, the proposed VRF of "High" is consistent

VRF Justifications for PRC-006-NPCC-2 Requirement R3	
	with the VRF of "High" in PRC-006-3 Requirement R9, which requires automatic tripping of Load in accordance with the UFLS program design and schedule for implementation.
FERC VRF Guideline 4 Consistency with NERC Definition of VRFs	The team relied on NERC's definition of a high risk requirement.
FERC VRF Guideline 5 Treatment of Requirements that comingle more than one obligation	Not applicable. The Requirement does not comingle a higher risk reliability objective with a lower risk reliability objective.

VSL Justification: The justification for the VSL is provided in the table below.

VSL Justifications for PRC-006-NPCC-2 Requirement R3	
FERC VSL Guideline 1 Violation Severity Level assignments should not have the unintended consequence of lowering the current level of compliance	The proposed Requirement is a reworking of several requirements from the currently effective Regional Reliability Standard, with the VSLs based on the percentage of relays in the UFLS program that entities failed to apply appropriate settings or the percentage deviation from the required amount of Load to be shed at each stage that was actually tripped. Therefore, the proposed VSLs do not have the unintended consequence of lowering the level of noncompliance.
FERC VSL Guideline 2 Violation Severity Level assignments should ensure uniformity and consistency in the determination of penalties Guideline 2a: A violation of a "binary" type requirement must be a "Severe" VSL Guideline 2b: Do not use ambiguous terms to describe noncompliant performance	The proposed VSLs are not binary and do not use any ambiguous terminology, thereby supporting uniformity and consistency in the determination of similar penalties for similar violations.
FERC VSL Guideline 3 Violation Severity Level assignment should be consistent with the corresponding Requirement	The proposed VSLs use the same terminology as used in the associated Requirement and are, therefore, consistent with the Requirement.

VSL Justifications for PRC-006-NPCC-2 Requirement R3	
FERC VSL Guideline 4 Violation Severity Level assignment should be based on a single violation, not a cumulative number of violations	Each VSL is based on a single violation and not cumulative violations.

4. **PRC-006-NPCC-2 Requirement R4.** Proposed Requirement R4 combines currently effective PRC-006-NPCC-1 Requirements R4 and R5 into a single new requirement and clarifies what registered entities must do in the event they are unable to meet the UFLS program parameters specified in the Tables of Attachment C or by its Planning Coordinator, and in what timeframe the registered entities must take the defined actions.

   VRF Justification: The VRF of "High" did not change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard.

   VSL Justification: The justification for the VSL is provided in the table below.

VSL Justifications for PRC-006-NPCC-2 Requirement R4	
FERC VSL Guideline 1 Violation Severity Level assignments should not have the unintended consequence of lowering the current level of compliance	The proposed Requirement is a combination of two Requirements from the currently effective Regional Reliability Standard. Therefore, the proposed VSLs do not have the unintended consequence of lowering the level of noncompliance.
FERC VSL Guideline 2 Violation Severity Level assignments should ensure uniformity and consistency in the determination of penalties Guideline 2a: A violation of a "binary" type requirement must be a "Severe" VSL Guideline 2b: Do not use ambiguous terms to describe noncompliant performance	The proposed VSLs are not binary and do not use any ambiguous terminology, thereby supporting uniformity and consistency in the determination of similar penalties for similar violations.
FERC VSL Guideline 3 Violation Severity Level assignment should be consistent with the corresponding Requirement	The proposed VSLs use the same terminology as used in the associated Requirement and are, therefore, consistent with the Requirement.

VSL Justifications for PRC-006-NPCC-2 Requirement R4	
FERC VSL Guideline 4 Violation Severity Level assignment should be based on a single violation, not a cumulative number of violations	Each VSL is based on a single violation and not cumulative violations.

5. **PRC-006-NPCC-2 Requirement R5.** Proposed Requirement R5 carries forward currently effective PRC-006-NPCC-1 Requirement R8 largely unchanged, but lengthens the periodicity of developing and reviewing settings for inhibit thresholds from once per calendar year to once per five calendar years.

   VRF Justification: The VRF of "Medium" did not change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard.

   VSL Justification: The justification for the VSL is provided in the table below.

VSL Justifications for PRC-006-NPCC-2 Requirement R5	
FERC VSL Guideline 1 Violation Severity Level assignments should not have the unintended consequence of lowering the current level of compliance	The proposed Requirement lengthens the periodicity of reviewing inhibit thresholds, while the proposed VSLs are based on the percentage of relays that were not included in the development or review of inhibit threshold settings during the longer period. Therefore, the proposed VSLs do not have the unintended consequence of lowering the level of noncompliance.
FERC VSL Guideline 2 Violation Severity Level assignments should ensure uniformity and consistency in the determination of penalties Guideline 2a: A violation of a "binary" type requirement must be a "Severe" VSL Guideline 2b: Do not use ambiguous terms to describe noncompliant performance	The proposed VSLs are not binary and do not use any ambiguous terminology, thereby supporting uniformity and consistency in the determination of similar penalties for similar violations.
FERC VSL Guideline 3	The proposed VSLs use the same terminology as used in the associated

VSL Justifications for PRC-006-NPCC-2 Requirement R5	
Violation Severity Level assignment should be consistent with the corresponding Requirement	Requirement and are, therefore, consistent with the Requirement.
FERC VSL Guideline 4 Violation Severity Level assignment should be based on a single violation, not a cumulative number of violations	Each VSL is based on a single violation and not cumulative violations.

6. **PRC-006-NPCC-2 Requirement R6.** Proposed Requirement R6 carries forward currently effective PRC-006-NPCC-1 Requirement R9 substantively unchanged, clarifying matters by removing language about initial determination of inhibit thresholds that is no longer needed.

   VRF Justification: The justification for the VRF is in the table below.

VRF Justifications for PRC-006-NPCC-2 Requirement R6	
Proposed VRF	**Lower**
VRF Discussion	A VRF of "Lower" is being proposed for this Requirement. A VRF of "Lower" is appropriate because the proposed Requirement is administrative in nature and is associated with providing relevant entities with applicable inhibit thresholds within 30 calendar days of a change. If violated, this Requirement in the planning timeframe would not, under the emergency, abnormal, or restorative conditions anticipated by the preparations, be expected to adversely affect the electrical state or capability of the Bulk Electric System, or the ability to effectively monitor, control, or restore the Bulk Electric System.
FERC VRF Guideline 1 Consistency with Blackout Report	Emergency operations, protection systems and their coordination, system modeling and data exchange, and clearer criteria for operationally critical facilities

VRF Justifications for PRC-006-NPCC-2 Requirement R6	
FERC VRF Guideline 2 Consistency within a Reliability Standard	Not applicable. There are no sub-Requirement VRFs in the Regional Reliability Standard.
FERC VRF Guideline 3 Consistency among Reliability Standards	The proposed VRF is consistent with other FERC-approved VRFs in different Reliability Standards that address similar reliability goals. Specifically, the proposed VRF of "Lower" is consistent with the VRF of "Lower" in PRC-006-3 Requirement R14, which requires Planning Coordinators to respond to comments provided by UFLS entities and Transmission Owners in its Planning Coordinator area and indicate whether the changes will be made or why changes will not be made to the UFLS program.
FERC VRF Guideline 4 Consistency with NERC Definition of VRFs	The team relied on NERC's definition of a lower risk requirement.
FERC VRF Guideline 5 Treatment of Requirements that comingle more than one obligation	Not applicable. The Requirement does not comingle a higher risk reliability objective with a lower risk reliability objective.

VSL Justification: The VSLs did not substantively change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard. Only minor revisions were made.

7. **PRC-006-NPCC-2 Requirement R7.** Proposed Requirement R7 carries forward currently effective PRC-006-NPCC-1 Requirement R11 substantively unchanged, clarifying that the trigger for action is receipt of a notification pursuant to proposed Requirement R6, and changing the requirement numbers that are referenced.

   VRF Justification: The VRF of "Lower" did not change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard.

VSL Justification: The VSLs did not substantively change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard. Only minor revisions were made.

8. **PRC-006-NPCC-2 Requirement R8.** Proposed Requirement R8 carries forward currently effective Requirement R10 substantively unchanged, updating the requirement numbers referenced and adding clarification that the Planning Coordinator provides the inhibit thresholds and approves the implementation plan.

VRF Justification: The VRF of "High" did not change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard.

VSL Justification: The justification for the VSL is provided in the table below.

VSL Justifications for PRC-006-NPCC-2 Requirement R8	
FERC VSL Guideline 1 Violation Severity Level assignments should not have the unintended consequence of lowering the current level of compliance	The proposed Requirement carries forward a currently effective Requirement substantively unchanged, while the proposed VSLs are based on the percentage of UFLS relays for which the entity implemented the inhibit threshold settings that were provided. Therefore, the proposed VSLs do not have the unintended consequence of lowering the level of noncompliance.
FERC VSL Guideline 2 Violation Severity Level assignments should ensure uniformity and consistency in the determination of penalties Guideline 2a: A violation of a "binary" type requirement must be a "Severe" VSL Guideline 2b: Do not use ambiguous terms to describe noncompliant performance	The proposed VSLs are not binary and do not use any ambiguous terminology, thereby supporting uniformity and consistency in the determination of similar penalties for similar violations.
FERC VSL Guideline 3 Violation Severity Level assignment should be consistent with the corresponding Requirement	The proposed VSLs use the same terminology as used in the associated Requirement and are, therefore, consistent with the Requirement.

VSL Justifications for PRC-006-NPCC-2 Requirement R8	
FERC VSL Guideline 4 Violation Severity Level assignment should be based on a single violation, not a cumulative number of violations	Each VSL is based on a single violation and not cumulative violations.

9. **PRC-006-NPCC-2 Requirement R9.** Proposed Requirement R9 revises currently effective PRC-006-NPCC-1 Requirement R12 by adding language that allows the calculation of load from the nearest available metering rather than actual metering.

VRF Justification: The VRF of "Lower" did not change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard.

VSL Justification: The justification for the VSL is provided in the table below.

VSL Justifications for PRC-006-NPCC-2 Requirement R9	
FERC VSL Guideline 1 Violation Severity Level assignments should not have the unintended consequence of lowering the current level of compliance	The proposed Requirement carries forward a Requirement from the currently effective Regional Reliability Standard substantively unchanged, with the VSLs based on how late the entity was in providing the required documentation. Therefore, the proposed VSLs do not have the unintended consequence of lowering the level of noncompliance.
FERC VSL Guideline 2 Violation Severity Level assignments should ensure uniformity and consistency in the determination of penalties Guideline 2a: A violation of a "binary" type requirement must be a "Severe" VSL Guideline 2b: Do not use ambiguous terms to describe noncompliant performance	The proposed VSLs are not binary and do not use any ambiguous terminology, thereby supporting uniformity and consistency in the determination of similar penalties for similar violations.
FERC VSL Guideline 3 Violation Severity Level assignment should be consistent with the corresponding Requirement	The proposed VSLs use the same terminology as used in the associated Requirement and are, therefore, consistent with the Requirement.
FERC VSL Guideline 4	Each VSL is based on a single violation and not cumulative violations.

VSL Justifications for PRC-006-NPCC-2 Requirement R9	
Violation Severity Level assignment should be based on a single violation, not a cumulative number of violations	

10. **PRC-006-NPCC-2 Requirement R10.** Proposed Requirement R10 carries forward currently effective PRC-006-NPCC-1 Requirement R13 substantively unchanged, but clarifies that the Underfrequency trip relay must be set to operate "on or below" the appropriate curve instead of "below" the appropriate curve in order to clarify what settings are considered compliant under the proposed Regional Reliability Standard.

    VRF Justification: The VRF of "High" did not change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard.

    VSL Justification: The VSLs did not substantively change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard. Only minor revisions were made.

11. **PRC-006-NPCC-2 Requirement R11.** Proposed Requirement R11 carries forward currently effective PRC-006-NPCC-1 Requirement R14 substantively unchanged, updating only the numbering of the requirement.

    VRF Justification: The justification for the VRF is in the table below.

VRF Justifications for PRC-006-NPCC-2 Requirement R11	
Proposed VRF	**Lower**
VRF Discussion	A VRF of "Lower" is being proposed for this Requirement. A VRF of "Lower" is appropriate because the proposed Requirement is administrative in nature and is associated with transmitting the generator underfrequency trip setting and time delay within 45 calendar days of a request. If

VRF Justifications for PRC-006-NPCC-2 Requirement R11	
	violated, this Requirement in the planning timeframe would not, under the emergency, abnormal, or restorative conditions anticipated by the preparations, be expected to adversely affect the electrical state or capability of the Bulk Electric System, or the ability to effectively monitor, control, or restore the Bulk Electric System.
FERC VRF Guideline 1 Consistency with Blackout Report	Emergency operations, protection systems and their coordination, system modeling and data exchange, and clearer criteria for operationally critical facilities
FERC VRF Guideline 2 Consistency within a Reliability Standard	Not applicable. There are no sub-Requirement VRFs in the Regional Reliability Standard.
FERC VRF Guideline 3 Consistency among Reliability Standards	The proposed VRF is consistent with other FERC-approved VRFs in different Reliability Standards that address similar reliability goals. Specifically, the proposed VRF of "Lower" is consistent with the VRF of "Lower" in PRC-006-3 Requirement R8, which requires entities to provide the Planning Coordinator with requested information within a specified timeframe.
FERC VRF Guideline 4 Consistency with NERC Definition of VRFs	The team relied on NERC's definition of a lower risk requirement.
FERC VRF Guideline 5 Treatment of Requirements that comingle more than one obligation	Not applicable. The Requirement does not comingle a higher risk reliability objective with a lower risk reliability objective.

VSL Justification: The VSLs did not substantively change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard. Only minor revisions were made.

12. **PRC-006-NPCC-2 Requirement R12.** Proposed Requirement R12 carries forward currently effective PRC-006-NPCC-1 Requirement R15 substantively unchanged, removing "on or after the effective date" language from the currently effective Requirement because Version 1 of the Regional Reliability Standard has been in place and transition and implementation concerns no longer need to be addressed in the proposed Requirement, and also changes the numbers of Figures referenced in the currently effective Requirement.

VRF Justification: The justification for the VRF is in the table below.

VRF Justifications for PRC-006-NPCC-2 Requirement R12	
Proposed VRF	**Medium**
VRF Discussion	A VRF of "Medium" is being proposed for this Requirement. A VRF of "Medium" is appropriate because the proposed Requirement is associated with, for new generating units or an existing generator unit increasing its net capability by greater than 10%, designing measures or auxiliary systems or devices used for the control and protection of auxiliary systems to prevent the generating unit from tripping during underfrequency conditions. If violated, this Requirement in the planning timeframe, would be unlikely, under emergency, abnormal, or restoration conditions anticipated by the preparations, to lead to Bulk Electric System instability, separation, or cascading failures, nor to hinder restoration to a normal condition.
FERC VRF Guideline 1 Consistency with Blackout Report	Emergency operations, protection systems and their coordination, system modeling and data exchange, and clearer criteria for operationally critical facilities

VRF Justifications for PRC-006-NPCC-2 Requirement R12	
FERC VRF Guideline 2 Consistency within a Reliability Standard	Not applicable. There are no sub-Requirement VRFs in the Regional Reliability Standard.
FERC VRF Guideline 3 Consistency among Reliability Standards	The proposed VRF is consistent with other FERC-approved VRFs in different Reliability Standards that address similar reliability goals. Specifically, the proposed VRF of "Medium" is consistent with the VRF of "Medium" in PRC-006-3 Requirement R12, which requires entities to conduct and document a design assessment to address identified UFLS program deficiencies.
FERC VRF Guideline 4 Consistency with NERC Definition of VRFs	The team relied on NERC's definition of a medium risk requirement.
FERC VRF Guideline 5 Treatment of Requirements that comingle more than one obligation	Not applicable. The Requirement does not comingle a higher risk reliability objective with a lower risk reliability objective.

VSL Justification: The VSLs did not substantively change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard. Only minor revisions were made.

13. **PRC-006-NPCC-2 Requirement R13.** Proposed Requirement R13 carries forward currently effective PRC-006-NPCC-1 Requirement R16 substantively unchanged, adding language to clarify that any compensatory load shedding must be within the same island as the generating unit resides.

VRF Justification: The justification for the VRF is in the table below.

VRF Justifications for PRC-006-NPCC-2 Requirement R13	
Proposed VRF	**High**
VRF Discussion	A VRF of "High" is being proposed for this Requirement.

VRF Justifications for PRC-006-NPCC-2 Requirement R13	
	A VRF of "High" is appropriate because the proposed Requirement is associated with setting underfrequency protection to operate at the lowest frequency allowed by the plant design and licensing limitations and arranging for compensatory load shedding that is adequate to compensate for the loss of generator(s) due to early tripping that is within the identified UFLS island. If violated, this Requirement in the planning timeframe could, under emergency, abnormal, or restorative conditions anticipated by the preparations, directly cause or contribute to Bulk Electric System instability, separation, or a cascading sequence of failures, place the Bulk Electric System at an unacceptable risk of instability, separation, or cascading failures, or could hinder restoration to a normal condition.
FERC VRF Guideline 1 Consistency with Blackout Report	Emergency operations, protection systems and their coordination, system modeling and data exchange, and clearer criteria for operationally critical facilities
FERC VRF Guideline 2 Consistency within a Reliability Standard	Not applicable. There are no sub-Requirement VRFs in the Regional Reliability Standard.
FERC VRF Guideline 3 Consistency among Reliability Standards	The proposed VRF is consistent with other FERC-approved VRFs in different Reliability Standards that address similar reliability goals. Specifically, the proposed VRF of "High" is consistent with the VRF of "High" in PRC-006-3 Requirement R15, which requires the Planning Coordinator to develop a corrective action plan and schedule if the UFLS program does not meet the required performance characteristics.
FERC VRF Guideline 4 Consistency with NERC Definition of VRFs	The team relied on NERC's definition of a high risk requirement.

VRF Justifications for PRC-006-NPCC-2 Requirement R13	
FERC VRF Guideline 5 Treatment of Requirements that comingle more than one obligation	The Requirement refers to a separate Requirement with a VRF of "Lower" that require entities to provide UFLS island boundaries within 30 days of a request, but retains a VRF of "High" that requires entities to set underfrequency protections and arrange compensatory load shedding that is adequate to compensate for the loss of generator(s) that is within the UFLS island identified by the referenced Requirement. Thus, the VRF of the higher risk reliability objective was not watered down to reflect the lower risk level associated with the lower risk reliability objective.

VSL Justification: The VSLs did not substantively change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard. Only minor revisions were made.

14. **PRC-006-NPCC-2 Requirement R14.** Proposed Requirement R14 carries forward currently effective PRC-006-NPCC-1 Requirement R17 substantively unchanged, updating only the numbering of the requirement and the number of a referenced requirement.

VRF Justification: The VRF of "High" did not change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard.

VSL Justification: The VSLs did not substantively change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard. Only minor revisions were made.

15. **PRC-006-NPCC-2 Requirement R15.** Proposed Requirement R15 carries forward currently effective PRC-006-NPCC-1 Requirement R18 substantively unchanged, updating only the numbering of the requirement and the number of a referenced requirement.

    VRF Justification: The VRF of "High" did not change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard.

    VSL Justification: The VSLs did not substantively change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard. Only minor revisions were made.

16. **PRC-006-NPCC-2 Requirement R16.** Proposed Requirement R16 carries forward currently effective PRC-006-NPCC-1 Requirement R19 substantively unchanged, updating only the numbering of the requirement and the number of a Figure referenced in the requirement.

    VRF Justification: The VRF of "High" did not change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard.

    VSL Justification: The VSLs did not substantively change from the previously FERC-approved PRC-006-NPCC-1 Regional Reliability Standard. Only minor revisions were made.