NERC

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Meeting Notes Under-frequency Load Shedding SDT — Project 2007-01

Thursday October 29, 2009 2:00–4:00 p.m. Eastern

1. Administrative

Roll Call

Lauren Koller welcomed the members and guests of the Standard Drafting Team for Project 2007-01 Underfrequency Load Shedding (see Roster — Attachment 1a).

- Robert J. O'Keefe American Electric Power (Chair)
- Brian Bartos Bandera Electric Cooperative
- Tony Rodrigues PacifiCorp
- Si Truc Phan TransEnergie
- Scott Berry Indiana Municipal Power Agency
- Lauren Koller NERC

Observers

- Anthony Jablonski ReliabilityFirst Corporation
- Steve Wadas Nebraska Public Power District

NERC Antitrust Compliance Guidelines

Lauren Koller reviewed the Antitrust Guidelines with the team.

2. Review of Proposed Violation Severity Levels and Measures

The drafting team reviewed the proposed VSLs drafted by Tony Jablonski. The team also reviewed the Measures revised by Carol Gerou and edited by Phil Tatro. The other compliance elements (VRFs and Time Horizons) were reviewed and agreed upon during the meeting in Orlando, FL.

Robert O'Keefe modified Measures 4, 5, 6, 9, and 11

An item identified during meeting, but not addressed was the need to check capitalization of "load" in the standard, measures, and VSL's.

116-390 Village Blvd. Princeton, NJ 08540 609.452.8060 | www.nerc.com Robert noted that the over-riding consideration in measures is that the wording of the measures mimics that of the requirement.

Robert made some changes to Measure 11 and VSL 11 after the meeting to better match the clarified wording of R11 in the standard.

An item identified during meeting, but not addressed was the need to check capitalization of "load" in the standard, measures, and VSL's.

The drafting team completed their review of the VSLs and made some modifying changes to what was proposed.

3. Action Items

The list of action items was not reviewed during the call.

Action Items:	Status:	Assigned To:
Stephanie to follow-up with Compliance and Standards to determine if the draft standard can require that the group of PC's use their regional standards development processes to develop the UFLS program.	Created 2/11 By 2/20 conference call Closed	Stephanie
The standard cannot require "how" the program is established only what is required of the program.		
Stephanie will follow up with Gerry regarding the FERC direction to include the PRC-009 requirements into the draft standard. FERC did not support the team's argument that they could be covered under the NERC ROP data request.	Created 6/11/09	Stephanie
Barry's Comments: The team will review Barry's comments and will review Stephanie's list of major issues (for Barry's comments) and will email additions to the list by COB June 22 , 2009.	Closed	Team
The sub-teams will begin writing formal responses to the comments based on the discussion of issues at the June 10 th meeting.		
Question 1 and 2: Bob and Carol Bob and Carol will finalize the responses by June 19 — the team will review and discuss by exception on the July 7 th meeting — Complete		
Question 3: Rob The team will discuss response to comments (not done at the June in person meeting). Jonathan will lead the discussion and identify the major issues for discussion. — Complete		
Question 4: Jonathan The team will discuss on the August 6 th call — Complete (on		

Action Items:	Status:	Assigned To:
the July 20 call)		
Barry Francis: Rob The team will discuss on the August 6 th call — Complete		
Question 5: Gary, Tony, Si Truc The team will discuss on the August 24 th — Complete		
Question 6: Gary, Tony, Si Truc August 24 th call – the team did not discuss Question 6 responses. The team will discuss on conference calls after the meeting in Montreal. Completed on the 9/8/09 call		
Question 7: Brian By exception — Completed on the 9/11/09 call		
Question 8: August 24 th call — the team did not discuss Question 6 responses. The team will discuss on conference calls after the meeting in Montreal. — Completed on 9/25 call.		

4. Next Steps

Date	Location	Comments
January 12-13, 2010	FMPA	Go-no decision to ballot standard
8-5 pm both days		

5. Adjourn

Standard Development Roadmap

This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.

Development Steps Completed:

- 1. The Standards Committee approved the SAR for posting on November 21, 2006
- 2. SAR posted for comments on November 29, 2006.
- 3. The Standards Committee appointed a SAR Drafting team on January 11, 2007.
- 4. SAR Drafting Team responds to comments, revises SAR and posts for comments on February 7, 2007.
- 5. SAR Drafting Team responds to comments on April 20, 2007.
- 6. Standards Committee approves development of Standard on April 10, 2007.
- 7. The Standards Committee appointed the Standard Drafting Team on April 10, 2007.
- 8. The Standards Drafting Team posted draft performance characteristics for comment on July 2, 2008.
- 9. Standards Drafting Team responds to comments, revises standard and posts for comments on April 15, 2009.
- 10. Standards Drafting Team responds to comments, revises standard and posts for comments on November XX, 2009.

Proposed Action Plan and Description of Current Draft:

This is the third posting of the proposed standard for a 45 day comment period, from November $\frac{XX}{-}$

Future Development Plan:

Anticipated Actions	Anticipated Date
1. Respond to comments on the draft of the proposed standard and implementation plan.	February, 2010
2. Obtain the Standards Committee's approval to move the standard forward to balloting.	March, 2010
3. Post the standard and implementation plan for a 30-day pre-ballot review.	April, 2010
4. Conduct an initial ballot for ten days.	May, 201-
5. Respond to comments submitted with the initial ballot.	June, 2010
6. Conduct a recirculation ballot for ten days.	June, 2010
7. BOT adoption.	

A. Introduction

- 1. Title: Automatic Underfrequency Load Shedding
- **2.** Number: PRC-006-01
- **3. Purpose:** To establish design and documentation requirements for automatic underfrequency load shedding (UFLS) programs to arrest declining frequency and assist recovery of frequency following underfrequency events.

4. Applicability:

- **4.1.** Planning Coordinators
- **4.2.** Distribution Providers that do not have an agreement with Transmission Owners to provide UFLS
- **4.3.** Transmission Owners:
 - 4.3.1 That have an agreement with Distribution Providers to provide UFLS, or
 - **4.3.2** <u>That Oowning F</u>acilities<u>[chk capitalization]</u> identified in the UFLS program design
- 5. (Proposed) Effective Date: <u>The standard is effective the first day of the first calendar</u> quarter after applicable regulatory approvals (or the standard otherwise becomes effective the first day of the first calendar quarter after NERC Board of Trustees adoption in those jurisdictions where regulatory approval is not required). <u>TBD</u>

B. Requirements

- **R1.** Each Planning Coordinator shall join a group consisting of all the Planning Coordinators within the region for each of the regions in which it performs the Planning Coordinator function. [VRF: Lower][Time Horizon: Long-term Planning]
- R2. Each group of Planning Coordinators shall develop and document criteria, including consideration of historical events and system studies, to select portions of the Bulk Electric System (BES), including portions of adjacent interconnected regions, that may form islands. [VRF: Lower][Time Horizon: Long-term Planning]
- **R3.** Each [pit1] group of Planning Coordinators shall identify an island(s) as a basis for designing a UFLS program including: [VRF: Medium][Time Horizon: Long-term Planning]
 - **3.1.** Those islands selected by applying the criteria in Requirement R2 -and
 - **3.2.** Any portions of the BES that are designed to be detached from the interconnection (planned islands) as a result of the operation of a relay scheme or special protection system -and
 - **3.3.** Any other islands necessary to ensure that all portions of the region's BES are included in at least one island.
- **R4.** Each_[sm2]- group of Planning Coordinators shall develop an <u>underfrequency load</u> <u>sheddingUFLS</u> program <u>withincluding</u> a- schedule for application across the region, <u>and</u> including technical design parameters required to meet 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]

- **4.1.** Frequency shall remain above the Under Frequency Performance Characteristic curve in Attachment 1 and
- **4.2.** Frequency shall remain below the Over Frequency Performance Characteristic curve in Attachment 2 and
- **4.3.** Control voltage during and following UFLS operations such that the per unit Volts per Hz (V/Hz) does not exceed 1.18 for longer than two seconds cumulatively per simulated event, and does not exceed 1.10 for longer than 45 seconds cumulatively per simulated event at each generator bus and generator step-up transformer high-side bus associated with any:

4.3.1 Individual generating units greater than 20 MVA (gross nameplate rating) or generating plants/facilitiesFacilities greater than 75 MVA (gross aggregate nameplate rating) directly connected to the BES.

- **R5.** Each group of Planning Coordinators shall conduct a UFLS assessment at least once every five years that determines through dynamic simulation whether the UFLS program design meets the performance characteristics in Requirement R4. The simulation shall ; [VRF: High][Time Horizon: Long-term Planning]
 - 5.1. Model the underfrequency trip settings of individual generating units greater than 20 MVA (gross nameplate rating) or generating plant/facilitiesFacilities greater than 75 MVA (gross aggregate nameplate rating) directly connected to the BES that trip above the Generator Underfrequency Trip Modeling curve in Attachment 1
 - **5.2.** Model the overfrequency trip settings of individual generating units greater than 20 MVA (gross nameplate rating) or generating plant/facilitiesFacilities greater than 75 MVA (gross aggregate nameplate rating) directly connected to the BES that trip below the Generator Over-frequency Trip Modeling curve in Attachment 2 and-
 - **5.3.** Model any automatic load restoration that impacts frequency stabilization and operates within the duration of the simulations run for the assessment.
- **R6.** Each group of Planning Coordinators shall reach concurrence onf assessment results with their adjacent region's group of Planning Coordinators of or any islands identified by any one region's group of Planning Coordinators that straddle the respective interconnected regions. [VRF: Medium][Time Horizon: Long-term Planning]
- **R7.** Each group of Planning Coordinators shall annually maintain a database for use in event analyses and assessments of the UFLS program. [VRF: Lower][Time Horizon: Long-term Planning]
- **R8.** Each Transmission Owner that has an agreement with Distribution Providers to provide UFLS and each Distribution Provider that does not have an agreement with Transmission Owners to provide UFLS shall provide data to its group of Planning Coordinators according to the format and schedule specified by the group of Planning

Coordinators to support maintenance of the database. [VRF: Lower][pits][_Time Horizon: Long-term Planning]

- **R9.** Each[sm6]-Transmission Owner that has an agreement with Distribution Providers to provide UFLS and each Distribution Provider that does not have an agreement with Transmission Owners to provide UFLS shall provide automatic tripping of load; in accordance with the UFLS program design and schedule for application determined by the group of Planning Coordinators for each region in which it operates. [VRF: High][Time Horizon: Long-term Planning]
- **R10.** Each Transmission Owner shall provide automatic switching of Facilities in accordance with the UFLS program design. [VRF: High][Time Horizon: Long-term Planning]

R11.

R11. Each group of Planning Coordinator(s), in whose region(s) an event <u>resulting in 500</u> <u>MW or greater of UFLS actuated loss of load</u> occurs, shall conduct an assessment of the performance of <u>the</u> UFLS program and associated <u>facilitiesFacilities for any</u> <u>actuation of UFLS resulting in 500 MW or greater of loss of load or during that event</u> within one year of an actuation. If an-event <u>resulting in 500 MW or greater of UFLS</u> <u>actuated loss of load</u> affects multiple regions, the groups of Planning Coordinators in those regions shall reach concurrence on the assessment results. [VRF: Medium][Time Horizon: Operations Assessment]

C. Measures (TO BE REVISED BASED ON CHANGES TO REQUIREMENTS)

- M1. Each Planning Coordinator shall provide evidence that it joined a group consisting of all the Planning Coordinators within the region for each of the regions in which it performs the Planning Coordinator function per Requirement R1.
- M2. Each Planning Coordinator shall provide evidence that its group of Planning Coordinators developed and documented its criteria, including consideration of historical events and system studies, to select portions of the Bulk Electric System that may form islands per Requirement R2.
- M3. Each Planning Coordinator shall provide evidence that its group of Planning Coordinators identified an island(s) as a basis for designing a UFLS program per Requirement R3[pig].
- M4. Each Planning Coordinator shall provide evidence that its group of Planning Coordinators developed an under frequency load shedding UFLS program with a schedule for application across the region-per Requirement R4. Evidence may include dynamic simulations, basis for load and generation capacity, including unit sizes and connection voltage, etc.
- M5. Each Planning Coordinator shall provide evidence that its group of Planning Coordinators conducted an UFLS assessment, per Requirement R5., at least once every five years that determines whether the UFLS program design meets the performance characteristics in Requirement R4. Evidence may include dynamic simulation input data and dynamic simulation results.
- M6. Each Planning Coordinator shall provide evidence that its group of Planning Coordinators reached concurrence of assessment results with their adjacent region's group of Planning Coordinators forof any islands identified by any one region's group of Planning Coordinators that straddle the respective interconnected regions per Requirement R6.
- M7. Each Planning Coordinator shall provide evidence that its group of Planning Coordinators annually maintained a database for use in event analyses and assessments of the UFLS program per Requirement R7.

- **M8.** Each Transmission Owner that has an agreement with a Distribution Provider(s) to provide UFLS and each Distribution Provider that does not have an agreement with a Transmission Owner(s) to provide UFLS shall provide evidence that it provided data to its group of Planning Coordinators according to the format and schedule specified by the group of Planning Coordinators to support maintenance of the database per Requirement R8.
- **M9.** Each Transmission Owner that has an agreement with a Distribution Provider(s) to provide UFLS and each Distribution Provider that does not have an agreement with a Transmission Owner(s) to provide UFLS shall provide evidence that it provided automatic tripping of load, in accordance with the UFLS program design and schedule for application determined by the group of Planning Coordinators for each region in which it operates per Requirement R9.
- M10. Each Transmission Owner shall provide evidence that it provided automatic switching of Facilities in accordance with the UFLS program design per Requirement R10.
- M11. Each Planning Coordinator shall provide evidence that its group of Planning Coordinators conducted an assessment of the performance of the UFLS equipment and associated Facilities, and reached concurrence on assessment results if applicable, for events within one year of an actuation of UFLS within its region resulting in 500 MW or greater of loss of load-per Requirement R11.
- M1.The Planning Coordinator shall provide evidence that it joined a group consisting of all the Planning Coordinators within the region for each of the regions in which it performs the Planning Coordinator function such as roster of participants (including organization), meeting minutes with recorded attendees, agreements, etc.
- M2. The Planning Coordinator shall provide evidence that their group of Planning Coordinators designed an underfrequency load shedding program for application across the region such as documentation of technical design parameters. [including participation in development of, or consent to, the technical parameters]
- **M3.**The Planning Coordinator shall provide evidence that their group developed criteria as specified in Requirement R3.
- M4.The Planning Coordinator shall provide evidence that their group developed a procedure as specified in Requirement R4.
- **M5.**The Planning Coordinator shall provide evidence that their group identified islands as specified in Requirement R5.
- M6.The Planning Coordinator shall provide evidence that their group developed a UFLS program that specifies the technical design parameters required to meet the performance characteristics in simulations as specified in Requirement R6 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). Evidence may include dynamic simulations, basis for load and generation capacity, including unit sizes and connection voltage.

- M7.The Planning Coordinator shall provide evidence that their group conducted a UFLS assessment as specified in Requirement R7 such as dynamic simulation input data, and dynamic simulation results.
- **M8.**The Planning Coordinator shall provide evidence that their group specified the content, created and annually maintained a UFLS database as specified in Requirement R8.
- **M9.**The Transmission Owner and Distribution Provider shall provide evidence that they provided data to their respective group of Planning Coordinators as specified in Requirement R9 such as transmittal document and associated data.
- M10.The Transmission Owner and Distribution Provider shall provide evidence of tripping of forecast load in accordance with the UFLS program designed by the group of Planning Coordinators for each region in which it operates such as relay records, setting sheets, and circuit forecast loading

D. Compliance

- 1. Compliance Monitoring Process
 - **1.1. Compliance Enforcement Authority**

Text

- **1.2. Compliance Monitoring Period and Reset Time Frame** Not applicable.
- 1.3. Data Retention

Text

1.4. Compliance Monitoring and Assessment Processes Text

1.5. Additional Compliance Information

Text

2. Violation Severity Levels

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL

E. Regional Variances

Hydro-Quebec

- 4.1. Frequency shall remain above the Under Frequency Performance Characteristic curve in Attachment 1A [500]
- 5.1. Model the underfrequency trip settings of generators (same as generators in 4.4) that trip above the the Generator Underfrequency Trip Modeling curve in Attachment 1A

WECC

4.1Frequency shall remain above the Under Frequency Performance Characteristic curve in Attachment 1B

F. Associated Documents

Version History

Version	Date	Action	Change Tracking



Underfrequency Curves for Requirements R4 Part 4.1 and R5 Part 5.1



Overfrequency Curves for Requirements R4 Part 4.2 and R5 Part 5.2





R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	N/A	N/A	N/A	The Planning Coordinator failed to join a group consisting of all the Planning Coordinators within the region for each of the regions in which it performs the Planning Coordinator function.
R2	N/A	The group of Planning Coordinators developed and documented criteria but failed to include the consideration of historical events, to select portions of the Bulk Electric System (BES) that may form islands OR The group of Planning Coordinators developed and documented criteria but failed to include the consideration of system studies, to select portions of the Bulk Electric System (BES) that may form islands	The group of Planning Coordinators developed and documented criteria but failed to include the consideration of historical events and system studies, to select portions of the Bulk Electric System (BES) that may form islands	The group of Planning Coordinators failed to develop and document criteria to select portions of the Bulk Electric System (BES) that may form islands
R3	N/A	The group of Planning	The group of Planning	The group of Planning

PRC-006 Draft Violation Severity Levels (VSL)

		Coordinators identified an island(s) as a basis for designing a UFLS program but failed to include one (1) of the itemsparts as specified in parts 3.1, 3.2 or 3.3	Coordinators identified an island(s) as a basis for designing a UFLS program but failed to include two (2) of the items-parts as specified in parts 3.1, 3.2 or 3.3	Coordinators identified an island(s) as a basis for designing a UFLS program but failed to include all of the itemsparts as specified in parts 3.1, 3.2 or 3.3 OR
				Planning Coordinators failed to identify any island(s) as a basis for designing a UFLS program.
R4	The group of Planning Coordinators developed an underfrequency load shedding program with a schedule for application across the region but failed to meet one (1) of the following performance characteristic in parts 4.1, 4.2, 4.3 or 4.4 in simulations of underfrequency conditions	The group of Planning Coordinators developed an underfrequency load shedding program with a schedule for application across the region but failed to meet twoone (12) of the following performance characteristic in parts 4.1, 4.2, or 4.3 or 4.4 in simulations of underfrequency conditions	The group of Planning Coordinators developed an underfrequency load shedding program with a schedule for application across the region but failed to meet three <u>two</u> (23) of the following performance characteristic in parts 4.1, 4.2, or 4.3 or 4.4 in simulations of underfrequency conditions	The group of Planning Coordinators developed an underfrequency load shedding program with a schedule for application across the region but failed to meet the performance characteristic in parts 4.1, 4.2, and 4.3 and 4.4 in simulations of underfrequency conditions OR The group of Planning
				Coordinators failed to

				develop an underfrequency load shedding program
R5		The group of Planning Coordinators conducted a UFLS assessment at least once every five years that determines through dynamic simulation whether the UFLS program design meets the performance characteristics in Requirement R4 but simulation failed to include one (1) of the items as specified in parts 5.1, 5.2 or 5.3.	The group of Planning Coordinators conducted a UFLS assessment at least once every five years that determines through dynamic simulation whether the UFLS program design meets the performance characteristics in Requirement R4 but simulation failed to include two (2) of the items as specified in parts 5.1, 5.2 or 5.3.	The group of Planning Coordinators conducted a UFLS assessment at least once every five years that determines through dynamic simulation whether the UFLS program design meets the performance characteristics in Requirement R4 but simulation failed to include all three (3) of the items as specified in parts 5.1, 5.2 and 5.3. OR The group of Planning Coordinators failed to conduct a UFLS assessment at least once every five years that determines through dynamic simulation whether the UFLS program design meets the performance characteristics in Requirement R4
R6	N/A	N/A	N/A	The group of Planning Coordinators failed reach concurrence of on assessment

				results with their adjacent region's group of Planning Coordinators offor any islands identified by any one region's group of Planning Coordinators that straddle the respective interconnected regions.
R7	N/A	N/A	N/A	The group of Planning Coordinators failed to annually maintain a database for use in event analyses and assessments of the UFLS program.
R8	The Responsible entity provided data to its group of Planning Coordinators more than 5 calendar days but less than or equal to 10 calendar days following the schedule specified by the group of Planning Coordinators to support maintenance of the database.	The Responsible entity provided data to its group of Planning Coordinators more than 10 calendar days but less than or equal to 15 calendar days following the schedule specified by the group of Planning Coordinators to support maintenance of the database. Or The Responsible entity provided data to its group of Planning Coordinators but the data was not according to the format specified by	The Responsible entity provided data to its group of Planning Coordinators more than 15 calendar days but less than or equal to 20 calendar days following the schedule specified by the group of Planning Coordinators to support maintenance of the database.	The Responsible entity failed to provide data to its group of Planning Coordinators more than 20 calendar days following the schedule specified by the group of Planning Coordinators to support maintenance of the database.

		the group of Planning		
		Coordinators to		
		support maintenance		
		of the database.		
R9	The responsible entity	The responsible entity	The responsible entity	The responsible entity
	provided less than	provided less than 95%	provided less than 90%	provided less than 85%
	95% of automatic	automatic tripping of	automatic tripping of	load in accordance with
	tripping of load in	load in accordance with	load in accordance with	all aspects of the UFLS
	accordance with all	all aspects of the UFLS	all aspects of the UFLS	program design and in
	aspects of the UFLS	program design and in	program design and in	accordance with the
	program design and in	accordance with the	accordance with the	schedule for application
	accordance with the	schedule for application	schedule for application	determined by the
	determined by the	determined by the	determined by the	Goordinators for each
	group of Planning	Coordinators for each	Coordinators for each	region in which it
	Coordinators for each	region in which it	region in which it	operates.
	region in which it	operates.	operates.	The responsible entity
	operates.	The responsible entity	The responsible entity	provided less than or
	The responsible entity	provided less than or	provided less than or	equal to 85% of
	provided less than	equal to 95% but	equal to 90% but	automatic tripping of
	100% but more than	more than 90% of	more than 85% of	load in accordance
	95% of automatic	automatic tripping of	automatic tripping of	with the UFLS
	tripping of load in	load in accordance	load in accordance	program design and
	accordance with the	with the UFLS	with the UFLS	schedule for
	UFLS program design	program design and	program design and	application
	and schedule for	schedule for	schedule for	determined by the
	application	application	application	group of Planning
	determined by the	determined by the	determined by the	Coordinators for each
	group of Planning	group of Planning	group of Planning	region in which it
	Coordinators for each	Coordinators for each	Coordinators for each	operates.
	region in which it	region in which it	region in which it	
	operates.	operates.	operates.	
R10	The Transmission	The Transmission	The Transmission	The Transmission
	Owner provided less	Owner provided less	Owner provided less	Owner provided less
	than 100% but more	than 95% but more	than 90% but more	than or equal to 85%
	than 95% automatic	than 90% automatic	than 85% automatic	automatic switching
	switching of Facilities	switching of Facilities	switching of Facilities	of Facilities in
	in accordance with	in accordance with	in accordance with	accordance with the
	the UFLS program	the UFLS program	the UFLS program	UFLS program
	design	design	design	design
	debigii.	design.	design.	design.
				[BEM1]
R11	N/A	The group of	N/A	The group of
		Planning		Planning
		Coordinator(s) , in		Coordinator(s) , in

whose region(s) an event occurs conducted an assessment of the performance of <u>the</u> UFLS program and associated facilities <u>Facilities for any</u> actuation of UFLS resulting in 500 MW or greater of loss of load or within one year of an actuation <u>event</u> , but failed to reach	whose region(s) an event occurs failed to conduct an assessment of the performance of <u>the</u> UFLS program and associated <u>fF</u> acilities for any actuation of <u>UFLS resulting in</u> 500 MW or greater of loss of load or within one year of an <u>event.actuation</u>
actuationevent, but failed to reach concurrence on the assessment results with the group(s) of Planning Coordinators in other regions forif an event affectings multiple regions, the groups of Planning Coordinators in those regions	