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I. INTRODUCTION

The North American Electric Reliability Corporation (“NERC”)¹ hereby provides these comments in response to the Federal Energy Regulatory Commission’s (“FERC” or “Commission”) Notice of Proposed Rulemaking (“NOPR”)² regarding proposed Reliability Standards PRC-006-1 (Automatic Underfrequency Load Shedding) and EOP-003-2 (Load Shedding Plans).

In the NOPR, the Commission proposed to approve the two revised Reliability Standards. The Commission also proposed to approve the retirement of three currently effective, FERC-approved Reliability Standards PRC-007-0, PRC-009-0, and EOP-003-1, as well as the NERC-approved Reliability Standard PRC-006-0.

The proposed Reliability Standards establish system modeling, analysis, design, and documentation requirements for automatic underfrequency load shedding (“UFLS”) programs for use in extreme conditions to stabilize the balance between generation and load after an electrical island has formed, dropping enough load to allow frequency to stabilize within the island.³ The Commission sought comment from NERC and other interested parties on several issues concerning the proposed standards.

By this filing, NERC submits its response to the NOPR.

¹ The Federal Energy Regulatory Commission (“FERC” or “Commission”) certified NERC as the electric reliability organization (“ERO”) in its order issued on July 20, 2006 in Docket No. RR06-1-000. *North American Electric Reliability Corporation, “Order Certifying North American Electric Reliability Corporation as the Electric Reliability Organization and Ordering Compliance Filing,”* 116 FERC ¶ 61,062 (July 20, 2006).

² *Automatic Underfrequency Load Shedding and Load Shedding Plans Reliability Standards*, 137 FERC ¶ 61,067 (October 20, 2011) (“NOPR”).

³ See NOPR at P 4 (citing *U.S.-Canada Power System Outage Task Force, Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations* at 92-93 (2004) (“Blackout Report”).

II. NOTICES AND COMMUNICATIONS

Notices and communications with respect to this filing may be addressed to:

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III. DISCUSSION

A. Background

In a March 31, 2011 petition,⁴ NERC requested Commission approval of two proposed Reliability Standards:

- PRC-006-1 — Automatic Underfrequency Load Shedding; and
- EOP-003-2 — Load Shedding Plans.

⁴ See NERC, *Petition of the North American Electric Reliability Corporation for Approval of Proposed New Reliability Standards and Implementation Plans Related to Underfrequency Load-Shedding*. Docket No. RM11-20-000 (March 31, 2011).

In addition, NERC requested the Commission approve the concurrent retirement of three currently effective, FERC-approved Reliability Standards, as well as one NERC-approved Reliability Standard:

- PRC-006-0 – Development and Documentation of Regional UFLS Programs;
- PRC-007-0 — Assuring Consistency of Entity Underfrequency Load Shedding Programs;
- PRC-009-0 — Analysis and Documentation of Underfrequency Load Shedding Performance Following an Underfrequency Event; and
- EOP-003-1 — Load Shedding Plans.

All of the standards proposed for retirement are superseded by proposed Reliability Standards PRC-006-1 and EOP-003-2. NERC also requested approval of associated Violation Risk Factors (“VRFs”) and Violation Severity Levels (“VSL”), an implementation plan, and effective dates for the two proposed standards.

The Commission seeks comment from NERC and other interested parties on several aspects of the proposed standards. NERC provides responses to the specific issues identified in the NOPR, including: (A) impact of resources not connected to the Bulk Electric System; (B) UFLS events assessments; (C) Generator Owner trip settings outside of the UFLS program; (D) UFLS program coordination with other Protection Systems; (E) identification of island boundaries in UFLS programs; (F) automatic Load shedding and manual Load shedding; (G) elimination of Balancing Authority responsibilities in EOP-003-2; (H) associated VRF and VSLs; and (I) the proposed implementation plan and effective date.

B. Specific Responses to Matters Identified by the Commission.

(A) Impact of Resources Not Connected to the Bulk Electric System

NOPR at P. 31. *“The Commission seeks comments from the ERO and other interested persons as to whether and how all resources required for the reliable operation of the bulk electric system, including resources not connected to bulk electric system facilities, are considered in the development of UFLS programs under Requirements R3 and R4.”*

The modeling of generation may impact assessments of UFLS programs in two ways. The first relates to modeling the Frequency Response of the generating units and the second relates to modeling generating unit Protection Systems that respond to off-nominal frequency.

As stated in the NOPR, failing to model generation units and plants that meet the threshold size requirements (20 MVA unit size or 75 MVA plant size) but are not directly connected to the Bulk Electric System could affect the simulated Frequency Response. NERC clarifies, however, that proposed Reliability Standard PRC-006-1 does not establish parameters for what resources are modeled in such simulations. The power system models used in UFLS assessments are generally the same models used in transmission planning assessments, which include models of all generation units and plants that meet the threshold size requirements even those not connected directly to the Bulk Electric System.

Requirement R4 of PRC-006-1 defines the generators for which underfrequency and overfrequency protection settings are modeled when these protection settings do not coordinate with the Generator Underfrequency Trip Modeling curve and Generator Overfrequency Trip Modeling curves in Attachment 1 to PRC-006-1. The effect on frequency of tripping a generator is virtually the same regardless of whether the generator is connected directly to the Bulk Electric System or at a lower voltage level. Thus, failing to model protection settings on units that meet the threshold size requirements, but that are not connected directly to the Bulk Electric

System, could have an effect on simulation results depending on the capacity of the units, the load and generation characteristics of the units assumed to be in the island and running, and whether the unit protection settings coordinate with the curves in Attachment 1.

A standard authorization request (“SAR”) is currently under development for a second phase of the standard development project to revise the definition of Bulk Electric System. One of the tasks in this project will be to determine the appropriate size thresholds and other criteria for real and reactive resources that are necessary to support reliable operation of the Bulk Electric System based on a sound technical assessment. Information developed as part of that project could be used to assess whether any changes are needed to the requirements for including Protection System settings for generation units and plants not directly connected to the Bulk Electric System.

Until the second phase of the Bulk Electric System definition is completed, the proposed standard provides a significant step forward in assessment of UFLS programs, and NERC urges the Commission to approve the proposed standard with the generator size thresholds defined therein.

(B) UFLS Events Assessments

1. Assessments in the Absence of Island Formation

NOPR at P. 36. “The Commission seeks clarification from the ERO regarding what actions must planning coordinators take under Requirement R11 if an event results in system frequency excursions falling below this initializing set point for UFLS but without the formation of a bulk electric system island.”

NERC agrees that an assessment of the performance of the UFLS program is useful for an Interconnection-wide event that results in system frequency excursions falling below the initializing set point for UFLS. An Interconnection-wide event that results in activation of UFLS, while highly unlikely, would be a significant event requiring assessment of several

aspects of system frequency, including system Frequency Response, equipment performance, and coordination of protection and control systems, in addition to the assessment of UFLS program operation. Although PRC-006-1 does not prescribe an analysis for this specific scenario, activating UFLS during an Interconnection-wide event would involve a significant loss of generation and analysis would be performed under the NERC Event Analysis program or the NERC Rules of Procedure, depending on the severity of the event.⁵

2. Coordination of Assessments and Results

NOPR at P. 38. “The options for coordinating event assessments in Requirement R13 include: (1) conducting a joint event assessment per Requirement R11 among planning coordinators whose areas were affected; (2) conducting an independent event assessment per Requirement R11 that reaches conclusions and recommendations consistent with other planning coordinators whose areas were affected; or (3) conducting an independent event assessment per Requirement R11 and where the assessment fails to reach conclusions and recommendations consistent with those of the other planning coordinators whose areas were affected by the same islanding event, identify differences in the assessments and report these differences to the other affected planning coordinators. The Commission seeks comments from the ERO and other interested persons as to whether the differences should be subsequently reported to the reliability coordinator for resolution in the event that the process does not resolve differences in the assessments.”

The Commission seeks comment on Requirements R5 and R13 of PRC-006-1, which require Planning Coordinators that share identified islands to coordinate UFLS program design and event assessment, and to identify differences in the assessments and reporting these differences to the other affected Planning Coordinators. NERC believes that differences identified in Planning Coordinator assessments under Requirements R5 or R13 should not be reported to the Reliability Coordinator for resolution. Such a requirement would raise a number of concerns, including:

⁵ <http://www.nerc.com/page.php?cid=1|8|169>.

- While the Reliability Coordinator has a wide-area view of the Bulk Electric System, it will not necessarily coincide with the island boundary.
- An entity that is registered as one of the Planning Coordinators involved may also be registered as the Reliability Coordinator, creating a potential conflict of interest in resolving the differences.
- Reliability Coordinators do not necessarily possess the tools required to resolve such planning time-frame or event analysis issues.
- The Reliability Coordinator's responsibilities lie largely in the real-time operating horizon whereas the Planning Coordinator responsibilities lie largely in the planning horizon; hence it is inconsistent and inappropriate to create a hierarchy where a Reliability Coordinator presides over a Planning Coordinator.

Therefore, NERC does not support reporting differences identified in Planning Coordinator assessments to the Reliability Coordinator for resolution.

3. Assessment Timeline for Completion

NOPR at P. 41. "The Commission asks the ERO and other interested persons what the basis is for proposing a two-year time frame. In addition, the Commission seeks clarification from the ERO as to how soon after event actuation would an entity need to implement corrections in response to any deficiencies identified in the event assessment under Requirements R11."

PRC-006-1 R11 and R12 require a Planning Coordinator to perform an island event assessment within one year of an event and, if the Planning Coordinator identifies program deficiencies, conduct and document UFLS design assessments within two years of an event. The one-year time frame to perform an island assessment and the two-year timeframe to conduct and document UFLS design assessments were selected to provide the Planning Coordinator sufficient time to assess UFLS performance and address any identified UFLS program deficiencies. While

some events may be analyzed in less time, one year is realistic to assess performance for complicated events and two years is realistic to address any identified deficiencies, especially in consideration of developing alternative plans, performing adequate technical and cost/benefit analyses, and considering stakeholder input when significant changes to the program are necessary.

The amount of time that a UFLS entity has to implement corrections will be established by the Planning Coordinator, as specified in Requirement R9 of PRC-006-1. The time allotted for corrections will depend on the extent of the deficiencies identified. The schedule specified by the Planning Coordinator will consider the time necessary for budget planning and implementation, recognizing that operating and maintenance budgets normally will not be sufficient to address major revisions and allowances will be necessary for inclusion of approved changes in budgeting cycles.

(C) Generator Owner Trip Settings Outside of the UFLS Program

NOPR at P. 43. “We agree that planning coordinators should consider generators that trip prior to underfrequency set points when developing their UFLS programs. The Commission seeks comments from the ERO and other interested persons on how generation losses outside of the UFLS set points (i.e., generators having trip settings prior to the UFLS underfrequency set points) should be accounted for in UFLS programs (e.g., generator owners who trip outside of the UFLS set points could procure load to shed to account for the loss in generation).”

While requiring the Planning Coordinator to account for generators that trip prior to underfrequency set points when developing their UFLS programs is appropriate, it is not appropriate for a Reliability Standard to prescribe how the Planning Coordinator will determine whether mitigation is necessary or who would be responsible for providing the mitigation. The reliability of the Bulk Electric System is maintained by requiring the Planning Coordinator to

ensure that the UFLS program meets the performance characteristics defined in the standard. This approach provides Planning Coordinators with flexibility in developing UFLS programs based on the conditions and circumstances within their Planning Coordinator area and the various islands that are studied.

(D) UFLS Program Coordination with Other Protection Systems

NOPR at P. 45. “While PRC-006-1 requires coordination of UFLS programs among planning coordinators in Requirements R5, R7, and R13, it does not appear to capture the same level of coordination with other protection systems as in Requirement R1.2.8 of PRC-006-0. The Commission seeks comments on whether and how coordination with other protection systems is or is not achieved under the new requirements.” (Footnote omitted).

PRC-006-0, Requirement R1.2.8, provides a broad mandate that UFLS program design include “[a]ny other schemes that are part of or impact the UFLS programs.” One of the objectives of PRC-006-1 is to replace the broad requirements in PRC-006-0 with more specific requirements that are clear and measurable. The proposed standard therefore includes requirements for coordination of the UFLS program with specific protection and controls that are part of or could impact the UFLS program. Requirements R3, R4, and R10 of PRC-006-1 address coordination of the UFLS program with other protection and control systems. The protection and control systems identified in the standard include generator protections that could respond to frequency and voltage excursions,⁶ automatic Load restoration, and equipment switching that may be included in the UFLS program to control voltage.

Requirement R3 of PRC-006-1 identifies the specific generator protections as underfrequency, overfrequency, and overexcitation (V/Hz). Coordination of the UFLS program with generator underfrequency protection (including generation protection that is “sensitive to”

⁶ Certain protection and control systems may not directly monitor frequency or voltage, but are “sensitive to” frequency or voltage (*e.g.*, reactor coolant pumps in nuclear plants).

underfrequency) is necessary to ensure that UFLS is permitted to operate to arrest declining frequency before generator tripping to prevent generator tripping from exacerbating the imbalance between load and generation. Coordination with generator overfrequency protection is necessary to avoid tripping generation during frequency “overshoot” that may occur following UFLS activation. As frequency recovers from UFLS activation, the system frequency may overshoot above 60 Hz before settling to a stable and sustainable level. It is important that generation does not trip during the frequency overshoot as this could create another imbalance between load and generation. Coordination is necessary with generator and generator step-up transformer overexcitation protection that may operate during underfrequency conditions, especially if the transmission system voltage increases following Load shedding and if power transfers are interrupted by island formation, leaving excess shunt reactive support connected to the system that is no longer necessary to support power transfer. The combined effect of increased voltage and reduced frequency may lead to tripping of generation by generator or generator step-up transformer overexcitation protection which could exacerbate the imbalance between load and generation.

Requirement R4 of PRC-006-1 provides that in cases where it is impractical to coordinate the UFLS program and generator underfrequency or overfrequency protection, because of the need to prevent generator damage, the UFLS program must be designed to account for this situation. Requirement R4 further requires coordination with automatic Load restoration. This coordination is necessary to ensure that frequency has stabilized following UFLS activation and that the system has reached a stable and sustainable operating state prior to reconnecting Load. Uncoordinated restoration of Load could reestablish an imbalance between Load and generation leading to another underfrequency event.

Requirement R10 of PRC-006-1 recognizes that after island formation and UFLS operation it may be necessary to control voltage for the reasons stated above in the discussion of overexcitation protection. While Requirement R10 does not explicitly require coordination, it does ensure that, when a Planning Coordinator identifies that automatic equipment switching is necessary to control voltage following UFLS activation, the Transmission Owner will provide this capability to restore the system to a sustainable operating state.

(E) Identification of Island Boundaries in UFLS Programs

NOPR at P. 47. “...The Commission seeks clarification from the ERO concerning the required degree of cooperation and/or ‘mutual consent’ between planning coordinators under the proposed Reliability Standard in order for island boundaries to be set so that, while deviating from Regional Entity boundaries, they better approximate actual island separation boundaries.

NERC clarifies that the “mutual consent” statement in NERC’s petition is in reference to Requirement R1 of PRC-006-1, which does not require coordination among Planning Coordinators in developing criteria for selecting portions of the Bulk Electric System in which islands may form.

As stated in the NOPR, “mutual consent” among Planning Coordinators is required by part 2.3 of Requirement R2, which ensures that Planning Coordinators assess all portions of the Bulk Electric System in their collective UFLS assessments and that regional or Interconnection-wide islands are assessed to ensure coordination of UFLS programs. To achieve this objective, each Planning Coordinator is required to assess a single island that includes all portions of the Bulk Electric System in either the Regional Entity areas or the Interconnections in which its Planning Coordinator area resides. Part 2.3 of Requirement R2 recognizes that assessing a Regional Entity area as one contiguous island may in some cases not be practical and so the proposed standard provides that the island boundary selected may deviate from the Regional

Entity boundary for the sole purpose of producing contiguous regional islands more suitable for simulation. Under part 2.3 of Requirement R2, when a Planning Coordinator selects an island boundary that does not coincide with the Regional Entity area or Interconnection boundary, mutual consent must be obtained from neighboring Planning Coordinators to ensure the deviation does not result in a portion of the Bulk Electric System that is not included in UFLS assessments.

(F) Automatic Load Shedding and Manual Load Shedding

NOPR at P. 49. “There are no requirements in PRC-006-1 to coordinate automatic load shedding by UFLS and manual load shedding under EOP-003-2. The Commission seeks comments from the ERO and other interested persons on how the coordination of automatic and manual load shedding is considered in light of the fact that the proposed Reliability Standards do not explicitly require coordination.”

While neither PRC-006-1 nor EOP-003-2 explicitly require coordination of automatic and manual load shedding, EOP-003-2 Requirement R6 addresses the concern that a load resource could be unintentionally double-counted in both an automatic and manual load shedding program. Specifically, Requirement R6 of EOP-003-2 provides that “if there is insufficient generating capacity to restore system frequency following automatic underfrequency load shedding [actuation], the Transmission Operator or Balancing Authority shall [then] shed additional load.” For the Transmission Operator or Balancing Authority to shed *additional* load there must be load identified in the manual load shedding program that is not included in the automatic UFLS program. This does not preclude the manual Load shedding program overlapping the underfrequency load shedding program, but it does require that the Transmission Operator and Balancing Authority include load in the manual load shedding program that is not included in the UFLS program to achieve the reliability objective of EOP-003-2.

(G) Elimination of Balancing Authority Responsibilities in EOP-003-2

NOPR at P. 52. *“The Commission seeks clarification from the ERO as to why these existing balancing authority responsibilities were not incorporated into Reliability Standards PRC-006-1 or EOP-003-2. The Commission also seeks comments from the ERO and other interested persons as to why balancing authorities should not be informed of UFLS program plans that directly impact balancing authority functions.”*

Requirements R2, R4, and R7 of EOP-003-1 contain requirements for Transmission Operators regarding automatic undervoltage load shedding, and for Balancing Authorities regarding automatic underfrequency load shedding. EOP-003-1 does not include requirements for Balancing Authorities related to undervoltage load shedding. This is consistent with other relevant standards related to undervoltage load shedding. For example, PRC-010-0 (Technical Assessment of the Design and Effectiveness of Undervoltage Load Shedding Program) and PRC-022-1 (Under-Voltage Load Shedding Program Performance) assign responsibilities to Transmission Operators, but not to Balancing Authorities.

The modifications proposed in EOP-003-2 remove requirements addressing UFLS design in EOP-003-1, but do not remove any requirements for undervoltage load shedding. All activities required for UFLS programs in the existing standards are incorporated into PRC-006-1, and are assigned to the Planning Coordinator. All activities required for undervoltage load shedding programs are retained in EOP-003-2 and are assigned to the Transmission Operator. These modifications ensure that all requirements necessary for reliability of the Bulk Electric System are retained and assigned to the appropriate Functional Model entity. While the Balancing Authority contributes to managing Interconnection frequency by balancing Load and generation resources in real-time, UFLS and undervoltage load shedding programs are automatic and must be planned and set in advance.

The Balancing Authority should be informed of UFLS program plans that directly impact the Balancing Authority function. The proposed changes in EOP-003-2 will not impact the ability of the Balancing Authority to fulfill its obligations. While the proposed standards no longer require the Balancing Authority to establish plans for UFLS, they do not preclude the Balancing Authority from obtaining information on UFLS programs that may be useful in fulfilling the Balancing Authority function. Indeed, PRC-001-1, R1 requires that each Balancing Authority: "... be familiar with the purpose and limitations of protection system schemes applied in its area."

(H) Associated VRFs and VSLs

NOPR at P. 54-55. *"The Commission proposes to approve the VRFs and VSLs in PRC-006-1 and EOP-003-2. However, the Commission seeks comments from the ERO and other interested persons regarding one proposed VSL and one proposed VRF for PRC-006-1.*

The "Lower VSL" assignment for Requirement R8 in PRC-006-1 applies when a UFLS entity fails to provide data to its planning coordinator for 5 to 10 calendar days following the schedule specified by the planning coordinator. Requirement R8 of PRC-006-1 does not include a 5-day grace period for providing data to planning coordinators. Accordingly, the subject VSL assignment may be inconsistent with the Commission's VSL Guideline 3. The guideline states that a VSL "should not appear to redefine or undermine the requirement." The five-day grace period implicit in the proposed VSL appears to be inconsistent with this guideline. In addition, the proposed VSL creates a compliance issue. Specifically, it is unclear where a UFLS entity falls in the VRF and VSL matrices if it fails to provide data to its planning coordinator within 1 to 5 days of its scheduled date." (Footnote omitted).

NOPR at P. 57. *"...The Commission seeks clarification from the ERO why coordination of load shedding plans is a 'High' VRF for transmission operators and balancing authorities in EOP-003-2 but NERC proposes a 'Medium' VRF for planning coordinators in PRC-006-1."*

NERC clarifies that the lower VSL assignment for Requirement R8 of PRC-006-1 should be revised as follows: "The UFLS entity provided data to its Planning Coordinator(s) ~~more than~~ 5 calendar days but less than or equal to 10 calendar days following the schedule specified by the

Planning Coordinator(s) to support maintenance of each Planning Coordinator's UFLS database.”

In addition, the VRF for Requirement R5 of PRC-006-1 should be revised from “Medium” to “High.”

(I) The Proposed Implementation Plan and Effective Date

NOPR at P. 60. “The Commission proposes to accept the implementation plan and effective date proposed by the ERO for PRC-006-1 and EOP-003-2. However, the Commission seeks comments from the ERO and other interested persons about any potential reliability gaps that may occur during the development and implementation of PRC-024-1, such as how the planning coordinators will adequately determine and apply UFLS simulations and plans in the absence of generator trip settings.”

Requirement R4, parts 4.1 through 4.6, requires Planning Coordinators to model underfrequency and overfrequency trip settings of generators. Planning Coordinators presently have access to and utilize these trip settings in underfrequency load shedding assessments and NERC anticipates this practice will continue. Accordingly, the proposed implementation schedule does not create a reliability gap. However, a compliance mechanism to compel the Generator Owners to provide trip settings to the Planning Coordinators does not currently exist. Thus, the implementation schedule for Requirement R4, parts 4.1 through 4.6 defers a compliance obligation for Planning Coordinators to model the trip settings until a compliance obligation exists for Generator Owners to provide the trip settings.

IV. CONCLUSION

NERC respectfully requests that the Commission take action consistent with these comments when it issues its Final Rule regarding Reliability Standards PRC-006-1 and EOP-003-1.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that I have served a copy of the foregoing document upon all parties listed on the official service list compiled by the Secretary in this proceeding.

Dated at Washington, D.C. this 23rd day of December, 2011.

/s/ Willie L. Phillips
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