

NERC SPCTF Technical Review of PRC-010-0 — Assessment of the Design and Effectiveness of UVLS Program

May 17, 2007

A Technical Review of Standards

Prepared by the
System Protection and Controls Task Force
of the
NERC Planning Committee

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This report was approved by the Planning Committee on June 7, 2007, for forwarding to the Standards Committee.

INTRODUCTION

Within scope the System Protection and Control Task Force is given the assignment to review the existing PRC-series Reliability Standards, to advise the Planning Committee of our assessment, and to develop Standards Authorization Requests, as appropriate, to address any perceived deficiencies.

This report presents the SPCTF's assessment of PRC-001-0- System Protection Coordination. The report includes the SPCTF's understanding of the intent of this standard and contains specific observations relative to the existing standard.

This report presents the SPCTF's technical review of PRC – 010-0 Technical Assessment of the Design and Effectiveness of Undervoltage Load Shedding Program, the standard whose purpose is to identify requirements and measures necessary to assess and document the effectiveness of UVLS programs. UVLS programs are intended to prevent system voltage collapse or voltage instability. That standard was developed by translating the requirements of an earlier Phase I Planning Standard; thus it has not been previously subjected to a critical review of the Requirements.

EXECUTIVE SUMMARY

The SPCTF comments are presented following the appropriate sections of the standard, presented as boxed paragraphs, within the Assessment section of this paper. SPCTF feels that the intent of this standard is to provide a technical assessment that will assure the UVLS Program is up-to-date, fully coordinated, and documented among responsible and applicable entities.

The SPCTF recommends that PRC-010 is more appropriately a transmission planning (TPL) standard in that it is a directive on design of the UVLS system, not the technical, nuts-and-bolts implementation of the system through specific protective relays and controls.

SPCTF Assessment of PRC-010-0

Purpose

Provide System preservation measures in an attempt to prevent system voltage collapse or voltage instability by implementing an Undervoltage Load Shedding (UVLS) program.

SPCTF recommends replacement of the word “preservation” with “requirements and measures” to be more in line with the exact intent of the standard.

Applicability

- 4.1. Load-Serving Entity that operates a UVLS program
- 4.2. Transmission Owner that owns a UVLS program
- 4.3. Transmission Operator that operates a UVLS program
- 4.4. Distribution Provider that owns or operates a UVLS program

SPCTF agrees with the list of those entities applicable and recommends addition of Generation Owners and Operators with specific attributes:

- 4.5. Generation Owners that have undervoltage protection and control setpoints, and time that must directly coordinate with UVLS programs.
- 4.6. Generation Operators that have undervoltage protection and control setpoints, and time that must directly coordinate with UVLS programs.

R1

- R2. The Load-Serving Entity, Transmission Owner, Transmission Operator, and Distribution Provider that owns or operates a UVLS program shall periodically (at least every five years or as required by changes in system conditions) conduct and document an assessment of the effectiveness of the UVLS program. This assessment shall be conducted with the associated Transmission Planner(s) and Planning Authority(ies).
 - R2.1. This assessment shall include, but is not limited to:
 - R2.1.1. Coordination of the UVLS programs with other protection and control systems in the Region and with other Regional Reliability Organizations, as appropriate.
 - R2.1.2. Simulations that demonstrate that the UVLS programs performance is consistent with Reliability Standards TPL-001-0, TPL-002-0, TPL-003-0 and TPL-004-0.
 - R2.1.3. A review of the voltage set points and timing.

SPCTF agrees with the FERC Order 693 comments that the assessment should include coordination with Generation Owners. Generation Owners and Generation Operators that have undervoltage relays with set points and time that need to be assessed with respect to the UVLS program coordination. It is important that generators are not miscoordinated undervoltage relay setpoints and timing which could trip

SPCTF Assessment of PRC-010-1 – Assessment of the Design and Effectiveness of UVLS Program

generators or critical balance of plant auxiliaries before an UVLS can improve system voltage within the area affected.

The UVLS system must be designed to recognize the physical and operational limitations of generators in the effected area. Similarly, UVLS systems must be designed to recognize the possible interaction with other UVLS systems or special protection systems (SPS), automated transmission controls, synchronous condensers, FACTS devices, StatComs, SVCs, etc. in the area.

R2

R2. The Load-Serving Entity, Transmission Owner, Transmission Operator, and Distribution Provider that owns or operates a UVLS program shall provide documentation of its current UVLS program assessment to its Regional Reliability Organization and NERC on request (30 calendar days).

The need for UVLS can be for local or bulk electric system reasons. Within R2, PRC-10 should include the requirement for documentation which states the exact reason and purpose of the UVLS program. Further, the UVLS program assessment documentation should be provided to all impacted Planning Coordinators and Reliability Entities.

SPCTF recommends replacement of “Regional Reliability Organization” with “Regional Entity.”

Measures

M1. Each Transmission Owner’s and Distribution Provider’s UVLS program shall include the elements identified in Reliability Standard PRC-010-0_R1.

M2. Each Load-Serving Entity, Transmission Owner, Transmission Operator, and Distribution Provider that owns or operates a UVLS program shall have evidence it provided documentation of its current UVLS program assessment to its Regional Reliability Organization and NERC as specified in Reliability Standard PRC-010-0_R2.

SPCTF recommends that the measure M2 documentation include the elements contained within M1 deliverable to the Planning Coordinators and Regional Entities impacted by the UVLS program and available to NERC within 30 days upon request.

SPCTF recommends replacement of “Regional Reliability Organization” with “Regional Entity.”

FERC ORDER 693 on PRC-010-0 — Assessment of the Design and Effectiveness of UVLS Program

Commission Discussion and Determination

The following is the determination portion of FERC Order 693 regarding PRC-010-0.

§1506. We agree with APPA’s comments and reiterate that the directed modification should be developed in the Reliability Standards development process. With regard to APPA’s concerns, while we direct the ERO to develop modifications that would require an integrated and coordinated approach to protection systems, we do not direct a specific approach to accomplish such integration and coordination. Rather, the ERO should develop an appropriate approach utilizing the Reliability Standards development process.

§1507. With regard to ISO-NE’s disagreement on integration of various system protections “because such integration cannot be technologically accomplished”, we note that the evidence collected in the Blackout Report indicates that “the relay protection settings for the transmission lines, generators and underfrequency load shedding in the northeast may not be entirely appropriate and are certainly not coordinated and integrated to reduce the likelihood and consequence of a cascade—nor were they intended to do so.” In addition, the Blackout Report stated that one of the common causes of major outages in North America is a lack of coordination on system protection. The Commission agrees with the protection experts who participated in the investigation, formulated Blackout Recommendation No. 21 and recommended that UVLS programs have an integrated approach.

§1508. Regarding FirstEnergy’s question of whether universal coordination among UVLS programs that address local system problems makes sense, we believe that PRC-010-0’s objective in requiring an integrated and coordinated approach is to address the possible adverse interactions of these protection systems among themselves and to determine whether they could aggravate or accelerate cascading events. We do not believe this Reliability Standard is aimed at universal coordination among UVLS programs that address local system problems.

§1509. As identified in the NOPR, NERC is continuing to develop an integrated and coordinated approach to protection for generators, transmission lines and UFLS and UVLS programs within its work on the fill-in-the-blank proposed Reliability Standards.

§1510. We appreciate MEAG’s feedback to our response in the NOPR. For the reasons discussed in the NOPR, as well as our explanation above, the Commission approves Reliability Standard PRC-010-0 as mandatory and enforceable. In addition, the Commission directs the ERO to develop a modification to PRC-010-0 through the Reliability Standards development process that requires that an integrated and coordinated approach be included in all protection systems on the Bulk-Power System, including generators and transmission lines, generators’ low voltage ride-through capabilities, and UFLS and UVLS programs.

SPCTF Discussion

SPCTF agrees that UVLS systems must be designed to be coordinated with all other protection systems, generator protection and control systems (including generator low voltage ride-through performance), UFLS systems, and other UVLS systems.

SPCTF Recommendations

1. The SPCTF recommends that PRC-010 is more appropriately a transmission planning (TPL) standard in that it is a directive on design of the UVLS system, not the technical, nuts-and-bolts implementation of the system through specific protective relays and controls.
 2. The SPCTF recommends that the term “voltage ride-through capabilities” in the FERC assessment be clarified with regards to UVLS. “Voltage ride-through capabilities” in recent technical literature has often been referred to as an attribute of protection and control systems which avoids unintended operation during a system fault. SPCTF feels this is not directly applicable to UVLS schemes in that they are intended to prevent system voltage collapse or voltage instability as opposed to operating to detect and eliminate system faults. As in the analysis of the August 2003 blackout, UVLS programs can perform their intended function with setpoints and timing that include many seconds during non-fault system conditions. A UVLS program that is well coordinated with generating station undervoltage protection and control systems provides the necessary “ride-through capability” needed to prevent system voltage collapse and voltage instability.
 3. The SPCTF also recommends that requirements of PRC-010 should reflect the following.
 - The UVLS system must be designed to recognize the physical and operational limitations of generators (including generator low voltage ride-through performance) in the effected area. Similarly
 - UVLS systems must be designed to recognize the possible interaction with other UVLS systems or special protection systems (SPS), automated transmission controls, synchronous condensers, FACTS devices, StatComs, SVCs, etc., in the area.
 - Documentation of those design considerations must be maintained.
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Appendix A — System Protection and Control Task Force

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