

# NERC

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

## Report to the Planning Committee

### NERC SPCS Technical Review of UVLS-Related Standards: PRC-010-0, PRC-020-1, PRC-021-1, and PRC-022-1

NERC System Protection and Control Subcommittee

December 2010

to ensure  
the reliability of the  
bulk power system

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# 1. Executive Summary

The System Protection and Control Subcommittee (SPCS) scope includes an assignment to review all 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. The 2010 SPCS Work Plan includes assessment of two standards related to Undervoltage Load Shedding: PRC-010-0 and PRC-022-1.

This report presents the SPCS assessment of these two PRC standards pertaining to design and performance assessment of Undervoltage Load Shedding (UVLS) programs, as well as two additional standards relating to UVLS program data: PRC-020-1 and PRC-021-1. Collectively, these standards address all aspects associated with developing, documenting, and evaluating performance of UVLS programs.

A Standard Authorization Request (SAR) was posted in February 2010 under Project 2008-02 to address consolidation of standards PRC-010-0 and PRC-022-1. The SAR includes addressing concepts presented in the NERC SPCTF Technical Review of PRC-010-0 – Assessment of the Design and Effectiveness of UVLS Program; an assessment of PRC-010-0 approved by the Planning Committee in May 2007. This report expands upon recommendations made in the May 2007 report and in some cases provides modified recommendations based on developments within the industry and the standards development process that have occurred subsequent to May 2007.

The SPCS recommends that the SAR for Project 2008-02 – Undervoltage Load Shedding, should be modified to include addressing the recommendations presented in this report. Project 2008-02 is not one of the 17 High Priority Projects Under Development (it is on the list of Additional Projects to be Initiated in Order of Priority). Since work on this project has not commenced, there is adequate time to amend the SAR for this project.

The SPCS recommendations related to the subject Reliability Standards focus on the following subjects:

- Combine PRC-010-0, PRC-020-1, PRC-021-1, and PRC-022-1 into one standard, and classify this new standard as a Transmission Planning (TPL) standard.
- Revise the Applicability to eliminate references to Regional Reliability Organizations and specifically include Functional Model entities responsible for UVLS program design, implementation, and coordination.

- Include in the standard a definitive list of requirements that must be fulfilled in a valid UVLS program assessment to ensure consistent application and enforcement and to address any fill-in-the-blank concerns.
- Specifically include a requirement for assessment of coordination between UVLS programs and all other protection systems, generator protection and control systems (including generator low voltage ride-through performance), UFLS systems, and other UVLS systems.
- Clearly differentiate between the post-event process of validating the effectiveness of the UVLS program design, its coordination with other protection and control systems, and the potential need to modify the program design (activities that should be covered in this standard) and the process of verifying correct operation of UVLS equipment (which should be covered in PRC-004).

The SPCS notes that these recommendations are valid regardless of whether these four standards remain independent or are combined into one or more Reliability Standards.

In preparing this report SPCS discussed issues related to coordination of UVLS programs with transmission system protection, generator protection and control, UFLS programs, and other UVLS programs. The SPCS notes that the issue of coordinating Protection Systems that respond to different quantities such as voltage, frequency, apparent impedance, and excitation, is not traditional relay-to-relay coordination. Coordination must be addressed in assessments of system performance to compare the response of protections responding to different quantities, and to account for time-based and location-based variations in these quantities.

The SPCS recommends that the NERC Transmission Issues Subcommittee, with support from the SPCS and other groups as necessary, develop a paper on the subject of coordinating the design and operation of these Protection Systems to support the Project 2008-02 Standard Drafting Team. This paper should include consideration of modifications to the Modeling (MOD) Reliability Standards to ensure that data is provided and proper modeling is included as necessary to support coordination through assessments of system performance.

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## 2. Introduction

The System Protection and Control Subcommittee (SPCS) scope includes an assignment to review all 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. The 2010 SPCS Work Plan includes assessment of two standards related to Undervoltage Load Shedding: PRC-010-0 and PRC-022-1.

This report presents the SPCS assessment of these two PRC standards pertaining to design and performance assessment of Undervoltage Load Shedding (UVLS) programs. In addition, the SPCS has decided to include in this assessment two additional standards relating to UVLS program data: PRC-020-1 and PRC-021-1. Collectively, these standards address all aspects associated with developing, documenting, and evaluating performance of UVLS programs.

A Standard Authorization Request (SAR) was posted in February 2010 under Project 2008-02<sup>1</sup> to address consolidation of standards PRC-010-0 and PRC-022-1. Work on Project 2008-02 has not yet commenced as it is not one of the 17 High Priority Projects Under Development; it is on the list of Additional Projects to be Initiated in Order of Priority.<sup>2</sup> The SAR includes addressing concepts presented in the NERC SPCTF Technical Review of PRC-010-0 – Assessment of the Design and Effectiveness of UVLS Program<sup>3</sup>; an assessment of PRC-010-0 approved by the Planning Committee in May 2007. This report expands upon recommendations made in the May 2007 report and in some cases provides modified recommendations based on developments within the industry and the standards development process that have occurred subsequent to May 2007. This report also addresses issues of concern identified by FERC in Order No. 693.

The SPCS comments are divided into six sections. The first section contains the rationale for combing these four standards into one reliability standard that addresses all Transmission Planning aspects associated with UVLS. The next four sections contain comments that are specific to each standard. These comments are applicable regardless of whether these four standards remain independent or are combined into one or more Reliability Standards. The last section contains an assessment of how modifications to these four standards relate to the Federal Energy Regulatory Commission Order No. 693.<sup>4</sup>

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<sup>1</sup> [Standard Authorization Request for Project 2008-02: Undervoltage Load Shedding](#), January 15, 2010.

<sup>2</sup> [NERC Reliability Standards Development Plan: 2011–2013](#), October 14, 2010

<sup>3</sup> [NERC SPCTF Technical Review of PRC-010-0 – Assessment of the Design and Effectiveness of UVLS Program](#), May 17, 2007.

<sup>4</sup> Docket No. RM06-16-000; Order No. 693 – Mandatory Reliability Standards for the Bulk-Power System, Issued March 16, 2007.

### 3. Recommendation to Combine These Four Reliability Standards

The four UVLS standards that are the subject of this report relate to the Transmission Planning aspects associated with developing, documenting, and evaluating performance of UVLS programs. These aspects of the UVLS program typically are addressed by the Transmission Planning function within the NERC Functional Model. These standards should be reclassified as a Transmission Planning (TPL) standard and consideration should be given to combining all of the Transmission Planning related aspects into one standard.

The SPCS has provided for consideration a draft Purpose for a combined standard addressing all of the Transmission Planning related aspects of UVLS programs.

Provide requirements for development and documentation of UVLS programs coordinated between regions within an interconnection, ensuring UVLS programs are implemented consistent with UVLS program design, and ensuring assessment and evaluation of UVLS programs following system events.

It should be noted that while Project 2008-02 appropriately includes consolidation of standards PRC-010-0 and PRC-022-1, the SPCS believes it is appropriate to expand the scope to also include standards PRC-020-1 and PRC-021-1. Combining all aspects associated with developing, documenting, and evaluating performance of UVLS programs in one standard is consistent with the approach taken in PRC-006-1, approved by the NERC Board of Trustees on November 4, 2010.

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### 4. Assessment of PRC-010-0

Within this section of the report the SPCS offers comments specific to PRC-010-0. These comments are valid independent of whether the four subject standards are combined into one or more Reliability Standards.

#### 4.1. 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 |

The SPCS believes that the applicability for this standard should be modified to include the entities responsible for designing the UVLS program, the entities that implement and own the UVLS program equipment, and the entities responsible for coordinating the UVLS program with other protection systems.

UVLS Program Design: The design of the UVLS program and assessment of its effectiveness requires modeling the UVLS program in various types of planning study simulations. These simulations model the response of the system to various operating conditions and system contingencies. Such studies are performed by the Planning Coordinator<sup>5</sup> and/or Transmission Planner. Requirements associated with design of the UVLS program should be assigned to either or both of these entities. If responsibility is assigned to both, it is necessary that the responsibilities of each are clearly defined, or that a requirement be included for the Planning Coordinator and Transmission Planner to agree upon and document the division of responsibility to ensure that the reliability objective of this standard is met.

UVLS Program Implementation: Requirements associated with ownership of the UVLS equipment should be assigned only to the Functional Model entities that own UVLS equipment. The owner is the entity with the direct responsibility and ability to ensure that the equipment it owns meets the requirements of the UVLS program design. Owners of UVLS equipment typically are Transmission Owners or Distribution Providers depending on where on the power system the equipment is installed.

UVLS Program Coordination: UVLS systems must be designed to be coordinated with all other protection systems, generator protection and controls systems (including generator low voltage ride-through performance), UFLS systems, and other UVLS systems. Requirements must be placed on the owners of these protection and control systems to ensure coordination. To the extent that requirements for generator protection contained in other NERC Reliability Standards are not sufficient to ensure coordination, it would be appropriate to assign requirements to Generator Owners and/or Generator Operators and to include Generator Owners and/or Generator Operators in the Applicability section of this standard.

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<sup>5</sup> The term Planning Coordinator in the NERC Glossary of Terms has the same meaning as the term Planning Authority. Within the NERC Functional Model, the term Planning Coordinator replaced Planning Authority in Version 3.



## 4.2. Requirements

**R1.** 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). Each Regional Reliability Organization shall develop, coordinate, and document an UFLS program, which shall include the following:

**R1.1.** This assessment shall include, but is not limited to:

**R1.1.1** Coordination of the UVLS programs with other protection and control systems in the Region and with other Regional Reliability Organizations, as appropriate. Requirements for coordination of UFLS programs within subregions, Regional Reliability Organization and, where appropriate, among Regional Reliability Organizations.

**R1.1.2.** 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.

**R1.1.3.** A review of the voltage set points and timing.

1. As noted in the Applicability discussion above, the responsibility for this requirement should be assigned to the Planning Coordinator and/or Transmission Planner.
2. In order to ensure consistent application and enforcement of this standard, and to avoid any concerns with fill-in-the-blank aspects of this requirement, a definitive list of requirements to be fulfilled through this assessment must be included in the standard.
3. Coordination of UVLS programs is a critical tenet of this standard. While UVLS programs have traditionally been applied on a local-area basis, this standard should consider the need for coordinating UVLS programs across Transmission Planner, Planning Coordinator, and Regional Entity boundaries within an interconnection.
4. As noted in the 2007 SPCTF report, the SPCS agrees with Order No. 693 that a coordinated approach to protection for generators, transmission lines and UFLS and UVLS is necessary, and must be included in the assessment required in this standard. As such, it is necessary to ensure that generator undervoltage relay set points and time delays are assessed with respect to UVLS program coordination. It is important that generator protections are not miscoordinated, which could result in tripping

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

The issue of coordinating Protection Systems that respond to different quantities such as voltage, frequency, apparent impedance, and excitation, is not traditional relay-to-relay coordination. Coordination must be addressed in assessments of system performance to compare the response of protections responding to different quantities, and to account for time-based and location-based variations in these quantities. The SPCS recommends that the NERC Transmission Issues Subcommittee, with support from the SPCS and other groups as necessary, develop a paper on the subject of coordinating the design and operation of these Protection Systems to support the Project 2008-02 Standard Drafting Team. This paper should include consideration of modifications to the Modeling (MOD) Reliability Standards to ensure that data is provided and proper modeling is included as necessary to support coordination through assessments of system performance.

**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).

1. While the SPCS supports the need for entities to maintain a database documenting their UVLS programs (see assessment of PRC-020-1 and PRC-021-1) and to make this data available, this requirement is administrative and does not serve a specific reliability objective; as such it should be deleted from the standard. This requirement is covered in the ERO Rules of Procedures, Section 401.<sup>6</sup> The SPCS notes that this position differs from the May 2007 SPCTF assessment of this standard. The reason for this difference is related to similar decisions made in other standards subsequent to May 2007.
2. In the event this requirement is retained, the SPCS recommends replacement of “Regional Reliability Organization” with “Regional Entity.”

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<sup>6</sup> Data Access — All bulk power system owners, operators, and users shall provide to NERC and the applicable regional entity such information as is necessary to monitor compliance with the reliability standards. NERC and the applicable regional entity will define the data retention and reporting requirements in the reliability standards and compliance reporting procedures.

## 4.3. Measures

The measures should be modified consistent with the recommended modifications to the requirements above.

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## 5. Assessment of PRC-020-1

Within this section of the report the SPCS offers comments specific to PRC-020-1. These comments are valid independent of whether the four subject standards are combined into one or more Reliability Standards.

### 5.1. Applicability

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|---|
| 4.1 Regional Reliability Organization with entities that own or operate a UVLS program. |
|---|

Responsibility for maintenance of a UVLS database should be assigned to a Functional Model entity that is a user, owner, or operator of the Bulk Electric System. The Planning Coordinator is the appropriate entity with the wide-area view and need for this data.

### 5.2. Requirements

- |  |
|--|
| <p><b>R1.</b> The Regional Reliability Organization shall establish, maintain and annually update a database for UVLS programs implemented by entities within the region to mitigate the risk of voltage collapse or voltage instability in the BES. This database shall include the following items:</p> <ul style="list-style-type: none"><li><b>R1.1.</b> Owner and operator of the UVLS program.</li><li><b>R1.2.</b> Size and location of customer load, or percent of connected load, to be interrupted.</li><li><b>R1.3.</b> Corresponding voltage set points and overall scheme clearing times.</li><li><b>R1.4.</b> Time delay from initiation to trip signal.</li><li><b>R1.5.</b> Breaker operating times.</li><li><b>R1.6.</b> Any other schemes that are part of or impact the UVLS programs such as related generation protection, islanding schemes, automatic load restoration schemes, UFLS and Special Protection Systems.</li></ul> |
|--|

1. As noted above, a Functional Model entity that is a user, owner, or operator of the Bulk Electric System, such as the Planning Coordinator should be assigned responsibility for this requirement.
2. The SPCS believes that requiring documentation of the owner of the UVLS program is sufficient in Requirement R1.1. There is no entity that operates the UVLS program, per se. Operation of the UVLS program is automatic. To the extent that a UVLS program requires arming and disarming, the hierarchy for implementing operating instructions already is defined and should not be duplicated in this standard.
3. Requirement R1.6 should be limited to data associated with the UVLS program. It should not duplicate requirements such as the UFLS program database. To the extent R1.6 is intended to document a list of schemes with which the UVLS must be coordinated, this should be stated clearly in the standard.
4. As noted in the May 2007 SPCTF report, the need for UVLS can be for local or Bulk Electric System reliability. Requirement R1 of PRC-020 should include a requirement for documentation that states whether the UVLS program is for local or Bulk Electric System reliability.

**R2.** The Regional Reliability Organization shall provide the information in its UVLS database to the Planning Authority, the Transmission Planner, or other Regional Reliability Organizations and to NERC within 30 calendar days of a request.

1. As noted above, a Functional Model entity that is a user, owner, or operator of the Bulk Electric System, such as the Planning Coordinator should be assigned responsibility for this requirement.
2. As noted above in the assessment of PRC-010-0, NERC and the Regional Entities already have the ability to obtain this data. However, it is important that this information is provided to entities that require this information to plan or operate the Bulk Electric System. As such, this requirement should be retained, and the entity responsible for maintaining this data should be required to provide this data to neighboring Reliability Coordinators, Planning Coordinators, Transmission Operators, and Transmission Planners within a specified time whenever the database is updated.

## 5.3. Measures

The measures should be modified consistent with the recommended modifications to the requirements above.

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## 6. Assessment of PRC-021-1

Within this section of the report the SPCS offers comments specific to PRC-021-1. These comments are valid independent of whether the four subject standards are combined into one or more Reliability Standards.

### 6.1. Applicability

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|-----|---|
| 4.1 | Transmission Owner that owns a UVLS program.    |
| 4.2 | Distribution Provider that owns a UVLS program. |

The responsibility for providing data for the UVLS database should be limited to the entities that implement the UVLS program and own the UVLS equipment. As discussed above under the Applicability for PRC-010-0, owners of UVLS programs typically are Transmission Owners or Distribution Providers depending on where on the power system the equipment is installed.

### 6.2. Requirements

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| <p><b>R1.</b> Each Transmission Owner and Distribution Provider that owns a UVLS program to mitigate the risk of voltage collapse or voltage instability in the BES shall annually update its UVLS data to support the Regional UVLS program database. The following data shall be provided to the Regional Reliability Organization for each installed UVLS system:</p> <ul style="list-style-type: none"><li><b>R1.1.</b> Size and location of customer load, or percent of connected load, to be interrupted.</li><li><b>R1.2.</b> Corresponding voltage set points and overall scheme clearing times.</li><li><b>R1.3.</b> Time delay from initiation to trip signal.</li><li><b>R1.4.</b> Breaker operating times.</li><li><b>R1.5.</b> Any other schemes that are part of or impact the UVLS programs such as related generation protection, islanding schemes, automatic load restoration schemes, UFLS and Special Protection Systems.</li></ul> |
|--|

1. The requirement for providing data in PRC-021 should be conformed to the revised requirement for maintaining the database in PRC-020, as described above in the assessment of PRC-020-1. This includes the data to be provided and the entity to which the data is provided.

**R2.** Each Transmission Owner and Distribution Provider that owns a UVLS program shall provide its UVLS program data to the Regional Reliability Organization within 30 calendar days of a request.

1. The Regional Reliability Organization should be replaced with the entity that maintains the database in PRC-020.
2. Data should be provided either on a regular schedule determined by the entity responsible for maintaining the database (e.g., annually), or whenever modifications are made to the UVLS program, or both.

## 6.3. Measures

The measures should be modified consistent with the recommended modifications to the requirements above.

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## 7. Assessment of PRC-022-1

Within this section of the report the SPCS offers comments specific to PRC-022-1. These comments are valid independent of whether the four subject standards are combined into one or more Reliability Standards.

### 7.1. Applicability

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

When considering post-event assessments, the SPCS believes it is necessary to differentiate between the process of verifying correct operation of UVLS equipment that should be assigned to the entities that own the equipment (typically Transmission Owners and Distribution Providers) and the process of assessing the effectiveness of the UVLS program

design, its coordination with other protection and control systems, and the potential need to modify the program design.

The SPCS believes this standard addresses the latter aspects of post-event assessments and recommends that the applicability for this standard should be assigned to the Planning Coordinator and/or Transmission Planner as the Functional Model entity that has the wide-area view and the capability to perform simulations of events involving potential for voltage collapse or voltage instability in the Bulk Electric System. As noted above for PRC-010-0, if responsibility is assigned to both entities it is necessary that the responsibilities of each are clearly defined or that a requirement be included for the Planning Coordinator and Transmission Planner to agree upon and document the division of responsibility to ensure that the reliability objective of this standard is met.

Other aspects of post-event assessments related to verifying correct operation of UVLS equipment should be included in PRC-004, Analysis and Mitigation of Transmission and Generation Protection System Misoperations, consistent with previous recommendations by the SPCS.<sup>7</sup>

## 7.2. Requirements

- R1.** Each Transmission Operator, Load-Serving Entity, and Distribution Provider that operates a UVLS program to mitigate the risk of voltage collapse or voltage instability in the BES shall analyze and document all UVLS operations and Misoperations. The analysis shall include:
- R1.1.** A description of the event including initiating conditions.
  - R1.2.** A review of the UVLS set points and tripping times.
  - R1.3.** A simulation of the event, if deemed appropriate by the Regional Reliability Organization. For most events, analysis of sequence of events may be sufficient and dynamic simulations may not be needed.
  - R1.4.** A summary of the findings.
  - R1.5.** For any Misoperation, a Corrective Action Plan to avoid future Misoperations of a similar nature.

1. As noted in the Applicability discussion above, the responsibility for this requirement should be assigned to the Planning Coordinator and/or Transmission Planner. The parts of Requirement R1 should be specific to the design of the program – e.g., R1.2

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<sup>7</sup> NERC SPCS Assessment of Standards: PRC-003-1 – Regional Procedure for Analysis of Misoperations of Transmission and Generation Protection Systems; PRC--004-1 – Analysis and Mitigation of Transmission and Generation Protection Misoperations; PRC-016-1 – Special Protection System Misoperations.

- should pertain to whether the UVLS setpoints and tripping times specified in the program design are appropriate and R1.5 should be deleted from this standard and specifically included in PRC-004.
2. This requirement should include a time-frame within which the assessment should be completed; e.g., 90 days after the event.
  3. The Regional Reliability Organization should be removed from this requirement and specific guidance should be included as to when dynamic simulations are required.
  4. To the extent it is necessary to obtain information from the UVLS program owner on actual operating performance of the UVLS equipment during the event, such as whether the relays operated at the correct setpoints and tripping times as specified in the UVLS program design, this should be included as a separate requirement assigned to the Transmission Owner and Distribution Provider. This requirement could specify that the Transmission Owner and Distribution Provider must verify that all UVLS relays operated in accordance with the specified program design when requested by the Planning Coordinator or Transmission Planner to support their post event-analysis.

**R2.** Each Transmission Operator, Load-Serving Entity, and Distribution Provider that operates a UVLS program shall provide documentation of its analysis of UVLS program performance to its Regional Reliability Organization within 90 calendar days of a request.

This requirement is administrative and does not serve a specific reliability objective: as such it should be deleted from the standard. This requirement is covered in the ERO Rules of Procedures, Section 401.<sup>8</sup>

## 7.3. Measures

The measures should be modified consistent with the recommended modifications to the requirements above.

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<sup>8</sup> Data Access — All bulk power system owners, operators, and users shall provide to NERC and the applicable regional entity such information as is necessary to monitor compliance with the reliability standards. NERC and the applicable regional entity will define the data retention and reporting requirements in the reliability standards and compliance reporting procedures.



## **8. FERC Assessment of PRC-010-0, PRC-020-1, PRC-021-1, and PRC-022-1**

### **8.1. PRC-010-0**

#### **8.1.1. Commission Discussion and Determination**

1509. We appreciate MEAG's feedback to our response in the NOPR. For the reasons discussed in the NOPR, ¶395 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.

#### **8.1.2. SPCS Discussion**

The SPCS 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. As noted above, the standard should require assessment of these protection systems with respect to UVLS program coordination in assessments of UVLS systems.

### **8.2. PRC-020-1**

#### **8.2.1. Commission Discussion and Determination**

1555. APPA is correct that the reason for not approving or remanding this Reliability Standard is because it applies solely to the regional reliability organization, and not because it is a fill-in-the-blank standard. For this reason, the Commission will not approve or remand PRC-020-1.

#### **8.2.2. SPCS Discussion**

The SPCS recommendation that appropriate Functional Model entities are included in the standard in place of the Regional Reliability Organization is consistent with addressing the Commission's concern.

## **8.3. PRC-021-1**

### **8.3.1. Commission Discussion and Determination**

1560. For the reasons stated in the NOPR and above, the Commission approves PRC-021-1 as mandatory and enforceable. The referenced information will be provided pursuant to the data gathering provisions of the ERO's rules of procedure and the Commission's ability to obtain information pursuant to section 215 of the FPA and Part 39 of the Commission's regulations. As stated in the Common Issues section, a reference to an unapproved Reliability Standard may be considered in an enforcement action, but is not a reason to delay approving and enforcing this Reliability Standard.

### **8.3.2. SPCS Discussion**

The SPCS believes the proposed modifications to these standards are consistent with the Commission's determination.

## **8.4. PRC-022-1**

### **8.4.1. Commission Discussion and Determination**

1564. FirstEnergy comments that Requirement R1.3 requires "a simulation of the event, if deemed appropriate by the RRO" and believes that the applicable entities such as transmission operators may not be able to simulate large system events. FirstEnergy suggests that Requirement R1.3 be revised to state that "a simulation of the event, if deemed appropriate, and assisted by the [regional reliability organization]."

1565. For the reasons discussed in the NOPR, the Commission concludes that Reliability Standard PRC-022-1 is just, reasonable, not unduly discriminatory or preferential, and in the public interest and approves it as mandatory and enforceable.

1566. The Commission directs the ERO to consider FirstEnergy's suggestion in the Reliability Standards development process.

### **8.4.2. SPCS Discussion**

The SPCS believes the proposed modifications to these standards address the concerns raised by FirstEnergy and are consistent with the Commission's determination.

## 9. Conclusions and Recommendations

The SPCS recommends that the SAR for Project 2008-02 – Undervoltage Load Shedding, should be modified to include addressing the recommendations presented in this report. Project 2008-02 is not one of the 17 High Priority Projects Under Development (it is on the list of Additional Projects to be Initiated in Order of Priority). Since work on this project has not commenced, there is adequate time to amend the SAR for this project.

The SPCS recommendations related to the subject Reliability Standards focus on the following subjects:

- Combine PRC-010-0, PRC-020-1, PRC-021-1, and PRC-022-1 into one standard, and classify this new standard as a Transmission Planning (TPL) standard.
- Revise the Applicability to eliminate reference to Regional Reliability Organizations and specifically include Functional Model entities responsible for UVLS program design, implementation, and coordination.
- Include in the standard a definitive list of requirements that must be fulfilled in a valid UVLS program assessment to ensure consistent application and enforcement and to address any fill-in-the-blank concerns.
- Specifically include a requirement for assessment of coordination between UVLS programs and all other protection systems, generator protection and control systems (including generator low voltage ride-through performance), UFLS systems, and other UVLS systems.
- Clearly differentiate between the post-event process of validating the effectiveness of the UVLS program design, its coordination with other protection and control systems, and the potential need to modify the program design (activities that should be covered in this standard) and the process of verifying correct operation of UVLS equipment (which should be covered in PRC-004).

The SPCS notes that these recommendations are valid regardless of whether these four standards remain independent or are combined into one or more Reliability Standards.

In preparing this report SPCS discussed issues related to coordination of UVLS programs with transmission system protection, generator protection and control, UFLS programs, and other UVLS programs. The SPCS notes that the issue of coordinating Protection Systems that respond to different quantities such as voltage, frequency, apparent impedance, and excitation, is not traditional relay-to-relay coordination. Coordination must be addressed in

assessments of system performance to compare the response of protections responding to different quantities, and to account for time-based and location-based variations in these quantities.

The SPCS recommends that the NERC Transmission Issues Subcommittee, with support from the SPCS and other groups as necessary, develop a paper on the subject of coordinating the design and operation of these Protection Systems to support the Project 2008-02 Standard Drafting Team. This paper should include consideration of modifications to the Modeling (MOD) Reliability Standards to ensure that data is provided and proper modeling is included as necessary to support coordination through assessments of system performance.

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## APPENDIX A – System Protection and Control Subcommittee Roster

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