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Standard Authorization Request Form

Title of Proposed Standard	**PRC-001-1 — System Protection Coordination**
Request Date	March 22, 2007

SAR Requestor Information	**SAR Type** (*Check a box for each one that applies.*)	
Name NERC System Protection and Control Task Force (Attachment A)	☐	New Standard
Primary Contact Charles Rogers (SPCTF Chairman)	☒	Revision to existing Standard
Telephone 517-788-0027 Fax 517-788-0917	☐	Withdrawal of existing Standard
E-mail cwrogers@cmsenergy.com	☐	Urgent Action

Purpose (Describe the purpose of the standard — what the standard will achieve in support of reliability.)

The purpose of standard PRC-001-1 — System Protection Coordination should remain "To ensure system protection is coordinated among operating entities." The standard should be revised to:

1. Assure that Protection System application and performance issues are coordinated among all related entities.
2. Correct the applicable entities within the standard to reflect the actual functional responsibilities, as described in the NERC Functional Model.
3. Incorporate other general improvements described in the standards development work plan and from other sources.
4. Consider comments received during the initial development of the standards and other comments received from ERO regulatory authorities and stakeholders.
5. Consider the observations and recommendations developed by the NERC SPCTF, which are detailed in the attached report (Attachment B), approved by the Planning Committee in December 2006.

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

Protection system coordination is an absolute necessity for the North American electric system to operate properly. The tenets of PRC-001 have long been recognized by the industry, with the NERC Board approval of them in the Planning Standards in 1995.

PRC-001 is a Version 0 standard, that was translated from historical operating and planning policies and guides that were appropriate in an era of voluntary compliance. The Version 0 standards and recent updates were put in place as a temporary starting point to start up the electric reliability organization and begin enforcement of mandatory standards. However, it is important to update those standards, incorporating improvements to make the standards more suitable for enforcement, and to capture prior technical recommendations that were deferred during the Version 0 translation.

Both FERC (within the NOPR on RM06-16-000) and the SPCTF (in their report on PRC-001) identified significant shortcomings in the existing standard.

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

The existing PRC-001 Standard has been identified in the draft Standards Development Plan as requiring revision, within the FERC Notice of Proposed Rulemaking on Docket Number RM06-16-000 as requiring revisions, and by a SPCTF report (attached) which identified a number of issues with the existing standard (the SPCTF report also includes the observations from the FERC NOPR). This revision of PRC-001 should address concerns from all of these sources.

Reliability Functions

The Standard will Apply to the Following Functions *(Check box for each one that applies.)*		
☒	Reliability Coordinator	Ensures the reliability of the bulk transmission system within its Reliability Coordinator area. This is the highest reliability authority.
☒	Balancing Authority	Integrates resource plans ahead of time, and maintains load-interchange-resource balance within its metered boundary and supports system frequency in real time.
☐	Interchange Authority	Authorizes valid and balanced Interchange Schedules.
☒	Planning Authority	Plans the Bulk Electric System.
☐	Resource Planner	Develops a long-term (>one year) plan for the resource adequacy of specific loads within a Planning Authority area.
☐	Transmission Planner	Develops a long-term (>one year) plan for the reliability of transmission systems within its portion of the Planning Authority area.
☐	Transmission Service Provider	Provides transmission services to qualified market participants under applicable transmission service agreements
☒	Transmission Owner	Owns transmission facilities.
☒	Transmission Operator	Operates and maintains the transmission facilities, and executes switching orders.
☒	Distribution Provider	Provides and operates the “wires” between the transmission system and the customer.
☒	Generator Owner	Owns and maintains generation unit(s).
☒	Generator Operator	Operates generation unit(s) and performs the functions of supplying energy and Interconnected Operations Services.
☐	Purchasing-Selling Entity	The function of purchasing or selling energy, capacity, and all necessary Interconnected Operations Services as required.
☐	Market Operator	Integrates energy, capacity, balancing, and transmission resources to achieve an economic, reliability-constrained dispatch.

☐	Load-Serving Entity	Secures energy and transmission (and related generation services) to serve the end user.

Reliability and Market Interface Principles

Applicable Reliability Principles *(Check box for all that apply.)*	
☒	1. Interconnected bulk electric systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards.
☐	2. The frequency and voltage of interconnected bulk electric systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
☒	3. Information necessary for the planning and operation of interconnected bulk electric systems shall be made available to those entities responsible for planning and operating the systems reliably.
☒	4. Plans for emergency operation and system restoration of interconnected bulk electric systems shall be developed, coordinated, maintained and implemented.
☐	5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk electric systems.
☒	6. Personnel responsible for planning and operating interconnected bulk electric systems shall be trained, qualified, and have the responsibility and authority to implement actions.
☒	7. The security of the interconnected bulk electric systems shall be assessed, monitored and maintained on a wide area basis.

Does the proposed Standard comply with all the following Market Interface Principles? *(Select "yes" or "no" from the drop-down box.)*
1. The planning and operation of bulk electric systems shall recognize that reliability is an essential requirement of a robust North American economy. Yes
2. An Organization Standard shall not give any market participant an unfair competitive advantage.Yes
3. An Organization Standard shall neither mandate nor prohibit any specific market structure. Yes
4. An Organization Standard shall not preclude market solutions to achieving compliance with that Standard. Yes
5. An Organization Standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards. Yes

Related Standards

Standard No.	Explanation
MOD-011-0	Modify to include the essential data for wide-area fault studies, as noted in the attached SPCTF report on PRC-001.

Related SARs

SAR ID	Explanation
	Project 2007-06 - System Protection, in the Reliability Standards Development Plan, addresses PRC-001

Regional Differences

Region	Explanation
ERCOT	None
FRCC	None
MRO	None
NPCC	None
SERC	None
RFC	None
SPP	None
WECC	None

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NERC
NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL

NERC SPCTF Assessment of Standard PRC-001-0 – System Protection Coordination

December 7, 2006

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 o December 7, 2006, for forwarding to the Standards Committee.

Introduction

When the original scope for the System Protection and Control Task Force was developed, one of the assigned items was to review all of 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 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

This reliability standard is intended to assure that system protection is coordinated between multiple transmission entities and between generation entities and transmission entities. It appears that this standard is intended to address coordination of protection functions and capabilities in both the operating time frame and the planning time frame. These time frames, as they apply to protective functions, are discussed, as are the various responsibilities to assure the related coordination.

The SPCTF concludes that the list of applicable entities in the existing standard is incomplete and that the assigned responsibilities do not reflect the activities of the identified functions. Significantly, the existing standard disregards the significant responsibilities and roles of the equipment owners; specifically, the Transmission Owners and Generator Owners.

The SPCTF also concludes that the Requirements of the existing standard are vague and ambiguous, and that, while Measures and Levels of Non-Compliance are defined, these are essentially unenforceable because of fundamental flaws within the requirements.

Assessment of PRC-001-0

General Comments

The SPCTF offers the following general comments:

1. None of the requirements within PRC-001-0 specifically indicate what protective systems are being addressed.
2. The phrase "protective relay or equipment" is a recurring phrase, and generally should be revised to "protective system" or "protective system equipment."
3. The phrase "If a protective relay or equipment failure reduces system reliability" is ambiguous, and needs additional clarification. This phrase does not clearly state when failures must be reported.
4. Many of the requirements list the Balancing Authority as an applicable entity. It does not seem that the Balancing Authority has the direct responsibility for any of these activities, and only needs to respond to the various issues when directed by the Transmission Operator and/or Generator Operator.

Applicability

4.1. Balancing Authorities
4.2. Transmission Operators

4.3. Generator Operators

The remainder of the PRC-series standards rarely assigns any responsibility for protection systems to any of the above entities. Specifically, the responsibilities for disturbance monitoring (which includes some monitoring of protective systems) and for protective system maintenance apply to the equipment owners, specifically Transmission Owners and Generator Owners. The current applicable entities do, however, have a role in the functions of this standard. The SPCTF asserts that Transmission Owner, Generator Owner, and Distribution Provider should be added to the list of Applicable Entities.

R1

> **R1.** Each Transmission Operator, Balancing Authority, and Generator Operator shall be familiar with the purpose and limitations of protective system schemes applied it its area.

This requirement is a statement of a highly laudable goal, but this is not specific and enforceable. In fact, the drafting team that was providing missing Measures and Compliance Elements was unable to assign either to this requirement.

It may be possible to restate this requirement in such a way to be measurable and enforceable. The protective system equipment owners (Transmission Owners, Generator Owners, and Distribution Providers) should be responsible to provide the necessary information to the Transmission Operator and Generator Operator to facilitate their familiarity with the relevant protective systems.

R2

> **R2.** Each Generator Operator and Transmission Operator shall notify reliability entities of relay or equipment failures as follows:
>
> **R2.1.** If a protective relay or equipment failure reduces system reliability, the Generator Operator shall notify its Transmission Operator and Host Balancing Authority. The Generator Operator shall take corrective action as soon as possible.
>
> **R2.2.** If a protective relay or equipment failure reduces system reliability, the Transmission Operator shall notify its Reliability Coordinator and affected Transmission Operators and Balancing Authorities. The Transmission Operator shall take corrective action as soon as possible.

Requirement R2 addresses the operating horizon, but the equipment owner entities will be familiar with the condition of their protective system equipment.

Therefore, the responsibility for this requirement must originate with the owner entities: the Transmission Owner, Generator Owner, and Distribution Provider. These entities should inform the Transmission Operator, Generator Operator, and Balancing Authorities of equipment failures pertinent to this requirement. The Transmission Operators may need to have to coordinate with each other, similar to the existing requirement R4.

The requirement for corrective action, “as soon as possible”, is vague and ambiguous, and needs modification to be specific.

As evidenced by the lack of a related Measure (via the drafting team for missing Measures and Compliance Elements), this requirement is currently not measurable.

R3

> **R3.** A Generator Operator or Transmission Operator shall coordinate new protective systems and changes as follows.
>
> **R3.1.** Each Generator Operator shall coordinate all new protective systems and all protective system changes with its Transmission Operator and Host Balancing Authority.
>
> **R3.2.** Each Transmission Operator shall coordinate all new protective systems and all protective system changes with neighboring Transmission Operators and Balancing Authorities.

Not only new protective systems and changes to protective systems should be coordinated. A requirement should be added to require coordination of all existing protective systems. Then, requirement R3 should require the coordination new protective systems and changes to protective systems with existing protective systems.

Requirement R3 addresses the planning horizon; therefore, this responsibility should be assigned to the Transmission Owner, Generator Owner, and Distribution Provider.

In addition, R3.1 should be bi-directional; the Transmission entity should provide similar coordination with the Generator entity.

R4

> **R4.** Each Transmission Operator shall coordinate protection systems on major transmission lines and interconnections with neighboring Generator Operators, Transmission Operators, and Balancing Authorities.

It's unclear whether this requirement addresses the operations planning horizon or the planning horizon.

If Requirement R4 addresses the planning horizon, the responsibilities should be assigned similarly to the recommendations for R3, to the Transmission Owner, Generator Owner, and Distribution Provider. If Requirement R4 addresses the planning horizon, it seems to be redundant with R3 to some extent.

R5

> **R5.** A Generator Operator or Transmission Operator shall coordinate changes in generation, transmission, load or operating conditions that could require changes in the protection systems of others:
>
> **R5.1.** Each Generator Operator shall notify its Transmission Operator in advance of changes in generation or operating conditions that could require changes in the Transmission Operator's protection systems.
>
> **R5.2.** Each Transmission Operator shall notify neighboring Transmission Operators in advance of changes in generation, transmission, load, or operating conditions that could require changes in the other Transmission Operators' protection systems.

Requirement R5 addresses the both the planning horizon and operating planning horizon. It is essential to the reliability of the system that this activity occurs, and it must occur in advance of any changes to the system.

In the operations planning horizon, the Operator entities should coordinate these changes with the Owner entities, since the Owners have the tools to analyze the effects of these system changes on the protective systems and the access to the protective systems to make any needed changes to the protective system.

In the planning horizon, the owner entities should be responsible for this requirement, similarly to Requirement R3.

R6

> **R6.** Each Transmission Operator and Balancing Authority shall monitor the status of each Special Protection System in their area, and shall notify affected Transmission Operators and Balancing Authorities of each change in status.

Requirement R6 addresses the operating horizon. The Owners have to monitor the status of Special Protection Systems and provide the status to the Operators. The Operators then should coordinate the availability of Special Protection Systems between each other, and take any necessary operating actions to address issues with Special Protection Systems.

This requirement needs to better define "status of … Special Protection System…"

This requirement may be better moved to one of the PRC-series standards specifically addressing Special Protection Systems.

Related Standard
MOD-011-0 — Regional Steady-State Data Requirements and Reporting Procedures

Also, while reviewing PRC-001, the SPCTF noted that no existing NERC Standard requires that a consistent model be maintained for protection studies, such as that required by MOD-011-0 — Regional Steady-State Data Requirements and Reporting Procedures, for other steady-state studies. Without such a model, various Transmission Owners, Generator Owners, and Distribution Providers cannot accurately

apply the protective relaying. To address this deficiency, the SPCTF recommends that MOD-011, Maintenance and Distribution of Steady-State Data Requirements and Reporting Procedures, be modified to include the essential data for wide-area fault studies. The specific MOD-011 requirements are listed below, together with suggested modifications.

R1.2 – Generators
Recommend including direct-axis synchronous reactance (X_d), transient reactance (X_d'), sub transient reactance (X_d"), and the associated time constants (T_{do}, T_{do}', and T_{do}") for synchronous generators. For induction and inverter generators, generically include the data necessary to model the equipment in short circuit models in the positive, negative, and zero sequence domains.

R1.3 – Transmission Lines
Recommend specifying the positive and zero sequence impedance, including mutual impedances

R1.5 – Transformers
Recommend specifying positive sequence and zero sequence impedance, including all grounding effects.

FERC Assessment of PRC-001-0

In the October 20, 2006, the Notice of Proposed Rulemaking for adoption of NERC Standards (Docket Number RM06-16-000), the Federal Energy Regulatory Commission, for the most part, considered the operating horizon impacts of PRC-001. FERC proposed that PRC-001-0 be approved as mandatory and enforceable. They did, however, propose that NERC be directed to make modifications to PRC-001. The modifications proposed in the NOPR are excerpted from the NOPR and repeated below:

> "The Commission proposes to direct that NERC submit a modification to PRC-001-0 that: (1) includes Measures and Levels of Non-Compliance; (2) includes a requirement that relevant transmission operators and generator operators must be informed immediately upon the detection of failures in relays or protection system elements on the Bulk-Power System that would threaten reliable operation, so that these entities can carry out the appropriate corrective control actions consistent with those used in mitigating IROL violations; and (3) clarifies that, after being informed of failures in relays or protection system elements on the Bulk-Power System, transmission operators or generator operators shall carry out corrective control actions, i.e., returning the system to a stable state that respects system requirements as soon as possible and no longer than 30 minutes."

Other Activities related to PRC-001-0

The Standard Drafting Team on Missing Measures and Compliance Elements modified PRC-001-0 as a part of their work, but the requirements were not changed. As this report is being prepared, the modified Standard is being balloted.

A draft SAR for the revision of PRC-001-0 is included in the "Draft Reliability Standards Development Plan: 2007–2009", which was presented to the NERC Board of Trustees for their approval on November 1, 2006. This draft SAR is entitled, "System Protection Project (2009-01)", and discusses many of the same deficiencies in PRC-001-1 that were identified by the SPCTF.

Conclusion and Recommendation

As it exists today, enforcement of PRC-001-0 will be very difficult. The applicable entities in the existing Standard are incorrect for many of the requirements, and the requirements themselves are vague and not measurable. In addressing the "operating horizon," "operations planning horizon," and "planning horizon" protection coordination issues, the deficiencies in the current standard are magnified.

The SPCTF recommends that the existing draft Standards Authorization Request that is included in the "Draft Reliability Standards Development Plan: 2007–2009" be modified to include the observations from the SPCTF assessment of PRC-001-0 and also include the modifications directed in the FERC NOPR on RM06-16-000. The SPCTF also recommends that the requirements for the operating horizon and planning horizon be clearly delineated and warrants consideration of dividing this standard into two standards.

In addition, it is not possible to effectively coordinate protective systems without having accurate short circuit models of neighboring systems. To address these modeling issues related to data for short circuit calculations, the SPCTF recommends that a Standards Authorization Request be developed to modify Standard MOD-013-1 — RRO Dynamics Data Requirements and Reporting Procedures, to address these issues. Data for short circuit calculations, as noted in this report, should be considered as additional requirements within MOD-013-1.

Appendices

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