NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

PRC-027-1

System Protection Coordination

Industry Webinar
April 27, 2015

RELIABILITY | ACCOUNTABILITY




Agenda

- Administrative Items
  - Antitrust and Disclaimers
  - Webinar Format
  - New Standard Balloting & Commenting System (SBS)
- Standard Drafting Team
- Presenters
- PRC-027-1 Overview of Draft 5
- Questions & Answers
- Closing Remarks

Administrative Items

Antitrust Guidelines

- It is NERC's policy and practice to obey the antitrust laws and to avoid all conduct that unreasonably restrains competition. This policy requires the avoidance of any conduct that violates, or that might appear to violate, the antitrust laws. Among other things, the antitrust laws forbid any agreement between or among competitors regarding prices, availability of service, product design, terms of sale, division of markets, allocation of customers or any other activity that unreasonably restrains competition. It is the responsibility of every NERC participant and employee who may in any way affect NERC's compliance with the antitrust laws to carry out this commitment

Disclaimers

- Public
  - Participants are reminded that this meeting is public. Notice of the meeting was widely distributed. Participants should keep in mind that the audience may include members of the press and representatives of various governmental authorities, in addition to the expected participation by industry stakeholders.
- Presentation Material
  - Wording in this presentation is used for presentation purposes and may not reflect the official posted drafts of requirements or other language

Standards Balloting & Commenting System (SBS)

- Since the ballot pools for this project are outdated, new ballot pools are being formed in the Standards Balloting & Commenting System (SBS). The ballot and non-binding poll for this posting are **additional**.
- If you had previously joined the ballot pools for PRC-027-1, you **must** join these ballot pools to cast a vote. Previous PRC-027-1 ballot pool members **will not** be carried over to these ballot pools.
- Ballot pools are being formed through **8 p.m. Eastern, Thursday, April 30, 2015.**

Standards Balloting & Commenting System (SBS) continued

SBS Login, Registration, Validation and Permissions

- To **comment** in the SBS, you must have a contributor, voter, or proxy role.
- To **join a ballot pool and vote** in the SBS, you must have a voter role.
- To be a **proxy and vote** in the SBS, you must have a proxy role.
- To register to become a proxy or voter in the **SBS**:
  - Go to 'My User Profile'
  - Select 'Click Here' to request additional permissions
  - Select 'Voter' or 'Proxy Voter'

Standard Drafting Team

Member	Entity
Phil Winston, Chair	Southern Company
Bill Middaugh, Vice Chair	Tri-State Generation & Transmission Association
Forrest Brock	Western Farmers Electric Cooperative
Sam Francis	Oncor Electric Delivery
Jeff Iler	American Electric Power
Kevin Wempe	Kansas City Power and Light

Presenters

- Standard Drafting Team (SDT)
  - Phil Winston, Chair
  - Sam Francis
  - Jeff Iler
- NERC staff
  - Al McMeekin, Standards Developer

Project 2007-06 Key Points

- PRC-027-1 Coordination of Protection System Performance During Faults
  - Addresses planning time horizon Requirements R3 and R4 of PRC-001
    - PRC-001-3 posted
  - Corrects applicable entities to owners – TO, GO, and DP
  - Addresses the coordination of Protection Systems during Faults
  - Addresses the coordination (reviewing/updating) of existing Protection Systems
  - Addresses the coordination of all Protection Systems installed for the purpose of detecting Faults on BES Elements

PRC-001, Requirement R3 (Existing)

- **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.

PRC-001, Requirement R4 (Existing)

- **R4.** Each Transmission Operator shall coordinate Protection Systems on major transmission lines and interconnections with neighboring Generator Operators, Transmission Operators, and Balancing Authorities.

PRC-027-1: Applicability

Applicability:

- **4.1 Functional Entities:**

  4.1.1 Transmission Owner

  4.1.2 Generator Owner

  4.1.3 Distribution Provider (that own Protection Systems identified in the Facilities section 4.2 below)

- **4.2 Facilities:**

  Protection Systems installed for the purpose of detecting Faults on BES Elements and isolating those faulted Elements:

PRC-027-1: Purpose

- **Purpose:**

  To maintain the coordination of Protection Systems installed for the purpose of detecting Faults on BES Elements and isolating those faulted Elements, such that the Protection Systems operate in the intended sequence during Faults.

PRC-027-1, Requirement R1

- **R1.** Each Transmission Owner, Generator Owner, and Distribution Provider shall establish a process to develop settings for its BES Protection Systems to operate in the intended sequence during Faults.
  - **Rationale for Requirement R1**
    - Requirement R1 captures the intent of the purpose of the Standard *(To maintain the coordination of Protection Systems installed for the purpose of detecting Faults on BES Elements and isolating those faulted Elements, such that the Protection Systems operate in the intended sequence during Faults)* by mandating an entity establish a process that, when followed, will facilitate consistent results for developing settings for its BES Protection Systems.

PRC-027-1, Requirement R1, Part 1.1

The process shall include:

1.1. A method to review and update the information required to develop new or revised Protection System settings.

- **Rationale for Part 1.1**
  - Reviewing and updating the information required to coordinate Protection Systems maximizes the likelihood that the process of reviewing and developing settings is completed using accurate, up-to-date information.
  - Examples of Information to be reviewed
    - » short-circuit databases, line and transformer impedances, station configurations, current and voltage transformer ratios, adjacent Protection System settings, and relay and control functional drawings

PRC-027-1, Requirement R1, Part 1.2

The process shall include:

1.2. A review of Protection System settings affected by System changes.

- **Rationale for Part 1.2**
  - Reviewing the affected Protection System settings when System changes occur maintains coordination.
  - Examples of System changes
    - » New or revised Protection System installations, changes to a transmission system Element that alters any sequence or mutual coupling impedance, changes to generator unit(s) that result in a change in impedance, or changes to the generator step-up transformer(s) that result in a change in impedance.

PRC-027-1, Requirement R1, Part 1.3

The process shall include:

1.3. A review of existing entity-designated* Protection System settings based on one of the following:

- **Periodic Fault current studies:** A 15 percent or greater deviation in Fault current (either three-phase or phase-to-ground) from an established Fault current baseline for Protection Systems at the bus under study, and evaluated in a time interval not to exceed six calendar years, or
- **Periodic review of Protection System settings:** A time interval, not to exceed six calendar years, or
- **A combination of the above.**

* Based on the Protection System design and/or susceptibility to changes in Fault current, applicable entities (Transmission Owners, Generator Owners, and Distribution Providers) will designate what Protection Systems must be included in the review(s) to ensure these Protection Systems continue to operate in the intended sequence during Faults.

PRC-027-1, Requirement R1, Part 1.3 (cont'd)

- **Rationale for Part 1.3 (Periodic Fault current studies)**
  - Periodically reviewing Fault current values and/or existing entity-designated Protection System settings maximizes the likelihood that small incremental changes to the power system have not altered the coordination of the Protection Systems.
  - The Fault current-based option requires an entity to first establish a Fault current baseline for Protection Systems at the bus under study.
    - Maximum Fault current deviation of 15 percent (as compared to the entity-established baseline)
    - Maximum time interval of six calendar years for the Fault current analysis to be performed
      - These maximum limits provide an entity with latitude to choose a Fault current threshold and time interval that best matches its protection philosophy, Protection System maintenance schedule, or other business considerations.

PRC-027-1, Requirement R1, Part 1.3 Example

- **Example of Fault current option**
  - A baseline is established at 10,000 amps. During the first short-circuit review, it is discovered that Fault current has increased to 11,250 amps (12.5 % change); consequently, no Protection System settings review is required since the increase is below 15% and the baseline value for next review remains at 10,000 amps. However, during the next short-circuit review, the Fault current has increased to 11,500 (15% change); therefore, a review of the Protection System settings is required, and a new baseline of 11,500 amps would be established.

PRC-027-1, Requirement R1, Part 1.3 (cont'd)

- **Rationale for Part 1.3 (Periodic review of Protection System settings)**
  - As a second option, an entity may choose to establish a periodic review of its existing Protection System settings. The maximum time interval for the review is six calendar years. The drafting team assigned a six calendar year time interval because that corresponds to the maximum allowable maintenance period established for certain relays in PRC-005-2; consequently, this allows Protection System settings revisions to be included with associated maintenance.
- **Rationale for Part 1.3 (Option three)**
  - As a third option, an entity may choose to apply a combination of the two review methodologies based on criteria such as voltage level or Protection System application.

PRC-027-1, Requirement R1, Part 1.3 (cont'd)

- **Rationale for Part 1.3 (Footnote)**
  - Based on the Protection System design and/or susceptibility to changes in Fault current, applicable Owners will designate what Protection Systems must be included in the review(s) to ensure these Protection Systems continue to operate in the intended sequence during Faults.
    - » A current differential scheme may not need to be included because changes in Fault current will not affect the coordination of this system. However, an instantaneous overcurrent element would need to be reviewed because changes in Fault current may cause this element to operate for Faults outside its zone of protection.

PRC-027-1, Requirement R1, Part 1.4

The process shall include:

1.4. A quality review of the Protection System settings prior to implementation.

- **Rationale for Part 1.4**
  - A quality review of the Protection System settings minimizes the introduction of human error into the development of Protection System settings and helps to ensure the settings produced meet the entity's design specifications for Protection System performance.
  - Examples of quality reviews
    - » Peer reviews, automated checking programs, and entity-developed review procedures

PRC-027-1, Requirement R1, Part 1.5

The process shall include:

1.5. For new or revised Protection System settings applied on BES Elements that electrically join Facilities owned by separate functional entities, (Transmission Owners, Generator Owners, and Distribution Providers), procedures to:

1.5.1. Communicate the proposed Protection System settings with the other functional entities.

1.5.2. Review proposed Protection System settings provided by other functional entities, and respond regarding the proposed settings. The response should identify any coordination issue(s) or affirm that no coordination issue(s) were identified.

1.5.3. Verify that any identified coordination issue(s) associated with proposed Protection System settings for the associated Elements are addressed prior to implementation.

PRC-027-1, Requirement R1, Part 1.5 (cont'd)

- **Rationale for Part 1.5**
  - The coordination of Protection Systems associated with Facilities owned by separate functional entities is critical to the reliability of the BES.
  - Communications among these entities is essential so potential coordination issues can be identified and addressed prior to implementation of any proposed Protection System changes.

PRC-027-1, Measure M1

- **M1.** Acceptable evidence includes, but is not limited to, electronic or physical dated records to demonstrate that the responsible entity established a process to develop settings for its BES Protection Systems, in accordance with Requirement R1.

PRC-027-1, Requirement R2

- **R2.** Each Transmission Owner, Generator Owner, and Distribution Provider shall implement the process established in accordance with Requirement R1.
  - **Rationale for Requirement R2**
    - Implementing each of the elements of the process ensures a consistent approach to the development of accurate Protection System settings, minimizes the possibility of introducing errors, and maximizes the likelihood of maintaining a coordinated Protection System.

PRC-027-1, Measure M2

- **M2.** Acceptable evidence includes, but is not limited to, electronic or physical dated records to demonstrate that the responsible entity implemented the process established in accordance with Requirement R1.

Questions and Answers

Question and Answer Session

- Please submit your questions via the chat window
  - To help facilitate a productive webinar
    - Preface comments with “Comment:”
    - Preface questions with “Question:”
  - This session is intended to help general understanding
  - Please reference slide number, standard section, etc.
  - Presenters will respond to as many questions as possible
  - Some questions may require discussion by the full drafting team

Closing Remarks

Going Forward

- PRC-027-1 is posted for comment and additional ballot
  - April 1- May 15, 2015
  - Additional ballot: May 6-15, 2015
- Draft RSAW is posted for comment through May 15, 2015
- SDT Meeting to respond to comments
  - June 2-4, 2015
- Anticipated final ballot
  - June-July 2015
- Anticipated NERC BOT-adoption
  - August 2015

Conclusion

- NERC Standards Developer, Al McMeekin
  - Email at al.mcmeekin@nerc.net
  - Telephone: 404-446-9675
  - To receive **Project 2007-06** announcements and updates
    - Request to be added to email distribution list: **SPCSDT_Plus**
- Project 2007-06 System Protection Coordination website: Project 2007-06 System Protection Coordination
- Webinar slides and recording will be posted to www.nerc.com
  - Within three business days following webinar under “Standards” / “Webinars”
  - Link will be provided in the next “Standards Bulletin”
- Remember to join the new ballot pool in the new SBS
- Thank you for participating.

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Project 2007-06 Webinar has ended Thank you for participating

Email at al.mcmeekin@nerc.net
Telephone: 404-446-9675
*Request to be added to **SPCSDT_Plus***

RELIABILITY | ACCOUNTABILITY