NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

# Meeting Notes

## Project 2010-13.3 – Relay Loadability: Stable Power Swings Standard Drafting Team

March 10, 2014
1:00 p.m.-3:00 p.m. Eastern

Conference Call

### Administrative

**1. Introductions and chair remarks**

The meeting was brought to order by Bill Middaugh, chair, at 1:01 p.m. Eastern Monday, March 10, 2014. He thanked everyone for joining. Mr. Barfield took roll of members and observers. Those in attendance were:

| Name | Company | Member/ Observer |
|---|---|---|
| Bill Middaugh, P.E. | Tri-State Generation & Transmission Association, Inc. | Chair |
| Kevin W. Jones, P.E. | Xcel Energy, Inc. | Vice Chair |
| David Barber, P.E. | FirstEnergy | Member |
| Steven Black | Southern Company Services | Member |
| Ding Lin | Manitoba Hydro | Member |
| Slobodan Pajic | GE Energy Consulting | Member |
| John Schmall | Electric Reliability Council of Texas (ERCOT) | Member |
| Matthew H. Tackett, P.E. | Midcontinent Independent System Operator (MISO) | Member |
| Ken Hubona | Federal Energy Regulatory Commission (FERC) | Observer |
| Scott Barfield-McGinnis (Standard Developer) | North American Electric Reliability Corporation (NERC) | Observer |
| William Edwards (Counsel) | North American Electric Reliability Corporation | Observer |
| Michael Gildea (Reliability Standards Advisor) | North American Electric Reliability Corporation | Observer |
| David Youngblood | Consultant (Luminant Energy) | Observer |

2. **Determination of quorum**

   The rule for NERC Standard Drafting Team (SDT or team) states that a quorum requires two-thirds of the voting members of the SDT. Quorum was achieved as eight of the nine members were present.

3. **NERC Antitrust Compliance Guidelines and Public Announcements**

   NERC Antitrust Compliance Guidelines and public disclaimer were reviewed by Mr. Barfield. There were no questions. Mr. Barfield also referred everyone to the two NERC policies related to use of the email listserv and standard drafting team meeting conduct.

4. **Review team roster**

   Mr. Barfield noted that the roster is posted on the NERC project page is the initial roster approved by the Standards Committee. No changes have been made.

5. **Review meeting agenda and objectives**

   Mr. Barfield reviewed the meeting agenda and objectives.

## Agenda

1. **Previous business and action items**

   Mr. Middaugh asked Mr. Barfield revisit Needs, Goals, and Objectives (NGO) document and about any other previous business items. Mr. Barfield noted that the team needed to have Mr. Si Truc Phan join and discuss his comments from the previous week and to have team members to review TPL-001-4 regarding its connection with the team's work. Mr. Middaugh pointed out the team modified the SPCS Report[1] criteria found on page 23 and wondered if moving toward "Elements" over naming equipment such as transformers, lines, etc. is a concern. Also, what the last bullet in the SPCS Report means in terms of capturing other Facilities that need to be subject to power swings. Mr. Barfield agreed the team discussed those items previously in order to differentiate transmission and generation Facilities. The second concern was how to address the "catch all" (last bullet), what did it really mean, and how will it be measurable. Additionally noting the team concluded last week that the intent was not to have the planner do a specific task, but to know to add an Element to the list if a discovery was made. The performance to set a relay should be on the Generator Owner (GO) or Transmission Owner (TO) if an Element makes it on the list for a power swing. Mr. Middaugh recalled the same and asked if team members had any issues that needed to be raised.

2. **Continue with Standard Development**

   The team began to discuss the other NGO Objective items. Objective #1, "ensure relays don't trip on stable power swings." The team was satisfied with that objective with one question about the use of "ensure." Mr. Barfield noted that an alternative might be "reduce the likelihood" and added a note

[1] NERC System Protection and Control Subcommittee technical report, Protection System Response to Power Swings, August 2013. (http://www.nerc.com/comm/PC/System%20Protection%20and%20Control%20Subcommittee%20SPCS%2020/SPCS%20Power%20Swing%20Report_Final_20131015.pdf)

for future reference. Mr. Youngblood questioned if it is the GO/TO's responsibility to ensure that relays don't trip for a stable power swing. Mr. Barfield noted that the asset owner will need to know what Elements to apply settings. He also noted that Mr. Thakur from the last meeting said that the planners don't model all the relays, but protection engineers can ask for specific modeling to be done it there is a concern. Mr. Black asked according to the directives if tripping on a stable power swing is not allowed. Mr. Barfield noted that the team may have to make decisions with regard to dependability and security. Mr. Schmall seemed to think the approach will depend on whether the team looks at the standard from a planning horizon or an operating horizon. Mr. Tackett believed the standard would have to be more open to allow the entity to account for varying conditions. For example, to minimize tripping for stable power swing. He noted that depending on the requirements that the entity may be set up for failure because there are an infinite number of conditions that may occur. Mr. Black remained concerned that relays may need to operate for stable power swings. Mr. Middaugh noted that the Commission understood that multiple contingencies was an issue (i.e., category D, TPL-004). Mr. Barfield noted that it made more sense to use the planning horizon because of time involved with studies and implementing settings. He provided background on the PRC-025-1 team. For example, that standard used three approaches which included: (1) a simple calculation that results in the most conservative setting, (2) a more complex calculation which is less conservative, and (3) to perform modeling of the generator's output for the most refined setting. He noted that this approach allowed the entity to determine its risk tolerance and allowed flexibility.

Concerning Objective #2, Mr. Schmall believed the planner needs to "define" and "identify" the Elements and communicate it to the asset owner and encouraged this approach. The Elements need to be based on the worst credible contingency and not N-x (e.g., N-17). Mr. Barfield noted that Mr. Rodriquez noted during this last meeting that he had found in studies that when multiple contingencies resulted in varying swings and it was only when the simpler contingencies were evaluated that the planner was able to make a better determination of the power swing. Mr. Schmall agreed and Mr. Black noted that Mr. Rodriquez's observations would be in line with the Commission's point about the TPL standards Category B and C. The team concurred.

On Objective #3, Mr. Middaugh asked if this objective needed to note that relays must be set where stable power swings are expected, but allowed to trip for unstable power swings. Mr. Black thought the approach was good. He suggested removing the islanding reference and replacing it with tripping for faults and unstable power swings where necessary. Mr. Gildea noted that it seemed that the issue was the studied versus the unstudied condition. Mr. Black noted there are cases where the planners can "tweak" the models to create a situation by placing the fault where the stable power swing would be at a point where you would want to trip. He noted that the Order No. 733 directed that relays must differentiate between faults and stable power swings and that there may be cases where the planner would want to trip for a stable power swing. Mr. Black disagreed that there should be no reason to trip on a stable power swing because it defeats the purpose of prevent cascading. Further noting that newer technology provides the functionality to allow the setting of relays to distinguish between faults and stable power swings. Mr. Tackett theorized that the standard needed to address two points. First, cases where the entity can use existing schemes by setting the relay adequately to mitigate the relay from tripping for stable power swings and reliably protect equipment. Second, if this cannot be achieved to replace the relay scheme recognizing that replacing relays can be

expensive. Mr. Middaugh noted that the team will need to determine the phase-out of relays that cannot meet the requirements (and directive) at some point.

Mr. Gildea noted that it appears the team's concern is the "unknown" state in Objective #1 (NGO). Mr. Jones recommended removing the "unstudied contingences" case and use the information only in the studied case. The proposed text for #1:

> "Have asset owners set relays to allow Protection Systems to trip for faults and unstable power swings where necessary, as studied, which may include tripping for some stable power swings where studies indicate it is necessary."

Mr. Middaugh was concerned that removing the unstudied contingency may cause an operation for a stable power swing and place the entity in violation. Mr. Jones noted that is an uncertain area because the studied condition may not reflect the actual conditions, such as the power swing trajectory being slower or faster than the study. Mr. Barfield added that if the settings are based on the studied condition, the asset owners would not be in violation because they set the relay based on information at the time. Mr. Schmall added that this issue lends the requirements toward the planning horizons. Mr. Black agrees that compliance would be based on the information used and not actual event outcomes. Mr. Tackett and Mr. Schmall agreed. There was additional confusion over the use of "necessary." Mr. Tackett questioned if this addresses the security of not tripping during a stable power swing and the dependability of tripping for an unstable power swing. Mr. Ding asked if studies would reveal places where it is desirable to trip for a stable power swing. Mr. Black responded that his colleagues are not sure and did not want to preclude the case of tripping for a stable power swing. The team remains concerned that tripping may occur for stable power swings when ensuring the entity can trip for unstable swings. Mr. Barfield reminded the team that the directive is to require relays to differentiate between faults and stable power swings. Whatever the team decides, there must be a basis for each condition or criteria. Mr. Schmall agrees that the criteria must be defined. Entities should not be subject to compliance for unstudied conditions. Mr. Middaugh wondered how to say that tripping for unstable power swings must also be achieved. Mr. Barfield noted that PRC-023-2 and the adopted PRC-025-1 use the words "while maintaining reliable fault protection."

Mr. Black proposed language connecting the settings back to the studies. This would give the entity an out should they trip for an unstudied event. He was not sure about how to address the condition where an entity needs to trip for a stable power swing. Mr. Barfield questioned if that is something that should be included and perhaps beyond the directive. Mr. Tackett proposed using a footnote to caveats any cases where the planner needs to allow tripping for a stable power swing. This would give the asset owner to trip and not be in violation. Mr. Middaugh was concerned that if an entity trips for a stable power swing and does not have a study, then that could be a problem. Mr. Barfield did not think that would be a problem so long as the relay owner set relays according to the planner's study. He questioned how the TO/GOs would accept a requirement from the planner to set relays a certain way especially when they will not have control over protecting their Facilities. Mr. Ding agreed that the TO/GOs do not need be in a position to challenge the settings, but be able to make their own assessment of the necessary settings. Therefore, the settings should be based on the planner's assessment. Mr. Youngblood referenced the NERC adopted PRC-025-1 in that the standard's criteria included a margin to account for equipment differences and other variations. Mr.

Barfield agreed that both the planners and protection engineers must have a dialog to achieve the best results.

Mr. Barfield posed the question to the team concerning what information (Objective #4) do the TO/GOs need to accomplish the goal for setting relays for the identified Elements. Mr. Jones suggested that an R-X plot versus time and slip rates would be one set of information. Others agreed. Mr. Middaugh suggested that the asset owner needs to have studies that include impedance plots and slip rates. Several attendees agreed. Mr. Pajic noted that planners already communicate these things to the protection engineers. When there are problems, the planner must have a dialog and document its findings when performing studies. Mr. Tackett asked if the intent of the dialog between planners and protection engineers is to provide an exchange of information so the study is based on actual protective settings rather than generic impedance models. Additionally, the study would only be for the Elements identified in Requirement R1. Other team members expressed concurrence.

Mr. Barber asked if the plots would be steady state or in a spreadsheet versus time because it would not necessarily reveal the slip rate. Mr. Schmall noted that he could calculate settings based on the maximum slip for a given R-X plot. Mr. Black asked if this information was the same for all Regions. There was no certainty among team members about the common use of R-X and slip rates across Regions. Mr. Barfield noted that the objective could be to provide "information" and add the detailed information in the Measures. Mr. Middaugh agreed a more generic approach might be better. This applies to the #4 objective is for the GO/TO for setting relays according to the information.

The team moved on to objective #5 and Mr. Middaugh asked if it is still necessary given objective #3. Before deciding, Mr. Black gave an example of a generator tripping on relay margin depending on where the fault is. The generator tripped on a stable power swing. Mr. Schmall believed that was an extreme case and would not be relevant unless it was a specific worst case found by the planner. Otherwise, the relay would not have to be set for Mr. Black's case and what would be an unconceivable number of conditions. He further noted the inability to study all conditions was recognized by the Commission and that each entity would have to rely on the studied condition. Also, it points out that the team needs to be clear to what extent the planner needs to study power swings. Mr. Black want to be sure the current objective does not go beyond the intent of #3. Mr. Barfield recommended an approach to capture a "lesson learned." For example, a case where a study was done and settings were adjusted, but it was found later that the relay tripped on a stable power swing. When undesirable tripping on a stable power swing is revealed, the protection and planning engineers would review the specific case and make adjustments. It would not be a violation, but a refinement to a known condition.

Mr. Barfield asked if objective #6 was better suited for the Application Guidelines. It was from a comment in the Order No. 733 (Paragraph #139) by a stakeholder (TAPS) concerning the standard possibly defeating backup protection. He recommended a team member to review and provide guidance around the issue so that the comment is not raised again when posting the standard. Mr. Youngblood theorized the commenter had relays set beyond PRC-023-2 and that their concern was that this standard may go even further. Mr. Middaugh also thought the commenter has gone beyond studied contingencies. The team agreed that comments about vertical clearances (paragraph #140) are beyond the scope of this project. Mr. Tackett noted that the comments in paragraph 141 (Exelon) appeared to be centered on making changes (phasing out impedance relays) that may cause other

issues undesirable to reliability. Mr. Jones noted that an entity may have to supplement its protection rather than replace relays. Mr. Tackett noted that a good relay engineer would be looking at local and backup systems, etc. to determine the best action and that all impacted systems must be reviewed. Mr. Middaugh recommended discussing that reliable relay operations must be foremost in protecting the system. With regard to paragraph 142, the team saw the comment as too broad and agreed with the Commission's comments of considering "islanding strategies" as a criteria. The team added a note to the section that will serve as a start to the Application Guidelines. Mr. Barfield thought that NERC legal may need to review this paragraph because it was not identified as a directive in Phase II. He took an action item to look into the islanding strategies.

The team raised a previous discussion about the last criteria listed in the SPCS Report which the team changed to:

> "Additional Elements that are identified as tripping for power swings in Planning Assessments (e.g., TPL-001-4)."

The team agreed that it pertained to the condition where tripping would occur and not where all swings are observed. The tripping component gave a clear line to what Elements are in scope.

Mr. Schmall was concerned about the implementation of this project's standard relative to the future implementation of TPL-001-4 which will become effective January 1, 2015. Mr. Barfield noted that the team would need to consider how the new standard will coordinate with any items in the TPL-001-4 implementation. Mr. Tackett noted that would need to consider when planning cycles are established by the new standard. Mr. Barfield noted that having the team fully understand the TPL-001-4 implementation will help the team communicate this to industry and avoid confusion.

Before concluding, Mr. Barfield noted to the team to how the NGO lends itself to forming the Applicability and Requirements for a standard and encouraged team members to take an initiative to begin drafting requirements on their own prior to the next meeting.

**3. Review of the schedule**

Mr. Barfield reviewed the schedule emphasizing to team members to add a placeholder on their calendars for a 2nd or 3rd week of June in-person meeting to respond to comments from the 45-day ballot.

**4. Action items or assignments**

Team (All) –

- Take time to draft out requirements based on the Needs, Goals, and Objectives (NGO).
- Consider how to handle communication between planners and protection engineers. Does it need to be formalized?

Team (Planners) –

- Planning members to consider whether it matters which particular contingencies in the planning studies are used to assess power swings.

Mr. Barfield –

- Discuss the potentially missing directive with NERC Legal concerning "islanding strategies" in Order No. 733, Paragraph 162. Also check the Standards Authorization Request (SAR) for the directive.
- Reach out to Mr. Si Truc Phan for input regarding his comments distributed via email (See Attachment A below).

**5. Next steps**

Mr. Tatro had noted in an earlier meeting he wanted to refresh himself with TPL-001-4 and better understand how it will relate to this project.

**6. Future meeting(s)**

Conference call at 2:00 p.m. Eastern on Thursday, March 13, 2014.

**7. Adjourn**

The conference call adjourned at 3:17 p.m. ET on Monday, March 10, 2014.

**Attachment A (From Mr. Si Truc Phan, Hydro Québec)**

Following the last conference call, here is the Quebec Interconnection's position on the applicable functions:

- **Planning Coordinator**

Generally, PCs participate on different committees/working groups at the ERO level. They have to demonstrate the reliability of their BES network by performing Transmission Assessment Studies within their entities and also to their Regional Entity. As an example for NPCC: TFSS, TFSP, SS-37, SS-38.

PCs are responsible to coordinate the integration of all new facilities elements within its footprint.

- **Transmission Owner**

TOs are responsible of the relay settings and protections of their systems.

Also, TOs coordinate the settings with the GOs within their jurisdiction.

- **Generator Owner**

Upon PCs' request, GOs are responsible to provide their data to PCs in order to perform Power Swing Simulations (load flow and dynamic studies).

- **Neither DP nor RC perform any assessment of the Dynamic Studies, therefore we don't feel they should be included.**

We think that this standard should address only the operation of relays under stable power swings.

Because of its characteristics, the Quebec Interconnection (already islanded and predominantly hydraulic generation) has been considered as an islanded network.

Our philosophy is to maintain all available generations on-circuit during stable power swings.

For unstable power swings we use Special Protection Systems.

**NEEDS, GOAL, and OBJECTIVES**

**Needs**: Prevent relays from tripping during a stable power swing because it is perceived as a fault, thus unnecessarily removing facilities from service.

**Goals**: Prevent undesirable tripping of elements that are susceptible to stable power swings. (733, P153)

1. Develop acceptable criteria for identifying facilities that are susceptible/applicable to stable power swings.
2. Ensure relays that protect Elements that are susceptible to power swings don't operate during non-fault stable power swings. (e.g., Order states that all conditions cannot be covered)
3. Minimize the burden on planners and asset owners through effective use of resources by using existing studies and taking a focused approach to facilities at risk.
4. Aim for risk-based approach (rather than competency- or performance-based) See RBS concepts.
5. Avoid modifying other standards, unless absolutely necessary (time constraints and added complexity)
6. Avoid diminishing the ability of relays to trip reliably for faults, and for unstable power swings where islanding is necessary.
7. Consider the five bullets in the SPCS document discussing the limiting of the applicability to only those transmission lines (and generating stations) on which protective relays are most likely to be challenged during stable power swings.

   **Purpose**: (Should describe the need and the goal).

**Objectives**:

1. Have the PC/TP identify Facilities based on the SPCS report (5 bullets as modified below)
   - Elements terminating at a generating plant, where a generating plant stability constraint is addressed by an operating limit or Special Protection System (SPS) (including line-out conditions), including the generating unit(s) if an impedance-based protection scheme is used
   - Elements that are associated with a System Operating Limit (SOL) that has been established based on stability constraints identified in system planning or operating studies (including line-out conditions)
   - Elements that have tripped due to power swings during system disturbances
   - Elements that form a boundary of the Bulk Electric System that may form an island. (See NERC Reliability Standard PRC-006 – Automatic Underfrequency Load Shedding, Requirement R1)
   - Additional Elements that are identified as tripping for power swings in Planning Assessments (e.g., TPL-001-4)
2. Ensure relays protecting identified Facilities don't trip on stable power swings- RISK-BASED

3. Allow Protection Systems to trip for faults and unstable power swings where islanding is necessary.
4. PRC-023-3 focuses on steady state and PRC-026-1 will focus on stability.
5. Do not defeat other protection means, such as, those used for emergency protection of equipment (733, P139).
6. Do not allow modifications to accommodate non-fault related transient overloads might leave system elements exposed to excessive loading longer than is prudent (733, P140)
7. Make certain that any phasing out of relays do not leave the electric system without any reliable backup for transmission lines with failed communication or other equipment failures (733, P141).
8. Consider "islanding strategies" in conjunction with out-of-step blocking (or tripping) requirements (733, P142).
9. Consider SPCS's recommendations on Applicability and Requirements.
10. Do not address contingency conditions beyond Planning Assessments due to the inability to study all scenarios.