UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Protection System Maintenance Reliability Standard	**)** **)**	**Docket No. RM13-7-000**

COMMENTS OF THE NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION IN RESPONSE TO NOTICE OF PROPOSED RULEMAKING

The North American Electric Reliability Corporation ("NERC")[1] hereby provides comments in response to the Notice of Proposed Rulemaking ("NOPR")[2] regarding proposed Reliability Standard PRC-005-2 (Protection System Maintenance), issued by the Federal Energy Regulatory Commission ("FERC" or "Commission") in this proceeding on July 18, 2013. In the NOPR, the Commission proposes to approve proposed Reliability Standard PRC-005-2 to supersede four currently-effective Reliability Standards, PRC-005-1.1b (Transmission and Generation Protection System Maintenance and Testing), PRC-008-0 (Underfrequency Load Shedding Equipment Maintenance), PRC-011-0 (Undervoltage Load Shedding Equipment Maintenance) and PRC-017-0 (Special Protection System Maintenance and Testing). As discussed more fully below, the Commission seeks comment on three aspects of the proposed Reliability Standard and proposes to modify one Violation Severity Level ("VSL").

I. Notices and Communications

Notices and communications with respect to this filing may be addressed to the following:[3]

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[1] The Federal Energy Regulatory Commission certified NERC as the electric reliability organization ("ERO") in its order issued on July 20, 2006, in Docket No. RR06-1-000. *N. Am. Elec. Reliability Corp.*, 116 FERC ¶ 61,062 (2006).

[2] *Protection System Maintenance Reliability Standard*, NOPR, 144 FERC ¶ 61,055 (2013).

[3] Persons to be included on the Commission's service list are identified by an asterisk. NERC respectfully requests a waiver of Rule 203 of the Commission's regulations, 18 C.F.R. § 385.203 (2013), to allow the inclusion of more than two persons on the service list in this proceeding.

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II. Verification of Operability and Settings Upon Placement In-Service

In the NOPR, the Commission explains that the proposed PRC-005-2 Reliability Standard does not include a requirement to verify that protection system equipment and components operate at least as accurately as required under the PRC-005-2 maintenance standards when those components are first placed in service or are modified.[4] The Commission is concerned that a reliability gap may exist if entities are not required to demonstrate compliance with proposed PRC-005-2 when equipment or components are placed in service or modified.[5] In support of its position, the Commission cites Notice of Penalty filings in Docket Nos. NP11-105, NP11-129, and NP13-37 where protection systems were placed in service and misoperated, resulting in violations of Reliability Standard PRC-004.[6] The Commission states that in these cases, the failure to verify the accurate functioning of protection system components

[4] NOPR at P 26.
[5] *Id.*
[6] *Id.* at P 27.

when placed in service, or when subsequently modified, was identified as a direct cause of Misoperations.[7]

The Commission seeks comment from NERC regarding how it intends to interpret and enforce proposed PRC-005-2 to require that newly installed or modified protection system equipment or components perform at the same level as is required for subsequent compliance, including verification of applicable settings as specified whenever a relay is repaired, replaced, or upgraded with a new firmware version. Alternatively, the Commission asks whether the proposed Reliability Standard should be modified to address the Commission's concern.[8]

A. **PRC-005-2 and Commissioning Testing**

Proposed PRC-005-2 is not designed to establish requirements for commission testing and such testing would go beyond the maintenance activities identified in proposed PRC-005-2. The standard drafting team summarizes in its *Supplementary Reference and FAQ* document:

> While a thorough commission testing program would include, either directly or indirectly, the verification of all those Protection System attributes addressed by the maintenance activities specified in the Tables of PRC-005-2, *verification of the adequacy of initial installation necessitates the performance of testing and inspections that go well beyond these routine maintenance activities*. For example, commission testing might set baselines for future tests; perform acceptance tests and/or warranty tests; utilize testing methods that are not generally done routinely like staged-Fault-tests.[9]

Therefore, NERC cannot interpret and enforce proposed PRC-005-2 to require that newly installed or modified protection system equipment or components perform at the same level as is required for subsequent compliance. However, the date of completion of the commission testing

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7 *Id.*

8 *Id.*

9 *Supplementary Reference and FAQ*, Ex. E at 35 (emphasis added).

of the Protection System component and its placement into service can be used by an entity as the starting point in determining its first maintenance due dates.[10]

B. Current NERC Actions Related to Commissioning Testing

NERC has already undertaken action to research whether a Reliability Standard governing commissioning testing programs should be developed and NERC is currently working to address improvements in commissioning testing practices. NERC requests that the Commission not issue a directive in its Final Rule to modify the proposed Reliability Standard to address commissioning testing until NERC can complete the on-going work described below and determine whether the actions have been sufficient to address commissioning testing. NERC commits to keep the Commission informed on the progress of its ongoing efforts to reduce protection system Misoperations through improved commissioning testing practices. NERC provides a summary below of its efforts to date.

On July 13, 2011, NERC's Event Analysis and Investigations Group submitted a Reliability Standard Suggestions Form[11] to initiate a new standard development project to create a standard to address the testing of protection system equipment before that equipment is placed into initial service.[12] NERC's Event Analysis and Investigations Group provided an example of an event where an entity did not perform in-service testing as part of commissioning a new protection system, resulting in line relays placed in service with the incorrect current transformer ratio. The defect remained undetected until the occurrence of a severe system disturbance when the relaying operated incorrectly, increasing the magnitude and scope of the disturbance.

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[10] *Id.* at 35-36.

[11] Reliability Standard Suggestions Forms are submitted to suggest topics for the Reliability Standards Development Plan.

[12] A copy of the Reliability Standard Suggestions Form is available in the materials posted for the March 6-7, 2012 NERC Planning Committee meeting. *See* Planning Committee Agenda, *available at* http://www.nerc.com/comm/PC/Agendas%20Highlights%20and%20Minutes%20DL/2012/1_March_2012_PC_Agenda_Finalv.pdf.

The NERC Standards Committee identified the Reliability Standard suggestion as a possible new development project, but determined additional research was needed prior to initiating the project. On December 27, 2011, the Standards Committee issued a request for research asking for concurrence that a problem exists and requesting suggestions for addressing the issue. The Standards Committee requested that the Planning Committee research the issue.[13] The Planning Committee assigned the System Protection and Control Subcommittee[14] ("SPCS") responsibility for conducting the analysis. The *SPCS Response to Standards Committee Request for Research* ("SPCS Report")[15] was approved by the NERC Planning Committee on March 5, 2013.[16] A copy of the Reliability Standard Suggestions Form, Request for Research and the SPCS Report are included in **Exhibit A** for ease of reference.

In the SPCS Report, the SPCS recommends actions to reduce protection system Misoperations through improved commissioning practices. The report recommends, as an alternative to a standard, a series of reactive and proactive activities related to analysis of Misoperations, sharing of lessons learned, and development of an industry reference document on protection system commissioning practices. The SPCS explained that inadequate or improper testing of protection systems during any time in the life cycle of a protection system may lead to a future Misoperation. However, the SPCS noted that it considers Misoperations due to

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[13] A copy of the request for research is available in the materials posted for the March 6-7, 2012 NERC Planning Committee meeting. *See* Planning Committee Agenda, *available at* http://www.nerc.com/comm/PC/Agendas%20Highlights%20and%20Minutes%20DL/2012/1_March_2012_PC_Agenda_Finalv.pdf.

[14] The SPCS provides subject matter expertise related to protection systems and control. The purpose of the SPCS is purpose of the SPCS is to promote the reliable and efficient operation of the North American power system through technical excellence in protection system and control system design, coordination, and practices A roster of current SPCS members is available at http://www.nerc.com/comm/PC/System%20Protection%20and%20Control%20Subcommittee%20SPCS%20DL/Roster_Updated-08-17-10.pdf.

[15] *SPCS Response to Standards Committee Request for Research* (Mar. 5, 2013), *available at* http://www.nerc.com/docs/pc/spctf/SPCS%20Commissioning%20Testing%20Response_Final.pdf.

[16] See NERC Planning Committee Meeting Minutes, *available at* http://www.nerc.com/comm/PC/Pages/AgendasHighlightsandMinutes-.aspx.

commissioning testing errors to be a relatively small subset of Misoperations overall, and often discovered upon initial energization. The SPCS also explained that the event cited in the Reliability Standard Suggestion Form is not typical because commissioning testing that includes in-service tests to verify current and potential circuits are properly connected is a common practice throughout the industry.

The SPCS Report notes that most entities have effective commissioning processes currently in place and that these processes are unlikely to be improved by a new reliability standard. The SPCS explains that a broad reliability standard with broad requirements to create and implement commissioning testing practices would introduce additional documentation burden without providing real guidance to entities for improving their processes. Conversely, a standard with detailed requirements prescribing how to commission protection systems would undermine the various methods that entities have developed specific to their circumstances and could have an unintended, negative impact on reliability.

Rather than developing a new reliability standard, the SPCS suggested improving commissioning practices through (1) analysis of protection system Misoperations; (2) sharing of lessons learned; and (3) development of an industry reference document on protection system commissioning practices. On the first two suggested methods of improvement, analysis of Misoperations is an ongoing obligation pursuant to the PRC-004 Reliability Standard. SPCS is working on a lesson learned document related directly to the issue involved in the initial request for research. With regard to the third item, SPCS recommended that the Institute of Electrical and Electronics Engineers ("IEEE") Power System Relaying Committee ("PSRC") create such a document and proposed to submit a formal request upon approval of the report. The Chair of the

SPCS issued this request to the IEEE Power System Relaying Committee on September 5, 2013.[17]

In May of 2013, the ITF25 task force reviewed the SPCS Report.[18] The task force determined that IEEE Guide C37.233 *Guide for Power System Protection Testing* should be reviewed prior to the next meeting since this guide has a section on commissioning.[19] It was also suggested that the group review proposed Reliability Standard PRC-005-2 before the next meeting. Several members volunteered to contribute outlines of commissioning practices at their companies and present for discussion at the group's next meeting in September of 2013.

A member of NERC staff and the SPCS vice chair attended the ITF25 task force meeting on September 11, 2013 and engaged the group in discussion. At the meeting, the task force agreed that PSRC should form a working group to develop a report to the Relaying Practices Subcommittee. The task force concluded that IEEE Guide C37.233, developed in 2009, addresses all aspects of testing (commissioning, acceptance testing, periodic maintenance) at a high level. The task force recommended development of a report that expands specifically on protection system commissioning.

The task force developed a scope of work and purpose statement for the proposed working group. The working group report is intended to provide guidance in the commissioning of power system protection systems. The report will cover overall system testing procedures for generators, line, line reactors, transformers, capacitors, and special protection schemes. This report is intended for power system protection professionals. It will include a reference list of

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[17] A copy of the letter request is included as **Exhibit B**.

[18] *See* Power System Relaying Committee of the IEEE Power and Energy Society – Minutes of the Meeting, May 16, 2013, *available at* http://www.pes-psrc.org/minutes/Baltimore%202013-%20%20Main%20Comm%20Minutes%20Draft-2.pdf.

[19] IEEE Guide for Power System Protection Testing, *IEEE Std C37.233-2009* , Dec. 11, 2009, *available at* http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5352213&isnumber=5352212 (sign in or purchase required for access).

type tests for protective devices as well as overall protection scheme performance tests applicable for commissioning testing for the various types of protection schemes.
The Relay Practices Subcommittee approved formation of the working group at its meeting on September 12, 2013. NERC staff will remain engaged with the working group to follow-up on the SPCS Report recommendations.

C. Scope of the Proposed Commission Directive

If the Commission determines it is necessary to issue a directive in its Final Rule, NERC requests that the Commission limit its directive to identifying the specific problem to be addressed so that NERC has a meaningful opportunity to propose an alternative to meet a directive. In the NOPR, the Commission notes that it requests comment on whether the Commission should direct NERC to modify proposed PRC-005-2 to require verification that newly-commissioned or modified equipment and components meet the same requirements specified for subsequent maintenance and testing in the proposed Reliability Standard. This proposed directive is narrowly tailored to a specific modification of proposed PRC-005-2. It is not clear from the Commission's NOPR discussion whether requiring newly-commissioned or modified equipment and components to meet the same requirements specified for subsequent maintenance and testing in proposed PRC-005-2 would resolve the Commission's underlying concern to address Misoperations that occur prior to a first scheduled maintenance such as occurred in the Notices of Penalty the Commission cites in P 27 of the NOPR.

III. Four Percent Target for Countable Events in Performance-Based Program

In the NOPR, the Commission describes how Requirement R2 of proposed Reliability Standard PRC-005-2 provides responsible entities with the choice to "establish performance-based maintenance intervals for individual component types, according to the procedures set out

in Attachment A of the standard."[20] Per Attachment A, the entity will develop a list of components and will then set a maximum allowable interval for each segment, such that "countable events will occur on no more than four percent of the components within a segment."[21] A maintenance history for the segment will also be reviewed and an inability to meet the four percent target will result in the entity developing and implementing an action plan to meet the target within a three year period. NERC provided an explanation in its technical justification document for selecting a four percent target as follows:

> The 4% number was developed using the following:
> General experience of the drafting team based on open discussions of past performance.
>
> Test results provided by Consumers Energy for the years 1998-2008 showing a yearly average of 7.5% out-of-tolerance relay test results and a yearly average of 1.5% defective rate.
>
> Two failure analysis reports from Tennessee Valley Authority (TVA) where TVA identified problematic equipment based on a noticeably higher failure of a certain relay type (failure rate of 2.5%) and voltage transformer type (failure rate of 3.6%).[22]

The Commission states that NERC does not provide any further details about the scope and specific results of the referenced studies, or a clear explanation of how the four percent figure was derived from these studies. The Commission also notes that the referenced studies appear to focus on out-of-tolerance rates for electro-mechanical protective relays, and NERC provided little to no support for application of those expected rates to other types of components. The Commission also explains that it is not clear whether the four percent rate is appropriate for

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20 NOPR at P 29.

21 *Id.*

22 *See* NERC Petition, Ex. D, *Technical Justification: PRC-005-2 Protection System Maintenance* at 5.

component types known to have higher levels of reliability such as microprocessor-based relays, trip coils, and lockout devices.[23]

The Commission seeks comment from NERC and other interested parties that provides further information and technical support for whether failure rates should be established for each component type rather than relying upon a blanket rate for all component types. If a blanket failure rate is to be established, the Commission asks whether the use of a blanket four percent failure rate for all component types is better-suited for setting appropriate performance-based maintenance intervals.

Alternatively, if the technical information to address the Commission's concern is not currently available and cannot be provided, the Commission proposes to direct that NERC study and submit a report and recommendations based on the study results concerning the expected failure rates for individual component types.[24]

NERC supports the inclusion of the four percent performance target as designed by the standard drafting team. A key objective of the drafting team was to enable the use of a performance based maintenance program on the smallest statistically valid populations of devices for which annual review of Countable Event and Misoperation experience will reveal the acceptability of the maintenance interval. Performance based maintenance is thus accessible to smaller organizations and can be used on generally reliable devices that an entity or group of entities own in only moderate numbers. The acceptable failure rate needs to balance between a goal of ultimate reliability and what could be reasonably expected of a well-performing component population. NERC provides the following additional explanation to support the designed four percent performance target.

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[23] NOPR at P 33.

[24] *Id.* at P 34.

A. Additional Explanation of Basis for Four Percent Performance Target

The 4% performance target was derived as a protection system performance target and was selected based on the drafting team's experience and past studies performed by several utilities. The statistics referenced in the Technical Justification document for selecting a four percent target are intended to corroborate the statistical basis developed by the standard drafting team. Section 9 of the *Supplementary Reference and FAQ – PRC-005-2 Protection System Maintenance* explains the statistical analysis and extracts recommendations on which the four percent threshold is based.

B. Relationship of Component Types and Performance Based Maintenance Failure Rate Threshold

NERC highlights a key feature of the performance based maintenance program as defined in Attachment A. In Attachment A, the entity initially demonstrates the potential for maintenance interval extension by using maintenance data from a time-based maintenance program found in Table 1 for each applicable component type. The minimum maintenance activities are specified for that specific component type, and these minimum requirements cannot be modified even if the entity has documented low Countable Events. The maximum maintenance interval is also specified in the relevant part of Table 1, and the specified intervals vary significantly with component type. The time intervals in Table 1 were developed from industry experience with each component, to achieve the necessary level of reliability throughout the complete protection system – in other words, to focus more maintenance attention on components that have a higher likelihood of showing a Countable Event test result.

Because variable performance expectations for different components are already reflected in the various Table 1 time intervals, it is appropriate to use a specified target percentage in a performance based maintenance program when applied to the results of time based maintenance

of various component types. Components with relatively high characteristic failure rates and shorter Table 1 intervals will achieve, at best, modest extensions of time intervals, unless dramatic advances in component reliability validate the use of significantly longer intervals. Also, components placed into a performance based maintenance program must meet the criteria for a performance based maintenance program identified in Attachment A. Attachment A also includes requirements to maintain the technical justification for the ongoing use of a performance-based maintenance program including a review process and mitigating actions for increasing failure rates.

Further, if a maintenance interval is lengthened as part of a performance based maintenance program, the number of allowable Countable Events will decrease. For example, assuming there are 1000 units in a segment with a testing interval of 8 years, the number of units tested each year will be 125 units. The total allowable Countable Events is 5 (125 x .04 = 5). This number includes failure of a Component requiring repair or replacement, corrective issues found during testing, and the total number of misoperations (attributable to hardware or calibration failure within the testing year) associated with the entire segment of 1000 units. If the testing interval is increased to 16 years, the number of units tested each year will be 63 units and the total allowable Countable Events for the entire segment of 1000 units is 2.5 (63 x .04 = 2.5). As shown in the example, doubling the testing interval reduces the number of allowable Countable Events by half.

NERC also notes that the four percent failure threshold has been included in the draft Reliability Standard since the first posting in 2009. It has not been a controversial issue during the standard development process, garnering only a few comments from industry. The four percent threshold was derived through statistical analysis, corroborated by practical experience

of from specific entities, evaluated by subject matter experts in their field based on their collective experience, and vetted with industry through multiple posted versions of the draft Reliability Standard. NERC supports the four percent threshold and asks the Commission to approve approach.

If the Commission determines that it needs additional support beyond the combination of the statistical analysis, practical corroborating experience from specific entities to confirm the accuracy of the statistical analysis, and the combined expertise of the drafting team in determining the four percent target rate, NERC is willing to provide additional support in lieu of a directive to modify the four percent target in order to confirm that the four percent rate is appropriate. NERC also requests that the Commission not assign a timeline for submission of the report and recommendations. NERC cannot provide an accurate assessment of the time it would take to collect the necessary information and process the results at this time. We also note that NERC continuously collects data on Misoperations. NERC will have the ability to track trends in Misoperations as industry gains practical experience with the performance based maintenance approach reflected in proposed PRC-005-2.

IV. Violation Severity Level for Requirement R1 – Station Batteries

In the NOPR, the Commission highlights that under Requirement R1, Part1.1, all batteries associated with station DC supply must be included in a time-based maintenance program. The Commission argues that the VSL assignment with respect to this element of Requirement R1 is both inconsistent with the binary nature of Part 1.1 of Requirement R1and inappropriate considering the number of historical violations associated with station battery maintenance.[25] The Commission cites NERC's explanation that Requirement R1 has an incremental aspect to the violation as "indicating that NERC believes the Commission's

[25] *Id.* at P 39.

violation severity guideline for binary requirements is not applicable."[26] In a footnote, the Commission states that "NERC's assignment appears to be inconsistent with its approach to the assignment of violation severity levels for binary requirements, as accepted by the Commission in 2011."[27] The Commission proposes to direct NERC to modify the violation severity level of this component to "severe."[28] The Commission's focus is on the emphasized language included below and found in the "lower" VSL for Requirement R1. The VSL reads:

> The responsible entity's PSMP failed to specify whether one Component Type is being addressed by time-based or performance-based maintenance, or a combination of both. (Part 1.1)
>
> OR
>
> *The responsible entity's PSMP failed to include applicable station batteries in a time based program (Part 1.1).*[29]

NERC disagrees with the Commission's conclusion that the VSL is properly set to "severe" and oppose the proposed directive related to the VSL for Requirement R1. As discussed below, the assignment of "lower" for Requirement R1 related to station batteries is appropriate given the expected performance of the Requirement. The purpose of Requirement R1 is to obligate the entity to establish a Protection System Maintenance Program for its Protection Systems. Parts 1.1 and 1.2 of the Requirement are not intended as separate subrequirements for compliance purposes, but are aspects of what should be reflected in the performance for Requirement R1 as a whole. The standard drafting team did distinguish station batteries within the body of Part 1.1 to clearly limit the program type to a Time-Based Maintenance program; however, it was not the intent of the standard drafting team to assign

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26 *Id.*

27 *Id.* at n. 53 (citing *N. Am. Elec. Reliability Corp.*, 135 FERC ¶ 61,166, at P 13 (2011)).

28 NOPR at P 39.

29 *See* Reliability Standard PRC-005-2 at 8. (emphasis added).

more importance to station batteries than any other Protection System component type as far as the initial establishment of the Protection System Maintenance Program. When measuring compliance for Requirement R1, it is appropriate to measure compliance based on the number of component types missed in the establishment of the Protection System Maintenance Program with a gradated level of non-compliance based on the number of component types missed. The "moderate" and "severe" VSLs reflect the incremental worsening of the non-compliance as an entity misses additional component types. Not performing the maintenance itself is addressed in the VSLs associated with Requirements R3 and R4. The standard drafting team included the emphasized phrase above solely to reflect the fact that there is only one type of maintenance program permitted for station batteries. The VSL was assigned based on the main Requirement. Because the components contribute to the reliability objective of the main Requirement, no violation severity levels will be assigned separately to the parts.[30] In lieu of a directive, NERC suggests deleting the emphasized phrase above as the compliance element is covered adequately by the remaining language in the "lower" VSL and this deletion would align the language with the remaining VSLs for Requirement R1.

NERC also disagrees with the Commission's statements that NERC's VSL assignment is inconsistent with NERC's approach to the assignment of VSLs for binary requirements. NERC did not intend to apply the approach for assigning VSLs for binary requirements, which the standard drafting team highlights in its justification document by marking the corresponding guideline for binary requirements as "N/A." Further, NERC's assignment is consistent with Commission guidance on "binary" VSLs in its past order approving NERC's approach to

[30] *See N. Am. Elec. Reliability Corp.*, 135 FERC ¶ 61,166, at P 14 (2011) (approving NERC's VSL approach, which provides that NERC will always assign a set of violation severity levels to the main requirement, and where the components contribute to the reliability objective of the main requirement, no violation severity levels will be assigned to the component.)

assigning VSLs.[31] In the order, the Commission explains that it does not agree with all instances in which NERC designates a requirement as "binary." For example, the Commission cites Reliability Standard BAL-005-0, which requires that an applicable entity include all tie line flows in a calculation. In lieu of a "binary" approach in the VSL, the Commission concludes that "it is more appropriate to employ a gradation approach to determine levels of non-compliance with Violation Severity Levels based on a percentage of the total tie line flows that were not included in the calculation."[32] The Commission also states that "as a general rule, gradated Violation Severity Levels, wherever possible, would be preferable to binary Violation Severity Levels since the application of any penalty for a violation could be more consistently and fairly applied commensurate with the degree of the violation."[33] Here, the standard drafting team used a total number of missed component types in lieu of a percentage, but the same concept applies to Requirement R1. The purpose of Requirement R1 is a complete initial establishment of a Protection System Maintenance Program and the VSLs are appropriately designed to define the degree to which compliance with the Requirement was not achieved.

V. Conclusion

For the reasons set forth above, NERC respectfully requests that the Commission accept these comments for consideration.

Respectfully submitted,

/s/ William H. Edwards

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31 See North American Electric Reliability Corporation, 135 FERC ¶ 61,166, at P 26 (2011).

32 *N. Am. Elec. Reliability Corp.*, 123 FERC P 61,284, at P 26 (2008).

33 *Id.* at P 27.

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Counsel for the North American Electric Reliability Corporation

Date: September 23, 2013

CERTIFICATE OF SERVICE

I hereby certify that I have served a copy of the foregoing document upon all parties listed on the official service list compiled by the Secretary in this proceeding.

Dated at Washington, D.C. this 23rd day of September, 2013.

/s/ William H. Edwards

William H. Edwards

Counsel for North American Electric Reliability Corporation

Exhibit A

Reliability Standard Suggestions Form, Request for Research and SPCS Report

Request for Research

Project 2012-04
Protection System Commissioning Testing

Introduction

NERC's Standards Committee has tentatively identified this project for initiation in mid-2012. Prior to then, there is a need for additional research and scoping of the project to determine:

- What is the problem that this project will try to solve?
- Is the development of a standard the appropriate manner to solve that problem, or should alternative approaches be used?
- If a standard is appropriate, what is the recommended solution to the problem?

Results based standards projects use the approach of defining the needs, goals, and objectives for the project. For this project, we would like your assistance in this effort. Below is a draft problem statement for your consideration.

Need (Problem)

Protection Systems can be set up to misoperate if not adequately tested during commissioning.

Does the need above correctly document the concern described in the attached suggestion (received during the development of the 2012-2014 RSDP)?

Do you agree that this is a problem that needs to be addressed?

Is a standard the appropriate vehicle to address this problem, or should an alternative approach be used? If an alternative, is recommended, what would that alternative be?

If development of a standard is appropriate, then please consider the following Goal and associated Objectives.

Goal (Solution)

Require the creation and implementation of commissioning testing practices.

Objectives (Actions necessary to achieve the goal)

Require all applicable entities to have documented commission testing practices, which meet a certain minimum criteria

Require all entities to implement their commissioning testing practices prior to putting any protection system into service

Request
Please provide the Standards Committee with the following information:

- An updated Need/Problem (or a statement of concurrence with the draft presented here)
- A statement indicating whether or not you believe this problem is one which needs to be addressed
- If you agree the problem needs to be addressed, a suggestion for how to address the problem
- If you suggest a standard be developed to address the problem, then please provide
    - An updated goal (or a statement of concurrence with the draft presented here)
    - An updated set of objectives in support of that goal (or a statement of concurrence with the draft presented here)
    - If you have specific recommendations for requirements language or additional information, please include them

Thank you in advance for your assistance.

Reliability Standards Suggestions

NERC welcomes suggestions to improve the reliability of the bulk power system through improved reliability standards and improvements to the standard development process. Please use this form to submit your suggestions related to NERC's Reliability Standards, Reliability Standards Development Plan (RSDP), or standard processes in general. NERC will consider all input received for future development projects, revisions of the RSDP, or wherever else appropriate.

Please return all completed forms via email to andy.rodriquez@nerc.net with the words "Standards Suggestions" in the subject line.

Submitter Information	Suggestion...	
Individual, Group, or Committee Name:	☐	**...for consideration by a drafting team assigned to an active project**
Company or Group Name: NERC, Event Analysis and Investigations Grp	☒	**...for consideration in a future project already identified in the RSDP**
Email: dennis.field@nerc.net	☐	**...to create a new project for inclusion in the RSDP**
Telephone: 609-651-9066	☐	**...to modify the Standard Development Process**
Date Submitted: 7-13-2011	☐	**...related to another issue or topic**

Suggestion Detail

Notes:

1. Please be as specific as possible.
2. Where applicable, please identify the specific element(s) of the standard (e.g. Requirement R1.2, Section D1.1, Measure M1, etc.) to which the suggestion pertains.
3. Where practical, please provide an example to clearly identify the issue.
4. Please provide an idea for improvement, including suggested alternative language where possible.

Standard or Project Number (if applicable):

Standard or Project Title (if applicable): Protection System Commissioning Testing

Other Identifying Information (e.g., step in the standard process):

Problem or Concern: Improper or inadequate commissioning testing practices are a common cause of protection system misoperations. These undesirable outcomes have an immediate negative impact on the reliability of the bulk power system; however, no reliability standard exists to prevent them.

The current set of approved NERC reliability standards do not include commissioning testing, the testing of protection system equipment before that equipment is placed into initial service. When an event occurs which was caused or exacerbated by improper or inadequate protection system commissioning practices, no reliability standard can be applied to the situation to formally identify this faulty practice and ensure that the entity puts plans and procedures in place to prevent a future event of a similar nature. The existing PRC family of reliability standards does not require registered entities to have a commissioning testing program in place nor to provide evidence that the equipment has been properly tested prior to initial service.

The language of the existing standard PRC-005-1 and the upcoming PRC-005-2 do not

require entities to have a commissioning testing program or that they peform commissioning testing before placing new or modified equipment in service. Instead, the intended purpose of PRC-005 is for equipment that is already in service. This standard only requires that entities must have a protection system maintenance and testing program, established testing intervals and basis, and be able to provide evidence of the date and results of the last test.

Creating a commissioning standard would also enhance the effectiveness of the mandatory auditing program. The PRC-005 standard pertains only to the ongoing periodic maintenance and testing of protection system equipment. When auditing PRC-005 for newer protection system equipment that has not yet reached the due date of its first test, auditors are often unsure of what evidence to request and how to evaluate that evidence. In this situation, auditors could rely on requirements of the commissioning standard to gather evidence and evaluate compliance.

No reliability standard is presently in place to address the testing procedures that entities must have in place or practices they must employ with respect to new equipment.

Example: An entity failed to employ proper commissioning testing practices during the installation of a new transformer. As a result, associated line relays were placed in service with the incorrect CT ratio. The defect remained undetected until the occurrence of a severe system disturbance when the relaying operated incorrectly, greatly increasing the magnitude and scope of the disturbance.

Suggestion: Initiate a Standard Drafting Project

Intended Outcome (e.g., describe how the suggestion would improve reliability, make the standard clearer for auditors, etc.): This standard will bridge a gap that exists between the initial installation of protection system equipment and its subsequent periodic testing covered by the existing PRC-005 Reliability Standard. Creation of this standrad will provide much needed oversight for registered entities responsible for placing new or revised protection system equipment in service on the BPS, ensuring that these entities have established programs and practices for the initial testing of that equipment.

Additional Information:

Thank you for taking the time to submit your suggestion for improving the reliability of the bulk power system through improved reliability standards and standard processes!

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

SPCS Response to Standards Committee Request for Research

Project 2012-04
Protection System Commissioning Testing
March 5, 2013

Background

The NERC Standards Committee requested the NERC Planning Committee to provide research to support the Standard Development Process on the subject of "Protection System Commissioning Testing." The Planning Committee assigned the NERC System Protection and Control Subcommittee (SPCS) responsibility for responding to this request. Specifically, the Standards Committee provided a draft need (problem) statement, goal (solution), and objectives (actions necessary to achieve the goal) and asked for the following information:

- "An updated Need/Problem Statement (or a statement of concurrence with the draft presented here)
- A statement indicating whether or not you believe this problem is one which needs to be addressed
- If you agree the problem needs to be addressed, a suggestion for how to address the problem
- If you suggest a standard be developed to address the problem, then please provide
  - An updated goal (or a statement of concurrence with the draft presented here)
  - An updated set of objectives in support of that goal (or a statement of concurrence with the draft presented here)
  - If you have specific recommendations for requirements language or additional information, please include them"

The Standards Committee request stems from a Reliability Standard Suggestions Form submitted in response to an event where an entity did not perform in-service testing as part of commissioning a new protection system. Specifically, the NERC suggestion paper states:

> "An entity failed to employ proper commissioning testing practices during the installation of a new transformer. As a result, associated line relays were placed in service with the incorrect CT ratio. The defect remained undetected until the occurrence of a severe system disturbance when the relaying operated incorrectly, greatly increasing the magnitude and scope of the disturbance."

The request for research proposed the following need statement.

> **Need (Problem)**
> Protection Systems can be set up to misoperate if not adequately tested during commissioning.

The request for research also proposed the following goal and objectives for consideration if development of a standard is appropriate.

> **Goal (Solution)**
> Require the creation and implementation of commissioning testing practices.
>
> **Objectives (Actions necessary to achieve the goal)**
> Require all applicable entities to have documented commission testing practices, which meet a certain minimum criteria
>
> Require all entities to implement their commissioning testing practices prior to putting any protection system into service

The SPCS has assessed the request from the Standards Committee and provides below its responses to the specific questions asked, recommendations to address this issue, and supporting information.

Need (Problem) Statement

The SPCS agrees with the problem statement. It is clear that "Protection Systems can be set up to misoperate if not adequately tested during commissioning." Inadequate or improper testing of protection systems during any time in the life cycle of a protection system may lead to a future misoperation.

The SPCS considers misoperations due to commissioning testing errors to be a relatively small subset of misoperations overall, and believes they are often, but not always, discovered upon initial energization. Further, it is the consensus of the SPCS that the event cited is not typical because commissioning testing that includes in-service tests to verify current and potential circuits are properly connected is a common practice throughout the industry. Regardless, the SPCS believes that addressing this problem could be beneficial for some entities.

Goal (Solution) Statement

The SPCS believes that establishing a goal to "Require the creation and implementation of commissioning testing practices" will increase burden on entities without a commensurate reliability benefit. The SPCS believes a more beneficial goal would be to "Improve existing commissioning practices through (i) analysis of protection system misoperations, (ii) sharing of lessons learned, and (iii) development of an industry reference document on protection system commissioning practices."

Most Entities have effective commissioning processes currently in place, so the occurrence of these types of events is limited. Entities have developed commissioning processes from years of experience with their own particular variations in construction and protection practices. These processes are unlikely to be improved by a new reliability standard; only burdened by it. A reliability standard with broad requirements (e.g., entities must create and implement commissioning testing practices) would introduce additional documentation burden without providing real guidance to entities for improving their processes. Conversely, a standard with detailed requirements prescribing how to commission protection systems would undermine the various methods that entities have developed specific to their circumstances and could have an unintended, negative impact on reliability.

The existence of industry-wide commissioning processes is acknowledged in Compliance Application Notice (CAN) – 0043 which states "CEAs are to use commissioning test records to verify compliance with PRC-005 R2. These records establish an origin for testing and maintenance intervals (R2.1), as well as the date each Protection System device was last tested and maintained (R2.2)."

Objectives (Actions necessary to achieve the goal)

The SPCS believes a combination of reactive and proactive actions will assist entities in improving their existing commissioning practices and will alert entities regarding emerging issues related to new protection system equipment.

Analysis of Protection System Misoperations

One of the objectives of PRC-004 is to identify and address common causes of misoperations. Weak commissioning methods are a subset of these. The PRC-004 corrective action plan process has proven to cause entities to change their practices to avoid future misoperations. The presently effective version, PRC-004-2a, requires entities to "develop and implement a Corrective Action Plan to avoid future Misoperations of a similar nature."[1] When misoperations are identified related to weak commissioning practices, revising commissioning practices is an effective method of preventing similar reoccurrences. Carrying out the requirements of PRC-004 as one action to address this need is particularly effective and fair in that it targets entities with weak commissioning practices, without increasing requirements for those who already have effective commissioning practices. The NERC events analysis process also targets and effects positive change in an entity in a similar manner for misoperation-related events with a larger scope. Although both of these approaches are effective and necessary, they are also reactive in that they require an event to occur and be analyzed prior to effecting change.

Sharing of Lessons Learned

A proactive approach would also be beneficial for those entities with inadequate commissioning practices. The complexities involved in creating a new standard to address commissioning testing would necessitate an effort likely to span many years. The SPCS believes this effort would ultimately

[1] This intent is carried forward with similar language in the present draft of PRC-004-3.

result in very little change in practices for most entities other than the added burden of documenting commissioning testing actions above what is already required for compliance with PRC-005. The SPCS believes that a more balanced and expedient approach to convey best practices and emerging issues in commissioning testing is via the issuance of NERC Lessons Learned documents. Lessons Learned documents are distributed throughout the industry. Entities generally have a process to review and incorporate the recommendations in NERC Lessons Learned documents where they apply to their existing practices. Using Lessons Learned as a proactive approach to monitoring and improving commissioning testing practices will not drain resources from entities that already have strong commissioning testing practices in place.

The SPCS recommends:

- The SPCS should draft a Lessons Learned document related to the proper verification of AC quantities as part of protection system commissioning.
- NERC should continue to use the Lessons Learned process to provide feedback so that industry is alerted of issues identified by entities through analysis of protection system misoperations and the event analysis process.

Development of an Industry Reference Document on Protection System Commissioning Practices

In addition, the SPCS believes that it would be beneficial to have a document on commissioning testing and that the IEEE Power System Relaying Committee (PSRC) is the appropriate body to create such a document. SPCS is prepared to submit a formal request to PSRC upon approval of this report.

This technical document was approved by the NERC Planning Committee on March 5, 2013.

Exhibit B

Letter Request for IEEE Power System Relay Committee Assistance

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

September 5, 2013

Roger A. Hedding
Chairman, IEEE Power System Relaying Committee
ABB Inc.
PSAC/ Substation Automation Products
598 N. Buth Road
Dousman, WI, 53118

Request for IEEE Power System Relay Committee Assistance

Mr. Hedding:

The NERC System Protection and Control Subcommittee (SPCS) were asked to provide input to the NERC Standards Committee regarding the subject of protection system commissioning. In its report[1] approved by the NERC Planning Committee, the SPCS recommended that as an alternative to a Reliability Standard, NERC and the industry should improve existing commissioning practices through (i) analysis of protection system misoperations, (ii) sharing of lessons learned, and (iii) development of an industry reference document on protection system commissioning practices. With regard to the third item, SPCS recommended that the IEEE Power System Relaying Committee (PSRC) would be the appropriate body to create such a document and proposed to submit a formal request upon approval of the report.

We understand that based on informal discussions between SPCS members and the PSRC leadership that PSRC has formed a task force, ITF25 – Commissioning of Substation Protection and Control Schemes, under its Relaying Practices Subcommittee, and that the task force had its initial meeting at the May 2013 PSRC meeting in Baltimore. We appreciate the prompt response and willingness of PSRC to engage in this task, and submit this formal request and offer of assistance. The SPCS vice chair, Phil Winston, and NERC coordinator, Phil Tatro, will attend the ITF25 meeting in September and answer any questions the task force may have regarding this request.

[1] SPCS Response to Standards Committee Request for Research: Project 2012-04, Protection System Commissioning Testing, March 5, 2013. Available at http://www.nerc.com/docs/pc/spctf/SPCS%20Commissioning%20Testing%20Response_Final.pdf.

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If you have any questions or require additional information, please feel free to contact me by email at williamj.miller@comed.com or by phone at (630) 576-6916. You also may contact the NERC coordinator for the SPCS, Phil Tatro, by email at phil.tatro@nerc.net or by phone at (404) 446-9645.

Thank you for your consideration,

Bill Miller

Bill Miller
Chairman, NERC System Protection and Control Subcommittee

cc: Rafael Garcia, ITF25 chair
System Protection and Control Subcommittee