NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

December 14, 2018

VIA ELECTRONIC FILING

Rachelle Verret Morphy
Saskatchewan Electric Reliability Authority
2025 Victoria Avenue
Regina, Saskatchewan, Canada S4P 0S1

Re: *North American Electric Reliability Corporation*

Dear Ms. Morphy:

The North American Electric Reliability Corporation ("NERC") hereby submits Notice of Filing of the North American Electric Reliability Corporation of Proposed Reliability Standard TPL-001-5.

Please contact the undersigned if you have any questions concerning this filing.

Respectfully submitted,

/s/ Shamai Elstein

Shamai Elstein
Senior Counsel for the North American Electric Reliability Corporation

Enclosure

3353 Peachtree Road NE
Suite 600, North Tower
Atlanta, GA 30326
404-446-2560 | www.nerc.com

BEFORE THE
CROWN INVESTMENT CORPORATION
OF THE PROVINCE OF SASKATCHEWAN

NORTH AMERICAN ELECTRIC	**)**
RELIABILITY CORPORATION	**)**

NOTICE OF FILING OF THE NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION OF PROPOSED RELIABILITY STANDARD TPL-001-5

Lauren A. Perotti
Counsel
North American Electric Reliability Corporation
1325 G Street, N.W., Suite 600
Washington, D.C. 20005
(202) 400-3000
(202) 644-8099– facsimile
lauren.perotti@nerc.net

Counsel for the North American Electric Reliability Corporation

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TABLE OF CONTENTS

BEFORE THE
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NORTH AMERICAN ELECTRIC	**)**
RELIABILITY CORPORATION	**)**

NOTICE OF FILING OF THE NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION OF PROPOSED RELIABILITY STANDARD TPL-001-5

The North American Electric Reliability Corporation ("NERC") hereby submits proposed Reliability Standard TPL-001-5 – Transmission System Planning Performance Requirements. As discussed more fully herein, proposed Reliability Standard TPL-001-5 improves upon currently effective Reliability Standard TPL-001-4 by providing for more comprehensive and robust planning studies, thereby improving reliability. Further, the proposed standard addresses certain Federal Energy Regulatory Commission ("FERC") directives from its Order No. 786 approving TPL-001-4.[1] The proposed standard is just, reasonable, not unduly discriminatory or preferential, and in the public interest. NERC also provides notice of: (i) the associated Implementation Plan (**Exhibit B**); (ii) the associated Violation Risk Factors ("VRFs") and Violation Severity Levels ("VSLs"), which remain unchanged from TPL-001-4 (**Exhibit D**); and (iii) the retirement of currently effective Reliability Standard TPL-001-4.

This filing presents the technical basis and purpose of the proposed Reliability Standard, a demonstration that the proposed Reliability Standard meets the Reliability Standards criteria

[1] *Transmission Planning Reliability Standards*, Order No. 786, 145 FERC ¶ 61,051 (2013).

(**Exhibit C**), and a summary of the standard development history (**Exhibit G**). The proposed Reliability Standard was adopted by the NERC Board of Trustees on November 7, 2018.

This filing is organized as follows: Section I of the filing presents a summary of the proposed Reliability Standard. Section II of the filing provides the individuals to whom notices and communications related to the filing should be provided. Section III provides information on the development of the proposed Reliability Standard through Project 2015-10 – Single Points of Failure TPL-001 and the FERC orders and NERC activities that informed its development. Section IV of the filing provides a detailed discussion of the proposed Reliability Standard and explains how the proposed standard enhances reliability by providing for more comprehensive consideration of Protection System[2] single points of failure, known outages, and the unavailability of long lead-time equipment in planning studies. Section V of the filing provides a summary of the proposed implementation plan.

I. SUMMARY

The TPL-001 Reliability Standard is one of two Transmission Planning Reliability Standards that set forth Requirements for Planning Authorities and Transmission Planners to develop studies of their portions of the Bulk Electric System ("BES"). The purpose of proposed Reliability Standard TPL-001-5 is to "[e]stablish Transmission system planning performance requirements within the planning horizon to develop a [BES] that will operate reliably over a broad spectrum of System conditions and following a wide range of probable Contingencies." The proposed standard would require each Planning Authority and Transmission Planner to

[2] Unless otherwise indicated, capitalized terms shall have the meaning set forth in the *Glossary of Terms used in NERC Reliability Standards* ("NERC Glossary"), https://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf.

perform an annual Planning Assessment[3] of its portion of the BES covering a number of System conditions and Contingencies described in the standard.

The proposed standard employs a risk-based approach to the study of Contingencies and the types of corrective action that are required if the entity's System cannot meet the standard's performance requirements. This risk-based approach is carried forward from currently effective Reliability Standard TPL-001-4. For the scenarios considered to be more commonplace ("planning events"), the planning entity must develop a Corrective Action Plan if it determines, through its studies, that its System would experience performance issues. For the scenarios considered to be less commonplace but which could result in potentially severe impacts such as Cascading ("extreme events"), the planning entity must conduct a comprehensive analysis to understand both the potential impacts on its system and the types of actions that could reduce or mitigate those impacts.

As discussed more fully in Section V, proposed Reliability Standard TPL-001-5 improves upon the currently effective standard by enhancing Requirements for the study of Protection System single points of failure. In this context, a Protection System "single point of failure" refers to a non-redundant component of a Protection System that, if it failed, would affect Normal Clearing[4] of faults. NERC identified this issue as a reliability risk to be addressed based on its analysis of potential single points of failure on the BES using data obtained pursuant to a request for data under Section 1600 of the NERC Rules of Procedure. The proposed standard contains revisions to both the Table 1 planning event (Category P5) and extreme events (Stability 2.a-h) and the associated footnote 13 to provide for more comprehensive study of the potential

[3] "Planning Assessment" is defined in the NERC Glossary as a "documented evaluation of future Transmission System performance and Corrective Action Plans to remedy identified deficiencies."

[4] "Normal Clearing" is defined in the NERC Glossary as "a protection system operates as designed and the fault is cleared in the time normally expected with proper functioning of the installed protection systems."

impacts of Protection System single points of failure. Planning entities would be required to take action, consistent with currently effective TPL-001 Requirements, to address System performance issues identified as a result of these studies.

Additionally, the proposed standard addresses two FERC directives from Order No. 786.[5] First, the proposed standard provides for a more complete consideration of factors for selecting which known outages will be included in Near-Term Transmission Planning Horizon studies. The modifications reflected in proposed TPL-001-5 address FERC's concern that the exclusion of known outages of less than six months in TPL-001-4 could result in outages of significant facilities not being studied.[6] Second, the proposed standard modifies Requirements for Stability analysis to require an entity to assess the impact of the possible unavailability of long lead time equipment, consistent with the entity's spare equipment strategy.[7]

Collectively, these revisions would help improve the quality and rigor of Planning Assessments, thereby contributing to a more reliable Bulk-Power System ("BPS"). The proposed standard also contains an update and a limited number of editorial revisions which improve the readability and organization of the standard.

As discussed more fully in Section V, NERC's proposed phased implementation plan strikes an appropriate balance between implementing the standard in a reasonably expeditious manner and allowing entities sufficient time to come into compliance. The proposed implementation plan recognizes the significant coordination and work that would need to be done to identify, study, and address potential Protection System single points of failure issues. Under the proposed plan, the proposed standard would become effective 36 months after

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5 *See* Order No. 786 at PP 40, 89.

6 *See id.* at PP 41-45.

7 *See id.* at P 89 (directing NERC to consider such a revision upon the next review cycle of TPL-001-4).

regulatory approval, with additional time afforded to entities to come into compliance with provisions related to Protection System single point of failure analysis and related Corrective Action Plans.

II. NOTICES AND COMMUNICATIONS

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

Shamai Elstein
Senior Counsel
Lauren A. Perotti
Counsel
North American Electric Reliability Corporation
1325 G Street, N.W., Suite 600
Washington, D.C. 20005
(202) 400-3000
(202) 644-8099– facsimile
shamai.elstein@nerc.net
lauren.perotti@nerc.net

Howard Gugel
Senior Director of Engineering and Standards
North American Electric Reliability Corporation
3353 Peachtree Road, N.E.
Suite 600, North Tower
Atlanta, GA 30326
(404) 446-2560
(404) 446-2595 – facsimile
howard.gugel@nerc.net

III. BACKGROUND

A. NERC Reliability Standards Development Procedure

The proposed Reliability Standard was developed in an open and fair manner and in accordance with the Reliability Standard development process. NERC develops Reliability Standards in accordance with Section 300 (Reliability Standards Development) of its Rules of Procedure and the NERC Standard Processes Manual.[8]

NERC's rules provide for reasonable notice and opportunity for public comment, due process, openness, and a balance of interests in developing Reliability Standards, and thus satisfy certain of the criteria for approving Reliability Standards. The development process is open to

[8] The NERC Rules of Procedure are available at http://www.nerc.com/AboutNERC/Pages/Rules-of-Procedure.aspx. The NERC Standard Processes Manual is available at http://www.nerc.com/comm/SC/Documents/Appendix_3A_StandardsProcessesManual.pdf.

any person or entity with a legitimate interest in the reliability of the BPS. NERC considers the comments of all stakeholders. Stakeholders must approve, and the NERC Board of Trustees must adopt, a Reliability Standard before NERC submits the Reliability Standard to the applicable governmental authorities.

B. 2009 NERC Advisory, FERC Order No. 754, and NERC Activities to Study Single Points of Failure on Protection Systems

On March 30, 2009, NERC issued an advisory report notifying the industry that failure of a single component of a Protection System caused three significant system disturbances in the previous five years.[9] Transmission Owners, Generation Owners, and Distribution Providers owning Protection Systems installed on the BES were advised to address single points of failure on their Protection Systems, when identified in routine system evaluations, to prevent N-1 transmission system contingencies from evolving into more severe or even extreme events. These entities were also advised to begin preparing an estimate of the resource commitment required to review, re-engineer, and develop a workable outage and construction schedule to address single points of failure.

On September 15, 2011, FERC issued Order No. 754 approving an interpretation of TPL-002-0 Requirement R1.3.10.[10] In this Order, FERC stated that it believed there is "an issue concerning the study of the non-operation of non-redundant primary protection systems; e.g., the study of a single point of failure on protection systems."[11] To address this concern, FERC directed "Commission staff to meet with NERC and its appropriate subject matter experts to

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[9] NERC, Industry Advisory, *Protection System Single Point of Failure* (Mar. 20, 2009), https://www.nerc.com/fileUploads/File/Events%20Analysis/A-2009-03-30-01.pdf.

[10] *Interpretation of Transmission Planning Reliability Standard*, Order No. 754, 136 FERC ¶ 61,186 (2011). Reliability Standard TPL-002-0 was a predecessor to the currently-effective TPL-001-4 standard.

[11] *Id.* at P 19.

explore the reliability concern, including where it can best be addressed, and identify any additional actions necessary to address the matter."[12] FERC also directed NERC to "to make an informational filing…explaining whether there is a further system protection issue that needs to be addressed and, if so, what forum and process should be used to address that issue and what priority it should be accorded relative to other reliability initiatives planned by NERC."[13]

In March 2012, NERC submitted an informational filing to FERC summarizing the results of its early work to study the issue.[14] As described more fully in that filing, NERC staff, FERC technical staff, and industry stakeholders attended a technical conference on October 24–25, 2011, the purpose of which was to focus on FERC's concern regarding assessment of Protection System failures. One outcome of the 2011 technical conference was that NERC would conduct a data collection effort to aid in assessing whether single points of failure in protection systems pose a reliability concern. To that end, the NERC Board of Trustees approved a request for data under Section 1600 of the NERC Rules of Procedure (the "Order No. 754 Data Request") on August 16, 2012.[15]

Over the next two years, NERC collected data from Transmission Planners. Using the collected data, two subcommittees of the NERC Planning Committee, the System Protection and Control Subcommittee ("SPCS") and the System Analysis and Modeling Subcommittee ("SAMS"), conducted an assessment of Protection System single points of failure. The findings

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12 *Id.* at P 20.

13 *Id*.

14 *Informational Filing of the North American Electric Reliability Corporation in Response to Order No. 754*, Docket No. RM10-6-000 (Mar. 15, 2012).

15 Request for Data or Information: Order No. 754 Single Point of Failure on Protection Systems (Aug. 16, 2012), http://www.nerc.com/pa/Stand/Pages/order_754.aspx. The process governing Requests for Data or Information is contained in Section 1600 of the NERC Rules of Procedure, http://www.nerc.com/AboutNERC/Pages/Rules-of-Procedure.aspx.

were presented in a September 2015 report titled *Order No. 754: Assessment of Protection System Single Points of Failure Based on the Section 1600 Data Request*.[16] In the report, the SPCS and SAMS found that single points of failure on Protection Systems did pose a reliability risk that warranted further action. The report concluded:

> Analysis of the data demonstrates the existence of a reliability risk associated with single points of failure in protection systems that warrants further action. The analysis shows that the risk from single point of failure is not an endemic problem and instances of single point of failure exposure are lower on higher voltage systems. However, the risk is sufficient to warrant further action. Risk-based assessment should be used to identify protection systems of concern (i.e., locations on the BES where there is a susceptibility to cascading if a protection system single point of failure exists). Not all failures adversely affect reliable operation of the bulk power system. The reliability risk varies based on which component of a protection system fails.[17]

The SPCS and the SAMS recommended, after considering a variety of alternatives to address this reliability concern, that NERC modify Reliability Standard TPL-001-4 through the NERC standards development process. The SPCS and the SAMS concluded that this approach best aligns with FERC Order No. 754 directives and maximizes reliability of Protection System performance. The report recommended that three-phase faults involving Protection System failures be assessed as an extreme event in the TPL-001 standard, as follows:

> Additional emphasis in planning studies should be placed on assessment of three-phase faults involving protection system single points of failure. This concern (the study of protection system single points of failure) is appropriately addressed as an extreme event in

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[16] NERC SPCS/SAMS, *Order No. 754: Assessment of Protection System Single Points of Failure Based on the Section 1600 Data Request* (Sep. 2015) ("SPCS/SAMS Report"), https://www.nerc.com/comm/PC/System%20Protection%20and%20Control%20Subcommittee%20SPCS%2020/FERC%20Order%20754%20Final%20Report%20-%20SPCS-SAMS.pdf.

NERC submitted this report to FERC on an informational basis on October 30, 2015 in Docket No. RM10-6-000. *See Informational Filing of NERC, Assessment of Protection System Single Points of Failure*, Docket No. RM10-6-000 (Oct. 30, 2015).

[17] SPCS/SAMS Report at 11.

> TPL-001-4 Part 4.5. From TPL-001-4, Part 4.5: If the analysis concludes there is cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences and adverse impacts of the event(s) shall be conducted.[18]

Following the issuance of this report, NERC initiated a standards development project to consider the specific recommendations from this report. Later, NERC expanded the scope of the project to address two FERC directives from Order No. 786 approving TPL-001-4, as discussed further below.

C. Order No. 786 Approving TPL-001-4

In Order No. 786, FERC approved the currently effective version of the transmission system planning standard, TPL-001-4.[19] In that Order, FERC also issued several directives to NERC, including two relating to future standard modifications that are addressed in proposed Reliability Standard TPL-001-5.

First, FERC expressed concern that the six month outage duration threshold in TPL-001-4 Requirement R1 could exclude planned maintenance outages of significant facilities from future planning assessments. FERC found that "planned maintenance outages of less than six months in duration may result in relevant impacts during one or both of the seasonal off-peak periods," and that "[p]rudent transmission planning should consider maintenance outages at those load levels when planned outages are performed to allow for a single element to be taken out of service for maintenance without compromising the ability of the system to meet demand without loss of load."[20] FERC further stated, "[a] properly planned transmission system should ensure the known, planned removal of facilities (i.e., generation, transmission or protection

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[18] *Id. at* 11; *see also id*. at 9 (discussion of alternatives to address reliability risks).

[19] Proposed Reliability Standard TPL-001-4 had been filed with this authority on March 19, 2013.

[20] Order No. 786 at P 41.

system facilities) for maintenance purposes without the loss of non-consequential load or detrimental impacts to system reliability such as cascading, voltage instability or uncontrolled islanding."[21] FERC directed NERC to modify the TPL-001 standard to address this concern.

Second, while stating that NERC had met FERC's Order No. 693 directive to include a spare equipment strategy for steady state analysis in TPL-001-4, FERC found that a spare equipment strategy for stability analysis was not addressed in the standard.[22] FERC stated that it "believes that a similar spare equipment strategy for stability analysis should exist that requires studies to be performed for P0, P1 and P2 categories with the conditions that the system is expected to experience during the possible unavailability of the long lead time equipment."[23] Rather than direct a change at that time, however, FERC directed NERC to consider the issue during the next review cycle of TPL-001-4.[24]

D. Project 2015-10 Single Points of Failure TPL-001

In October 2015, NERC initiated Project 2015-10 Single Points of Failure TPL-001 to address the Protection System single points of failure recommendations from the SPCS/SAMS report. Subsequently, the scope of the project was expanded to add consideration of FERC's Order No. 786 directives and an update to a MOD standard reference in the TPL-001 standard. In developing the proposed standard, the standard drafting team considered the discussion and recommendations of the SPCS/SAMS report on Protection System single points of failure. The

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21 *Id.*

22 Order No. 786 at P 88. In Order No. 693, FERC directed NERC to modify TPL-001-0 "to require assessments of outages of critical long lead time equipment, consistent with the entity's spare equipment strategy." *See Mandatory Reliability Standards for the Bulk-Power System*, Order No. 693 at P 1768, FERC Stats. & Regs. ¶ 31,242 (2007) (Order No. 693), *order on reh'g*, Order No. 693-A, 120 FERC ¶ 61,053 (2007). This led to the development of TPL-001-4 Requirement R2, Part 2.1.5 addressing steady-state conditions to determine system response when critical equipment is unavailable for a prolonged period of time.

23 Order No. 786 at P 89.

24 *Id.*

standard drafting team also considered additional recommendations developed by the SAMS to address the two Order No. 786 directives,[25] feedback received throughout the standard development process, and its own experience and expertise in the subject matter area.[26]

The proposed standard and implementation plan were posted once for informal comment and three times for formal comment and ballot. The fifth draft of proposed Reliability Standard TPL-001-5 and the associated implementation plan were approved by the ballot body on October 22, 2018. The proposed standard received a 66.69 percent approval rating, with 86.39 percent quorum. The proposed implementation plan received a 72.44 percent approval rating, with 86.73 percent quorum. The NERC Board of Trustees adopted the proposed standard on November 7, 2018. A summary of the development history and the complete record of development is attached to this filing as Exhibit G.

IV. JUSTIFICATION

As discussed in Exhibit C and below, proposed Reliability Standard TPL-001-5 satisfies the Reliability Standards criteria and is just, reasonable, not unduly discriminatory or preferential, and in the public interest. The purpose of the proposed standard is to "[e]stablish Transmission system planning performance requirements within the planning horizon to develop a Bulk Electric System (BES) that will operate reliability over a broad spectrum of System conditions and following a wide range of probable Contingencies." As with the purpose statement, the applicability of the proposed standard (Planning Coordinators and Transmission Planners) remains unchanged from the currently effective standard.

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[25] NERC SAMS, *FERC Order 786 Directives* (2016), https://www.nerc.com/comm/PC/System%20Analysis%20and%20Modeling%20Subcommittee%20SAMS%20201/FERC%20Order%20786%20Directives%20-%20SAMS%20White%20Paper%20-%202016-07-22.pdf.

[26] The standard drafting team roster for Project 2015-10 Single Points of Failure TPL-001 is attached to this filing as Exhibit **H**.

Proposed Reliability Standard TPL-001-5 improves upon the currently effective version of the standard by revising the existing Table 1 planning and extreme events to require a more complete, risk-based analysis of how the failure of a non-redundant component of a Protection System would affect a planning entity's System. The proposed standard also improves upon the currently effective standard and addresses FERC's standard modification directives from Order No. 786 by: (i) requiring a more comprehensive analysis of known outages in planning studies; and (ii) requiring entities to consider, in Stability analysis, the impacts of the possible unavailability of long lead time equipment, consistent with the entity's spare equipment strategy. Lastly, the proposed standard contains an update to a MOD standard reference and editorial revisions to improve organization.

The proposed standard revisions and the justification for each is provided below. The proposed revisions are shown in the TPL-001-5 redline attached to this filing as Exhibit A.

A. Revisions to Address Studies of Single Points of Failure on Protection Systems

Proposed Reliability Standard TPL-001-5 contains a series of revisions to help ensure that planning entities are: (1) performing a more complete analysis of potential Protection System single point of failure issues on their Systems; and (2) taking appropriate action to address these concerns. The SPCS/SAMS report concluded that "the data demonstrates the existence of a reliability risk associated with single points of failure in protection systems that warrants further action" and that "risk-based assessment should be used to identify protection systems of concern (i.e., locations on the BES where there is a susceptibility to cascading if a

protection system single point of failure exists)."[27] To address this concern, proposed Reliability Standard TPL-001-5 revises:

- the Table 1, Category P5 planning event, which would require the planning entity to study the impact on its System of Delayed Fault Clearing[28] due to the failure of a non-redundant component of a Protection System protecting the Faulted element to operate as designed;

- the Table 1, Stability Extreme Events 2.a-2.h, which would require the planning entity to study the impact on its System of a three-phase fault with failure of a non-redundant component of a Protection System resulting in Delayed Fault Clearing; and

- Table 1, footnote 13, which specifies the Protection System equipment to be considered as part of studying the Category P5 planning event and Stability Extreme Events 2.e-2.h.

Collectively, the proposed revisions help ensure that planning entities are performing a risk-based assessment of the potential impacts of Protection System single points of failure that could pose a risk to reliability. Each of these revisions in the proposed standard is discussed below, beginning with the revisions to Table 1, footnote 13 which specify the non-redundant Protection System components to be considered as part of planning studies.

1. Revisions to Table 1, Footnote 13

Proposed Reliability Standard TPL-001-5 employs a risk-based approach to the study of Protection System single points of failure. Accordingly, proposed Table 1, footnote 13 is intended to focus the planning entity's consideration on those non-redundant components of a

[27] SPCS/SAMS Report at 11.

[28] "Delayed Fault Clearing" is defined in the NERC Glossary as "Fault clearing consistent with correct operation of a breaker failure protection system and its associated breakers, or of a backup protection system with an intentional time delay."

Protection System that may, when they fail, lead to Delayed Fault Clearing when simulating the Category P5 planning event and Stability extreme events 2.e-h.

In proposed Reliability Standard TPL-001-5, the limited set of relay functions or types in Table 1, Footnote 13 is replaced with an expanded list of components to capture the Protection System single point of failure concern. Guided by the SPCS/SAMS report recommendations, the TPL-001-5 standard drafting team selected a list of components to account for: (1) those failed non-redundant components of a Protection System that may impact one or more Protection Systems; (2) the duration that faults remain energized until Delayed Fault Clearing; and (3) the additional system equipment removed from service following fault clearing depending on the specific failed non-redundant component of a Protection System.[29]

Footnote 13 is revised to list four specific types of non-redundant Protection System components, as follows:

~~13. Applies to the following relay functions or types: pilot (#85), distance (#21), differential (#87), current (#50, 51, and 67), voltage (#27 & 59), directional (#32, & 67), and tripping (#86, & 94).~~

13. For purposes of this standard, non-redundant components of a Protection System to consider are as follows:

    a. A single protective relay which responds to electrical quantities, without an alternative (which may or may not respond to electrical quantities) that provides comparable Normal Clearing times;

    b. A single communications system associated with protective functions, necessary for correct operation of a communication-aided protection scheme required for Normal Clearing (an exception is a single communications system that is both monitored and reported at a Control Center);

    c. A single station dc supply associated with protective functions required for Normal Clearing (an exception

[29] See Technical Rationale at 4-5. Additional information regarding the selection of each particular component is available in the Technical Rationale on pages 5-10.

is a single station dc supply that is both monitored and reported at a Control Center for both low voltage and open circuit);

d. A single control circuitry (including auxiliary relays and lockout relays) associated with protective functions, from the dc supply through and including the trip coil(s) of the circuit breakers or other interrupting devices, required for Normal Clearing (the trip coil may be excluded if it is both monitored and reported at a Control Center).

The revised Footnote 13 does not include all Protection System components in the list of potential non-redundant components to consider. The SPCS/SAMS report described failure of voltage or current sensing devices as having a lower level of risk of failure to trip.[30] The reliability risk associated with the failure of these components is lower than the risk posed by the failure of a Protection System component that is needed to clear a fault. Therefore, voltage or current sensing devices are not included in the revised footnote 13. Similarly, control circuitry whose failure does not prevent Normal Clearing of a fault, such as reclosing circuitry and reclosing relays, is not considered under the revised footnote 13.[31]

An explanation for each of the types of devices to be included in Protection System single point of failure studies under revised footnote 13a.-d is provided below.

a) Footnote 13.a – Protective Relays

Footnote 13.a includes among the components to consider "a single protective relay which responds to electrical quantities, without an alternative (which may or may not respond to electrical quantities) that provides comparable Normal Clearing times." Other Requirements address simulation of Protection System action.[32] Footnote 13.a therefore limits the potential

30 *See* Technical Rationale at 5; *see also* SPCS/SAMS Report at 7.

31 *See* Technical Rationale at 5.

32 *See* TPL-001-5 Requirement R3 Part 3.3.1 and Requirement R4 Part 4.3.1.

single points of failure to study to those single protective relays which respond to electrical quantities and are used for primary protection resulting in Normal Clearing. A single point of failure in such a relay may result in the primary Protection System failing to operate properly, leading to Delayed Fault Clearing performed by backup protective relays and/or overlapping zonal protection.[33] For footnote 13.a, an "alternative that provides comparable Normal Clearing times" refers to a relay that results in fault clearing within the expected Normal Clearing time period and isolates the fault by tripping similar System Elements than if the single protective relay that is simulated to fail were to function properly. By noting that the alternative may or may not respond to electrical quantities, Footnote 13.a accounts for those Protection System designs in which non-redundant single protective relays which respond to electrical quantities may be redundant to protective relays that do not respond to electrical quantities.[34]

b) Footnote 13.b – Communications Systems

Footnote 13.b includes among the Protection System components to consider a "a single communications system associated with protective functions, necessary for correct operation of a communication-aided protection scheme required for Normal Clearing (an exception is a single communications system that is both monitored and reported at a Control Center)." Given the increasing importance of communication-aided Protection Systems, the proper operation of the communication system must be considered when considering potential Protection System components to study for single points of failure concerns. A communication-aided Protection System that may experience a single point of failure, causing it to operate improperly or not at all, must be considered among non-redundant components.

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[33] Footnote 13.a does not include backup protective relays given that a single point of failure in a single protective relay used for backup protection will not affect primary protection resulting in Normal Clearing.

[34] For an example of such a design, see the Technical Rationale at 5-7.

Footnote 13 provides that certain non-redundant components that are both monitored and reported at a Control Center would not need to be considered as part of planning studies. This includes the communications systems identified in footnote 13.b. The standard drafting team considered that the monitoring and reporting of a non-redundant component to a centralized location (i.e., the Control Center) would facilitate prompt identification and correction of abnormal conditions to minimize the exposure to and consequence of the failed component. Therefore, it concluded that such monitored and reported components exhibited a lower risk, on par with being redundant, than a non-redundant component that reported to a remote location or one whose failure might go undetected for some time.[35]

c) Footnote 13.c – Station DC Supply

Footnote 13.c includes among the Protection System components to consider "a single station dc supply associated with protective functions required for Normal Clearing (an exception is a single station dc supply that is both monitored and reported at a Control Center for both low voltage and open circuit)." Failure of a single station Protection System DC supply is a significant point of failure as it will prevent the operation of all local protection, including back-up protection. Similar to footnote 13.b, monitoring and reporting the status of the DC supply to a centralized location can be considered a sufficient alternative to physical redundancy if the result is prompt notification and remediation which minimizes the exposure to and consequence of DC supply failure.

d) Footnote 13.d – Control Circuitry

Lastly, footnote 13.d would require consideration of "a single control circuitry (including auxiliary relays and lockout relays) associated with protective functions, from the dc supply

[35] Technical Rationale at 5.

through and including the trip coil(s) of the circuit breakers or other interrupting devices, required for Normal Clearing (the trip coil may be excluded if it is both monitored and reported at a Control Center)." Failure of a Protection System single control circuitry is a significant point of failure as it will prevent proper tripping and, depending upon its design and mode of failure, may also prevent the initiation of breaker failure protection.[36] Further, most, if not all, constituent parts of the control circuitry are generally unmonitored, may fail, and may remain undetected until periodic testing is conducted. This is particularly significant for non-redundant auxiliary relays or lockout relays within the control circuitry because they may be used for multiple functions, such as multiplexing trip signals for differential or breaker failure initiation. Single control circuitry should be considered a non-redundant component of a Protection System given that Delayed Fault Clearing, including significantly delayed remote end or backup clearing, is expected when the non-redundant auxiliary or lockout relay device within the single control circuitry fails.

The single control circuitry is demarcated from the DC supply through and including the trip coil(s) for the purpose of including all devices in the control circuitry which, if failed, may prevent proper Protection System action leading to Delayed Fault Clearing. Trip coils are commonly employed in pairs for the purpose of incorporating redundancy to actuate the tripping of a circuit breaker or other interrupting device. When a single trip coil is employed, monitoring and reporting the status of the single trip coil to the Control Center can be considered as a sufficient alternative to its physical redundancy given that prompt notification and remediation is expected, which minimizes the risk the trip coil failure. However, all constituent parts of the

[36] Breaker failure is addressed by the Table 1, Category P4 planning event.

single control circuit (including wires) should be included when considering whether the single control circuit may be a non-redundant component of a Protection System.

2. Revisions to the Table 1, Category P5 Planning Event

The Category P5 event in Table 1 of proposed Reliability Standard TPL-001-5 would require the planning entity to simulate a Contingency where a single line-to-ground fault occurs and Delayed Fault Clearing results due to the failure of a non-redundant component of a Protection System protecting the Faulted element to operate as designed. Stated differently, the Protection System does not operate as designed to clear the single line-to-ground fault in the time normally expected with proper functioning of the Protection System due to a single point of failure. When a Protection System does not operate as designed or fails to isolate faulted equipment within the time normally expected with its proper functioning, backup protection capabilities must act to clear the fault. Such backup systems are designed with intentional time delays before fault clearing. Additionally, the operation of these backup systems could result in significant differences in final System configuration. For example, more System Elements may be removed from service when the backup Protection System operates than may be expected during primary Protection System operation.

Revisions are proposed to the Category P5 event to be consistent with the revisions to footnote 13, replacing the word "relay" with the more inclusive phrase "component of a Protection System", as follows:

Category	Initial Condition	Event [1]	Fault Type [2]	BES Level [3]	Interruption of Firm Transmission Service Allowed [4]	Non-Consequential Load Loss Allowed
P5 Multiple Contingency *(Fault plus ~~relay~~non-redundant component of a Protection System failure to operate)*	Normal System	Delayed Fault Clearing due to the failure of a non-redundant ~~relay[12]~~component of a Protection System[13] protecting the Faulted element to operate as designed, for one of the following: 1. Generator 2. Transmission Circuit 3. Transformer[5] 4. Shunt Device[6] 5. Bus Section	SLG	EHV	No[9]	No
				HV	Yes	Yes

Consistent with currently effective Reliability Standard TPL-001-4, the entity would be required to develop a Corrective Action Plan in the event it determines that its System would be unable to meet the performance requirements of Table 1 for the Category P5 event. Corrective action requirements for the revised Protection System single point of failure studies are discussed in Section IV.A.4, below.

3. Revisions to Table 1, Extreme Events, Stability Column Events

Consistent with the recommendations of the SPCS/SAMS report, proposed Reliability Standard TPL-001-5 revises the Table 1 Extreme Events to place additional emphasis on assessment of three-phase faults involving single points of failure on a Protection System. In proposed Reliability Standard TPL-001-5, the extreme events in the Stability column of Table 1 is revised so that four distinct items, 2.e-2.h, would address study of Protection System single points of failure in combination with three-phase faults, as follows:

Table 1, Steady State & Stability Performance Extreme Events

Stability

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2. Local or wide area events affecting the Transmission System such as:

   a. 3Ø fault on generator with stuck breaker[10] ~~or a relay failure~~[13] resulting in Delayed Fault Clearing.

b. 3Ø fault on Transmission circuit with stuck breaker[10] ~~or a relay failure~~[13] resulting in Delayed Fault Clearing.

c. 3Ø fault on transformer with stuck breaker[10] ~~or a relay failure~~[13] resulting in Delayed Fault Clearing.

d. 3Ø fault on bus section with stuck breaker[10] ~~or a relay failure~~[13] resulting in Delayed Fault Clearing.

e. 3Ø fault on generator with failure of a non-redundant component of a Protection System[13] resulting in Delayed Fault Clearing.

f. 3Ø fault on Transmission circuit with failure of a non-redundant component of a Protection System[13] resulting in Delayed Fault Clearing.

g. 3Ø fault on transformer with failure of a non-redundant component of a Protection System[13] resulting in Delayed Fault Clearing.

h. 3Ø fault on bus section with failure of a non-redundant component of a Protection System[13] resulting in Delayed Fault Clearing.

~~e.~~ i. 3Ø internal breaker fault.

~~f.~~ j. Other events based upon operating experience, such as consideration of initiating events that experience suggests may result in wide area disturbances

As demonstrated above, Table 1, Extreme Events, Stability column, items 2.a. through 2.d are revised to strike the term "relay failure." Items 2.e through 2.h are added to address specifically the study of a three-phase fault on a generator, Transmission circuit, transformer, or bus section in combination with a failure of a non-redundant component of a Protection System resulting in Delayed Fault Clearing. Footnote 13, discussed above, identifies the specific non-redundant components of a Protection System that should be considered as part of these extreme event studies.

As discussed in the following section, proposed Reliability Standard TPL-001-5 carries forward requirements from TPL-001-4 relating to the action the planning entity must take in the event its studies indicate System performance issues for this event.

4. Corrective Action Requirements for the Revised Table 1 Category P5 and Stability Extreme Events Items 2.e-2.h Studies

The proposed TPL-001-5 Reliability Standard, like the currently effective TPL-001-4 standard, takes a risk-based approach to System planning studies. Generally, the standard contains more stringent corrective action requirements for the more commonplace scenarios, and less stringent corrective action requirements for the rarest, but potentially most severe, scenarios. This general framework is based on widely-accepted principles of cost-effective, risk-based planning. As FERC stated in a prior proceeding, "The Commission agrees that [the extreme event Transmission Planning] Reliability Standard should not require improvements for low probability events that cannot be justified."[37] The planning entity should, however, be required to fully understand the potential impacts such events could have on its System and the steps that could be taken to address those impacts.[38] The planning entity would then use this information to make an informed decision on the best way to plan its System for these rare scenarios. This decision should take into account all relevant considerations. By way of example, those considerations could include the entity's planning priorities, the probability of the event, and the expected impacts of the event. These considerations could also include the interests of its customers and the entity's ability to obtain cost recovery.

Proposed Reliability Standard TPL-001-5 carries forward this risk-based approach to the study of Protection System single points of failure. As discussed in the previous sections, TPL-001-5 replaces "relays" as the equipment to be studied in the Table 1, Category P5 planning

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[37] *See* Notice of Proposed Rulemaking, *Mandatory Reliability Standards for the Bulk-Power System*, 117 FERC ¶ 61,084 (Oct. 20, 2006) at P 1112 (proposing to approve Reliability Standard TPL-004-0 – System Performance Following Extreme BES Events, which is a predecessor to the currently effective TPL-001-4 standard).

[38] *See id.* and Order No. 693 at P 1836 (approving TPL-004-0 and directing NERC to modify the standard to require, among other things, "the identification of options for reducing the probability or impacts of extreme events that cause cascading.")

event and Stability extreme events items 2.e-2.h with a broader list of potentially problematic non-redundant Protection System components. The approach to mitigation for these events remains unchanged from currently effective TPL-001-4.

The single line-to-ground fault scenario described in the revised Category P5 planning event is considered to be the more commonplace scenario involving Protection System single points of failure; therefore, if the planning entity determines that its System is unable to meet the standard's performance requirements, it must develop a Corrective Action Plan to address the deficiencies. Requirement R2.7 in proposed Reliability Standard TPL-001-5 addresses Corrective Action Plan requirements and remains substantively unchanged from the currently effective standard. Such Corrective Action Plans for the Category P5 planning event may include adding redundant components; however, this is only one of many alternatives for corrective actions that planning entities may consider to achieve required System performance.

By contrast, the three phase fault scenario described in the revised Table 1, Extreme Events, Stability column items 2.e-h is considered to be the much rarer occurrence, as discussed further below. Like the other extreme events in the proposed standard, this scenario, while rare, could result in more significant impacts to an entity's System. During the development of the proposed standard, the standard drafting team considered several alternative approaches to the study of Protection System single points of failure with three-phase faults, particularly the type of mitigation action that should be required by the standard. Taking into account all relevant considerations, including industry feedback and the recommendations of the SPCS/SAMS report, the TPL-001-5 drafting team determined that the most appropriate and cost effective approach would be to carry forward the approach of currently effective TPL-001-4. Under this approach, if

an entity determines that its System will experience Cascading[39] as a result of a three-phase fault scenario, "an evaluation of possible actions designed to reduce the likelihood or mitigate the consequence(s) of the event shall be conducted." In proposed Reliability Standard TPL-001-5, this Requirement is carried forward in Requirement R4 Part 4.2.[40] The ERO would continue to audit compliance with this analysis provision similarly to how it is audited under the currently effective standard, taking into account the expanded list of Protection System components considered in the study.

The corrective action requirements for the revised single line-to-ground fault and three phase fault scenarios fit within the risk-based framework of the TPL-001 standard. Data collected by NERC since 2011 provides further support that this framework remains appropriate for Protection System single points of failure studies. Like all of the "extreme event" scenarios in this framework, the impacts of a Protection System single point of failure in combination with a three phase fault could be severe in some cases, but are very unlikely. A historical analysis of NERC's data on Protection System misoperations indicates that the expected likelihood of such an event occurring and resulting in the most severe impacts would be small. NERC recently completed a review of over 12,000 Protection System misoperations in its Misoperation Information Data Analysis System ("MIDAS") database reported since 2011.[41] Of the over

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[39] Cascading is defined in the NERC Glossary as: "The uncontrolled successive loss of System Elements triggered by an incident at any location. Cascading results in widespread electric service interruption that cannot be restrained from sequentially spreading beyond an area predetermined by studies."

[40] This provision is unchanged from currently-effective TPL-001-4, except that it is moved from Requirement R4 Part 4.5 to Part 4.2 in proposed TPL-001-5 for editorial reasons. Similarly, the provision applicable to steady state extreme events analysis is moved from Requirement R3 Part 3.5 to Part 3.2.

[41] The ERO began to collect misoperations data in a common format beginning in 2011. Applicable entities are currently required to report information on Protection System misoperations to NERC pursuant to a request for data or information under Section 1600 of the NERC Rules of Procedure approved by the NERC Board of Trustees on August 14, 2014. Previously, the PRC-004 standard contained requirements for misoperation reporting.

12,000 Protection System misoperations in MIDAS, 28 involved three-phase faults. Of that number, only 10 involved breakers that failed to operate (the remaining 18 involved breakers that were slow to operate). Failure to operate potentially indicates instances of a Protection System single point of failure. While the potential for severe impacts from such events remains, none of the 10 failure to trip scenarios reported since 2011 resulted in events that reached the threshold for reporting to NERC under Reliability Standard EOP-004.[42]

For these reasons, it remains appropriate to carry forward the risk-based mitigation approach in currently effective Reliability Standard TPL-001-4 to the revised Protection System single points of failure planning studies in proposed Reliability Standard TPL-001-5.

B. Revisions to Address Order No. 786 Directives

In addition to addressing reliability issues involving single points of failure on Protection Systems, proposed Reliability Standard TPL-001-5 revises the TPL-001 standard to address two FERC directives from Order No. 786. Under the first directive, FERC directed NERC to modify TPL-001-4 to address the concern that the six month threshold could exclude planned maintenance outages of significant facilities from future planning assessments.[43] Under the second directive, FERC directed NERC to consider whether TPL-001-4 should contain a spare equipment strategy for Stability analysis, similar to that for steady state analysis.[44] For steady state analysis, TPL-001-4 Requirement R2 Part 2.1.5 requires studies to be performed for P0, P1, and P2 categories with the conditions that the system is expected to experience during the

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[42] The EOP-004 Reliability Standard specifies Requirements for entities to report disturbances and events that have the potential to impact the reliability of the BPS.

[43] Order No 786 at P 40.

[44] *Id.* at P 89.

possible unavailability of the long lead-time equipment. A discussion of the revisions in proposed TPL-001-5 to address these directives is provided below.

1. Study of Known Planned Outages

In proposed Reliability Standard TPL-001-5, NERC made several revisions to address FERC's concern in Order No. 786 that the six-month threshold in TPL-001-4 Requirement R1 Part 1.1.2 could exclude planned maintenance outages of significant facilities from future planning assessments.[45] The proposed revisions are intended to complement Reliability Standard IRO-017-1, which requires: (1) each Reliability Coordinator to maintain an outage coordination process within its Reliability Coordinator Area; and (2) each Planning Coordinator and Transmission Planner to provide its Planning Assessment to impacted Reliability Coordinators and to jointly develop solutions with its Reliability Coordinator(s) for identified issues or conflicts with planned outages.

The proposed revisions are intended to strengthen the collaboration and consultation between the Reliability Coordinator and the Transmission Planner or Planning Coordinator at the outset of determining the known outages that should be assessed in the Near-Term Transmission Planning Horizon. In developing a comprehensive approach to the study of known outages in Planning Assessments, and one that is flexible enough to accommodate the various outage coordination processes in use across the North America, the TPL-001-5 standard drafting team considered FERC's guidance in Order No. 786, the recommendations of the NERC SAMS, feedback received during the standard development process, as well its own experience and subject matter expertise.

[45] *Id.* at P 40.

In proposed TPL-001-5, the provision relating to the assessment of known outages (Requirement R1 Part 1.1.2) is struck from Requirement R1 and new provisions are added under Requirement R2, Parts 2.1 and 2.4. These new provisions specify how analyses shall be assessed and supported by studies. The relevant revisions to Requirement R2 are shown below:

> **R2.** Each Transmission Planner and Planning Coordinator shall prepare an annual Planning Assessment of its portion of the BES. This Planning Assessment shall use current or qualified past studies (as indicated in Requirement R2, Part 2.6), document assumptions, and document summarized results of the steady state analyses, short circuit analyses, and Stability analyses. *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*
>
> **2.1.** For the Planning Assessment, the Near-Term Transmission Planning Horizon portion of the steady state analysis shall be assessed annually and be supported by current annual studies or qualified past studies as indicated in Requirement R2, Part 2.6. Qualifying studies need to include the following conditions:
>
> **2.1.1.** System peak Load for either Year One or year two, and for year five.
>
> **2.1.2.** System Off-Peak Load for one of the five years.
>
> ~~**2.1.3.** P1 events in Table 1, with known outages modeled as in Requirement R1, Part 1.1.2, under those System peak or Off-Peak conditions when known outages are scheduled~~.
>
> ***
>
> **2.1.4.** When known outage(s) of generation or Transmission Facility(ies) are planned in the Near-Term Planning Horizon, the impact of selected known outages on System performance shall be assessed. These known outage(s) shall be selected for assessment consistent with a documented outage coordination procedure or technical rationale by the Planning Coordinator or Transmission Planner. Known outage(s) shall not be excluded solely based upon outage duration. The assessment shall be performed for the P0 and P1 categories identified in Table 1 with the System peak or Off-Peak conditions that the System is expected to experience when the known outage(s) are planned. This assessment shall include, at a minimum known outages expected to produce more severe System impacts on the

Planning Coordinator or Transmission Planner's portion of the BES. Past or current studies may support the selection of known outage(s), if the study(s) has comparable post-Contingency System conditions and configuration such as those following P3 or P6 category events in Table 1.

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2.4. For the Planning Assessment, the Near-Term Transmission Planning Horizon portion of the Stability analysis shall be assessed annually and be supported by current or past studies as qualified in Requirement R2, Part 2.6. The following studies are required:

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2.4.4. When known outage(s) of generation or Transmission Facility(ies) are planned in the Near-Term Planning Horizon, the impact of selected known outages on System performance shall be assessed. These known outage(s) shall be selected for assessment consistent with a documented outage coordination procedure or technical rationale by the Planning Coordinator or Transmission Planner. Known outage(s) shall not be excluded solely based upon outage duration. The assessment shall be performed for the P1 categories identified in Table 1 with the System peak or Off-Peak conditions that the System is expected to experience when the known outage(s) are planned. This assessment shall include, at a minimum, those known outages expected to produce more severe System impacts on the Planning Coordinator or Transmission Planner's portion of the BES. Past or current studies may support the selection of known outage(s), if the study(s) has comparable post-Contingency System conditions and configuration such as those following P3 or P6 category events in Table 1.

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In proposed Reliability Standard TPL-001-5, the six month outage threshold is removed. Planning entities would instead select known outages for study based on a documented procedure or rationale that takes into account relevant factors, but does not exclude known planned outages based solely on the outage duration. The change to where the assessment of

known outages is specified in the TPL-001-5 requirements better aligns the approach necessary for the planning entities to execute their annual Planning Assessments. Further, the proposed Requirement language recognizes the various means that Planning Coordinators and Transmission Planners currently employ to consider the maintenance outages that could potentially be of concern.

Under proposed Requirement R2 Parts 2.1.4 and 2.4.4., each Planning Coordinator and Transmission Planner must have either a documented outage coordination procedure or technical rationale to select which known outages shall be assessed as part of the steady state (Requirement R2, Part 2.1.4) and Stability (Requirement R2, Part R2.4.4) analysis. The documented outage coordination procedure would include consultation with the affected Reliability Coordinator, consultation with Transmission and/or Generator Owner(s) affected by the known outage, or application of documented outage coordination processes. The technical rationale would include the well-reasoned technical bases for making the determination of which known outages to assess.

Consistent with the intention of Order No. 786, the proposed provisions specify that an entity shall not exclude known outages to be modeled based solely on the outage duration. However, the presence of other accompanying factors, which in conjunction with outage duration, may form a reasonable basis for supporting that the known outage need not be assessed in the Near-Term Transmission Planning Horizon.

Under the proposed standard, an entity would be required to include, at a minimum, those known outages expected to cause more severe System impacts, such as those that may result in Non-Consequential Load Loss for the Table 1 Category P1 event. The Planning Coordinator and Transmission Planner would have flexibility to use the appropriate means to assess which known

outages are expected to be significant, and to exclude from the assessment those outages which the Planning Coordinator and Transmission Planner do not expect to be problematic. When selecting those known outages for study, consideration must be paid to the System conditions, such as On-Peak or Off-Peak, that are expected during the period when the known outage is planned. The proposed standard provides that past or current studies may support the selection of one or more known outages, if the past or current study or studies has comparable post-Contingency System conditions and configuration. For example, in many cases the Category P3 and P6 event study could result in the same System state as the Category P1 event with the known outage. Such analysis, therefore, may be useful in helping to select which known outages to study.

2. Spare Equipment Strategy for Stability Analysis

NERC also proposes revisions to address FERC's Order No. 786 directive to consider adding provisions for spare equipment strategy as part of Stability analysis. In Order No. 786, FERC noted that TPL-001-4 Requirement R2 Part 2.1.5 requires that steady state studies be performed for the P0, P1, and P2 categories identified in Table 1 with the conditions that the system is expected to experience during the possible unavailability of the long lead time equipment. FERC stated that it believed that "a similar spare equipment strategy for stability analysis should exist that requires studies to be performed for P0, P1 and P2 categories with the conditions that the system is expected to experience during the possible unavailability of the long lead time equipment." FERC directed NERC to consider the issue upon the next review cycle of TPL-001-4.[46]

[46] Order No. 786 at P 89.

Consistent with FERC's Order No. 786 guidance, the standard drafting team revised the standard to add a similar requirement for Stability analysis, as follows:

> **2.4.** For the Planning Assessment, the Near-Term Transmission Planning Horizon portion of the Stability analysis shall be assessed annually and be supported by current or past studies as qualified in Requirement R2, Part2.6. The following studies are required:
>
> ***
>
> **2.4.5.** When an entity's spare equipment strategy could result in the unavailability of major Transmission equipment that has a lead time of one year or more (such as a transformer), the impact of this possible unavailability on System performance shall be assessed. Based upon this assessment, an analysis shall be performed for the selected P1 and P2 category events identified in Table 1 for which the unavailability is expected to produce more severe System impacts on its portion of the BES. The analysis shall simulate the conditions that the System is expected to experience during the possible unavailability of the long lead time equipment.

The addition of Requirement R2, Part 2.4.5, which includes similar language to that used for the steady-state analysis under Requirement R2, Part 2.1.5,[47] clarifies that the outage of long lead time Elements has an equally important impact from a Stability standpoint as it does from a steady-state standpoint and should be assessed commensurate with an entity's spare equipment strategy. While the language in the two provisions is similar, there are two important differences.

First, the Category P0 event is not included because it is implied in the study. The nature of Stability analysis is to observe the System dynamic response during and after a disturbance. The Category P0 event conditions represent the undisturbed, initial, "normal" state of the System. Given that initial System conditions for each long-lead time Element that is removed from service are identical between steady state and Stability analyses, the Stability analysis of

[47] Corresponding editorial changes are proposed in Requirement R2, Part 2.1.5, as shown in Exhibit A.

the P0 event is implicitly assessed when conducting the steady state analysis of the P0 event. Similarly, the prerequisite for conducting the Category P1 and P2 event Stability analysis is a System model that incorporates and is initialized as the undisturbed (P0) state of the System. Therefore, Category P0 is redundant and is appropriately omitted from Requirement R2 Part 2.4.5.

Second, proposed Reliability Standard TPL-001-5 Requirement R2 Part 2.4.5 provides that "an analysis shall be performed for the selected P1 and P2 category events identified in Table 1 for which the unavailability is expected to produce more severe System impacts on its portion of the BES." The dynamic response of the System and its ability to meet performance requirements are expected to be more stressed for certain Category P1 and P2 category events, topologically close to where the long-lead time Element is removed from service. Consistent with Requirement R3 Part 3.4, those Category P1 and P2 events expected to produce more severe System impacts are selected for Stability analysis. Additionally, prior testing and knowledge of system performance can help to limit Stability testing to the relevant limiting events.

C. Other Revisions

Proposed Reliability Standard TPL-001-5 also contains several other revisions not specifically highlighted above. First, the reference to the MOD-010 and MOD-012 standard in Requirement R1 is replaced with a reference to the MOD-032 standard, which now contains the relevant Requirements.[48] Second, references to "Special Protection System" have been replaced with "Remedial Action Scheme," consistent with previously-submitted revisions to those defined

[48] NERC provided notice of proposed Reliability Standard MOD-032-1 and the retirement of Reliability Standards MOD-010-0 and MOD-012-0 on March 11, 2014.

terms.[49] Lastly, a series of moves and formatting changes have been made to conform the standard to the current NERC standard template. These proposed changes are shown in redline in Exhibit A.

D. Enforceability of the Proposed Reliability Standard

The proposed Reliability Standard contains Violation Risk Factors ("VRFs") and Violation Severity Levels ("VSLs") for each of the standard's Requirements. The VRFs and VSLs provide guidance on the way that NERC will enforce the Requirements of the proposed Reliability Standard. The VRFs and VSLs are substantively unchanged from currently effective Reliability Standard TPL-001-4 and continue to comport with NERC and FERC guidelines related to their assignment.

In addition, the proposed Reliability Standard also includes Measures that support the Requirements by clearly identifying what is required and how the Requirement will be enforced. The Measures, which are unchanged from currently-enforceable Reliability Standard TPL-001-4, helps ensure that the Requirements will be enforced in a clear, consistent, and non-preferential manner and without prejudice to any party.

V. EFFECTIVE DATE

The proposed implementation plan is attached to this filing as Exhibit B. Under the proposed implementation plan, where approval by an applicable governmental authority is required, the standard shall become effective on the first day of the first calendar quarter that is 36 months after the effective date of the applicable governmental authority's order approving the standard, or as otherwise provided by the applicable governmental authority. Where approval

[49] On February 25, 2015, NERC provided notice of the revised definition of Remedial Action Scheme. On May 13, 2016, NERC submitted a revised definition of Special Protection System, to have the same meaning as Remedial Action Scheme.

by an applicable governmental authority is not required, the standard shall become effective on the first day of the first calendar quarter that is 36 months after the date the standard is adopted by the NERC Board of Trustees, or as otherwise provided for in that jurisdiction.

Under the TPL-001-5 implementation plan, entities have additional time to come into compliance with certain Requirements related to the study of single points of failure on Protection Systems. Specifically, planning entities would have an additional 24 months after the effective date of the standard to develop Corrective Action Plans under Requirement R2, Part 2.7 for the Table 1 Category P5 planning event involving the non-redundant components of a Protection System specified in Footnote 13 items a, b, c, and d. Further, entities shall have an additional 72 months after the effective date of the standard to comply with the underlined part of Requirement R2, Part 2.7 that states: "Revisions to the Corrective Action Plan(s) are allowed in subsequent Planning Assessments <u>but the planned System shall continue to meet the performance requirements in Table 1.</u>"

As explained in Exhibit B, the proposed implementation plan recognizes that Planning Coordinators and Transmission Planners will need time to develop a procedure or technical rationale for selecting known outages for study and for completing those planning studies. Further, the implementation plan recognizes that Planning Coordinators and Transmission Planners would need to engage in a substantial amount of work and coordination with asset owners and protection engineers to perform the new Protection System single points of failure studies and to coordinate on appropriate Corrective Action Plan measures and timetables to address System performance issues. This is especially true in cases where Corrective Action Plans may call for adding redundant Protection System components.

The proposed implementation plan recognizes the importance of ensuring that the potential risks of known outages and Protection System single points of failure are being addressed in planning studies. Based upon the considerations described above, the proposed implementation plan also provides a reasonable period of time for entities to come into compliance with the proposed standard.

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Respectfully submitted,

/s/ Lauren A. Perotti

Lauren A. Perotti
Counsel
North American Electric Reliability Corporation
1325 G Street, N.W., Suite 600
Washington, D.C. 20005
(202) 400-3000
(202) 644-8099– facsimile
lauren.perotti@nerc.net

Counsel for the North American Electric Reliability Corporation

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EXHIBITS A-B and D-H

Exhibit C

Reliability Standards Criteria

Exhibit C — Reliability Standards Criteria — Proposed Reliability Standard TPL-001-5

Reliability Standards Criteria

The discussion below explains how the proposed Reliability Standard has met or exceeded the Reliability Standards criteria:

1. **Proposed Reliability Standards must be designed to achieve a specified reliability goal and must contain a technically sound means to achieve that goal.**

The purpose of proposed Reliability Standard TPL-001-5 is to establish Transmission system planning performance requirements within the planning horizon to develop a Bulk Electric System (BES) that will operate reliably over a broad spectrum of System conditions and following a wide range of probable Contingencies.

Reliability Standard TPL-001-5 requires applicable entities to perform an annual Planning Assessment of its portion of the BES covering a number of System conditions and Contingencies described in the standard. Proposed Reliability Standard TPL-001-5 enhances reliability by providing for more comprehensive consideration of Protection System single points of failure, known outages, and the unavailability of long lead-time equipment in planning studies. Specifically, proposed Reliability Standard TPL-001-5 improves upon currently effective Reliability Standard TPL-001-4 by revising the existing Table 1 planning and extreme events to require a more complete, risk-based analysis of how the failure of a non-redundant component of a Protection System would affect a planning entity's System. These revisions are based on recommendations following the analysis of data collected under request for data under Section 1600 of the NERC Rules of Procedure. The proposed standard also addresses FERC's standard modification directives from Order No. 786 by: (i) requiring a more comprehensive analysis of known outages in planning studies; and (ii) requiring entities to consider, in Stability

analysis, the impacts of the possible unavailability of long lead time equipment, consistent with the entity's spare equipment strategy.

2. **Proposed Reliability Standards must be applicable only to users, owners and operators of the bulk power system, and must be clear and unambiguous as to what is required and who is required to comply.**

The proposed Reliability Standard is clear and unambiguous as to what is required and who is required to comply. Proposed Reliability Standard TPL-001-5 continues to apply to Planning Coordinators and Transmission Planners. The proposed standard clearly articulates the actions that each entity must take to comply.

3. **A proposed Reliability Standard must include clear and understandable consequences and a range of penalties (monetary and/or non-monetary) for a violation.**

The Violation Risk Factors ("VRFs") and Violation Severity Levels ("VSLs") for proposed Reliability Standard TPL-001-5, as reflected in **Exhibit A,** are substantively unchanged from currently effective Reliability Standard TPL-001-4. The VRFs and VSLs comport with NERC and FERC guidelines related to their assignment. The VSLs are consistent with the corresponding Requirements and do not use any ambiguous terminology, thereby supporting uniformity and consistency in the determination of similar penalties for similar violations. For these reasons, the proposed Reliability Standard includes clear and understandable consequences.

4. **A proposed Reliability Standard must identify clear and objective criterion or measure for compliance, so that it can be enforced in a consistent and non-preferential manner.**

The proposed Reliability Standard includes Measures that support the proposed standard's Requirements by clearly identifying what is required and how the Requirements will be enforced. These Measures, which remain substantively unchanged from the Measures in currently effective Reliability Standard TPL-001-4, help provide clarity regarding how the Requirements will be enforced, and help ensure that the Requirements will be enforced in a

clear, consistent, and non-preferential manner and without prejudice to any party.

5. **Proposed Reliability Standards should achieve a reliability goal effectively and efficiently — but do not necessarily have to reflect "best practices" without regard to implementation cost or historical regional infrastructure design.**

The proposed Reliability Standard achieves its reliability goals effectively and efficiently. The proposed standard provides for more comprehensive planning studies, thereby contributing to a more reliable BES. First, the proposed standard provides for a more complete consideration of factors for selecting which known outages will be included in Near-Term Transmission Planning Horizon studies. The revisions reflected in proposed Reliability Standard TPL-001-5 effectively address FERC's concern that the exclusion of known outages of less than six months in TPL-001-4 could result in outages of significant facilities not being studied and account for variations in regional practices. Second, the proposed Reliability Standard provides for a more comprehensive analysis of the potential impacts of Protection System single points of failure. Third, the proposed standard requires the entity assess the impact of the possible unavailability of long lead time equipment, consistent with the entity's spare equipment strategy, in its Stability analysis. Consistent with the currently effective standard, entities retain flexibility to select appropriate mitigation measures in the event System performance issues are identified. The proposed standard thereby achieves its reliability goal effectively and efficiently.

6. **Proposed Reliability Standards cannot be "lowest common denominator," *i.e.*, cannot reflect a compromise that does not adequately protect Bulk-Power System reliability. Proposed Reliability Standards can consider costs to implement for smaller entities, but not at consequences of less than excellence in operating system reliability.**

The proposed Reliability Standard does not reflect a "lowest common denominator" approach. To the contrary, the revisions reflected in proposed Reliability Standard TPL-001-5 provide significant benefits for the reliability of the Bulk Power System by providing for more comprehensive planning studies: The proposed Reliability Standard does not sacrifice excellence

in operating system reliability for costs associated with implementation of the Reliability Standard.

7. **Proposed Reliability Standards must be designed to apply throughout North America to the maximum extent achievable with a single Reliability Standard while not favoring one geographic area or regional model. It should take into account regional variations in the organization and corporate structures of transmission owners and operators, variations in generation fuel type and ownership patterns, and regional variations in market design if these affect the proposed Reliability Standard.**

The proposed Reliability Standard applies throughout North America and does not favor one geographic area or regional model.

8. **Proposed Reliability Standards should cause no undue negative effect on competition or restriction of the grid beyond any restriction necessary for reliability.**

The proposed Reliability Standard has no undue negative effect on competition. The proposed Reliability Standard requires the same performance by each of applicable entity. The proposed Reliability Standard does not unreasonably restrict the available generation or transmission capability or limit use of the Bulk-Power System in a preferential manner.

9. **The implementation time for the proposed Reliability Standard is reasonable.**

The proposed effective date for the proposed Reliability Standard is just and reasonable and appropriately balances the urgency in the need to implement the proposed Reliability Standard against the reasonableness of the time allowed for those who must comply to develop necessary procedures, software, facilities, staffing or other relevant capability. NERC proposes an effective date for TPL-001-5 as provided in the Implementation Plan. Reliability Standard TPL-001-4 would be retired immediately prior to the effective date of TPL-001-5.

Under the TPL-001-5 implementation plan, entities have additional time to come into compliance with certain Requirements related to the study of single points of failure on Protection Systems. Specifically, planning entities would have an additional 24 months after the

effective date of the standard to develop Corrective Action Plans under Requirement R2, Part 2.7 for the Table 1 Category P5 planning event involving the non-redundant components of a Protection System specified in Footnote 13 items a, b, c, and d. Further, entities shall have an additional 72 months after the effective date of the standard to comply with the underlined part of Requirement R2, Part 2.7 that states: "Revisions to the Corrective Action Plan(s) are allowed in subsequent Planning Assessments but the planned System shall continue to meet the performance requirements in Table 1."

The proposed effective date and phased compliance dates are reflected in the proposed implementation plan, attached as **Exhibit B**.

10. The Reliability Standard was developed in an open and fair manner and in accordance with the Reliability Standard development process.

The proposed Reliability Standard was developed in accordance with NERC's ANSI-accredited processes for developing and approving Reliability Standards. **Exhibit G** includes a summary of the Reliability Standard development proceedings, and details the processes followed to develop the proposed Reliability Standard. These processes included, among other things, comment periods, pre-ballot review periods, and balloting periods. Additionally, all meetings of the standard drafting team were properly noticed and open to the public.

11. NERC must explain any balancing of vital public interests in the development of proposed Reliability Standards.

NERC has identified no competing public interests regarding the request for approval of the proposed Reliability Standard. No comments were received indicating the proposed Reliability Standard is in conflict with other vital public interests.

12. Proposed Reliability Standards must consider any other appropriate factors.

No other factors relevant to whether the proposed Reliability Standard is just, reasonable, not unduly discriminatory or preferential were identified.