

January 22, 2015

**VIA OVERNIGHT MAIL**

Sheri Young, Secretary of the Board  
National Energy Board  
517 – 10<sup>th</sup> Avenue SW  
Calgary, Alberta  
T2R 0A8

RE: *North American Electric Reliability Corporation*

Dear Ms. Young:

The North American Electric Reliability Corporation (“NERC”) hereby submits Notice of Filing of the North American Electric Reliability Corporation of Proposed Reliability Standard PRC-005-4. NERC requests, to the extent necessary, a waiver of any applicable filing requirements with respect to this filing.

Please contact the undersigned if you have any questions.

Respectfully submitted,

/s/ Holly A. Hawkins

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Enclosure

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**BEFORE THE  
NATIONAL ENERGY BOARD**

**NORTH AMERICAN ELECTRIC )  
RELIABILITY CORPORATION )**

**NOTICE OF FILING OF THE  
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION  
OF PROPOSED RELIABILITY STANDARD PRC-005-4**

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January 22, 2015

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**BEFORE THE  
NATIONAL ENERGY BOARD**

**NORTH AMERICAN ELECTRIC )  
RELIABILITY CORPORATION )**

**NOTICE OF FILING OF THE  
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION  
OF PROPOSED RELIABILITY STANDARD PRC-005-4**

The North American Electric Reliability Corporation (“NERC”) hereby submits :

- proposed Reliability Standard PRC-005-4 (Protection System, Automatic Reclosing, and Sudden Pressure Relaying Maintenance) (Exhibit A);
- one new (Sudden Pressure Relaying) and four revised definitions (Protection System Maintenance Program, Component Type, Component, and Countable Event);<sup>1</sup>
- the implementation plan for proposed Reliability Standard PRC-005-4 (“Implementation Plan”) (Exhibit B); and
- the Violation Risk Factors (“VRFs”) and the revised Violation Severity Levels (“VSLs”) for proposed PRC-005-4 (Exhibits A and G).

The proposed Reliability Standard is just, reasonable, not unduly discriminatory or preferential, and in the public interest.<sup>2</sup> NERC also provides notice of the retirement of Reliability Standard PRC-005-3 as detailed in the Implementation Plan. NERC notes that proposed Reliability Standard PRC-005-4 builds on the prior version, PRC-005-3. This filing

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<sup>1</sup> These terms are PRC-005 specific definitions. The definitions can be found in the posted PRC-005-2 Reliability Standard. The revised versions of the definitions will be located in the posted version of proposed PRC-005-4.

<sup>2</sup> Unless otherwise designated, all capitalized terms shall have the meaning set forth in the *Glossary of Terms Used in NERC Reliability Standards*, available at [http://www.nerc.com/files/Glossary\\_of\\_Terms.pdf](http://www.nerc.com/files/Glossary_of_Terms.pdf)

presents the technical basis and purpose of proposed Reliability Standard PRC-005-4, a summary of the development history (Exhibit H), and a demonstration that the proposed Reliability Standard meets the Reliability Standards criteria (Exhibit C). Proposed Reliability Standard PRC-005-4 was adopted by the NERC Board of Trustees (“Board”) on November 13, 2014.

In addition to proposed version 4, NERC is separately filing limited revisions to PRC-005-2 and proposed PRC-005-3, which have been developed in two other NERC Projects. In Project 2014-01 – Standards Applicability for Dispersed Generation Resources, NERC developed changes to the applicability section of version 2 and version 3 of PRC-005 to ensure that the Generator Owners and Generator Operators of dispersed power producing resources are appropriately assigned responsibility in certain Reliability Standards in light of the new definition of Bulk Electric System. These changes are separate from the current proposed changes in proposed PRC-005-4. Corresponding changes to proposed PRC-005-4 to align the changes developed in Project 2014-01 are currently being developed by NERC. NERC anticipates that these changes will be submitted for approval to the NERC Board in February of 2015 and subsequently submitted to the applicable governmental authorities in a separate filing.

NERC has also developed changes to version 2 and version 3 of PRC-005 in Project 2010-05.2 “Phase 2 of Special Protection Systems” to replace the use of “Special Protection System” with the defined term “Remedial Action Scheme.” These two terms share a common definition in the NERC Glossary. These changes were developed in anticipation of the development of a revised definition of “Remedial Action Scheme,” which is the subject of a separate NERC filing. Proposed PRC-005-4 includes this change to the use of “Remedial Action Scheme.” These changes are also independent of this filing.

NERC has coordinated the implementation timing and adjusted the NERC numbering convention to provide for proper sequencing of changes. The timing of this filing does not need to be coordinated with any other upcoming filings.

## **I. EXECUTIVE SUMMARY**

To satisfy NERC's commitment to develop modifications to PRC-005 in response to Federal Energy Regulatory Commission ("FERC") Order No. 758,<sup>3</sup> the proposed Reliability Standard PRC-005-4 adds "Sudden Pressure Relaying" that can affect the reliable operation of the Bulk-Power System to the applicability of Reliability Standard PRC-005. Sudden pressure relays are designed to quickly detect faults on Bulk-Power System transformer equipment that may remain undetected by other Protection Systems, and can operate to limit any potential damage on the equipment. Potential misoperation of sudden pressure relays that initiate tripping in response to fault conditions can impact the reliability of the Bulk-Power System. As a result of the addition of Sudden Pressure Relaying in proposed PRC-005-4, applicable entities will be obligated to document and implement programs for the maintenance of applicable sudden pressure relays affecting the reliability of the Bulk Electric System so that the equipment is kept in working order.

In the Notice of Proposed Rulemaking ("NOPR")<sup>4</sup> preceding Order No. 758, FERC noted a concern that NERC's proposed interpretation of PRC-005-1 may not include all components that serve in some protective capacity.<sup>5</sup> FERC proposed to direct NERC to develop a modification to the Reliability Standard to include "any component or device that is designed to detect defective lines or apparatuses or other power system conditions of an abnormal or

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<sup>3</sup> *Interpretation of Protection System Reliability Standard*, Order No. 758, 138 FERC ¶ 61,094 ("Order No. 758"), *order on reh'g*, 139 FERC ¶ 61,227 (2012).

<sup>4</sup> *Interpretation of Protection System Reliability Standard*, Notice of Proposed Rulemaking, 133 FERC ¶ 61,223 (2010) ("Interpretation NOPR").

<sup>5</sup> *Id.* at P 11.

dangerous nature and to initiate appropriate control circuit actions.”<sup>6</sup> NERC commented that the proposed directive was overly broad and proposed an alternative, which was accepted by FERC to provide technical analysis that describes the devices and functions (to include sudden pressure relays which trip for fault conditions) to address FERC’s concerns, and propose minimum maintenance activities and maximum maintenance intervals for such devices. FERC directed NERC to submit a schedule for the development of the technical document and standards development work that resulted from the report recommendations.

In response to Order No. 758, the NERC System Protection and Control Subcommittee (“SPCS”) performed a technical study to determine which devices that respond to non-electrical quantities should be addressed within PRC-005 identified devices (“SPCS Report”) (Exhibit D).<sup>7</sup> The standard drafting team developed revisions to Reliability Standard PRC-005-3 in line with the SPCS Report recommendations.

## **II. NOTICES AND COMMUNICATIONS**

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

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<sup>6</sup> *Id.*

<sup>7</sup> NERC Petition, Ex. D, *Sudden Pressure Relays and Other Devices that Respond to Non-Electrical Quantities: SPCS Input for Standard Development in Response to FERC Order No. 758*, NERC SPCS (Dec. 2013).

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### **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.<sup>8</sup> NERC's proposed rules provide for reasonable notice and opportunity for public comment, due process, openness, and a balance of interests in developing Reliability Standards and thus satisfies the criteria for approving Reliability Standards. The development process is open to any person or entity with a legitimate interest in the reliability of the Bulk-Power System. NERC considers the comments of all stakeholders, and a vote of stakeholders and the NERC Board of Trustees is required to approve a Reliability Standard before the Reliability Standard is submitted to the applicable governmental authorities.

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<sup>8</sup> 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](http://www.nerc.com/comm/SC/Documents/Appendix_3A_StandardsProcessesManual.pdf).



## **B. History of Project 2007-17.3**

In Order No. 693,<sup>9</sup> FERC approved Reliability Standard PRC-005-1 and directed NERC to “develop a modification ... through the Reliability Standards development process that includes a requirement that maintenance and testing of a protection system must be carried out within a maximum allowable interval that is appropriate to the type of the protection system and its impact on the reliability of the Bulk-Power System.”<sup>10</sup> In 2007, NERC initiated Project 2007-17 Protection System Maintenance and Testing to address FERC’s directive.

While the standard drafting team was developing the necessary reliability enhancements to PRC-005, NERC submitted two interpretations of PRC-005-1. On June 8, 2011, NERC submitted an interpretation of Requirements R1 and R3 of Reliability Standard PRC-004-1 (Analysis and Mitigation of Transmission and Generation Protection System Misoperations) and Requirements R1 and R2 of Reliability Standard PRC-005-1 (Transmission and Generation Protection System Maintenance and Testing).

On December 8, 2009, NERC submitted an interpretation of Requirement 1 of PRC-005-1. On February 3, 2012, FERC issued Order No. 758, approving this second interpretation of PRC-005-1. In the NOPR preceding Order No. 758 FERC noted a concern that NERC’s proposed interpretation of PRC-005-1 may not include all components that serve in some protective capacity.<sup>11</sup> FERC proposed to direct NERC to develop a modification to the Reliability Standard to include “any component or device that is designed to detect defective lines or apparatuses or other power system conditions of an abnormal or dangerous nature,

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<sup>9</sup> *Mandatory Reliability Standards for the Bulk-Power System*, Order No. 693, FERC Stats. & Regs. ¶ 31,242 (“Order No. 693”), *order on reh’g*, Order No. 693-A, 120 FERC ¶ 61,053 (2007).

<sup>10</sup> *Id.* at P 1475.

<sup>11</sup> Interpretation NOPR at P 11.

including devices designed to sense or take action against any abnormal system condition that will affect reliable operation, and to initiate appropriate control circuit actions.”<sup>12</sup>

NERC responded that it “understands FERC’s concerns related to protective relays that do not respond to electrical quantities and agrees that sudden pressure relays which trip for fault conditions should be maintained in accordance with NERC Reliability Standard requirements.”<sup>13</sup> NERC also commented that the proposed directive was overly broad and proposed an alternative, which was accepted by FERC to provide technical analysis that describes the devices and functions (to include sudden pressure relays which trip for fault conditions) to address FERC’s concerns, and propose minimum maintenance activities and maximum maintenance intervals for such devices. FERC directed NERC to submit a schedule for the development of the technical document and standards development work that results from the report recommendations.

### **C. SPCS Report**

In response to Order No. 758, the SPCS performed a technical study to determine which devices that respond to non-electrical quantities should be addressed within PRC-005 identified devices. The SPCS Report recommended that the standard drafting team modify Reliability Standard PRC-005 to:

1. explicitly address maintenance and testing of the actuator device of the sudden pressure relay when applied as a protective device that trips a facility described in the applicability section of the Reliability Standard;
  2. develop minimum maintenance intervals and activities for sudden pressure relays;
- and

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<sup>12</sup> *Id.*

<sup>13</sup> *Comments of the North American Electric Reliability Corporation in Response to Notice of Proposed Rulemaking*, Docket No. RM10-5-000, at 6-7 (Feb. 25, 2011) (“NERC Comments”).

3. modify the applicable tables of the Reliability Standard to explicitly include sudden pressure control circuitry.<sup>14</sup>

To reach these recommendations, the SPCS considered FERC's concerns in Order No. 758 and studied a broad range of devices that respond to non-electrical quantities to determine specifically which devices present a risk to the Bulk-Power System. To ensure the full scope of devices responding to non-electrical quantities were considered in the study, the SPCS used the list of ninety-four devices included in the IEEE Standard Electrical Power System Device Function Numbers standard as a starting point for its assessment.<sup>15</sup> The SPCS applied multiple layers of analysis to each device to select the ones that can affect the reliability of the Bulk-Power System, and, therefore, require maintenance and testing under PRC-005.

First, the SPCS considered what attributes of a device could affect the reliability of the Bulk-Power System<sup>16</sup> and created three categories of devices based on the risk these devices present to the Bulk-Power System. The SPCS concluded that only one of the three categories presented a risk to Bulk-Power System reliability that is sufficient to require maintenance and testing. This category included all devices that *initiate actions to clear faults or mitigate abnormal system conditions*.<sup>17</sup>

Second, the SPCS applied a two-step process to more narrowly identify the devices that should be subject to maintenance and testing. In the first step, the SPCS eliminated from the ninety-four IEEE devices the ones that were previously considered as a result of the revised definition of Protection System or those that are clearly not protective devices, such as primary

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<sup>14</sup> NERC Petition, Ex. D, SPCS Report at 4.

<sup>15</sup> A list of all IEEE device numbers, including a description of each device is included in Appendix B of the SPCS Report. See NERC Petition, Ex. D, SPCS Report at 13-20.

<sup>16</sup> For detailed explanation of the considerations of the risk to the reliable operations of the Bulk-Power System, see *Id.* at 7.

<sup>17</sup> *Id.* (emphasis added)

equipment and control devices.<sup>18</sup> Following this initial screening, the SPCS developed a short list of devices that required in-depth analysis.

Finally, the SPCS grouped the devices on the short list into three categories<sup>19</sup> based on their function and whether the device supports the reliable operation of the Bulk-Power System.<sup>20</sup> Following this final analysis, the SPCS concluded that only the first category – sudden pressure relays that are utilized in a trip application – should be included within the scope of PRC-005. The SPCS Report recommended that monitoring devices, and devices that initiate action in response to abnormal equipment conditions, but are not necessary for the reliable operation of the Bulk-Power System, should be excluded from the requirements of PRC-005. The SPCS recommendations for minimum maintenance activities and maximum intervals for sudden pressure relays that are utilized in a trip application are discussed in the Section IV below in the discussion of the changes to the PRC-005 Reliability Standard.

#### **D. SPCS Supplemental Report**

In response to comments and questions during the standards development process from FERC staff observers, the SPCS also revisited whether additional devices should be included to address FERC’s concern articulated in Order No. 758. Particularly, questions arose whether PRC-005 should include turbine generator vibration monitors and circuit breaker arc extinguishing systems. The SPCS issued a supplement to the SPCS Report, which provided information on events during which these devices operated or failed to operate, and concluded that the devices do not affect the reliable operation of the Bulk-Power System (“SPCS

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<sup>18</sup> The initial categorization of devices is documented in Appendix C of the SPCS Report. *See id.* at 25.

<sup>19</sup> *Id.* at 8. The short list of devices and the SPCS evaluation of each device are included in Appendix D of the SPCS Report. *Id.* at 37-32.

<sup>20</sup> *Id.* Classification of the devices on the short list is presented in Table 1 of the SPCS Report. *Id.* at 9.

Supplemental Report”).<sup>21</sup> The SPCS reaffirmed its original conclusion in the SPCS Report that these devices should not be included in the applicability of PRC-005.<sup>22</sup>

#### **IV. JUSTIFICATION**

As discussed in Exhibit C and below, proposed Reliability Standard PRC-005-4 satisfies the Reliability Standards criteria and is just, reasonable, not unduly discriminatory or preferential, and in the public interest. The enhanced proposed Reliability Standard promotes reliability by adding Sudden Pressure Relaying to the language of Reliability Standard PRC-005-2, and to the pending proposed PRC-005-3, thereby extending the coverage of an entity’s Protection System Maintenance Program to include Sudden Pressure Relaying Components. The purpose of proposed PRC-005-4 is to document and implement programs for the maintenance of all Protection Systems, Automatic Reclosing, and Sudden Pressure Relaying affecting the reliability of the Bulk Electric System so that they are kept in working order. Proposed PRC-005-4 adds detailed tables of minimum maintenance activities and maximum maintenance intervals for Sudden Pressure Relaying Components to the proposed PRC-005-3 Reliability Standard, extending the benefits of a strong maintenance program to these Components.

The Sudden Pressure Relaying Components included in proposed PRC-005-4 are based on the findings of the SPCS Report and SPCS Supplemental Report included as Exhibits D and E respectively. To assist responsible entities in understanding the addition of Sudden Pressure Relaying Components to PRC-005, the standard drafting team revised the *Supplementary Reference and FAQ* document (Exhibit F) developed concurrently with proposed PRC-005-4.

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<sup>21</sup> NERC Petition, Ex. E, *Sudden Pressure Relays and Other Devices that Respond to Non-Electrical Quantities: Supplemental Information to Support Project 2007-17.3: Protection System Maintenance and Testing*, NERC SPCS (Oct. 31, 2014).

<sup>22</sup> For detailed explanation of the SPCS considerations related to these devices, see *SPCS Supplemental Report*, Exhibit E.

This revised document will be posted with the proposed PRC-005-4 Reliability Standard following approval.

Proposed PRC-005-4 satisfies FERC's concerns raised in Order No. 758 by including in the scope of Reliability Standard PRC-005 sudden pressure relays that detect fault on Bulk-Power System transformer equipment and trip in response to fault conditions, as recommended by the SPCS Report. Provided below is a summary of the recommendations from the SPCS Report, including discussion of sudden pressure relays, an overview of the modifications to Reliability Standard PRC-005-3 necessary to meet NERC's obligations stemming from Order No. 758, and a discussion of the Implementation Plan.

#### **A. Sudden Pressure Relays**

Sudden pressure relays respond to changes in pressure and are utilized as protective devices for power transformers. Sudden pressure relays can detect rapid changes in gas pressure, oil pressure, or oil flow that are indicative of faults within the transformer equipment. Sudden pressure relays can rapidly detect transformer equipment faults that could remain undetected by other Protection Systems. In addition to detecting, certain sudden pressure relays can trip the associated transformer circuitry in response to fault conditions, therefore limiting the potential damage on the equipment.<sup>23</sup>

There are three main types of fault pressure relays included within this general class of sudden pressure relays – rapid gas pressure rise devices, rapid oil pressure rise devices, and rapid oil flow devices. Rapid gas pressure relays monitor the pressure in the space above the oil (or other liquid) within the transformer, and initiate tripping action in response to a rapid rise in gas pressure resulting from the expansion of the liquid caused by a fault. Similarly, rapid oil pressure devices have a sensor located in the liquid and monitor the pressure in the oil (or other

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<sup>23</sup> NERC Petition, Ex. F, *Supplementary Reference and FAQ Document* at 12-14.

liquid), and initiate tripping action when a fault causes a rapid pressure rise. Finally, rapid oil flow devices monitor the liquid flow between a transformer/reactor and its conservator. Normal liquid flow occurs continuously with ambient temperature changes and with internal heating from loading and does not operate the rapid oil flow device. When an internal arc occurs, a sudden expansion of liquid can be monitored as rapid liquid flow from the transformer into the conservator, which triggers the fault pressure relay.<sup>24</sup>

Because certain applications of sudden pressure relays have the potential to impact the Bulk-Power System, it is beneficial to reliability that those relays be included within the scope of PRC-005. As described below, the three types of fault pressure relays described in this section are included within the definition of “Sudden Pressure Relaying” associated with the proposed PRC-005-4.

## **B. Modifications in proposed Reliability Standard PRC-005-4**

As discussed below, certain parts of Reliability Standard PRC-005-3 have been modified in order to add the necessary Sudden Pressure Relaying to the PRC-005 Reliability Standard.

### **1. Definitions**

NERC developed one new and four revised definitions along with proposed PRC-005-4.<sup>25</sup> NERC proposes the following new definition to define the scope of what is included when “Sudden Pressure Relaying” is referenced within the proposed PRC-005-4 Reliability Standard:

**Sudden Pressure Relaying** – A system that trips an interrupting device(s) to isolate the equipment it is monitoring and includes the following Components:

- Fault pressure relay – a mechanical relay or device that detects rapid changes in gas pressure, oil pressure, or oil

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<sup>24</sup> *Id.*

<sup>25</sup> The definitions were posted in the draft PRC-005-4 Reliability Standard during the standards development process and will be implemented concurrently with the proposed Reliability Standard.

flow that are indicative of Faults within liquid-filled, wire-wound equipment

- Control circuitry associated with a fault pressure relay

This definition is intended only for use within the proposed Reliability Standard and will not, at this time, be listed in the NERC Glossary of Terms.<sup>26</sup> The term will be included within the posted Reliability Standard itself.<sup>27</sup> This definition reflects the SPCS Report recommendation and establishes that “Sudden Pressure Relaying” includes fault pressure relays and the associated control circuitry. The SPCS Report recommendation included both Component Types because a failure in either the fault pressure relay or the control circuitry may lead to an adverse reliability impact. For example, the control circuitry associated with a sudden pressure relay is the circuit which trips the breaker or other interrupting device. As noted above, the three main types of fault pressure relays – rapid gas pressure rise devices, rapid oil pressure rise devices, and rapid oil flow devices, are included within the scope of the definition of the proposed Reliability Standard.

In addition, the previously-approved defined terms “Protection System Maintenance Program”, “Component Type”, “Component”, and “Countable Event.” were revised to add the necessary reference to “Sudden Pressure Relaying” or the associated Table within the proposed Reliability Standard to facilitate coverage of Sudden Pressure Relaying Components within the PRC-005 Requirements. The revised definitions are as follows:

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<sup>26</sup> NERC acknowledges FERC’s statement in Order No. 793 that “NERC should not adopt inconsistent definitions for the same term.” *Protection System Maintenance Reliability Standard*, Order No. 793, 145 FERC ¶ 61,253 at P 70 (2013). Although this term will be posted along with the proposed Reliability Standard, NERC will not develop additional definitions of the same term approved for use in a particular Reliability Standard. If a future standards development project seeks to broaden the applicability of a standard-specific defined term, the defined term and where the term is posted (in the Reliability Standard or in the NERC Glossary of Terms) would need to be revisited through the standards development process.

<sup>27</sup> For clarity, NERC relocated the definitions specific to the PRC-005 Reliability Standard into a separate section in the posted version of the proposed Reliability Standard.



**Protection System Maintenance Program (PSMP)** — An ongoing program by which Protection System, Automatic Reclosing, and Sudden Pressure Relaying Components are kept in working order and proper operation of malfunctioning Components is restored. A maintenance program for a specific Component includes one or more of the following activities:

- **Verify** — Determine that the Component is functioning correctly.
- **Monitor** — Observe the routine in-service operation of the Component.
- **Test** — Apply signals to a Component to observe functional performance or output behavior, or to diagnose problems.
- **Inspect** — Examine for signs of Component failure, reduced performance or degradation.
- **Calibrate** — Adjust the operating threshold or measurement accuracy of a measuring element to meet the intended performance requirement.

**Component Type** –

- Any one of the five specific elements of a Protection System.
- Any one of the two specific elements of Automatic Reclosing.
- Any one of the two specific elements of Sudden Pressure Relaying.

**Component** –Any individual discrete piece of equipment included in a Protection System, Automatic Reclosing, or Sudden Pressure Relaying.

**Countable Event** – A failure of a Component requiring repair or replacement, any condition discovered during the maintenance activities in Tables 1-1 through 1-5, Table 3, Tables 4-1 through 4-2, and Table 5, which requires corrective action or a Protection System Misoperation attributed to hardware failure or calibration failure. Misoperations due to product design errors, software errors, relay settings different from specified settings, Protection System Component, Automatic Reclosing, or Sudden Pressure Relaying configuration or application errors are not included in Countable Events.

## **2. Applicability**

### **a) Changes for Sudden Pressure Relaying**

The specific locations for applicable Sudden Pressure Relaying are addressed in subsections 4.2.1, 4.2.5.2, 4.2.5.3, and 4.2.5.4, under the listing of covered “Facilities.” The PRC-005-4 *Supplementary Reference and FAQ* document depicts which Sudden Pressure Relaying applications are included in the scope of the proposed PRC-005-4 Reliability Standard. The Applicability, as detailed below, was recommended by the SPCS Report after a review of the use of a wide range of devices that respond to non-electrical quantities. SPCS concluded that the only applicable non-electrical sensing devices are sudden pressure relays utilized in a trip application.<sup>28</sup>

4.2.1 Protection Systems and Sudden Pressure Relaying that are installed for the purpose of detecting Faults on BES Elements (lines, buses, transformers, etc.)

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4.2.5 Protection Systems and Sudden Pressure Relaying for generator Facilities that are part of the BES, including:

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4.2.5.2 Protection Systems and Sudden Pressure Relaying for generator step-up transformers for generators that are part of the BES.

4.2.5.3 Protection Systems and Sudden Pressure Relaying for transformers connecting aggregated generation, where the aggregated generation is part of the BES (e.g., transformers connecting facilities such as wind-farms to the BES).

4.2.5.4 Protection Systems and Sudden Pressure Relaying for station service or excitation transformers connected to

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<sup>28</sup> See Exhibit F, *Supplementary Reference and FAQ*, at 12.

the generator bus of generators which are part of the BES, that act to trip the generator either directly or via lockout or tripping auxiliary relays.

The SPCS Report assessed Sudden Pressure Relaying for potential effects to Reliable Operation of the Bulk-Power System. The SPCS Report identified that non-electrical sensing devices that are utilized in a trip application can affect the reliability of the Bulk-Power System. The report concluded that these devices can quickly detect faults that could remain undetected by other Protection Systems and can trigger tripping of the equipment to limit potential damages.

Therefore, certain applications of Sudden Pressure Relaying are addressed in PRC-005-4 by explicitly including fault pressure relays and their associated circuitry in the list of applicable Facilities, in addition to the Protection Systems that already fall within the scope of the standard. Subsection 4.2.1 includes Sudden Pressure Relaying devices that are installed for the purpose of detecting Faults on Bulk-Electric System Elements. In addition, subsection 4.2.5 specifies that only Sudden Pressure Relaying for generator Facilities that are part of the Bulk-Electric System are included within the scope of the standard, and provides examples of such Facilities in subsections 4.2.5.2, 4.2.5.3, and 4.2.5.4.

In this context, the applicability of the proposed standard includes Sudden Pressure Relaying that detect faults on Bulk- Electric System Elements, and initiate tripping action to protect these Elements. The applicability extends only to Sudden Pressure Relaying that trips an interrupting device to isolate the equipment it is monitoring and protecting, and does not include other non-electrical sensing devices, pressure relays that only initiate an alarm, or pressure relief devices.<sup>29</sup>

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<sup>29</sup> *Id.* at 13.

## **b) Other Applicability Changes**

In addition to the changes to the Applicability for the addition of Sudden Pressure Relaying, the term “Special Protection Systems” in subsection 4.2.4 and 4.2.6.3 were replaced by the term “Remedial Action Schemes.”<sup>30</sup> These terms are currently synonymous in the NERC Glossary of Terms. This change is intended to align the proposed Reliability Standard with Project 2010-05.2 Phase 2 of Special Protection Systems where the standard drafting team has modified the definition of “Remedial Action Scheme” and begun the process of moving to employ the single term ‘Remedial Action Scheme’ in Reliability Standards in order to promote consistency.

Related to changes made in proposed PRC-005-3, the standard drafting team also revised section 4.2.6.1 and footnote 2 of the Applicability to address situations where Balancing Authorities participate in a Reserve Sharing Group.<sup>31</sup> The subsection now reads:

Automatic Reclosing applied on the terminals of Elements connected to the BES bus located at generating plant substations where the total installed gross generating plant capacity is greater than the gross capacity of the largest BES generating unit within the Balancing Authority Area or, if a member of a Reserve Sharing Group, the largest generating unit within the Reserve Sharing Group.

In these cases, a group of Balancing Authorities share reserves to cover any contingency within the boundaries of the group; therefore, generation loss within a Reserve Sharing Group would

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<sup>30</sup> Exhibit A at 35.

<sup>31</sup> “Reserve Sharing Group” is defined in the NERC Glossary of Terms as  
A group whose members consist of two or more Balancing Authorities that collectively maintain, allocate, and supply operating reserves required for each Balancing Authority’s use in recovering from contingencies within the group. Scheduling energy from an Adjacent Balancing Authority to aid recovery need not constitute reserve sharing provided the transaction is ramped in over a period the supplying party could reasonably be expected to load generation in (e.g., ten minutes). If the transaction is ramped in quicker (e.g., between zero and ten minutes) then, for the purposes of Disturbance Control Performance, the Areas become a Reserve Sharing Group.  
NERC Glossary of Terms at 74.

not impact reliability of the Bulk-Power System unless the aggregate capacity loss exceeds the largest generating unit within the Reserve Sharing Group. This change is consistent with the rationale described in the SPCS Report for basing applicability on the “largest unit in the Balancing Authority Area.”

### **3. Requirements in Reliability Standard PRC-005-4**

The proposed Reliability Standard consists of five Requirements. The Requirements and the associated Measures have been modified, as necessary, to add in the coverage of Sudden Pressure Relaying to the proposed Requirement language. As a result of the addition, Proposed Requirement R1 requires that Transmission Owners, Generator Owners, and Distribution Providers also establish a Protection System Maintenance Program for Sudden Pressure Relaying. Proposed Requirement R3 now requires Transmission Owners, Generator Owners, and Distribution Providers that utilize time-based maintenance programs to maintain Sudden Pressure Relaying. Proposed Requirement R4 now requires Transmission Owners, Generator Owners, and Distribution Providers that utilize performance-based maintenance programs to implement and follow a Protection System Maintenance Program for Protection Systems, Automatic Reclosing, and Sudden Pressure Relaying. Revisions to Requirements R2 and R5 were not necessary as each will apply in the same fashion in the proposed Reliability Standard PRC-005-4.

The proposed Reliability Standard also includes proposed Table 5, which describes the maintenance activities and intervals for Sudden Pressure Relaying. Once the SPCS identified the devices for inclusion in the proposed Reliability Standard, it conducted an informal industry survey to develop recommendations for minimum maintenance activities and maximum

maintenance intervals.<sup>32</sup> The SPCS survey received responses from seventy-five (75) Transmission Owners and one hundred nine (109) Generator Owners. Based on the survey, SPCS determined that the activities necessary for sudden pressure relay maintenance and testing are analogous to activities already performed during maintenance and testing of electromechanical protective relays.<sup>33</sup> The SPCS also determined that the maximum interval for time-based maintenance programs should be six years.<sup>34</sup>

To validate the information collected from the survey, the SPCS performed an additional step in the analysis and contacted the following entities for their feedback: the IEEE Power System Relaying Committee, the IEEE Transformer Committee, the Doble Transformer Committee, the North American Transmission Form System Protection Practices Group, and the Electric Power Research Institute Generator Owner/Operator Technical Focus Group. All of these industry organizations indicated the results of the SPCS survey are consistent with their respective experiences.<sup>35</sup>

### **C. Implementation Plan**

The Implementation Plan for proposed Reliability Standard PRC-005-4 addresses Protection Systems, Automatic Reclosing, and Sudden Pressure Relaying. PRC-005-2 has a twelve-year phased-in implementation period. The compliance dates for the various Requirements with respect to maintenance of Protection System and Automatic Reclosing Components in PRC-005-2 and PRC-005-3, respectively, key off of the date of approval of that specific version by an applicable regulatory authority. To account for this timing, and in order

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<sup>32</sup> *Id.* at 10.

<sup>33</sup> The maintenance of electromechanical protective relays is identified in Table 1-1: Protective Relay of PRC-005.

<sup>34</sup> *See* Table 1-1 of PRC-005-4, Exhibit A, p. 17. Table 5 of the proposed PRC-005-4 includes maintenance activities and intervals for Sudden Pressure Relaying. *See* Exhibit A at p. 37.

<sup>35</sup> *Id.* at p. 10.

not to lose time on maintenance activities completed prior to the approval of PRC-005-4, the standard drafting team has carried forward the language in the approved implementation plan for PRC-005-2 and proposed implementation plan for PRC-005-3, and modified the language to add compliance dates for the Requirements with respect to Sudden Pressure Relaying.

Because PRC-005-4 has carried the Requirements from PRC-005-2 forward, including language regarding implementation timing, there is no need for an entity to cite to the prior versions of the Reliability Standard during the phased-in implementation period once the proposed Reliability Standard is approved.<sup>36</sup> Additional aspects of the Implementation Plan are addressed below.

### **1. Retirement of Legacy Reliability Standards**

The Implementation Plan continues to reflect that the retirement of the legacy Reliability Standards will continue to key off of the applicable regulatory approval date of PRC-005-2. Because Sudden Pressure Relaying is a new Component covered by the PRC-005 Reliability Standard, the retirement of the legacy Reliability Standards does not need to correspond with the enforcement date of proposed PRC-005-4. Proposed PRC-005-4 will retire Reliability Standard PRC-005-3 “at midnight of the day immediately prior to the first day of the first calendar quarter following applicable regulatory approval of PRC-005-4, or as otherwise made effective pursuant to the laws applicable to such ERO governmental authorities; or, in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter from the date of Board of Trustees’ adoption.”

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<sup>36</sup> The same approach will be used with respect to Sudden Pressure Relaying. This will allow for the full retirement of PRC-005-3 and its Implementation Plan, leaving only one version of a new PRC-005 as the enforceable Reliability Standard rather than needing to reference versions 2 through 4 for the next twelve years.

## 2. Compliance Timeframes for Each Requirement

The Implementation Plan includes identical timeframes for entities to become compliant with the Requirements in PRC-005-4 as exist in the implementation plan for PRC-005-3.

Entities will continue to calculate compliance dates for Requirements in connection with any Sudden Pressure Relaying by counting forward from the applicable regulatory approval date of PRC-005-4.

### D. Evidence Retention Periods

In order to establish effective maintenance procedures to ensure Reliable Operation of the Bulk-Power System, the standard drafting team established evidence retention periods associated with the proposed PRC-005-4. The retention periods are shorter than the ones required by the preceding versions of this Reliability Standard and reflect FERC's concern expressed in the NOPR related to PRC-005-3. In the NOPR, FERC noted that the data retention requirement for PRC-005-2 and PRC-005-3 could extend to 24 years (two 12-year maintenance cycles) and exceeds the three-year period that is routinely allowed for regulations requiring record retention.<sup>37</sup> FERC sought comment regarding the reasonableness of the data retention obligations established by PRC-005-2 and PRC-005-3.<sup>38</sup>

In response to the NOPR, NERC consulted with compliance staff and determined that there is not a substantial need to maintain records for two maintenance cycles. Through the standards development process, NERC made the appropriate changes to the required evidence retention periods. The compliance section of the proposed PRC-005-4 now requires Transmission Owners, Generator Owners, and Distribution Providers to keep documentation of the most recent performance of maintenance activity for the relevant Component in cases where the interval of the

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<sup>37</sup> PRC-005-3 NOPR at P 33.

<sup>38</sup> *Id.* at P 39.



maintenance activity is longer than the audit cycle. In cases where the interval of the maintenance activity is shorter than the audit cycle, documentation of all performances of the maintenance activity for the Component since the previous scheduled audit date must be retained.<sup>39</sup>

**E. Enforceability of Proposed Reliability Standard PRC-005-4**

The proposed Reliability Standard includes corresponding changes, where necessary, to the VRFs and VSLs to align with the changes to the Requirements in proposed PRC-005-4. The VRFs and VSLs for the proposed Reliability Standard comport with NERC and FERC guidelines related to their assignment. A detailed review of the VRFs, the VSLs, and the analysis of how the VRFs and VSLs were determined using these guidelines is provided in Exhibit G.

Because the Requirements contained in proposed Reliability Standard PRC-005-4 track with those contained in the previous versions, the standard drafting team determined that no revisions were necessary to the VRFs for the proposed Reliability Standard.<sup>40</sup> The VRFs apply to the Sudden Pressure Relaying Components now included in the proposed Reliability Standard.

The VSLs in PRC-005-3 have been revised accordingly to add the additional Component into the levels of severity. The changes are consistent with the approach taken for the VSLs in Reliability Standard PRC-005-3. The VSLs provide guidance on the way that NERC will enforce the Requirements of the proposed Reliability Standard for each of the Component Types.

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<sup>39</sup> See Exhibit A, Compliance Section.

<sup>40</sup> The VSL change associated with PRC-005-2, as directed by FERC, were reflected in PRC-005-3, and are included in the proposed PRC-005-4.

Respectfully submitted,

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**EXHIBITS A—B and D – I**

(Available on the NERC Website at

<http://www.nerc.com/FilingsOrders/ca/Canadian%20Filings%20and%20Orders%20DL/PRC-005-4%20exhibits.pdf>)

**Exhibit C — Reliability Standards Criteria — Proposed Reliability Standard PRC-005-4**

**Reliability Standards Criteria**

In The discussion 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 PRC-005-4 is to document and implement programs for the maintenance of all Protection Systems, Automatic Reclosing, and Sudden Pressure Relaying affecting the reliability of the Bulk Electric System so that they are kept in working order. The revised Reliability Standard requires that entities develop an appropriate Protection System Maintenance Program, that they implement their program, and that, in the event they are unable to restore Sudden Pressure Relaying Components to proper working order while performing maintenance, they initiate the follow-up activities necessary to resolve those maintenance issues. Proposed PRC-005-4 adds detailed tables of minimum maintenance activities and maximum maintenance intervals for Sudden Pressure Relaying to PRC-005-2 and to the proposed PRC-005-3 Reliability Standards, extending the benefits of a strong maintenance program to these Components. The Sudden Pressure Relaying devices included in the proposed PRC-005-4 are based on the findings of the SPCS Report and Supplemental Report included as **Exhibit D and E**. The proposed Reliability Standard is also designed to fulfill FERC's concern in Order No. 758 regarding the addition of certain devices that respond to non-electrical quantities to the requirements of PRC-005 Reliability Standard.

**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. Aside from minor modifications to facilitate coverage of Sudden Pressure Relaying in the Reliability Standard, the Requirements in PRC-005-2, and the Requirements in PRC-005-3 currently under review, are unchanged. The proposed Reliability Standard applies to Generator Owners, Transmission Owners, and Distribution Providers and clearly articulates the actions that each entity must take to comply with the proposed Reliability Standard.

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

Because the Requirements contained in proposed Reliability Standard PRC-005-4 have not changed compared to those contained in Reliability Standard PRC-005-2 and in the proposed PRC-005-3, the Standard Drafting Team determined that no revisions were necessary to the VRFs for the proposed Reliability Standard. The VRFs apply to the additional Sudden Pressure Relaying Components now included in the proposed Reliability Standard.

The VSLs in PRC-005-2 and PRC-005-3 have been revised accordingly to add the additional Component into the levels of severity. The changes are consistent with the approach taken for the VSLs in the previous versions of Reliability Standard PRC-005.

**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 continues to include Measures that support the Requirements by clearly identifying what is required and how the Requirement will be enforced.

The Measures have been slightly modified to include Sudden Pressure Relaying references where necessary. The proposed Measures are as follows:

**M1.** Each Transmission Owner, Generator Owner and Distribution Provider shall have a documented Protection System Maintenance Program in accordance with Requirement R1.

For each Protection System, Automatic Reclosing, and Sudden Pressure Relaying Component Type, the documentation shall include the type of maintenance method applied (time-based, performance-based, or a combination of these maintenance methods), and shall include all batteries associated with the station dc supply Component Types in a time-based program as described in Table 1-4 and Table 3. (Part 1.1)

For Component Types that use monitoring to extend the maintenance intervals, the responsible entity(s) shall have evidence for each Protection System, Automatic Reclosing, and Sudden Pressure Relaying Component Type (such as manufacturer's specifications or engineering drawings) of the appropriate monitored Component attributes as specified in Tables 1-1 through 1-5, Table 2, Table 3, Table 4-1 through 4-2, and Table 5. (Part 1.2)

**M2.** Each Transmission Owner, Generator Owner, and Distribution Provider that uses performance-based maintenance intervals shall have evidence that its current performance-based maintenance program(s) is in accordance with Requirement R2, which may include, but is not limited to, Component lists, dated maintenance records, and dated analysis records and results.

**M3.** Each Transmission Owner, Generator Owner, and Distribution Provider that utilizes time-based maintenance program(s) shall have evidence that it has maintained its Protection System, Automatic Reclosing, and Sudden Pressure Relaying Components included within its time-based program in accordance with Requirement R3. The evidence may include, but is not limited to, dated maintenance records, dated maintenance summaries, dated check-off lists, dated inspection records, or dated work orders.

**M4.** Each Transmission Owner, Generator Owner, and Distribution Provider that utilizes performance-based maintenance intervals in accordance with Requirement R2 shall have evidence that it has implemented the Protection System Maintenance Program for the Protection System, Automatic Reclosing, and Sudden Pressure Relaying Components included in its performance-based program in accordance with Requirement R4. The evidence may include, but is not limited to, dated maintenance records, dated maintenance summaries, dated check-off lists, dated inspection records, or dated work orders.

**M5.** Each Transmission Owner, Generator Owner, and Distribution Provider shall have evidence that it has undertaken efforts to correct identified Unresolved Maintenance

Issues in accordance with Requirement R5. The evidence may include, but is not limited to, work orders, replacement Component orders, invoices, project schedules with completed milestones, return material authorizations (RMAs) or purchase orders.

These Measures 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 Reliability Standard includes certain Sudden Pressure Relaying devices as explained in the filing and reflected in the Applicability section of the proposed Reliability Standard. NERC engaged the System Protection and Control Subcommittee (“SPCS”), a subcommittee of the NERC Planning Committee, to support the Project 2007-17-3 Standard Drafting Team assigned to modify PRC-005-3. The SPCS Report and Supplemental Report (**Exhibit D and E**) recommend including sudden pressure relays that are utilized in a trip application and may affect the Reliable Operation of the Bulk-Power System within the scope of PRC-005. These specific sudden pressure relays have been included in the Applicability section of PRC-005-3 to address FERC Order No. 758. By engaging the NERC technical subcommittee of the Planning Committee in the analysis to determine which specific sudden pressure relays should be included, the proposed Reliability Standard does not over-include devices that do not affect reliability. Engaging the technical committee in this analysis assisted the Standard

Drafting Team in reaching the most efficient and effective determination regarding the Applicability inclusions in the proposed Reliability Standard.

- 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. In addition to satisfying FERC reliability concerns, the revisions contained in the proposed Reliability Standard require expanded application of maintenance plans and processes, helping to preserve reliability by addressing potential issues before they impact reliability. The Sudden Pressure Relaying devices included in the proposed Reliability Standard also reflect the detailed studies by NERC’s technical subcommittee, as noted above and in the filing. NERC staff also conducted an informal industry survey to develop recommendations for minimum maintenance activities and maximum maintenance intervals associated with Sudden Pressure Relaying. Lastly, to validate the information collected from the survey, the SPCS contacted several industry organizations, which indicated the results of the SPCS industry survey were consistent with their respective experiences.

- 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.**

Proposed Reliability Standard PRC-005-4 has no undue negative effect on competition.

The proposed Reliability Standard requires the same performance by each of the applicable Functional Entities—Generator Owners, Transmission Owners, and Distribution Providers—in requiring the development of maintenance plans for Sudden Pressure Relaying.

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 dates for the proposed Reliability Standard are just and reasonable and appropriately balance 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. This will allow applicable entities adequate time to ensure compliance with the Requirements. The proposed effective dates are explained in the proposed Implementation Plan, attached as **Exhibit B**. Except for the addition of certain Sudden Pressure Relaying devices, the Implementation Plan remains unchanged from the prior versions of this Reliability Standard. The same timeframes for compliance with the Requirements will apply counting forward from the effective date of an order approving proposed PRC-005-4, or as otherwise provided in the Implementation Plan.

**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 H** 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, multiple 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. The initial and recirculation ballots both achieved a quorum and exceeded the required ballot pool approval levels.

**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 and reasonable were identified.