

**UNITED STATES OF AMERICA  
BEFORE THE  
FEDERAL ENERGY REGULATORY COMMISSION**

Coordination of Protection Systems for )  
Performance During Faults and Specific Training ) Docket No. RM16-22-000  
for Personnel Reliability Standards )

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

The North American Electric Reliability Corporation (“NERC”) provides comments on the Federal Energy Regulatory Commission’s (“FERC” or the “Commission”) Notice of Proposed Rulemaking (“NOPR”) proposing to approve: (1) Reliability Standards PRC-027-1 (Coordination of Protection Systems for Performance During Faults) and PER-006-1 (Specific Training for Personnel); and (2) the retirement of Reliability Standard PRC-001-1.1(ii).<sup>1</sup> NERC supports the Commission’s proposal to approve the proposed Reliability Standards.

The proposed Reliability Standards improve upon currently-effective Reliability Standard PRC-001-1.1(ii) in addressing the coordination of Protection Systems. The proposed Reliability Standards would more effectively accomplish the reliability goals of ensuring that appropriate personnel are trained on Protection Systems and that Protection System settings are appropriately studied, coordinated, and monitored. As discussed in the NOPR, proposed Reliability Standard PRC-027-1 improves upon Reliability Standard PRC-001-1.1(ii) “by (1) modifying the applicability section to include the appropriate functional entity types with the responsibilities, resources, and skill sets to the studies required to coordinate protection systems, and (2) listing the protection system functions on all bulk electric system [(“BES”)] elements that require

---

<sup>1</sup> Notice of Proposed Rulemaking, *Coordination of Protection Systems for Performance During Faults and Specific Training for Personnel Reliability Standards*, 161 FERC ¶ 61,159, Docket No. RM16-22 (2017).

coordination. Proposed Reliability Standard PER-006-1, along with existing formal training requirements in the PER group of Reliability Standards, also improves upon Reliability Standard PRC-001-1.1(ii), Requirement R1 by ensuring that the necessary personnel are familiar with and understand the purpose and limitations of protection systems schemes while providing more precise and auditable requirements.”<sup>2</sup>

In the NOPR, the Commission “proposes to direct NERC to modify proposed Reliability Standard PRC-027-1 to require an initial protection system coordination study to ensure that applicable entities will perform (or have performed), as a baseline, a study demonstrating proper coordination of its protection systems.”<sup>3</sup> The Commission also sought comment on the technical basis for using a 15 percent deviation threshold in proposed Reliability Standard PRC-027-1, Requirement R2, Option 2.<sup>4</sup>

As discussed below, the proposed directive is not necessary to ensure reliable operation of the BES and would impose a significant burden on entities without a proportional reliability benefit. Further, for the reasons discussed in NERC’s Petition, it is appropriate to use a 15 percent deviation threshold in proposed Reliability Standard PRC-027-1, Requirement R2, Option 2 as it provides a sufficient margin for determining when a new coordination study is necessary.<sup>5</sup>

---

<sup>2</sup> NOPR at P 12.

<sup>3</sup> *Id.* at P 1.

<sup>4</sup> *Id.* at P 25.

<sup>5</sup> *Petition of NERC for Approval of Proposed Reliability Standards PRC-027-1 and PER-006-1 and Retirement of PRC-001-1.1(ii)*, at 36-37, Docket No. RM16-22-000 (Sep. 2, 2016) (“Petition”).

# 1. The Proposed Directive is Not Necessary to Ensure Reliable Operation of the BES and Would Impose a Significant Burden on Registered Entities

## a. Proposed Directive

As discussed in the Petition, proposed Reliability Standard PRC-027-1 is designed to improve upon and replace Requirements R3 and R4 of PRC-001-1.1(ii) in addressing the coordination of Protection Systems installed to detect and isolate Faults on the BES.<sup>6</sup> Proposed Reliability Standard PRC-027-1 provides a clear set of Requirements that require entities to: (1) implement a process for establishing and coordinating new or revised Protection System settings; and (2) periodically study Protection System settings that could be affected by incremental changes in Fault current to ensure the Protection Systems continue to operate in their intended sequence during Faults.<sup>7</sup> Specifically, proposed Reliability Standard PRC-027-1 consists of the following three requirements:

- *Requirement R1* mandates that each Transmission Owner, Generator Owner, and Distribution Provider establish a process for developing new and revised Protection System settings for BES Elements to operate in the intended sequence during Faults. The process must include provisions for coordinating those settings with owners of electrically joined facilities.
- *Requirement R2* mandates that, for each BES Element with a Protection System that could be affected by changes in Fault current, applicable entities must determine every six years whether the Protection System settings continue to be appropriate by: (1) performing a Protection System Coordination Study (Option 1); (2) first evaluating whether there were any changes in Fault current that could affect the coordination of Protection System and, if so, performing a Protection System Coordination Study (Option 2); or (3) a combination of the above two options (Option 3).<sup>8</sup>
- *Requirement R3* requires applicable entities to implement the process established according to Requirement R1 for developing new or revised Protection System settings.<sup>9</sup>

---

<sup>6</sup> *Id.* at 26-42.

<sup>7</sup> *Id.* at 26.

<sup>8</sup> The proposed definition for the term Protection System Coordination Study is “[a]n analysis to determine whether Protection Systems operate in the intended sequence during Faults.” *Id.*, Exh. A-3, Proposed Definitions.

<sup>9</sup> *Id.* at 27.

In the NOPR, the Commission expressed concern that proposed Reliability Standard PRC-027-1 does not require entities to perform an initial, or baseline, Protection System Coordination Study for every BES Element with a Protection System. The Commission stated:

Proposed Reliability Standard PRC-027-1, Requirement R2 does not require an initial protection system coordination study if an applicable entity elects Option 2. Unlike Option 1, which requires performance of protection system coordination studies every six years, Option 2 requires applicable entities to '[c]ompare present Fault current values to an established Fault current baseline and perform a Protection System Coordination Study when the comparison identifies a 15 percent or greater deviation.<sup>10</sup>

The Commission further noted that the initial fault current baseline may be established through the use of short-circuit studies instead of a full Protection System Coordination Study. The Commission stated that short-circuit studies do not provide a sufficient level of protection system coordination as they do not involve a full Protection System Coordination Study.<sup>11</sup>

To address its concern, the Commission proposes to direct that NERC modify proposed Reliability Standard PRC-027-1 to require applicable entities to perform an initial Protection System Coordination study for every BES Element with a Protection System within six years of the effective date of the proposed Reliability Standard. The proposed directive would apply to every existing Protection System, regardless of the Protection System's size, location, impact to the BES, or whether it is associated with tie-lines or internal lines.

b. NERC Comments

NERC appreciates the Commission's concern and recognizes that the proposed directive could potentially help reduce misoperations caused by coordination issues. It would also impose a significant burden on industry, however, requiring a substantial expenditure of resources. As

---

<sup>10</sup> NOPR at P 15.

<sup>11</sup> *Id.* at P 16

discussed in the Petition, performing Protection System Coordination Studies for every BES Element with Protection Systems is a resource intensive activity.<sup>12</sup> These studies require engineers to review Protection Systems at a number of substations to evaluate the coordination between the Protection Systems. This review includes performing fault simulations, creating impedance plots with relay characteristics, and time-overcurrent curve reviews. For entities with many BES Elements with Protection System functions, significant time and personnel must be devoted to conducting Protection Systems Coordination Studies and preparing the necessary documentation to demonstrate compliance.

Proposed Reliability Standard PRC-027-1 is appropriately designed to ensure the prudent use of industry resources, balancing the need to study existing Protection Systems with the resource needs of the electric industry. As discussed in the Petition, any changes to BES Elements that require changes to Protection System settings will be addressed in the Requirement R1 process and implemented pursuant to Requirement R3. These requirements require a full Protection System Coordination Study. Requirement R2 provides assurance that entities confirm coordination periodically where no change to a BES Element would have otherwise addressed changes to Protection System settings under Requirements R1 and R3. NERC expects that many entities will choose to do a full Protection System Coordination Study under Requirement R2 for their more impactful BES Elements, including those that interconnect with neighboring entities, to confirm that the systems will operate in the intended sequence during Faults. For less impactful BES Elements or for those BES Elements more recently studied, Requirement R2 provides entities the flexibility to perform a Fault current comparison prior to expending resources to perform a full Protection System Coordination Study.

---

<sup>12</sup> Petition at 40-41.

NERC and the standard drafting team concluded that Protection System coordination did not present a prevalent enough risk to the reliable operation of the BES to warrant imposing the burden of requiring applicable entities to perform a full Protection System Coordination Study for every BES Element with a Protection System. Based on the experience of its members, the standard drafting team maintained that it is highly likely that the overwhelming majority of entities have already conducted coordination studies for their Protection Systems to ensure that those Protection Systems operate in their intended sequence during Faults. The standard drafting team concluded that industry resources should be more focused on ensuring the coordination of new or modified Protection Systems.

Additionally, as discussed in the Petition, from 2012 through 2015, only 11% of “Incorrect Setting” misoperation events (17 events out of 151) and only 2.9% of total events (17 events out of 574) involved Protection System coordination issues.<sup>13</sup> Further, as discussed in the 2016 and 2017 State of Reliability reports, the Protection System misoperation rate across the North American Bulk Power System continues to decline. The 2017 State of Reliability Report provides that “[t]he overall NERC misoperation rate is lower in 2016 than last year (8.7 percent, down from 9.5 percent), continuing a four-year trend of declining rates across North America.”<sup>14</sup> These numbers show that miscoordination of existing Protection Systems does not present a widespread risk to BES reliability that would necessitate the expenditure of resources required to conduct full Protection System Coordination Studies for every BES Element with a Protection System.

To support its proposed directive, the Commission points to past misoperations and outages involving Protection System coordination issues and NERC reports addressing Protection System

---

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

<sup>14</sup> 2017 State of Reliability Report at 1, [http://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/SOR\\_2017\\_MASTER\\_20170613.pdf](http://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/SOR_2017_MASTER_20170613.pdf).

misoperations. As discussed below, while these events and reports highlight the need to continue focusing on reducing Protection System misoperation rates on the BES (from coordination issues or otherwise), they do not indicate that the reliability benefit from the proposed directive is necessary to ensure reliable operation of the BES and outweighs the burden it would impose on applicable entities.

The Commission first cites the Arizona Southern California September 8, 2011 Outage Report (“2011 Outage Report”), which identified an instance where a lack of coordination contributed to an event.<sup>15</sup> While the Outage Report demonstrates the importance of coordination in limiting the scope of events, each of the coordination issues discussed in the 2011 Outage Report related to Remedial Action Schemes (“RAS”). Proposed Reliability Standard PRC-027-1 does not cover RAS coordination. The proposed directive would therefore not address the type of coordination issues that contributed to the 2011 outage.<sup>16</sup> Further, the primary issue in that event related to relay loadability, not coordination. Since the 2011 blackout, there have been no significant system disturbances caused by coordination issues and, as noted above, only 2.9% of total events from 2012-2015 involved Protection System coordination issues.

The Commission then discusses the NERC System Protection Control Task Force’s 2006 assessment of Reliability Standard PRC-001, which, as the NOPR states, included a recommendation that the Reliability Standard should be modified “to require coordination of all existing protective systems.”<sup>17</sup> The recommendation, however, did not go so far as to require a

---

<sup>15</sup> NOPR at P 17.

<sup>16</sup> RAS are addressed in Reliability Standard PRC-012-2, which was recently approved by the Commission in Order No. 837. *Remedial Action Schemes Reliability Standard*, 160 FERC ¶ 61,071 (2017).

<sup>17</sup> NERC SPCTF Assessment of Standard PRC-001-0 – System Protection Coordination 4 (2006), [http://www.nerc.com/comm/PC/System%20Protection%20and%20Control%20Subcommittee%20SPCS%20DL/PRC\\_001\\_Report\\_approved\\_by\\_PC\\_2.pdf](http://www.nerc.com/comm/PC/System%20Protection%20and%20Control%20Subcommittee%20SPCS%20DL/PRC_001_Report_approved_by_PC_2.pdf).

coordination study of all existing Protection Systems within six years, as proposed by the Commission. Further, the Protection Control Task Force's 2006 assessment was specific to the generation transmission interface, not all BES Elements with Protection Systems. Consistent with the recommendation, however, and in contrast to the PRC-001 Reliability Standard, proposed Reliability Standard PRC-027-1 covers new and modified Protection Systems and existing Protection Systems, consistent with the task force's recommendation. For the reasons stated above, proposed Reliability Standard PRC-027-1 does not require a full Protection System Coordination Study for every Protection System. The proposed standard allows for a different approach to accomplish the objective of ensuring the coordination of Protection Systems, providing entities flexibility to use their resources where most needed to ensure reliable BES operations.

The Commission next points to a 2009 letter from the NERC President to the NERC Board of Trustees identifying generation and transmission miscoordination as responsible for 30 percent of the misoperations that occurred between 2005 and 2008.<sup>18</sup> As discussed above, however, more recent event analysis data from 2012-2015 indicates that coordination issues are responsible for a significantly less percentage of misoperations and have not caused any recent significant system disturbances. In light of this newer data, requiring entities to study every BES Element with a Protection System may not be necessary. This letter was also drafted prior to the effective date of the PRC-004 Reliability Standard, which requires entities to identify and correct the causes of misoperations of Protection Systems to help prevent future misoperations. NERC expects the PRC-004 Reliability Standard to have a significant impact on reducing misoperation rates. As discussed

---

<sup>18</sup> NOPR at P 19.



in the 2017 State of Reliability Report, the Protection System misoperation rate continues to decline, continuing a four-year trend of declining rates across North America.<sup>19</sup>

The Commission also cites the 2013 Misoperation Report prepared by NERC's Protection System Misoperation Task Force.<sup>20</sup> That report discussed ways to reduce future misoperations, including misoperations caused by incorrect settings from, among other things, coordination issues. NERC continues to maintain that reducing misoperations, whether caused by coordination issues or otherwise, is an important priority for BES reliability. As most recently stated in the 2017 State of Reliability Report, while misoperation rates continued to decline, misoperations remain a priority for NERC.<sup>21</sup> Nothing in this report, however, indicates that requiring Protection System Coordination Studies for every BES Element with a Protection System is the only or optimal way to reduce future misoperations due to coordination issues. The report was also issued prior to evaluating the impact of the mitigation requirements in the PRC-004 Reliability Standard. Proposed Reliability Standard PRC-027-1 will help improve Protection System coordination while prudently using electric industry resources.

---

<sup>19</sup> 2017 State of Reliability Report at 1-2.

<sup>20</sup> NOPR at P 20.

<sup>21</sup> 2017 State of Reliability Report at 1. The 2017 State of Reliability Report (at 2) outlines the following three recommendations for reducing misoperations:

1. Identify protection system misoperations as a primary focus for industry: Protection system misoperations should remain an area of focus as it continues to be one of the largest contributors to the severity of transmission outages.
2. Expand seminars on protection misoperations topic: Continue with and expand upon Regional efforts on education, outreach, and training with industry and stakeholders to reduce protection system misoperations and continue the downward trend.
3. Form partnerships to broaden message on misoperations: Continue collaboration with the North American Transmission Forum, vendors, manufacturers, and others to understand, mitigate, and reduce the protection system misoperation rate and impact on the BES. Seek new venues for understanding the challenges associated with the top causes of misoperations and broaden data sharing and information outreach where possible.

The Commission next cites a 2014 NERC “lessons learned” document on “Generation Relaying – Underfrequency Protection Coordination,” which discusses a 2014 incident where underfrequency relay trip settings were installed on the system unnecessarily and were not coordinated with a generator’s relay trip setting.<sup>22</sup> The Commission’s proposed directive, however, would not address the coordination issue discussed in the “lessons learned” document. As discussed in the Petition, proposed Reliability Standard PRC-027-1 applies only to coordination of Protection Systems associated with Fault clearing. Aspects of protection coordination other than Fault coordination are addressed in other Reliability Standards, such as over/under frequency, over/under voltage, coordination of generating unit or plant voltage regulating controls, and relay loadability. Generator performance during declined frequency and voltage excursions is addressed in the PRC-024 Reliability Standard.

The Commission also references the 2016 State of Reliability Report,<sup>23</sup> which noted the correlation between Protection System misoperations and transmission outages. Like the other reports the Commission references in the NOPR, the 2016 State of Reliability Report highlights the continued need to focus on reducing misoperations, whether caused by coordination issues or otherwise. Nothing in the report, however, indicates there is a need to require entities to perform a Protection System Coordination Study for every BES Element with a protection system. As discussed above, proposed Reliability Standard PRC-027-1 strikes the appropriate balance between the reliability need to ensure Protection Systems are coordinated and the resource needs of the electric industry.

---

<sup>22</sup> NOPR at P 21.

<sup>23</sup> *Id.* at P 22.

The Commission also notes that the 2016 State of Reliability Report identified that “[t]he ERCOT System Protection Working Group analyzed misoperations within the [Texas Reliability Entity (“Texas RE”)] Region and found that over 40 percent of the incorrect settings/logic/design misoperations were due to miss coordination of ground overcurrent settings.”<sup>24</sup> The 2016 State of Reliability Report also indicated that Texas RE had a 4-year misoperation rate (from the fourth quarter of 2012 to the third quarter of 2015) of 7.9 percent, the second lowest misoperation rate of all Regional Entities.<sup>25</sup> As discussed in the 2017 State of Reliability Report, Texas RE and ERCOT took mitigating action to address this issue that led to the reduction in misoperations caused by Incorrect Settings, Logic, and Design Errors.<sup>26</sup> The 2017 State of Reliability Report shows that Texas RE’s 4-year misoperation rates dropped to 7.2 percent, with a rate of 5.7 percent in year four (from the third quarter of 2015 to the third quarter of 2016). This continued improvement highlights the need to balance the reliability benefit of mandating that entities perform Protection System Coordination Studies for every BES Element with a Protection System and industry resources.

For these reasons, the Commission should not issue the proposed directive, finding that requiring a full Protection System Coordination Study for every BES Element with a Protection System is not necessary to ensure the reliable operation of the BES and would impose a significant burden on entities without a proportional reliability benefit.

Should the Commission find otherwise, however, it should consider modifying the proposed directive in the following fundamental respects to create a more risk-based approach:

1. Limit the directive to higher risk Protection Systems (e.g., those that are associated with major transmission lines and tie lines) and provide NERC, working with its stakeholders

---

<sup>24</sup> 2016 State of Reliability Report at 166.

<sup>25</sup> *Id.*

<sup>26</sup> 2017 State of Reliability Report at 177.

through its standards development processes, the flexibility to determine the appropriate thresholds. Limiting the directive in this manner will help ensure that applicable entities can focus their resources on the more impactful Protection Systems.

2. Provide NERC the flexibility to determine the appropriate implementation period for performing the studies. The six-year timeframe in the proposed Reliability Standard was based on the flexibility provided in Option 2 of Requirement R2. Should the Commission require Protection System Coordination Studies for every Protection System (or the overwhelming majority of Protection Systems), six years may not be a sufficient period.

As proposed in the NOPR, the Commission should also state in any final rule in this proceeding that applicable entities could use pre-existing Protection System Coordination Studies to satisfy the requirement, provided the entity could demonstrate that the study remains valid.

## **2. The 15 Percent Deviation Threshold in Proposed Reliability Standard PRC-027-1, Requirement R2, Option 2 is Appropriate**

As noted above, Requirement R2 mandates that, for each BES Element with a Protection System that could be affected by changes in Fault current, applicable entities must determine every six years whether the Protection System settings continue to be appropriate by: (1) performing a Protection System Coordination Study (Option 1); (2) first evaluating whether there were any changes in Fault current that could affect the coordination of a Protection System and, if so, performing a Protection System Coordination Study (Option 2); or (3) a combination of the above two options (Option 3). Under Option 2, an entity must perform a Protection System Coordination Study if the Fault current changes by 15 percent or more.

As discussed in the Petition, NERC proposes a 15 percent deviation threshold for determining whether a Protection System Coordination Study is required under Option 2 based on generally-accepted margins for setting Protection Systems in which incremental Fault current changes would not interfere with coordination. Accepted engineering practices require entities to consider proper margins while setting relays. Those margins are based on measurement errors, possible errors in fault studies, or unknown system configuration changes that can occur during

system disturbances or short-term operating conditions. Margins are used to help ensure that the Protection Systems operate as designed during any Fault condition and that relatively small (up to 15 percent) changes in Fault current do not interfere with that coordination. The 15 percent maximum deviation provides an entity with latitude, however, to choose a Fault current deviation threshold that is less than 15 percent to better match its protection philosophy or other business considerations without creating undue risk to reliability.

### **3. Conclusion**

NERC respectfully requests that the Commission consider these comments and approve proposed Reliability Standards PRC-027-1 and PER-006-1 without modification.

Respectfully submitted,

*/s/ Shamai Elstein*

Shamai Elstein  
Senior Counsel  
North American Electric Reliability Corporation  
1325 G Street, N.W., Suite 600  
Washington, D.C. 20005  
(202) 400-3000  
shamai.elstein@nerc.net

*Counsel for the North American Electric Reliability  
Corporation*

Date: January 29, 2018