

EEI is the association that represents all U.S. investor-owned electric companies. Our members provide electricity for about 220 million Americans, and operate in all 50 states and the District of Columbia. As a whole, the electric power industry supports more than 7 million jobs in communities across the United States. EEI's members are committed to providing affordable and reliable electricity to customers now and in the future. EEI's diverse membership includes Planning Coordinators, Transmission Planners and Owners, and Generator Owners that will be subject to the mandatory Reliability Standard TPL-007-2 (Transmission System Planned Performance for Geomagnetic Disturbance Events) developed by NERC. Accordingly, EEI members are directly affected by the NOPR.

ELCON is the national association representing large industrial consumers of electricity. ELCON member companies produce a wide range of products from virtually every segment of the manufacturing community. ELCON members operate hundreds of major facilities and are consumers of electricity in the footprints of all organized markets and other regions throughout the United States. ELCON represents NERC-registered manufacturing facilities; but most ELCON members are not NERC-registered. Reliable electricity supply is essential to our members' operations, but not at any cost. Accordingly, ELCON members are directly affected by the NOPR.

LPPC is an association of the 26 largest state-owned and municipal utilities in the nation and represents the larger, asset-owning members of the public power sector. LPPC members are also members of APPA and own approximately 90% of the transmission assets owned by non-federal public power entities. LPPC members are located throughout the nation, both within and outside RTO boundaries, and they are subject to the Commission's electric reliability authority under Federal Power Act ("FPA") section 215.

NRECA is the national service organization for the nation's member-owned, not-for-profit electric cooperatives. More than 900 rural electric cooperatives are responsible for keeping the lights on for more than 42 million people across 47 states. Because of their critical role in providing affordable, reliable, and universally accessible electric service, electric cooperatives are vital to the economic health of the communities they serve. Cooperatives serve 56% of the nation's land area, 88% of all counties, and 12% of the nation's electric customers, while accounting for approximately 11% of all electric energy sold in the United States. NRECA's member cooperatives include entities that will be subject to the mandatory Reliability Standard proposed in this proceeding. Accordingly, NRECA members are directly affected by the NOPR.

As discussed herein, the Trades encourage the Commission to approve TPL-007-2 as well as the associated violation risk factors, violation severity levels, and implementation plan without directing further modifications. We do not support the Commission's proposed directives to further modify TPL-007-2 at this time because the industry needs to gain experience modeling wide-area impacts of GMD events and mitigating benchmark GMD vulnerabilities before focusing on localized impacts.

II. COMMENTS

In Order No. 830, the Commission approved TPL-007-1 but also directed NERC to revise the benchmark GMD event definition so that it is "not based solely on spatially-averaged data," require the collection of necessary geomagnetically induced current ("GIC") data, and set deadlines for applicable entities to complete and implement their corrective action plans.² Also, to facilitate the "additional research and analysis" that is necessary to adequately address GMD

² *Reliability Standard for Transmission System Planned Performance for Geomagnetic Disturbance Events*, Order No. 830, 156 FERC ¶ 61,215 (2016), reh'g denied, 158 FERC ¶ 61,041 (2017).

threats, the Commission directed NERC to develop, submit, and implement a GMD Research Work Plan that addresses specific research areas.³ On May 30, 2017 NERC filed the GMD Research Work Plan for Commission review and the Commission accepted the plan on October 19, 2017. On January 22, 2018, NERC filed the proposed TPL-007-2 for approval by the Commission. NERC filed a revised GMD Research Work Plan on April 19, 2018, and the Commission issued the NOPR for TPL-007-2 on May 17, 2018.

In the NOPR, the Commission proposes to approve TPL-007-2 and direct NERC to modify the standard to require the development and implementation of corrective action plans to mitigate vulnerabilities identified by the supplemental GMD event vulnerability assessments.⁴ In addition, the Commission seeks comment on two options it is considering on Requirement R7, Part 7.4, which allows applicable entities to revise their corrective action plans if situations beyond their control prevent implementation under the timeframe provided by Requirement R7, Part 7.3.⁵ For both of the options the Commission proposes to direct NERC to report “how often and why applicable entities are exceeding” their corrective action plan deadlines.⁶

The Trades support the Commission’s proposal to approve TPL-007-2 because it is a technically feasible and reasonable approach to enhancing the reliability of the BPS. The science surrounding the impacts of GMD events on the BPS is still in the earliest stages of research, and the current tools available for use by the industry have not yet been tested and optimized for wide-area impacts of these events. It is for this reason that spatial averaging to characterize wide-area geomagnetic phenomena was so important in the NERC standard drafting team’s approach to identifying and addressing GMD event impacts. Time is needed for NERC, the

³ *Id.* at P 76-81.

⁴ NOPR at P 4.

⁵ *Id.* at P 5.

⁶ *Id.*

scientific community, and applicable entities to study BPS vulnerabilities to the benchmark and supplemental GMD events and gain experience mitigating the benchmark GMD event. Once the mitigations for the benchmark GMD event are in place, more informed evaluations of the effective measures for expanding the protections that improve and refine those mitigations to the effects of localized events can be pursued.

Next, the Trades support the second option relative to Requirement R7, Part 7.4, which would approve the requirement without any additional directives to modify the standard while requiring “NERC to prepare and submit a report regarding how often and why applicable entities are exceeding corrective action plan deadlines.” While we recognize this approach goes beyond what was originally contemplated by Order No. 830, the Trades feel strongly that the industry is committed to mitigating identified risks to the BPS resulting from GMD events while also recognizing that there are many factors affecting entity mitigation, many of which go well outside the entity’s immediate control. It is for this reason that we fully support affording the industry with the latitude provided within the language of Requirement R7.4 and ask that the Commission not apply unnecessary administrative tasks that are more likely to cause further delays while adding very little benefit to the reliability of the BPS. Moreover, the compliance obligations of Requirement R7.4 and the report in Option 2 will provide the Commission with sufficient protections and assurances that entities are acting in the best interest of reliability by providing details on applicable entities that have exceeded corrective action deadlines.

A. The Trades support the Commission’s proposal to approve TPL-007-2.

The Trades support the Commission’s proposal to approve TPL-007-2 and the associated violation risk factors, violation severity levels, and implementation plan. NERC’s revisions in TPL-007-2 will enhance reliability by requiring applicable entities to assess vulnerabilities to severe, localized GMD event impacts; implementing new deadlines for addressing benchmark

vulnerabilities; and improving availability of GMD monitoring data to inform vulnerability assessments. The Trades agree with NERC that TPL-007-2 addresses the Commission’s concerns⁷ and “reflects the latest in GMD understanding and provides a technically sound and flexible approach.”⁸ Accordingly, the proposed TPL-007-2 Reliability Standard is just, reasonable, not unduly discriminatory or preferential, and in the public interest.⁹

B. The Trades ask the Commission not to direct NERC to modify the standard to require mitigation of supplemental GMD events, at this time.

The Trades believe that the proposed Reliability Standard TPL-007-2 provides reasonable protections for the BPS. While we appreciate the Commission’s concerns relative to how localized effects of a severe GMD event might impact some high value assets, it is also important for the Commission to recognize that the industry’s ability to model those impacts with precision is limited by both the known science and tools currently available. For example, standardized methods or models for capturing non-uniform geoelectric fields must be developed.¹⁰ As a result, the Trades ask the Commission to allow the work already planned through the GMD Research Work Plan and for applicable entities to gain experience implementing TPL-007-2 to inform needed enhancements to the standard.

1. TPL-007-2 provides reasonable and effective mitigation consistent with the current state of the art of GMD science.

The Trades continue to support the use of spatial-averaging for mitigating GMD events since the benchmark GMD event was intended to address wide-area effects, which are more

⁷ Order No. 830, 156 FERC ¶ 61,215 at P 44, 65, 88, and 101-102.

⁸ NERC, *Petition for Approval of Proposed Reliability Standard TPL-007-2* at 3 (Jan. 22, 2018) (“NERC Petition”).

⁹ 16 U.S.C. 824o (2016).

¹⁰ NERC, *Order No. 830 GMD Research Work Plan: Addressing Geomagnetic Disturbance Events and Impacts on Reliability* at 14 (Apr. 2018) (“GMD Research Work Plan”).

likely to have broad impacts on BPS reliability.¹¹ Mitigating benchmark GMD events addresses the broad reliability impacts that are most likely to cause cascading failure and voltage collapse. The benchmark GMD event also provides a realistic assessment of wide-area effects caused by severe GMD events. While in contrast, the supplemental GMD event “takes into consideration observed characteristics of a local geomagnetic field enhancement, recognizing that the science and understanding of these events is evolving.”¹²

While the Trades recognize that severe, localized impacts consistent with the supplemental GMD event could have significant impacts on individual equipment, these impacts are unlikely to initiate a cascading outage.¹³ Although implementation of TPL-007-2 and ongoing research will help to inform the industry on how to better identify and protect these important assets, it is premature to mandate mitigation of localized effects. Localized impacts need to be further studied to determine reasonably accurate impacts¹⁴ before potential mitigation measures can be tested and potentially mandated. Moreover, we ask the Commission to consider that the purpose of this Reliability Standard is not to ensure protection of individual assets, but “to provide for reliable operation of the bulk-power system.”¹⁵ As a result, TPL-007-2 appropriately focuses industry resources on the mitigation of the broader impacts that are most likely to cause cascading outages.

¹¹ Comments of the Edison Electric Institute, American Public Power Association, Electricity Consumers Resource Council, The Electric Power Supply Association, Large Public Power Counsel, and the National Rural Electric Cooperative Association, Docket No. RM15-11-000 (Jul. 2015) (“Trade Association Comments”).

¹² NERC, *Supplemental Geomagnetic Disturbance Event Description* at iv (Jun. 2017).

¹³ “A small set of transformers that are affected by the local amplification of the geo-electric field but that the impact on the GIC distribution of the entire network due to a local intensification of the geoelectric field in a ‘local peak’ is minor.” NERC, *Benchmark Geomagnetic Disturbance Event Description* at 15 (May 2014).

¹⁴ “Without characterization on regional scales, statistical estimates could be weighted by local effects and suggest unduly pessimistic conditions from cascading failure and voltage collapse points of view.” *Id.* at 9.

¹⁵ 16 U.S.C. § 824o (2016).

2. Mandating supplemental GMD event vulnerability mitigations is premature.

The science and understanding of GMD events is still evolving.¹⁶ NERC continues to evaluate and build upon the technical basis of TPL-007-2 through its GMD Research Work Plan and data requests, which were both directed by the Commission in Order No. 830. This work will help applicable entities implement TPL-007-2 and ensure the industry builds experience characterizing and mitigating the impacts of GMD events. Implementation will also drive enhancements of the available modeling tools, which will help to more accurately model and understand localized impacts associated with the supplemental GMD event. In addition, the work associated with the GMD Research Work Plan (i.e., Task 1: Further Analyze Spatial Averaging Used in the Benchmark GMD Event; Task 3: Improve Earth Conductivity Models for GIC Studies (including Task 3C: Non-uniform Field Modeling) and Task 9: Harmonic Impact Studies) must be completed before the industry can model the localized impacts of the supplemental GMD events with necessary precision. Until then characterizations are likely to be overly conservative and mitigation will provide unclear benefits to BPS reliability.¹⁷

Although current tools are available to model localized events, we understand that such modeling will require significant time as the processes involved are still largely manual, making it difficult to develop accurate, system-wide models that appropriately consider the localized impacts of the supplemental GMD event. While we understand that automating the process is

¹⁶ See NERC, *Supplemental Geomagnetic Disturbance Event Description* (Jun. 2017).

¹⁷ “The supplemental GMD event is based on a small number of observed localized enhanced geoelectric field events that provide only general insight into the geographic size of localized events during severe solar storms. Additionally, currently available modeling tools do not provide entities with capabilities to model localized enhancements within a severe GMD event realistically. As a result, entities may need to employ conservative approaches when performing the supplemental GMD Vulnerability Assessment, such as applying the localized peak geoelectric field over an entire planning area. For these reasons, requiring mandatory mitigation may not provide effective reliability benefit or use resources optimally.” NERC Petition at 23-24. See also, NERC, *Comments of the North American Electric Reliability Corporation in Response to Notice of Proposed Rule Making*, Docket No. RM18-9-000 at 12-16 (filed Jul. 23, 2018).

possible, such processes would need to be developed internally (i.e., by applicable entities) and would create substantial volumes of data while complicating the burdens associated with analyzing the broader impacts. Furthermore, current modeling efforts remain limited by the science associated with the current understanding of the size and other characteristics of localized geoelectric fields during a severe GMD event. The benchmark GMD event was developed to specifically address “known characteristics of a severe GMD event and its impact on an interconnected transmission system,”¹⁸ whereas there is insufficient knowledge of the effects and characteristics of the less understood, localized events that contain components that are “spatially non-uniform with higher and lower strengths across a region.”¹⁹

The industry has limited experience applying mitigation measures for the benchmark GMD event. While we appreciate the Commission’s interest in extending the TPL-007-2 mitigation efforts to localized impacts that might be uncovered through modeling the supplemental GMD event, mandating mitigation—based on unproven characteristics derived from very limited historical data²⁰—may result in unnecessary mitigation efforts that could cause unintended impacts on the BPS. For this reason, we ask the Commission to consider allowing the industry and NERC time to study the results of the benchmark and supplemental GMD event assessments before the Commission considers mandating additional measures for supplemental GMD events. Mitigating for the benchmark GMD events will provide a foundation to build upon, while allowing the science time to evolve to yield better tools to assess GMD impacts as well as corrective action plans to efficiently and effectively mitigate these risks to the BPS.

¹⁸ NERC, *Benchmark Geomagnetic Disturbance Event Description* at 4 (May 2016).

¹⁹ NERC, *Supplemental Geomagnetic Disturbance Event Description* at iv (Jun. 2017).

²⁰ “Due to the lack of long-term accurate geomagnetic field observations, assigning probabilities to the occurrence of historical extreme geomagnetic storms is difficult because of the lack of high fidelity geomagnetic recordings of events prior to the 1980s.” NERC, *Benchmark Geomagnetic Disturbance Event Description* at 8.

The Trades are also concerned with the immaturity of emerging mitigation solutions for GMD events. The application of hardware mitigation (e.g., GIC blocking) must be considered untested by any reasonable standard. We are aware of only one deployment of a GIC blocking device in the field, which was deployed on a single, remote autotransformer.²¹ While the results of this deployment have been promising, entities will need time to develop internal expertise and standards to ensure any solution applied does not have any unintended consequences to normal BPS operations. Additionally, the current availability of this hardware device (i.e., GIC blocking device) is only obtainable through a single source with no known record of an ability to deliver this product on a wide scale, at this time. Furthermore, this device has only been tested during low-level GMD events (i.e., has not been tested under high GICs) and has not yet been deployed or tested for a generation step-up transformer (“GSU”). Although this device has been deployed on a single transformer, remotely located from generation to limit potential impacts of its operation on GSUs in the area, broader deployments may uncover scalability issues or other unknown technical issues when applied to other locations, transformer voltages, and transformer sizes as a variety of variables must be considered and studied. As a result, more study and industry experience applying this technology is needed.

The benchmark GMD event mitigation requirement in TPL-007-2 will push industry to develop and test such devices; however, extending this requirement to a more severe, localized event before benchmark GMD event mitigations have been developed and tested may expand the effort required by industry without allowing for lessons learned to be shared and strong technical-based mitigations to be developed. In fact, as the science for GMD events change, the

²¹ Faxvog, Fuchs, et. al., *HV Power Transformer Neutral Blocking Device (NBD) Operating Experience in Wisconsin* (Nov. 2017), available at: <https://ccaps.umn.edu/documents/CPE-Conferences/MIPSYCON-Papers/2017/OperationalExperiencesofanHVTTransformerNeutralBlockingDevice.pdf>

event threshold may change, which increases uncertainty for industry’s deployment of mitigation measures.

Before directing mandatory mitigation of supplemental GMD events, the Commission should consider the efficiency and effectiveness of such a directive in maintaining the reliability of the BPS. The NERC standards drafting team for TPL-007-2 “consisted of individuals with extensive planning, engineering, and scientific knowledge and experience.”²² These experts and NERC concluded that an evaluation of possible mitigations is a more “prudent approach” than mandating formal Corrective Action Plans.²³ While we agree with the Commission that it may be possible to model the supplemental GMD event through the use of other methods,²⁴ it is premature to consider such enhancements when the available data, modeling tools, and mitigation measures remain immature.

Also, in Order No. 830, the Commission relies on its NOPR proposal guidance that the Reliability Standard could “require applicable entities to take corrective actions, using engineering judgment based on the results of both assessments.” This is what TPL-007-2 allows by requiring applicable entities to mitigate benchmark GMD events and evaluate possible mitigation actions for supplemental GMD events. As currently envisioned in TPL-007-2, engineering judgment can be used by the applicable entity to evaluate a range of options to address potential system vulnerabilities to the supplemental GMD events. However, requiring mitigating measures before the science and research can provide reliable parameters, could force entities to rely on inaccurate vulnerability assessments or mitigation measures that have not yet been tested. This approach is unlikely to be effective in reducing reliability risk, may not be an

²² NERC Petition at 9.

²³ NERC Petition at 15.

²⁴ NOPR at P 38.

efficient use of resources, and may create new, unintended consequences that could actually reduce the reliability of the BPS. Therefore, we agree with NERC and the standard drafting team's conclusion that requiring formal Corrective Action Plans based on the supplemental GMD event assessments is not appropriate at this time.²⁵

Although the Commission seeks to avoid unnecessary delay in implementing protection against GMD events, it is equally important that its directives for new Reliability Standard requirements do not get in front of research already directed by the Commission. For the above reasons, the Trades recommend that the Commission approve TPL-007-2 without modification and continue to support the necessary science. In this light, we ask the Commission to limit any new directives to NERC to developing a study of the mitigation measures deployed and the effectiveness of these measures to mitigate benchmark GMD events before mandating mitigation measures on more localized events. This approach will ensure the efficient and effective application of mitigation measures for GMD events.

C. The Commission should not direct NERC to modify TPL-007-2 to require approval of Corrective Action Plans on a case-by-case basis.

In its efforts to avoid unnecessary delay in implementing protection against GMD threats, the Commission seeks comments on the need for Requirement R7 Part 7.4,²⁶ which allows applicable entities to extend their corrective action plans due to “situations beyond the control of the responsible entity.”²⁷ The Commission notes that this requirement is different than the Commission's guidance of case-by-case basis consideration of extensions of time in Order No.

²⁵ NERC Petition at 23.

²⁶ NOPR at P 25.

²⁷ TPL-007-2 Requirement R7, Part 7.4.

830²⁸ and questions whether Requirement R7 Part 7.4 will allow applicable entities to delay mitigation.²⁹ The Trades encourage the Commission to approve TPL-007-2 without modification. Requirement R7 Part 7.4 is the most efficient method for allowing extensions of time for mitigations for circumstances out of the applicable entity's control.

A case-by-case approval process by NERC would only increase administrative tasks for NERC and applicable entities. Additionally, such an approval process would further delay any actions to mitigate rather than expedite the approval process. If the approval process was timely and NERC disagreed with the applicable entity, then it is unclear what could be done to control the circumstance.

Although the Trades supported a case-by-case approval process in the Trade Associations comments, we support NERC's approach in TPL-007-2 as a more efficient and still effective approach to addressing extensions of time for mitigations. This approach is especially useful due to the inexperience in mitigating GMD events by both NERC and industry. The applicable entities will be the most familiar with their circumstances, although as mentioned above, we encourage the Commission to direct NERC to further study the effectiveness of mitigation measures, which will help NERC pull together and share the experiences and expertise developed nation-wide.

Also, Requirement R7 Part 7.4 will not delay mitigation because this requirement is only applicable if circumstances are beyond the applicable entity's control. Accordingly, even if a case-by-case basis review was done, in sufficient time, the entity would not be able to comply with the corrective action plan since the circumstance was beyond the entity's control. Due to these concerns, the Trades encourage the Commission to approve TPL-007-2 without

²⁸ NOPR at P 45.

²⁹ NOPR at P 47.

modification and support the Commission directing NERC to report on the use of corrective action plan deadline extensions. Such a report will inform the Commission as to whether the requirement(s) need further modification. Identifying the circumstances beyond applicable entities' control may also be useful to NERC and the Commission in facilitating efforts to further mitigate impacts from GMD events. For example, although an extension was needed by applicable entity A for circumstance X, entity A could share how they were eventually able to mitigate and overcome circumstance X, which can help other entities that run into similar circumstances. Such a report may also identify issues with mitigation measures, which can be the focus of future guidance documents for industry.

III. CONCLUSION

The Trades appreciate the opportunity to submit comments in response to the NOPR. As discussed above, we encourage the Commission to approve TPL-007-2 as well as the associated violation risk factors and violation severity levels, and implementation plan. Also, we urge the Commission to allow NERC and the industry to gain experience assessing GMD event vulnerabilities and implementing the wide-area, benchmark GMD events before directing modifications to TPL-007-2 to address the less understood, localized, supplemental GMD events. A more effective and efficient approach for BPS reliability—such as mitigation study suggested above—will seek to facilitate the development and sharing of best practices for GMD event mitigations.

Respectfully Submitted,

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