151 FERC ¶ 61,134
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

18 CFR Part 40

[Docket No. RM15-11-000]

Reliability Standard for Transmission System Planned Performance for Geomagnetic Disturbance Events

(May 14, 2015)

AGENCY: Federal Energy Regulatory Commission.

ACTION: Notice of proposed rulemaking.

SUMMARY: The Federal Energy Regulatory Commission (Commission) proposes to approve Reliability Standard TPL-007-1 (Transmission System Planned Performance for Geomagnetic Disturbance Events). Proposed Reliability Standard TPL-007-1 establishes requirements for certain entities to assess the vulnerability of their transmission systems to geomagnetic disturbance events (GMDs), which occur when the sun ejects charged particles that interact and cause changes in the earth's magnetic fields. Entities that do not meet certain performance requirements, based on the results of their vulnerability assessments, must develop a plan to achieve the requirements. The North American Electric Reliability Corporation (NERC), the Commission-certified Electric Reliability Organization, submitted the proposed Reliability Standard for Commission approval in response to a Commission directive in Order No. 779. In addition, the Commission proposes to direct that NERC develop modifications to the benchmark GMD event definition set forth in Attachment 1 of the proposed Reliability Standard so that the

definition is not based solely on spatially-averaged data. The Commission also proposes to direct NERC to submit a work plan, and subsequently one or more informational filings, that address specific GMD-related research areas.

DATES: Comments are due **[INSERT DATE 60 days after publication in the FEDERAL REGISTER]**.

ADDRESSES: Comments, identified by docket number, may be filed in the following ways:

- Electronic Filing through http://www.ferc.gov. Documents created electronically using word processing software should be filed in native applications or print-to-PDF format and not in a scanned format.
- Mail/Hand Delivery: Those unable to file electronically may mail or hand-deliver comments to: Federal Energy Regulatory Commission, Secretary of the Commission, 888 First Street, NE, Washington, DC 20426.

Instructions: For detailed instructions on submitting comments and additional information on the rulemaking process, see the Comment Procedures Section of this document

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SUPPLEMENTARY INFORMATION:

151 FERC ¶ 61,134
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Reliability Standard for Transmission System Planned Performance for Geomagnetic Disturbance Events — Docket No. RM15-11-000

NOTICE OF PROPOSED RULEMAKING

(May 14, 2015)

1. Pursuant to section 215 of the Federal Power Act (FPA),[1] the Commission proposes to approve Reliability Standard TPL-007-1 (Transmission System Planned Performance for Geomagnetic Disturbance Events). Proposed Reliability Standard TPL-007-1 establishes requirements for certain entities to assess the vulnerability of their transmission systems to geomagnetic disturbance events (GMDs), which occur when the sun ejects charged particles that interact and cause changes in the earth's magnetic fields. Entities that do not meet certain performance requirements, based on the results of their vulnerability assessments, must develop a plan to achieve the requirements. The North American Electric Reliability Corporation (NERC), the Commission-certified Electric Reliability Organization (ERO), submitted the proposed Reliability Standard for Commission approval in response to a Commission directive in Order No. 779.[2] The

[1] 16 U.S.C. 824o.

[2] *Reliability Standards for Geomagnetic Disturbances*, Order No. 779, 78 FR 30,747 (May 23, 2013), 143 FERC ¶ 61,147, *reh'g denied*, 144 FERC ¶ 61,113 (2013).

Commission also proposes to approve one definition for inclusion in the NERC Glossary of Terms submitted by NERC as well as the proposed Reliability Standard's associated violation risk factors and violation severity levels, implementation plan, and effective dates.[3]

2. In addition, as discussed below, the Commission proposes to direct NERC to develop modifications to Reliability Standard TPL-007-1 and submit informational filings to address certain issues described herein.

3. Geomagnetic disturbances are considered to be "high impact, low frequency" events.[4] In other words, while the probability of occurrence of a severe geomagnetic disturbance may be low, a geomagnetic disturbance of sufficient magnitude could have potentially severe consequences to the reliable operation of the Bulk-Power System.[5] Such events could cause widespread blackouts and cause damage to equipment that could result in sustained system outages.[6] On that basis, it is important that NERC, planning

[3] NERC, Glossary of Terms Used in NERC Reliability Standards (April 2015) (NERC Glossary), *available at* http://www.nerc.com/files/glossary_of_terms.pdf.

[4] *See* NERC Petition at 3; *see also* NERC Petition, Ex. D (White Paper on GMD Benchmark Event Description) at 5.

[5] Order No. 779, 143 FERC ¶ 61,147 at P 15 (quoting NERC comment that "as a high-impact, low frequency event, GMDs pose a unique threat to Bulk-Power System reliability, and NERC is committed to working with stakeholders and the Commission to address these challenges consistent with its responsibilities as the ERO").

[6] *Id.* PP 3, 16 (citing NERC, 2012 Special Reliability Assessment Interim Report: Effects of Geomagnetic Disturbances on the Bulk Power System at 69 (February 2012) (GMD Interim Report); Oak Ridge National Laboratory, Electromagnetic Pulse: Effects

(continued ...)

coordinators, transmission planners, transmission owners and generator owners take appropriate actions to prepare to withstand potentially harmful geomagnetic disturbances. For that reason, Order No. 779 required NERC to identify what severity GMD events (i.e., benchmark GMD events) responsible entities will have to assess, and that NERC should technically support its choice. In the proposed reliability standard, NERC set the benchmark GMD event as a "1-in-100 year" event.

4. We believe, based on information available at this time, that the provisions of proposed Reliability Standard TPL-007-1 are just and reasonable and address the specific parameters for the Second Stage GMD Reliability Standards on geomagnetic disturbance events, as set forth in Order No. 779. For example, the proposed Reliability Standard requires responsible entities to maintain system models needed to complete "GMD Vulnerability Assessments" (Requirements R1 and R2),[7] have criteria for acceptable system steady state voltage performance during a benchmark GMD event (Requirement R3), and complete a GMD Vulnerability Assessment once every 60 calendar months, based on the benchmark GMD event definition described in Attachment 1 of the proposed Reliability Standard (Requirement R4). Further, if an applicable entity

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on the U.S. Power Grid: Meta-R-319 at page 1-14, Tables 4-1, 4-2, 4-3 (discussing at-risk transformers) (January 2010)).

[7] NERC proposes to define the term GMD Vulnerability Assessment to mean a "documented evaluation of potential susceptibility to voltage collapse, Cascading, or localized damage of equipment due to geomagnetic disturbances." *See* NERC Petition, Ex. B (Implementation Plan for TPL-007-1) at 1.

concludes, based on the GMD Vulnerability Assessment, that its system does not meet specified performance requirements, it must develop a corrective action plan that addresses how the performance requirements will be met (Requirement R7). We propose to determine that the framework of the proposed Reliability Standard, as outlined above, is just and reasonable and provides a basis for approval. We believe that, when tested against an appropriate benchmark GMD event, compliance with the proposed Reliability Standard should provide adequate protection for an applicable entity's system to withstand a geomagnetic disturbance based on a 1-in-100 year GMD event design.

5. Our primary concerns with the proposed Reliability Standard pertain to the benchmark GMD event described in Attachment 1 of the proposed Reliability Standard. While there is limited historical geomagnetic data and the scientific understanding of geomagnetic disturbance events is still evolving, we have concerns regarding the proposed Reliability Standard's heavy reliance on spatial averaging. Thus, while proposing to approve proposed Reliability Standard TPL-007-1, we also propose to direct NERC to make several modifications to better ensure that, going forward, the study and benchmarking of geomagnetic disturbance events are based on a more complete set of data and a reasonable scientific and engineering approach. Further, we propose specific revisions to Requirement R7 of the proposed Reliability Standard to ensure that, when an applicable entity identifies the need for a corrective action plan, the entity acts in a timely manner.

I. Background

A. Section 215 and Mandatory Reliability Standards

6. Section 215 of the FPA requires the Commission to certify an ERO to develop mandatory and enforceable Reliability Standards, subject to Commission review and approval. Once approved, the Reliability Standards may be enforced in the United States by the ERO, subject to Commission oversight, or by the Commission independently.[8]

B. GMD Primer

7. GMD events occur when the sun ejects charged particles that interact and cause changes in the earth's magnetic fields.[9] Once a solar particle is ejected, it can take between 17 to 96 hours (depending on its energy level) to reach earth.[10] A geoelectric field is the electric potential (measured in volts per kilometer (V/km)) on the earth's surface and is directly related to the rate of change of the magnetic fields.[11] The geoelectric field has an amplitude and direction and acts as a voltage source that can cause geomagnetically-induced currents (GICs) to flow on long conductors, such as

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[8] 16 U.S.C. 824o(e).

[9] GMD Interim Report at i-ii. On April 30, 2015, the Space Weather Operations, Research, and Mitigation Task Force, under the auspices of the National Science and Technology Council, sought comment on a draft 2015 National Space Weather Strategy, which is designed to "articulate high-level strategic goals for enhancing National preparedness to space weather events." *National Science and Technology Council; National Space Weather Strategy*, 80 FR 24,296 (Apr. 30, 2015).

[10] GMD Interim Report at ii.

[11] *Id.*

transmission lines.[12] The magnitude of the geoelectric field amplitude is impacted by local factors such as geomagnetic latitude and local earth conductivity.[13] Geomagnetic latitude is the proximity to earth's magnetic north and south poles, as opposed to earth's geographic poles. Local earth conductivity is the ability of the earth's crust to conduct electricity at a certain location to depths of hundreds of kilometers down to the earth's mantle. Local earth conductivity impacts the magnitude (i.e., severity) of the geoelectric fields that are formed during a GMD event by, all else being equal, a lower earth conductivity resulting in higher geoelectric fields.[14]

C. Order No. 779

8. In Order No. 779, the Commission directed NERC, pursuant to FPA section 215(d)(5), to develop and submit for approval proposed Reliability Standards that address the impact of geomagnetic disturbances on the reliable operation of the Bulk-Power System. The Commission based its directive on the potentially severe, wide-spread impact on the reliable operation of the Bulk-Power System that can be caused by GMD events and the absence of existing Reliability Standards to address GMD events.[15]

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[12] *Id.*

[13] NERC Petition, Ex. D (White Paper on GMD Benchmark Event Description) at 4.

[14] *Id.*

[15] Order No. 779, 143 FERC ¶ 61,147 at P 3.

9. Order No. 779 directed NERC to implement the directive in two stages. In the first stage, the Commission directed NERC to submit, within six months of the effective date of Order No. 779, one or more Reliability Standards (First Stage GMD Reliability Standards) that require owners and operators of the Bulk-Power System to develop and implement operational procedures to mitigate the effects of GMDs consistent with the reliable operation of the Bulk-Power System.[16]

10. In the second stage, the Commission directed NERC to submit, within 18 months of the effective date of Order No. 779, one or more Reliability Standards (Second Stage GMD Reliability Standards) that require owners and operators of the Bulk-Power System to conduct initial and on-going assessments of the potential impact of benchmark GMD events on Bulk-Power System equipment and the Bulk-Power System as a whole. The Commission directed that the Second Stage GMD Reliability Standards must identify benchmark GMD events that specify what severity GMD events a responsible entity must assess for potential impacts on the Bulk-Power System.[17] Order No. 779 explained that, if the assessments identify potential impacts from benchmark GMD events, the Reliability Standards should require owners and operators to develop and implement a plan to protect against instability, uncontrolled separation, or cascading failures of the Bulk-Power System, caused by damage to critical or vulnerable Bulk-Power System

[16] *Id.* P 2.

[17] *Id.*

equipment, or otherwise, as a result of a benchmark GMD event. The Commission directed that the development of this plan could not be limited to considering operational procedures or enhanced training alone, but should, subject to the potential impacts of the benchmark GMD events identified in the assessments, contain strategies for protecting against the potential impact of GMDs based on factors such as the age, condition, technical specifications, system configuration, or location of specific equipment.[18] Order No. 779 observed that these strategies could, for example, include automatically blocking GICs from entering the Bulk-Power System, instituting specification requirements for new equipment, inventory management, isolating certain equipment that is not cost effective to retrofit, or a combination thereof.

D. Order No. 797

11. In Order No. 797, the Commission approved Reliability Standard EOP-010-1 (Geomagnetic Disturbance Operations).[19] NERC submitted Reliability Standard EOP-010-1 for Commission approval in compliance with the Commission's directive in Order No. 779 corresponding to the First Stage GMD Reliability Standards. In Order No. 797-A, the Commission denied the Foundation for Resilient Societies' (Resilient Societies) request for rehearing of Order No. 797. The Commission stated that the rehearing

[18] *Id.*

[19] *Reliability Standard for Geomagnetic Disturbance Operations*, Order No. 797, 79 FR 35,911 (June 25, 2014), 147 FERC ¶ 61,209, *reh'g denied*, Order No. 797-A, 149 FERC ¶ 61,027 (2014).

request "addressed a later stage of efforts on geomagnetic disturbances (i.e., NERC's future filing of Second Stage GMD Reliability Standards) and [that Resilient Societies] may seek to present those arguments at an appropriate time in response to that filing."[20] In particular, the Commission stated that GIC monitoring requirements should be addressed in the Second Stage GMD Reliability Standards.[21]

E. NERC Petition and Proposed Reliability Standard TPL-007-1

12. On January 21, 2015, NERC petitioned the Commission to approve proposed Reliability Standard TPL-007-1 and its associated violation risk factors and violation severity levels, implementation plan, and effective dates.[22] NERC also submitted a proposed definition for the term "Geomagnetic Disturbance Vulnerability Assessment or GMD Vulnerability Assessment" for inclusion in the NERC Glossary. NERC maintains that the proposed Reliability Standard is just, reasonable, not unduly discriminatory or preferential, and in the public interest. NERC further contends that the proposed

[20] Order No. 797-A, 149 FERC ¶ 61,027 at P 2.

[21] *Id.* P 27 (stating that the Commission continues "to encourage NERC to address the collection, dissemination, and use of geomagnetic induced current data, by NERC, industry or others, in the Second Stage GMD Reliability Standards because such efforts could be useful in the development of GMD mitigation methods or to validate GMD models").

[22] Proposed Reliability Standard TPL-007-1 is not attached to this notice of proposed rulemaking (NOPR). The proposed Reliability Standard is available on the Commission's eLibrary document retrieval system in Docket No. RM15-11-000 and on the NERC website, www.nerc.com. NERC submitted an errata on February 2, 2015 containing a corrected version of Exhibit A (Proposed Reliability Standard TPL-007-1).

Reliability Standard satisfies the directive in Order No. 779 corresponding to the Second Stage GMD Reliability Standards.[23]

13. NERC states that proposed Reliability Standard TPL-007-1 applies to planning coordinators, transmission planners, transmission owners and generation owners who own or whose planning coordinator area or transmission planning area includes a power transformer with a high side, wye-grounded winding connected at 200 kV or higher. NERC explains that the applicability criteria for qualifying transformers in the proposed Reliability Standard is the same as that for the First Stage GMD Reliability Standard in EOP-010-1, which the Commission approved in Order No. 797.

14. The proposed Reliability Standard contains seven requirements.

15. Requirement R1 requires planning coordinators and transmission planners to determine the individual and joint responsibilities in the planning coordinator's planning

[23] We note that Resilient Societies has submitted to NERC, pursuant to Section 8.0 of the NERC Standards Process Manual, an appeal alleging certain procedural errors in the development of proposed Reliability Standard TPL-007-1. *See* NERC Rules of Procedure, Attachment 3A (Standards Process Manual), Section 8.0 (Process for Appealing an Action or Inaction). The appeal is currently pending NERC action. On May 12, 2015, Resilient Societies submitted a request for stay of the proceedings in Docket No. RM15-11-000, asking that the Commission refrain from issuing a notice of proposed rulemaking until NERC acts on Resilient Societies' appeal. We deny Resilient Societies' request. We see no irreparable harm in issuing a proposal for public comment as we do today. Rather, we will consider any necessary issues pertaining to the appeal before or in a final rule issued in this proceeding.

area for maintaining models and performing studies needed to complete the GMD Vulnerability Assessment required in Requirement R4.[24]

16. Requirement R2 requires planning coordinators and transmission planners to maintain system models and GIC system models needed to complete the GMD Vulnerability Assessment required in Requirement R4.

17. Requirement R3 requires planning coordinators and transmission planners to have criteria for acceptable system steady state voltage limits for their systems during the benchmark GMD event described in Attachment 1 (Calculating Geoelectric Fields for the Benchmark GMD Event).

18. Requirement R4 requires planning coordinators and transmission planners to conduct a GMD Vulnerability Assessment every 60 months using the benchmark GMD event described in Attachment 1 to the proposed Reliability Standard. The benchmark GMD event is based on a 1-in-100 year frequency of occurrence and is composed of four elements: (1) a reference peak geoelectric field amplitude of 8 V/km derived from statistical analysis of historical magnetometer data; (2) a scaling factor to account for local geomagnetic latitude; (3) a scaling factor to account for local earth conductivity; and (4) a reference geomagnetic field time series or wave shape to facilitate time-domain

[24] Proposed Reliability Standard TPL-007-1, Requirements R2, R3, R4, R5, and R7 refer to planning coordinators and transmission planners as "responsible entities."

analysis of GMD impact on equipment.[25] The product of the first three elements is referred to as the regional geoelectric field peak amplitude.[26]

19. Requirement R5 requires planning coordinators and transmission planners to provide GIC flow information, to be used in the transformer thermal impact assessment required in Requirement R6, to each transmission owner and generator owner that owns an applicable transformer within the applicable planning area.

20. Requirement R6 requires transmission owners and generator owners to conduct thermal impact assessments on solely and jointly owned applicable transformers where the maximum effective GIC value provided in Requirement R5 is 75 amperes per phase (A/phase) or greater.

21. Requirement R7 requires planning coordinators and transmission planners to develop corrective action plans if the GMD Vulnerability Assessment concludes that the system does not meet the performance requirements in Table 1 (Steady State Planning Events).

II. Discussion

22. Pursuant to section 215(d) of the FPA, the Commission proposes to approve Reliability Standard TPL-007-1 as just, reasonable, not unduly discriminatory or

[25] *See* Proposed Reliability Standard TPL-007-1, Att. 1; s*ee also* NERC Petition, Ex. D (White Paper on GMD Benchmark Event Description) at 5.

[26] NERC Petition, Ex. D (White Paper on GMD Benchmark Event Description) at 5.

preferential, and in the public interest. The proposed Reliability Standard addresses the directives in Order No. 779 corresponding to the development of the Second Stage GMD Reliability Standards. Proposed Reliability Standard TPL-007-1 does this by requiring applicable Bulk-Power System owners and operators to conduct initial and on-going vulnerability assessments regarding the potential impact of a benchmark GMD event on the Bulk-Power System as a whole and on Bulk-Power System components.[27] In addition, the proposed Reliability Standard requires applicable entities to develop and implement corrective action plans to mitigate any identified vulnerabilities.[28] Potential mitigation strategies identified in the proposed Reliability Standard include, but are not limited to, among other things, the installation, modification, or removal of transmission and generation facilities and associated equipment.[29] Accordingly, proposed Reliability Standard TPL-007-1 constitutes an important step in addressing the risks posed by GMD events to the Bulk-Power System.

23. While proposed Reliability Standard TPL-007-1 addresses the Order No. 779 directives, pursuant to FPA section 215(d)(5), the Commission proposes to direct NERC to develop modifications to the Reliability Standard concerning: (1) the calculation of the reference peak geoelectric field amplitude component of the benchmark GMD event

[27] *See* Order No. 779, 143 FERC ¶ 61,147 at PP 67, 71.

[28] *Id.* P 79.

[29] *Id.*

definition; (2) the collection of GIC monitoring and magnetometer data; and (3) deadlines for completing corrective action plans and the mitigation measures called for in corrective action plans. In addition, to improve the understanding of GMD events generally and address the specific research areas discussed below, the Commission proposes to direct that NERC submit informational filings. These proposals are discussed in greater detail below.

24. The Commission seeks comments from NERC and interested entities on these proposals.

A. Benchmark GMD Event Definition

NERC Petition

25. NERC states that the purpose of the benchmark GMD event is to "provide a defined event for assessing system performance during a low probability, high magnitude GMD event."[30] NERC explains that the benchmark GMD event represents "the most severe GMD event expected in a 100-year period as determined by a statistical analysis of recorded geomagnetic data."[31] The benchmark GMD event definition is used in the GMD Vulnerability Assessments and thermal impact assessment requirements of the proposed Reliability Standard.

[30] NERC Petition at 15.

[31] *Id.*

26. As noted above, NERC states that the benchmark GMD event definition has four elements: (1) a reference peak geoelectric field amplitude of 8 V/km derived from statistical analysis of historical magnetometer data; (2) a scaling factor to account for local geomagnetic latitude; (3) a scaling factor to account for local Earth conductivity; and (4) a reference geomagnetic field time series or wave shape to facilitate time-domain analysis of GMD impact on equipment.[32]

27. The standard drafting team determined that a 1-in-100 year GMD event would cause an 8 V/km reference peak geoelectric field amplitude at 60 degree geomagnetic latitude using Québec's earth conductivity.[33] The standard drafting team stated that:

> the reference geoelectric field amplitude was determined through statistical analysis using … field measurements from geomagnetic observatories in northern Europe and the reference (Quebec) earth model …. The Quebec earth model is generally resistive and the geological structure is relatively well understood. The statistical analysis resulted in a conservative peak geoelectric field amplitude of approximately 8 V/km …. The frequency of occurrence of this benchmark GMD event is estimated to be approximately 1 in 100 years.[34]

28. The standard drafting team explained that it used field measurements taken from the IMAGE magnetometer chain, which covers Northern Europe, for the period 1993-2013 to calculate the reference peak geoelectric field amplitude used in the benchmark

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[32] NERC Petition, Ex. D (White Paper on GMD Benchmark Event Description) at 5.

[33] *Id.*

[34] *Id.* (footnotes omitted).

GMD event definition.[35] As described in NERC's petition, the standard drafting team "spatially averaged" four different station groups of IMAGE data, each spanning a square area of approximately 500 km (roughly 310 miles) in width.[36] The standard drafting team justified the use of spatial averaging by stating that the proposed Reliability Standard is designed to "address wide-area effects caused by a severe GMD event, such as increased var absorption and voltage depressions. Without characterizing GMD on regional scales, statistical estimates could be weighted by local effects and suggest unduly pessimistic conditions when considering cascading failure and voltage collapse."[37]

29. NERC states that the benchmark GMD event includes scaling factors to enable applicable entities to tailor the reference peak geoelectric field to their specific location for conducting GMD Vulnerability Assessments. NERC states that the scaling factors in the benchmark GMD event definition are applied to the reference peak geoelectric field

[35] *Id.* at 8. The International Monitor for Auroral Geomagnetic Effects (IMAGE) consists of 31 magnetometer stations in northern Europe maintained by 10 institutes from Estonia, Finland, Germany, Norway, Poland, Russia, and Sweden. *See* IMAGE website, *available at* http://space.fmi.fi/image/beta/?page=home#.

[36] As applied by the standard drafting team, spatial averaging refers to the averaging of geoelectric field amplitude readings within a given area. NERC Petition, Ex. D (White Paper on GMD Benchmark Event Description) at 9.

[37] NERC Petition, Ex. D (White Paper on GMD Benchmark Event Description) at 9.

amplitude to adjust the 8 V/km value for different geomagnetic latitudes and earth conductivities.[38]

30. The standard drafting team also identified a reference geomagnetic field time series from an Ottawa magnetic observatory during a 1989 GMD event that affected Québec.[39] The standard drafting team used this time series to estimate a geoelectric field, represented as a time series (i.e., 10-second values over a period of days), that is expected to occur at 60 degree geomagnetic latitude during a 1-in-100 year GMD event. NERC explains that this time series is used to facilitate time-domain analysis of GMD impacts on equipment.[40]

Discussion

31. The Commission proposes to approve proposed Reliability Standard TPL-007-1, including the proposed benchmark GMD event definition submitted by NERC. However, pursuant to FPA section 215(d)(5) , the Commission proposes to direct that NERC develop modifications to the benchmark GMD event definition set forth in Attachment 1 of the proposed Reliability Standard so that the definition is not based solely on spatially-averaged data. The Commission also seeks comment from NERC and other interested entities regarding the scaling factor used to account for geomagnetic

[38] NERC Petition at 18-19.

[39] NERC Petition, Ex. D (White Paper on GMD Benchmark Event Description) at 15-16.

[40] *Id.* at 5-6.

latitude in the benchmark GMD event definition. The Commission also proposes to direct NERC to submit a work plan, and subsequently one or more informational filings, that address the specific issues discussed below.

32. The benchmark GMD event definition proposed by NERC complies with the directive in Order No. 779 requiring that the Second Stage GMD Reliability Standards identify benchmark GMD events that specify what severity GMD events a responsible entity must assess for potential impacts on the Bulk-Power System. Order No. 779 did not specify the severity of the storm or define the characteristics of the benchmark GMD event. Instead, the Commission directed NERC, through the standards development process, to define the benchmark GMD events. Consistent with the guidance provided in Order No. 779, the benchmark GMD event definition proposed by NERC addresses the potential widespread impact of a severe GMD event, while taking into consideration the variables of geomagnetic latitude and local earth conductivity.[41] Accordingly, we propose to approve the definition submitted by NERC. Nonetheless, while acceptable as consistent with FPA section 215 and the Order No. 779 directives, we believe that the

[41] *See* Order No. 779, 143 FERC ¶ 61,147 at P 71 ("the benchmark GMD events should be based on factors that may include, but are not limited to, varying severity of the GMD … duration, geographic footprint of the GMD, how the GMD's intensity varies with latitude, system configuration, and the orientation of the magnetic fields produced by the GMD); *see also id*. P 70 ("[GMD] vulnerability assessments would be based on uniform criteria (e.g., geographic location and geology) but the values for such criteria would be entity-specific").

benchmark GMD event definition should be improved through the proposed revision and research discussed below.

33. First, the proposed Reliability Standard's exclusive use of spatial averaging to calculate the reference peak geoelectric field amplitude could underestimate the impact of a 1-in-100 year GMD event, which was the design basis arrived upon by the standard drafting team. NERC states that the benchmark GMD event "expands upon work conducted by the NERC GMD Task Force in which 1-in 100 year geoelectric field amplitudes were calculated from a well-known source of dense high-resolution geomagnetic data commonly used in space weather research [i.e., IMAGE data]."[42] However, the application of spatial averaging significantly reduces the reference peak geoelectric field amplitude using the IMAGE data compared with a prior analysis of nearly the same data set. As noted in the NERC petition, the GMD Interim Report described a study that used the same IMAGE magnetometers and data as the standard drafting team for the period 1993-2006.[43] That study calculated a 1-in-100 year peak geoelectric amplitude of 20 V/km for Québec.[44] The study calculated a significantly higher figure (20 V/km versus 8 V/km) using similar data as the standard drafting team because, instead of averaging geoelectric field values occurring simultaneously over a

[42] NERC Petition at 17.

[43] GMD Interim Report at 22.

[44] *Id.*

large geographic area, the study cited by the GMD Interim Report used the magnitude of the geoelectric amplitude in individual geomagnetic observatories.

34. Based on our review of NERC's petition, it does not appear that spatial averaging of geomagnetic fields is discussed in the studies cited by the standard drafting team except in the standard drafting team's GMD Benchmark Event White Paper. In addition, it is unclear how the standard drafting team determined that spatial averaging should be performed using a square area 500 km in width. The GMD Benchmark Event White Paper explains that the IMAGE magnetometers were organized into four groups comprised of squares 500 km wide, and the readings within a group were averaged. The GMD Benchmark Event White Paper also states, citing to the statistical analysis in its Appendix I, that "geomagnetic disturbance impacts within areas of influence of approximately 100-200 km do not have a widespread impact on the interconnected transmission system."[45] While Appendix I of the GMD Benchmark Event White Paper discusses why local geomagnetic disturbances do not have a significant impact on all transformers operating within a square 500 km in width, it does not explain why the standard drafting team chose a square area 500 km in width as opposed to a square with a smaller or larger total area. These questions largely inform our concerns regarding the proposed Reliability Standard's heavy reliance on spatial averaging.

[45] NERC Petition, Ex. D (White Paper on GMD Benchmark Event Description) at 4.

35. The geoelectric field values used to conduct GMD Vulnerability Assessments and thermal impact assessments should reflect the real-world impact of a GMD event on the Bulk-Power System and its components. A GMD event will have a peak value in one or more location(s), and the amplitude will decline over distance from the peak. Only applying a spatially-averaged geoelectric field value across an entire planning area would distort this complexity and could underestimate the contributions caused by damage to or misoperation of Bulk-Power System components to the system-wide impact of a GMD event within a planning area. However, imputing the highest peak geoelectric field value in a planning area to the entire planning area may incorrectly overestimate GMD impacts. Neither approach, in our view, produces an optimal solution that captures physical reality.

36. To address this issue, the Commission proposes to direct NERC to develop modifications to the Reliability Standard so that the reference peak geoelectric field amplitude element of the benchmark GMD event definition is not based solely on spatially-averaged data. For example, NERC could satisfy this proposal by revising the Reliability Standard to require applicable entities to conduct GMD Vulnerability Assessments and thermal impact assessments using two different benchmark GMD events: the first benchmark GMD event using the spatially-averaged reference peak geoelectric field value (8 V/km) and the second using the non-spatially averaged peak

geoelectric field value found in the GMD Interim Report (20 V/km).[46] The revised Reliability Standard could then require applicable entities to take corrective actions, using engineering judgment, based on the results of both assessments. That is, the applicable entity would not always be required to mitigate to the level of risk identified by the non-spatially averaged analysis; instead, the selection of mitigation would reflect the range of risks bounded by the two analyses, and be based on engineering judgment within this range, considering all relevant information. This proposed revision is consistent with the directive in Order No. 779 that owners and operators develop and implement a plan to protect against instability, uncontrolled separation, or cascading failures of the Bulk-Power System.[47] Alternatively, NERC could propose an equally efficient and effective modification that does not rely exclusively on the spatially-averaged reference peak geoelectric field value.[48]

[46] Conducting a GMD Vulnerability Assessment using essentially two measures of the same benchmark GMD events is consistent with Order No. 779 because, in that order, the Commission contemplated that an applicable entity could be required to assess GMD vulnerabilities using multiple benchmark GMD events. Order No. 779, 143 FERC ¶ 61,147 at P 2 ("The Second Stage GMD Reliability Standards must identify 'benchmark GMD events' that specify what severity GMD events a responsible entity must assess for potential impacts on the Bulk-Power System.").

[47] Order No. 779, 143 FERC ¶ 61,147 at P 2.

[48] For example, responsible entities could calculate GIC flows and resulting Bulk-Power System impacts using models that utilize both spatially averaged and non-spatially averaged peak geoelectric field values to simulate GMD conditions.

37. The Commission also seeks comment from NERC and other interested entities regarding the scaling factor used in the benchmark GMD event definition to account for differences in geomagnetic latitude. Specifically, the Commission seeks comment on whether, in light of studies indicating that GMD events could have pronounced effect on lower geomagnetic latitudes, a modification is warranted to reduce the impact of the scaling factors.[49]

38. Next, the record submitted by NERC and other available information manifests a need for more data and certainty in the knowledge and understanding of GMD events and their potential effect on the Bulk-Power System. For example, NERC's proposal is based on data from magnetometers in northern Europe, from a relatively narrow timeframe with relatively low solar activity, and with little or no data on concurrent GIC flows. Similarly, the adjustments for latitude and ground conductivity are based on the limited information currently available, but additional data-gathering is needed. To address this

[49] *See*, *e.g.*, Ngwira, C. M., Pulkkinen, A., Kuznetsova, M. M., Glocer, A., "Modeling extreme 'Carrington-type' space weather events using three-dimensional global MHD simulations," 119 Journal of Geophysical Research: Space Physics 4472 (2014) (finding that in Carrington-type events "the region of large induced ground electric fields is displaced further equatorward … [and] thereby may affect power grids … such as [those in] southern states of [the] continental U.S."); Gaunt, C. T., Coetzee, G., "Transformer Failures in Regions Incorrectly Considered to have Low GIC-Risk," 2007 IEEE Lausanne 807 (July 2007) (stating that twelve transformers were damaged and taken out of service in South Africa (at -40 degrees latitude) during a 2003 GMD event).

limitation on relevant information, we propose to direct that NERC conduct or oversee additional analysis on these issues.[50]

39. In particular, we propose to direct that NERC submit informational filings that address the issues discussed below. In the first informational filing, NERC should submit a work plan indicating how NERC plans to: (1) further analyze the area over which spatial averaging should be calculated for stability studies, including performing sensitivity analyses on squares less than 500 km per side (e.g., 100 km, 200 km); (2) further analyze earth conductivity models by, for example, using metered GIC and magnetometer readings to calculate earth conductivity and using 3-D readings; (3) determine whether new analyses and observations support modifying the use of single station readings around the earth to adjust the spatially averaged benchmark for latitude; and (4) assess how to make GMD data (e.g., GIC monitoring and magnetometer data) available to researchers for study.[51] We propose that NERC submit the work plan within six months of the effective date of a final rule in this proceeding. The work plan submitted by NERC should include a schedule to submit one or more informational

[50] *See, e.g., Revisions to Reliability Standard for Transmission Vegetation Management*, Order No. 777, 142 FERC ¶ 61,208 (2013) (approving Reliability Standard but directing that NERC perform a study to develop empirical evidence on one input to the "Gallet equation" used to calculate minimum clearances for vegetation).

[51] The Commission seeks comment on the barriers, if any, to public dissemination of GIC and magnetometer readings, including if the dissemination of such data poses a security risk and if any such data should be treated as Critical Energy Infrastructure Information or otherwise restricted to authorized users.

filings that apprise the Commission of the results of the four additional study areas as well as any other relevant developments in GMD research. Further, in the submissions, NERC should assess whether the proposed Reliability Standard remains valid in light of new information or whether revisions are appropriate.

B. Thermal Impact Assessments

NERC Petition

40. Proposed Reliability Standard TPL-007-1, Requirement R6 requires owners of transformers that are subject to the proposed Reliability Standard to conduct thermal analyses to determine if the transformers would be able to withstand the thermal effects associated with a benchmark GMD event. NERC states that transformers are exempt from the thermal impact assessment requirement if the maximum effective GIC in the transformer is less than 75 A/phase during the benchmark GMD event as determined by an analysis of the system. NERC explains that "based on available power transformer measurement data, transformers with an effective GIC of less than 75 A per phase during the Benchmark GMD Event are unlikely to exceed known temperature limits established by technical organizations."[52]

41. As provided in Requirements R5 and R6, "the maximum GIC value for the worst case geoelectric field orientation for the benchmark GMD event described in Attachment 1" determines whether a transformer satisfies the 75 A/phase threshold. If the 75

[52] NERC Petition at 30.

A/phase threshold is satisfied, Requirement R6 states, in relevant part, that a thermal impact assessment should be conducted on the qualifying transformer based on the effective GIC flow information provided in Requirement R5.

Discussion

42. The Commission proposes to approve proposed Reliability Standard TPL-007-1, Requirement R6. However, the Commission has two concerns regarding the proposed thermal impact assessment in Requirement R6. These concerns reflect in part the difficulty of replacing large transformers quickly, as reflected in studies, such as an April 2014 report by the Department of Energy that highlighted the reliance in the United States on foreign suppliers for large transformers.[53]

43. First, as discussed in the previous section, the Commission proposes to direct NERC to develop modifications to the Reliability Standard such that the benchmark GMD event definition's reference peak geoelectric field amplitude element does not rely on spatially-averaged data alone. The proposed modification is relevant to thermal impact assessments, as it is relevant to GMD Vulnerability Assessments, because both are ultimately predicated on the benchmark GMD event definition. Indeed, the concern is even greater in this context because a thermal impact assessment assesses the localized

[53] U.S. Department of Energy, Large Power Transformers and the U.S. Electric Grid (April 2014), *available at* http://energy.gov/sites/prod/files/2014/04/f15/LPTStudyUpdate-040914.pdf

impact of a GMD event on an individual transformer. Thus, we propose to direct NERC to modify the Reliability Standard to require responsible entities to apply spatially averaged and non-spatially averaged peak geoelectric field values, or some equally efficient and effective alternative, when conducting thermal impact assessments.

44. Second, Requirements R5.1 and R6 provide that the geoelectric field orientation causing the maximum effective GIC value in each transformer should be used to determine if the assessed transformer satisfies the 75 A/phase qualifying threshold in Requirement R6. However, Requirement R6 does not use the maximum GIC-producing orientation to conduct the thermal assessment for qualifying transformers (i.e., transformers with an maximum effective GIC value greater than 75A/phase). Instead, Requirement R6 uses the effective GIC time series described in Requirement R5.2 to conduct the thermal assessment on qualifying transformers.[54] The Commission seeks comment from NERC as to why qualifying transformers are not assessed for thermal impacts using the maximum GIC-producing orientation. NERC should address whether, by not using the maximum GIC-producing orientation, the required thermal impact assessments could underestimate the impact of a benchmark GMD event on a qualifying transformer.

[54] *See also* NERC Petition, Ex. E (White Paper on Transformer Thermal Impact Assessment) at 8-9.

C. Monitoring Devices

NERC Petition

45. Proposed Reliability Standard TPL-007-1, Requirement R2 requires responsible entities to "maintain System models and GIC System models of the responsible entity's planning area for performing the study or studies needed to complete GMD Vulnerability Assessment(s)." NERC states that proposed Reliability Standard TPL-007-1 contains "requirements to develop the models, studies, and assessments necessary to build a picture of overall GMD vulnerability and identify where mitigation measures may be necessary."[55] NERC explains that mitigating strategies "may include installation of hardware (e.g., GIC blocking or monitoring devices), equipment upgrades, training, or enhanced Operating Procedures."[56]

Discussion

46. The Commission proposes to direct NERC to develop revisions to Reliability Standard TPL-007-1 requiring installation of monitoring equipment (i.e., GIC monitors and magnetometers) to the extent there are any gaps in existing GIC monitoring and magnetometer networks, which will ensure a more complete set of data for planning and operational needs. Alternatively, we seek comment on whether NERC itself should be responsible for installation of any additional, necessary magnetometers while affected

[55] NERC Petition at 13.

[56] *Id.* at 32.

entities would be responsible for installation of additional, necessary GIC monitors. As part of NERC's work plan, we propose to direct that NERC identify the number and location of current GIC monitors and magnetometers in the United States to assess whether there are any gaps.

47. NERC maintains that the installation of monitoring devices could be part of a mitigation strategy. We agree with NERC regarding the importance of GIC and magnetometer data. As the Commission stated in Order No. 779, the tools for assessing GMD vulnerabilities are not fully mature.[57] Data from monitors are needed to validate the analyses underlying NERC's proposed Reliability Standard and the analyses to be performed by affected entities.[58] GIC monitors also can facilitate real-time adjustments to grid operations during GMD events, to maintain reliability and prevent significant equipment damage, by enhancing situational awareness for grid operators. For example, PJM's operating procedures for GMDs are triggered when GICs are above 10 A for 10 minutes at either of two specified locations, and confirmed by other sources of information.[59]

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[57] Order No. 779, 143 FERC ¶ 61,147 at P 68.

[58] *See*, *e.g.*, *Disturbance Monitoring and Reporting Requirements Reliability Standard*, 80 FR 22,441 (Apr. 16, 2015), 151 FERC ¶ 61,042 (2015) (notice of proposed rulemaking proposing to approve Reliability Standard PRC-002-2 requiring the collection of disturbance monitoring data).

[59] *See* PJM Manual 13 (Emergency Operations), Revision 57, at 55 (2015).

48. Accordingly, rather than wait to install necessary monitoring devices as part of a corrective action plan, GIC and magnetometer data should be collected by applicable entities at the outset to validate and improve system models and GIC system models, as well as improve situational awareness. To be clear, we are not proposing that every transformer would need its own GIC monitor or that every entity would need its own magnetometer. Instead, we are proposing the installation and collection of data from GIC monitors and magnetometers in enough locations to provide adequate analytical validation and situational awareness. We propose that NERC's work plan use this criterion in assessing the need and locations for GIC monitors and magnetometers.

49. Cost recovery is potentially available for costs associated with or incurred to comply with proposed Reliability Standard TPL-007-1, including for the purchase and installation of monitoring devices.[60] The Commission seeks comment on whether it should adopt a policy specifically allowing recovery of these costs.

[60] Order No. 779, 143 FERC ¶ 61,147 at P 14 n.20 (stating that "nothing precludes entities from seeking cost recovery if needed"); *see Extraordinary Expenditures Necessary to Safeguard National Energy Supplies*, 96 FERC ¶ 61,299, at 61,129 (2001) (stating that the Commission "will approve applications to recover prudently incurred costs necessary to further safeguard the reliability and security of our energy supply infrastructure in response to the heightened state of alert. Companies may propose a separate rate recovery mechanism, such as a surcharge to currently existing rates or some other cost recovery method"); *see also Policy Statement on Matters Related to Bulk Power System Reliability*, 107 FERC ¶ 61,052, at P 28 (2004) (affirming and clarifying that "the policy extends to the recovery of prudent reliability expenditures, including those for vegetation management, improved grid management and monitoring equipment, operator training and compliance with NERC standards").

D. Corrective Action Plan Deadlines

NERC Petition

50. Proposed Reliability Standard TPL-007-1, Requirement R7 provides that:

> Each responsible entity, as determined in Requirement R1, that concludes, through the GMD Vulnerability Assessment conducted in Requirement R4, that their System does not meet the performance requirements of Table 1 shall develop a Corrective Action Plan addressing how the performance requirements will be met ….

NERC explains that the NERC Glossary defines corrective action plan to mean, "A list of actions and an associated timetable for implementation to remedy a specific problem."[61] Requirement R7.3 states that the corrective action plan shall be provided within "90 calendar days of completion to the responsible entity's Reliability Coordinator, adjacent Planning Coordinator(s), adjacent Transmission Planner(s), functional entities referenced in the Corrective Action Plan, and any functional entity that submits a written request and has a reliability-related need."

Discussion

51. The Commission proposes to direct that NERC revise Reliability Standard TPL-007-1 to include deadlines concerning the development and implementation of corrective action plans under Requirement R7.

52. In accordance with Order No. 779 directives, Requirement R7 requires applicable entities to develop and implement measures when vulnerabilities from a benchmark

[61] NERC Petition at 31.

GMD event are identified.[62] However, Requirement R7 does not establish deadlines for developing or implementing corrective action plans. Requirement R7 only requires responsible entities to distribute corrective action plans within 90 days of completion to certain registered entities. By contrast, other NERC Reliability Standards include deadlines for developing corrective action plans, such as Reliability Standard PRC-006-2 (Automatic Underfrequency Load Shedding) and Reliability Standard TPL-001-4 (Transmission System Planning Performance Requirements). In addition, by definition, a corrective action plan includes "an associated timetable for implementation" of a remedy.[63] Consistent with the definition of corrective action plan and the other NERC Reliability Standards, the Commission proposes to direct that NERC modify Reliability Standard TPL-007-1 to require corrective action plans to be developed within one year of the completion of the GMD Vulnerability Assessment.

53. A corrective action plan is defined in the NERC Glossary as "[a] list of actions and an associated timetable for implementation to remedy a specific problem." Because of the complexities surrounding GMDs and the uncertainties about mitigation techniques, the time needed to implement a corrective action plan may be difficult to determine. At

[62] Order No. 779, 143 FERC ¶ 61,147 at P 2 ("If the assessments identify potential impacts from benchmark GMD events, the Reliability Standards *should* require owners and operators to develop and implement a plan to protect against instability, uncontrolled separation, or cascading failures of the Bulk-Power System, caused by damage to critical or vulnerable Bulk-Power System equipment, or otherwise, as a result of a benchmark GMD event.").

[63] NERC Glossary at 26.

the same time, the absence of reasonable deadlines for completion of corrective actions may risk significant delay before identified corrective actions are started or finished. The Commission, therefore, proposes to direct NERC to modify the Reliability Standard to require a deadline for non-equipment mitigation measures that is two years following development of the corrective action plan and a deadline for mitigation measures involving equipment installation that is four years following development of the corrective action plan. The Commission recognizes that there is little experience with installing equipment for GMD mitigation and thus we are open to proposals that may differ from our proposal, particularly from any entities with experience in this area.

54. We seek comments from NERC and interested entities on these proposals. Further, we seek comment on appropriate alternative deadlines and whether there should be a mechanism that would allow NERC to consider, on a case-by-case basis, requests for extensions of required deadlines.

E. Minimization of Load Loss and Curtailment

NERC Petition

55. Proposed Reliability Standard TPL-007-1, Requirement R4 states that each responsible entity "shall complete a GMD Vulnerability Assessment of the Near-Term Transmission Planning Horizon once every 60 calendar months." Requirement R4.2 further states that the "study or studies shall be conducted based on the benchmark GMD event described in Attachment 1 to determine whether the System meets the performance requirements in Table 1."

56. NERC maintains that Table 1 sets forth requirements for system steady state performance. NERC explains that Requirement R4 and Table 1 "address assessments of the effects of GICs on other Bulk-Power System equipment, system operations, and system stability, including the loss of devices due to GIC impacts."[64] Table 1 provides, in relevant part, that load loss and/or curtailment are permissible elements of the steady state:

> Load loss as a result of manual or automatic Load shedding (e.g. UVLS) and/or curtailment of Firm Transmission Service may be used to meet BES performance requirements during studied GMD conditions. The likelihood and magnitude of Load loss or curtailment of Firm Transmission Service should be minimized.

Discussion

57. The Commission seeks comment from NERC regarding the provision in Table 1 that "Load loss or curtailment of Firm Transmission Service should be minimized." Because the term "minimized" does not represent an objective value, the provision is potentially subject to interpretation and assertions that the term is vague and may not be enforceable. Similarly, use of the modifier "should" might indicate that minimization of load loss or curtailment is only an expectation or a guideline rather than a requirement.

58. The Commission seeks comment from NERC that explains how the provision in Table 1 regarding load loss and curtailment will be enforced, including: (1) whether, by

[64] NERC Petition at 39.

using the term "should," Table 1 requires minimization of load loss or curtailment, or both; and (2) what constitutes "minimization" and how it will be assessed.

F. Violation Risk Factors and Violation Severity Levels

59. Each requirement of proposed Reliability Standard TPL-007-1 includes one violation risk factor and has an associated set of at least one violation severity level. NERC states that the ranges of penalties for violations will be based on the sanctions table and supporting penalty determination process described in the Commission-approved NERC Sanction Guidelines.

60. The Commission proposes to approve the violation risk factors and violation severity levels submitted by NERC, for the requirements in Reliability Standard TPL-007-1, consistent with the Commission's established guidelines.[65]

G. Implementation Plan and Effective Dates

61. NERC proposes a phased, five-year implementation period.[66] NERC maintains that the proposed implementation period is necessary: (1) to allow time for entities to develop the required models; (2) for proper sequencing of assessments because thermal impact assessments are dependent on GIC flow calculations that are determined by the responsible planning entity; and (3) to give time for development of viable corrective action plans, which may require applicable entities to "develop, perform, and/or validate

[65] *North American Electric Reliability Corp.*, 135 FERC ¶ 61,166 (2011).

[66] NERC Petition, Ex. B (Implementation Plan for TPL-007-1).

new or modified studies, assessments, procedures … [and because] [s]ome mitigation measures may have significant budget, siting, or construction planning requirements."[67]

62. The proposed implementation plan states that Requirement R1 shall become effective on the first day of the first calendar quarter that is six months after Commission approval. For Requirement R2, NERC proposes that the requirement shall become effective on the first day of the first calendar quarter that is 18 months after Commission approval. NERC proposes that Requirement R5 shall become effective on the first day of the first calendar quarter that is 24 months after Commission approval. NERC proposes that Requirement R6 shall become effective on the first day of the first calendar quarter that is 48 months after Commission approval. And for Requirement R3, Requirement R4, and Requirement R7, NERC proposes that the requirements shall become effective on the first day of the first calendar quarter that is 60 months after Commission approval.

63. The Commission proposes to approve the implementation plan and effective dates submitted by NERC. However, given the serial nature of the requirements in the proposed Reliability Standard, we are concerned about the duration of the timeline associated with any mitigation stemming from a corrective action plan. As a result, the Commission seeks comment from NERC and other interested entities as to whether the length of the implementation plan, particularly with respect to Requirements R4, R5, R6, and R7, could be reasonably shortened.

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[67] *Id.* at 2.

III. Information Collection Statement

64. The collection of information contained in this notice of proposed rulemaking is subject to review by the Office of Management and Budget (OMB) regulations under section 3507(d) of the Paperwork Reduction Act of 1995 (PRA).[68] OMB's regulations require approval of certain informational collection requirements imposed by agency rules.[69]

65. Upon approval of a collection(s) of information, OMB will assign an OMB control number and an expiration date. Respondents subject to the filing requirements of a rule will not be penalized for failing to respond to these collections of information unless the collections of information display a valid OMB control number.

66. We solicit comments on the need for this information, whether the information will have practical utility, the accuracy of the burden estimates, ways to enhance the quality, utility, and clarity of the information to be collected or retained, and any suggested methods for minimizing respondents' burden, including the use of automated information techniques. Specifically, the Commission asks that any revised burden or cost estimates submitted by commenters be supported by sufficient detail to understand how the estimates are generated.

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[68] 44 U.S.C. 3507(d).

[69] 5 CFR 1320.11 (2014).

Public Reporting Burden: The Commission proposes to approve Reliability Standard TPL-007-1 and the associated implementation plan, violation severity levels, and violation risk factors, as discussed above. Proposed Reliability Standard TPL-007-1 will impose new requirements for transmission planners, planning coordinators, transmission owners, and generator owners. Proposed Reliability Standard TPL-007-1, Requirement R1 requires planning coordinators, in conjunction with transmission planner, to identify the responsibilities of the planning coordinator and transmission planner in the planning coordinator's planning area for maintaining models and performing the study or studies needed to complete GMD Vulnerability Assessments. Proposed Requirements R2, R3, R4, R5, and R7 refer to the "responsible entity, as determined by Requirement R1," when identifying which applicable planning coordinators or transmission planners are responsible for maintaining models and performing the necessary study or studies. Proposed Requirement R2 requires that the responsible entities maintain models for performing the studies needed to complete GMD Vulnerability Assessments, as required in proposed Requirement R4. Proposed Requirement R3 requires responsible entities to have criteria for acceptable system steady state voltage performance during a benchmark GMD event. Proposed Requirement R4 requires responsible entities to complete a GMD Vulnerability Assessment of the near-term transmission planning horizon once every 60 calendar months. Proposed Requirement R5 requires responsible entities to provide GIC flow information to transmission owners and generator owners that own an applicable bulk electric system power transformer in the planning area. This information is necessary for applicable transmission owners and generator owners to conduct the

thermal impact assessments required by proposed Requirement R6. Proposed Requirement R6 requires applicable transmission owners and generator owners to conduct thermal impact assessments where the maximum effective GIC value provided in proposed Requirement R5, Part 5.1 is 75 A/phase or greater. Proposed Requirement R7 requires responsible entities to develop a corrective action plan when its GMD Vulnerability Assessment indicates that its system does not meet the performance requirements of Table 1 – Steady State Planning Events. The corrective action plan must address how the performance requirements will be met, must list the specific deficiencies and associated actions that are necessary to achieve performance, and must set forth a timetable for completion. The Commission estimates the annual reporting burden and cost as follows:

FERC-725N, as modified by the NOPR in Docket No. RM15-11-000 (TPL-007-1 Reliability Standard for Transmission System Planned Performance for Geomagnetic Disturbance Events)[70]

[70] Eng.=engineer; RK =recordkeeping (record clerk); PC=planning coordinator; TP=transmission planner; TO=transmission owner; and GO=generator owner.

	Number of Respondents (1)	Annual Number of Responses per Respondent (2)	Total Number of Responses (1)*(2)=(3)	Average Burden Hours & Cost Per Response [71] (4)	Total Annual Burden Hours & Total Annual Cost (3)*(4)=(5)	Cost per Respondent ($) (5)÷(1)
(One-time) Requirement 1	121 (PC & TP)	1	121	Eng. 5 hrs. ($331.75); RK 4 hrs. ($149.80)	1,089 hrs. (605 Eng., 484 RK); $58,267.55 ($40,141.75 Eng., $18,125.80 RK)	$481.55
(On-going) Requirement 1	121 (PC & TP)	1	121	Eng. 3 hrs. ($199.05); RK 2 hrs. ($74.90)	605 hrs. (363 Eng., 242 RK); $33,147.95 ($24,085.05 Eng., $9,062.90 RK)	$273.95

[71] The estimates for cost per response are derived using the following formula: Burden Hours per Response * $/hour = Cost per Response. The $66.35/hour figure for an engineer and the $37.45/hour figure for a record clerk are based on data on the average salary plus benefits from the Bureau of Labor Statistics obtainable at **Error! Hyperlink reference not valid.**http://bls.gov/ oes/current/naics3_221000.htm and http://www.bls.gov/news.release/ecec.nr0.htm.

(One-time) Requirement 2	121 (PC & TP)	1	121	Eng. 22 hrs. ($1,459.70); RK 18 hrs. ($674.10)	4840 hrs. (2,662 Eng., 2,178 RK); $258,189.80 ($176,623.70 Eng., $81,566.10 RK)	$2,133.80
(On-going) Requirement 2	121 (PC & TP)	1	121	Eng. 5 hrs. ($331.75); RK 3 hrs. ($112.35)	968 hrs. (605 Eng., 363 RK); $53,736.10 ($40,141.75 Eng., $13,594.35 RK)	$444.10
(One-time) Requirement 3	121 (PC & TP)	1	121	Eng. 5 hrs. ($331.75); RK 3 hrs. ($112.35)	968 hrs. (605 Eng., 363 RK); $53,736.10 ($40,141.75 Eng., $13,594.35 RK)	$444.10
(On-going) Requirement 3	121 (PC & TP)	1	121	Eng. 1 hrs. ($66.35); RK 1 hrs. ($37.45)	242 hrs. (121 Eng., 121 RK); $12,559.80 ($8,028.35 Eng., $4,531.45 RK)	$103.80

(On-going) Requirement 4	121 (PC & TP)	1	121	Eng. 27 hrs. ($1,791.45); RK 21 hrs. ($786.45)	5,808 hrs. (3,267 Eng., 2,541 RK); $311,919.85 ($216,765.45 Eng., $95,154.40 RK)	$2,277.85
(On-going) Requirement 5	121 (PC & TP)	1	121	Eng. 9 hrs. ($597.15); RK 7 hrs. ($262.15)	1936 hrs. (1,089 Eng., 847 RK); $103,975.30 ($72,255.15 Eng., $31,720.15 RK)	$859.30
(One-time) Requirement 6	881 (TO & GO)	1	881	Eng. 22 hrs. ($1,459.70); RK 18 hrs. ($674.19)	35,240 hrs. (19,382 Eng., 15,858 RK); $1,879,957.09 ($1,285,995.70 Eng., $593,961.39 RK)	$2,133.89
(On-going) Requirement 6	881 (TO & GO)	1	881	Eng. 2 hrs. ($132.70); RK 2 hrs. ($74.90)	3,524 hrs. (1,762 Eng., 1762 RK); $182,895.60 ($116,908.70 Eng., $65,986.90 RK)	$207.60

(On-going) Requirement 7	121 (PC & TP)	1	121	Eng. 11 hrs. ($729.85); RK 9 hrs. ($337.05)	2,420 hrs. (1,331 Eng., 1,089 RK); $129,094.90 ($88,311.85 Eng., $40,783.05 RK)	$1,066.90
TOTAL			**2851**		**57,640[72] hrs. (31,792 Eng., 25,848 RK); $3,077,480.04 ($2,109,399.20 Eng., $968,080.84 RK)**	

Title: FERC-725N, Mandatory Reliability Standards: TPL Reliability Standards

Action: Proposed Additional Requirements.

OMB Control No: 1902-0264.

Respondents: Business or other for-profit and not-for-profit institutions.

Frequency of Responses: One time and on-going.

Necessity of the Information: The Commission has reviewed the requirements pertaining to proposed Reliability Standard TPL-007-1 and has made a determination that the

[72] Of the 57,640 total burden hours, 42,137 hours are one time burden hours, and 15,503 hours are on-going annual burden hours.

proposed requirements of this Reliability Standard are necessary to implement section 215 of the FPA. Specifically, these requirements address the threat posed by GMD events to the Bulk-Power System and conform to the Commission's directives regarding development of the Second Stage GMD Reliability Standards, as set forth in Order No. 779.

Internal review: The Commission has assured itself, by means of its internal review, that there is specific, objective support for the burden estimates associated with the information requirements.

67. Interested persons may obtain information on the reporting requirements by contacting the Federal Energy Regulatory Commission, Office of the Executive Director, 888 First Street, NE, Washington, DC 20426 [Attention: Ellen Brown, e-mail: DataClearance@ferc.gov, phone: (202) 502-8663, fax: (202) 273-0873].

68. Comments concerning the information collections proposed in this notice of proposed rulemaking and the associated burden estimates, should be sent to the Commission in this docket and may also be sent to the Office of Management and Budget, Office of Information and Regulatory Affairs [Attention: Desk Officer for the Federal Energy Regulatory Commission]. For security reasons, comments should be sent by e-mail to OMB at the following e-mail address: oira_submission@omb.eop.gov. Please reference FERC-725N and OMB Control No. 1902-0264 in your submission.

IV. Environmental Analysis

69. The Commission is required to prepare an Environmental Assessment or an Environmental Impact Statement for any action that may have a significant adverse effect

on the human environment.[73] The Commission has categorically excluded certain actions from this requirement as not having a significant effect on the human environment. Included in the exclusion are rules that are clarifying, corrective, or procedural or that do not substantially change the effect of the regulations being amended.[74] The actions proposed here fall within this categorical exclusion in the Commission's regulations.

V. Regulatory Flexibility Act

70. The Regulatory Flexibility Act of 1980 (RFA)[75] generally requires a description and analysis of proposed rules that will have significant economic impact on a substantial number of small entities. The Small Business Administration's (SBA) Office of Size Standards develops the numerical definition of a small business.[76] The SBA revised its size standard for electric utilities (effective January 22, 2014) to a standard based on the number of employees, including affiliates (from a standard based on megawatt hours).[77] Under SBA's new size standards, planning coordinators, transmission planners,

[73] *Regulations Implementing the National Environmental Policy Act*, Order No. 486, FERC Stats. & Regs. Preambles 1986-1990 ¶ 30,783 (1987).

[74] 18 CFR 380.4(a)(2)(ii).

[75] 5 U.S.C. 601-12.

[76] 13 CFR 121.101.

[77] SBA Final Rule on "Small Business Size Standards: Utilities," 78 FR 77,343 (Dec. 23, 2013).

transmission owners, and generator owners are likely included in one of the following categories (with the associated size thresholds noted for each):[78]

- Hydroelectric power generation, at 500 employees
- Fossil fuel electric power generation, at 750 employees
- Nuclear electric power generation, at 750 employees
- Other electric power generation (e.g., solar, wind, geothermal, biomass, and other), at 250 employees
- Electric bulk power transmission and control,[79] at 500 employees

71. Based on these categories, the Commission will use a conservative threshold of 750 employees for all entities.[80] Applying this threshold, the Commission estimates that there are 440 small entities that function as planning coordinators, transmission planners, transmission owners, and/or generator owners. However, the Commission estimates that only a subset of such small entities will be subject to the proposed Reliability Standard given the additional applicability criteria in the proposed Reliability Standard (i.e., to be subject to the requirements of the proposed Reliability Standard, the applicable entity must own or must have a planning area that contains a large power transformer with a high side, wye grounded winding with terminal voltage greater than 200 kV).

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[78] 13 CFR 121.201, Sector 22, Utilities.

[79] This category covers transmission planners and planning coordinators.

[80] By using the highest number threshold for all types of entities, our estimate conservatively treats more entities as "small entities."

72. Proposed Reliability Standard TPL-007- 1 enhances reliability by establishing requirements that require applicable entities to perform GMD Vulnerability Assessments and to mitigate any identified vulnerabilities. The Commission estimates that each of the small entities to whom the proposed Reliability Standard TPL-007-1 applies will incur one-time compliance costs of $5,193.34 and annual ongoing costs of $5,233.50.

73. The Commission does not consider the estimated cost per small entity to impose a significant economic impact on a substantial number of small entities. Accordingly, the Commission certifies that the proposed Reliability Standard will not have a significant economic impact on a substantial number of small entities.

VI. Comment Procedures

74. The Commission invites interested persons to submit comments on the matters and issues proposed in this notice to be adopted, including any related matters or alternative proposals that commenters may wish to discuss. Comments are due **[INSERT DATE 60 days after publication in the FEDERAL REGISTER]**. Comments must refer to Docket No. RM15-11-000, and must include the commenter's name, the organization they represent, if applicable, and their address in their comments.

75. The Commission encourages comments to be filed electronically via the eFiling link on the Commission's web site at http://www.ferc.gov. The Commission accepts most standard word processing formats. Documents created electronically using word processing software should be filed in native applications or print-to-PDF format and not in a scanned format. Commenters filing electronically do not need to make a paper filing.

76. Commenters that are not able to file comments electronically must send an original of their comments to: Federal Energy Regulatory Commission, Secretary of the Commission, 888 First Street NE, Washington, DC, 20426.

77. All comments will be placed in the Commission's public files and may be viewed, printed, or downloaded remotely as described in the Document Availability section below. Commenters on this proposal are not required to serve copies of their comments on other commenters.

VII. Document Availability

78. In addition to publishing the full text of this document in the Federal Register, the Commission provides all interested persons an opportunity to view and/or print the contents of this document via the Internet through the Commission's Home Page (http://www.ferc.gov) and in the Commission's Public Reference Room during normal business hours (8:30 a.m. to 5:00 p.m. Eastern time) at 888 First Street, NE, Room 2A, Washington DC 20426.

79. From the Commission's Home Page on the Internet, this information is available on eLibrary. The full text of this document is available on eLibrary in PDF and Microsoft Word format for viewing, printing, and/or downloading. To access this document in eLibrary, type the docket number excluding the last three digits of this document in the docket number field.

80. User assistance is available for eLibrary and the Commission's website during normal business hours from the Commission's Online Support at 202-502-6652 (toll free at 1-866-208-3676) or email at ferconlinesupport@ferc.gov, or the Public Reference

Room at (202) 502-8371, TTY (202)502-8659. E-mail the Public Reference Room at public.referenceroom@ferc.gov.

By direction of the Commission.

Kimberly D. Bose,
Secretary.

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