UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Reliability Standards for Geomagnetic Disturbances	**)** **)**	**Docket No. RM12-22-000**

SUPPLEMENTAL COMMENTS OF THE FOUNDATION FOR RESILIENT SOCIETIES

Submitted to FERC on May 14, 2013

Pursuant to the Federal Energy Regulatory Commission's ("FERC" or "Commission") Notice of Proposed Rulemaking (NOPR) issued on October 18, 2012,[1] the Foundation for Resilient Societies respectfully submits Supplemental Comments on the Commission's proposal to direct the North American Electric Reliability Corporation (NERC), the Commission-certified Electric Reliability Organization (ERO), to submit for approval Reliability Standards that address the impact of geomagnetic disturbances (GMD) on the reliable operation of the Bulk-Power System (BPS).

BACKGROUND

The Foundation for Resilient Societies (or "Foundation") is incorporated in the State of New Hampshire as a non-profit organization engaged in research and education that relates to protecting technologically-advanced societies from natural disasters or breakdowns in human reliability.

The Commission's Notice of Proposed Rulemaking on Geomagnetic Disturbance (GMD) when issued on October 18, 2012 did not propose to include a standard for mandatory monitoring equipment relating to *geomagnetically induced currents* (GICs) or for other monitoring equipment or diagnostic equipment relating to operability of grid-critical equipment before, during and following geomagnetic disturbances.

[1] *Reliability Standards for Geomagnetic Disturbances*, Notice of Proposed Rulemaking, 141 FERC ¶ 61,045 (2012) ("GMD NOPR").

When the Geomagnetic Disturbance NOPR was issued in October 2012, the Board of Trustees of the North American Electric Reliability Corporation ("NERC") had in force a previously board-reviewed and scheduled standard to be developed. This was **NERC Project 2012-01, Equipment Monitoring and Diagnostic Devices.** This proposed standard was included in NERC's Reliability **Standards Development Plan, 2012-2014,** and in prior RSDP tasks for 2011-2013.

Hence, there was no need in October 2012 for FERC's Commissioners to include specific requirements for near-real-time GIC monitoring of extra high voltage (EHV) transformers or other critical grid equipment such as Static Var Capacitors (SVCs); and no need to include in a FERC Order (relating to standards to mitigate GMD) complementary diagnostic equipment for grid-critical equipment alerting, or near-real time release of safety and risk-related monitoring data to regional balancing authorities and to FERC for access by the Commission, the Commission staff, and the general public.

On December 19, 2012, shortly before the initial GMD NOPR Comment deadline, the NERC Board of Trustees approved an updated **Reliability Standards Development Plan, 2013-2015**, which still included Project 2012-01, Equipment Monitoring and Diagnostic Devices, *but with the Project now listed as a "Candidate for Dismissal" from standards development requirements.* See Appendices I, II, and III of this Comment, for the birth, commitment, and planned burial of this proposed NERC standard.

By the December 24, 2012 GMD NOPR Comment deadline, several commentators identified the importance of continuous GIC monitoring of extra high voltage transformers and other grid critical equipment, and the benefits of public release of GIC monitoring data, just as safety data relating to earthquakes, floods, and other safety hazards are publicly released by operators of critical transportation equipment and other critical infrastructures.

Notwithstanding these comments, NERC's Committees have proceeded towards the elimination of a mandatory standard for equipment monitoring and diagnostic devices, and procedures that might require near-real-time reporting to regional balancing authorities and to

FERC. These are the same equipment monitoring and diagnostic devices that would be required for geomagnetic disturbance operating procedures to have any chance of being effective.

In March 2013 the Operating Reliability Subcommittee (ORS) of NERC's Operating Committee asked of "Requests for Research" on "Equipment Monitoring": "Do we know what is being asked?" The Minutes of the March 5-6, 2013 Albuquerque Meeting of the Operating Committee provide no answer to that question.[2] The recent NERC Operating Committee "request for research" without identification of any specific research needs, is in reality just a cosmetic framework for the unexplained but permanent termination of NERC's multi-year commitment (2009 through 2012) to develop a standard for "Equipment Monitoring and Diagnostic Devices."[3]

When this Project was first proposed to the Standards Committee in September 2008[4], and when the Project was adopted by NERC in 2009, then again in years 2010 and 2011[5], the NERC Standards Committee agreed that no further research was needed before standards development for equipment monitoring and diagnostic devices.

However, following public comments on the benefits of continuous GMD monitoring and near-real-time reporting of GICs during the GMD Task Force meetings in year 2012, and in

[2] A NERC Operating Committee Excel spreadsheet dated March 8, 2013, found on the Operating Committee section of the NERC website, indicates a query by the Operating Reliability Subcommittee regarding the proposed research, but with no answer provided.

[3] Comment of Christine M. Schwab, Chair, NERC Reliability Issues Steering Committee (RISC), at the RISC Face-to-Face meeting in Boston, Massachusetts on May 9, 2013 explained that NERC's Operating Committee (OC) was an "important" committee in the NERC standards-setting process. The NERC Operating Committee queried the current sponsorship for this Project at an OC meeting in the first week of March 2013.

[4] R. W. Kenyon proposed this project in year 2008, to develop standards for "major equipment monitoring and diagnostic devices and procedures, with the intent of identifying potential equipment failures prior to their occurrence. This will provide more time to address failing systems and avoid or minimize lead times." Specific equipment to be considered, per the NERC approved project as of April 2009 included "dissolved gas and moisture sampling processes and the application of on-line monitoring devices to detect incipient faults within BES major components such as EHV transformers…. In some instances early warning of evolving faults can permit field repair of the unit, avoiding a system fault and destruction of a major piece of equipment."

[5] See NERC Reliability Standards Development Plan 2011-2013, Project 2011-01, filed by Gerald W. Cauley, et al. on April 5, 2011, in FERC Docket RM05-17-000, Docket RM05-25-000, and Docket RM06-16-000. The project tasking schedule was for standard development in years 2011-2013. On October 7, 2009 NERC rescheduled the Project as Project 2012-02, for implementation in years 2012-2014. The December 2012 NERC filing with FERC, the Reliability Standards Development Plan 2013-2015, carried the project forward for implementation in 2013 Q2-2015.

public comments filed in this NOPR Docket in December 2012, NERC's leadership acted to eliminate this reliability-enhancing standard altogether.

NERC's Operating Committee recommended unspecified "further research" but not for a rescheduled Project standard. Instead, both the NERC Operating Committee and the NERC RISC Committee supported reversal of NERC's multi-year commitment for a standard to be developed for Equipment Monitoring and Diagnostic Devices. Claiming that "research has been requested by the [NERC] Operating Committee" the Chair of the Standards Committee, in a presentation dated May 3, 2013, indicated to the full NERC RISC Committee on May 9, 2013 that a standard for equipment monitoring and diagnostic devices was "no longer needed."[6]

At the face-to-face NERC Reliability Issues Steering Committee (RISC) held in Boston on May 9, 2013, the RISC Committee voted unanimously to recommend elimination of the scheduled standard development. The next scheduled step in NERC's effort to halt any standard for equipment monitoring and diagnostic devices is for the Standards Committee, whose Chairman advocated elimination of this proposed standard at the May 9th RISC Committee, to formally remove this proposed standard from the 2013-2015 Reliability Standards Development Plan (RSDP). The Standards Committee is scheduled to vote upon removal of Project 2012-01 from the standards development requirements for 2013-2015 on June 5-6, 2013.

To summarize: The procedural background indicates that an order to develop standards for equipment monitoring and diagnostic devices, while not needed in the October 2012 Draft

[6] Brian J. Murphy, Chair, NERC Standards Committee, PowerPoint Presentation, "Elimination of Outdated or Unnecessary Standard Projects," as posted to the NERC website on May 3, 2013. See in particular Viewgraph 8 of 19. Excerpts from this PowerPoint Presentation are reproduced as Appendix IV.

FERC Order, are now essential to include in any Final FERC Order to mitigate geomagnetic disturbances to the bulk power system.

REASON FOR LATE FILING

On May 9, 2013, the NERC Reliability Issues Steering Committee (RISC) voted to recommend elimination of a planned reliability standard previously approved by the NERC Board of Trustees. The RISC is the NERC body that advises the Board of Trustees. Prior to the RISC vote, it could not have been reasonably anticipated that the Board of Trustees would have acquiesced in the technically unjustified elimination of a planned reliability standard.

INADEQUATE NERC PROCDEDURAL SAFEGUARDS IN STANDARD-SETTING PROCESS

The Foundation for Resilient Societies expresses concern about both *the process* by which NERC decides to eliminate a NERC commitment to standards development and by the *substantive harm* to future grid reliability. It is essential that FERC include in any GMD Mitigation Order the requirement for standards relating to monitoring equipment, diagnostic devices, and procedures for near-real-time data sharing with balancing authorities, FERC, and the general public.

Because NERC has a duty to assure balance, openness, and transparency in its standard-setting or standards-elimination process under Section 215 of the Federal Power Act, we have concern that the Chairpersons of key NERC Committees have not recused themselves from making standards recommendations, including standards elimination recommendations, when the organizations that employ them operate capital equipment with aggravated vulnerabilities to geomagnetic disturbances.

Specifically, the Chair of NERC's RISC Committee indicated at the face-to-face meeting on the afternoon of May 9, 2013 that it was the Operating Committee that was the primary initiator of the NERC effort to reverse a commitment to a standard for *equipment monitoring and diagnostic devices and procedures.* The Chair of the Operating Committee is Tom Bowe, Executive Director of Reliability and Compliance, PJM Interconnection, L.L.C. It is widely

reported in NERC records as far back as the Hydro Québec blackout of March 1989 that key PJM Interconnection-serving generating facilities including Salem 1, Salem 2, and Hope Creek have particularly susceptibility to geomagnetic disturbances.

Further, it was the Standards Committee Chairman Brian J. Murphy, who presented the proposal to eliminate Standards Project 2012-01 before the RISC Committee on May 9, 2012, recommending the *termination* of this standard development before referral back of the RISC recommendation to the Standards Committee. While chairing the Standards Committee, Mr. Murphy serves as Manager, NERC Reliability Standards, for NextEra Energy. A NextEra subsidiary operates two nuclear generating facilities that NextEra (April 2013 Boulder, Colorado conference presentation) recently acknowledged to be "GIC hotspots" – Seabrook Station in New Hampshire, and Point Beach in Wisconsin. Our Foundation authored and made public a research paper on Seabrook Station vulnerabilities to GMD as far back as January 2012. More recently, our Foundation has commented (in this Docket) that Seabrook's GIC monitor is not automatically reported to ISO-New England, and that the NextEra calculation of "withstand" capabilities appears to be inconsistent with past correlations of geomagnetic observatories during prior solar storms that have caused failure of critical grid equipment. [7]

Moreover, the Chairperson of the RISC Committee that recommended termination of NERC standards Project 2012-01 on May 9, 2013, also has employment with a holding company, Dominion Resources, Inc. subsidiary that operates at least one generating facility that appears to be a "GIC hot spot." Christine M. Schwab, Chair of NERC's RISC Committee, serves as Vice President, Chief Compliance and Risk Officer, Dominion Resources Services, a Dominion subsidiary, operates two North Anna nuclear plants in central Virginia, an area known to be susceptible to GIC. Both North Anna plants reported "SOLAR MAGNETIC DISTURBANCE GRID WARNING" in the Nuclear Regulatory Commission (NRC) Power Reactor Status Report for January 25, 2012. Of thirty-three nuclear plants in NRC Region 2, only the North Anna and Surry

[7] See the Report of the Foundation for Resilient Societies on the unworkability of current "operating procedures" to mitigate geomagnetic storms in Maine and ISO-New England, as filed in FERC Docket RM12-22-000 on May 1, 2012.

plants registered geomagnetic disturbance warnings on that day. It is therefore reasonable to conclude that the North Anna nuclear plants have a potential GIC issue and that Dominion, the plant operator, knows of this vulnerability. So three key NERC Committees are chaired by employees of entities that operate or serve wholesale markets for generating facilities with particular geomagnetic disturbance vulnerabilities. And all three support elimination of NERC Project 2012-01 that might result in adoption of mandatory near-real-time monitoring and data-sharing systems. These critical equipment monitoring and diagnostic capabilities could significantly mitigate geomagnetic disturbances. NERC's lack of procedural safeguards during the elimination of a scheduled NERC reliability standard create, at a minimum, concerns about the appearance of conflicts of interest in standard setting.

BENEFITS OF EQUIPMENT MONITORING & DIAGNOSTIC DEVICES, COMBINED WITH NEAR-REAL-TIME REPORTING TO CONTROL CENTERS, BALANCING AUTHORITIES, AND FERC

Substantial benefits would result from equipment monitoring and diagnostic devices, especially for mitigation of geomagnetic disturbance as outlined in the tables below. These benefits would be lost were the planned NERC standard to be eliminated.

Benefits of GIC Monitoring

BENEFIT	COMMENT
Near-real-time GIC monitoring	Allows operating utility to prepare for and "operate through" moderate solar storms with slow onset, depending upon location; identifies facilities and equipment for which hardware protection is necessary; increases transformer life if network is de-energized during solar storms;
GIC monitoring shared with balancing authorities	Allows pre-positioning of generation and transmission assets based on space storm warnings; enables load shedding to minimize blackout recovery times; independently supports cost-sharing for hardware protective equipment; enables redesign of new transmission systems to reduce GMD vulnerabilities
GIC monitoring shared with FERC & DOE	Enables prudent non-delegable Presidential orders to de-energize facilities for grid protection in severe geomagnetic storm & to reduce grid recovery delays; enables alerts to backup and off-grid protected generation facilities; facilitates FERC cost-sharing rulemaking for GMD protective equipment improving BPS reliability; aids allocation of spare EHV transformers in emergencies.
Complementary E1 man-made EMP protection initiatives	GIC monitoring & GMD protective equipment databases assist in prioritizing E1 protections that depend for effectiveness upon complementary E3 protection system operability.
GIC Monitoring for research purposes	Allows better understanding of geomagnetic storms and their effects on electric grid operations and equipment

Benefits of EHV Transformer Monitoring

BENEFIT	COMMENT
Monitoring of GIC exposure at individual transformers	Increases transformer life if vulnerable transformers are de-energized during solar storms.
Monitoring of EHV transformer heating and vibration	May allow operators to de-energize stressed transformers; may predict which transformers will fail in the aftermath of solar storms.
Monitoring of EHV dissolved gases	Anticipates and averts some system contingencies due to unexpected transformer failure; can prevent transformer fires and explosions and resulting safety risks

CONCLUSION

The FERC NOPR on GMD did not have a requirement for diagnostic and GIC monitoring of EHV transformers, as these requirements could be reasonably be anticipated by a planned NERC reliability standard. Now NERC proposes to eliminate this planned standard without technical justification. Ironically, while the electric utility industry proposes in its RM12-22-000 docket comments to rely principally on operating procedures, NERC now intends to eliminate a planned reliability standard for the GIC monitoring that would be required for effective use of operating procedures. The FERC Commissioners should now add a requirement for diagnostic and GIC monitoring of EHV transformers into the final wording of any geomagnetic disturbance Order. In order for diagnostic and GIC monitoring to be most effective, the data must be shared in near real-time with regional balancing authorities, FERC, and DOE.

Respectfully submitted by

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APPENDIX 1

NERC 2009-2011 Reliability Standards Development Plan, 09-22-2008

Comment 5
Name: R. W. Kenyon, J.D., P.E.
Organization: NERC
Reliability Issue: Reliability of Major BES Components
Suggestion or Comment: Develop Reliability Standards covering the application of major equipment monitoring and diagnostic devices and procedures.
Example: The Reliability Standard would address dissolved gas and moisture sampling processes and the application on on-line monitoring devices to detect incipient faults within BES major components, such as EHV transformers. These processes and devices enable the equipment owner to detect evolving internal faults, allowing corrective action under controlled conditions. In some instances, early warning of evolving faults can permit field repair of the unit, avoiding a system fault and destruction of a major piece of equipment. In other circumstances, the warning obtained permits the equipment owner to monitor the situation and to schedule unit replacement in a deliberate, controlled manner. Again, occurrence of a major system fault and unscheduled loss of a major unit can be avoided. Obviously, such measures can contribute significantly to reliability of the Bulk Electric System.
Recommendation for improvement: Ideally, the envisioned standard would make the application of this technology mandatory for classes of critical equipment, with EHV transformers and shunt reactors an obvious example. Similar diagnostic approaches should be taken on critical EHV and/or major generator Gas Insulated Switchgear. The general approach could follow PRC-005, where the owner must have a system, but particulars are left to the equipment owner. The standard could extend to other equipment condition monitoring such as Doble testing. In many instances, equipment owners already recognize the value of major equipment monitoring and have equipment and/or procedures in place addressing this technology. However, there is far less assurance that monitoring equipment is properly maintained, that scheduled routine sampling is being fully performed, and that full use is being made of data obtained. Again, as with the Protective Relay Standard PRC-005, the standard would contribute to insuring that equipment owners indeed have a program addressing this technology and are indeed following their program. In other instances, equipment owners without such equipment might be obligated to establish a monitoring program.
NERC Response:
Because of your suggestion, a new project (2011-01 Equipment Monitoring and Diagnostic Devices) has been added to this 2008 revision of the Reliability Standards Development Plan to consider the development Reliability Standard(s) covering the application of major equipment monitoring and diagnostic devices and procedures.
Appendix A — Summary of Industry Comments
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APPENDIX II

NERC 2010-2012 Reliability Standards Development Plan (excerpt)

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Project 2012-01 Equipment Monitoring and Diagnostic Devices

Standards Involved:
New
Research Needed:
None
Brief Description:

This project was proposed Mr. R. W. Kenyon, J.D., P.E. during the 2008 revision of the Reliability Standards Development Plan.

The drafting team will propose Reliability Standard(s) covering the application of major equipment monitoring and diagnostic devices and procedures. As proposed by Mr. Kenyon, the Reliability Standard(s) will address dissolved gas and moisture sampling processes and the application on on-line monitoring devices to detect incipient faults within BES major components, such as EHV transformers. These processes and devices enable the equipment owner to detect evolving internal faults, allowing corrective action under controlled conditions. In some instances, early warning of evolving faults can permit field repair of the unit, avoiding a system fault and destruction of a major piece of equipment. In other circumstances, the warning obtained permits the equipment owner to monitor the situation and to schedule unit replacement in a deliberate, controlled manner. Again, occurrence of a major system fault and unscheduled loss of a major unit can be avoided. Obviously, such measures can contribute significantly to reliability of the Bulk Electric System.

Ideally, the proposed Reliability Standard(s) would make the application of this technology mandatory for classes of critical equipment, with EHV transformers and shunt reactors an obvious example. Similar diagnostic approaches could be taken on critical EHV and/or major generator Gas Insulated Switchgear. The general approach could follow PRC-005, where the owner must have a system, but particulars are left to the equipment owner. The proposed Reliability Standard(s) could extend to other equipment condition monitoring such as Doble testing.

In many instances, equipment owners already recognize the value of major equipment monitoring and have equipment and/or procedures in place addressing this technology. However, there is far less assurance that monitoring equipment is properly maintained, that scheduled routine sampling is being fully performed, and that full use is being made of data obtained. Again, as with the Protective Relay Standard PRC-005, the proposed Reliability Standard(s) would contribute to insuring that equipment owners have a program addressing this technology and are indeed following their program. In other instances, equipment owners without such equipment might be obligated to establish a monitoring program.

APPENDIX III

NERC 2013-2015 Reliability Standards Development Plan (at p. 45) Approved by the NERC Board of Trustees December 19, 2012

Project 2012-01 Equipment Monitoring and Diagnostic Devices
Summary:
This project will consider the development of reliability standards for the application of major equipment monitoring and diagnostic devices and procedures, with the intent of identifying potential equipment failures prior to their occurrence. This will provide more time to address failing systems and avoid or minimize long lead times.
Standards affected: New
Requested Deliverable from the Operating Committee:
The Operating Committee has been asked to provide an analysis of the major equipment monitoring and diagnostic devices and procedures necessary to identify potential equipment failures prior to their occurrence.

CANDIDATE FOR DISMISSAL

APPENDIX IV
EXCERPTS, NERC STANDARDS COMMITTEE CHAIR, PRESENTATION TO NERC RISC COMMITTEE ELIMINATING OUTDATED STANDARD PROJECTS
MAY 9, 2013

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Project 2012-01 — Equipment Monitoring and Diagnostic Devices

- **Summary:** Application of major equipment monitoring and diagnostic devices and procedures to identify potential equipment failures prior to their occurrence.
- **No longer needed:** Standards projects should only be initiated after sufficient analysis and study – research has been requested from the Operating Committee.