

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

**Reliability Standards for
Geomagnetic Disturbances**

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Docket No. RM12-22-000

REPLY COMMENTS OF THE FOUNDATION FOR RESILIENT SOCIETIES

Submitted to FERC on January 11, 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 reply comments to the comments of the North American Electric Reliability Corporation (NERC), the Commission-certified Electric Reliability Organization (ERO), late submitted to Docket RM12-22 on January 10, 2013.

REPLY COMMENTS OF NERC

In its reply comments regarding the Standards Development Process, NERC states:

“The NERC standard development process is accredited by the American National Standards Institute (“ANSI”) and provides reasonable notice and opportunity for public comment, due process, openness, and balance of interests in developing a proposed Reliability Standard, consistent with the attributes necessary for ANSI accreditation. The same attributes, as well as transparency, consensus-building, and timeliness, are also required under Section 304 of the NERC Rules of Procedure.”

In its reply comments regarding the Geomagnetic Task Force (GMD Task Force), NERC states:

“To clarify the record, the meetings of the GMD Task Force are open and publicly noticed. Pursuant to its certification as the Electric Reliability Organization (“ERO”) and Section 215 of the Federal Power Act, NERC is independent of the users and owners and operators of the Bulk-Power System, while assuring fair stakeholder representation and balanced decisionmaking.”

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

NERC NON-COMPLIANCE WITH SECTION 215 OF FEDERAL POWER ACT

The NERC GMD Task Force met in four face-to-face meetings in 2011 and released its “2012 Special Reliability Assessment: Effects of Geomagnetic Disturbances on the Bulk Power System” (hereafter referred to as the “Interim Report”) on February 29, 2012. In the conduct of the GMD Task Force and in preparation of the “Interim Report,” NERC has established a pattern of non-compliance with Section 215 of the Federal Power Act, which requires that the ERO “provide for reasonable notice and opportunity for public comment, due process, openness, and balance of interests in developing reliability standards and otherwise exercising its duties.” Moreover, there are significant questions regarding whether the NERC Board of Trustees has performed its fiduciary duty to “assure its independence of the users and owners and operators of the bulk-power system, while assuring fair stakeholder representation in the selection of its directors and balanced decisionmaking in any ERO committee or subordinate organizational structure.”

The Foundation for Resilient Societies emailed the General Counsel of NERC on February 8, 2012 to protest a pattern of apparent non-compliance with Section 215 in the conduct of the GMD Task Force, including closed meetings, lack of public notice on the “Interim Report,” lack of opportunity to comment on the conclusions of the “Interim Report,” and lack of balance in formulating the conclusions of the “Interim Report;” this email is included as Appendix 1 of this comment. The Foundation for Resilient Societies and other observers of the GMD Task Force wrote the NERC Board of Trustees on February 21, 2012 protesting that the pending-for-approval “Interim Report” had not been made available to the public as required in the NERC By-Laws and asking that the report not be approved; this letter is included as Appendix 2 of this comment.

The General Counsel of NERC wrote a reply letter to the Foundation for Resilient Societies and other observers on March 1, 2012, stating, “I find your assertions regarding procedural inadequacies to be without merit” and further stating, “The actions of the GMD Task Force have been fully consistent with NERC's Bylaws and Rules of Procedure as well as the Federal

Power Act and Federal Energy Regulatory Commission ("Commission") regulations." The Foundation for Resilient Societies encourages NERC to file its full reply letter as a comment on FERC Docket RM12-22.

The Foundation for Resilient Societies cannot understand why the full text of the "Interim Report" was not placed on the NERC web site within 24 hours of being provided to the NERC Board of Trustees—as specifically required in the NERC By-Laws—and how NERC could be compliant with public notice requirements of Section 215 when the "Interim Report" was discussed and approved in *public board session without the public being afforded a copy of that same report until 6 days after the "public meeting."* Section 4 of the NERC By-Laws with requirements for NERC board meetings is reproduced below (emphasis added):

Section 4 Meetings of the Board to be Open Notice to the public of the dates, places, and times of meetings of the board, and *all nonconfidential material provided to the board, shall be posted on the Corporation's Web site, and notice of meetings of the board shall be sent electronically to members of the Corporation, within 24 hours of the time that notice or such material is given to the trustees.* Meetings of the board shall be open to the public, subject to reasonable limitations due to the availability and size of meeting facilities; provided, that the board may meet in or adjourn to closed session to discuss matters of a confidential nature, including but not limited to personnel matters, compliance and enforcement matters, litigation, or commercially sensitive or critical infrastructure information of any entity. Any or all of the trustees, or members of a committee, may participate in a meeting of the board, or a meeting of a committee, by means of a communications system by which all persons participating in the meeting are able to hear each other.

An email notice of the February 23, 2012 board meeting to approve the "Interim Report" was delayed until February 17, 2012, a full nine days after its announcement at the NERC Members Representative Meeting and only five days before the board meeting. Moreover, notice of the February 23, 2013 board meeting was not posted on the NERC web site within 24 hours, per the By-Law requirement. When the public is deprived of "reasonable notice" of meetings, this is not a mere formality, but strikes at the heart of the regulatory system set up by Congress in Section 215 of the Federal Power Act as amended.

The prospective concerns of the Foundation for Resilient Societies and other GMD Task Force observers were borne out when the NERC Board of Trustees met and approved the “Interim Report” for public release on February 29, 2012. The NERC Board of Trustees devoted less than one-half hour of its meeting time to reviewing and approving the GMD Task Force “Interim Report.” The “Interim Report” was widely criticized by multiple commenters on FERC Docket AD12-13-000 for its lack of rigorous science and unfounded conclusions—conclusions that were unavailable to the public in any draft of the “Interim Report” before its final release.

CONTINUING CONDUCT OF NERC IN REGARD TO SECTION 215

The Foundation for Resilient Societies has concerns that noncompliance of NERC with Section 215 will continue into formal standard-setting and continued conduct of the GMD Task Force. Two examples illustrate:

First, there is a continuing shortfall in reasonable notice of meetings. Notice of the December 19, 2012 Board of Trustees telephonic meeting was not “posted” by email notice until December 13, 2012. It defies credulity that the NERC Board of Trustees, with busy calendars and 100% attendance at the meeting, did not know of this meeting substantially before December 13. Because a previous complaint was lodged with the NERC General Counsel regarding notice of Board of Trustee meetings, NERC noncompliance with the “reasonable notice” requirement in Section 215 cannot be inadvertent.

Second, it appears that non-posted meetings of selected invitees from within the GMD Task Force may be continuing, despite NERC’s statement in its January 10, 2013 comment on Docket RM12-22, “To clarify the record, the meetings of the GMD Task Force are open and publicly noticed.” The GMD Task Force has been divided into four “subgroups” or “teams” where the vast majority of work is performed. A face-to-face meeting for Team 3, “GIC Model Development and Validation” was held on November 29, 2012 at the EPRI office in Washington DC, without advance notice to public observers, some of whom may have subject matter expertise equal to or exceeding that of selected Task Force invitees. A subsequent GMD Task Force conference call on December 14, 2012 disclosed that observers were not invited to the

November 29 Team 3 meeting, despite the meeting's plan being set as far back as October 5, 2012.

While this and other due process shortfalls may or may not have been inadvertent, the Foundation for Resilient Societies previously complained about non-notice to observers of closed subgroup meetings of the GMD Task Force in its February 8, 2012 letter to the NERC General Counsel. Section 215 specifically requires "fair stakeholder representation in the selection of its directors and balanced decisionmaking in any *ERO committee or subordinate organizational structure.*" (Emphasis added.) Subgroups or "teams" of the GMD Task Force, where the majority of work is performed, are "*subordinate organizational structures.*"

When the GMD Task Force is divided into subgroups, and observers are prevented from monitoring the proceedings of more than one subgroup, and the meetings of subgroups are not publicly posted, this defeats the Section 215 regulatory structure and due process safeguards established by Congress.

CONCLUSION

The process that produced the "Interim Report" of the GMD Task Force did not provide reasonable notice and opportunity for public comment, due process, openness, and balance of interests. As a result, the conclusions contained in the "Interim Report" are irredeemably tainted and should not be used in any ANSI-compliant standard setting.

Meetings of the NERC Board of Trustees do not appear to have met the "reasonable notice" requirements of Section 215 of the Federal Power Act, as well as the detailed posting requirements contained within the NERC By-Laws. The NERC Board of Trustees may not have fulfilled its fiduciary duties in approving the "Interim Report;" the board-approved conclusions contained in the "Interim Report" should not be used in any ANSI-compliant standard setting.

Compliance with Section 215, the NERC By-Laws, and ANSI Guidance Documents are not mere formalities. The results of work by the GMD Task Force and NERC standards-setting bodies could determine whether millions of Americans live or die in the aftermath of a severe solar

storm. Public safety demands that all legal requirements be strictly adhered to. The Foundation for Resilient Societies requests that the FERC Commissioners consider NERC compliance with Section 215 as part of any recertification process for NERC as the designated ERO as provided by the Federal Power Act.

Respectfully submitted by:
Thomas S. Popik, Chairman, and
William R. Harris, Secretary, for the

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Appendix 1: Email to NERC General Counsel

From: Thomas S Popik [<mailto:thomasp@resilientsocieties.org>]
Sent: Wednesday, February 08, 2012 2:31 PM
To: david.cook@nerc.net
Cc: 'Mark Lauby'; Eric.Rollison@nerc.net; 'Watkins,Donald S (BPA) - TO-DITT2'; 'kozaf@pjm.com'
Subject: Procedural Issues with GMD Task Force

Mr. Cook:

I am a member of the Geomagnetic Disturbance (GMD) Task Force and represent the Foundation for Resilient Societies, a group that advocates critical infrastructure protections. We are writing to you as General Counsel of NERC to ask that you intercede to remedy processes of the GMD Task Force that do not appear to comply with the Electricity Modernization Act of 2005, NERC Rules of Procedure, and the American National Standards Institute (ANSI) standard-setting process.

We recently learned through happenstance, but not through official notification, that the GMD Task Force Report has already been finalized and approved by NERC technical committees. Also, we learned through happenstance that the GMD Task Force Report has been reviewed by the Electricity Sub-Sector Coordinating Council at an unknown date which may have been February 1, 2012. We learned this information not by official notification, but by reading an advance copy of a presentation "Electricity Sub-sector Coordinating Council (ESCC) Update" to be given to the NERC Board of Trustees on February 9, with "Task Force Completion Milestones" on page 5. We have attached this presentation.

The final GMD Task Force Report has not been provided to members of the GMD Task Force. Also, we were not given official notice of dates and times of Planning and Operating Committee meetings to review and approve the final GMD Task Force Report nor have these meetings been posted on the online NERC calendar. These Planning and Operating Committee meetings appear to have been closed meetings.

NERC has appropriate forums to communicate information to GMD Task Force members but these forums have not been used. In particular, the final GMD Task Force Report has not been posted on the GMD Task Force Sharepoint website (a password protected site for use of task force members). Any minutes from Planning and Operating Committee meetings to approve the report have not been made available to GMD Task Force members.

This non-posting in the calendar of official NERC meetings is part of a troubling pattern that we have repeatedly noticed. For example, two meetings regarding the investigations of major 2011 blackouts were not posted on the online NERC calendar: "Southwest Cold Snap Recommendations" on January 23, 2012 and "MRC Informational Session Conference Call and Webinar" on January 31, 2012 which included the presentation titled "Status of September 8, 2011 Southwestern Outage Inquiry."

NERC Board of Trustee Conference Call meetings (purportedly “public” meetings) are regularly not posted on the online NERC calendar. Recent examples include the November 18, 2011 Board of Trustees Conference Call meeting with the agenda item “2011 Special Reliability Assessment: A Primer of the Natural Gas and Electric Power Interdependency in the United States” and the November 22, 2011 Board of Trustees Conference Call meeting with the agenda item “2011/2012 Winter Reliability Assessment.”

An “Open Session Electricity Sub-Sector Coordinating Council” conference call meeting was held on January 17, 2012 from 2:00pm to 2:30pm ET with the agenda item “Geomagnetic Disturbance Task Force, discussion of key vetting issues.” This meeting was not posted on the online NERC calendar. Moreover, this ESCC meeting was scheduled to overlap completely with a GMD Task Force conference call scheduled for the same day from 1pm to 2:30 pm ET. I have attached the email notice for the GMD Task Force conference call on January 17.

The comment period for the GMD Task Force Report closed on January 19, 2012. While the presentation to be given to the NERC Board of Trustees states that Electricity Sub-Sector Coordinating Council review occurred on February 1, 2012, no meeting of the ESCC was posted on the online NERC calendar in the period January 19 through February 1, 2012. Any review of the GMD Task Force Report by the ESCC before January 19 could not have considered comments of task force members.

The GMD Task Force has had persistent issues with reasonable notice and opportunity for public comment. For example, a substantially revised report draft was intended to be distributed on October 11, 2011—only one day before the close of the comment period on October 12. A significant number of task force members did not receive the report draft on October 11. In fact, these task force members were only supplied the draft by email on October 18 when it became apparent on a GMD Task Force conference call that the report draft had not been sent and/or received; as a result, there was no appropriate public comment period for this draft.

We learned only through happenstance, but not through the official NERC calendar or email notification that a NERC Board of Trustees meeting has been scheduled for some time on February 22, 2012 to approve the final GMD Task Force Report. The scheduled time of this meeting is presently unknown to us.

We also learned through happenstance during the January 17, 2012 GMD Task Force conference call (and then only by incidental disclosure of a transformer manufacturer engineer) that a meeting of transformer engineers and selected GMD Task Force members occurred sometime in January 2012 and that preparation for this meeting included a list of key questions on transformer overheating during solar storms. This list of questions asked and full list of attendees has not been disclosed to all members of the GMD Task Force. As task force members, we have no visibility into what information from this meeting with transformer manufacturers may have been incorporated into the final GMD Task Force Report. While there

may be a legitimate need for drafting teams to communicate with industry representatives, it is clearly out of bounds for the results of these discussions to be incorporated into the final report with zero visibility for observers of the GMD Task Force. Moreover, the GMD Task Force Report should not be finalized in secret and approved by NERC committees and the Board of Trustees without advance disclosure to GMD Task Force Members.

We must protest in the strongest terms this pattern of undisclosed and/or closed meetings and also protest the fact that the GMD Task Force Report has been finalized, reviewed, and approved by NERC committees without any official notification to observer members of the GMD Task Force. The draft GMD Task Force Report made available to task force members on January 9, 2012 resulted in over 300 comments. In light of the substantial comments on the preliminary draft, and further information gathered during the closed meeting with transformer manufacturers, it is reasonable to expect that the final GMD Task Force Report has been substantially revised.

We have included at the end of this message the provisions of the Electricity Modernization Act of 2005 which require NERC as designated ERO to “provide for reasonable notice and opportunity for public comment, due process, openness, and balance of interests in developing reliability standards and otherwise exercising its duties.”

We reviewed the NERC Rules of Procedure and found nothing to support the secret processes of the GMD Task Force, including withholding of the final GMD Task Force report from task force members. The NERC Rules of Procedure state that task forces can be the first step in justifying a new Reliability Standard and are therefore part of the standards setting process: “NERC’s technical committees, subcommittees, working groups, and task forces provide technical research and analysis used to justify the development of new Reliability Standards and provide guidance, when requested by the Standards Committee, in overseeing field tests or collection and analysis of data.” Indeed, under “Essential Attributes of NERC’s Reliability Standards Processes” this requirement is stated: “Transparency—The process shall be transparent to the public.”

The processes of the GMD Task Force also appear to violate due process requirements established by the American National Standards Institute.

We ask that the following documents be immediately released to all members of the GMD Task Force, including observers:

- A list of attendees to the closed meeting with transformer manufacturers and the date on which this meeting was held
- The prepared list of questions presented to the transformer manufacturers in advance of the closed meeting
- Any minutes from the closed meeting with transformer manufacturers, including any written material provided by the transformer manufacturers

- Any minutes from NERC Operations Committee meeting that approved the final GMD Task Force Report, including a list of attendees and votes taken
- Any minutes from NERC Planning Committee meeting that approved the final GMD Task Force Report, including a list of attendees and votes taken
- Any minutes from Electric Sub-sector Coordinating Committee meeting that reviewed the final GMD Task Force Report, including a list of attendees and votes taken
- The full text of the final GMD Task Force report, including all appendices

We also ask that the time of the NERC Board of Trustees Conference Call meeting which we believe will be held on February 22, 2012 be disclosed to members of the GMD Task Force and that this meeting be placed on the official NERC calendar, along with instructions as to how the public might attend in a “listen only” mode.

Thomas Popik
 Foundation for Resilient Societies
 (603) 321-1090

Electricity Modernization Act of 2005

SEC. 1211. ELECTRIC RELIABILITY STANDARDS.

(a) IN GENERAL.—Part II of the Federal Power Act (16 U.S.C. 824 et seq.) is amended by adding at the end the following:

==SEC. 215. ELECTRIC RELIABILITY...

(b) JURISDICTION AND APPLICABILITY.—(1) The Commission shall have jurisdiction, within the United States, over the ERO certified by the Commission under subsection (c), any regional entities, and all users, owners and operators of the bulk-power system, including but not limited to the entities described in section 201(f), for purposes of approving reliability standards established under this section and enforcing compliance with this section. All users, owners and operators of the bulk-power system shall comply with reliability standards that take effect under this section.

(2) The Commission shall issue a final rule to implement the requirements of this section not later than 180 days after the date of enactment of this section.

(c) CERTIFICATION.—Following the issuance of a Commission rule under subsection (b)(2), any person may submit an application to the Commission for certification as the Electric Reliability Organization. The Commission may certify one such ERO if the Commission determines that such ERO—

(1) has the ability to develop and enforce, subject to subsection (e)(2), reliability standards that provide for an adequate level of reliability of the bulk-power system; and

(2) has established rules that—

(A) assure its independence of the users and owners and operators of the bulk-power system, while assuring fair stakeholder representation in the selection of its directors and balanced decisionmaking in any ERO committee or subordinate organizational structure;

(B) allocate equitably reasonable dues, fees, and other charges among end users for all activities under this section;

- (C) provide fair and impartial procedures for enforcement of reliability standards through the imposition of penalties in accordance with subsection (e) (including limitations on activities, functions, or operations, or other appropriate sanctions);
- (D) provide for reasonable notice and opportunity for public comment, due process, openness, and balance of interests in developing reliability standards and otherwise exercising its duties; and
- (E) provide for taking, after certification, appropriate steps to gain recognition in Canada and Mexico.

Appendix 2: Letter to NERC Board of Trustees

Task Force on National and Homeland Security

Foundation for Resilient Societies

Instant Access Networks

ADVANCED FUSION SYSTEMS LLC

February 21, 2012

Board of Trustees

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Jan Schori

Roy Thilly

North American Electric Reliability Corporation

3353 Peachtree Road,

N.E. Suite 600, North Tower

Atlanta, GA 30326

Dear Trustees:

We are writing to you in regard to your pending review and requested approval of the Geomagnetic Disturbance (GMD) Task Force Report, which is scheduled for 2-3pm ET on February 23, 2012. We call on you as Trustees to decline to approve this report. We also ask you to direct NERC to make a data request with legal force to investigate impacts of past geomagnetic disturbances on power transformers and to make the information gathered by this request available to the GMD Task Force for study during open sessions.

The report of the GMD Task Force should not be approved because of pervasive and persistent procedural issues in its preparation which are in apparent conflict with the Title 16 United States Code §215, [Title 18 Code of Federal Regulations §39](#), the [NERC Rules of Procedure](#), and the

[NERC By-Laws](#). Procedural issues include a lack of reasonable notice and opportunity for public comment, a lack of due process, a lack of openness, and an imbalance of interests in the conduct of the GMD Task Force. These procedural issues affect not only the accuracy and credibility of the GMD Task Force Report, but due to the public safety and national security implications of widespread and persistent blackout from geomagnetic disturbance, could also call into question the legislative basis of the self-regulatory system for electric reliability. Willful non-compliance of NERC with federal law by failing to develop reliability standards or otherwise exercise its duties could also call into question the recertification of NERC as designated Electricity Reliability Organization (ERO).

We give the lack of notice of your upcoming Board of Trustees meeting on February 23, 2012 as a prime example of procedural non-compliance. The NERC By-Laws read:

Section 4 Meetings of the Board to be Open Notice to the public of the dates, places, and times of meetings of the board, and all nonconfidential material provided to the board, shall be posted on the Corporation's Web site, and notice of meetings of the board shall be sent electronically to members of the Corporation, within 24 hours of the time that notice or such material is given to the trustees. Meetings of the board shall be open to the public, subject to reasonable limitations due to the availability and size of meeting facilities; provided, that the board may meet in or adjourn to closed session to discuss matters of a confidential nature, including but not limited to personnel matters, compliance and enforcement matters, litigation, or commercially sensitive or critical infrastructure information of any entity. Any or all of the trustees, or members of a committee, may participate in a meeting of the board, or a meeting of a committee, by means of a communications system by which all persons participating in the meeting are able to hear each other.

An email notice of this meeting and website posting was delayed until February 17, 2012, a full nine days after its announcement at the NERC Members Representative Meeting. Moreover, the nonconfidential material to be considered at this meeting in public session—namely, the full text of the GMD Task Force Report—has not been posted on the NERC website or conveyed by email link, in contrast to other background materials for other February 23 meeting agenda items which were conveyed by email link and placed on the NERC website. These kinds of procedural issues are not one-time events for the North American Electric Reliability Corporation. Notices of Board of Trustees meetings on key issues, including a blackout that affected millions of people, have not been posted on the Corporation's website calendar. Reports to be considered for approval at these public Board of Trustee meetings have not been posted on the NERC website until after the meetings.

Procedural issues affect not only NERC and the conduct of the Board of Trustees in its business but also extend down to the conduct of the GMD Task Force. Task force observers have been excluded from closed meetings. Task force observers have not been given proper notice of

meetings to review and approve the GMD Task Force Report. Finally and most importantly, task force observers have not been given a copy of the GMD Task Force Report as presented to Board of Trustees for approval.

These procedural issues are not mere formalities, because they fundamentally affect the potential accuracy and credibility of the conclusions and recommendations of the GMD Task Force. An emerging narrative within the GMD Task Force may have erroneously minimized the likelihood of permanent damage to power transformers from geomagnetic disturbance events. Key elements of this erroneous and misleading narrative may well include:

1. A potential geomagnetic storm with intensity ten times the 1989 Hydro-Quebec disturbance has no supported scientific basis; the narrative also omits scientific data from storms in 1972, 1982, and 1989 with recorded intensities approximately five times the intensity of the 1989 Hydro-Quebec disturbance, and scientific data from a storm in 1921 with an estimated intensity approximately ten times the 1989 Hydro-Quebec disturbance.
2. Geomagnetic storms of likely intensity would be too small to produce currents large enough to overheat and damage most power transformers.
3. The currents produced by geomagnetic storms do not last long enough to overheat and damage most power transformers.
4. Transformer impacts due to geomagnetic disturbance have been confined to transformers built before a certain date, or transformers having an old design, or transformers having insulation near end-of life. By implication, other transformers would not be vulnerable to damage from geomagnetic disturbance.

This is a convenient narrative for the electric power industry because it minimizes the necessity for immediate action, other than continuance of so-called “operating procedures” and further study.

The preponderance of scientific evidence and previous reports indicate that the above narrative is simply incorrect. Scientific evidence includes peer-reviewed and published incidents of power transformer overheating and damage found after geomagnetic disturbance events. Previous scientific studies include reports of the congressionally chartered EMP Commission, the National Academy of Sciences, the Oak Ridge National Laboratory, and a report jointly commissioned by the Department of Energy and NERC itself. More recently, the JASONs, a group of scientists independent of the electric power industry, performed a study, “Impacts of Severe Space Weather on the Electric Grid,” which concluded that “Possible widespread and sustained grid damage is within the broader view of national security issues taken after 9/11, and severe space weather could be one of the causes.” (The Department of Homeland Security attempted to suppress the public release of this JASON report marked “Approved for public release; distribution unlimited,” but a leaked copy of the report was placed on the Internet.)

We ask the NERC Board of Trustees to be especially alert to any potential misrepresentations in the GMD Task Force Report of the findings of a study by Oak Ridge National Laboratory for the Federal Energy Regulatory Commission in joint sponsorship with the Department of Energy and the Department of Homeland Security, "[Geomagnetic Storms and Their Impacts on the U.S. Power Grid](#)," Meta-R-319, with John Kappenman as principal investigator. In particular, any representation that the Oak Ridge study claims large numbers of power transformers will "instantaneously" or "simultaneously" fail when subjected to a moderate level of Geomagnetically-Induced Current (GIC) such as 90 amps is patently false. *The Oak Ridge National Laboratory study does not claim that power transformers will "instantaneously" or "simultaneously" fail when subjected to 90 amps GIC.* The Oak Ridge study explains that transformer failures due to GIC can appear over weeks or even months after the GIC exposure: "Other anecdotal evidence, post-March '89, suggested that many other important transformers in the network sustained damage that *eventually precipitated failures.*" (Emphasis added.) Because we know that some participants in the GMD Task Force seek to discredit the government-sponsored Oak Ridge study, we must quote at length to show what the study really said:

Very large GICs from extremely intense geomagnetic storms could pose the concern of large-scale and geographically widespread failures and permanent loss of the EHV transformers on the network. If enough of these key assets are lost, the restoration of the EHV power grid could also be considerably delayed. Because there is considerable uncertainty as to the threshold level of GIC that will cause transformer failure, two levels of minimum GIC (30 amps per phase and 90 amps per phase) were considered as the screening level for possible transformer failure for the severe geomagnetic storm 4800nT/min threat environment. For evaluations that were reported to the National Academy of Sciences and for the economic impact analysis performed for FEMA, a damage level threshold of 90 amps/phase was utilized, which makes overall estimates of damage levels more conservative. In contrast, a 30 amp/phase level is the approximate GIC withstand threshold for the Salem nuclear plant GSU transformer and possibly for others of similar less robust design in the legacy population of U.S. EHV transformers. Also, it is also important to note that other transformer failures have been observed at much lower thresholds and that other transformers have been exposed to levels higher than 30 amps/phase without indication of permanent damage. These variations largely stem from the diversity of design of the internal core and coil assemblies of large EHV transformers.

The vast majority of peer-reviewed literature on GIC-induced failures supports the Oak Ridge study finding that transformer failures from GIC are generally delayed. Moreover, other peer-reviewed research shows that levels of GIC far lower than 90 amps can cause transformer failure. Finally, as the Oak Ridge study explains at length, the principal problem with transformer failures in the aftermath of a geomagnetic disturbance is not that the failures will occur

“instantaneously” or “simultaneously,” but that the failures will occur faster than replacement units can be manufactured and installed.

When confronted with peer-reviewed and published reports of previous power transformer damage and results of previous scientific studies, the action of NERC management has been to hold closed meetings and prevent disclosure of the results of these meetings to the majority of task force participants who do not work for electricity generators or transmission companies. (In fact, only representatives of electricity generators or transmission companies—so-called “Registered Entities”—are now designated as “members” of the GMD Task Force in the [latest task force roster](#) published on February 2, 2012.) Even more significantly, multiple task force participants have specifically asked that NERC request data from electric utilities on impacts of past geomagnetic disturbance events on power transformers, but these requests have been ignored or declined by NERC management.

Instead of investigating real-world transformer impacts due to geomagnetic disturbance, NERC management has promoted the scientifically unsound practice of convening a handpicked panel of purported transformer “experts” to meet in closed session and provide information to be used in preparation of the GMD Task Force Report. For your reference we present an attached PDF of correspondence between NERC management and task force observers on event investigations, wherein a NERC official stated:

In any event, NERC is assessing the landscape of risks to the bulk power system, specific to solar storms. However, we do not complete this assessment by performing root-cause or event investigations. Rather industry engineering experts’ review and vet information using engineering concepts to determine the state of potential vulnerabilities as well as develop recommendations and conclusions.

We know that a closed teleconference meeting of transformer “experts” was held sometime in January 2012. We know that a prepared list of questions was given to the “experts,” but NERC management has declined to give us the list of questions. We would expect that the results of this meeting of “experts” have been incorporated into the final GMD Task Force Report.

We have great difficulty as observers in commenting on the final report of the GMD Task Force because this report has been kept secret from us. Based on the over 300 comments submitted by January 19, 2012 in response to a prior draft, and based on the fact that a closed meeting with transformer “experts” occurred after the date of the most recent draft provided to task force observers, we believe that the GMD Task Force Report presented to you for approval has been substantially revised from previous versions, including critically important conclusions and recommendations that have not been reviewed by the entire GMD Task Force.

In your review of the GMD Task Force Report we ask you to look for material misstatements and material omissions of fact, particularly if generalized assertions are made in the passive

voice and without reference, as we have seen in previous drafts. Material misstatements could include:

1. Any statement that a potential geomagnetic storm with intensity ten times the 1989 Hydro-Quebec disturbance has no supported scientific basis. In fact, there is recorded scientific data on storms in 1972, 1982, and 1989 with intensities approximately five times the intensity of the 1989 Hydro-Quebec disturbance. In fact, the government-sponsored Oak Ridge study estimated the intensity of a storm in 1921 as approximately ten times the 1989 Hydro-Quebec disturbance, based on real-world data of electric circuit potential collected at the time of the 1921 storm.
2. Any statement that the majority of power transformers are unlikely to overheat or otherwise sustain damage from geomagnetic disturbance, because only older transformers or transformers built before a certain year are vulnerable. In fact, there has been no inventory taken of the vintages of power transformers in service. In fact, there has been no comprehensive testing program of power transformers in service under Geomagnetically-Induced Current (GIC) conditions. In fact, there is no recognized standard for “GIC withstand” of power transformers.
3. Any statement that most power transformers are largely invulnerable to overheating because of results from a theoretical model of an idiosyncratic transformer design, especially when the model has not been published or peer-reviewed.
4. Any revisionist statements that power transformers suspected to have failed due to GIC, as described in peer-reviewed and published reports, are determined by “experts” to have instead failed due to other causes. In fact, such claims have not been substantiated.
5. Any statement that space weather and geomagnetic disturbance can be reliably forecast and these forecasts will likely prevent blackouts. In fact, forecasts of geomagnetic disturbance depend almost entirely on the Advanced Composition Explorer (ACE) satellite. The ACE satellite is past its planned operational life and there is no budgeted replacement. ACE satellite is a single point of failure and there is no backup or ready replacement.
6. Any statement that the electric grid can be made reliable during geomagnetic disturbance by employing so-called “operating procedures.” In fact, “operating procedures” depend on geomagnetic disturbance forecasting. In fact, “operating procedures” have never been tested during extreme solar storm conditions. In fact, there is published and peer-reviewed evidence that GIC can arise so quickly that electric grid operators will not have time to react with effective “operating procedures.” In fact, the premise of “operating procedures” is to reduce power generation, which could cause blackouts. In fact, there has been no published calculation of power reductions during “operating procedures” on reserve margins. In fact, the power reduction curves used in operating procedures have not been tested on the vast majority of power transformers in service and therefore there is no conclusive evidence that “operating procedures” would protect power transformers from damage.
7. Any statement that the GMD Task Force did significant study of the issue of reactive power consumption (so-called “VAR consumption”) and associated voltage instability under geomagnetic disturbance conditions as a task force, with observers participating. Any statement that the GMD Task Force, as a group and with observers participating,

determined reactive power consumption and associated voltage instability is the most likely risk for the North American power grids. In fact, there was no chapter or separate treatment of reactive power consumption in the most recent January 9, 2012 draft report provided to the GMD Task Force, including observers.

8. Any statement that GMD Task Force, as a group and with observers participating, determined that rapid electric grid collapse caused by reactive power consumption and associated voltage instability would likely protect power transformers from permanent damage. In fact, the NERC Hydro Quebec GMD Event Report (1989) determined that “Among the major pieces of damaged equipment were two La Grande 4 generating station step-up transformers damaged by overvoltage when the network separated and a shunt reactor at Nemiscau that requires factory repair.” In fact, NERC CEO Gerry Cauley testified at the Electric Infrastructure Security Summit on April 12, 2011: (1) “The rapid manifestation of the storm and impacts to the Québec power grid did not allow system operators sufficient time to fully assess the situation or to meaningfully intervene.” (2) “Two large generator step-up transformers were damaged due to overvoltage condition.” (3) “This storm proved that individual transformers may be damaged from overheating, which can result in long-term outages of key transformers in the network.”
9. Any material misrepresentation of the findings of previous studies on geomagnetic disturbance, especially government-sponsored studies.

Material omissions of fact could include:

1. Any omission of evidence of the vulnerability of individual power transformers to GIC, when that evidence has been made known to the GMD Task Force, including peer-reviewed research, published articles, records of the Nuclear Regulatory Commission, investigative transcripts, and/or records of legal proceedings, and especially when the evidence concerns vulnerabilities for transformers of newer design or so-called “non-shell form” design.
2. Any omission of statistical evidence of the aggregate vulnerability of power transformers to GIC, when that evidence has been made known to the GMD Task Force, including a statistical study of claims performed by an insurance company.
3. Deletions of photographic evidence of damage to power transformers from GIC, when these photographs were contained in a previous draft of the GMD Task Force Report.
4. Any omission of information that transformer manufacturers have actively sold transformers that are purportedly resistant to GIC, because of the risk of GIC-induced blackout and/or GIC-induced damage to vulnerable transformers. In fact, manufacturers have sold transformers with assurances that their transformers are resistant to damage from GIC currents. In fact, in a 2006 press release, "[ABB engineering protects power plant from solar storms](#)," ABB disclosed that it sold a newly designed power transformer "immune to solar storms" to nuclear utility in Sweden to prevent future blackouts. The ABB press release further stated: “Solar flares unleash magnetic storms that hit the earth’s magnetic field and create geomagnetic currents that can enter power lines and the neutral point of transformers. GICs frequently lead to severely damaged transformers and voltage collapse at a cost of millions of dollars per hour in lost revenues and damaged assets.”

5. Any omission of information that electric utilities have spent millions of dollars replacing transformers vulnerable to GIC, before the transformers failed. In fact, multiple electric utilities have replaced power transformers before failure with units that are purportedly more resistant to GIC, although there is no recognized standard for GIC withstand. In fact, these transformer replacement programs have been discussed during GMD Task Force meetings.
6. Any omission of information that multiple nuclear power plants have regularly employed “operating procedures” to protect their transformers against geomagnetic disturbance and that power downratings during “operating procedures” have been up to 35%. Any omission of information on the effect of power downratings during solar storms on reserve margins.
7. Any omission of information that the Electric Power Research Institute (EPRI) has worked with electric utilities for 20 years to collect data on GIC as part of its “Sunburst” program. Any omission of the fact that the EPRI GIC data provided to the GMD Task Force was one graph of maximum GIC readings by year, without reference to the location of the readings.

Should the GMD Task Force Report be approved, and should it contain any material misstatements or material omissions of fact, NERC and its Board of Trustees should expect tremendous public scrutiny, not only for the contents of the report, but for the manner in which the report was prepared.

The disenfranchisement of GMD Task Force members who do not work for electric utilities, now classified as “participant observers,” has had a real effect on the subject areas examined by the task force. As a result, there has been a lost opportunity to understand the economic impact of geomagnetic disturbance and the financial benefits of protection. EMPrimus, a vendor of protective equipment and task force “observer,” had drafted a report chapter on the costs and financial benefits of hardware protection, but this work was not included in the most recent draft of the GMD Task Force report distributed on January 9, 2012. Moreover, economic data available from other studies was not included either. For example, the Oak Ridge National Laboratory study, previously referenced, found that “The cost of damage from the most extreme solar event has been estimated at \$1 to \$2 trillion with a recovery time of four to ten years, while the average yearly cost of installing equipment to mitigate an EMP event is estimated at less than 20 cents per year for the average residential customer.” The JASONs report, previously referenced, found that “Mitigation should be undertaken as soon as possible to reduce the vulnerability of the U.S. grid. The cost appears modest compared to just the economic impact of a single storm, e.g. \$8B in August 2003.”

A description of potential operational cost savings due geomagnetic disturbance protection were not included in the most recent draft of the GMD Task Force report distributed on January 9, 2012. These cost savings could result from fewer and less severe power downratings resulting in increased generation revenue during geomagnetic disturbances, higher capacity utilization, and

less reactive power consumption and associated transmission “uplift costs” during VAR-related congestion.

The risk of widespread and long-term blackout due to geomagnetic disturbance is fundamentally different than most issues addressed by NERC such as vegetation management, relay misoperations, and frequency response. These day-to-day issues, while important, are unlikely to cause blackouts extending beyond a few hours or days. Because geomagnetic disturbance has the potential to damage hard-to-replace equipment such as power transformers and generators, and because loss of life from months-long or years-long blackouts could be extraordinary, adherence to procedural requirements set forth for NERC by Congress—including independence from owners and operators of the bulk-power system and balanced decision-making—is especially important.

While there has been much attention to the 1-in-100 year probability of an extreme solar storm and resulting geomagnetic disturbance—a so-called Carrington Event—there has been much less attention to the much higher probability of a smaller event that nonetheless will cause a significant blackout. A major blackout due to geomagnetic disturbance occurred during Solar Cycle 22 in Canada and another major blackout occurred during Solar Cycle 23 in Sweden.

Since the end of Solar Cycle 23 in December 2008 the electric grid is in a more precarious state; reserve margins are low, non-dispatchable renewable power has been placed on the grid, and the transformer fleet is older and more vulnerable to geomagnetic disturbance. A significant blackout due to geomagnetic disturbance in the upcoming solar cycle is by no means a low-probability or theoretical event. Should any significant blackout occur due to geomagnetic disturbance during the upcoming solar cycle, a formal investigation of the conduct of NERC in regard to geomagnetic disturbance protection is a near certainty—especially because NERC has studied geomagnetic disturbance effects for over 20 years without setting a regulatory standard on geomagnetic disturbance.

We, as members of the public and observers of the GMD Task Force, call on you to exercise your legal responsibilities as an independent board and decline to approve the report of the GMD Task Force in its current state. We ask you to direct NERC to perform a real investigation of the effects and risks of geomagnetic disturbance by reforming the GMD Task Force and making a data request to electric utilities.

The results of any data collected by NERC on geomagnetic disturbance should not be held in a data clearinghouse as “confidential information” or withheld from the public under the pretense of the data being of “Critical Energy Infrastructure Information” under FERC regulations. Already, the results of a scenario prepared by a consultant to NERC, showing which power transformer locations would be most vulnerable to geomagnetic disturbance, has been withheld from the GMD Task Force under the pretense that this data is “Critical Energy Infrastructure Information.” This is akin to saying that information regarding which nuclear power plants lay

on earthquake fault lines is “Critical Energy Infrastructure Information”; in any case, concealment of information is no protection against naturally occurring phenomena such as earthquakes or solar storms.

We urge the NERC Board of Trustees to take great caution in reviewing the GMD Task Force Report and to take the opportunity to closely question NERC officials during the scheduled February 23, 2012 meeting. Were the Trustees to approve and release a report that propounds key elements of the false narrative described above, and that deliberately omits key evidence, through a secret process inconsistent with the requirements of 16 U.S.C. § 215, we could only conclude that NERC would have knowingly and willfully made materially false statements to FERC Commissioners charged with electric reliability oversight, and to the Congress of the United States, and to the American and Canadian public.

If NERC officials were to knowingly and willfully transmit to federal officials a document with materially false statements or representations, which could constitute a felony per 18 U.S.C. § 1001, we will have no alternative but to call for a Congressional investigation of both the persistent breaches of due process and the junk science born of secrecy. If requested by members of Congress, we would then offer our personal testimony to the improper procedures that excluded pertinent evidence and in secrecy conveyed materially false misrepresentations. The NERC Board of Trustees has a fiduciary duty to set reliability standards and protect the American and Canadian public from long-term and widespread blackout. We call on you to perform your duty.

Sincerely (by electronic concurrence),

Dr. Peter Vincent Pry
Executive Director
Task Force on National and Homeland Security
U.S. House of Representatives

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Attachments:

1. Title 16 United States Code § 215
2. Correspondence on Event Investigation of GIC Impacts to Transformers

Title 16 United States Code § 215

SEC. 215. ELECTRIC RELIABILITY...

(b) JURISDICTION AND APPLICABILITY.—(1) The Commission shall have jurisdiction, within the United States, over the ERO certified by the Commission under subsection (c), any regional entities, and all users, owners and operators of the bulk-power system, including but not limited to the entities described in section 201(f), for purposes of approving reliability standards established under this section and enforcing compliance with this section. All users, owners and operators of the bulk-power system shall comply with reliability standards that take effect under this section.

(2) The Commission shall issue a final rule to implement the requirements of this section not later than 180 days after the date of enactment of this section.

(c) CERTIFICATION.—Following the issuance of a Commission rule under subsection (b)(2), any person may submit an application to the Commission for certification as the Electric Reliability Organization. The Commission may certify one such ERO if the Commission determines that such ERO—

(1) has the ability to develop and enforce, subject to subsection (e)(2), reliability standards that provide for an adequate level of reliability of the bulk-power system; and

(2) has established rules that—

(A) assure its independence of the users and owners and operators of the bulk-power system, while assuring fair stakeholder representation in the selection of its directors and balanced decisionmaking in any ERO committee or subordinate organizational structure;

(B) allocate equitably reasonable dues, fees, and other charges among end users for all activities under this section;

(C) provide fair and impartial procedures for enforcement of reliability standards through the imposition of penalties in accordance with subsection (e) (including limitations on activities, functions, or operations, or other appropriate sanctions);

(D) provide for reasonable notice and opportunity for public comment, due process, openness, and balance of interests in developing reliability standards and otherwise exercising its duties; and

(E) provide for taking, after certification, appropriate steps to gain recognition in Canada and Mexico.