



**Transmission System Planned Performance for Geomagnetic Disturbance Events  
RM15-11-000  
March 1, 2016**

**Agenda**

***Welcome and Opening Remarks by Commission Staff***

**9:00 – 9:15 a.m.**

***Introduction***

In a May 14, 2015 Notice of Proposed Rulemaking (NOPR) in the above-captioned docket, the Commission proposed to approve Reliability Standard TPL-007-1 (Transmission System Planned Performance for Geomagnetic Disturbance (GMD) Events). In addition, the Commission proposed to direct the North American Electric Reliability Corporation (NERC): (1) to develop certain revisions to proposed Reliability Standard TPL-007-1; and (2) to submit a work plan, and subsequently one or more informational filings, that address specific GMD-related research areas. The Commission sought and received comments on these proposals, including the NOPR proposal: (1) to 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; and (2) to revise proposed Reliability Standard TPL-007-1 to require the installation of monitoring equipment (i.e., geomagnetically-induced current (GIC) monitors and magnetometers) to the extent there are any gaps in existing GIC monitoring and magnetometer networks. The purpose of this conference is to clarify issues, share information, and determine appropriate ways to address the issues raised in the NOPR and NOPR comments, in light of the Oak Ridge National Lab study<sup>1</sup>, the NERC study<sup>2</sup>, and various other studies on these issues.

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<sup>1</sup> [http://www.ferc.gov/industries/electric/indus-act/reliability/cybersecurity/ferc\\_meta-r-319.pdf](http://www.ferc.gov/industries/electric/indus-act/reliability/cybersecurity/ferc_meta-r-319.pdf).

<sup>2</sup> <http://www.nerc.com/pa/Stand/Project201303GeomagneticDisturbanceMitigation/Benchmark GMD Event Dec5 clean.pdf>

**Panel 1: Benchmark GMD Event(s) Definition****9:15 - 11:45 a.m.**

The Commission staff seeks information, including next steps and timing of future work and/or research, concerning the benchmark GMD event definition in proposed Reliability Standard TPL-007-1. Panelists are encouraged to address the following:

- Geomagnetic fields:
  - Discuss the statistical methods used to develop the benchmark event.
  - Describe the advantages and disadvantages of using the proposed spatial-averaging method for amplitude scaling of the geoelectric field.
  - Describe the characteristics of non-spatially averaged geomagnetic fields (e.g., magnitude(s), size of affected region(s)) and how they could be developed.
  - Describe potential changes to proposed Reliability Standard TPL-007-1 that might be appropriate due to incorporating non-spatially averaged geomagnetic fields.
  - Is the proposed adjustment for latitude scaling supported by the available data and analysis?
- Earth Conductivity
  - Explain how 3-D magnetotelluric readings are taken and discuss the current availability of data.
  - Describe some of the main characteristics of the data to date, including:
    1. Whether there are regions of uniform data and if interpolations are made between reading locations.
    2. Margins of error associated with USGS data.
  - Explain the obstacles to, and potential timeline for, completing 3-D magnetotelluric readings in the contiguous 48 states.
  - Explain whether the partially completed 3-D magnetotelluric readings data can be used in GIC calculations now.
  - Discuss efforts to validate the proposed benchmark model using GIC data from actual events in the contiguous 48 states.

**Panelists:**

1. Mark Lauby (Senior Vice President and Chief Reliability Officer, North American Electric Reliability Corporation)
2. Antti Pulkkinen (Standard Drafting Team, NASA Research Astrophysicist)
3. Dr. Scott Backhaus (Los Alamos National Laboratory)

4. Dr. Jeffrey Love (Research Geophysicist, U.S. Geological Survey)
5. Prof. Adam Schultz (Professor, Oregon State University)
6. David Boteler (Head, Space Weather Group, Natural Resources Canada)
7. David Roodman (Senior Advisor at the Open Philanthropy Project )
8. John Kappenman (Principal Consultant, Storm Analysis Consultants)

***Lunch*****11:45 a.m. - 12:45 p.m.*****Panel 2: Vulnerability Assessments*****12:45 p.m. - 2:30 p.m.**

The Commission staff seeks information, including next steps and timing of future work and/or research, about the GMD Vulnerability Assessments and transformer thermal impact assessments in proposed Reliability Standard TPL-007-1. Panelists are encouraged to address the following:

- Harmonics and vibrational effects during benchmark GMD events.
  - Describe the state of knowledge and modeling capabilities regarding the harmonics and vibrational effects during benchmark GMD events.
  - Describe the impacts of such effects on equipment (e.g., protection equipment, reactive sources, generators).
  - Describe power system impacts related to the reactive power demand associated with GMD events.
- Describe the state of knowledge and modeling capabilities regarding transformer thermal assessments.
  - Discuss the use of a threshold level of GIC to trigger a requirement to perform a thermal impact assessment of a transformer, including the appropriateness of a 75 ampere/phase GIC threshold.
  - Describe the state of knowledge and modeling capabilities regarding system assessments, including interaction with equipment vulnerabilities (e.g., harmonics).
- Non-uniform geoelectric fields
  - Describe the modeling capabilities to use non-uniform geoelectric fields to calculate grid GIC flows now and if any changes are expected soon.
  - Describe the advantages and disadvantages of using non-uniform geoelectric fields in modeling to calculate grid GIC flows.

**Panelists:**

1. Mark Lauby (Senior Vice President and Chief Reliability Officer, North American Electric Reliability Corporation)
2. Dr. Luis Marti (Standard Drafting Team, Director of Reliability Studies, Standards and Compliance at Hydro One Networks)
3. Michael Steckelberg (Senior Transmission Planning Engineer, Great River Energy)
4. Randy Horton (Standard Drafting Team, Planning Manager, Southern Company Services, Inc.)
5. Prof. Thomas Overbye (Fox Family Professor, University of Illinois)
6. Prof. Trevor Gaunt (University of Cape Town, Cape Town, South Africa)
7. Terry Volkmann (President, Volkmann Consulting, Inc.)

***Break*****2:30 p.m. - 2:45 p.m.*****Panel 3: Monitoring and Future Work*****2:45 – 4:45 p.m.**

The Commission staff seeks information, including next steps and timing of future work and/or research, about GIC monitoring and magnetometers. Panelists are encouraged to address the following:

- Current State of Monitoring.
  - Describe the extent of existing monitoring and monitoring in development, including GIC, geomagnetic fields, and geoelectric fields.
  - Describe the uses of monitored data (e.g., model validation, near-real time situational awareness).
- Potential for Additional Monitoring.
  - Describe the amount of additional monitoring that would be useful and the process of selecting monitoring locations.
  - Describe the proper techniques to ensure maximum benefit of monitoring data (e.g., cadence).
  - Describe the costs and other factors to consider in installing, operating and maintaining monitoring devices for GIC, geomagnetic fields and geoelectric fields, including opportunities to collaborate.
- Discuss the availability of monitored data (e.g., availability today and in the future, any needs for protection, methods for sharing).

**Panelists:**

1. Mark Lauby (Senior Vice President and Chief Reliability Officer, North American Electric Reliability Corporation)
2. David Boteler (Head, Space Weather Group, Natural Resources Canada)
3. Dr. Jeffrey Love (Research Geophysicist, U.S. Geological Survey)
4. Prof. Trevor Gaunt (University of Cape Town, Cape Town, South Africa)
5. Dr. Luis Marti (Standard Drafting Team, Director of Reliability Studies, Standards and Compliance at Hydro One Networks)
6. Frank Koza (Standard Drafting Team Chair, Executive Director, PJM Interconnection, L.L.C.)
7. Jerry Schuman (PingThings, Inc.)
8. Thomas Popik (Chairman, Foundation for Resilient Societies)

**4:45 p.m. - 5 p.m. Closing Remarks**