

# NERC

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

# GMD Standards Update

Project 2013-03 Geomagnetic Disturbance Mitigation

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**RELIABILITY | ACCOUNTABILITY**



- Background: FERC Order No. 830 directs NERC to revise the GMD planning standard
- Geomagnetic Disturbances (GMD) Standards Drafting Team (SDT) discussed revisions to TPL-007 with the GMD TF during May webinar

*...the Commission **approves Reliability Standard TPL-007-1** as just, reasonable, not unduly discriminatory or preferential and in the public interest. While we recognize that scientific and operational research regarding GMD is ongoing, we believe that the potential threat to the bulk electric system warrants Commission action at this time, including efforts to conduct critical GMD research and **update Reliability Standard TPL-007-1 as appropriate.***

U.S. Federal Energy Regulatory Commission (FERC)  
September 2016

- Order No. 830 directs NERC to revise TPL-007 to address Commission concerns
  - Modify the benchmark geomagnetic disturbance (GMD) event definition used for GMD assessments
  - Require entities to collect GMD data for model validation purposes
  - Establish deadlines for Corrective Action Plans (CAPs) and mitigating actions to address identified GMD impacts
- Revisions must be filed by May 2018

- TPL-007-1 addresses risks of voltage collapse and equipment damage in the Bulk Electric System (BES) caused by GMD events
- Applicable Entities:
  - **Planning Coordinators and Transmission Planners**—perform geomagnetically-induced current (GIC) calculation and network analysis (Vulnerability Assessments)
  - **Transmission Owners**—assess extra high voltage transformers (Wye-grounded on high side, 200kV and higher)
  - **Generator Owners**—assess extra high voltage transformers (Wye-grounded on high side, 200kV and higher)

- Components of TPL-007-1
  - Benchmark GMD event
  - GMD Vulnerability Assessment
  - Transformer Thermal Assessment
  - CAP
- Implementation phased in over five year period beginning January 2017 (R1 compliance date: July 1, 2017)

*The Commission approves the reference peak geoelectric field amplitude figure proposed by NERC. In addition, the Commission... directs NERC to develop revisions to the benchmark GMD event definition so that the reference peak geoelectric field amplitude component is not based solely on spatially-averaged data.*

-Order No. 830 P 44

- The SDT is developing a *Supplemental GMD Event* based on peak (non-averaged) geoelectric fields



- The regional geoelectric field peak amplitude,  $E_{\text{peak}}$ , to be used in calculating GIC in the GIC system model can be obtained from the reference value of 17 V/km using the following relationship:

$$E_{\text{peak}} = 17^* \times \alpha \times \beta \quad (\text{V/km})$$

$\alpha$  = Factor adjustment for geomagnetic latitude

$\beta$  = Factor adjustment for regional Earth conductivity

- \* 17 V/km is based on Los Alamos National Labs (LANL) report of August 2015. SDT is conducting statistical analysis which could change the value used for the supplemental assessment



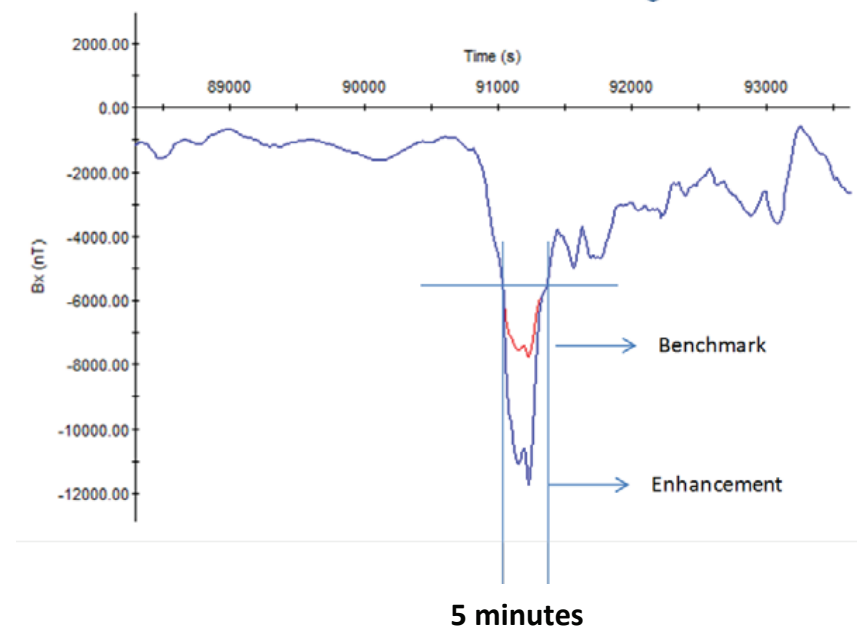
- TPL-007-2 includes requirements for entities to perform a supplemental GMD Vulnerability Assessment using this event
- CAP would NOT be required (like TPL Extreme Event category) and the methods for applying the supplemental GMD benchmark are left to the planners
  - If analysis concludes there is Cascading, responsible entities are required to evaluate mitigating actions

*...the Commission directs NERC to revise Requirement R6 to require registered 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.*

-Order No. 830 P 65

- TPL-007-2 includes a new requirement (R10) to meet the directive

- Key differences with requirement (R6) for benchmark thermal assessments:
  - Based on a supplemental GMD event waveform (with local enhancement)
  - Screening criterion is **85 A per phase**. i.e. if GIC will exceed this value then the supplemental thermal assessments must be performed



Geomagnetic Field Waveform For Thermal Assessment (Expanded View)

- TPL-007 requires CAP when system does not meet performance for the benchmark GMD Vulnerability Assessment
- Options include
  - Hardening the system
  - Operating procedures and installing monitors
- Order No. 830 directs revisions to establish CAP deadlines (P 101)

- TPL-007-2 includes a revised CAP requirement (R7) to meet the directive
  - One year for development of CAP
  - Two years for implementing operating procedure mitigation
  - Four years for implementing hardware mitigation
- Revisions to CAP deadlines must be reported to Reliability Coordinators and affected entities with updates on an annual basis until completed

*The Commission ... adopts the NOPR proposal in relevant part and directs NERC to develop revisions to Reliability Standard TPL-007-1 to **require responsible entities to collect GIC monitoring and magnetometer data as necessary to enable model validation and situational awareness**, including from any devices that must be added to meet this need.*

-Order No. 830 P 88

SDT developed Requirement R11 to meet the GIC data directive.

- **R11.** Each responsible entity, as determined in Requirement R1, shall implement a process to obtain GIC monitor data from at least one GIC monitor located in the Planning Coordinator's planning area or other part of the system included in the Planning Coordinator's GIC System model.



SDT developed Requirement R12 to meet the magnetometer data directive.

- **R12.** Each responsible entity, as determined in Requirement R1, shall implement a process to obtain geomagnetic field data for its Planning Coordinator's planning area.

- Sources of geomagnetic field data include:
  - Observatories such as those operated by U.S. Geological Survey, Natural Resources Canada, research organizations, or university research facilities
  - Installed magnetometers
  - Commercial or third-party sources of geomagnetic field data
- Geomagnetic field data products from government or research organizations can meet the requirement when magnetometers are not located in the planning area

- Targeting initial posting for formal comment (45-days) during Summer 2017
  - Initial ballot during last 10-days of commenting
- SDT is keeping GMD Task Force informed of progress
- Standards must be filed by May 2018
- Refer to NERC website, Standards Under Development:  
[Project 2013-03 GMD Mitigation](#)



# Discussion