Consideration of Directives

Reliability Standard for Transmission System Planned Performance for Geomagnetic Disturbance Events

Order No. 830, 156 FERC ¶ 61,215 (Sep. 22, 2016)

approving Reliability Standard TPL-007-1

Consideration of Directives

#	P	Directive/Guidance	Resolution
1)	**PP 44** 47-49	**MODIFY THE BENCHMARK GMD EVENT re SPATIAL AVERAGING** P44: "[T]he Commission, as proposed in the NOPR, 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." P47: "Without prejudging how NERC proposes to address the Commission's directive, NERC's response to this directive should satisfy the NOPR's concern that reliance on spatially-averaged data alone does not address localized peaks that could potentially affect the reliable operation of the Bulk-Power System." P48: "NERC could revise [the standard] to apply a higher reference peak geoelectric field amplitude value to assess the impact of localized hot spots on the Bulk-Power System, as suggested by the Trade Associations." P49: "Consistent with Order No. 779, the Commission does not specify a particular reference peak geoelectric field amplitude value that should be applied to hot spots given present uncertainties."	The directive is addressed in proposed TPL-007-2 through Requirements for applicable entities to perform supplemental geomagnetic disturbance (GMD) Vulnerability Assessments based on the supplemental GMD event. The supplemental GMD event is a defined event for assessing system performance that is not based on spatially-averaged data. The supplemental GMD event is described in the standard drafting team's (SDT) white paper available on the project page: http://www.nerc.com/pa/Stand/Pages/Project-2013-03-Geomagnetic-Disturbance-Mitigation.aspx

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2)	**P65**	**REVISE R6 RE SPATIAL AVERAGING** P65: "Consistent with our determination above regarding the reference peak geoelectric field amplitude value, 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."	The directive is addressed in proposed TPL-007-2 Requirements R9 and R10. Applicable entities use geomagnetically-induced current (GIC) information for the supplemental GMD event to perform supplemental thermal impact assessments of applicable power transformers. Requirement R9 obligates responsible Planning Coordinators and Transmission Planners to provide GIC flow information to Transmission Owners and Generator Owners for performing supplemental thermal impact assessments. The GIC flow information is based on the supplemental GMD event. Requirement R10 obligates Transmission Owners and Generator Owners to perform supplemental thermal impact assessments on applicable power transformers and provide results to responsible Planning Coordinators and Transmission Planners.

3)	**PP 88** 90, 91, 92	**REVISE STANDARD TO REQUIRE COLLECTION OF GMD DATA** P 88: "The Commission … adopts the NOPR proposal in relevant part an 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. The NERC standard drafting team should address the criteria for collecting GIC monitoring and magnetometer data discussed below and provide registered entities with sufficient guidance in terms of defining the data that must be collected, and NERC should propose in the GMD research work plan how it will determine and report on the degree to which industry is following that guidance." *GIC Requirements* P 91: "Each responsible entity that is a transmission owner should be required to collect necessary GIC monitoring data. However, a transmission owner should be able to apply for an exemption from the GIC monitoring data collection requirement if it demonstrates that little or no value would be added to planning and operations. In developing a requirement regarding the collection of GIC monitoring data, NERC should consider the following criteria discussed at the March 1, 2016 Technical Conference: (1) the GIC data is from areas found to have high GIC based on system studies; (2) the GIC data comes from sensitive installations and key parts of the transmission grid; and (3) the data comes from GIC monitors that are not situated near transportation systems using direct current (e.g., subways or light rail." *Magnetometer Requirements* P90: "In developing a requirement regarding the collection of	The directive is addressed in proposed TPL-007-2 Requirements R11 and R12. Requirement R11 obligates responsible Planning Coordinators and Transmission Planners to 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. The SDT described GIC data collection criteria in the guidance section to promote consistency in achieving the reliability objective and provide responsible entities with flexibility to tailor procedures to their planning area. The guidance addresses the following considerations: monitor locations, monitor specifications, sampling interval, collection periods, data format, and data retention. Requirement R12 obligates responsible Planning Coordinators and Transmission Planners to implement a process to obtain geomagnetic field data for its Planning Coordinator's planning area. Sources of geomagnetic field data include government observatories, installed equipment owned or operated by the entity, and third-party sources. Entities are referred to INTRAMAGNET guidance for criteria and considerations including data sampling rate (10-s or faster) and data format. By requiring responsible Planning Coordinators and Transmission Planners to obtain geomagnetic field data for their planning areas, the requirement ensures data is obtained from diverse geographic areas (latitudes and longitudes) of the North American Bulk-Power System.

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		magnetometer data, NERC should consider the following criteria discussed at the March 1, 2016 Technical Conference: (1) the data is sampled at a cadence of at least 10-seconds or faster; (2) the data comes from magnetometers that are physically close to GIC monitors; (3) the data comes from magnetometers that are not near sources of magnetic interference (e.g., roads and local distribution networks); and (4) data is collected from magnetometers spread across wide latitudes and longitudes and from diverse physiographic regions." *** P 91: GIC monitoring and magnetometer locations should also be revisited after GIC system models are run with improved ground conductivity models. NERC may also propose to incorporate the GIC monitoring and magnetometer data collection requirements in a different Reliability Standard (e.g., real-time reliability monitoring and analysis capabilities as part of the TOP Reliability Standards). P 92: "[T]he Commission determines that requiring responsible entities to collect necessary GIC monitoring and magnetometer data, rather than install GIC monitors and magnetometers, affords greater flexibility while obtaining significant benefits."	

4)	**P 101, 102**	**REVISE TPL-007 TO REQUIRE DEADLINES FOR THE DEVELOPMENT AND COMPLETION OF CORRECTIVE ACTION PLANS** P 101: "The Commission directs NERC to modify Reliability Standard TPL-007-1 to include a deadline of one year from the completion of the GMD Vulnerability Assessments to complete the development of corrective action plans." P 102: "The Commission also directs NERC to modify Reliability Standard TPL-007-1 to include a two-year deadline after the development of the corrective action plan to complete the implementation of non-hardware mitigation and four-year deadline to complete hardware mitigation…"	The directive is addressed in proposed TPL-007-2 Requirement R7. Part 7.2 specifies that responsible entities must develop Corrective Action Plans (CAP) within one year of completing the benchmark GMD Vulnerability Assessment. Part 7.3 requires responsible entities to include a timetable in the CAP that must specify: • Specify implementation of non-hardware mitigation, if any, within two years of development of the CAP; and • Specify implementation of hardware mitigation, if any, within four years of development of the CAP. Part 7.4 provides responsible entities with flexibility to revise the CAP and timetables if situations beyond the control of the responsible entity prevent implementation of the CAP within the specified timetable. The provision is necessary to account for potential planning, siting, budgeting approval, or regulatory uncertainties associated with transmission system projects that are not within the responsible entity's control. Responsible entities are obligated to document the revised CAP and update the revised CAP every 12 calendar months until implemented. Requirement R8 requires responsible entities to complete a supplemental GMD Vulnerability Assessment, based on the supplemental GMD event, to evaluate localized enhancements of geomagnetic field during a severe GMD event that could potentially affect

			the reliable operation of the Bulk-Power System. Localized enhancements of geomagnetic field can result in geoelectric field values above the spatially-averaged benchmark in a local area. Part 8.3 specifies that if the responsible entity concludes that there is Cascading caused by the supplemental GMD event, then the responsible entity shall conduct an analysis of possible actions to reduce the likelihood or mitigate the impacts and the event. Proposed TPL-007-2 does not require responsible entities to implement a Corrective Action Plan to address impacts identified in the supplemental GMD Vulnerability Assessment because mandatory mitigation on the basis of the supplemental GMD Vulnerability Assessment may not provide effective reliability benefit or use industry resources optimally. As discussed in the Supplemental GMD Event Description white paper, the supplemental GMD event is based on a small number of observed localized enhancement events that provide only general insight into the geographic size of localized events during severe solar storms. Additionally, the state-of-the-art modeling tools do not provide entities with capabilities to realistically model localized enhancements within a severe GMD event, and as a result entities may need to employ conservative approaches in the GMD Vulnerability Assessment such as applying the localized peak geoelectric field over an entire planning area. The approach taken in TPL-007-2 to mitigating impacts identified in the supplemental GMD Vulnerability Assessment provides responsible entities with flexibility to consider and select actions based on entity-specific

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			factors. This is similar to the approach taken in Reliability Standard TPL-001-4 for extreme events (TPL-001-4 Requirement R3 Part 3.5).