

**Gerry Cauley, P.E.**  
**President and Chief Executive Officer (CEO)**  
**North American Electric Reliability Corporation**  
**Atlanta, Georgia, USA**

Good afternoon FERC staff and fellow panelists.

My name is Gerry Cauley and I am the President and Chief Executive Officer (CEO) of the North American Electric Reliability Corporation (NERC).

NERC's mission is to ensure the reliability of the bulk power system of North America and promote reliability excellence and accountability. To ensure the reliability of the bulk power system, NERC relies on the combined expertise of the electric industry. NERC works collaboratively with industry experts to address issues from standards development to responding to high impact, low frequency threats.

The NERC 2012 Special Assessment interim report on geomagnetic disturbances highlights the potential for voltage collapse and the damage or loss of a limited number of vulnerable transformers across the bulk power system of North America. Previous examples, such as the 1989 event in Hydro Québec demonstrate that severe solar storms represent a serious risk that can challenge the reliability of the bulk power system. NERC is working with industry to develop strategies and plans to control this risk.

NERC's interim report identifies four recommendations for industry:

- Improved tools for industry planners to develop geomagnetic mitigation strategies
- Improved tools for system operators to manage geomagnetic impacts
- Develop education and information exchanges between researchers and industry
- Review the need for enhanced NERC Reliability Standards

From a high level perspective regarding next steps, I see three key activities:

1. Vulnerability assessment through system analysis, and enhancing system design, operating procedures, and, if required, addition of neutral current blocking
2. Training of planners and operators
3. Spare equipment inventory management
4. Transformer Specifications

I will cover each of these with more specificity:

**1. Vulnerability assessment through system analysis, and enhancing system design, operating procedures, and, if required, retrofitting of existing transformers**

The conclusions of the 2012 Special Assessment interim report will be validated with the completion of a vulnerability assessment that NERC, along with industry in 2012, with final results being published in 2013. This joint effort will examine transformer vulnerability and will take into consideration the two primary risks to reliability from geomagnetic disturbances: reactive power loss and transformer hot spot heating. These two phenomena involve two very different time constants, seconds for reactive power loss and potential voltage collapse compared to tens of minutes for transformer heating.

NERC has supported the development of publically available simulation software to support the overall vulnerability assessment. We are now validating reactive power and thermal models to focus attention on the appropriate characteristics of the system. This information will be used to complete the high level vulnerability assessment which can be used to further industry discussion on mitigation strategies. To complete the vulnerability assessment, NERC is working with a number of private and governmental agencies. For example:

- Transformer vendors to determine the thermal characteristics of hot spot heating due to geomagnetic induced currents to identify the risk associated with specific transformer types
- U.S. Geological Survey and Natural Resources Canada to improve the ground impedance maps of North America
- Interconnection modeling groups (Eastern Reliability Assessment Group or ERAG, WECC, ERCOT, and Québec) to improve system models so the effects of geomagnetic disturbances on and across grids can be simulated
- U.S. National Aeronautics and Space Administration and Canadian Space Agency to develop a credible study design basis for systems, which can differ based on geology and geomagnetic latitude, as well as develop the theoretical maximum geomagnetic disturbance
- North American Transmission Forum to support review of confidential information on bulk power system and equipment performance, as well as to support the vulnerability assessment

To support these activities, NERC will pursue an industry voluntary data request on the existing transformer fleet to gather the important transformer characteristics and appreciate the risks to reliability. The data collected through this request would remain confidential and would be subject to NERC's Rules of Procedures regarding data confidentiality. If there is low industry participation and the data cannot be obtained through other avenues, NERC can make a mandatory request for information under Section 1600 of its Rules of Procedure.

Further, we are reviewing the existing NERC Alert on geomagnetic disturbances, to determine if it requires updating with recommendations outlined in the NERC report to ensure that the guidance given reflects the most recent information.

## **2. Training of planners and operators**

NERC will continue to educate industry on the topic of geomagnetic disturbances, work with industry to refine operator tools and procedures, and to consider actions such as preemptively increasing reserves, enabling forced cooling or taking equipment out of service in advance of storm. As part of this transfer of knowledge, it will be vital that open-source models are developed to facilitate industry learning, study and action. Further, NERC will also add training as part of its Operator Certification program.

### **3. Spare equipment inventory management**

The industry continues to work hard to demonstrate its commitment to reliability in the response to high impact, low frequency events. One way is to develop programs to share spare equipment in the event of a severe event. NERC's Spare Equipment Database has been now fully vetted by industry and will be re-launched with specific focus on spare transformer equipment. The Spare Equipment Database is a voluntary program whereby owners of long lead-time transformers would share information about their spares in a database for potential equipment sharing.

### **4. Transformer Specifications:**

Resulting from NERC's recently released report, the IEEE Transformers committee has begun development on a guide on transformer and step response specifications to meet the service conditions related to a geomagnetic disturbance as well as the magnitude and stress cycle due to geomagnetically induced current transformers should be designed to withstand. This project was initiated at the spring 2012 meeting of the IEEE Transformers Committee in Nashville, Tennessee. We will continue to monitor the progress of this effort, and provide technical expertise as warranted to its conclusion.

From an operational perspective, more useful forecasting is needed to support operator action. The U.S. National Oceanic and Atmospheric Administration (NOAA) and SpaceWeather Canada need to enhance warning time frames and granularity of forecasts so industry can take the right action, in the most affected parts of North America.

The GMD task force interim report provided a roadmap for action for industry to address GMD. For industry to recognize that, just as they prepare for earthquakes, hurricanes and snowstorms, preparations for GMD should be a part of their planning efforts. It is important for us to learn from those who have had experiences with GMD, to get the source code information out to industry and train the planners and system operators to deal with these events.

Thank you for the opportunity to speak to the Commission today and I welcome your questions.