



Geomagnetic Disturbances

Regis Binder

**Federal Energy Regulatory
Commission**

Office of Electric Reliability

June 15, 2012

Disclaimer

The content of this presentation does not necessarily represent the opinions of the Federal Energy Regulatory Commission or any individual commissioners.

Geomagnetic Disturbances

- **Coronal mass ejections from the sun send gusts of ionized particles into space**
- **Earth's magnetic field captures ionized particles causing varying magnetic fields on Earth's surface**
- **Changing fields induce voltage in the Earth (V/km) and cause DC electrical flows called Geomagnetically Induced Current (GIC) in the Bulk Power System**

Geomagnetic Disturbances

- **Threats to the BPS**
 - **Damage/destruction of equipment**
 - **Transformers**
 - **Generators**
 - **Breakers trying to operate**
 - **Capacitors**
 - **Increased VAR consumption**
 - **System voltage instability**
 - **Blackouts**
 - **Creation of harmonics**
 - **Incorrect operation of protection systems**

Conflicting Results

- **Oakridge National Laboratory Study**
 - Predicts that well over 300 EHV transformers will be at-risk for failure or permanent damage
- **NERC Interim Report**
 - Most likely worst-case system impacts from a severe GMD event and corresponding GIC flow is voltage instability

Mitigation Steps

- **Hardware solutions**
 - **Series blocking capacitors**
 - **Neutral devices**
 - **Blocking capacitors**
 - **Reducing resistors**
 - **Increased GIC withstand capability**
- **Operations solutions**
 - **Reduced loading and load shedding**
 - **Increased reactive generation reserve**

GMD Staff Tech Conference

- **Held April 30, 2012**
- **Panel I: Assessment of GMD Risks**
 - **DHS, researchers, NERC, industry**
- **Panel II: Moving Forward on GMD**
 - **NOAA, NRC, UK Dept. of Energy and Climate Change, researcher, NERC, industry**
- **Written comments accepted thru May 21**

GMD Staff Tech Conference

- **General agreement on:**
 - **Knowledge can be improved as urgent actions are taken**
 - **Standards are necessary to protect grid from GMDs**
 - **Grid collapse is unacceptable**
 - **GMD must be addressed regionally**
 - **Vulnerable & critical assets should be examined/protected**

Potential Approaches to GMD

- **Encourage voluntary action**
- **Industry development of standard(s)**
- **FERC order to develop reliability standard(s)**
- **Some combination**

Geomagnetic Disturbances

- **Thank you, and I look forward to discussing any questions.**