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High-Impact, Low-Frequency Event Risk to the North American Bulk Power System

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NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

About NERC

International regulatory authority for electric reliability in North America

- Develop & enforce reliability standards
- Analyze system outages and near-misses & recommend improved practices
- Assess current and future reliability

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North America's Critical Infrastructure

- North America's bulk power system is one of our most critical infrastructures; it underpins our government, economy and society in many important ways
- Comprised of over 200,000 miles of transmission lines, thousands of generating plants, and millions of digital controls

Electric sector has a long history of successfully managing day-to-day reliability risk

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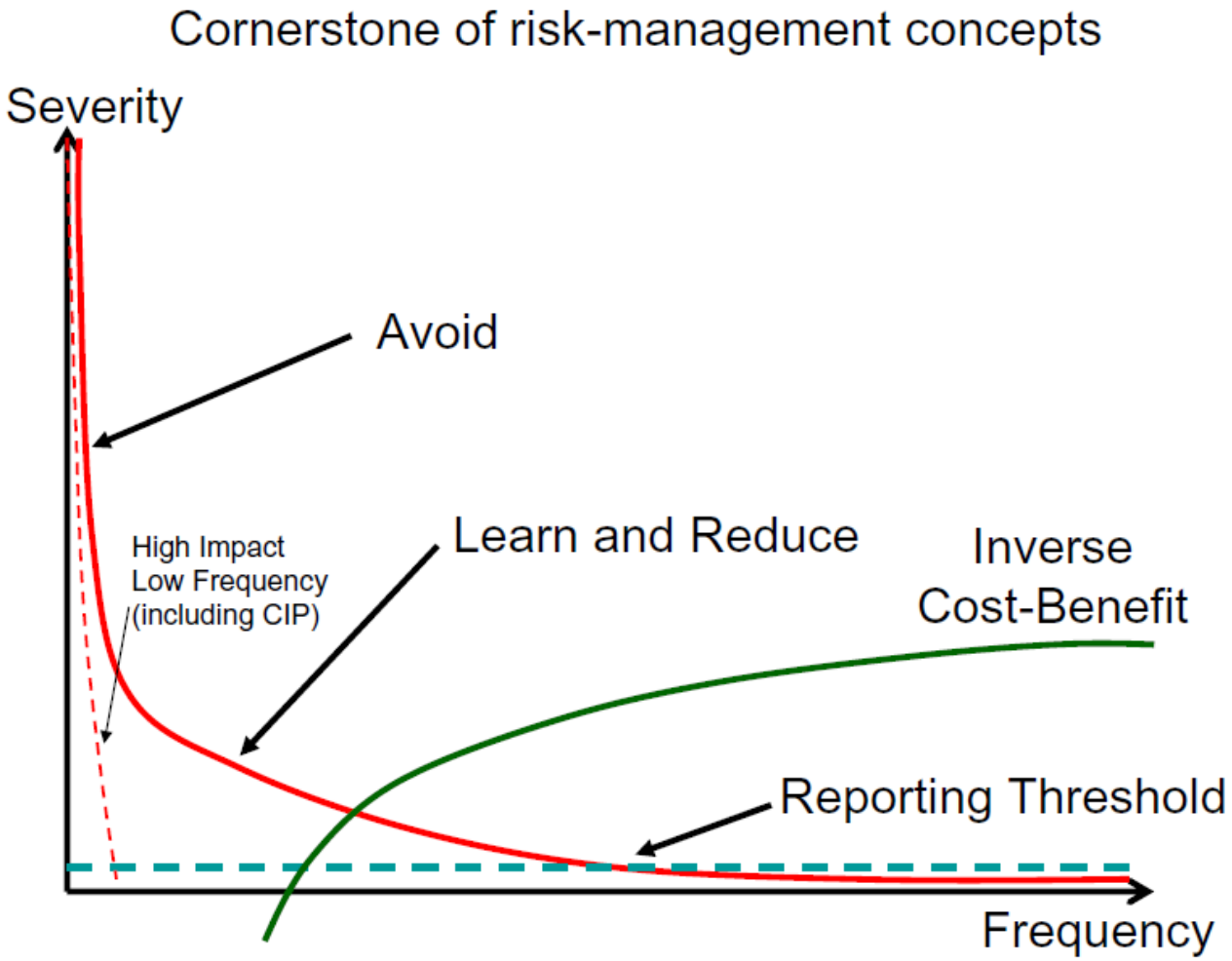
Managing Risk



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High-Impact, Low-Frequency (HILF) Risks

- "Black Swan" events
  - Occur very infrequently, or, in some cases, have never occurred
  - Little real-world operational experience with addressing these risks
  - Generally have the potential to impact many assets at once
  - Catastrophic impacts on the bulk power system and society-at-large

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Examples of Ongoing Public/Private Efforts to Address HILF Risks

Year	Effort
2009	NERC Pandemic Influenza Working Group coordinates with government authorities to provide guidance to the electric sector on the 2009 A/H1N1 Pandemic July 1 – First requirements of NERC's Critical Infrastructure Protection Standards become mandatory and enforceable across the U.S.
2008	U.S. EMP Commission issues summary report on Electromagnetic Pulse risk to civilian infrastructure National Academy of Sciences releases report on Geo-magnetic Disturbances

NERC/DOE Joint HILF Effort

- Partnered in July 2009
- Formed Steering Committee
- Conducted Workshop in November 2009
  - 110 Subject Matter Experts, including DOD, DHS, FERC, Congressional staff, intelligence community, EMP Commission, all sectors of the electric industry

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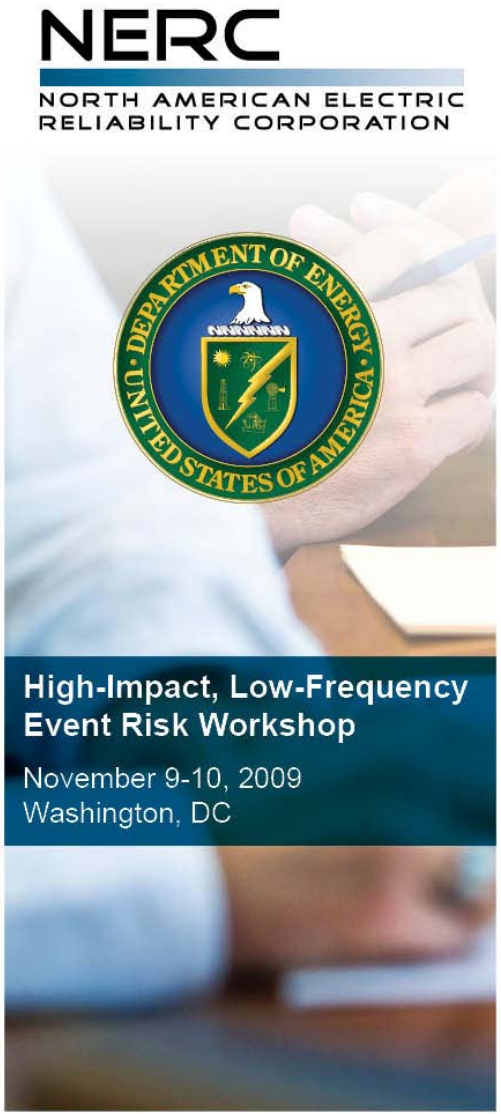
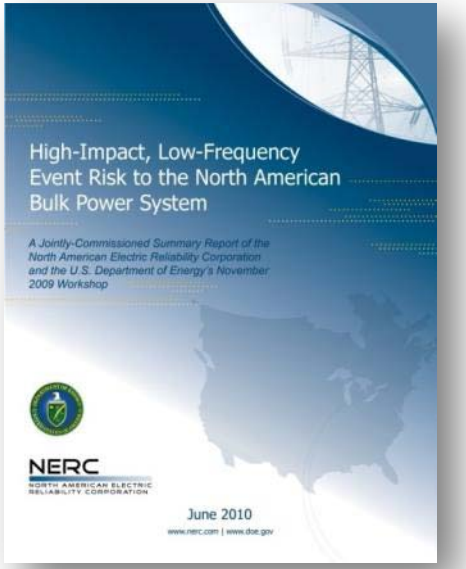


Today's Report

- Summary of November workshop
- Creates a common understanding of three HILF risks
  - Segmented analysis of threat, vulnerability, and consequence
- Lays the groundwork for the development of an action plan
  - 19 *Proposals for Action* suggested by workshop participants



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Three Principal HILF Risks

- Coordinated Cyber, Physical, and Blended Attacks
- Pandemics
- Geomagnetic Disturbances (GMD), Electromagnetic Pulse (EMP), and Intentional Electromagnetic Interference (IEMI)

Common Framework Approach to HILF Risk

HILF Risk Differs from Traditional Risks

Requires risk managers to take a different approach to handling these risks.

Sound Risk Management Must Take Holistic, Sector-Wide Approach

Impossible to fully protect the grid from all threats. Cannot “gold plate” the system. Must focus on balance of resilience, restoration, and protection.

Key Interdependencies Must Be Identified and Understood

Electric sector highly dependent on telecommunications and fuel supply and delivery infrastructure.

HILF Risk Must be Placed In Context

HILF Risks are part of a larger risk landscape facing the sector. Many competing priorities strain available resources: “smart grid” implementation, climate change…

Public/Private Partnership Critical to Progress

More effective public private partnership must include better information sharing, coordinated R&D, and clearer risk indicators.

Coordinated Attack Risk

- Concerted, well-planned attack against multiple key nodes
- Potential for cyber attacker to manipulate key systems and provide misleading information to system operators
- Adaptive attack could actively attempt to thwart responders efforts to restore power

Coordinated Attack Risk
Key *Proposals for Action*

- More effective information sharing between government and industry on specific threats and vulnerabilities
- Consider traditional system planning and operating practices with respect to coordinated attack threats
- Research and development to create forensic tools for industrial control systems (i.e. SCADA)

Pandemic Risk

- “People Event”
- Potential loss of significant portion of workforce needed to reliably operate the power system
- 2009 A/H1N1 outbreak a mild event and did not exhibit the characteristics of most concern to the electric sector

Hospitals are overrun during the 1918 Pandemic

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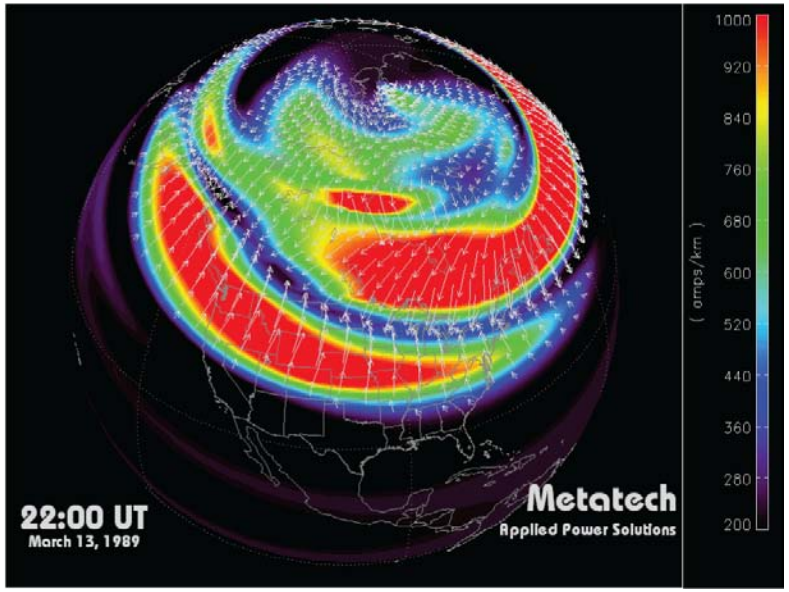
Pandemic Risk
Key *Proposals for Action*

- Electric sector entities should review pandemic plans to incorporate lessons learned from 2009 A/H1N1 event
- Pandemic severity scale should be created to better track societal impacts
- Better leading indicators should be developed and communicated to businesses during a pandemic outbreak

Geomagnetic Disturbance Risk

- Earthly effects of solar weather
- Geomagnetically-induced currents can cause widespread tripping of high-voltage transmission lines
- Potential for lasting damage to high-voltage transformers



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Geomagnetic Disturbance Risk
Key *Proposals for Action*

- Existing measurement index for strength of geomagnetic disturbances (K-index) should be improved
- Spare equipment database for high-voltage transformers should be considered
- Evaluate and recommend cost-effective and efficient mitigations

Electromagnetic Pulse and Intentional Electromagnetic Interference Risk

- High-Altitude detonation of a nuclear weapon would simultaneously interrupt and potentially damage many system components
- Intentional Electromagnetic Interference, if coordinated, could result in local disruptions to multiple key nodes

Electromagnetic Pulse and Intentional Electromagnetic Interference Risk

Key *Proposals for Action*

- Identify and prioritize “top ten” mitigations that are both cost effective and sufficient to protect the system
- Spare equipment database for high-voltage transformers should be considered
- Long-term R&D roadmap

Question & Answer

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