

## FERC Reliability Technical Conference Panel I: State of Reliability and Emerging Issues

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### Introduction

Acting Chair LaFleur, Commissioners, staff, and fellow panelists. I appreciate the opportunity to discuss the constantly evolving issues facing the bulk power system (BPS). Reliability remains a top priority at the Commission and I appreciate our partnership in addressing significant threats to reliability. As I testified to the Senate Energy Committee earlier this year, I remain deeply concerned about the changing risk landscape from conventional risks, such as extreme weather and equipment failures, to new and emerging risks in the security arena. These threats are not new, but have evolved and continue to demand more and more attention from industry, which faces numerous risks. Recognizing the costs for ratepayers associated with these efforts requires prioritization, along with risk management, to ensure that we are focusing resources on the greatest risks to the reliability of the BPS. NERC, along with the regions and stakeholders, work together to collectively address these issues through risk-based, fact-driven analysis that identifies the most serious risks to bulk power system reliability.

The Commission asked what NERC has done to foster the culture of reliability excellence in industry and what are the best indicators of an effective culture of reliability excellence. Sample indicators of an effective culture of reliability excellence include:

- Awareness and empowerment and training for all employees to do the right thing for reliability and customer service
- Awareness and attention to reliability at the top levels of executive management and the board
- A focus on small failures and near-misses – what can be learned and fixed to prevent bigger events
- Deference toward the technical experts on reliability matters
- A focus on learning and continuous improvement
- Continuous scanning to anticipate significant emerging risks
- Commitment to reliability actions and investments

NERC has fostered this culture of reliability excellence by adopting and promoting the use of risk management approaches across all ERO program areas and promoting risk-informed and prioritized actions by industry. The heart of this approach is detailed and systematic root cause analysis of bulk power system events and analysis of overall reliability performance trends. Additionally, the ERO evaluates potentially very serious risks in such areas as physical and cybersecurity or a major solar magnetic disturbance. Working with the Reliability Issues Steering Committee, a senior executive advisory group from industry, as well as NERC's technical committees and other stakeholders, we are able to evaluate various competing risk priorities by understanding the inherent risk, what controls are in place, and what additional risk mitigation is needed. With this approach, the ERO is beginning to demonstrate an ability to methodically identify and mitigate a specific risk affecting the reliability of the bulk power system. This approach

affects all programs across the ERO. Today you will hear of numerous efforts and initiatives underway at NERC that reflect our commitment and focus to ensuring reliability of the North American BPS and further foster a culture of reliability excellence.

## Standards and Compliance

In standards, NERC is approaching the end of a large initiative to streamline the mandatory performance requirements and focus the requirements on specific reliability objectives. In addition to improving the quality and clarity of the standards, and addressing previous FERC directives, this work is eliminating more than 200 requirements that have been deemed to be administrative or not focused on specific reliability outcomes. This will allow BPS owners, operators, and users to better align their compliance programs with the objective of achieving reliability excellence in planning and operations.

A number of critical new or revised standards have also focused industry on important reliability risks to be addressed, including: the definition of the bulk electric system, frequency response and frequency bias settings, generator relay loadability, geomagnetic disturbance operations, cybersecurity, and physical security.

Standards are having a positive effect in driving industry resources toward controlling important risks. For example, a mandatory standard on vegetation management, a major cause of the 2003 and several preceding large blackouts, along with strong enforcement actions by NERC and Regional Entities, has significantly reduced the risk of cascading failures of the BPS due to vegetation grow-ins. Working with industry system protection experts, NERC developed new relay-loadability requirements for transmission line relays. In the August 2003 Northeast Blackout, more than 300 high voltage transmission lines tripped in a high speed cascade due to a previously little understood issue with the relay settings, even though no fault conditions existed on those lines. Industry experts were able to determine that the settings could be modified to prevent a similar future cascade and the requirements were included in new reliability standards. The risk of repeating this mode of uncontrolled high speed cascade of transmission lines has been substantively mitigated. Industry experts have worked with NERC and the Regional Entities to develop new standards for frequency response to address decades of gradual decline in resources available to respond to frequency disturbances. Experts are currently developing technical methods and tools to mitigate the risks and potential consequences of solar magnetic disturbances. These are but a few examples of how well-structured standards, focused on addressing risks to BPS reliability, can affect positive change by industry.

The compliance monitoring and enforcement program implemented by NERC and the Regional Entities has been effective in ensuring that compliance violations are identified and mitigated, thereby reducing reliability risk. The *State of Reliability 2014* report, similar to previous years, indicates that risks due to noncompliance have trended significantly lower in recent years. NERC and Regional Entities have encouraged self-reporting of violations and timely mitigation – to date, more than 70 percent of all violations are self-identified by registered entities.

In recent years, the ERO developed greater efficiencies in processing enforcement issues through the find, fix and track (FFT) and spreadsheet notice of penalty (SNOP) initiatives. Work is now continuing to develop the Reliability Assurance Initiative (RAI) to ensure risks are effectively and efficiently addressed through the compliance monitoring and enforcement programs. RAI specifically seeks to improve the reliability of the BPS due to enhanced focus on high reliability risks and registered entities' internal controls relative to those risks, performance of self-assessments and corrective actions, and enhancement of the enforcement processes to process violations in accordance with risk.

## Event Analysis

The ERO has developed a systematic approach to capturing and analyzing BPS events. Industry has been very responsive to a program established in 2010 for the voluntary reporting of system events, including sequence of events, root causes, and mitigating actions. Though voluntary, the ERO is experiencing virtually 100 percent participation by industry. The information arising from this program is valuable in identifying reliability risks and trends and in developing lessons learned and mitigating actions for industry. Since its inception, the process has yielded more than 470 qualified events reported to the ERO, and more than 84 lessons learned.

NERC assesses every event to identify and share the possible threats to reliability with industry. The NERC cause coding process has provided valuable information to the industry, including greater ability for historical trending and predictive analysis. Industry actively participates in the assignment of cause codes as events are closed to trending. This provides greater transparency on how NERC trends events and provides a venue for active collaboration and sharing.

As a clear demonstration of the reliability benefit, these analyses resulted in NERC issuing a Level 1 advisory alert after the identification of a trend in 345 kV SF6 puffer-type circuit breaker failure and the potential risk this poses to the reliability of the BPS. Breaker failures can lead to serious, multiple-facility outages, including loss of load. The alert made industry aware of the recent failures and the published maintenance advisories so appropriate action could be taken by entities with this type of equipment.

While the alert was advisory in nature, there was close collaboration with the North American Generator Forum and North American Transmission Forum, as well as trade associations with members who have this type of 345 kV equipment. This advisory provided an excellent opportunity for NERC to work directly with the forums and trades to determine the extent of the condition and address the potential risk to the bulk power system. To date, significant progress has been made in inspecting and remediating this class of circuit breakers and NERC continues to monitor the frequency of breaker failures to verify a downward trend.

Energy management systems (EMS), which encompass supervisory control and data acquisition (SCADA), communications and real-time tools, are vital for maintaining situational awareness and making operating decisions at both the individual and the organizational level. EMS are reliable and typically redundant. While an outage of the EMS increases the risk to the reliability of the BPS, to date, there has been no loss of load as a result of an EMS outage. The NERC Event Analysis program received 30 events in 2013 that detailed a complete loss of SCADA, monitoring or control lasting more than 30 minutes. The voluntary reporting by the industry in this area has been exceptional and NERC published four lessons learned specifically about EMS outages in 2013 and worked to build and support an industry-led EMS Task Force. The work and active information sharing of this group has reduced residual risk associated with this potential loss of situation awareness and monitoring capability and continues to provide valuable information to industry. NERC now has a lower category event for potential precursors to EMS outages, and is collecting even more voluntary reports from the industry to proactively address these challenges.

NERC focused efforts on human performance and identified possible workforce capability and human performance challenges that pose threats to reliability. Workforce capability and human performance can be divided into management, team and individual levels - more than half of all event reports indicate some management or organizational challenges. In an effort to support industry, NERC had its third annual human performance conference

in Atlanta in March 2014. NERC has provided human performance support and Event Analysis training to more than 250 entities in North America.

## **Critical Infrastructure Protection**

Since the initiation of the ERO model, major progress has been made in securing critical infrastructure in BPS using risk-based approaches. Mandatory cybersecurity standards have been established, and the ERO has actively monitored compliance with these standards, noting significant numbers of compliance gaps mitigated by registered entities. FERC approved CIP Version 5 in November 2013. CIP Version 5 requires that all cyber assets must now be categorized as low, medium, or high impact assets. The revised standards include 12 new requirements with new cybersecurity controls to address emerging cyber threats. In addition, CIP Version 5 removes technology-specific requirements by replacing them with a risk-based approach to implementing appropriate and changing technologies. That is, rather than specifying how to implement a requirement, the revised requirements specify the risk-based result that must be achieved, which enables industry to implement new and emerging technologies to address the risk. NERC is working with industry on the transition to this new standard, which is one of the most comprehensive, risk-based standards ever mandated.

On May 23, 2014, NERC filed its physical security standard with FERC, prior to the 90 day deadline. The proposed CIP-014-1 standard addresses the requirements of FERC's March 7 order and, as is the case for all cyber and physical security standards, is deliberately dynamic and adaptable to the constantly changing threat environment. The proposed standard enhances NERC's foundational physical security efforts and helps ensure that owners and operators of the bulk power system take the necessary steps to protect the grid from physical attacks.

In addition to standards, the culture of reliability excellence is furthered through education and training focused on security and critical infrastructure protection. More than 230 organizations participated in NERC's second grid security exercise, GridEx II, in November 2013. The biennial event, which began in 2011, brought together industry and government from the United States, Canada and Mexico to work on the response to a scenario that simulated a physical and cybersecurity attack. The 2013 exercise incorporated recommendations detailed in the 2011 GridEx report and added an executive discussion after completion of the simulated scenario.

More than 325 industry and government stakeholders attended NERC's annual grid security conference, GridSecCon, in October 2013, which focused on physical and cybersecurity issues. Speakers at NERC's third conference focused on transformational, strategic and tactical approaches to securing systems. Specifically, participants considered different information-sharing techniques; determined whether their organizations were resilient through self-assessments; tested response activities through exercises; worked to ensure that security is considered when building operations; and developed ways to enhance the workforce by recruiting, training and retaining individuals who can address these and other issues. Additionally, almost 200 stakeholders attended credentialed training sessions in cyber and physical security.

The Electricity Subsector – Information Sharing and Analysis Center (ES-ISAC) is operated by NERC and serves to share actionable information regarding physical and cyber security threats and vulnerabilities with industry. To build cybersecurity response capabilities within the industry, the ES-ISAC continues to conduct Cyber Risk Preparedness Assessments exercises. The ES-ISAC directly supported six CRPA engagements in 2013, including the first exercise with a Canadian entity. Additionally, the CRPA program continued to mature in 2013 with the addition of the

Electricity Sub-sector Cybersecurity Capability Maturity Model (ES-C2M2) key practice areas informing and complementing the CRPA program. As part of the ES-ISAC's strategy to support adoption of the CRPA methodology more broadly across the industry, a SANS SCADA workshop was held that provided training and templates for industry to use in support of their own exercise programs.

The ES-ISAC, the Department of Homeland Security, the Department of Energy and the FBI collaborated to host a series of classified briefings focused on tactics and tools of emerging cyber threat actors. This campaign included a multi-city tour across the United States and was developed following a NERC alert that detailed how common tools can be used to infiltrate critical infrastructure networks and gain access to control system networks. The briefings were designed to raise awareness within the control systems community to better protect the bulk power system. In addition, the ES-ISAC, DOE, FERC, DHS and the FBI developed an outreach effort to raise awareness of the physical attack on a California substation, inform industry of mitigation activities, and provide a forum for industry to meet with state, local, and federal authorities to discuss physical security concerns for their regions. This was an unprecedented public-private partnership involving U.S. and Canadian interests.

The ES-ISAC, under direction from the Electricity Sub-sector Coordinating Council, is partnering with Pacific Northwest National Laboratory to transition the Cybersecurity Risk Information Sharing Program from a DOE pilot effort to an industry-driven effort in 2014. The partnership is working to deploy the capability across 20 companies in 2014. This effort will not only support the cybersecurity programs of the participating organizations, but also, through the ES-ISAC, enhance the industry's cybersecurity efforts by sharing CRISP information more broadly through portal posts and analytic products.

## **Reliability Assessments and Performance Analysis (RAPA)**

Tom Burgess will be speaking on this panel about the State of Reliability Report, as well as other initiatives we have underway at RAPA on the second panel. I was asked "what are the best indicators of an effective culture of reliability excellence?" In addition to the efforts I've described, I believe our RAPA division is a key in the development of those indicators. Between our assessments and the State of Reliability report, the data, metrics and analysis provided give us excellent perspective for not only what has happened on the system, the outlook for the near term, but true insight to the challenges that lie ahead. Over the years we've highlighted areas ahead of their impact on reliability and raised awareness of the concerns, provided recommendations and continued to track and monitor their implementation. Whether it is integration of variable energy, gas/electric interdependency, regulatory initiatives, or essential services, the topics are analyzed, impacts forecasted and risk informed recommendations are provided to regulators, policymakers and stakeholders to support a learning environment for maintaining electric reliability.

## **Conclusion**

As outlined in this testimony, NERC has many initiatives that not only foster, but create a culture of reliability excellence not only for our stakeholders, but for NERC, the Regions - all participants in our process. We work together to share what we know, educate our partners, and learn what we can to stay ahead of the threats, address risks to the system, and provide a reliable BPS for the consumers in North America. I thank you for the opportunity to be here today and appreciate the Commission's focus on reliability.