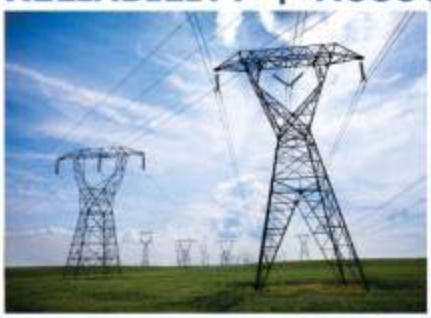
NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Facility Ratings Assurance Best Practices - White Paper 2

April 2014

RELIABILITY | ACCOUNTABILITY






3353 Peachtree Road NE
Suite 600, North Tower
Atlanta, GA 30326
404-446-2560 | www.nerc.com

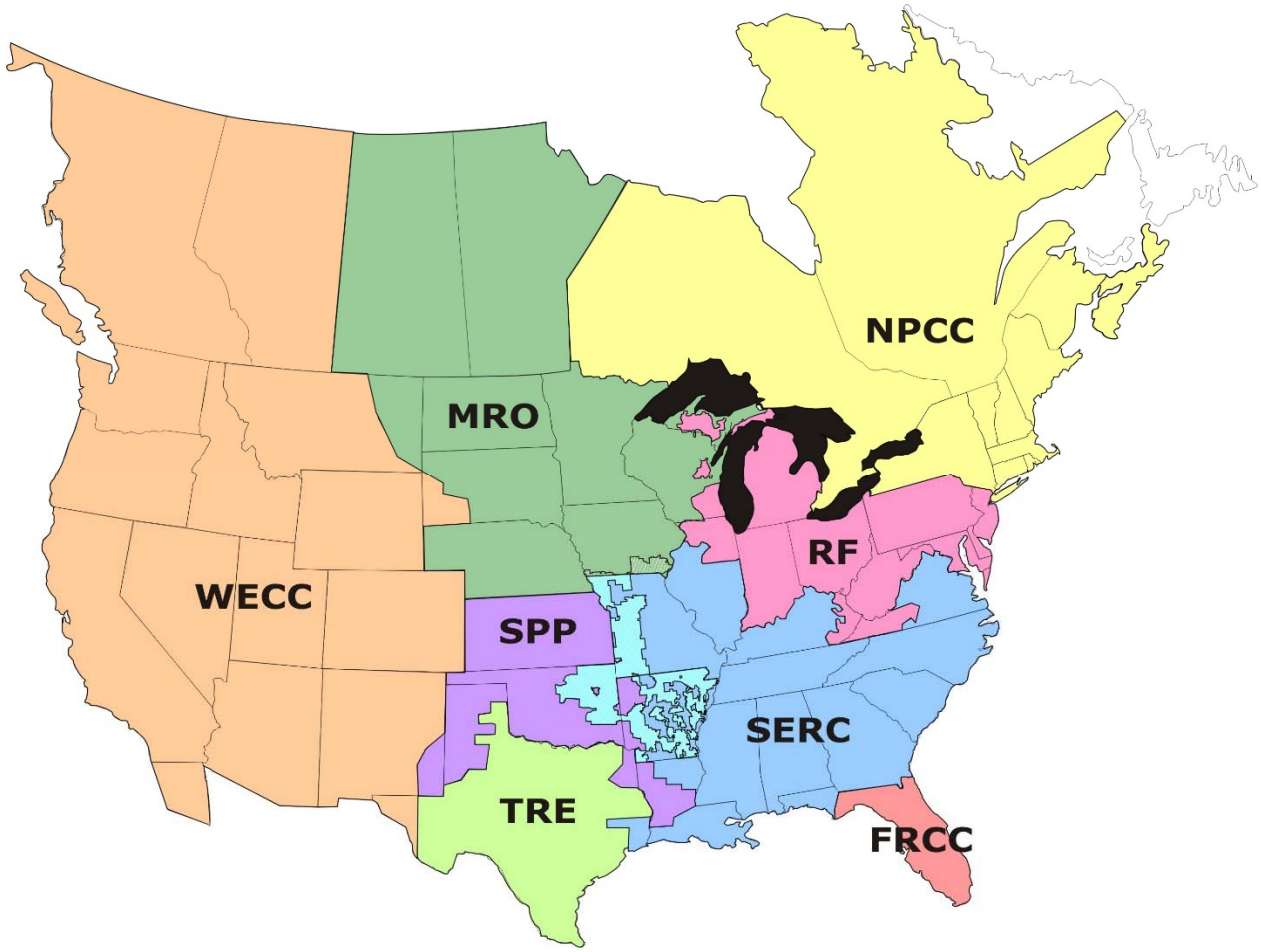
Table of Contents

Preface

The North American Electric Reliability Corporation (NERC) is a not-for-profit entity whose mission is to ensure the reliability of the Bulk-Power System (BPS) in North America. NERC develops and enforces Reliability Standards; annually assesses seasonal and long-term reliability; monitors the BPS through system awareness; and educates, trains, and certifies industry personnel. NERC's area of responsibility spans the continental United States, Canada, and the northern portion of Baja California, Mexico. NERC is the electric reliability organization (ERO) for North America, subject to oversight by the Federal Energy Regulatory Commission (FERC) and governmental authorities in Canada. NERC's jurisdiction includes users, owners, and operators of the BPS, which serves more than 334 million people.

The North American BPS is divided into several assessment areas within the eight Regional Entity (RE) boundaries, as shown in the map and corresponding table below.

FRCC	Florida Reliability Coordinating Council
MRO	Midwest Reliability Organization
NPCC	Northeast Power Coordinating Council
RF	ReliabilityFirst
SERC	SERC Reliability Corporation
SPP-RE	Southwest Power Pool Regional Entity
TRE	Texas Reliability Entity
WECC	Western Electric Coordinating Council



Summary

FAC Alert Project

Transmission line facilities historically were designed and built for long-term sustainability. The design of transmission lines has not been reviewed in light of current field conditions, and there is no outstanding requirement for such an analysis. As man-made developments and vegetation growth persist, the construction of transmission lines starts to deviate from their "as designed" status, which causes clearance violations between the lines and their surroundings.

While clearance buffers were built into the original transmission line design, natural and man-made elements significantly contributed to reducing those buffers, which are invisible to the naked eye. Utilities have successfully maintained the vegetation growth in rights-of-way (ROWs) and easements. The "man-made elements," like underbuilds, road signage, street lights, and ground-line grade changes, have proven difficult to prevent or regulate. As a result, the compromised transmission line clearances could potentially violate current facility standards and the original design assumptions, leading to increased risk to the reliability of the BPS.

In October 2010, after an internal analysis indicated a reliability risk in facility clearances, NERC issued the *Facility Ratings Alert* (FAC Alert) as a recommendation to industry to determine the extent of the condition and address and mitigate issues with transmission line clearances. The FAC Alert project[1] contains recommendations that entities divide their circuits into high, medium, and low priorities for assessment and mitigation, to be completed by year-end 2013. This provided a structured means for entities to address this project and report the progress to their respective Regional Entities. The Regions submitted the data to NERC and ultimately NERC reported[2] the progress to FERC. NERC staff conducted webinars[3] for industry after each report was posted. Participation in the FAC Alert project required significant amounts of time, resources, and finances for all involved. The entities that participated developed a good methodology for addressing the relevant reliability risks. While the obligation for entities to report to NERC has concluded, many entities will continue remediation efforts for the next few years. As well, some have put maintenance practices in place to help preclude the recurrence of similar issues and minimize the reliability risk posed to the BPS.

Background

The electric utility industry has had heightened awareness of transmission line clearance design—particularly ROW vegetation—since the 2003 Northeast blackout, as vegetation contact with transmission line was one of its initiating causes. As a result, the industry shifted major focus to ROW/vegetation maintenance and transmission line clearance issues. Many transmission owner entities re-evaluated their programs and started assessing their transmission line designs versus as-builts. This report will highlight one such entity's successful efforts in proactively implementing a risk-based approach to addressing transmission line clearance issues, prior to the issuance of the FAC Alert in October 2010. The entity (referred to in this report as "Entity") has upwards of 105,000 miles of overhead facilities, with expansion projects that will develop additional circuit miles of overhead facilities in the near future. The Entity assessed its transmission lines using LiDAR[4] technology well in advance of the issuance of the FAC Alert. The Entity was faced with stricter state regulations for safety and enforcement; thus, a self-report in 2007 led it to assess its BES facilities.

[1] Facility Alert Project - http://www.nerc.com/pa/rrm/bpsa/Pages/Facility-Ratings-Alert.aspx.
[2] Facility Ratings Alert Update Report to FERC Staff - http://www.nerc.com/pa/rrm/bpsa/Pages/Facility-Ratings-Alert.aspx
[3] Facility Ratings Alert Report Update Webinars - http://www.nerc.com/pa/rrm/bpsa/Pages/Facility-Ratings-Alert.aspx
[4] LiDAR technology is a remote sensing technology that measures distances by illuminating a target with a laser and analyzing the reflected light.

Assessment

Prior to the issuance of the FAC Alert, the Entity self-reported a FAC-009 violation to NERC, which led the entity to assess their entire BES system, excluding the radial transmission lines, using LiDAR technology. This prompted the Entity to closely monitor its ROW lines and implement a targeted program to assess and mitigate line clearance issues. The Entity worked in close coordination with their Regional RC and ISO in addition to the state Public Utilities Commission (PUC). Over a span of five years and prior to issuance of the FAC Alert, the Entity completed their BES facilities assessment. The Entity completed the LiDAR assessment and based on those results chose to field verify the facilities in an ascending order of most discrepancies found. By the issuance of the FAC Alert in 2010, the Entity had identified close to 47,000 spans of facilities with discrepancies. Since the majority of its assessment was complete and adhered to the stricter state regulations for safety, the Entity developed a "Safety and Reliability" plan to prioritize facilities. Facilities located in a densely populated area with the most discrepancy were first to be field verified and remediated, followed by the rest of facilities. This was done in contrast to a NERC-prescribed priority scheme that assorted the BPS facilities by voltage class.

Survey

LiDAR technology is a remote sensing technology that measures distances by illuminating a target with a laser and analyzing the reflected light. The Entity used LiDAR for assessing all their BPS facilities and found the LiDAR assessments to be fairly accurate, with minor infractions such as non-walkable areas for crews and substations located under transmission facilities. The LiDAR results included pictures and videos that helped the team with assessments without needing to re-verify the discrepancy or infraction. Along with LiDAR, the Entity via a multi-year project prioritized field assessments with LiDAR and addressed the facilities that had the most discrepancies first. The Entity efficiently utilized both LiDAR and field assessment methodologies in determining as-built versus the existing design of the transmission facilities. In addition, the LiDAR tool recorded line ampacity that would be used in the transmission line design and modeling. Because of the FAC Alert, the Entity positively changed its overall assessment model so that all its new and existing BES facilities use LiDAR for survey and PLS-CADD for modeling.

Modeling

The Entity used PLS-CADD software to integrate their survey results and model the transmission lines. Using the advanced technology of PLS-CADD enabled the Entity to successfully document the design of its transmission lines, capturing not only vegetation but also crossings and underbuilds. Analytical work performed by its transmission planning department provided actual line loading ampacity, which was incorporated in PLS-CADD and assisted in providing two years of load forecast model and sag requirements for new and existing lines.

Mitigation

Completion of LiDAR survey, design, and modeling enabled the Entity to start planning its mitigating efforts by implementing a safety and reliability plan. Given the stricter-than-NESC-code state regulations for transmission line clearances, the Entity grouped spans on transmission lines with discrepancy and sorted them per area. The more populated areas with the greatest number of discrepancies were assessed and mitigated first. Along with strong internal coordination, the Entity worked successfully with neighboring entities, the ISO, and the RC in coordinating efforts to mitigate discrepancies specifically related to underbuild distribution. In cases of public use infractions like street lights and lamp posts, the Entity reached out to cities and towns and worked with its technical staff to mitigate discrepancies. The Entity also worked with its local public affairs group to educate the public and other agencies in the importance of transmission line clearances. Other considerations, such as environmental regulations and historically significant artifacts found in any area, were included as part of the large project mitigation. Overall, this Entity's unique approach to mitigation, partly due to state requirements, makes them an ideal model for addressing issues found in as-built designs and actual field conditions.

Sustainability

The Entity has made LiDAR and PLS-CADD modeling a standard in its design process for new and existing transmission facilities. This is a big shift in design philosophy from DOS-based programs and paper trails for as-built drawings. The Entity uses dynamic calculation based on LiDAR and field assessment data, which enables it to close out its as-builts by doing accurate design verification. Since the alert commenced, the Entity has acquired GIS technology, which enhances the transmission line design and construction practices. This has given an opportunity to modify its existing standards and procedures, ultimately leading to a sustainable practice of transmission line design and maintenance.

Conclusion

FAC Alert project was implemented by NERC after an internal analysis indicated a reliability risk in facility clearances. NERC issued the FAC Alert recommendation to determine the extent of the condition and address and mitigate issues with transmission line clearances. This allowed the industry to address facility ratings issues on their system in an orderly fashion with ample time and without significant regulatory implications. The sole purpose for the manner in which the FAC Alert was implemented was to preserve BPS reliability while addressing an industry-wide issue. In this case, the Entity had already started assessing its transmission line facilities prior to the issuance of FAC Alert; the alert expedited its projects. Entity decided to assess all the transmission facilities at the same time and mitigate large and safety-related discrepancies first, then focused on mitigating facilities in remote areas. The FAC Alert project heightened the Entity's sense of awareness and realization of BPS reliability. Sustainable programs have been placed in the Entity's philosophy towards reliability, which will assist the next generation of departments in future rerating and design processes. The Entity mentioned above did an outstanding job in addressing the FAC Alert project and cooperating with NERC and Regional regulatory bodies.