NERC

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Reliability and Security Technical Committee Meeting

September 9, 2021

RELIABILITY | RESILIENCE | SECURITY




NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Supply Chain Working Group

Tony Eddleman, NPPD and SCWG Chair
Reliability and Security Technical Committee
September 8-9, 2021

RELIABILITY | RESILIENCE | SECURITY




Supply Chain Effectiveness Survey

- The NERC Supply Chain Risk Management (SCRM) Reliability Standards are:
  - CIP-013-1; CIP-005-6 (parts 2.4 and 2.5); and CIP-010-3 (part 1.6)
  - Initially effective on October 1, 2020
  - CIP-013-2, CIP-005-7 and CIP-010-4 to be effective on October 1, 2022
- The NERC Board of Trustees (Board) requested an update on the effectiveness of the Supply Chain requirements and recommended actions that may be necessary
  - The results of this survey will be analyzed and consolidated by the Supply Chain Working Group (SCWG)
  - Then, combined with results from compliance audits by the ERO Enterprise, will develop the update for the Board
  - During the consolidation it will be anonymized so no entity specific information will be shared with CMEP staff

Supply Chain Effectiveness Survey

- Survey will be open for a 45-day response period
- Requesting company name to:
  - Determine if the survey results represent a fair cross section of registered entities, and
  - Avoid reporting multiple survey results from the same organization
- This is a voluntary survey – please encourage participation!!!

Supply Chain Effectiveness Survey

- Survey will help determine if entities are applying the Supply Chain Risk Management principles to:
  - Low impact transmission cyber assets
  - Low impact generation cyber assets
  - Control center cyber assets
  - Any other operational systems
  - Business systems
  - Provide incidental benefits derived from the implementation of the Supply Chain Standards
- Clarity of the Supply Chain Risk Management requirements
- Identify gaps in the requirements
- Understand if ERO Enterprise outreach efforts were effective

Supply Chain Effectiveness Survey

- Determine whether entities have been able to successfully negotiate contracts that include required supply chain controls, or whether other controls have been required to manage the risk
- Understand vendor reactions to supply chain questions
  - Vendor cooperation
  - Do you support vendors providing a Software Bill of Materials (SBoM)
- Identification of previously unknown supply chain risk
- Impact of new requirements on Critical Infrastructure Protection (CIP) compliance program resources

Questions and Answers

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Sector Elections and RSTC Nominating Subcommittee Update

Rich Hydzik, RSTC Vice Chair
RSTC Meeting
September 9, 2021

RELIABILITY | RESILIENCE | SECURITY




2022-2024 Timeline – Sectors

- ***Sector nominations will occur October 15-November 12, 2021.***
  - ***If more than one nominee is submitted for a Sector,*** **elections will be held November 15-30, 2021**
- We will notify each RSTC member whose term is to expire in 2022 for awareness prior to the nomination period
- There will be one open seat per Sector for Sectors 1-10 and 12
- The sector nominations/elections will follow newly approved NERC Bylaws here. https://www.nerc.com/gov/Annual%20Reports/Amended%20and%20Restated%20Bylaws%204-5-21.pdf

Nominating Subcommittee (NS) Overview

- The RSTC NS consists of five members (the RSTC Vice Chair and four members drawing from different sectors and at-large representatives)
- NS members are nominated by the RSTC Chair and approved by the full RSTC membership
- The term for members of the Nominating Subcommittee is two years
- In addition to recommending individuals for at-large representative seats, the NS manages the process to select the Chair and/or Vice Chair of the RSTC
  - The RSTC Vice Chair shall recuse him or herself from this process if he or she is a candidate

Nominating Subcommittee

- NS Members
  - Rich Hydzik– Vice Chair
  - Jodirah Green – Sector 7, 2022
  - Sandra Ellis – At-Large, 2023
  - Wayne Guttormson – At-Large, 2022
- NERC Staff:
  - Mark Lauby
  - Nina Johnston
  - Candice Castaneda
  - Stephen Crutchfield
  - Tina Buzzard

2022-2024 Timeline – At-Large

- ***December 1-8, 2021*** – After Sector elections, the NS will evaluate the expertise of all Sector reps to determine the additional expertise/diversity needed to balance through the At-Large nominees to meet the goals of the Charter:
  - Selection of At-Large members will allow for better balancing of representation on the RSTC of the following:
    - Regional Entity and Interconnection diversity (i.e., goal of having at least one representative from each Interconnection and Regional Entity footprint);
    - Subject matter expertise (Planning, Operating, or Security);
    - Organizational types (Cooperatives, Investor-Owned Utilities, Public Power, Power Marketing Agencies, etc.); and,
    - North American countries, consistent with the NERC bylaws (Canada, Mexico, and U.S.).

2022-2024 Timeline – At-Large

- ***December 10-24, 2021*** – There will be six open At-Large seats
  - The NS will announce the expertise/diversity they are seeking via e-mail (industry-wide) and ask for nominations for At-Large members
  - Current Chair and Vice Chair terms expire in June 2022 (per NERC Board minutes from November, 2019, page 8).
- ***January 13, 2022*** – The NS reviews the At-Large nominations and develops a slate to be presented to the NERC Board for approval
- February 2022 – NERC Board approves Sector and At-Large members
- March 2022 – First meeting for new members

Questions and Answers

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

RSTC Subordinate Group Review Process

Robert Reinmuller, RSTC Executive Committee Member
RSTC Meeting
September 9, 2021

RELIABILITY | RESILIENCE | SECURITY




Subordinate Group Review Process

- The RSTC Charter specifies subgroup reviews in Section 6, RSTC Subordinate Groups
- Charter Provisions – Working Group
  - The RSTC will conduct a "sunset" review of each working group every year. The working group will be accountable for the responsibilities assigned to it by the RSTC or subcommittee and will, at all times, work within its assigned scope. The RSTC should consider promoting to a subcommittee any working group that is required to work longer than one term.
- Charter Provisions – Task Force
  - Each task force will have a finite duration, normally less than one year. The RSTC will review the task force scope at the end of the expected duration and at each subsequent meeting of the RSTC until the task force is retired. Action of the RSTC is required to continue the task force past its defined duration. The RSTC should consider promoting to a working group any task force that is required to work longer than one year.

Subordinate Group Review Process

- To initiate the review process, a draft process and template is being proposed and will include the RSTC Sponsors in coordination with subordinate group leadership and NERC Staff Liaisons review the working group or task force deliverables and work plans to complete the information in the template.
  - If a subordinate group does not have a Sponsor, the parent group Sponsor will fill that role for this review process (e.g. the Sponsor for the RAS would serve as the Sponsor for the PAWG)
- After testing the draft process and feedback, the RSTC can make the necessary adjustments and adopt it for 2022

Subordinate Group Review Process

- Once the templates are complete, the RSTC EC and Sponsors will review them to make a recommendation on the status of the subordinate group.
- This will be reviewed with the full RSTC at the December RSTC meeting for approval.

Subordinate Group Review Template

Task Force Name:	**Date of Self-Evaluation:** DD-MM-YYYY

Background: As per RSTC Charter – section 6

The RSTC *may assign specific work* to a task force. The RSTC *will approve the scope* of each task force it forms. The chair of the RSTC *will appoint the task force officers* (typically a chair and a vice chair). Each task force *will have a finite duration*, normally less than one year. The RSTC *will review the task force scope* at the end of the expected duration and at each subsequent meeting of the RSTC until the task force is retired. Action of the RSTC is required to continue the task force past its defined duration. The RSTC should consider promoting to a working group any task force that is required to work longer than one year.

Actions to Complete	Complete
Action 1: Each Task Force (TF) will *complete a Self-Evaluation* once a year and *submit 60 days prior to the last RSTC meeting* occurring before the completion of the TF mandate (expected last day)	Yes/No
Action 2: The RSTC will request 6 volunteers to review all TF Self-Evaluations submitted with a broad view of understanding the current status, meeting its specific scope of work and completion of the task. Consideration will be given to the impact of ongoing tasks that are critical to reliability, security, operability, planning as well as close alignment to RISC. The review findings and recommendations will be tabled 30 days before the RSTC meeting and included for discussion.	Yes/No
Action 3: The RSTC to review recommendations in Action 2 and decide if the FT will retire, continue work or will be promoted to a working group.	Yes/No

TF Self-Evaluation Questions		**Explanations**	
1.	Did the TF complete the specific work assignment?	Yes / No	*If Yes STOP the evaluation*
1.	Task is still on track to meet the due date?	Yes / No	
1.	Are the objectives and goals still valid and clear?	Yes / No	
1.	The priority of the work was confirmed?	Yes / No	*Explain the priority*
1.	Alignment with RISC is confirmed?	Yes / No	*Explain to alignment*
1.	Did the TF identify required future steps?	Yes / No	*Explain steps*
1.	Is the TF requesting a new due date?	Yes / No	*Provide details on the request*
1.	Is the TF requesting to stand down?	Yes / No	*Provide details on the date*

RSTC Review and Recommendation	**Explanations**
Recommendation # 1 – continue, retire or promote	*Are objectives and goals still met and the TF assignment provides the expected value?*
Recommendation # 2 – etc	

RSTC Final Decision – Meeting Date DD-MM-YYYY	**Explanations**
Based on the Self-Evaluation and RSTC review discussed at large at the meeting, the TF status is	*Additional explanation as required*

A similar template was drafted for working groups

RSTC Subgroup Review Request

- Request: Seeking RSTC volunteers to:
  - Complete the development of Working Group and Task Force Review Template(s)
  - Coordinate with Working Groups and Task Forces to review their deliverables and work plan to complete the template for their subgroup
  - Develop a recommendation for the RSTC regarding the subordinate group
    - Retain
    - Retire
    - Promote Working Group to Subcommittee if appropriate
    - Promote Task Force to Working Group if appropriate

Questions and Answers

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Reliability Assessments

Update on 2021 Long-Term Reliability Assessment and 2021-2022 Winter Reliability Assessment

Lewis De La Rosa, RAS Chair, Anna Lafoyiannis, RAS Vice Chair, and Mark Olson, NERC Reliability Assessments

RSTC Meeting

September 9, 2021

RELIABILITY | RESILIENCE | SECURITY




ERO Reliability Assessments

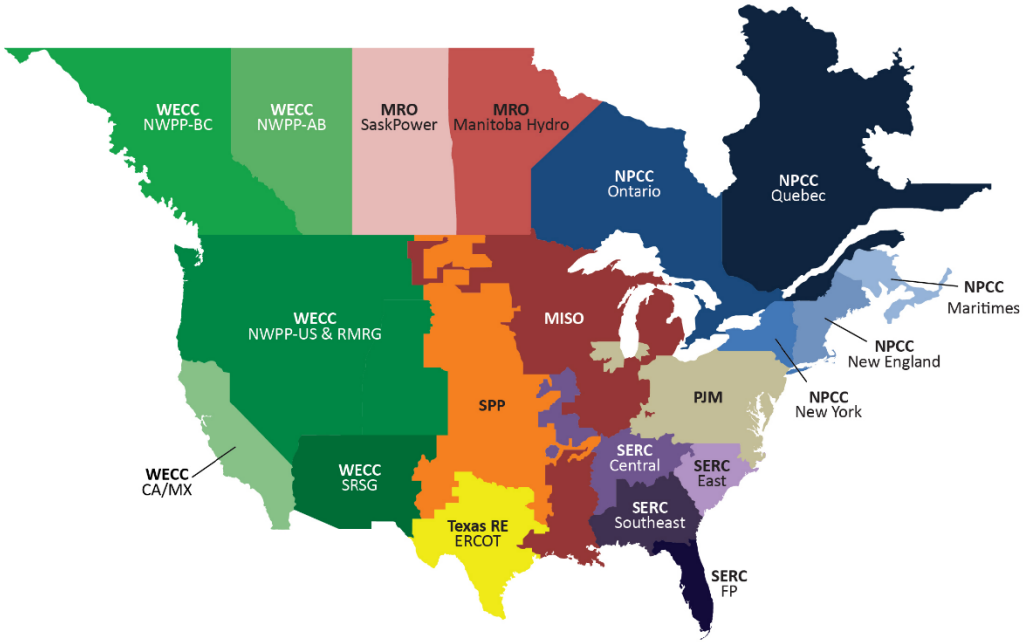
NERC's long-term, seasonal, and special reliability assessments help the Electric Reliability Organization deliver on its vison for a highly reliable and secure Bulk Power System

The Reliability Assessment Subcommittee (RAS) provides subject matter expertise and peer reviews that support the reliability assessment process

Long-Term Reliability Assessment

- High-level assessment of resource adequacy
- Demand, generation, and transmission projections
- Emerging issues

- Coordination and Review
  - RSTC
  - Regional Entities and Region stakeholder groups



MRO – Midwest Reliability Organization
- MISO
- MRO-Manitoba Hydro
- MRO-SaskPower
- SPP

NPCC – Northeast Power Coordinating Council
- NPCC-Maritimes
- NPCC-New England
- NPCC-New York
- NPCC-Ontario
- NPCC-Québec

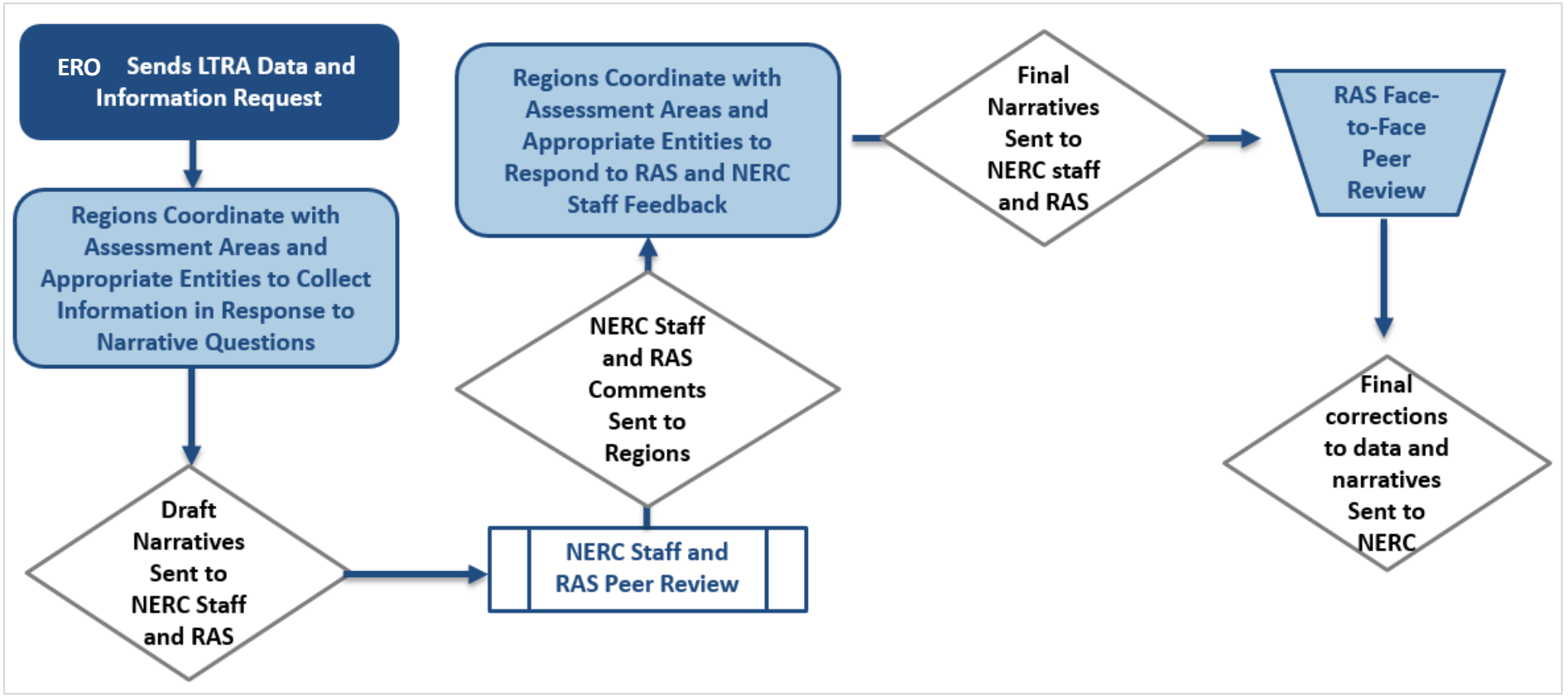
RF – ReliabilityFirst
- PJM

SERC – SERC Reliability Corporation
- SERC-East
- SERC-Central
- SERC-Southeast
- SERC - Florida Penninsula

Texas RE – Texas Reliability Entity
- Texas RE-ERCOT

WECC – Western Electricity Coordinating Council
- WECC-CA/MX
- WECC-NWPP-AB
- WECC-NWPP-BC
- WECC-NWPP-US & RMRG
- WECC-SRSG

LTRA Development Process



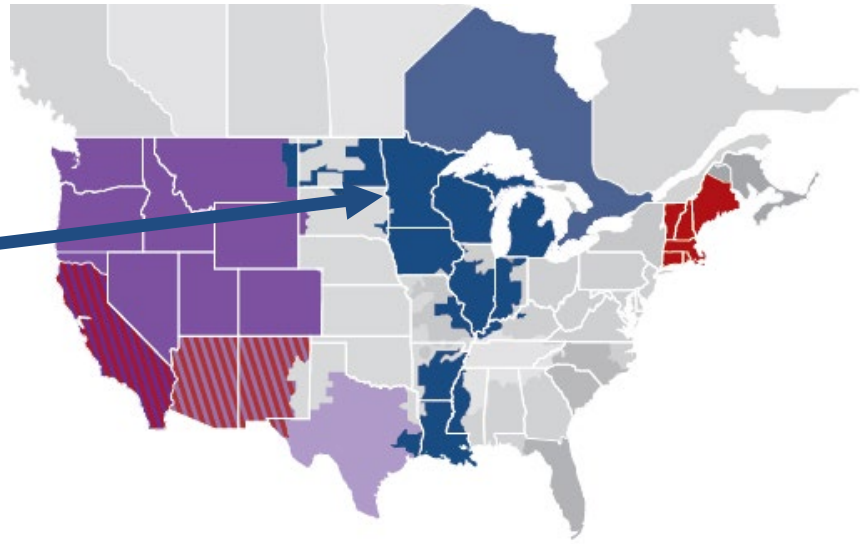
LTRA Topics

- NERC and RAS are analyzing trends and developing findings in the following areas:
  - On-peak resource adequacy and planning reserve margins
  - Updates to the 2020 NERC Probabilistic Assessment (ProbA) for risk areas
  - Risks of energy and capacity shortfalls due to extreme weather
  - Forward-looking frequency response assessment of the Interconnections
  - Trends in generation resource mix, Distributed Energy Resources, and demand projection

On-Peak Resource Adequacy

The ***2020 LTRA*** highlighted future-year planning reserve margin shortfalls in MISO and Ontario

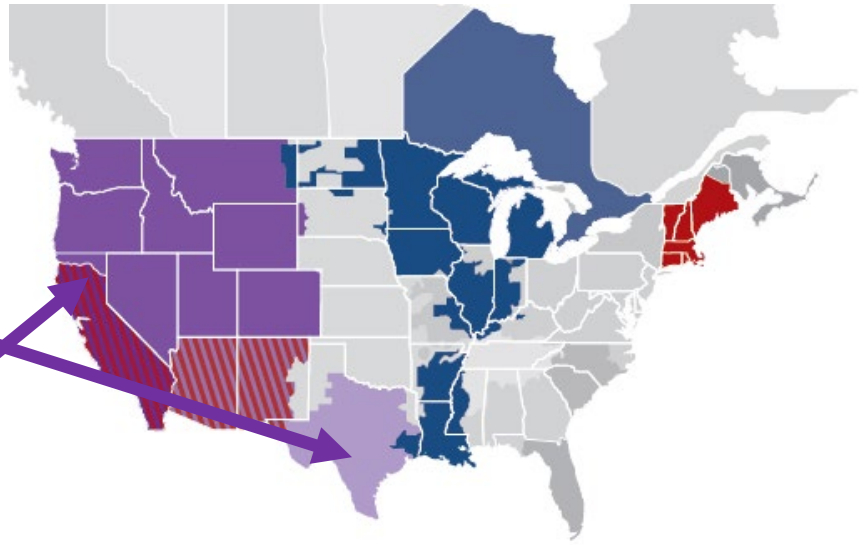
- All other areas met reference levels



- Preliminary ***2021 LTRA*** analysis indicates that planning reserve margins have further declined in MISO
- WECC CAMX is projected to have a shortfall in the 5-year horizon

Energy Adequacy

The ***2020 LTRA*** *(ProbA)* highlighted risk of unserved energy in parts of the Western Interconnection and increasing energy risks in Texas

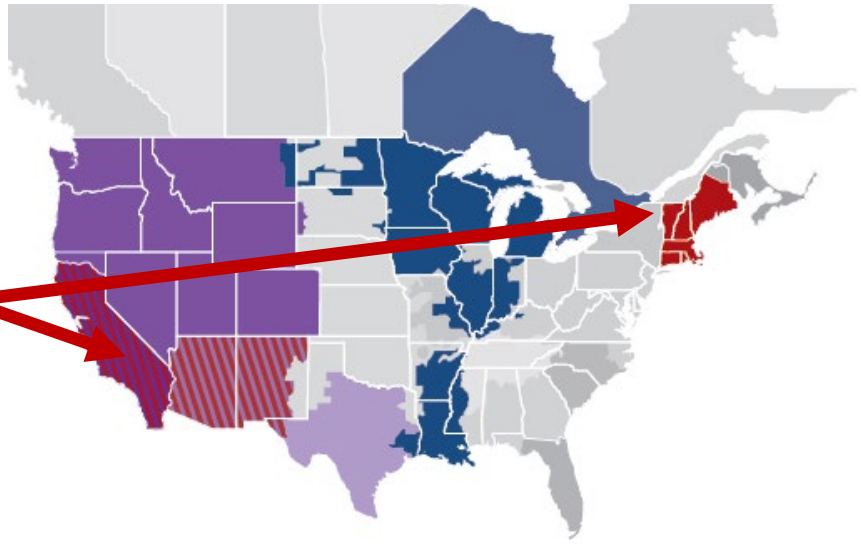


- Near-term energy risk metrics continue to be elevated in parts of the U.S. Western Interconnection
- ***2021 LTRA*** will provide updated probabilistic assessments and additional scenario results for risk areas

Extreme Event Risks to Resource Adequacy

2020 LTRA and ***WRA*** identified risk of reliability impacts due to potential fuel supply issues

- Disruption during extreme winter conditions
- Fuel at risk from extreme events due to limited storage and supply infrastructure



- Analysis for the ***2021 LTRA*** includes assessment area exposure to energy shortfall risk from wide-area weather events
  - load forecast volatility
  - level of reliance on variable energy resources and imports
  - thermal generation exposure to fuel supply risks

LTRA Topics (continued)

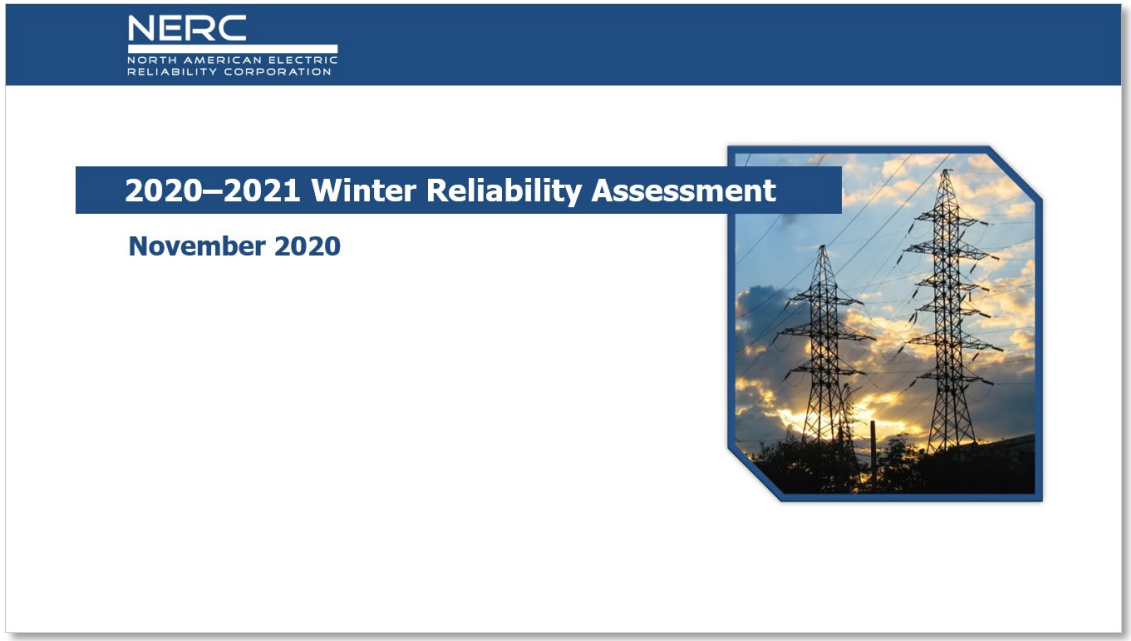
- Other trends and findings being analyzed:
  - Forward-looking frequency response assessment of the Interconnections
  - Generation resource mix, Distributed Energy Resources, and demand projection

2021 LTRA Schedule Highlights

Date	Milestone
February	Data and Narrative Request sent to NERC Regions
June	Preliminary Data and Narratives Provided to NERC
June – July	RAS Peer Review
August – **September**	Assessment Report Development
September 27 – October 8	RSTC Review and Comment
November 8 – 15	Report sent to RSTC for Endorsement Vote
November 23	Report sent to NERC Board
December	NERC Board Conference Call on report acceptance and Release

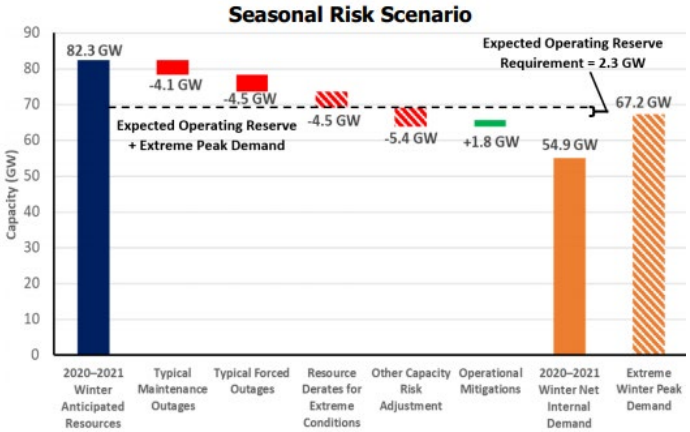
Winter Reliability Assessment

- NERC's Winter Reliability Assessment (WRA) examines potential regional resource deficiencies and operating reliability concerns
  - Describes industry preparations to manage seasonal risks
- Developed with the RAS and reviewed by the RSTC
- 2021-2022 WRA Will Consider Inputs from NERC Level 2 Alert



2020-2021 WRA

- Adequate Installed Capacity
- ERCOT and MISO highlighted for heightened "Extreme Weather Risk"
- Energy assurance concerns



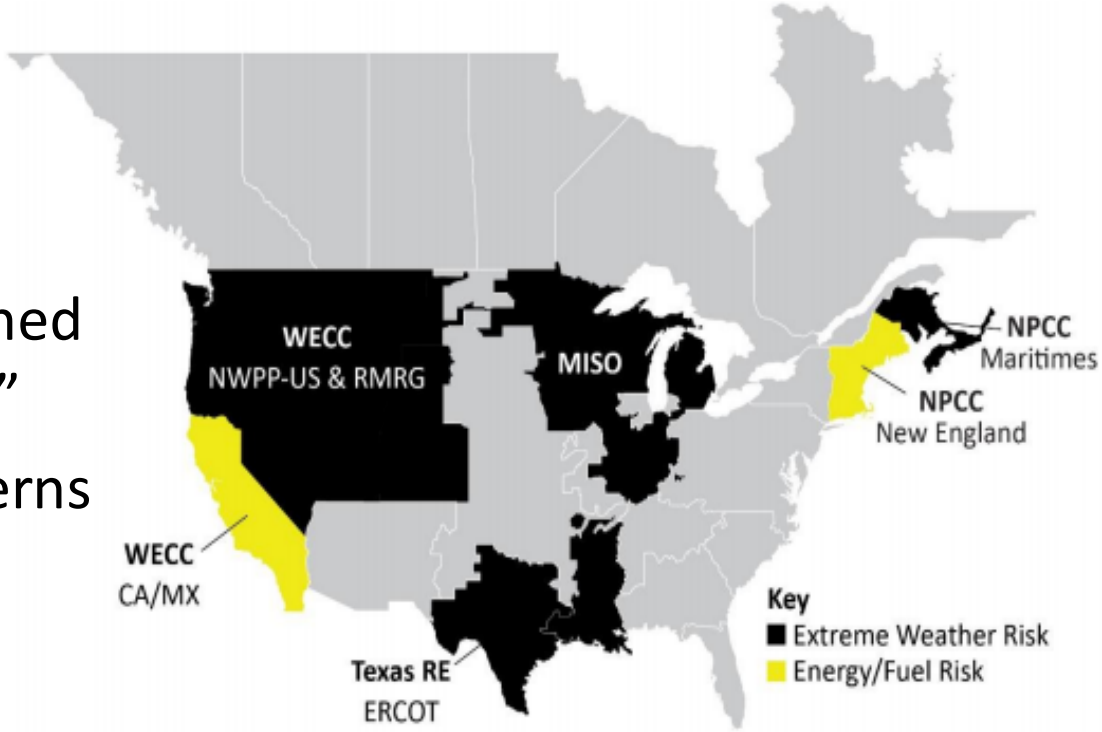
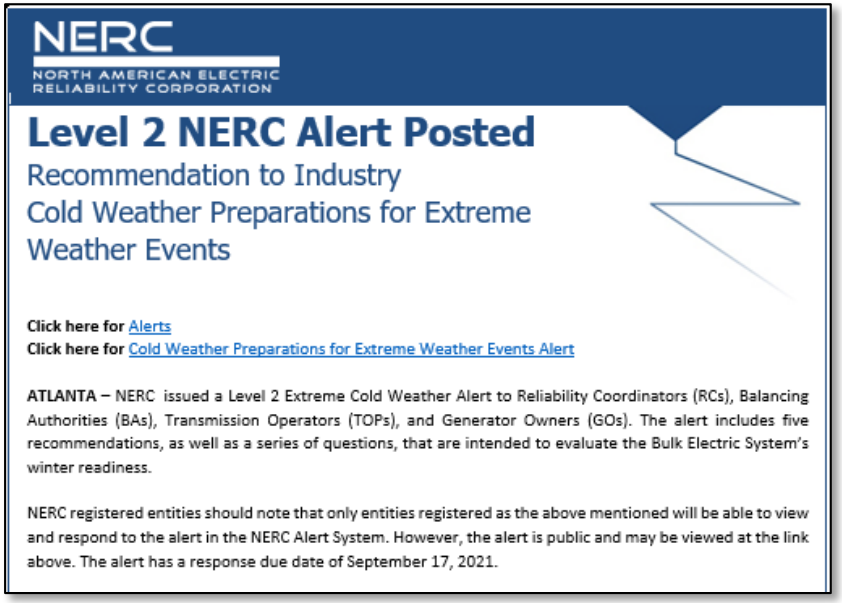


Figure 1: Areas with Reliability Risks during Extreme Weather Events and/or Fuel Supply Disruptions

Approach for 2021-2022 WRA

- Deterministic scenario analysis
  - Expected (average) conditions
  - Extreme conditions based on a scenario event (e.g., polar vortex scenario)
  - Identify high-risk period—not necessarily peak demand hour
- Probability-based risk analysis
  - Probabilistic measures could include expected unserved energy or load-loss hours
- Insights from NERC Level 2 Alert



NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Level 2 NERC Alert Posted

Recommendation to Industry
Cold Weather Preparations for Extreme Weather Events

Click here for Alerts
Click here for Cold Weather Preparations for Extreme Weather Events Alert

ATLANTA – NERC issued a Level 2 Extreme Cold Weather Alert to Reliability Coordinators (RCs), Balancing Authorities (BAs), Transmission Operators (TOPs), and Generator Owners (GOs). The alert includes five recommendations, as well as a series of questions, that are intended to evaluate the Bulk Electric System's winter readiness.

NERC registered entities should note that only entities registered as the above mentioned will be able to view and respond to the alert in the NERC Alert System. However, the alert is public and may be viewed at the link above. The alert has a response due date of September 17, 2021.

WRA Schedule Highlights

Date	Milestone
July 30	Data and Narrative Request sent to NERC Regions
August 17	NERC Alert Issued
September	Inputs Provided to NERC
September – October	Assessment Report Development
October 14 – 22	Reliability and Security Technical Committee (RSTC) Review and Comment
October 27 – November 5	Report sent to RSTC for Endorsement Vote
November 10 – 17	NERC Executive Leaders Approve and Release

Questions and Answers

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Standing Committees Coordinating Group Quarterly Report

Rich Hydzik, RSTC Vice Chair
RSTC Meeting
September 9, 2021

RELIABILITY | RESILIENCE | SECURITY




Standing Committees Coordinating Group Status Report

Compliance and Certification Committee (CCC)

Chair: Jennifer Flandermeyer Vice-Chair: Scott Tomashefsky

Purpose: The CCC will engage, support, and advise the NERC Board and NERC Management regarding all facets of the NERC Compliance Monitoring and Enforcement Program, and Organization Registration and Certification Programs and specific elements of the Reliability Standards Development Process.

Top Priorities for SCCG Discussion:

- Issue Triage Process
  - CCC recommendations from RSTC subordinate groups / feedback loops
  - Efficient Stakeholder feedback participation with CCC

What information/guidance/support is needed from another committee?

- RSTC (Facility Ratings, Risk Tool Selection ((Guideline, SAR, White Paper, etc.)), Order 2222)
- SC (Standards Grading, SER collaboration)
- All Committees (Stakeholder Perception Feedback input)
- RISC (Feedback loops for Risk Reliability priorities)

Recent Risk Identification, Mitigation, Monitoring Activity

- Supply Chain Risk Management CMEP implementation
- Facility Ratings Risk Evaluation
- Continued support of ERO Program Alignment topics
- Risk Based Standards and Compliance Oversight
- Compliance Guidance

Upcoming Risk Identification, Mitigation, Monitoring Activity

- Stakeholder Perception Feedback Plan
  - Risk Based Standards
  - Certification Program
  - Enforcement Tools
  - Facility Ratings
  - Supply Chain
  - Align and SEL
- Changes to Internal Audit / CCC engagement
- Q3 Focused Discussion on Enforcement Processes and Administration

Standing Committees Coordinating Group Status Report

Personnel Certification Governance Committee (PCGC)

Chair: Cory Danson Vice-Chair: Michael B. Hoke

Purpose: The PCGC shall be to provide oversight to the policies and processes used to implement and maintain the integrity and independence of NERC's System Operator Certification Program.

Top Priorities for SCCG Discussion:

- PER-003 SAR withdrawal

What information/guidance/support is needed from another committee?

- CCC
- RISC
- RSTC
- SC

- PER SAR was withdrawn July 21, 2021. Plan to resubmit the SAR in the future.

Recent Risk Identification, Mitigation, Monitoring Activity

- N/A

Upcoming Risk Identification, Mitigation, Monitoring Activity

- Industry questions about SAR withdrawal.
- The PCGC and the CMWG are working to issue a contract from the RFP recently issued for the research project to quantify/verify the number of Credential Maintenance hours that are needed for each credential or 1 single credential.

Standing Committees Coordinating Group Status Report

Reliability Issues Steering Committee (RISC)

Chair: Nelson Peeler Vice-Chair: Brian Allen Slocum

Purpose: The RISC is an advisory committee that triages and provides front-end, high-level leadership and accountability for nominated issues of strategic importance to bulk power system reliability.

Top Priorities for SCCG Discussion:
How to best coordinate between the RSTC and RISC, ensure effective communication, and execution of RISC identified areas for risk mitigation.

What information/guidance/support is needed from another committee?

- RSTC and RISC to work in collaboration to develop appropriate work plans to address identified risks in the 2021 RISC Report

Recent Risk Identification, Mitigation, Monitoring Activity

- The RISC report was approved by the RISC on July 8 and will be published in August. This report identifies all relevant risks to BPS reliability and their relativity against other risks. It also identifies mitigating activities and attempt to define responsible parties for mitigating those risks. This mitigation will largely happen through the efforts of the RSTC and associated sub-committees.

Upcoming Risk Identification, Mitigation, Monitoring Activity

- The RISC report will be published in August. This report will identify all relevant risks to BPS reliability and their relativity against other risks. It will also identify mitigating activities and attempt to define responsible parties for mitigating those risks. This mitigation will largely happen through the efforts of the RSTC and associated sub-committees.

Standing Committees Coordinating Group Status Report

Reliability and Security Technical Committee (RSTC)

Chair: Greg Ford Vice-Chair: Rich Hydzik

Purpose: The RSTC strives to advance the reliability and security of the BPS by creating a forum for ideas and interests to support the ERO's mission, and leveraging such expertise to identify solutions to study, mitigate, and/or eliminate emerging risks.

Top Priorities for SCCG Discussion:

- Continue to monitor progress on RSTC work plan
- Prioritize and incorporate RISC report risks into RSTC work plan
- Incorporate metrics into Reliability Guidelines

What information/guidance/support is needed from another committee?

- CCC – Participate in FRTF and SCTF as needed.
- PCGC – N/A
- RISC – Quarterly coordination meeting will continue as the RISC report is developed. Coordination in risk identification and prioritization as well as risk mitigation activities and RSTC work plan updates.
- SC – IRPWG SAR on revisions to TPL-001 was on the June RSTC Agenda but was not endorsed. The IRPWG is seeking guidance fro the RSTC EC. A companion SAR for revisions to TPL-001 from the SPIDERWG is expected to be ready for the September RSTC meeting. The SPIDERWG is also considering revisions to a previously rejected SAR regarding MOD-032. These SARs will be submitted to the SC for action if endorsed by the RSTC. We are also coordinating with SC/NERC legal on the potential for a CIP-002 field test.

Recent Risk Identification, Mitigation, Monitoring Activity

- Approved the 1) *Reliability Guideline: ACE Diversity Interchange; 2) Reliability Guideline: Operating Reserve Management; 3) Balancing and Frequency Control Reference Document; 4) IRPWG San Fernando Disturbance Follow-Up White Paper; 5) Probabilistic Assessments Working Group (PAWG) 2020 ProbA Scenario Case Study Report;* and 6) *PAWG Data Collections Technical Reference Document*

Upcoming Risk Identification, Mitigation, Monitoring Activity

- Industry coordination on energy assessments, metrics, analysis, and unique considerations based on geography.
- Assist on work plans and completion of the ERATF worksheets that facilitate coordination.
- 9th annual Monitoring and Situational Awareness Technical Conference.
- *White Paper: BPS-Connected IBR and Hybrid Plant Capabilities for Frequency Response for posting for comment*
- 2021-2022 WRA input request will be sent to the regions in August.
- *2021 Probabilistic Analysis Forum* in October 2021

Standing Committees Coordinating Group Status Report

Standards Committee (SC)

Chair: Amy Casuscelli Vice-Chair: Todd Bennett

Purpose: The SC oversees the development of NERC Reliability Standards as its members review actions to ensure the standards development process is being followed.

Top Priorities for SCCG Discussion:

- 2020 and 2021 Periodic Reviews - Standards Grading
- Standards Efficiency Review
- Standards Committee Process Subcommittee (SCPS)

What information/guidance/support is needed from another committee?

- CCC – Participate and support standards efficiency review as needed.
- PCGC – N/A
- RISC – N/A
- RSTC – Increased awareness of SAR development process through standing agenda item on SC agenda.
- Participation in Standards Drafting Teams

Recent Risk Identification, Mitigation, Monitoring Activity

- Project 2016-02 Virtualization current posting ends August 20, 2021
- Project 2021-04, 2021-05 and 2021-06 current nomination solicitation and SAR postings
- Project 2020-03 Supply Chain Low Impact posting starting end of August 2021

Upcoming Risk Identification, Mitigation, Monitoring Activity

- Standards Development projects coming from NERC technical committees
- Standards Development Plan will be considering the output from the RISC Priorities Report

Questions and Answers

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Lessons Learned Summary

Richard Hackman – NERC Event Analysis
RSTC Meeting
September 9, 2021

RELIABILITY | RESILIENCE | SECURITY




Brief update note to a March LL20210301 - Battery Energy Storage System Cascading Thermal Runaway

Tesla's "Victorian Big Battery" in Australia had a fire in one of their many battery containers at that station.

Crews battle Tesla battery fire at Moorabool, near Geelong - ABC News

Three Lessons Learned (LL) have been published since the last (May 2021) meeting:

- LL20210801 – Insulator Flashovers Due to Combination of Salt Spray Deposits Followed by Light Rainfall Initiating Loss of Load
- LL20210802 – Multiple Faults in Rapid Succession Contribute to Relay Misoperations Leading to Loss of Load
- LL20210803 – Loss of Monitoring or Control Capability due to a Software Version Mismatch

The following slides are summaries. See the actual Lessons Learned documents (click the hyperlinks above) for details.

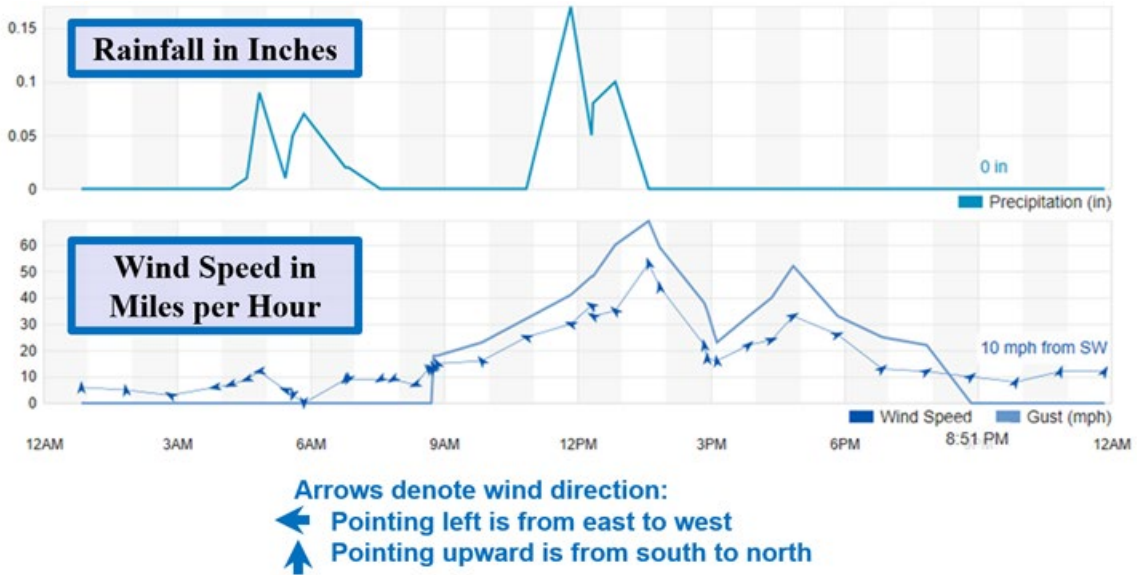
Problem Statement

Multiple parallel insulators in a bulk power substation that had been exposed to salt spray during a tropical storm flashed over two and a half days later when light rain began to fall. Subsequent relay misoperations resulted in loss of load.

Details

A tropical storm with winds >50 mph and moderate rainfall of one-half inch went over the area surrounding a waterfront substation. The rainfall ceased in the early afternoon as the winds were peaking. Around 3:00 p.m., the wind direction shifted. A second period of strong winds ensued with no rain. The wind shift coincided with a time of high water in a nearby saltwater channel.

The wind caused airborne salt spray above the channel to be carried over the substation and deposited on surfaces therein, including insulators. Without any further rain to wash the deposits off, a thin, dry salt film remained.



LL20210801 – "Insulator Flashovers Due to Combination of Salt Spray Deposits Followed by Light Rainfall Initiating Loss of Load"

Details (Continued)

2½ days after the storm had passed, a light rainfall began with no appreciable wind. Within minutes after the rain began, four 345 kV insulator columns flashed over on separate bus sections in various locations in the substation. All four flashovers occurred within a time span of only 23 seconds, and all resulted in single-line-to-ground faults on phase C that were cleared properly by bus differential relaying and circuit breaker tripping.

Misoperation of protective relays on other transmission facilities during the faults, however, tripped non-faulted lines connected to the substation, leading to a loss of load. Wetting of insulators in the initial minutes of rainfall caused elevated leakage currents to flow along insulator surfaces.

This is referred to as the critical wetting period. Heat from these currents burned off the salt film. This resulted in uneven voltage gradients along the columns with highly concentrated electric fields in areas where the film had been burned off. Dry band arcing ensued in these areas.

LL20210801 – "Insulator Flashovers Due to Combination of Salt Spray Deposits Followed by Light Rainfall Initiating Loss of Load"

Corrective Actions

The substation where the faults occurred had been in service for 56 years without simultaneous column insulator flashovers. No other waterfront substations of similar design in the entity's service territory have experienced this. Considering that experience, the entity opted for a measured response.

Leakage current detectors are being installed on selected insulator columns so that the phenomenon can be tracked and trended over time during a variety of weather conditions. If any issues are identified, a mitigation plan will be formulated at that time.

Lessons Learned

- During certain weather conditions at substations located near bodies of salt water, a combination of strong winds from a particular direction, high tide, and the absence of rain can cause airborne salt spray to be carried over these facilities and deposited on surfaces in significant amounts, leaving a dry film. This phenomena occurs worldwide along salt water coasts, and can occur near inland salt lakes.
- Wetting of that film during subsequent rainfall, even days later, can wreak havoc with the overall dielectric withstand capability of insulator columns. Dry band arcing can develop during the critical wetting period, possibly resulting in flashovers.
- The probability of flashovers is significantly increased where parallel columns are used as arcing on one column can jump across and meet up with arcing on the adjacent column.
- The event described in this Lesson Learned was driven by a more rapid contamination process than generally considered for scheduled insulator cleanings. While regular cleaning and maintaining anti-contamination coatings may remove and slow contaminant accumulation, awareness of conditions that cause rapid conductive contaminant deposition or remote leakage current monitoring and alarming are important tools for prompting actions that can prevent faults like these.

LL20210802 – "Multiple Faults in Rapid Succession Contribute to Relay Misoperations Leading to Loss of Load"

Problem Statement

Four separate faults occurred in rapid succession in a bulk power substation as a result of weather-induced salt contamination. Relay misoperations in the presence of the faults resulted in loss of load.

Details

The following relay misoperations prompted by the faults resulted in load loss:

- A breaker failure relaying scheme incorrectly registered one breaker closed and tripped the adjacent bus section and the transmission line connected to it.
- A back-up relaying scheme used to protect a Phase Angle Regulator (PAR) did not have a proper polarizing source.
- Saturation of an auxiliary CT caused inaccurate input to a line differential relaying circuit, resulting in tripping of the associated transmission line.
- Overreaching of the Zone 1 ground distance elements occurred in the stepped distance relaying scheme that serves as backup to the line current differential relaying for two terminals remote from the fault location.

Details of each misoperation are discussed in the Lesson Learned document.

Corrective Actions

- The breaker failure scheme comprised of current sensing to determine if the breaker has opened and a separate timer will no longer be used. These two functions will be integrated into the same relay as is generally the case. The installation that resulted in the misoperation during this event was atypical.
- The PAR protection has been corrected by installing the proper polarizing source.
- The faulty aux CT that saturated has been disconnected. The approach has been modified to eliminate the need for the aux CT. Rather than subtracting shunt reactor current from the line differential zone of protection, the line differential settings have been desensitized to tolerate the natural imbalance introduced by the shunt reactor current. Adequate margin was available to permit this change because of high fault currents in the relevant portion of the transmission system.
- The zone one elements of the stepped distance back-up relaying on the underground pipe-type cables have been put on standby to be armed only when communications used by the line current differential relaying are unavailable. This will be automatic so that if communications are suddenly and unexpectedly lost, the zone one elements will immediately begin protecting the lines.

Lessons Learned

- Interconnecting old and new protective relays can introduce unforeseen problems. A breaker failure relaying scheme consisting of a legacy timer supervised by the current sensing element of a newer relay that had been installed as part of a relay upgrade project. Thus, two functions (i.e., the current sensing and the timing) that would typically be included in a single device in a new installation resided in separate devices that needed to logically be linked to one another via an auxiliary output relay and control wiring. The auxiliary output relay, a mechanical component, took the place of internal electronic logic to accomplish supervision of the timer by the current sensing element, and it was the mechanical failure of the auxiliary relay's output contacts that led to the misoperation. (For another discussion on mixed relay issues, see NERC Lesson Learned: Mixing Relay Technologies in DCB Schemes.)
- Current sensing elements used to determine if circuit breakers have opened when called upon to trip may be subjected to repeated pickup and dropout if loading levels fluctuate around the setpoint. While that is not a problem for logic registers internal to a given electronic or digital relay, it can be a problem when the output needs to be routed to a separate device via an auxiliary relay. The auxiliary relay may be subjected to chattering that can result in mechanical damage, including tack welding of its contacts.

Lessons Learned (Continued)

- Multifunction microprocessor relays offer a variety of protective elements and schemes. From a protection perspective, it is tempting to employ additional elements to achieve more sensitive fault detection and perhaps faster clearing times beyond what is required. These additional elements, however, also are candidates for misoperation, so that risk must be weighed when considering whether or not to deploy them. Furthermore, they add to the testing required during commissioning, periodic testing, and troubleshooting following an event.

- Aux CTs permit compensation of differential relaying to remove sources of imbalance. While this is desirable conceptually, practically it introduces complexity to the overall CT secondary wiring circuits while also adding a component, the aux CT, which is subject to failure itself that can impact the entire differential relaying scheme. Wherever possible, it is preferable to remove the aux CTs and opt for desensitizing differential relay setpoints to account for known imbalances, provided all faults can still be adequately detected. (There might be a question in cases where Inverter Based Resources (IBRs) have displaced synchronous machines and fault duties are low. Note the phrase "provided all faults can still be adequately detected." That implies that sufficient fault current is still available from sources on the system through transmission ties into the differential relay's zone of protection. Where IBRs are predominant to the point that sufficient fault current is not available to the differential zone, the stipulation in that key phrase is not satisfied. In that case, alternative methods of detecting and clearing faults will have to be in place and in service.)

Lessons Learned (Continued)

- The impedance of the return paths for ground fault currents can vary where steel pipe-type transmission cables are used in underground and submarine installations. Magnetic saturation of the steel changes both the resistance and the reactance of the return path to varying degrees, depending on the level of fault current with the resistance changing significantly more than the reactance. While this phenomenon was accounted for in the design of the relaying scheme and its applied settings, the event proved that a multiple fault scenario beyond the design basis can result in dynamic excursions in the zero sequence impedance exceeding expected values. This should be considered when applying stepped distance relaying to protect steel pipe-type cables. The overall scheme was modified so that the Zone 1 elements of the stepped distance relaying that were originally providing continuously armed back-up protection to the line differential relaying were placed on standby to be armed only when the communications needed by the line differential relaying are unavailable. This approach permits the stand-alone distance relaying that doesn't require communications to still provide back-up protection while significantly reducing its exposure to misoperation. It eliminates a potential source of misoperation during the preponderance of time when communications for line differential relaying are available and functioning normally.

LL20210802 – "Multiple Faults in Rapid Succession Contribute to Relay Misoperations Leading to Loss of Load"

Lessons Learned (Continued)

- Failure to recognize that back-up directional overcurrent elements on a PAR were armed to trip as omnidirectional elements despite the absence of a polarizing voltage source highlights the need for thorough oversight, peer reviews, and simulation testing of protection schemes during the design and commissioning stages of new or upgraded protective relaying installations.
- The added complexity of the AC circuits of the protective relays due to the use of aux CTs increases the opportunities for human error in the design, installation, and testing of these circuits. This includes considerations regarding burden calculations, saturation, polarity, and neutral/ground connections as well as the physical requirements for mounting the aux CTs and the routing of control cables to and from them.

LL20210803 – "Loss of Monitoring or Control Capability due to a Software Version Mismatch"

Problem Statement

A couple of entities have experienced energy management system (EMS) outages due to a software version mismatch between the product development system (PDS), quality assurance system (QAS), and production system (production).

Details

Case 1

An entity performed front-end processor (FEP) database maintenance on the PDS and then applied that database to the QAS and then production. The rollout affected all production servers. After an FEP database validation on production, the entity lost the ability to monitor and control its BES elements remotely. The investigation revealed that a software version mismatch between the PDS, the QAS, and production caused the incident. The PDS and the QAS had a later software version number than production because the SCADA/EMS vendor installed a patch on the PDS and QAS but not on production.

LL20210803 – "Loss of Monitoring or Control Capability due to a Software Version Mismatch"

Details (Continued)

Case 2

As part of the routine database maintenance to include new supervisory control and data acquisition (SCADA) points, a SCADA engineer made a minor change to an FEP database on production and executed an FEP database validation. After the validation on production, the FEP stopped scanning the remote terminal units. After investigation, it was found that the incident was caused by a software version mismatch between the PDS and production.

There are two modes of database validation:

- Full validation: checking the accuracy and quality for all source data and inserting the software version of the environment that the validation performs (This type of validation is time-consuming.)
- Incremental validation: checking the accuracy and quality for change-related data (Instead of inserting the software version, this type of validation checks the software versions between the database and the environment that the validation performs as part of quality checking. This type of validation is fast.)

LL20210803 – "Loss of Monitoring or Control Capability due to a Software Version Mismatch"

Details (Continued)

The FEP database was initially created on the PDS that had a software update installed to fix a problem unique to the PDS. The software version of the PDS was inserted into the database during a full database build. The software version mismatch was not checked when the database was replicated from the PDS to production. As a result, the database with the mismatched version had been running on production for some time before the incident occurred.

The database validation that the SCADA engineer executed after making the minor changes was an incremental validation, so the database validation detected a mismatch between the database and production.

Corrective Actions

In each of these cases, upon noticing the degradation of the situational awareness, the entity contacted the appropriate personnel (the RC and operations support staff) to assist with monitoring and to help repair the situation. Other actions included the following:

Case 1

The entity contacted the SCADA/EMS vendor and initiated a full FEP build on production.

Case 2

The entity contacted the SCADA/EMS vendor and manually updated the version in the FEP database followed by a full FEP build on production. The entity updated all the production and backup SCADA servers at the primary and the backup control center with the new version that matched the one installed on the PDS.

Lessons Learned

While these EMS-related events are slightly different, there are some common themes and Lessons Learned that can be applied to both:

- Entities should work with SCADA/EMS vendors to review and build patching procedures and database maintenance processes to ensure any environments involved in maintenance workflows are updated to the same software patch level as production.
- Checking the software version across all the entity's systems (PDS, QAS, and production) is paramount during database maintenance and should be executed before the database is rolled out to production.
- Any database changes requiring FEP/SCADA validation should not be made on production directly. Instead, the changes must be completed in the QAS first. The database may then be propagated to all machines after all testing indicates the database is working.
- Entities should work with SCADA/EMS vendors to seek a feature to prevent databases with mismatched versions from being promoted to production or at the very least alarmed to notify the SCADA engineer.

2021 to Date Lessons Learned Metrics

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
ERO Team*	0	0	0	0	0	0	0	0	0	2	1	**0**	**3**
MRO	0	2	2	0	3	1	2	0	3	0	4	**0**	**17**
NERC	23	1	0	0	1	0	0	1	0	0	1	**3**	**30**
NPCC	0	5	2	5	4	10	6	2	4	3	2	**5**	**48**
RF	0	3	1	3	4	1	1	1	5	2	1	**0**	**22**
SERC	0	1	0	2	4	2	2	0	0	1	0	**0**	**12**
TRE	0	5	8	1	2	1	1	2	0	0	0	**1**	**21**
WECC	0	5	5	3	1	1	1	3	3	3	2	**2**	**29**
Total	23	22	18	14	19	16	13	9	15	11	11	**11**	**182**

***"ERO Team" means multiple Regions contributed**

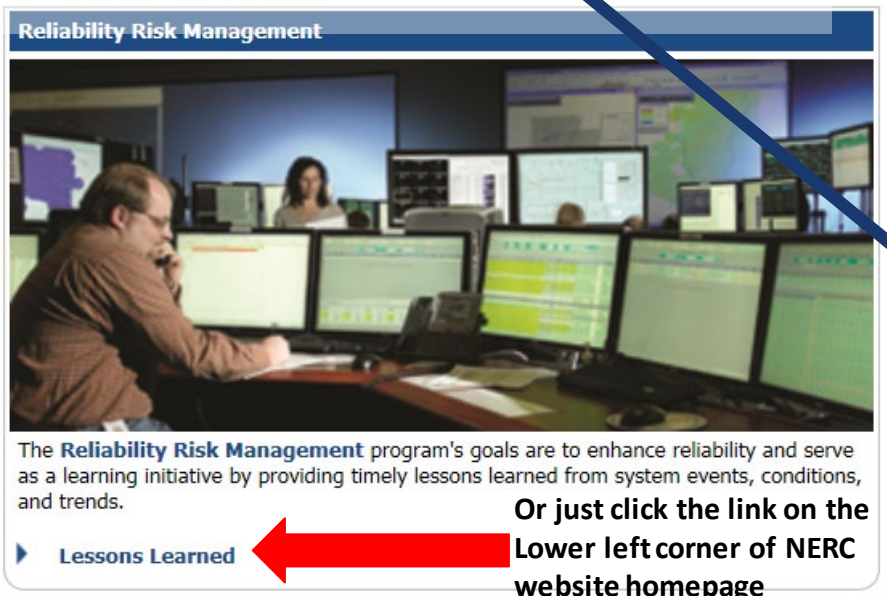
NERC Lessons Learned Webpage

Ways to Access Lessons Learned

- On the NERC website,

  Go to www.NERC.com > Click on the "**Program Areas & Departments**" tab and click "**Reliability Risk Management**"

  Then on the left side menu under "**Event Analysis**" click "**Lessons Learned**"



Or just click the link on the Lower left corner of NERC website homepage

Questions and Answers