NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Reliability Guideline

Generating Unit Winter Weather Readiness—Current Industry Practices–Version 4

June 2023

RELIABILITY | RESILIENCE | SECURITY




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

Table of Contents

Preface iii

Preamble iv

Introduction v

- Purpose v
- Expectations v

Chapter 1: Guideline Details 1

- Safety 1
- Management Roles and Expectations 1
- Processes and Procedures 2
- Evaluation of Potential Problem Areas with Critical Components 2
  - Conventional Generation 2
  - Inverter-Based Resources 4
- Testing of Emergency and Backup Systems 4
- Training 5
- Winter Event Communications 5

Appendix A: Cold Weather Event Reports 6

Appendix B: Cold Weather Related Lessons Learned 7

Appendix C: Elements of Cold Weather Preparation Procedures 8

Contributors 12

Guideline Information and Revision History 13

Metrics 14

Preface

Electricity is a key component of the fabric of modern society and the Electric Reliability Organization (ERO) Enterprise serves to strengthen that fabric. The vision for the ERO Enterprise, which is comprised of the North American Electric Reliability Corporation (NERC) and the six Regional Entities, is a highly reliable and secure North American bulk power system (BPS). Our mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid.

Reliability | Resilience | Security
Because nearly 400 million citizens in North America are counting on us

The North American BPS is made up of six Regional Entity boundaries as shown in the map and corresponding table below. The multicolored area denotes overlap as some load-serving entities participate in one Regional Entity while associated Transmission Owners /Operators participate in another.

MRO	Midwest Reliability Organization
NPCC	Northeast Power Coordinating Council
RF	ReliabilityFirst
SERC	SERC Reliability Corporation
Texas RE	Texas Reliability Entity
WECC	WECC

Preamble

The NERC Reliability and Security Technical Committee (RSTC), through its subcommittees and working groups, develops and triennially reviews reliability guidelines in accordance with the procedures set forth in the RSTC Charter. Reliability guidelines include the collective experience, expertise, and judgment of the industry on matters that impact BPS operations, planning, and security. Reliability guidelines provide key practices, guidance, and information on specific issues critical to promote and maintain a highly reliable and secure BPS.

Each entity registered in the NERC compliance registry is responsible and accountable for maintaining reliability and compliance with applicable mandatory Reliability Standards. Reliability guidelines are not binding norms or parameters nor are they Reliability Standards; however, NERC encourages entities to review, validate, adjust, and/or develop a program with the practices set forth in this guideline. Entities should review this guideline in detail and in conjunction with evaluations of their internal processes and procedures; these reviews could highlight that appropriate changes are needed, and these changes should be done with consideration of system design, configuration, and business practices.

Introduction

Purpose

This reliability guideline is applicable to electric sector organizations responsible for the operation of the BPS. This guideline will provide a general framework for developing an effective winter weather readiness program for generating units throughout North America. The focus is on maintaining individual unit reliability and mitigating future cold weather-related events. This document will provide a collection of recommended industry practices compiled by NERC. While the incorporation of these practices is strictly voluntary, developing a winter weather readiness program using these practices in keeping with local conditions is highly encouraged to promote and achieve the highest levels of reliability for these high impact weather events.

Expectations

- Each BPS Generator Owner and Generator Operator is responsible and accountable for maintaining generating unit reliability. It is recognized that nuclear power plants already have more detailed winterization and summarization procedures with NRC regulation and INPO guidance than indicated in this document.
- What constitutes severe or extreme weather is different in different locations. Each entity will need to make its own determination for what constitutes normal winter weather and what is extreme for each of its own locations, and thus what level of preparedness and response steps to include in its normal and extreme cold weather procedures.
- After identifying issues related to derates, outages, or other operational issues, Generator Owners should communicate with their Balancing Authorities, Transmission Operators, and Reliability Coordinators (Reliability Entities) as soon as possible. Generator Operators should also use past experiences at the plant to identify the potential for freezing issues (including potential fuel concerns) and warn the Reliability Entities of that potential if measures to address the issue are not available. This level of communication allows the Balancing Authorities, Transmission Operators, and Reliability Coordinators to better assess the level of risk on the system.

Chapter 1: Guideline Details

An effective winter weather readiness program that includes severe winter weather event preparedness should generally address the following components: Safety, Management Roles and Expectations, Processes and Procedures, Evaluation of Potential Problem Areas with Critical Components, Testing, Training, and Communications.

Safety

Safety remains the top priority during winter weather events. Job safety briefings should be conducted during preparation for and in response to these events. Robust safety programs to reduce risk to personnel include identifying hazards involving cold weather, such as personnel exposure risk, travel conditions, and slip/fall issues due to icing. A job safety analysis (JSA) should be completed to address the exposure risks, travel conditions, and slips/falls related to icing conditions. Winter weather alerts should be communicated to all impacted entities. A business continuity and emergency response plan should also be available and communicated in the event of a severe winter weather event.

Management Roles and Expectations

Management plays an important role in maintaining effective winter weather programs. The management roles and expectations below provide a high-level overview of the core management responsibilities related to winter weather preparation. Each entity should tailor these roles and expectations to fit within their own corporate structure:

- Senior Management
  - Set expectations for safety, reliability, and operational performance
  - Ensure that a winter weather preparation procedure exists for each operating location
  - Consider a fleet-wide annual winter preparation meeting, training exercise, or both to share best practices and lessons learned
  - Share lessons learned across the fleet and through industry associations (formal groups or other informal networking forums)
- Plant Management
  - Ensure development of a cold/winter weather preparation program and consider appointing a designee responsible for keeping its processes and procedures updated with industry identified best practices and lessons learned
  - Ensure the site-specific winter weather preparation procedure includes processes, staffing plans, and timelines that direct all key activities before, during, and after severe winter weather events
  - Ensure proper execution of the winter weather preparation procedures
  - Conduct a plant readiness review prior to an anticipated severe winter weather event
  - Encourage plant staff to look for areas at risk due to winter conditions and bring up opportunities to improve readiness and response
  - Following each winter, conduct an evaluation of the effectiveness of the winter weather preparation procedure and incorporate lessons learned

Processes and Procedures

Winter weather preparation procedures should be developed for seasonal winter preparedness. Components of effective winter weather preparation procedures are included in **Appendix C**.

After a severe winter weather event, entities should utilize a formal review process to determine what program elements went well and which need improvement. Identify and incorporate lessons learned within applicable procedures. Changes to the procedures and lessons learned must be communicated to the appropriate personnel. NERC encourages sharing appropriate lessons learned with other entities so that grid reliability and the industry may benefit as a whole. NERC lessons learned documents provide a process in which that sharing may be performed anonymously.

Evaluation of Potential Problem Areas with Critical Components

Identify and prioritize critical components, systems, and other areas of vulnerability that may experience freezing problems or other cold weather operational issues. Schedule any routine cold weather readiness inspections, repairs, and winterization work to be completed prior to the local expected seasonal first freeze date. Depending on the plant, further checks and winterization activities might be needed prior to forecasted extreme winter events in addition to seasonally. Links to the National Oceanic and Atmospheric Administration first frost date[1] and last frost date[2] maps are included for reference.

Winterization efforts should include addressing critical instrumentation or equipment that has the potential to perform the following when frozen:

- Initiate an automatic unit trip
- Impact unit start-up
- Initiate automatic unit runback schemes or cause partial outages
- Cause damage to the unit
- Adversely affect environmental controls that could cause full or partial outages
- Adversely affect the delivery of fuel or water to the units
- Cause operational problems such as slowed or impaired field devices
- Create a weather-related safety hazard

Based on previous cold weather events, a list of typical problem areas is provided below. This is not meant to be an all-inclusive list. The list has been split into two sections to assist with the identification of issues seen at conventional generators and inverter-based resources. Individual entities should review their plant design and configuration, identify areas where critical components' potential exposure to the elements, ambient temperatures, or both might cause issues and tailor their plans to address them accordingly.

Conventional Generation

- Critical level transmitters
  - Drum level transmitters and sensing lines
  - Condensate tank level transmitters and sensing lines

[1] https://www.ncdc.noaa.gov/monitoring-content/sotc/national/2014/sep/earliest-first.png
[2] https://www.ncdc.noaa.gov/file/day-last-spring-freeze-mapjpg

  - De-aerator tank level transmitters and sensing lines
  - Hotwell level transmitters and sensing lines
  - Fuel oil tank level transmitters/indicators
- Critical pressure transmitters
  - Gas turbine combustor pressure transmitters and sensing lines
  - Feed water pump pressure transmitters and sensing lines
  - Condensate pump pressure transmitters and sensing lines
  - Steam pressure transmitters and sensing lines
- Critical flow transmitters
  - Steam flow transmitters and sensing lines
  - Feed water pump flow transmitters and sensing lines
  - Natural gas or liquid fuel flow transmitters and sensing lines
- Instrument air system
  - Verify that automatic blow downs, traps, dew point monitoring, and instrument air dryers are functioning correctly within acceptable parameters
  - Ensure that low point drain lines are periodically drained by operators to remove moisture during extreme cold weather
- Motor-operated valves, valve positioners, and solenoid valves
- Drain lines, steam vents, and intake screens
- Water pipes, water treatment, and fire suppression systems[3]
  - Low/no water flow piping systems
- Fuel supply, materials, and ash handling
  - Coal piles, other solid fuel storage, and handling equipment
  - Transfer systems for backup fuel supply
  - Gas supply regulators, other valves, and instrumentation (may require coordination with gas pipeline operator)
  - Fuel oil heaters and flow control devices
  - Ash disposal systems and associated equipment
  - Lime storage and transfer equipment
- Tank Heaters
  - Conduct initial tests
  - Check availability of spare heaters

[3] For safety reasons, fire protection systems should also be included in this identification process. These problem areas should be noted in site-specific winter weather preparation procedures.

  - Record current tank indicators for sodium-based solution injection systems, flue gas desulfurization systems, dibasic acid additives, mercury control additives, etc.
- Lube oil and greases for mechanical equipment necessary to support generation in locations that may be exposed to cold weather.
- Ensure batteries and uninterruptible power supply systems critical to the functioning of the facility are housed in temperature-controlled locations and protected from weather
- Functional heat tracing, insulation, and temperature responsive ventilation (heaters, fans, dampers, and louvers) based on expected weather conditions
- Adjust operation of cooling tower fans, deicing rings, and riser drains to prevent icing
- Operation of necessary equipment to prevent accumulation of ice or snow on combustion turbine air inlet filter medium
- Steam soot-blowing systems (transmitters, regulators, drain valves, and traps)

Inverter-Based Resources

- Functional wind turbine lube oil equipment within the nacelle, such as radiators, fans, heaters, and bypass valves
- Adequacy of tracking systems' lube oil for expected temperature during cold weather
- Accessibility of roads throughout the facility
- Anemometer functionality
- Ensure liquid-cooled inverters have freeze protection measures, such as anti-freeze or heaters, to address expected temperatures for that location
- Ensure winterization measures for battery systems are sufficient for expected cold weather conditions
- Ensure blade de-icing capabilities are known
- Consider snow removal and de-icing plans for facilities

Potential vulnerabilities associated with emergency generators, including Blackstart Resources, should be evaluated when developing the site-specific winter weather preparation procedure(s) as they may provide critical system(s) backup.

Testing of Emergency and Backup Systems[4]

In addition to the typical problem areas identified above, emphasis should be placed on cold weather preparation and testing of infrequently used equipment and systems where applicable, such as startup of emergency generators, operation on secondary fuels, fire pumps, and auxiliary boilers.

[4] See **Appendix C**, Section 8, "Special Operations Instruction" for more information

Training

Coordinate annual winter training with plant specific awareness and maintenance training. This may include, but is not limited to, the following: response to freeze protection panel alarms, troubleshooting and repair of freeze protection circuitry, identification of plant areas most affected by winter conditions, review of special inspections or rounds implemented during severe weather, fuel switching procedures, knowledge of the ambient temperature for which the freeze protection system is designed, installation of winter-season wind breaks, preparation and staging of portable heaters, and lessons learned from previous experiences or the NERC Lessons Learned program. In addition, training should also include the following:

- Entities should consider holding a winter readiness meeting on an annual basis to highlight preparations and expectations for severe cold weather.
- Operations personnel should review cold weather scenarios affecting instrumentation readings, alarms, and other indications on plant control systems.
- Entities should maintain the correct coding for NERC Generation Availability Data Systems on unit derates or trips as a result of severe winter weather events to promote lessons learned, knowledge retention, and consistency. Examples may include NERC GADS code 9036 “Storms (ice, snow, etc.)” or code 9040 “Other Catastrophe.”

Winter Event Communications

Clear and timely communication is essential to an effective program. Key communication points should include the following actions:

- Before a severe winter weather event, plant management should communicate with their appropriate senior management and Reliability Entities that the site-specific winter weather preparation procedure, checklists, and readiness reviews have been completed.
- Before and during a severe winter weather event, entities should communicate with all personnel about changing conditions and potential areas of concern to heighten awareness around safe and reliable operations.
- Before and during a severe winter weather event, affected entities should keep their BA up to date on changes to plant availability, capacity, low temperature cut-offs, or other operating limitations. Depending on regional structure and market design, notification to the Reliability Coordinator and Transmission Operator may also be necessary.
- After a generating plant trip, derate, or failure to start due to severe winter weather, plant management should conduct an analysis, develop lessons learned and appropriate corrective actions, and incorporate good industry practices as appropriate:
  - This process should include a feedback loop to enhance current winter weather readiness programs, processes, procedures, checklists and training (continuous improvement).
  - Sharing of technical information and lessons learned through the NERC Event Analysis Program or some other method is encouraged.

Appendix A: Cold Weather Event Reports

The list below provide previous cold weather event reports:

- FERC-NERC-Regional Entity Staff Report: The February 2021 Cold Weather Outages in Texas and the South Central United States *November 2021, Federal* Energy Regulatory Commission, North American Electric Reliability Corporation and Regional Entity Staff Report[5]
- Report on Outages and Curtailments during the Southwest Cold Weather Event of February 1–5, 2011, dated August 2011, Federal Energy Regulatory Commission and North American Electric Reliability Corporation[6]
- 2019 FERC and NERC Staff Report: "The South Central United States Cold Weather Bulk Electric System Event of January 17, 2018"[7]
- Electric Reliability Organization Event Analysis Process,[8] dated January 2017, ERO Event Analysis Process and associated Lessons Learned[9]
- Previous Cold Weather Reports and Training Materials[10]
- There are a number of "sound practices"' from the industry that are detailed in the *Southcentral Cold Weather Report*, starting on page 100.[11]

[5] *https://www.ferc.gov/media/february-2021-cold-weather-outages-texas-and-south-central-united-states-ferc-nerc-and*
[6] *https://www.nerc.com/pa/rrm/ea/Pages/February-2011-Southwest-Cold-Weather-Event.aspx*
[7] https://www.nerc.com/pa/rrm/ea/Documents/South_Central_Cold_Weather_Event_FERC_NERC_Report_20190718.pdf#search=South%20Central%20United%20States%20Cold%20Weather
[8] http://www.nerc.com/pa/rrm/ea/ERO_EAP_Documents%20DL/ERO_EAP_v3.1.pdf
[9] http://www.nerc.com/pa/rrm/ea/Pages/Lessons-Learned.aspx
[10] http://www.nerc.com/pa/rrm/ea/Pages/February-2011-Southwest-Cold-Weather-Event.aspx
[11] https://www.ferc.gov/legal/staff-reports/2019/07-18-19-ferc-nerc-report.pdf

Appendix B: Cold Weather Related Lessons Learned

The list of lessons learned shown below provide details related to previous cold weather events impacting generators:

- LL20230401 – "Combustion Turbine Anti-Icing Control Strategy"[12]
- LL20221201 – "Air Breaker Cold Weather Operations"[13]
- LL20110902 – "Adequate Maintenance and Inspection of Generator Freeze Protection"[14]
- LL20110903 - "Generating Unit Temperature Design Parameters and Extreme Winter Conditions"[15]
- LL20111001 - "Plant Instrument and Sensing Equipment Freezing Due to Heat Trace and Insulation Failures"[16]
- LL20120101 – "Plant Onsite Material and Personnel Needed for a Winter Weather Event"[17]
- LL20120102 – "Plant Operator Training to Prepare for a Winter Weather Event"[18]
- LL20120103 – "Transmission Facilities and Winter Weather Operations"[19]
- LL20120901 – "Wind Farm Winter Storm Issues"[20]
- LL20120902 – "Transformer Oil Level Issues During Cold Weather"[21]
- LL20120903 – "Winter Storm Inlet Air Duct Icing"[22]
- LL20120904 – "Capacity Awareness During an Energy Emergency Event"[23]
- LL20120905 – "Gas and Electricity Interdependency"[24]
- LL20180702 – "Preparing Circuit Breakers for Operation in Cold Weather"[25]
- LL20200601 – "Unanticipated Wind Generation Cutoffs during a Cold Weather Event"[26]
- LL20201101 – "Cold Weather Operation of SF6 Circuit Breakers"[27]

[12] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20230401_CT_Anti-Icing_Control_Strategy.pdf
[13] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20221201_Air_Breaker_Cold_Weather_Operation.pdf
[14] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20110902_Adequate_Maintenance_and_Inspection_of_Generator_Freeze_Protection.pdf
[15] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20110903_Generating_Unit_Temperature_Design_Parameters_and_Extreme_Winter_Conditions.pdf
[16] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20111001_Plant_Instrument_and_Sending_Equipment_Freezing_Due_to_Heat_Trace_and_Insulation_Failures.pdf
[17] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20120101_Plant_Onsite_Material_and_Personnel_Needed_for_a_Winter_Weather_Event.pdf
[18] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20120102_Plant_Operator_Training_to_Prepare_for_a_Winter_Weather_Event.pdf
[19] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20120103_Transmission_Facilities_and_Winter_Weather_Operations.pdf
[20] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20120901_Wind_Farm_Winter_Storm_Issues.pdf
[21] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20120902_Transformer_Oil_Level_Issues_During_Cold_Weather.pdf
[22] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20120903_Winter_Storm_Inlet_Air_Duct_Icing.pdf
[23] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20120904_Capacity_Awareness_during_an_Energy_Emergency_Event.pdf
[24] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20120905_Gas_and_Electricity_Interdependency.pdf
[25] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20180702_Preparing_Circuit_Breakers_for_Operation_in_Cold_Weather.pdf
[26] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20200601_Unanticipated_Wind_Generation_Cutoffs_during_a_Cold_Weather_Event.pdf
[27] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20201101_SF6_CB_Operation_during_Cold_Weather.pdf

Appendix C: Elements of Cold Weather Preparation Procedures

This attachment provides some key points to address in each of the winter weather preparation procedure elements, including severe winter weather event preparedness. These are not all inclusive lists. Individual entities should review their plant design and configuration, identify areas of potential exposure to the elements and ambient temperatures, and tailor their plans to address them accordingly:

- **Work management system**
  - Review the work management system to ensure adequate annual preventative work orders exist for freeze protection and winter weather preparedness
  - Ensure all freeze protection and winter weather preparedness preventative work orders are completed prior to the onset of the winter season
  - Review work management system for open corrective maintenance items that could affect plant operation and reliability in winter weather, and ensure that they are completed prior to the onset of the winter season
  - As appropriate to the climate, suspend freeze protection measures and remove freeze protection equipment after the last probable freeze of the winter. This may be a plant specific date established by senior management
  - Ensure all engineered modification and construction activities are performed such that the changes maintain winter readiness for the plant (Newly built plants or engineered modifications can be more susceptible to winter weather.)
- **Critical instrumentation and equipment protection**
  - Ensure all critical site specific problem areas (as noted in the **Evaluation of Potential Problem Areas with Critical Components** section) have adequate protection to ensure operability during a severe winter weather event and emphasize the points in the plant where equipment freezing would cause a generating plant trip, derate, or failure to start
  - Develop a list of critical instruments and transmitters that require maintenance prior to winter and increase surveillance during severe winter weather events
- **Insulation, heat trace, and other protection options**
  - Entities should ensure processes and procedures verify adequate protection and necessary functionality (by primary or alternate means) before and during winter weather and consider the effect of wind chill and precipitation when applying freeze protection. Considerations include, but are not limited to, insulation thickness, quality, and proper installation.
  - Entities should verify the integrity of the insulation on critical equipment identified in the winter weather preparation procedure. Following any maintenance, insulation should be re-installed to original specifications.
- **Heat trace capability and electrical continuity/ground faults**
  - Entities should perform a complete evaluation of all heat trace lines and heat trace power supplies (including all breakers, fuses, and associated control systems) to ensure they maintain their accuracy. Label heat tracing and insulation in the field in reference to the circuit feed panel to reduce troubleshooting and repair times. This inspection may include checking for loose connections, broken wires, corrosion, and other damage to the integrity of electrical insulation that could lead to heat trace malfunctioning. Measure heat trace amperage and voltage, if possible, to determine whether the circuits

are producing the design output. If there are areas where heat tracing is not functional, an alternate means of protection should be identified in the winter weather preparation procedure.

- Evaluation of heat trace and insulation on critical lines should be performed during new installation, during regular maintenance activities, or if damage or inappropriate installation is identified (i.e., wrapped around the valve and not just across the valve body):
  - For example, inspect heat tracing before it is covered by insulation to confirm that the extra cable length specified by the designer for the purpose of being concentrated at valves and supports has not been applied as a constant-pitch spiral over the length of the line
  - Re-install removed or disturbed heat tracing following any equipment maintenance to restore heat tracing integrity and equipment protection
  - Update and maintain all heat tracing circuit drawings and labeling inside cabinets
  - Require a report of calculations from the heat tracing contractor and ensure that their design basis is consistent with the insulation that will be applied with regards to exposure of valve bonnets, actuators, and pipe supports

- **Wind breaks**
  - Install permanent or temporary wind barriers as deemed appropriate to protect critical instrument cabinets, crucial equipment, heat tracing and sensing lines
    - Heaters and heat lamps
  - Ensure operation of all permanently mounted and portable heaters
  - Evaluate plant electrical circuits to ensure they have enough capacity to handle the additional load. Circuits with ground fault interrupters should be continuously monitored to make sure they have not tripped due to condensation
  - Steps should be taken to prevent unauthorized relocation of heating elements
  - Ensure adequate fuel supply for heaters
- **Covers, enclosures, and buildings**
  - Enclose cold-weather sensitive critical transmitters in enclosures with local heating elements
  - Install covers on valve actuators to prevent ice accumulation
  - Inspect building penetrations, windows, doors, fan louvers, and other openings for potential exposure of critical equipment to the elements
- **Supplemental equipment**
  - Prior to the onset of the winter season, entities should inspect inventories of all commodities, equipment, and other supplies that would aid in severe winter weather event preparation or response and ensure that they are readily available to plant staff. Supplemental equipment might include the following:
    - Tarps
    - Portable heaters, heat lamps, or both
    - Scaffolding
    - Blankets
    - Extension cords
    - Kerosene/propane

  - Temporary enclosures
  - Temporary insulation
  - Plastic rolls
  - Portable generators
  - Portable lighting
  - Instrumentation tubing
  - Heat guns or handheld welding torches
  - Ice removal chemicals and equipment
  - Snow removal equipment
  - Cold weather personal protective equipment available to personnel as appropriate.
  - Properly winterize service vehicles
  - Supplies for slip hazard reduction, such as sand, rock salt, or calcium chloride

- **Operational supplies**
  - Prior to the onset of a severe winter weather event, entities should conduct an inventory of critical supplies needed to keep the plant operational. Appropriate deliveries should be scheduled based on the severity of the event, lead times, etc. Operational supplies might include the following items:
    - Aluminum sulfate
    - Anhydrous ammonia
    - Aqueous ammonia
    - Carbon dioxide
    - Caustic soda
    - Chlorine
    - Diesel fuel
    - Ferric chloride
    - Gasoline (unleaded)
    - Hydrazine
    - Hydrogen
    - Sulfuric acid
    - Calibration gases
    - Lubricating oils (lighter grades or synthetic)
    - Welding supplies
    - Limestone
- **Staffing (as necessary)**
  - Enhanced staffing during severe winter weather events
  - Arrangements for lodging and meals

- Arrangements for transportation
- Arrangements for support and appropriate staffing from responsible entity for plant switchyard to ensure minimal line outages
- Arrangements for storage of in-house food inventories for extended work shifts
- Arrangements for on-site lodging during severe winter weather events

- **Communications**
  - Identify appropriate communication protocols to follow during a severe winter weather event
  - Identify and verify operations of a back-up communication option in case interpersonal communications capability is not available (e.g., satellite phone)
  - Include availability of interpersonal communication capability and available back-up communication options in job safety briefing for severe winter weather events
- **Special operations instruction**
  - Should be just prior to or during a severe winter weather event as appropriate
  - Utilize the "buddy system" during severe winter weather events to promote personnel safety
  - Utilize cold weather checklists to verify critical equipment is protected (e.g., pumps running, heaters operating, igniters tested, barriers in place, temperature gauges checked)
  - Monitor room temperatures as required so that instrumentation and equipment in enclosed spaces (e.g., pump rooms) do not freeze.
  - Evaluate freeze protection needs for standby systems idled during current operations (out of service filters, heat exchangers, stagnant piping, etc.)
  - Prior to cold weather, test dual fuel capability where applicable. Identify alternate suppliers of fuel as necessary
  - Ensure that alternate fuel suppliers are capable of delivering required quantities of fuel during adverse winter conditions
  - Discuss with the Balancing Authority the possibility for the unit to be called upon (If likely, initiate pre-warming and/or early start-up, of scheduled units prior to a forecasted severe winter weather event.)
  - Run emergency generators immediately prior to severe winter weather events to help ensure availability
  - Review fuel quality and quantity
  - Place critical equipment in service, such as intake screen wash systems, cooling towers, auxiliary boilers, and fuel handling equipment, where freezing weather could adversely impact operations or forced outage recovery

Contributors

NERC gratefully acknowledges the contributions and assistance of the following industry experts in the preparation of this guideline.

Name	Entity
David Lemmons – Chair	Greybeard Compliance Services, LLC
Valerie Carter-Ridley	NERC
Brad Gordon	NERC
Richard Hackman	NERC
Michael Jenkins	Duke Energy
Jagan Mandavilli	Texas Reliability Entity
Dane Rogers	Oklahoma Gas and Electric
Ed Ruck	NERC
Brantley Tillis	Duke Energy
Luke Weber	Milwaukee School of Engineering

Guideline Information and Revision History

Guideline Information	
Category/Topic: Energy Assurance	**Reliability Guideline/Security Guideline/Hybrid:** Reliability Guideline
Identification Number: RG-ENA-0623-4	**Subgroup:** Event Analysis Subcommittee

Revision History		
Version	**Comments**	**Approval Date**
1.0	Initial Version – *Winter Weather Readiness*	March 5, 2013
2.0	Three year document review per the OC Charter	August 23, 2017
3.0	Three year document review	December 15, 2020
4.0	Expand for generator types, add metrics structure	June 22 , 2023

Metrics

Pursuant to the Commission's Order on January 19, 2021, *North American Electric Reliability Corporation*, 174 FERC ¶ 61,030 (2021), reliability guidelines shall now include metrics to support evaluation during triennial review consistent with the RSTC Charter.

Baseline Metrics

All NERC reliability guidelines include the following baseline metrics:

- BPS performance prior to and after a reliability guideline as reflected in NERC's State of Reliability Report and Long Term Reliability Assessments (e.g., Long Term Reliability Assessment and seasonal assessments)
- Use and effectiveness of a reliability guideline as reported by industry via survey
- Industry assessment of the extent that a reliability guideline is addressing risk as reported via survey

Effectiveness Survey

On January 19, 2021, FERC accepted the NERC proposed approach for evaluating Reliability Guidelines. This evaluation process takes place under the leadership of the RSTC and includes:

- industry survey on effectiveness of Reliability Guidelines;
- triennial review with a recommendation to NERC on the effectiveness of a Reliability Guideline and/or whether risks warrant additional measures; and
- NERC's determination whether additional action might be appropriate to address potential risks to reliability in light of the RSTC's recommendation and all other data within NERC's possession pertaining to the relevant issue.

NERC is asking entities who are users of Reliability and Security Guidelines to respond to the short survey provided in the link below.

Effectiveness Survey: Generating Unit Winter Weather Readiness