

ERO Enterprise CMEP Practice Guide

Cold Weather Preparedness v1.0

October 12, 2021

Background

The ERO Enterprises'¹ mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid. One of the key ways NERC accomplishes the mission is through implementation of its Compliance Monitoring and Enforcement Program (CMEP). The CMEP includes obligations for CMEP staff to conduct specific compliance monitoring activities consistent with professional auditing standards, such as audits and spot-checks. Additionally, the CMEP includes obligations to understand the risk an entity poses to the reliability and security of the Bulk Electric System (BES), or how the entity is mitigating that risk as part of risk-based compliance monitoring. In support of successful implementation of, and compliance with, the North American Electric Reliability Corporation (NERC) Reliability Standards, the ERO Enterprise adopted the Compliance Guidance Policy.² The Compliance Guidance Policy outlines the purpose, development, use, and maintenance of guidance for implementing Reliability Standards. According to the Compliance Guidance Policy, Compliance Guidance includes two types of guidance – Implementation Guidance and CMEP Practice Guides.³ CMEP practice guides may address a variety of topics along the full spectrum of CMEP activities.

Purpose

CMEP Practice Guides are developed solely by the ERO Enterprise to reflect the independent, objective professional judgment of ERO Enterprise CMEP staff and, at times, may be initiated following policy discussions with industry stakeholders. Following their development, the guides are posted on the NERC website for transparency purposes. It should be noted, especially to registered entities using this guide for reference, that some aspects of this guide assist CMEP staff directly in determining compliance; other aspects of this guide assist CMEP staff in understanding how an entity mitigates risk in order to inform risk-based compliance monitoring. This understanding of how entity controls mitigate risk can affect monitoring activities, including requests for information and adjustments to an entity's Compliance Oversight Plan (COP).

The purpose of this CMEP Practice Guide is to provide guidance to CMEP staff around understanding entity risk and evaluating entity practices and controls, relative to cold weather preparedness, during CMEP activities. In light of the February 2021 Texas cold weather event, the recently expedited FERC

¹ The ERO Enterprise consists of NERC and the Regional Entities.

² The ERO Enterprise Compliance Guidance Policy is located on the NERC website [here](#).

³ Implementation Guidance provides a means for registered entities to develop examples or approaches to illustrate how registered entities could comply with a Standard that are vetted by industry and endorsed by the ERO Enterprise. CMEP Practice Guides differ from Implementation Guidance in that they address how ERO Enterprise CMEP staff executes compliance monitoring and enforcement activities, rather than examples of how to implement the Standard.

approval⁴ of the Cold Weather Reliability Standards⁵, and the recent *Cold Weather Preparations for Extreme Weather⁶ Events Alert*,⁷ it is necessary to understand how entities are taking steps to mitigate this risk. The Cold Weather Reliability Standards does not become enforceable until April 1, 2023. Therefore, ERO Enterprise CMEP staff may find that an entity has yet to develop and implement the relevant processes and procedures. However, it is important to understand entity plans for, and progress toward, mitigating risk for the upcoming winter and going forward. As part of current and ongoing CMEP activities, CMEP staff will conduct cold weather preparedness reviews, in support of the NERC Alert, from the date of this practice guide through the Cold Weather Reliability Standards implementation period.

The registered functions included in the scope of this Practice Guide include Reliability Coordinator (RC), Transmission Operator (TOP), Balancing Authority (BA), Generator Owner (GO), Generator Operator (GOP), and Planning Authority/Planning Coordinator (PA/PC). CMEP staff will consider the data points provided by the questions that follow. Additional resources include the *Reliability Guideline Generating Unit Winter Weather Readiness – Current Industry Practices⁸* document, and the *NERC Information Resources on Cold Weather Preparation and BPS Impacts⁹* document.

Questions for Understanding Entity Cold Weather Preparedness Risk Mitigation and Practices

CMEP staff shall consider the data points provided by the following questions to gain an understanding of how an entity mitigates risk relative to cold weather preparedness. The risk mitigation practices and controls identified through these questions can affect monitoring activities, including requests for information and adjustments to an entity’s compliance oversight plan and future monitoring activities.

Reliability Coordinator (RC):

1. What is, and will be, your definition, or criteria, for “cold weather” relative to your documented data specifications for Real-time monitoring, and for performing Operational Planning Analyses (OPA) and Real-time Assessments (RTA)? (IRO-010-4 R1)
2. What other data specification provisions do you, and will you, consider in addition to those identified in the Reliability Standards? (IRO-010-4 R1)
 - a. How were those provisions determined?
 - b. Are there other provisions that should be considered based on your geographical location and typical weather?

⁴ [eLibrary | File List \(ferc.gov\)](#)

⁵ [Project 2019-06 Cold Weather \(nerc.com\)](#)

⁶ Extreme Cold Weather as defined in the [Polar Vortex Review](#) dated September 2014; Extreme Cold Weather conditions occurred in lower latitudes than normal, resulting in temperatures 20 to 30° F below average.

⁷ <https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/NERC%20Alert%20R-2021-08-18-01%20Extreme%20Cold%20Weather%20Events.pdf>

⁸ https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_Generating_Unit_Winter_Weather_Readiness_v3_Final.pdf#search=Reliability%20Guideline%20Generating%20Unit%20Winter%20Weather%20Readiness%20%E2%80%93%20Current%20Industry%20Practices

⁹ https://www.nerc.com/pa/rrm/ea/ColdWeatherTrainingMaterials/Info_on_cold_weather_prep_and_bps_impacts.pdf

3. How do you maintain situational awareness concerning weather impacts in your RC area and neighboring RC areas? (IRO-008-2 R4, IRO-014-3 R1, IRO-017-1 R1)
4. Do you perform Real-time voltage stability analysis during cold weather and under high transfer conditions? (IRO-008-2 R1-R4)
5. How do you benchmark the planning and operations models for extreme cold weather events? (IRO-008-2 R1-R4)
6. Do you perform periodic impact studies to determine which elements of adjacent RC systems have the most impact on your system? (IRO-008-2 R1, IRO-014-3 R1)
 - a. E.g., how an out of service element in an adjacent RC area affects your system voltages, Facility loadings, or other conditions.
 - b. Does this include adjacent RC systems interconnected by DC ties?
7. Do you conduct periodic Capacity Emergency and Energy Emergency readiness drills simultaneous with transmission emergency drills with your BA and TOP?
 - a. Do these drills include load shed and Transmission Loading Relief (TLR) exercises? (IRO-006-5 R1)
8. How do you manage awareness and actions associated with natural gas generation resources that receive their gas supplies from a common gas supply (e.g., single point of failure results in loss of multiple units)?
 - a. Do your system maps, EMS screens, etc. indicate resources that receive their gas supplies from a common gas supply?

Balancing Authority (BA):

1. How do you maintain a documented specification for the data necessary to perform Real-time monitoring and analysis functions? (IRO-010-3 R3-R4)
 - a. Does your data specification include provisions for notification of BES generating unit(s) during local forecasted cold weather and account for operating limitations based on:
 - i. Capability and availability
 - ii. Fuel supply and inventory concerns
 - iii. Fuel switching capabilities
 - iv. Environmental constraints
 - b. Does your data specification include provisions for notification of BES generating unit(s) during local forecasted cold weather and generating unit(s) minimum:
 - i. Design temperature
 - ii. Historical operating temperature
 - 1) Does this include a minimum “historical” period (i.e., based on no less than five (5) years of operational data), and if not, why not?

- 2) Does this include the most recent extreme cold weather event data available if outside the five (5) year timeframe?
 - a) Current cold weather performance temperature determined by an engineering analysis
 - c. If the answer to A or B above is “No”; how is this type of information gathered and utilized to support reliable operations?
2. Do you have one or more Reliability Coordinator-reviewed Operating Plan(s) to mitigate Capacity Emergencies and Energy Emergencies within your BA area? (BAL-002-3 R1)
 - a. If so, does the Operating Plan(s) include processes to prepare for and mitigate Capacity Emergencies and Energy Emergencies including provisions to determine reliability impacts of:
 - i. Cold weather conditions
 - ii. Extreme weather conditions
3. Do you review the distribution of reserves to ensure they are usable and deliverable during extreme cold weather event contingencies? (IRO-017-1 R2, BAL-002-3 R1)
 - a. Does this review consider transmission constraints, other demands on reserve sharing resources and, as applicable, the possibility that more than one Reserve Sharing Group member might experience simultaneous Emergencies?
 - b. Does this review include loss of certain gas supply lines supporting multiple units, loss of renewables (e.g., wind turbine icing, solar panel icing/snow coverage, battery performance, etc.)?
4. Do you consider increasing the reserve requirement during extreme cold weather events to compensate for the probability that a number of generating units might fail?
5. Do you conduct periodic Capacity Emergency and Energy Emergency readiness drills simultaneous with transmission Emergency drills with your RC and TOP?
 - a. Do these drills include load shed and Transmission Loading Relief (TLR) exercises? (IRO-006-5 R1)
6. How do you manage awareness and actions associated with natural gas generation resources that receive their gas supplies from a common gas supply (e.g., single point of failure results in loss of multiple units)?
 - a. Do your system maps, EMS screens, etc. indicate resources that receive their gas supplies from a common gas supply?

Transmission Operator (TOP):

1. What is, and will be, your definition, or criteria, for “cold weather” relative to your documented data specifications for Real-time monitoring, and for performing OPA and RTA? (TOP-003-5 R1)
2. How is, and will be, cold weather considered in your list of data and information needed for Real-time monitoring, and for performing OPA and RTA? (TOP-003-5 R1.1)

3. What is, and will be, your provisions for notification of current Protection System and Remedial Action Scheme (RAS) status or degradation that impacts System reliability? (TOP-003-5 R1.3)
4. How do you maintain a documented specification for the data necessary to perform Real-time monitoring, OPA, and RTA?
 - a. Does your data specification include provisions for notification of BES generating unit(s) during local forecasted cold weather and account for operating limitations based on:
 - i. Capability and availability
 - ii. Fuel supply and inventory concerns
 - iii. Fuel switching capabilities
 - iv. Environmental constraints
 - b. Does your data specification include provisions for notification of BES generating unit(s) during local forecasted cold weather and generating unit(s) minimum:
 - i. Design temperature
 - ii. Historical operating temperature
 - 1) Does this include a minimum “historical” period (i.e. based on no less than five (5) years of operational data), and if not why not?
 - 2) Does this include the most recent extreme cold weather event data available if outside the five (5) year timeframe?
 - iii. Current cold weather performance temperature determined by an engineering analysis
5. Do you have one or more Reliability Coordinator-reviewed Operating Plan(s) to mitigate operating Emergencies in your TOP area?
 - a. If so, does the Operating Plan(s) include processes to prepare for and mitigate Emergencies including provisions to determine reliability impacts of:
 - i. Cold weather conditions
 - ii. Extreme weather conditions
6. How do you ensure transmission facilities are capable of performing during cold weather conditions?
 - a. Note: Most cold weather breaker trips relate to low air in the breaker, low sulfur hexa-fluoride (SF6) gas pressure, failed or inadequate heaters, bad contacts, or gas leaks.
7. How do you ensure SF6 gas in breakers, metering, and other equipment is at the correct pressure and temperature to operate during extreme cold weather?
8. How do you ensure transformer operation in cold weather?

- a. NOTE: Some options include checking heaters in control cabinets, verifying main tank oil levels are appropriate for the actual oil temperature, checking bushing oil levels, and checking nitrogen pressure if necessary.
- 9. Do you conduct periodic Capacity Emergency and Energy Emergency readiness drills simultaneous with transmission Emergency drills with your RC and BA, including load shed and TLR exercises?
- 10. How do you manage awareness and actions associated with natural gas generation resources that receive their gas supplies from a common gas supply (e.g. single point of failure results in loss of multiple units)?
 - a. Do your system maps, EMS screens, etc. indicate resources that receive their gas supplies from a common gas supply?

Generator Owner (GO)/Generator Operator (GOP):

- 1. Do you have one or more cold weather preparedness plan(s) for your generating units?
 - a. If so, does it include:
 - i. Generating unit(s) freeze protection measures based on geographical location and plant configuration.
 - ii. Annual inspection and maintenance of generating unit(s) freeze protection measures.
 - iii. Generating unit(s) cold weather data, including Generating unit(s) operating limitations in cold weather, and account for:
 - 1) Capability and availability
 - 2) Fuel supply and inventory concerns
 - 3) Fuel switching capabilities
 - 4) Environmental constraints
 - 5) Generating unit design temperature, or historical operating temperature, or current cold weather performance temperature determined by an engineering analysis
 - a) Does the analysis include a minimum “historical” period (i.e. based on no less than five (5) years of operational data), and if not why not?
 - b) Does the analysis include the most recent extreme cold weather event data available if outside the five (5) year timeframe?
- 2. When was the last time you assessed your unit’s temperature design parameters?
 - a. Did the assessment determine at what temperature heat tracing and insulation can prevent water or moisture in critical components from freezing?
 - i. Was this considered for both on-line and off-line conditions?
 - b. Did the assessment consider wind chill factor and potential need for windbreaks?

- c. Did the assessment consider all temperature-affected generator, turbine, boiler equipment, and associated ancillary equipment and controls?
 - d. Did the assessment identify components/systems that have the potential to:
 - i. Initiate an automatic unit trip
 - ii. Prevent successful unit start-up
 - iii. Initiate automatic unit runback schemes
 - iv. Adversely affect environmental controls
 - v. Adversely affect the delivery of fuel
 - vi. Cause other operational problems such as slowed valve/damper operation
 - e. Did the assessment consider the life expectancy of cold weather mitigations to meet desired performance during extreme cold weather? (e.g., pipe insulation may be effective for a certain amount of time, but would become less effective over time)
 - f. What, if any, unit modifications have you made based on the assessment?
3. What level of corporate management ensures a winter weather preparation procedure exists for each operating location?
- a. E.g., corporate management, business unit management, plant management, etc.
4. Does your organization participate in industry associations to share and gain insights on cold weather preparedness?
5. Describe your inspection and maintenance program, specifically how it addresses extreme cold weather.
- a. Do you track cold weather maintenance activities in a work management system?
 - i. Are they designated as “cold weather” activities?
 - b. Does the program consider accountability for ensuring inspection and maintenance are performed?
 - c. How are cold weather inspection and maintenance activities prioritized?
 - d. How are intervals for cold weather inspection and maintenance established?
 - e. How do you ensure required/scheduled cold weather inspection and maintenance is performed?
 - f. Does the program include inspection of heat tracing circuit power supplies, breakers, fuses, connections, controls, and thermostats prior to winter and forecasted extreme cold weather?
 - g. Does the program include inspection of thermal insulation and windbreaks prior to winter and forecasted extreme cold weather?
 - h. Does it include key communication points and protocols? (internal and external)

6. How are issues identified during cold weather inspection and maintenance activities tracked to completion?
 - a. Are processes and procedures evaluated after each cold weather event?
 - b. Who is responsible for procedure review and updates?
7. Does the inspection and maintenance program include a winter preparedness/extreme cold weather checklist?
 - a. If so, how is the checklist kept current?
8. How do you ensure winterization supplies and equipment are in place before the winter season?
9. What is your plan if fuel is curtailed or becomes unavailable? (e.g., gas, coal, oil, etc.)
10. Do your procedures include communication and coordination with fuel providers (suppliers and pipelines) regarding fuel availability during an Emergency?
 - a. Does this include contingency plans when weather makes such delivery impossible (e.g., icy roads, deep snow, frozen rivers, etc.)
11. Is your unit capable of fuel switching?
 - a. If so, how often do you verify this capability will function as expected during cold weather?
12. Do you have a process in place to obtain an emissions waiver in the event one is needed to operate?
13. Does your organization conduct fleet-wide annual winter preparation meetings, training exercises, or both to share best practices and lessons learned?
14. How often is winter-specific, cold weather plan, plant-specific training provided to operators and support personnel?
 - a. Who receives this training?
 - b. What do you cover in the training?
 - i. Note: Training could include the capabilities and limitations of the freeze protection monitoring system, proper methods to check insulation integrity, the reliability and output of heat tracing, and prioritization of repair orders when problems are discovered.
15. How do you ensure all operators and support personnel receive winter-specific and plant-specific training?
16. What is your plant staffing policy regarding anticipated extreme cold weather events?
 - a. Do you schedule additional personnel, or assign designated stand-by status?
17. How do you manage awareness and actions associated with natural gas generation resources that receive their gas supplies from a common gas supply (e.g., single point of failure results in loss of multiple units)?

- a. Do your system maps, EMS screens, etc. indicate resources that receive their gas supplies from a common gas supply?

Planning Authority/Planning Coordinator (PA/PC):

1. How is unit availability during extreme cold weather events accounted for in your winter assessment for the upcoming winter?
 - a. How do you know there will be sufficient generation and reserves for the upcoming winter?
2. Have you included sensitivity studies in your winter assessment?
 - a. Did the sensitivity studies identify system stress points?
 - b. How did you share any stress point information with appropriate RC, BA, and TOP so they can improve and refine strategies used during extreme cold weather events?
3. To what extent have you included planned outages, limited operations, ambient temperature limitations, and any likely loss of fuel sources in your winter assessment?
4. Have you performed seasonal transfer studies and sensitivity analyses which model same-direction simultaneous transfers (e.g., north to south, south to north, west to east, etc.) to determine constrained facilities? If so, did these seasonal transfer studies include:
 - a. Intra-market power transfers, without offsetting transfers in a way that would reduce the impact on determining constrained facilities
 - b. Transfers of wind generation output to load areas using near-peak wind generation levels
 - c. Simultaneous generation outages in adjacent RC footprints
 - d. Increasing simultaneous transfers to levels where constraints cannot be fully alleviated
 - e. Loss of multiple natural gas generation resources that receive their gas supplies from a common gas supply
5. Do you perform periodic impact studies to determine which elements of adjacent RC systems have the most impact on your system? (IRO-008-2 R1, IRO-014-3 R1)
 - a. E.g., how an out of service element in an adjacent RC area affects your system voltages, facility loadings, or other conditions.
 - b. Does this include those interconnected by DC ties?
6. Have you jointly developed and studied more-extreme condition scenarios for seasonal extreme conditions with Transmission Planners? If so, did this include:
 - a. Removing generation units entirely to represent actual generation outages versus scaling of generating unit outputs
 - b. Modeling system loads to ensure the study accurately tests the system for the extreme conditions
 - c. Modeling and studying actual extreme events experienced in your PC area

- d. Modeling and studying actual extreme events experienced in other PC areas
- e. Modeling the loss of multiple generation units due to a cyber-attack of a natural gas suppliers control system
- f. Sharing results with operations staff for training purposes

BA, TOP, GO, and GOP:

1. How do you verify the adequacy of fuel switch capable units to remain on-line during natural gas curtailments?
2. Does your fuel switching verification consider:
 - a. The time required to switch equipment
 - b. The unit capacity while on alternate fuel
 - c. Operator training and experience
 - d. Fuel switching equipment problems
 - e. Boiler and combustion control adjustments needed to operate on alternate fuel
3. What steps do you take to verify blackstart resources are operational prior to extreme cold weather events?
 - a. Does this include verification of operator availability and training?
4. How are you made aware of ambient operating temperature limitations of blackstart resources?
5. How do BA/TOP obtain forecasts of real output capability from GO/GOP prior to anticipated extreme cold weather events?
 - a. Do forecasts take into account both 1) the temperature beyond which the availability of the generating unit cannot be assumed, and 2) the potential for natural gas curtailments?
 - b. Do BAs make proactive decisions prior to extreme cold weather, including but not limited to:
 - i. Requesting cancellation of planned outages
 - ii. Directing advanced fuel switching
 - iii. Directing startup of units with startup times greater than one day
 - iv. Directing startup of units that have a history of problems starting below a forecasted temperature
 - v. Requesting startup of seasonally mothballed units
 - vi. Making advance requests for conservation
6. Do your procedures include communication and coordination with fuel providers (suppliers and pipelines) regarding fuel availability during an Emergency?

- a. Does this include contingency plans when weather makes such delivery impossible (e.g., icy roads, deep snow, frozen rivers, etc.)
7. Are you aware of the generation resources that could be affected by the outage of a:
- a. Common pipeline section(s)
 - b. Common compressor station(s)
 - c. Cyber-attack of a common control system

Revision History

Revision #	Revision Date	Revision Details
v1.0	10/12/2021	Initial Publication

Appendix 1

NERC Information Resources on Cold Weather Preparation and BPS Impacts

(As of 2/11/2021)

NERC has been collecting and sharing information on cold weather preparation and BPS impacts for years via Webinars, Special Reports, Lessons Learned, Failure Modes & Mechanisms, and other resources.

Version 3 of the [Generating Unit Winter Weather Readiness Reliability Guideline](#) was approved by the RSTC at the end of 2020. The changes between versions 2 and 3 were discussed in the 2020 [Winter Weather Webinar](#).

Here are links to some cold weather resources:

Reports on major BPS-impacting Cold Weather events

[Outages and Curtailments during the Southwest Cold Weather Event of February 1-5, 2011](#)

[Winter Weather Readiness for Texas Generators](#), (2011)

[January 2014 Polar Vortex Review](#)

[The South Central United States Cold Weather Bulk Electric System Event of January 17, 2018](#) (There are a number of 'sound practices' from the industry, starting on page 100.)

Other Cold Weather Reports and Training Materials can be found [on this site](#).

Cold weather related Lessons Learned:

[LL20110902 Adequate Maintenance and Inspection of Generator Freeze Protection](#)

[LL20110903 Generating Unit Temperature Design Parameters and Extreme Winter Conditions](#)

[LL20111001 Plant Instrument & Sensing Equipment Freezing Due to Heat Trace & Insulation Failures](#)

[LL20120101 Plant Onsite Material and Personnel Needed for a Winter Weather Event](#)

[LL20120102 Plant Operator Training to Prepare for a Winter Weather Event](#)

[LL20120103 Transmission Facilities and Winter Weather Operations](#)

[LL20120901 Wind Farm Winter Storm Issues](#)

[LL20120902 Transformer Oil Level Issues During Cold Weather](#)

[LL20120903 Winter Storm Inlet Air Duct Icing](#)

[LL20120904 Capacity Awareness During an Energy Emergency Event](#)

[LL20120905 Gas and Electricity Interdependency](#)

[LL20180702 Preparing Circuit Breakers for Operation in Cold Weather](#) (also [2018 Webinar w/FMM](#))

[LL20200601 Unanticipated Wind Generation Cutoffs during a Cold Weather Event](#)

[LL20201101 Cold Weather Operation of SF6 Circuit Breakers](#)

Winter Weather Webinars from 2012 – 2021 can be found [on this site](#).

Annual Winter Reliability Assessments 2003/2004 thru 2019/2020 can be found [on this site](#).