NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Extreme Cold Weather Preparedness

Technical Rationale and Justification for EOP-012-1

September 2022

RELIABILITY | RESILIENCE | SECURITY




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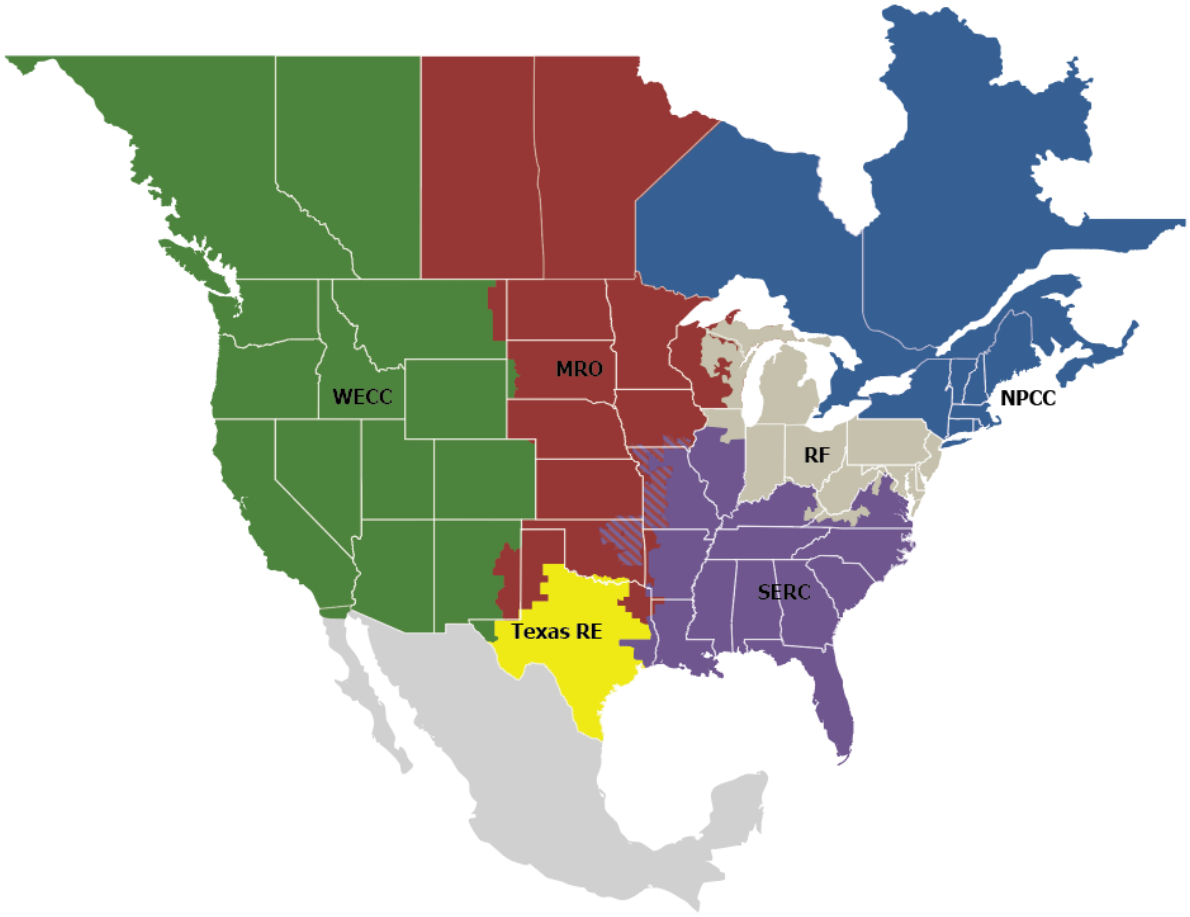
Preface

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

Introduction

This document explains the technical rationale and justification for the proposed Reliability Standard EOP-012-1. It provides stakeholders and the ERO Enterprise with an understanding of the technology and technical requirements in the Reliability Standard. This Technical Rationale and Justification for EOP-012-1 is not a Reliability Standard and should not be considered mandatory and enforceable.

Background

From February 8 through February 20, 2021, extreme cold weather and precipitation caused large numbers of generating units to experience outages, derates or failures to start, resulting in energy and transmission emergencies (referred to as "the Event"). The total Event firm load shed was the largest controlled firm load shed event in U.S. history and was the third largest in quantity of outaged megawatts (MW) of load after the August 2003 northeast blackout and the August 1996 west coast blackout. The Event was most severe from February 15 through February 18, 2021, and it contributed to power outages affecting millions of electricity customers throughout the regions of ERCOT, SPP, and MISO South. Additionally, the February 2021 event is the fourth cold weather event in the past 10 years, which jeopardized bulk-power system reliability. A joint inquiry was conducted to discover reliability-related findings and develop recommendations from FERC, NERC, and Regional Entity staff. The FERC, NERC, and Regional Entity Staff Report into the February 2021 Cold Weather Outages ("Joint Inquiry Report") was published on November 16, 2021.

The scope of the proposed project is to address the ten recommendations for new or enhanced NERC Reliability Standards proposed by the Joint Inquiry Report. In November 2021, the NERC Board of Trustees (Board) approved a Board Resolution directing that new or revised Reliability Standards addressing these recommendations be completed in accordance with the timelines recommended by the joint inquiry team, as follows:

- New and revised Reliability Standards to be submitted for regulatory approval before Winter 2022/2023: development completed by September 30, 2022, for the Board's consideration in October 2022 to address Key Recommendations 1d, 1e, 1f, and 1j;

- New and revised Reliability Standards to be submitted for regulatory approval before Winter 2023/2024: development completed by September 30, 2023, for the Board's consideration in October 2023 to address Key Recommendations 1a, 1b, 1c, 1g, 1h, and 1i.

EOP-012-1

Facilities

4.2 Facilities:

4.2.1 For purposes of this standard, the term "generating unit" subject to these requirements refers to the following Bulk Electric System (BES) resources:

4.2.1.1 A Bulk Electric System generating unit that commits or is obligated to serve a Balancing Authority load pursuant to a tariff obligation, state requirement as defined by the relevant electric regulatory authority, or other contractual arrangement, rule, or regulation, for a continuous run of four hours or more at or below a temperature of 32 degrees Fahrenheit (zero degrees Celsius); or

4.2.1.2 A Blackstart Resource

4.2.2 Exemptions:

4.2.2.1 Any Bulk Electric System generating unit included under Section 4.2.1 above that has a calculated Extreme Cold Weather Temperature exceeding 32 degrees Fahrenheit (zero degrees Celsius) under Requirement R3 Part 3.1 and as part of the required five year review in Requirement R4 Part 4.1 is exempt from further requirements in this standard.

4.2.2.2 A Bulk Electric System generating unit that is not committed or obligated to operate at or below a temperature of 32 degrees Fahrenheit (zero degrees Celsius) for any continuous run of more than four hours, but is called upon to operate for more than four hours in order to assist in the mitigation of BES Emergencies, Capacity Emergencies, or Energy Emergencies during periods at or below a temperature of 32 degrees Fahrenheit (zero degrees Celsius).

In the Joint Inquiry Report, Key Recommendation 1f includes clarifying information, which states "consideration should be given to designing all new generation plants and designing modifications to existing plants (unless committed solely for summer peaking purposes)…[.][1] FERC staff from the Joint Inquiry Report team clarified further to the standard drafting team (SDT) that the reference to summer peaking units acknowledges that some units have not implemented freeze protection measures or may not be able to secure fuel in the winter and therefore, plan to commit solely to serve Balancing Authority load during non-winter conditions. The standard provides an Applicability section identifying which generating units are subject to the requirements, with two exemptions available if the generating unit meets two narrowly construed conditions.

The Applicability section first defines "generating unit" as a Bulk Electric System (BES) resource. The NERC Glossary of Terms provides the foundation for what BES resources are included in the definition (see Inclusions I2 through I4). The Applicability section further defines which BES resources are intended to be subject to the standards' requirements, and explains exemptions available consistent with Key Recommendation 1f. The intent of the proposed standard is not to mandate that all generating units provide capacity in extreme cold weather, but instead to ensure that those BES resources that are obligated to serve Balancing Authority load during periods at or below freezing due to commitments pursuant to tariff obligations, state requirements defined by regulatory authorities, or other contractual arrangements, rules, or regulations are subject to the winterization requirements. The SDT chose the four-hour timeframe in consideration of generators that typically do not commit during freezing conditions but are running when conditions drop below freezing for a short period of time (under four hours) and would therefore not

[1] See Report, page 189.

automatically be subject to the standard. Additionally, Blackstart Resources are also specifically declared subject to the winterization requirements. Such Blackstart Resource, consistent with the NERC Glossary of Terms, are those units designated in the Transmission Operator's restoration plans.

Applicability section 4.2.2.1 clarifies further that a BES resource that is included pursuant to Applicability section 4.2.1 but that has a calculated Extreme Cold Weather Temperature exceeding freezing is also exempt. However, such generators must comply with the ongoing five-year review requirements of R4 Part 4.1 to ensure its ongoing exemption is appropriate. If a five-year review determines that the Extreme Cold Weather Temperature for the BES resource has fallen to freezing or below, then such BES resource will become subject to the requirements. With regards to the exemption provision contained in the Applicability section 4.2.2.2, BES resources exempt under the Applicability section but are called upon during extreme cold weather emergency contingencies should be able to respond to the Balancing Authority's commitment requests without triggering the requirements. This language ensures that this intent is satisfied for all requirements that follow.

In summary, to meet the intent of Recommendation 1f as clarified by FERC staff, a BES resources as defined by the NERC Glossary of Terms is subject to EOP-12-1 if it operates pursuant to an obligation to run for more than four continuous hours at or below freezing. However, the BES resource may be exempt from the requirements if the BES resources not be committed or otherwise obligated to run at or below freezing conditions for more than a four-hour continuous operation.

Additionally, such exclusion applies even when such generator is called upon to assist in the mitigation of a declared energy contingency (defined in the NERC Glossary of Terms as a BES Emergency, Capacity Emergency, or Energy Emergency). The language works as a blanket inclusion of all BES resources that serve Balancing Authority load for a period of more than four hours in freezing conditions, with the exemption of summer units or BES Resources that are not committed to serve load during non-winter conditions (e.g. summer peaking units); and the exemption is maintained by such BES resources when committed for a short period during energy contingencies.

Defined Terms

The SDT developed three terms to be added to the NERC Glossary to make the requirements easier to read and understand. These three terms are:

Extreme Cold Weather Temperature

The temperature equal to the lowest 0.2 percentile of the hourly temperatures measured in December, January, and February from 1/1/2000 through the date the temperature is calculated.

The definition of Extreme Cold Weather Temperature was developed by the SDT to provide clarity to the Generator Owner on determining what temperature triggers the requirement obligations. Each Generator Owner should select a reliable source of data from a recording location near the plant to determine their Extreme Cold Weather Temperature. Sources would include, for example, the National Weather Service (NWS) or National Oceanographic and Atmospheric Administration (NOAA) weather stations, Federal Aviation Administration (FAA) weather stations, or Environment and Climate Change Canada location for Canadian entities[2], etc. NOAA's National Centers for Environmental Information provides Climate Data Online (CDO) as a free resource that includes quality-controlled weather data and 30-year Climate Normals[3]. In general, Generator Owners should use the location nearest the plant, but may select a further location if geographic or local climatic patterns make a further location more representative of the weather at the generating unit. Generator Owners may use on-site weather stations if data, which reasonably matches reliable nearby off-site sources since January 1, 2000, is available. The starting period chosen by the SDT to gather data to determine the lowest temperatures that occur near a facility is based on the completion of the

[2] Environment and Climate Change Canada - Canada.ca

[3] https://www.ncei.noaa.gov/products/land-based-station/us-climate-normals

modernization of the National Weather Service project known as MAR (Modernization and Associated Restructuring). This project was completed in the year 2000. In general, the National Weather Service modernization provides weather data to be available at most large airports at a 99%+ availability. This will make it fairly accessible for companies to gather data and perform the required analysis. The December through February timeframe was selected to correspond to the meteorological winter, as defined by NOAA.[4]

The SDT discussed methods for determining an Extreme Cold Weather Temperature with engineering design professionals, and it was determined that it is typical engineering practice to use a statistical approach to determine the design temperature when implementing generation facility freeze protection measures. The SDT determined that only winter temperature values (i.e. between December and February) shall be used for the statistical approach and based on analysis of multiple sites, it was determined that by using the lowest 0.2 percentile, there will be sufficient data points to ensure that a single hour at a temperature that may not be accurate, or may be a statistical anomaly, doesn't result in an overly conservative design or preclude the ability of the Generator Owner to use historical operating data to prove compliance to the standards. The SDT selected the 0.2 percentile of winter month temperatures since 1/1/2000 to identify a temperature which has been rarely surpassed, but which allows some margin for a Generator Owner to have previously demonstrated successful operation. The SDT considered using the lowest recorded hourly ambient temperature but, upon further review of the historical weather data and generally accepted design principles, determined that the statistical approach to setting the extreme cold weather temperature for a site was more reasonable.

Generator Cold Weather Critical Component

Any generating unit component or associated fixed fuel supply component, that is under the Generator Owner's control and that is susceptible to freezing issues, the occurrence of which would likely lead to a generating unit(s): (1) forced derate of more than 10% of the total capacity of the unit and exceeding 20 MWs for longer than four hours in duration, (2) a start-up failure where the unit fails to synchronize within a specified start-up time, or (3) a Forced Outage.

The SDT felt the best method to address where freeze protection measures should be implemented was to define a term which specifies a subset of components that may be susceptible to freezing, and are critical to the operation of generating units. A fixed fuel supply component is intended to cover non-mobile equipment that supports the reliable delivery of fuel to the generating unit that is controlled by the Generator Owner. It would include gaseous, liquid, or solid fuel handling components that are installed as fixed parts of the fuel delivery system that are under the Generator Owner's control. It would not include mobile equipment such as trains, bulldozers, or other equipment that are not fixed in one location.

The SDT's intent with regard to the language "that is under the Generator's Owner's control" was to clearly delineate that cold weather events external to Generation site such as loss of fuel supply or loss of auxiliary power to the site that resulted in a Cold Weather Reliability Event would not be subject to this standard. Furthermore, ice buildup on Transmission lines would not constitute a freezing condition in the context of this Standard and therefore these Transmission Lines would not be considered a Generator Cold Weather Critical Component.

Generator Cold Weather Reliability Event

One of the following events for which the apparent cause(s) is due to freezing of equipment within the Generator Owner's control and the dry bulb temperature at the time of the event was at or above the Extreme Cold Weather Temperature:

> *(1) a forced derate of more than 10% of the total capacity of the unit and exceeding 20 MWs for longer than four hours in duration;*

[4] https://www.ncei.noaa.gov/news/meteorological-versus-astronomical-seasons

(2) a start-up failure where the unit fails to synchronize within a specified start-up time; or

(3) a Forced Outage.

The SDT is using the definition of apparent as defined in the dictionary as "clear or manifest to the understanding". For more explanation on this definition please see Requirement R6 Technical Rationale Below.

Requirement R1 and R2

R1. *For a generating unit(s) with a commercial operation date subsequent to [Effective Date of this requirement], the Generator Owner shall: [Violation Risk Factor: Medium] [Time Horizon: Long-term Planning, Operations Planning]*

- *Implement freeze protection measures that provide capability to operate for a period of not less than twelve (12) continuous hours at the Extreme Cold Weather Temperature for the unit(s), assuming a concurrent twenty (20) mph wind speed on any exposed Generator Cold Weather Critical Components; or*
- *Explain in a declaration, any technical, commercial, or operational constraints as defined by the Generator Owner that preclude the ability to implement appropriate freeze protection measures to provide capability of operating for twelve (12) hours at the documented Extreme Cold Weather Temperature.*

R2. *For each generating unit(s) in commercial operation prior to [Effective Date of this requirement], the Generator Owner shall ensure its generating unit(s) add new or modify existing freeze protection measures as needed to provide the capability to operate for a period of not less than one (1) hour at the unit(s) Extreme Cold Weather Temperature. Generating unit(s) that are not capable of operating for one (1) hour at its Extreme Cold Weather Temperature shall develop a Corrective Action Plan (CAP) for the identified issues, including identification of any needed modifications to the cold weather preparedness plan required under Requirement R3. [Violation Risk Factor: Medium] [Time Horizon: Long-term Planning, Operations Planning]*

Key Recommendation 1f: To require Generator Owners to retrofit existing generating units, and when building new generating units, to design them to operate to a specified ambient temperature and weather conditions (e.g., wind, freezing precipitation). The specified ambient temperature and weather conditions should be based on available extreme temperature and weather data for the generating unit's location.

General Considerations

As referenced in Key Recommendation 1f above, the specified ambient temperature and weather conditions should be based on available extreme temperature and weather data for the generating unit's location. FERC staff from the Joint Inquiry Report team clarified to the SDT that the reliability goal of the recommendation for existing generating units is to have the necessary freeze protection measures to be able to operate at extreme cold temperatures and weather for the generating unit's location. For example, those measures may consist of existing[5] or new, permanent and/or temporary measures[6] to maintain operation during extreme cold temperatures. Therefore, FERC staff clarified that the joint team's intent of the word retrofit is "to implement new, and/or make modifications to existing freeze protection measures for existing generating units."

[5] While the dictionary definition of the word retrofit includes to install (new or modified parts or equipment) in something previously manufactured or constructed, its origin suggests the need for replacing existing equipment with new technologies, which was not the intent of the joint team in this case. See Merriam-Webster definition.

[6] Some freeze protection measures may need to be removed for summer temperature operation.

In discussions with the Joint Inquiry Report team and in reading the Joint Inquiry Report itself, it is clearly stated that "consideration should be given to designing all new generation plants and designing modifications to existing plants (unless committed solely for summer peaking purposes) to be able to perform at the lowest recorded ambient temperature for the nearest city for which historical weather data is available …)". The Report went on to provide evidence that "Not only did generating units fail to perform at the lowest recorded ambient temperature for the nearest city, but many failed to perform at their own ambient design temperatures". The Joint Inquiry Report also notes that "Over 40 percent of the GOs/GOPs in the south-central U.S. regions where "freezing issues" were identified as the predominant cause of unplanned generation outages, derates or failures to start stated that they did not incorporate specific generator-related recommendations from the 2011 Report[7] or specific recommendations from the Guideline[8]."

Based on the generating unit data contained in the Joint Inquiry Report, many generating units that operate in the winter season are not properly winterized to remain in reliable service during the most extreme cold weather conditions that they may reasonably be expected to experience at their locations. As the load on the grid is the most elevated at these extreme conditions, these are the periods when it is most critical that these generating units maintain their reliability. As such, Requirement 1 ensures that generating units are proactively taking steps to design and maintain their units to maintain their reliability during extreme cold weather.

Requirement R1

The Joint Inquiry Report key recommendation 1f references recommendation 12 of the 2011 report suggesting that consideration should be given to designing all new generation plants and designing modifications to existing plants (unless committed solely for summer peaking purposes) to be able to perform at the lowest recorded ambient temperature for the nearest city for which historical weather data is available. The Joint Inquiry Report states "The Standards Drafting Team can decide what additional specificity is desirable for this requirement, for example, specifying the number of years of weather data to be considered in establishing the required ambient temperature and weather conditions, and the source of the extreme temperature and weather data". The SDT considered several options of how many years back historical data should be analyzed (e.g., 10 years, 30 years, 50 years, 100 years). There is concern that some geographical areas may not have reliable data dating back 100 years. The SDT's meteorological research finds that significant improvements were made and modernization of weather stations implemented in the early years of the 21st century. Given this, the SDT settled on the look back date of January 1, 2000.

The key recommendation identifies wind and freezing precipitation as examples of weather conditions to consider during the design of new generating units and modifications to existing plants. Realizing the many differences in weather that generator sites face across the Regions, the 2021-07 SDT developed language to provide additional context and detail around these weather conditions, while allowing flexibility for site-specific circumstances. The requirement language considers wind at a specific rate when designing new facilities. New units with commercial operation dates after the effective date of EOP-012-1 shall implement freeze protection measures such that their facilities are capable of continuous operation for not less than 12 hours at the Extreme Cold Weather Temperature assuming a concurrent twenty (20) mph wind speed on any exposed Generator Cold Weather Critical Component.

Because R1 is applicable to newly designed facilities, there is no allowance for a CAP. However, it is recognized that technical, commercial, or operational constraints may exist that prevent a new generating unit(s) from being capable of twelve (12) continuous hours of operation at their identified Extreme Cold Weather Temperature. Thus, the SDT included in R1, the option for the Generator Owner to make a declaration supporting why technical, commercial, or operational constraints preclude the ability to implement appropriate freeze protection measures. The SDT chose 12 hours of continuous operation because it is a typical length of the nighttime in winter and the maximum amount of

[7] Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011
[8] Reliability Guideline Generating Unit Winter Weather Readiness - Current Industry Practices

time that generating units would experience the Extreme Cold Weather Temperature. The SDT chose a concurrent 20 mph speed after an evaluation using the wind chill formula developed by the US National Weather Service (NWS) in the United States. Though wind chill temperature is not an exact science, it is widely understood to reflect the non-linear increased rate of convective heat loss due to air moving at different velocities. Commonly available charts show wind chill temperatures as a function of actual air temperature at various wind speeds. As it turns out, about 2/3 of the wind chill temperature drop between 0 – 60 mph is already achieved at 20 mph. Using the NWS chart, this holds true for still air temperatures starting at 40 F and dropping in 20-degree increments to -40 F. Further, 20 mph is a wind speed commonly experienced across the NERC area and yet appropriately higher than the approximate average wind speeds in the United States and Canada, 6-12 mph and 8-11 mph respectively.

Requirement R2

The SDT created a requirement to develop a CAP for generating units in commercial operation prior to the effective date of EOP-012-1 that requires either new freeze protection measures, or modification of existing freeze protection measures, to be capable of one hour of continuous operation at their identified Extreme Cold Weather Temperature. The SDT chose one hour as opposed to 12 hours for existing generation to recognize the fact that it is extremely difficult to perform the same level of design analysis, and/or documented historical operation on existing generation as on new generation. However, it is recognized that modifications or corrective actions may not be feasible under all circumstances due to technical, commercial, or operational constraints.

Additionally, the SDT considered the potential for unintended consequences, such as limiting participation by generation units in cold temperatures or accelerating generator retirements, caused by requirements to develop and implement CAPs to be capable of operations under the conditions defined in R2.

The SDT discussed setting a timeframe needed for the CAP to be completed during the drafting phase. While it is important that the CAP be completed, it would be difficult to set a definite timeframe due to the number of variables that could impact the completion of the CAP once the cause is determined. The requirements five year implementation plan is focused solely on the development of the CAP, not completion of the CAP. The SDT believes that it is more important to develop a CAP that identifies the solution and resolves the situation correctly regardless of time. Therefore, the team did not define a time when the CAP needs to be completed.

Requirement R3

R3. *Each Generator Owner shall implement and maintain one or more cold weather preparedness plan(s) for its generating units. The cold weather preparedness plan(s) shall include the following, at a minimum: [Violation Risk Factor: High] [Time Horizon: Operations Planning and Real-time Operations]*

- **3.1** *The Extreme Cold Weather Temperature for their unit(s) including the calculation date and source of temperature data;*
- **3.2** *Documentation identifying the Generator Cold Weather Critical Components;*
- **3.3** *Documentation of freeze protection measures implemented on Generator Cold Weather Critical Components which may include measures used to reduce the cooling effects of wind determined necessary by the Generator Owner to protect against heat loss, and where applicable, the effects of freezing precipitation (e.g., sleet, snow, ice, and freezing rain);*
- **3.4** *Annual inspection and maintenance of generating unit(s) freeze protection measures; and*
- **3.5** *Generating unit(s) cold weather data, to include:*
  - **3.5.1** *Generating unit(s) operating limitations in cold weather to include:*
    - **3.5.1.1** *Capability and availability;*
    - **3.5.1.2** *Fuel supply and inventory concerns;*

3.5.1.3 *Fuel switching capabilities; and*

3.5.1.4 *Environmental constraints.*

3.5.2 *Generating unit(s) minimum:*

- *Design temperature;*
- *Historical operating temperature; or*
- *Current cold weather performance temperature determined by an engineering analysis.*

General Considerations

Requirement R3 requires Generator Owners to develop and maintain cold weather preparedness plans for its unit(s) and describes the information and documentation required in such plans. It is an expansion of the cold weather preparedness plan required under Requirement R7 of EOP-011-2, and is intended to be used and reviewed regularly by the Generator Owner; R3.4 requires the GO to annually inspect the freeze protection measures. Working in concert with other parts of EOP-012, including R4 and R5, the plan will be regularly reviewed and updated and the GO is required to annually train personnel on its requirements.

Requirement R3 Part 3.1

In R3.1, the Generator Owner is required to determine the Extreme Cold Weather Temperature, as defined in the standard, for each unit using reliable source of data. The SDT believes that the GO is in the best position to select the most representative weather information relative to its generating unit.

Requirement R3 Part 3.2

In R3.2, the Generator Owner identifies the Generator Cold Weather Critical Components to help inform their decision on where to implement appropriate freeze protection measures. The document *Reliability Guideline, Generating Unit Winter Weather Readiness – Current Industry Practices*[9], NERC, 2012 presents a suggested list of components that Generator Owners may choose to utilize when developing their own Generator Cold Weather Critical Component inventory.

Requirement R3 Part 3.3

R3.3 requires GOs to document the freeze protection measures implemented on cold-weather-critical components. These freeze protection measures may include those to reduce the cooling effects of wind. Requirement R3 does not require Generator Owners to install new freeze protection measures to reduce the cooling effects of wind, but rather to document those measures. These measures would include temporary measures such as wind breaks. There is no expectation for entities to list all climate controlled areas as freeze protection measures. Similar to the cooling effects of wind, R3 requires Generator Owners to document freeze protection measures taken to reduce the effects of freezing precipitation on cold-weather-critical components, as the Generator Owners determine if necessary (e.g. water-resistant insulation, protective shielding, insulated boxes, etc.).

Requirement R3 Part 3.4

R3.4 is carried over from the previously approved EOP-011-2 standard, and requires annual inspection and maintenance of the freeze protection measures identified in the cold weather preparedness plan. This requirement ensures these freeze protection measures will be ready and serviceable when needed. Examples of documentation to demonstrate inspections and maintenance has been completed would be completed work order(s) from the Generator Owner's work management system and/or freeze protection checklists identifying the measures inspected and maintained.

[9] Reliability Guideline Generating Unit Winter Weather Readiness – Current Industry Practices

Requirement R3 Part 3.5

R3.5 is carried over from the previously approved EOP-011-2 standard, and requires the Generator Owner to document several cold weather performance parameters for the unit. This information is valuable, and in some cases, must be shared with other entities. Defining the operating limitations in R3.5.1 will make affected personnel more aware of unit capabilities and constraints as well as systems and practices that may be necessary to ensure reliability in cold weather, particularly when alternative fuels are involved. In addition, the unit minimum temperature identified in R3.5.2 is used to demonstrate compliance with R2 for existing units.

Requirement R4

R4. *Once every five calendar years, each Generator Owner shall for each generating unit: [Violation Risk Factor: Low] [Time Horizon: Operations Planning, Real-Time Operations]*

4.1 *Calculate the Extreme Cold Weather Temperature, and update the cold weather preparedness plan if this temperature is now lower than the previous lowest calculation;*

4.2 *Review its documented generating unit(s) minimum temperature contained within its cold weather preparedness plan(s), pursuant to Part 3.5.2; and*

4.3 *Review whether its generating units have the freeze protection measures required to operate at the Extreme Cold Weather Temperature pursuant to R1 or R2 as applicable, and if not develop a CAP for the identified issues, including identification of any needed modifications to the cold weather preparedness plan required under Requirement R3.*

The SDT has developed the new standard with language that supports the ongoing consideration of new technologies when protecting against extreme cold weather, and an ongoing review requirement to validate or update the Extreme Cold Weather Temperature associated with each unit. This five-year review supports the desire for Generator Owners to periodically vet these new technologies and consider whether any technical, commercial, or operational constraints are still applicable.

Requirement R5

R5. *Each Generator Owner in conjunction with its Generator Operator shall identify the entity responsible for providing the generating unit-specific training, and that identified entity shall provide annual training to its maintenance or operations personnel responsible for implementing cold weather preparedness plan(s) developed pursuant to Requirement R3. [Violation Risk Factor: Medium] [Time Horizon: Long-term Planning, Operations Planning]*

Key Recommendation 1e: To revise EOP-011-2, R8, to require Generator Owners and Generator Operators to conduct annual unit-specific cold weather preparedness plan training.

Project 2019-06 Cold Weather established the requirement that the Generator Owner, in conjunction with its Generator Operator, would provide generating unit-specific training for its personnel responsible for implementing cold weather preparedness plan(s) for its generating units. The Joint Inquiry Report recommended that EOP-011-2 R8 be revised to require the generating unit-specific training be provided on an "annual" basis. The report explains "Responses from the GOs/GOPs involved in the Event show that annual training is not yet universal in the Event Area." To address this recommendation, the SDT has utilized the existing language in EOP-011-2 and added the word "annual" to require the training on an annual basis. The requirement is deleted from EOP-011-3, and will be placed as a requirement in a new EOP-012-1 Reliability Standard dedicated solely to extreme cold weather preparedness.

Requirement R6

R6. *Each Generator Owner that owns a generating unit that experiences a Generator Cold Weather Reliability Event shall develop a CAP, within 150 days or by July 1, whichever is earlier, that contains at a minimum: [Violation Risk Factor: High] [Time Horizon: Long-term Planning]*

- ***6.1*** *A summary of the identified cause(s) for the Generator Cold Weather Reliability Event where applicable and any relevant associated data;*
- ***6.2*** *A review of applicability to similar equipment at other generating units owned by the Generator Owner;*
- ***6.3*** *An identification of any temporary operating limitations or impacts to the cold weather preparedness plan, that would apply until execution of the corrective action(s) identified in the CAP.*

Key Recommendation 1d: To require Generator Owners that experience outages, failures to start, or derates due to freezing to review the generating unit's outage, failure to start, or derate and develop and implement a corrective action plan (CAP) for the identified equipment, and evaluate whether the CAP applies to similar equipment for its other generating units. Based on the evaluation, the Generator Owner will either revise its cold weather preparedness plan to apply the CAP to the similar equipment, or explain in a declaration (a) why no revisions to the cold weather preparedness plan are appropriate, and (b) that no further corrective actions will be taken. The standard drafting team should specify the specific timing for the CAP to be developed and implemented after the outage, derate, or failure to start, but the CAP should be developed as quickly as possible, and be completed by no later than the beginning of the next winter season.

The key recommendation from the report recommends a standard that requires Generator Owners to develop a CAP for generating units that experience outages, failures to starts, or derates due to freezing. The Report identifies that most of the outages and derates in the February 2021 event were due to freezing of instrumentation, transmitters, sensing lines, or wind turbine blades (p 166 in report). As such, the team followed the Report recommendation to require a CAP when the apparent cause of the event is freezing. The Project 2021-07 SDT has developed parameters around these events to clarify a reasonable baseline of what level of de-rate qualifies as an event, and provide additional language to identify what constitutes a start-up failure. With the additional clarifications, the SDT determined that the standard would benefit from a defined term, to clearly and efficiently state what constitutes an event. The result is to a new defined term, Generator Cold Weather Reliability Event, that defines the circumstances for which a CAP is required (i.e., when a freezing event effects the equipment within the control of the Generator Owner). The defined term will make the standard easier to understand and implement by providing clear and reasonable factors to determine whether the impact of an event requires mitigation

General Considerations for All CAPs

To simplify the proposed requirements related to creating a CAP, the SDT has modified the proposed requirements addressing the need for a CAP while better incorporating the NERC Definition of a CAP. The CAP definition reads "A list of actions and an associated timetable for implementation to remedy a specific problem." As written, the definition requires two parts for a document to qualify as a CAP, i.e., a list of items to be addressed and a timeline for completion. In the original posting, the SDT included both items in separate bullets to be included in the CAP. To simplify the requirements, the SDT has removed the bullets. As these two elements are both required for a document to qualify as a CAP, there is no need to list these items separately within the standard. A CAP without both a list of actions and the timeline to implement is not complete.

Requirement R6

The CAP requirement applies to any forced outage due to freezing, regardless of duration. Derates, which are short-lived (specified as 4 hours by the SDT) or of small capacity impact (specified as less than 20 MW by the SDT, which corresponds with the threshold for BES impacting Generation units), are excluded from the CAP requirement to limit

the administrative burden to Generator Owners for events that are minimally impacting to the BES. It should be noted that nothing in this standard prevents a Generator Owner from taking its own corrective actions resulting from such events. Startup failures are defined using the GADS definition with the removal of "following an outage or reserve shutdown", since the definition of Reserve shutdown is different in GADS than it is in some of the RTO's.

R6 requires the Generator Owner to act within 150 days or by July 1 to develop the CAP. These timeframe options were chosen by the SDT to allow Generator Owner's to review multiple events holistically following a winter season if that scenario occurs, and create one CAP for components with common failure causes.

The SDT determined that CAPs will be required for any freezing event that occurs at temperatures above the site's Extreme Cold Weather Temperature. By using the site's Extreme Cold Weather Temperature, as opposed to the Generator Unit Minimum Temperature as defined by the Generator Owner as the threshold, this achieves the following:

- Provides a consistent basis for the temperature at which CAPS are required for all Generator Owners
- Provides a consistent basis for when CAPS are required for all Generation types
- Provides a consistent basis for when CAPS are required regardless of the level of effort that Generators may have applied to-date winterizing their generators such that they can operate to the Extreme Cold Weather Temperature that their sites will reasonably experience
- Removes any incentive (perceived or real) to not further winterize Generator Owner's sites to meet the Extreme Cold Weather temperature at the Generator Owner site by not providing a window where one site might not be subject to the CAP requirement while sites in the same vicinity experiencing the same temperatures are subject to this requirement
- Removes any disincentive for Generator Owner's to design the units to operate well below the Extreme Cold Weather Temperature for a site by not requiring them to perform CAPs while sites in the same vicinity experiencing the same temperatures are subject to this requirement

Requirement R7

R7. Each Generator Owner shall: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*

7.1 Implement each CAP developed pursuant to Requirements R2, R4, or R6, or explain in a declaration why corrective actions are not being implemented due to any technical, commercial, or operational constraints as defined by the Generator Owner.

7.2 Update each CAP if actions or timetables change, until completed.

The SDT has also separated the requirement to implement a CAP from the requirement to create a CAP. This is similar in structure to PRC-004-6 R5 and R6. For CAPs developed pursuant to Requirements R2, R4, and R6 in the proposed standard, the Generator Owner creates a document with a date of approximately the time of the event/determination of the need to make changes. This shows that the Generator Owner identified issues caused by cold weather. Implementation of the CAP is demonstrated through updates to the original document or completion of the tasks listed in the CAP under a separate requirement. The separation of these distinct functions facilitates administration of the process and makes it less likely for a CAP to be written but not implemented. Requirement R7 also defines the requirement to make a declaration when technical, commercial, or operational constraints are asserted.