NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Technical Rationale

Project 2024-03 Revisions to EOP-012-2
Reliability Standard EOP-012-3 | January 2025

EOP-012-3 – Extreme Cold Weather Preparedness and Operations

Introduction

This document explains the technical rationale and justification for the proposed Reliability Standard EOP-012-3. 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-012-3 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 (BPS) reliability. A joint inquiry was conducted to discover reliability-related findings and develop recommendations from Federal Energy Regulatory Commission (FERC), NERC, and Regional Entity staff. The FERC, NERC, and Regional Entity Staff Report about the February 2021 Cold Weather Outages[1] ("Joint Inquiry Report") was published on November 16, 2021.

Project 2021-07 was a two-phase project to address the 10 sub-recommendations in Key Recommendation 1 of the Joint Inquiry Report for new or enhanced NERC Reliability Standards. Reliability Standard EOP-012-1 was originally developed to address Recommendations 1d, 1e, and 1f of the Joint Inquiry Report through new and enhanced requirements for generator preparedness for extreme cold weather conditions. Reliability Standard EOP-012-2 was revised to address Key Recommendations 1a, 1b, and 1c as well as the FERC directives in the February 2023 Order approving the Phase 1 standards EOP-011-3 and EOP-012-1.[2] Reliability Standard EOP-012-3 is being revised to address FERC directives in the June 2024 Order approving EOP-011-4 and EOP-012-2[3].

1 The February 2021 Cold Weather Outages in Texas and the South Central United States | FERC, NERC and Regional Entity Staff Report | Federal Energy Regulatory Commission

2 *N. Am. Elec. Reliability Corp.*, 182 FERC ¶ 61,094 (2023) (FERC Order), *notice denying reh'g and providing for further consideration*, 183 FERC ¶ 62,034 (2023).

3 *N.AM.Elec.Reliability Corp.*, 187 FERC ¶ 61,204 (FERC Order)

Defined Terms

Previous drafting teams (DTs) developed five defined terms to be added to the NERC Glossary of Terms to make the requirements easier to understand. Project 2024-03 updated the term "Generator Cold Weather Constraint" to meet the FERC directives in the June 2024 Order and provided additional language to clarify issues noted during the development of EOP-012-3, 2024 Small Group Advisory Session(s), and input received during outreach with industry. The five 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 (ECWT) was developed by the 2021-07 DT to provide clarity to the Generator Owner (GO) on determining what temperature triggers the requirement obligations. Each GO should select a reliable source of data from a recording location near the plant to determine their ECWT. Sources could 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[4], 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[5]. In general, GOs 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. GOs 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 2021-07 DT to gather data to determine the lowest temperatures that occur near a facility is based on the completion of the 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. 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.[6]

The 2021-07 DT discussed methods for determining an ECWT 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 2021-07 DT 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 weather data 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 GO to use historical operating data to prove compliance to the requirements. The 2021-07 DT 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

4 Environment and Climate Change Canada - Canada.ca
5 U.S. Climate Normals | National Centers for Environmental Information (NCEI) (noaa.gov)
6 Meteorological Versus Astronomical Seasons | News | National Centers for Environmental Information (NCEI) (noaa.gov)

GO to have previously demonstrated successful operation. The 2021-07 DT 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 ECWT for a site's location was more reasonable.

The 2024-03 DT recognized comments and concerns raised during the 2024 Small Group Advisory Session on cold weather preparedness regarding application of the ECWT calculation if hourly temperature values were questionable. If complete data sets are not available (e.g., data is corrupt or missing) at a single weather station back to January 1, 2000, the GO should document the methodology they use to determine their ECWT, such as appending data from multiple weather stations or selecting a complete or partial data set from a weather station further away from the facility. The 2021-07 and 2024-03 DTs realized that a complete data set (i.e., all hours of every day of every year for the months of December, January, and February) may not be available due to a variety of technical reasons. To that point, the GO's approach in handling the missing/corrupt data should be documented in their methodology and available to Compliance Monitoring Enforcement Program (CMEP) staff as needed. To accommodate concerns raised by industry, the 2024-03 DT felt additional clarification was needed to address missing data and set an expectation for entities to meet when reviewing the inputs to the ECWT calculations within Requirement R1. Entities should be able to explain the reasoning behind the substitution of missing or corrupt data points.

It has been noted by the industry that there may be the possibility of missing temperature data utilized for the ECWT calculation. The 2024-03 DT discussed data completeness concerns and, after considering the likely variability in such hourly temperature data sets across North America, ultimately chose not to establish a requirement regarding the size of the data set necessary to support an accurate ECWT determination. The 2024-03 DT understands the entity may very well have an overall approach to missing data versus a generating unit-by-unit approach. By the nature of the percentile function, significant data loss may not change the ECWT value. The key is where the data is missing in relationship to the ECWT determined value. Note that compliance obligations when the ECWT is determined near 32 degrees Fahrenheit, tend to dictate the need for a more rigorous level of effort needed to help determine possible impacts of missing temperature data. Missing hourly temperature values above the ECWT has limited impact to the determination. However, missing hourly temperature values below the ECWT can impact the ECWT determination value. For example, the 0.2 percentile of 50,000 hourly values equates to 100 hourly values (in this case the lowest recorded hourly temperatures.) If there are missing hourly values that would have been included in the list of the lowest 100 hourly temperature values, those values should be explained by the entity and may warrant further review. Missing data in the lowest 100 values effectively has the potential of moving the ECWT value higher but that is dependent upon the data set. This simplified example is intended to demonstrate a principle; not establish a fixed number of lowest temperature values of concern. Any data set with missing or invalid hourly temperature values recorded during the coldest periods since January 1, 2000 should be carefully evaluated to ensure that any adjustments utilized on those particular values are properly addressed in a transparent and logical way. Please reference the Calculating Extreme Cold Weather Temperature document drafted by the 2021-07 DT and updated by the 2024-03 DT for an example of how to calculate the ECWT[7].

7 Report (nerc.com)

Generator Cold Weather Critical Component

Any generating unit component or system, or associated Fixed Fuel Supply Component, that is under the Generator Owner's control, and is susceptible to freezing issues, the occurrence of which would likely lead to a Generator Cold Weather Reliability Event. This definition excludes any component or system or associated Fixed Fuel Supply Component located inside a permanent building with a heating source that regularly maintains the space at a temperature above 32 degrees Fahrenheit (0 degrees Celsius).

The 2021-07 DT 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. GOs should consider previous freeze-related issues experienced by the generating unit(s), as well as actions taken to mitigate those freeze-related issues, when establishing its list of Cold Weather Critical Components. The 2021-07 DT also felt it is appropriate to specifically exclude components that are not susceptible to freezing due to being inside heated buildings that maintain the interior temperature above freezing.

The 2021-07 DT'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 the generation site such as loss of fuel supply or loss of auxiliary power to the site that resulted in a Generator Cold Weather Reliability Event (see definition below) would not be subject to this standard. Furthermore, ice buildup on transmission lines and/or high voltage lines between the generating station and point of interconnection with the Transmission Owner would not constitute a freezing condition in the context of this Standard, and therefore, these lines would not be considered a Generator Cold Weather Critical Component.

The 2021-07 DT's intent with the use of the phrase "permanent building" is to refer to a structure that is in place year-round, shall accommodate personnel entry, and has a heating source that regularly maintains the space at a temperature above 32 degrees Fahrenheit for the purpose of protecting components from freezing (e.g. heated container that protects inverter-based resources or battery energy systems). The 2024-03 DT recognized comments and concerns raised during the 2024 Small Group Advisory Session on cold weather preparedness regarding heating of the "permanent building." The HVAC/heating system is not a freeze protection measure in terms of being included in the cold weather preparedness plan as it is not protecting a Generator Cold Weather Critical Component (per the definition) nor is it a Generator Cold Weather Critical Component. The 2024-03 DT expects the HVAC/heating system to be part of routine maintenance and monitoring to ensure that the heated building remains above 32 degrees Fahrenheit.

Fixed Fuel Supply Component

Non-mobile equipment that supports the reliable delivery of fuel to the generating unit and under the control of the Generator Owner at a plant site. Gaseous, liquid, or solid fuel handling components that are installed on site as fixed parts of the fuel delivery system that are under the Generator Owner's control are included. Mobile equipment such as trains, bulldozers, or other equipment that are not fixed in one location are excluded.

The 2021-07 DT wanted to clarify the boundaries of responsibility for the GO as it relates to sites having fuel handling equipment within their control and responsibility to provide freeze protection. The intent of

this definition is to clarify that mobile equipment is not part of this requirement, but permanent fixed equipment impacting fuel delivery needed for generation is included.

Generator Cold Weather Reliability Event

One of the following events for which the apparent cause(s) is due to freezing of equipment or impacts of freezing precipitation (e.g., sleet, snow, ice, and freezing rain) on 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 but not less than 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.

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 Joint Inquiry Report recommends a Reliability Standard that requires GOs to develop a Corrective Action Plan for generating units that experience outages, failures to starts, or derates due to freezing. The Joint Inquiry 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 the Joint Inquiry Report). As such, the 2021-07 DT followed the Joint Inquiry Report recommendation to require a Corrective Action Plan when the apparent cause of the event is freezing of equipment or impacts of freezing precipitation (e.g., sleet, snow, ice, or freezing rain) on equipment. The 2021-07 DT felt that it was important to clearly call out freezing precipitation as these events were included in the outages and derates that identified as freezing in the Joint Inquiry Report. Furthermore, Key Recommendation 1c of the report requires GOs to account for the effect of precipitation. The 2021-07 DT has developed parameters around these events to clarify a reasonable baseline of what level of derate qualifies as an event, and provide additional language to identify what constitutes a start-up failure. With the additional clarifications, the 2021-07 DT determined that the standard would benefit from a defined term, to clearly and efficiently state what constitutes an event. The result is a new defined term, Generator Cold Weather Reliability Event, that defines the circumstances for which a Corrective Action Plan is required (i.e., when a freezing event affects the equipment within the control of the GO). 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. The 2021-07 DT is

using the definition of apparent as defined in the Webster's dictionary as "clear or manifest to the understanding".

Note that the 2024-03 DT provided additional language to alleviate concerns regarding the administrative nature of developing Corrective Action Plans specifically for similar noted issues occurring at one or more locations (e.g., freezing precipitation on wind turbines). Care should be taken if updating existing Corrective Action Plans for additional units especially in terms of effectively capturing the actions and timetables applicable to the additional units.

The Corrective Action Plan requirement applies to any forced outage due to freezing, regardless of duration. Derates, which are short lived (specified as four hours by the 2021-07 DT) or of small capacity impact (specified as less than 20 MW by the 2021-07 DT, which roughly corresponds with the threshold for Bulk Electric System (BES) impacting generation units), are excluded from the Corrective Action Plan requirement to limit the administrative burden to GOs for events that are minimally impacting to the BES. Also excluded are proactive operational actions to limit the potential of forced outages or derates. It should be noted that nothing in this standard prevents a GO from taking its own corrective actions resulting from such events. Startup failures for conventional generation are defined using the Generating Availability Data System (GADS) definition with the removal of "following an outage or reserve shutdown", since reserve shutdown is defined differently by NERC in GADS than it is by some of the Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs). From the GADS data reporting instructions, the startup period for each unit is determined by the operating company. It is unique for each unit and may depend on the condition of the unit at the time of startup (cold, warm, or hot). A typical unit startup occurs in three phases: warm up, synchronization, and ramp up. NERC defines a startup period to begin with the command to start and end when the unit is synchronized. A startup failure begins when a problem, preventing the unit from synchronizing, occurs. The startup failure ends when the unit is synchronized, another startup failure occurs, or the unit enters another permissible state.

The 2021-07 DT determined that Corrective Action Plans will be required for any freezing event that occurs at temperatures above the generator site's ECWT. By using the site's ECWT, as opposed to the generator unit minimum temperature as defined by the GO in Requirement R1 Part 1.2.2 as the threshold, this achieves the following:

- Provides a consistent basis for the temperature at which CAPS are required for all GOs
- Provides a consistent basis for when Corrective Action Plans are required for all generation types
- Provides a consistent basis for when Corrective Action Plans are required regardless of the level of effort that GOs may have applied to-date winterizing their generators such that they can operate to the ECWT that their sites will reasonably experience
- Removes any incentive (perceived or real) to not further winterize GOs generating sites to meet the ECWT at the GO site by not providing a window where one site might not be subject to the Corrective Action Plan requirement while sites in the same vicinity experiencing the same temperatures are subject to this requirement

- Removes any disincentive for GOs to design the units to operate well below the ECWT for a site by not requiring them to perform Corrective Action Plans while sites in the same vicinity experiencing the same temperatures are subject to this requirement

Generator Cold Weather Constraint

Any condition that would preclude a Generator Owner from implementing freeze protection measures on one or more Generator Cold Weather Critical Components. Freeze protection measures include practices, methods, or technologies implemented by the electric industry in areas that experience similar winter climate conditions and are not intended to be limited to optimum practices, methods, or technologies.

The 2024-03 DT reviewed the material from the June 2024 Order when determining how best to update the Generator Cold Weather Constraint definition. The 2024-03 DT relied upon industry and FERC guidance as a basis for updating the definition language and the process captured in Attachment 1 of EOP-012-3. The 2024-03 DT also ensured that constraint language would be fully captured within the Standard itself through Attachment 1.

The 2024-03 DT felt that an Attachment that included specific language further explaining Generator Cold Weather Constraints with discrete known Generator Cold Weather Constraints and other case-by-case Generator Cold Weather Constraints meets the FERC (and industry) expectations to provide unambiguous, objective, and auditable language. The 2024-03 DT discussed providing clarity with examples knowing that additional instances or conditions that may be considered a Generator Cold Weather Constraint may exist.

Per the FERC Order, NERC staff are responsible to provide a process describing the receipt, evaluation, approval (as needed), and validation of Generator Cold Weather Constraints. This process is captured in the Generator Cold Weather CAP Extension and Constraint Process ("NERC Process") document.

Attachment 1 contains a non-comprehensive list of known Generator Cold Weather Constraints as well as a list of situations, circumstances, and criteria that may constitute a Generator Cold Weather Constraint. The GO **must** submit all Generator Cold Weather Constraints to the Compliance Enforcement Authority (CEA) for approval, regardless of which category it might fall into.

Once a declaration is approved by the CEA, it is considered valid. It is the GO's responsibility to document, in the Generator Cold Weather Constraint declaration, the circumstances and reasons why the modification needed to address the freeze protection measure(s) is not being implemented. A Generator Cold Weather Constraint declaration, that no further corrective actions will be taken, is expected to be used sparingly.

The 2024-03 DT is intentionally leaving room for additional instances of Generator Cold Weather Constraints as it would be impossible to foresee every potential circumstance that could possibly necessitate a review of potential freeze protection technologies across the breadth of the United States and Canada and the breadth of generating unit types and ages that fall under this Standard.

Furthermore, the 2024-03 DT wants to ensure the Standard language supports the adoption of new freeze protection measure practices, methods, or technologies while not immediately requiring a new freeze protection measure practice, method, or technology to be implemented industry-wide when a leading utility pilots a novel approach, as this would be a disincentive to utilities piloting new technologies. The 2024-03 DT encourages additional studying and implementation of freeze protection measures to remove Generator Cold Weather Constraints as appropriate over time.

In the June 2024 Order, there was a directive to change the frequency of Generator Cold Weather Constraint reviews to facilitate consideration of new freeze protection measure technologies to reduce the risk resulting from the need for a Generator Cold Weather Constraint. That change is captured in Requirement R9 discussed later in this Technical Rationale document.

Facilities

After reviewing the reference material and the efforts of the 2021-07 DT, the 2024-03 DT determined that EOP-012-3 should continue to apply to all BES generating units in order to ensure consistency in extreme cold weather preparedness. The Applicability section first defines "generating unit" as a BES resource. The NERC Glossary of Terms provides the foundation for what BES resources are included in the definition (see Inclusions I2 through I4). Additionally, Blackstart Resources are also specifically declared subject to the winterization requirements. Such Blackstart Resources, consistent with the NERC Glossary of Terms, are those units designated in the Transmission Operator's (TOP) restoration plans. Proposed EOP-012-3 clarifies which Facilities and their Generator Cold Weather Critical Components are subject to implementing freeze protection measures through specific language in Requirements R2 and R3. The 2024-03 DT briefly discussed GO Category 2 Inverter-Based Resource (IBR) applicability to EOP-012-3 but it was noted the applicability is under review as part of the Registration of IBR Work Plan so no changes were presented.

Rationale for Requirement R1

The Project 2024-03's Technical Rationale language for Requirement R1 did not substantially change from 2021-07 DT language and, as such, use of DT below is referencing 2021-07 DT. Much of the criteria of R1 is carried over from the previously approved EOP-011 Standard and requires the GO to document several cold weather performance parameters for the unit. This information is valuable, and in some cases, must be shared with other entities. For Requirement R1 Part 1.1, the GO is required to calculate the Extreme Cold Weather Temperature (ECWT) for each unit using a reliable source of data (See the supporting document "Calculating Extreme Cold Weather Temperature"). The DT believes that the GO is in the best position to select the most representative weather information relative to its generating unit. The ECWT will be updated if a new lower ECWT is determined under the periodic review requirement of R1. Defining the operating limitations in Requirement R1 Part 1.2.1 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 Requirement R1 Part 1.2.2 is used to demonstrate compliance with Requirement R3 for existing units. The DT chose one hour of historical operating data recognizing there is extremely limited historical operating data available for a unit below their ECWT. This was not to infer the DT expects that existing generation will only reliably operate for one hour during an extreme cold weather event. The information contained within Requirement R1 Part 1.2 is required to be requested by the BAs in TOP-003 to make sure they have the most accurate unit performance information possible for their reliability analysis during the winter season. It is critical, especially if a Corrective Action Plan, extension request for a Corrective Action Plan, or a Generator Cold Weather Constraint declaration is in effect, that the GO keep Requirement R1 Part 1.2 information updated with those entities requiring said information. The 2024-03 DT did not add a notification Requirement to EOP-012-3 as TOP-003 and IRO-010 obligate the applicable entities (Balancing Authority (BA), Reliability Coordinator (RC), and Transmission Operator (TOP)) to have "*Provisions for notification of BES generating unit(s) during local forecasted cold weather to include*"

Requirement R1 Part 1.2 information. BAs, RCs, and TOPs should have already reviewed their data specifications with regards to EOP-012. The flexibility that industry has required in the determination of data specifications - -were limited by industry approved Standard language regarding cold weather data and attributes. BAs, RCs, and TOPs should ensure complete coverage and timeliness of Requirement R1 Part 1.2 data submission within their data specifications especially during local forecasted cold weather.

It is recognized that the determination of a single unit minimum temperature is of limited value if applied without consideration of the other ambient conditions under which it was determined, that is, wind and precipitation. Consideration of wind and precipitation, along with the minimum temperature, provides a greater understanding of the potential generating unit capability for cold weather resource planning. The Standard requires that the GO include wind and precipitation data with their generating unit minimum temperature data when the data is available. The impact of deviations from this known temperature/wind/precipitation stated point are expected to be evaluated qualitatively. For example, if the historical minimum temperature occurred at low wind and dry conditions, and actual future cold weather event expected conditions are high winds with precipitation, planning personnel will recognize that a specific unit may not achieve the minimum temperature and can arrange for additional resources. The opposite also applies, i.e., if a design minimum temperature assumes some level of wind and precipitation and actual cold weather expectations are for low wind and dry conditions, planning personnel will recognize that there is increased likelihood that a generation resource may continue to be available below its minimum temperature. If no information about wind or precipitation is known, wind and precipitation are assumed to be zero at the minimum temperature until further information is obtained. The 2024-03 DT did provide updated language within the “Defined Terms” section of this Technical Rationale document to capture concerns regarding ECWT data availability.

Rationale for Requirement R2

The Joint Inquiry Report Key Recommendation 1f referenced recommendation 12 of the 2011 report[8] 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 location for which historical weather data is available.

In developing the original version of the EOP-012 Reliability Standard, Reliability Standard EOP-012-1, the Project 2021-07 DT determined to impose different cold weather capability requirements for new generation compared to existing generation. Consistent with Key Recommendation 1f of the February 2021 Event Report, GOs would be required to design new units to operate to a specified ambient temperature (the ECWT) and weather conditions for the location, accounting for the cooling effects of wind. Due to the difficulty of performing the same level of design analysis on existing generation as on new generation, the high threshold of the ECWT, and the expected availability of historical data to

8 https://www.nerc.com/pa/rrm/ea/February%202011%20Southwest%20Cold%20Weather%20Event/SW_Cold_Weather_Event_Final.pdf

support sustained operations at that ECWT, the Project 2021-07 DT determined to impose less stringent requirements for retrofitting existing generating units. The Project 2021-07 DT initially specified the "effective date of the requirement," which would be determined in accordance with the EOP-012-1 Implementation Plan, as establishing which set of generators would be "grandfathered" and subject to the less stringent requirements, and which generators would be subject to the more stringent requirements for new generation.

The 2021-07 DT chose 12 hours of continuous operation because it is a typical length of the nighttime in winter in most regions of the US and Canada and typically include the hours with the coldest experienced temperatures. The 2021-07 DT was of the opinion that tying the requirement to the 12-hour period would provide a reasonable level of reliability during a cold weather event. The 2021-07 DT chose a concurrent sustained 20 mph wind speed after an evaluation using the wind chill formula developed by the 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. Approximately 2/3 of the wind chill temperature drop between 0–60 mph is achieved at 20 mph. Using the NWS chart, this holds true for still air temperatures starting at 40ºF and dropping in 20-degree increments to -40°F. Further, 20 mph is a wind speed commonly experienced across the ERO and yet appropriately higher than the approximate average wind speeds in the United States and Canada, 6-12 mph and 8-11 mph respectively. GOs should consider that wind concurrent with cold temperatures will decrease the amount of time for a unit's equipment (e.g., sensing lines) to reach the ambient temperature. While this may not be readily apparent in all cases, operational history of operating at a certain temperature may not equate (in terms of capability or duration of operation) to operating at that same temperature with a 20 mph (32 km/h) wind speed. Providing freeze protection measures, such as tarps or temporary wind block structures, may support the ability to operate longer during extreme cold weather. Each of these three probabilistically infrequent conditions (the ECWT, a steady 20 mph (32 km/h) wind, and a duration of 12 continuous hours at these conditions) is, in and of itself, conservative. When they have their effects combined, it results in a requirement that will significantly contribute to BES reliability during extreme cold weather conditions.

In developing Reliability Standard EOP-012-2 and a shorter Implementation Plan to meet the directives of the FERC February 2023 Order, the Project 2021-07 determined to replace "effective date of this requirement" with a date certain, October 1, 2027. In establishing this date, the 2021-07 DT considered the original proposed Implementation Plan for Reliability Standard EOP-012-1 which would have had this requirement effective April 1, 2028, FERC's directives to shorten this plan as it related to existing generation, the need to ensure generation is prepared for cold weather, as well as the fact that new generation coming online prior to October 1, 2027 is likely to be significantly advanced past the design phase when incorporating measures to provide capability in sustained wind conditions would be most cost effective and reasonable. Reliability Standard EOP-012-2 introduced the option for owners of new

generating units to develop a Corrective Action Plan, in the event they could not meet the more stringent requirements for new generation upon entering commercial operation on or after October 1, 2027.

In the June 2024 Order (paragraph 72), FERC directed NERC to modify EOP-012-2 to address Corrective Action Plans for new generating units. The Commission stated that, while it was persuaded by NERC's rationale that there needs to be allowances made for units that are well into their construction phase to complete corrective action plans for elements already designed, it was concerned that Reliability Standard EOP-012-2 did not clearly differentiate between projects in an advanced stage of construction and those in a lesser phase of construction. The Commission found that "generators that are commercially operational after October 1, 2027, should have freeze protection measures either designed into their generating systems, or, if a corrective action plan is needed, then it should be completed by the time that such generating units go into commercial operation." Based on this finding, the Commission directed NERC to revise the EOP-012 standard "to clarify that any Requirement R2 corrective action plans must be completed prior to the generating unit's commercial operation date."

In developing the posted draft of proposed EOP-012-3, the Standards Committee considered the FERC directive and the concern underlying that directive – that EOP-012-2 did not clearly differentiate between projects advanced in construction and those that were not.

It was thought that units that were coming online the first winter of the new requirements (winter 2027-2028), but that were designed prior to June 2023, would be significantly far in development and construction, and this represented a reasonable demarcation point for the Corrective Action Plan option.

Under proposed EOP-012-3 Requirement R2, **most** new generation entering commercial operation on or after October 1, 2027 will either need to: (1) meet the more stringent freeze protection measures called for new generation; or (2) declare a constraint that prevents them from doing so in accordance with Requirement R8. As concerns were raised about requiring Corrective Action Plans of GOs before they may be formally subject to compliance with standards, there is no requirement for GOs to complete Corrective Action Plans ahead of entering commercial operation in Requirement R2. This is consistent with the underlying intent of the June 2024 Order and more closely resembles the original EOP-012-1 requirements for new generation.

However, the Project 2024-03 DT believed that some allowance needed to be made for the units that were thought to be far along in the construction process, using designs that may have predated the development and approval of the EOP-012 standard and which may not meet the standard's requirements for new generation without significant additional work. The Project 2024-03 DT also considered that some of these generating units may even be fully constructed but not yet in "commercial operation" by October 1, 2027 due to the varying requirements for achieving that designation in different regions. While the Project 2024-03 DT did not believe many GOs developing new generating units would be in this position, the Project 2024-03 DT was cognizant of the burden eliminating the Corrective Action Plan option at this stage could place on these entities, especially when combined with the proposed

changes to the Generator Cold Weather Constraint criteria. The drafting team was also concerned that if such GOs felt they had no choice but to delay the commercial operation date for their new units past winter 2027-2028 to meet the new requirements, it could reduce needed generation at a time when NERC has projected an increased risk of reserve margin shortfalls in several areas of North America (see 2024 LTRA).

The Project 2024-03 DT considered several options to both address the FERC directive and account for this identified concern. These options included extending the "grandfathering" date past October 1, 2027 and redefining "commercial operation" to a less specific phrase, such as "in operation". However, the Project 2024-03 DT determined that maintaining the October 1, 2027 date as the "grandfathering" date was important in the interest of raising the bar for reliability in future cold weather seasons. It did not identify any compelling reason to change either that date or the existing measure of "commercial operation" from the previous versions of the standard. Rather, the Project 2024-03 DT concluded a time-limited Corrective Action Plan option for the first winter season the more stringent requirements for new generation are in effect (i.e. winter 2027-2028) was the most appropriate option to address the issue. This option would clearly separate the units that were far along in construction, and for whom such a limited option might be appropriate and consistent with the underlying findings in the June 2024 Order, and those that were not far along in construction.

In reviewing the Project 2024-03 DT's determination, the Standards Committee, in carrying out its responsibilities under Section 321 of the NERC Rules of Procedure, determined to carry forward this limited Corrective Action Plan option, with some modifications as needed to clarify the scope and intent in response to stakeholder comments.

Under proposed Requirement R2 Part 2.1, GOs of certain new generating units would have the option to develop a Corrective Action Plan if they are unable to implement the required freeze protection measures for new generation before entering commercial operation, and a Generator Cold Weather Constraint would not apply. For this option to apply, the GO must have first contractually committed to the design criteria for the unit before June 29, 2023, and the unit must first enter commercial operation between October 1, 2027 and March 31, 2028 (inclusive of the start and end dates). The Corrective Action Plan must be completed by April 1, 2028, a date which reflects consideration of NERC's original proposed effective date of EOP-012-1 requirements for new generation.[9]

It is important to note that this is simply an additional *option* for such GO, intended to enable them to enter commercial operation sooner and begin supplying needed power to the grid faster than if they were required to delay their commercial operation dates to provide the required capability.

The June 29, 2023 date represents the date by which the Project 2024-03 DT concluded that GOs would have had reasonable certainty regarding the freeze protection requirements for new generation under

9 Under NERC's original proposed implementation plan for EOP-012-1, this requirement for new generation would have become effective April 1, 2028. In its February 2023 Order, FERC directed NERC to modify the proposed EOP-012-1 implementation plan to reflect the urgency of the need to implement the standard, including to shorten the 60-month implementation plan for existing generating units. Reliability Standard EOP-012-2 shortened these dates and established October 1, 2027 as the "grandfathering" date for new generation.

the EOP-012 standard and should have begun including them in their design criteria for new generating units. FERC issued its order approving EOP-012-1 and the definition of Extreme Cold Weather Temperature in February 2023; however, the Project 2024-03 DT considered comments stating that there was still some regulatory uncertainty past this time, as several entities had filed for rehearing on various aspects of the standard. On June 29, 2023, FERC issued an order addressing arguments raised on rehearing, resolving any remaining uncertainty regarding the standard to which new generation would be expected to perform in the future (see FERC decision).

The Project 2024-03 DT and the Standards Committee considered stakeholder comments that this "designed by" date should instead be the effective date of the EOP-012-2 standard, October 1, 2024. Specifically, there were some stakeholder concerns that the standard would be applied retroactively to a date before the first version of the EOP-012 Reliability Standard became effective on October 1, 2024. However, using the EOP-012 effective date for this particular measure would not be consistent with the underlying intent of several directives the February 2023 and June 2024 Orders, which was to speed up the process by which generating units are prepared for the known reliability risks of extreme cold weather. Further, this June 29, 2023 date does not represent a compliance date, but rather the date by which entities would have been on reasonable notice of the specific nature of their new obligations and could take the appropriate steps to change their designs to facilitate compliance upon entering commercial operation several years later. In determining the appropriate demarcation point for the Corrective Action Plan option for new generation, the drafting team determined that units designed after this date should not be eligible.

Nevertheless, to provide further clarity as to intent and enforceability, the Standards Committee added language to clarify that, for this option to apply, the unit must first enter commercial operation between October 1, 2027 and March 31, 2028. (Recall that Requirement R2 applies only to generation entering commercial operation on or before October 1, 2027 – there is no provision for retroactive applicability.)

In summary, Requirement R2 Part 2.1 specifies that, for certain entities that undertook certain design steps before June 29, 2023 before the scope of new requirements became clear, those entities have the option of developing a Corrective Action Plan to achieve the required capability during their first winter in commercial operation, and they would not need to delay their commercial operation date if they can complete that plan by April 1, 2028. Entities seeking to use this option would be expected to demonstrate that they are eligible to use it, such as through dated contracts showing that it contractually committed to design criteria for the unit in question before that time. It was considered that entities would generally retain such contracts for their units under construction in the normal course of business and this would impose no additional burden.

For all other new generating units entering commercial operation on or after October 1, 2027, those units must either implement the more stringent capability required in Requirement R2 or declare a Generator Cold Weather Constraint. This includes units entering commercial operation after March 31, 2028 that are designed before June 29, 2023, as well as generating units entering commercial operation after October 1, 2027 that are designed after June 29, 2023. It is recognized that such generating units may need to delay their originally planned commercial operation date if they do not have the required capability and a

Generator Cold Weather Constraint would not apply. *See* June 2024 Order at P 72. Further, even if an entity has the option to implement a Corrective Action Plan, it is not required to do so. It may delay its commercial operation date until the required capability is installed, if a Generator Cold Weather Constraint would not apply.

Rationale for Requirement R3

The 2021-07 Drafting Team created a requirement for existing generating units, as defined in Requirement R3, to be able to operate at their ECWT. Many existing generating units have already demonstrated this capability. An early FERC order on EOP-012-1 rejected a one-hour timing requirement, consequently the 2021-07 DT chose to forego any specific time requirement in Requirement R3. If a generating unit cannot meet the requirements of Requirement R3, it is required to develop a CAP to add new freeze protection measures or modify existing freeze protection measures to be capable of operations at the ECWT (as calculated in Requirement 1).

Rationale for Requirement R4

General Considerations

Requirement R4 requires GOs to develop and maintain cold weather preparedness plans for their 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 GO. Originally, Requirement R4 Part 4.5 required the GO to annually inspect and perform necessary maintenance of freeze protection measures. The 2024-03 DT added some clarifying language to ensure that annual inspection and maintenance of freeze protection measures is applied specifically to Generator Cold Weather Critical Components. While other freeze protection measures may be applied to equipment by the GO, the freeze protection measures included in the cold weather preparedness plan with annual inspections and maintenance are expected to be those applied to Generator Cold Weather Critical Components. Working in concert with other parts of EOP-012-3, including but not limited to Requirements R1, R5, R6, and R7, the substantive elements of the cold weather preparedness plan will be subject to review requirements, updated as necessary, and the responsible party (GO or GOP) is required to annually train personnel on the cold weather preparedness plan requirements.

Requirement R4 Part 4.1

In Requirement R4 Part 4.1, the GO is required to include in the cold weather preparedness plan the lowest ECWT, as calculated pursuant to Requirement R1, for each unit using reliable source(s) of data. The 2021-07 DT believed that the GO is in the best position to select the most representative weather information relative to its generating unit. The cold weather preparedness plan will be updated if a new lower ECWT is calculated under the Requirement R1 periodic review language.

Requirement R4 Part 4.2

Requirement R4 Part 4.2 is intended to capture, within the cold weather preparedness plan, the information being developed pursuant to Requirement R1 Part 1.2, which is carried over from the previously approved EOP-011 Standard and requires the GO to document several cold weather performance parameters for the unit. This information is valuable, and in some cases, must be shared with other entities consistent with the data specification requirements contained in TOP-003 and IRO-010. A requirement for the GO to document this information within the cold weather preparedness plan ensures the information is readily available and documented when the GO responds to a data specification. It should be noted that if a Corrective Action Plan extension request is approved, the underlying generator cold weather data, as called out in Requirement R1 Part 1.2, should be correctly identified by the GO and provided to the RCs, BAs, and TOPs as requested. The June 2024 Order mentions this in Paragraph 3. The 2024-03 DT believes that the data specification Reliability Standards applicable to RCs, BAs, and TOPs (e.g., IRO-010 and TOP-003) require the entities to request the information and the GO is therefore obligated to provide the most current version of the relevant information within a Corrective Action Plan. The 2024-03 DT did not believe a notification Requirement was needed in EOP-012-3 in addition to those already existing in the data specification Reliability Standards. The 2024-03 DT encourages parties to work together to ensure the most accurate and up-to-date information is provided, especially when conditions increase risk to reliable operations. See the Technical Rationale for Requirement R1 for substantive rationale regarding the operating limitations and generating unit minimum temperatures documented in the cold weather preparedness plan.

Requirement R4 Part 4.3

In Requirement R4 Part 4.3, the GO identifies the Generator Cold Weather Critical Components to help inform their decision on where to implement appropriate freeze protection measures. The NERC *Reliability Guideline, Generating Unit Winter Weather Readiness – Current Industry Practices*[10], presents a suggested list of components that GOs may choose to utilize when developing their own Generator Cold Weather Critical Component inventory. The GO shall develop and maintain a list of Generator Cold Weather Critical Components for each unit.

Requirement R4 Part 4.4

Requirement R4 Part 4.4 requires GOs to document the freeze protection measures implemented on Generator Cold Weather Critical Components. These freeze protection measures should include those to reduce the cooling effects of wind. Requirement R4 does not require GOs to install new freeze protection measures to reduce the cooling effects of wind, but rather to identify freeze protection measures for Generator Cold Weather Critical Components that will protect against heat loss and the effect of freezing precipitation, where applicable, and document those measures (e.g., water-resistant insulation, protective shielding, insulated boxes, etc.). These measures could include temporary measures as well, such as wind breaks, but there is no expectation for entities to list all climate-controlled areas as freeze protection measures. Specifically, the freeze protection measures applied to Generator Cold Weather Critical Components must be captured in the cold weather preparedness plan.

Requirement R4 Part 4.5
Requirement R4 Part 4.5 is largely carried over from the previously approved EOP-011 Standard and requires annual inspection and maintenance of the freeze protection measures applied to Generator Cold Weather Critical Components identified in the cold weather preparedness plan. The 2024-03 DT added clarifying language to emphasize the need to effectively mitigate risk on the Generator Cold Weather Critical Components. This Requirement ensures these freeze protection measures will be ready and serviceable when needed.

Rationale for Requirement R5

The 2024-03 DT noted that there could be a combination of operations and maintenance personnel that require training, so minor adjustments were made to that extent. Additionally, the personnel may not be physically located at the generator site depending on how an entity implements their cold weather preparedness plan(s).

Rationale for Requirement R6

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 Joint Inquiry Report recommended a Reliability Standard that requires GOs to develop a Corrective Action Plan for generating units that experience outages, failures to starts, or derates due to freezing. The Joint Inquiry 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 the Joint Inquiry Report). As such, the 2021-07 DT followed the Joint Inquiry Report recommendation to require a Corrective Action Plan when the apparent cause of the event is freezing. The 2021-07 DT developed parameters around these events to clarify a reasonable baseline of what level of derate qualified as an event and provide additional language to identify what constitutes a start-up failure. With the additional clarifications, the 2021-07 DT determined that the Reliability Standard would benefit from a defined term, to clearly and efficiently state what constitutes an event. The result was a defined term, Generator Cold Weather Reliability Event, that describes the circumstances for which a Corrective Action Plan is required (i.e., when a freezing event affects the equipment within the control of the GO). The defined term made the Reliability Standard easier to understand and implement by providing clear and reasonable factors to determine whether the impact of an event requires mitigation.

However, because of the June 2024 Order, the 2024-03 DT updated Requirement R6 to provide clearer timeline obligations for those units that suffer a Cold Weather Reliability Event. In general, the 2024-03 DT understands that if a Generator Cold Weather Reliability Event occurs, GOs will remediate the issue as soon as possible.

General Considerations for All Corrective Action Plans

To simplify the proposed requirements related to creating a Corrective Action Plan, the 2021-07 DT used the NERC Definition of a Corrective Action Plan. The Corrective Action Plan 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 Corrective Action Plan, i.e., a list of items to be addressed and a timeline for completion. A Corrective Action Plan without both a list of actions and the timeline to implement is not complete. The 2024-03 DT provided additional language for Corrective Action Plans to clarify expectations for those Corrective Action Plans created as a result of a Generator Cold Weather Reliability Event and other Corrective Action Plans referenced throughout the Requirement language. The resulting language kept the underlying structure developed during previous Projects but clarified and added information as needed to meet the June 2024 Order.

The Corrective Action Plan requirement applies to Generator Cold Weather Reliability Events as well as other instances of required actions to support reliable operations within the EOP-012-3 Standard Requirements. It should be noted that nothing in this standard prevents a GO from taking its own corrective actions resulting from events that do not meet the criteria of a Generator Cold Weather Reliability Event. Startup failure criteria were based on 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 Regional Transmission Organizations (RTOs).

Requirement R6 requires the GO to develop, implement, and complete a Corrective Action Plan prior to the first day of December following a Generator Cold Weather Reliability Event. Note that the 2024-03 DT considered early occurrences (e.g., October or November) of Generator Cold Weather Reliability Events and provided a footnote to allow remedial activities to be completed by December 1 of the following calendar year. The December 1 date was chosen based on the FERC directives and the urgency stated within the June 2024 Order regarding this risk. This timeframe was maintained by the 2024-03 DT to allow GOs to review multiple events holistically following a winter season, if that scenario occurs, and create one Corrective Action Plan for components with common failure causes. Care should be taken when developing a multi-unit or multi-event Corrective Action Plan to ensure it meets the Corrective Action Plan criteria for each unit (e.g., actions and timetables may be different.)

The 2021-07 DT determined that Corrective Action Plans would be required for any freezing event that occurs at temperatures at or above the site's ECWT in accordance with the definition of a Generator Cold Weather Reliability Event. Using the site's ECWT as the threshold, as opposed to the generator unit minimum temperature as determined by the GO, achieves the following:

- Provides a consistent basis for the temperature at which Corrective Action Plans are required for all GOs

- Provides a consistent basis for when Corrective Action Plans are required for all generation types
- Provides a consistent basis for when Corrective Action Plans are required regardless of the level of effort that GOs may have applied to-date winterizing their generators such that they can operate to the ECWT that their sites will reasonably experience
- Removes any incentive (perceived or real) to not further winterize GOs sites to meet the ECWT at the GO site by not providing a window where one site might not be subject to the Corrective Action Plans requirement while sites in the same vicinity experiencing the same temperatures are subject to this requirement
- Removes any disincentive for GOs to design the units to operate well below the ECWT for a site by not requiring them to perform Corrective Action Plans while sites in the same vicinity experiencing the same temperatures are subject to this requirement

The 2024-03 DT provided clarifying language to have Corrective Action Plans developed in response to Generator Cold Weather Reliability Events developed and completed by the first day of December of the winter season following the Generator Cold Weather Reliability Event. Allowances for events which occur early winter season, which varies across the North American continent, were provided with the expectation that more transient fixes occurring after a Generator Cold Weather Reliability Event would be applied quickly but allowing a reasonable time horizon for compliance with this Requirement. A Corrective Action Plan triggered by a Generator Cold Weather Reliability Event and for which the apparent cause is the failure of relatively simple existing piece of freeze protection equipment, the scope of the Corrective Action Plan may be documented after the fact. Such prompt repairs may be completed before creation of the Corrective Action Plan, and the GO may complete the implementation of the Corrective Action Plan simply by evaluating the requirements of R6 and documenting how and when the repair work was completed. An example of this circumstance would be a freezing event caused by a single heat trace circuit failure which would have been sufficient to prevent the event had it not failed.

The June 2024 Order also directed changes affecting the application of a Generator Cold Weather Reliability Event Corrective Action Plans to other units within a GO's fleet. The 2024-03 DT added clarifying language to provide guidance on what the extent of condition (i.e., the review of other generating units) should encompass to help alleviate concerns raised by the industry during the comment and ballot period. Each GO should already know, per Requirement R4, the freeze protection measures on Generator Cold Weather Critical Components. The GOs also have the responsibility, per Requirement R4, to annually maintain and inspect the freeze protection measures on Generator Cold Weather Critical Components. Effectively those Requirements would support quick identification of same or similar equipment susceptible to freezing.

The 2024-03 DT, and later the Standards Committee in the exercise of its responsibility under Section 321 of the NERC Rules of Procedure, established a 12-calendar month window from the time of the originating Generator Cold Weather Reliability Event to complete its fleet-wide review for similar vulnerabilities and develop or update such a Corrective Action plan to address them. In response to multiple stakeholder comments, the Standards Committee provided a 24-calendar to 36-calendar month window (initiated

based on the date of the Generator Cold Weather Reliability Event) to implement corrective actions. GOs that complete their fleet-wide reviews sooner than the 12 months allowed would have a longer period of time overall to implement any required corrective actions, incentivizing prompt action to identify the extent of condition across a fleet. While the FERC directive suggesting a potentially longer staggered implementation was considered for more complex implementations, it was determined that developing specific requirements for staggering often presents many logistical challenges, and it may not promote an orderly and efficient implementation depending on the issue needing to be addressed. Allowing up to 36 months total to complete corrective actions would allow GOs with larger fleets to accommodate any required changes. Industry experience with Winter Storms URI and Elliott suggests that the timelines are sufficient in general to mitigate reliability risks. However, a Corrective Action Plan extension may be requested if a particularly complex implementation issue arises requiring longer time to implement.

Entities should evaluate the issue with the freeze protection measure that may have initiated the Generator Cold Weather Reliability Event to see if the maintenance and inspection efforts need to be adjusted (at the unit that suffered the Generator Cold Weather Reliability Event as well as at other similar units with similar freeze protection measures applied to Generator Cold Weather Critical Component(s)).

The existence of a Corrective Action Plan should not discourage the GO from applying any other actions necessary and feasible to prepare a unit to perform at extreme cold weather temperatures during the Corrective Action Plan implementation period.

The 2024-03 DT also created language that allows for Corrective Action Plan extension requests using the NERC Process. ERO Enterprise staff developed the NERC Process that leveraged the current TPL-007 Corrective Action Plan extension process (See ERO Enterprise Periodic Data Submittal Schedule). While TPL-007 has not been utilized extensively, the NERC Process is flexible enough to manage the expected submittals. The DT is not in control of updates to the NERC Process but the NERC staff have been engaged and responsive to industry concerns noted during the Standard development timeline. The NERC Process will allow a thorough review in a timely manner for any Corrective Action Plan extension requests including those that go beyond the 24 or 48 calendar month timetables. While there may be actions impacting the implementation and completion of Corrective Action Plans beyond the control of GOs (e.g., supply chain issues), the GOs should accelerate completion of corrective actions as much as possible to support reliable operations.

The 2024-03 DT updated language regarding Generator Cold Weather Constraints to clarify expectations. Please review Requirements R8 and R9 and Attachment 1 for further discussions of Generator Cold Weather Constraints.

In carrying out its responsibilities under Section 321 of the NERC Rules of Procedure, the Standards Committee determined to carry forward the general framework developed by the Project 2024-03 DT, with some modifications. First, to address stakeholder concerns about the lack of a clear deadline for implementing Corrective Action Plans, the Standards Committee added a deadline to develop Corrective Action Plans for units experiencing the Generator Cold Weather Reliability Event. This deadline would be the same as the date any required Corrective Action Plans for the units must be completed – by the first

day of the first December following the event (or for early season events, the first day of the first December of the following year). By adding this deadline, the Standards Committee intends to add clarity as to the latest date by which such Corrective Action Plans must be developed, while recognizing that the main reliability benefit will come from completing the corrective actions in an expeditious manner. As Corrective Action Plans contain important information to document causes and corrective actions that may inform future winter operations, there is still a reliability benefit to develop these Corrective Action Plans, even if any corrective actions in the Corrective Action Plan are completed in short order.

Rationale for Requirement R7

In EOP-012-2, R7 was expanded from EOP-012-1 to provide additional definition on the requirements to implement a Corrective Action Plan, and to meet the direction for this requirement set by the February 2023 FERC Order. One such direction was to define expectations on implementation timelines for Corrective Action Plans. Under EOP-012-2 R7, Corrective Action Plans were divided into two categories: 1) those which address existing freeze protection measure(s), and 2) those which require new equipment or freeze protection measure(s). The former category required completion of the Corrective Action Plan to remedy the cause(s) within 24 months, and the latter required completion of the Corrective Action Plan within 48 months. The 2021-07 DT modeled this timeline structure after similar Corrective Action Plan implementation requirements in TPL-007. These are maximum durations and entities are expected to work diligently to correct issues and take prompt actions to mitigate future issues as soon as practical. At the same time, the 2021-07 DT recognized that the following time-consuming activities make the 24 and 48 calendar months maximum timelines reasonable: scoping applicability to similar units, freeze protection engineering and design, project development, budgeting processes, material supply lead times, outage scheduling, skilled labor availability, and startup/commissioning. However, the June 2024 Order established directives to clarify timelines and responsibilities associated with Corrective Action Plans. The 2024-03 DT chose to specifically remove Corrective Action Plan obligations for Generator Cold Weather Reliability Events and place those in Requirement R6. For Requirement 7, the 2024-03 DT provided clarifying language regarding existing and new freeze protection measures and the associated completion timelines. Language was provided for Corrective Action Plans that may include changes to existing freeze protection measures and addition of new freeze protection measures to help clarify expectations for completing the corrective actions. The Project 2024-03 DT discussed the adjectives “new” and “existing” freeze protection measures as it is used within the Requirements. If there is the failure of a freeze protection measure (e.g., heat trace) and that freeze protection measure is replaced with the same/similar/commonly used technology that is considered “existing”. The change of a heat trace from 40 foot to 60 foot or change in the amperage capability of the heat trace is not a “new” freeze protection measure. A change in lightbulb wattage in an enclosure should not be considered “new”. The industry did provide some examples of “new” freeze protection measures (i.e., new permanent structures or new technologies not already applied) that may take longer to implement depending upon the nature of the freeze protection measure. A wind block made of tarps and a wooden or steel frame should not be considered “new” and require 48 months to implement even if the site did not have a wind block already. Care should be exercised by GOs in the use of “new” and “existing” freeze protection measures and the

resulting Corrective Action Plan timelines. Industry experience with Winter Storms URI and Elliott suggests that the shorter timelines are sufficient in general to mitigate reliability risks. Entities are expected to work diligently to correct issues and take prompt actions to mitigate future recurrence. The 2024-03 DT updated Parts 7.1.3. and 7.1.4 for completeness to ensure updates would be made to document needed changes to the cold weather preparedness plan(s) to eliminate recurrence of issue(s) identified in the Corrective Action Plan. In clarifying these timeframes, the 2024-03 DT considered the FERC directives.

Within the revised Requirement R7, the GO is required to implement the Corrective Action Plan within a timetable defined by the GO in the Corrective Action Plan but limited by maximum durations in Part 7.1. If the GO is unable to complete the Corrective Action Plan within the time limits in Part 7.1, or the corrective action(s) change, the GO is required to update the Corrective Action Plan with justification. GOs that are unable to complete the Corrective Action Plan due to a Generator Cold Weather Constraint are required under Part 7.3 to create a declaration of the Generator Cold Weather Constraint which shall be provided to the Compliance Enforcement Authority per Requirement R8. Further requirements for the Generator Cold Weather Constraints are provided under Requirements R8 and R9.

The 2024-03 DT also created language that allows for Corrective Action Plan extension requests using the NERC Process. ERO Enterprise staff developed the NERC Process that leveraged the current TPL-007 Corrective Action Plan extension process (See ERO Enterprise Periodic Data Submittal Schedule). The NERC Process will allow a thorough review in a timely manner for any Corrective Action Plan extension requests including those that go beyond the 24 or 48 calendar months. The 2024-03 DT utilized the precedent set by TPL-007 to ensure the unique circumstances of each request will be considered while also avoiding potential compliance burdens which may not have a corresponding reliability benefit (e.g. specific timelines for submission and approval of extension requests). While there may be actions impacting the implementation and completion of Corrective Action Plans beyond the control of GOs (e.g., supply chain issues), the GOs should accelerate completion of corrective actions as much as possible to support reliable operations. It is expected that extension requests will be limited in nature. GOs will have to provide clear justifications with supporting materials within the extension request. Due diligence in ordering equipment, obtaining permits, etc., will be considered as part of the determination of whether a particular set of facts constitute circumstances beyond the control of the entity. Denials of extension requests will be minimized if GOs work diligently to correct issues and take prompt actions. Denial of an extension means the initial timelines for corrective actions must be met.

The 2024-03 DT updated language regarding Generator Cold Weather Constraints to clarify expectations. Please review Requirements R8 and R9 for further discussions of Generator Cold Weather Constraints.

If one or more actions within a Corrective Action Plan fall under a Generator Cold Weather Constraint declaration, it is the intent of the DT that only those constraint affected actions would not be implemented as part of the Corrective Action Plan. The remaining corrective actions should be implemented per the timelines provided unless dependent upon the corrective action triggering the Generator Cold Weather Constraint declaration.

Rationale for Requirement R8

In the February 2023 FERC Order, the Commission expressed concern that a GO may make a Generator Cold Weather Constraint declaration without informing planning and operational entities (e.g., the BA) that are expecting the reliable operation of the generating unit to its ECWT. An additional concern was that the Generator Cold Weather Constraint declarations may be used by a functional entity as an opt-out of compliance with requirements set forth in the standards or in a corrective action plan. To mitigate the concern, the Commission directed NERC to work with Commission staff and submit a data collection and assessment plan that contains information related to GO constraint declarations and explanations thereof. The 2021-07 DT expected that ERO Enterprise compliance staff will be responsible for reviewing declared Generator Cold Weather Constraints and assessing compliance with the Generator Cold Weather Constraint definition criteria in accordance with established processes. The June 2024 Order directives included more direct language that required NERC to receive, review, evaluate, and confirm the validity of each Generator Cold Weather Constraint in a timely manner. Additionally, the June 2024 Order directives required an increase in the frequency of reviews of Generator Cold Weather Constraints. If a Corrective Action Plan extension request is denied by the CEA, then the GO may request a joint CEA/NERC review of the denial.

The 2024-03 DT updated Requirement R8 to require the GO to submit, to the Compliance Enforcement Authority, a Generator Cold Weather Constraint in accordance with Attachment 1 under specific timelines. The ERO Enterprise staff have developed the Generator Cold Weather CAP Extension and Constraint Process ("NERC Process") that leveraged the current TPL-007 Corrective Action Plan extension process (See ERO Enterprise Periodic Data Submittal Schedule) as a foundation for the Generator Cold Weather Constraint process. The NERC Process will allow a thorough review in a timely manner for any Generator Cold Weather Constraint submitted. The 2024-03 DT created Attachment 1 to provide clear expectations on Generator Cold Weather Constraint conditions. Attachment 1 contains some known Generator Cold Weather Constraint conditions as well as examples of other case-by-case Generator Cold Weather Constraint conditions that may also be considered valid. To be clear, all Generator Cold Weather Constraint declarations require submittal per the NERC Process. The 2024-03 DT could not create an exhaustive list of Generator Cold Weather Constraint conditions but provided language that allows professional judgement to be utilized. The 2024-03 DT believes the NERC Process in conjunction with Requirement R8 and Attachment 1 effectively meets the FERC directive regarding receiving, reviewing, evaluating, and confirming the validity of Generator Cold Weather Constraints.

To address concerns about potential administrative burdens associated with repeated, known issues at generating unit(s) with a valid Generator Cold Weather Constraint, the Project 2024-03 DT developed Part 8.4. Part 8.4 provides that, in such a case, the GO will provide notice to the CEA. This helps maintain visibility over known reliability issues while reducing the administrative burdens associated with repeating requirements in this case.

The 2021-07 DT believed that Generator Cold Weather Constraint declarations would be the exception, but it is clear to the 2024-03 DT that certain conditions may exist (based on general weather patterns)

that will increase the amount of Generator Cold Weather Constraint declarations and subsequent submittals. In anticipation of that scenario, and following the June 2024 Order, the 2024-03 DT considers the NERC Process a valuable tool to capture data that may help future understanding of the effectiveness of the ECWT. The February 2023 FERC Order and subsequent NERC filing require the collection of data to evaluate the effectiveness of the EOP-012-3 Reliability Standard.

Updated Generator Cold Weather Constraint declarations would also require an update to the operating limitations provided via data specifications to the entities overseeing reliability (e.g., BA, TOP, or RC). In this manner, information relevant to valid Generator Cold Weather Constraint declarations are made available to the planning and operational entities pursuant to their data collection authority contained in TOP-003 and IRO-010. BAs, RCs, and TOPs should ensure complete coverage and timeliness of cold weather related data submission within their data specifications especially during local forecasted cold weather.

Rationale for Requirement R9

Based on multiple comments regarding Requirement R8, the FERC directive regarding periodicity of reviews, and what a GO should do if a Generator Cold Weather Constraint is determined to be no longer valid, the 2024-03 DT developed a separate new Requirement R9.

Initially EOP-012-1 required an annual review of Generator Cold Weather Constraints. That frequency of reviews was subsequently changed to five years in EOP-012-2. The June 2024 Order directed that the review frequency be increased from the five-year periodicity. While GOs should perform a review and update any Generator Cold Weather Constraint declarations as needed, the 2024-03 DT has developed language requiring a review of validated Generator Cold Weather Constraints every 36 calendar months.

Initially, the Project 2024-03 proposed that reviews be conducted every 24 calendar months. There were multiple concerns raised about the 24 calendar month periodicity. Based on consideration of these concerns, the 2024-03 DT chose, and the Standards Committee , in carrying out its responsibilities under Section 321 of the NERC Rules of Procedure, determined to carry forward the decision, to extend it to 36 calendar months. Reliability Standard CIP-014, a Reliability Standard addressing another significant risk, is proposing a review every 36 calendar months. Based on information shared at the Technical Conference held on November 12, 2024, changes to some technologies that may affect Generator Cold Weather Constraints may take a significant amount of time (well in excess of 36 months) to become available. By shortening from the five calendar years, the 36 calendar month timeline provides a reasonable approach to meeting the Commission’s directives without creating undue administrative burden to periodically monitor if Generator Cold Weather Constraints remain valid or if new technologies have become available that effectively obviate the originally validated Generator Cold Weather Constraint.

Part 9.1 addresses what a GO must do if it finds that a declared Generator Cold Weather Constraint is no longer valid. For example, a new technology exists that would address the freezing issue, and no other Generator Cold Weather Constraint criteria would apply. In that case, the GO must develop a Corrective Action Plan or update an existing Corrective Action Plan (if applicable), in accordance with the requirements for Corrective Action Plans in Requirement R7. This would include timetables specifying completion of the corrective actions in accordance with that requirement.

Attachment 1

The 2024-03 DT chose to utilize a limited and discrete list of known Generator Cold Weather Constraints as well as a description of other case-by-case situational descriptions that may constitute Generator Cold Weather Constraints. All declared Generator Cold Weather Constraints must be confirmed as valid by the Compliance Enforcement Authority. Nevertheless, the limited and discrete list is intended to describe specific circumstances that, if met, would have a very high probability of being approved. The 2024-03 DT discussed providing clarity with examples (as noted by FERC Order Paragraph 47) knowing that additional instances or conditions that may be considered a Generator Cold Weather Constraint may exist.

Per the FERC Order, NERC staff are responsible to provide a process describing the receipt, evaluation, approval (as needed), and validation of Generator Cold Weather Constraints. This process is captured in the Generator Cold Weather CAP Extension and Constraint Process ("NERC Process") document.

Once a declaration is approved by the CEA it is considered valid.

The 2024-03 DT is intentionally leaving room for additional instances of Generator Cold Weather Constraints to be presented as it would be impossible to foresee every potential set of circumstances that could possibly constitute a constraint. Furthermore, the 2024-03 DT wants to ensure that the Standard language supports the development and adoption of new freeze protection measures, practices, methods, or technologies while not immediately requiring that the new freeze protection measures, practices, methods, or technologies be implemented industry-wide. The 2024-03 DT encourages additional study and implementation of freeze protection measures to remove Generator Cold Weather Constraints, as appropriate, over time.

The 2024-03 DT updated the definition of Generator Cold Weather Constraints to provide clarity as directed by FERC. In addition to modifying the definition, the 2024-03 DT developed Attachment 1. Requirement R8 provides entities a clear understanding of what is expected when managing Generator Cold Weather Constraints and directly references use of Attachment 1. The DT broadly categorized Generator Cold Weather Constraints into two types; known and those that would be determined on a case-by-case basis.

The first of the known Generator Cold Weather Constraints, addressing low temperature operability of wind turbine towers, was debated at length in the 2024-03 DT meetings. Discussion among the Drafting Team, observers, and in the Technical Conference indicated a typical limit of -22°F for operation of wind turbines. This typical limit may apply specifically to heated areas or equipment within the nacelle and not be associated with other known ductile-to-brittle transition temperatures for specific mild steel alloys used in turbine towers. Nevertheless, unless a tower is constructed of Austenitic stainless steel or other face-centered cubic atomic structure materials, such a transition temperature generally will exist. The dynamic stresses of operating the wind turbine below such transition temperatures could imperil the structure itself. Anecdotally, it was noted that this limit would cause this Constraint to apply to a portion of the north-central United States and central Canada. It was broadly recognized that the standard needs

to recognize and allow this limitation for existing wind turbine tower equipment, and the DT sought to determine an appropriate date beyond which it should be expected that industry can meet low temperature operating capability. Ultimately, October 1, 2029 was established as the manufacturing limit date for compliance of new wind turbine towers. This was determined based on an accelerated interpretation of general feedback from the 2024-03 Technical Conference indicating that generational technological development cycles in the industry are on the order of 5-7 years. The October 1, 2029 date would allow four years beyond the anticipated implementation date of EOP-012-3 (October 1, 2025) for manufacturers to select, apply, test, and begin production of wind turbine towers constructed of materials capable of lower temperature operation appropriate for those locations with Extreme Cold Weather Temperatures below the limits associated with current tower material designs[10]. In addition, the 2024-03 DT also received feedback through industry outreach from participants indicating delivery and construction lead times for wind turbines were years into the future, providing additional support for the selected dates. The language in the Standard also requires those units to enter commercial operation before October 1, 2031, which prevents an entity from simply procuring an abundance of equipment prior to the manufacturing date limit (October 1, 2029) and constructing them over a long period of time in the future. The two-year gap was established to give a reasonable timeframe for entities to receive, construct, and commission the equipment. The DT felt that these dates would appropriately allow projects that are currently in different phases of planning or execution to be completed while also creating end dates beyond which wind turbine towers must be designed and erected to meet all aspects of EOP-012-3 and this particular known Generator Cold Weather Constraint would no longer be considered valid.

Regardless of a Generator Cold Weather Constraint being of the “known” type, a GO is still required to submit known Generator Cold Weather Constraints for approval.

The case-by-case situations and circumstances that may constitute a Generator Cold Weather Constraint are described separately. The enumerated list in Attachment 1 is not intended to be exhaustive but rather to provide clear descriptions of circumstances that may constitute Generator Cold Weather Constraints depending on the facts and circumstances presented by the GO. Generator Operators bear the burden of defending and supporting their declared constraints while the ERO bears the burden of confirming them as valid, or not.

Among these circumstances, the DT recognized the need to balance potential adverse effects to the Bulk Power System reliability caused by requiring implementing of a freeze protection measure with the beneficial effects of doing the same. Because such circumstances can and do change by location and over time, this weighing process is best done on a localized basis and ideally interactively between the GO and other affected functional entities while broadly considering immediate and potential future impacts of a declared constraint.

[10] The DT also consulted with a representative from a wind OEM with experience in operations in Northern Europe, United States, and Canada, all areas that can experience extremely low temperatures. This representative indicated that there were no wind turbine tower designs in their current and projected future global portfolio that operate at temperatures colder than -30 degrees Celsius (-22 degrees Fahrenheit). The OEM follows IEC 61400-1 Ed 2019 (Chapter 14 Cold Climate)(https://webstore.iec.ch/en/publication/26423) and when operations as low as -30 degrees Celsius is desired, low temperature environmental modification kits are added.

Two particular cases seemed particularly well-suited for a threshold for quantification of impacts: those that reduce a generating unit's real or reactive power when the freeze protection measure is not in place and those that would reduce net dependable capacity during summer or at Peak Demand. These two cases are addressed in sections 5.c. and 5.d. of Attachment 1. In them, the DT has selected a value of three (3) percent, reduction as an appropriate level of impact above which the deleterious impact to the Bulk Power System resulting from requiring a specific freeze protection measure may be appropriately determined to outweigh the benefits of applying the measure. Recognizing that local and temporal conditions are best understood, measured and predicted by the GO and affected functional entities, the DT chose to allow flexibility in the selected three percent value when a different value is supported by the appropriate functional entity as more supportive of reliable operation of the grid.

In addition to being a sensible threshold, use of a three (3) percent value has precedent in BAL-002-WECC-3 where it is used as a barometer for reliable operations in terms of Contingency Reserve.

The language provided in both the known and case-by-case portions of Attachment 1 is meant to describe criteria that are objective, unambiguous, and auditable.

In all cases, when submitting a Generator Cold Weather Constraint declaration to the CEA per Requirement R8, the GO must include documentation that defends and supports the declared constraint and also describes other compensating or mitigating freeze protection measures, if applicable, that the GO will apply. If a Generator Cold Weather Constraint declaration indicates that the application of a specific freeze protection measure or measures would adversely affect the reliability of the Bulk-Power System to an extent that outweighs the reliability benefit of applying the freeze protection measure(s), the documentation that defends and supports the constraint could properly include any assessment that the applicable functional entity (e.g., BA or RC) might agree to provide concerning the impact to the reliability of the Bulk-Power System if the constraint were to be deemed invalid by the CEA. Such an assessment, or other means of demonstrating agreement from an appropriate functional entity, would serve to strengthen the Generator Cold Weather Constraint declaration.

It should also be emphasized, as written in Attachment 1, that an approved Generator Cold Weather Constraint declaration for any specific Generator Cold Weather Critical Component does not relieve the GO of its obligation to otherwise prepare its applicable generating unit(s) to meet the requirements of EOP-012-3.

With all Generator Cold Weather Constraints, it is the responsibility of the GO to provide supporting materials to facilitate approval and validation of the Generator Cold Weather Constraint by the ERO Enterprise. As mentioned in the Requirement R8 Technical Rational discussion, the NERC Process was developed to support the FERC directives in the June 2024 Order. The 2024-03 DT believes the new definition of Generator Cold Weather Constraint, updated language throughout the Standard with

emphasis on Requirement R8, and the contents of Attachment 1 provide significant clarity to industry on what is expected for Generator Cold Weather Constraints to be considered valid.

EOP-012-3 Process Flow Chart: Below is a graphical representation demonstrating the relationship between Requirements: