NAGF
(in coordination with
Project 2024-03 DT)

Determining Extreme Cold Weather Temperature

EOP-012-3 Requirement R1

April 2025

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Introduction

NERC developed the original version of the generator cold weather preparedness Reliability Standard EOP-012-1 in 2022, under Project 2021-07 Extreme Cold Weather Grid Operations, Preparedness, and Coordination. The purpose of this project was to address standards-related recommendations from the Federal Energy Regulatory Commission (FERC)/NERC/Regional Entity staff review of generator operations during the February 2021 Winter Storm Uri event.

NERC developed the Extreme Cold Weather definition while developing Reliability Standard EOP-012-1. The definition of Extreme Cold Weather Temperature is:

> "*The temperature equal to the lowest 0.2 percentile of the hourly temperatures measured in December, January, and February from 01/01/2000 through the date the temperature is calculated*."

NERC developed Reliability Standard EOP-012-2 in 2023-2024 to address FERC Commission directives from the February 2023 Order approving Reliability Standards EOP-012-1 and EOP-011-3.[1] In its February 2023 Order, FERC directed NERC to revise EOP-012-1 to clarify the applicability of the Standard's Requirements for generator cold weather preparedness, among other things. In order to address FERC's Order, the Project 2021-07 Drafting Team (DT) modified the applicability section of EOP-012 and individual Requirements requiring any generating unit with an Extreme Cold Weather Temperature (ECWT) below 32 degrees Fahrenheit to perform certain tasks to help ensure reliable operations during extreme cold weather. In addition, with the revised applicability section, every Generator Owner must calculate an ECWT for every generating unit in the Generator Owner's fleet at least once every five (5) calendar years.

On June 27, 2024, FERC issued an Order approving Reliability Standard EOP-012-2.[2] This Order reaffirmed the ECWT definition and ordered additional modifications to EOP-012-2.

1 *N. Am. Elec. Reliability Corp.*, 182 ¶ 61,094 (2023) ("February 2023 Order").

2 *N. Am. Elec. Reliability Corp.*, 187 FERC ¶ 61, 204 (2024) ("June 2024 Order").

Goal/Problem Statement

This Implementation Guidance is focused on the Extreme Cold Weather Temperature (ECWT) value determination. This Implementation Guide is intended to provide guidance, through examples, to demonstrate how a Generator Owner could use available temperature data in a reasonable and logical manner to determine a generating unit's ECWT. The need for such guidance was identified by the following:

During the industry's efforts to determine site-specific ECWT, several issues became apparent due to the public temperature data sources cited for use in the determination efforts[3].

- The ECWT definition, when developed, assumed the existence of a continuous hourly temperature record from the year 2000 to the present.
- Practically, it is highly unlikely that a given weather station will have a complete hourly temperature record from the year 2000 to the present.
- The ECWT definition does not establish thresholds for the acceptable amount of missing or excessive temperature data.
- The minimal guidance on ECWT determination provided by Project 2021-07 DT was enhanced by Project 2024-03 DT, but examples of how to deal with missing or excessive temperature data were not provided.

Primarily, the issues of missing temperature data, dealing with multiple temperature readings within a single hour, how missing data may or may not affect the ECWT value, how to consider other temperature sources, and how to demonstrate compliance when missing data (large and small amounts) is identified, became points of concern for the industry. The goals of this Implementation Guidance are to:

- Propose some acceptable approaches for dealing with the missing data.
- Outline options for supplementing a "raw" temperature dataset with a large amount of missing data, including when to utilize a next most representative weather station.
- Suggest methodss to summarize and present the temperature data and calculations to demonstrate how missing data was addressed in the calculation.

Scope

This Implementation Guidance does not guarantee a demonstration of compliance and is based on precise language of the Standard, individual facts, circumstances, system configuration, quality of evidence, and the efforts of the registered entity when using the Implementation Guidance. This Implementation Guidance provides guidance to stakeholders on how to apply the Standard Requirement (i.e., EOP-012 R1) and implementation of the ECWT determination.

Based on industry experience, during the determination of the ECWT, missing and excessive hourly temperature data is likely to occur and can still be deemed acceptable if appropriately considered by the Generator Owner.

[3] See "Calculating Extreme Cold Weather Temperature" document at Project 2024-03 Revisions to EOP-012-2.

The scope of the Implementation Guidance is to provide examples of temperature data reasonably necessary to determine an ECWT and means to address missing and excessive temperature data, if needed. Given that the ECWT is the benchmark temperature for certain EOP-012 compliance obligations. This Implementation Guidance will additionally address the scenario for when the ECWT is determined to be a few degrees above 32 degrees Fahrenheit with imperfect data, due to the significant impact this may cause to the final ECWT value and resulting compliance obligations.

In general, most ECWT determinations will be based on publicly available data (e.g., NOAA/NWS or ASOS). However, there may be entities that have privately recorded on-site temperature data available for use. In some cases, the private data may be a full dataset (i.e., timeline provided in ECWT definition), but it is likely that a full dataset may not exist. The examples provided below are focused on publicly available data, but private data may fit the examples as well (i.e., either as the primary or secondary source). One key point to recognize by an entity using private data is that demonstrating the use of that data may require more interaction or engagement with regulators without direct access to the data. Private data use in the determination of ECWT will likely require a thorough review of internal controls (e.g., controls associated with the maintenance, retrieval, and storage) used to manage the data source, along with review of the weather station location.

The examples provided in the Implementation Guidance are not meant to be all inclusive, as there are likely other methods for implementing EOP-012. The ERO Enterprise's endorsement of an example means the ERO Enterprise CMEP staff will give these examples deference when conducting compliance monitoring activities. Registered entities can rely upon the examples and be reasonably assured that compliance requirements will be met with the understanding that compliance determinations depend on facts, circumstances, and system configurations (e.g., evidence provided.)

Reliability Standard Overview

EOP-012 requires the determination of ECWT in Requirement R1. Project 2021-07[4] introduced the term and the definition to provide a consistent threshold for Generator Owners to use. Other Requirements and definitions within EOP-012 are dependent upon the ECWT to determine additional compliance obligations. This makes the ECWT determination crucial for Generator Owners to demonstrate compliance with the entire Standard. It should be noted that the ECWT is simply a threshold temperature value at and above which capability to operate generating unit(s) is a compliance obligation.

In addition to introducing the ECWT definition, the Project 2021-07 DT developed a document ("*Calculating Extreme Cold Weather Temperature*"[5]) illustrating how to determine the ECWT for any specific location. Project 2024-03 DT updated this document during the Standards development process and provided significant changes emphasizing the management of missing data due to industry concerns

[4] Project 2021-07 Extreme Cold Weather Grid Operations, Preparedness, and Coordination

[5] See "Calculating Extreme Cold Weather Temperature" document at Project 2024-03 Revisions to EOP-012-2.

that had been raised. This Implementation Guidance will enhance the understanding of how to address concerns associated with missing or excessive hourly temperature data.

EOP-012-3 (proposed as of January 2025) Requirement 1 related to the ECWT:

R1. At least once every five calendar years, each Generator Owner shall, for each of its applicable generating unit(s): [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]

1.1. Calculate the Extreme Cold Weather Temperature for each of its applicable generating unit(s) and identify the calculation date, source(s) of temperature data, and adjustments utilized for missing or invalid hourly temperature data, if necessary; and

1.1.1. If the recalculated Extreme Cold Weather Temperature is lower than the previous Extreme Cold Weather Temperature, the entity shall review and update its cold weather preparedness plan(s) under Requirement R4 within six (6) calendar months of the recalculation, and if new corrective actions are needed, to provide the required operational capability described in Requirement R2 or R3, the entity shall develop a Corrective Action Plan within six (6) calendar months of the recalculation.

The general premise is that missing hourly temperature data will likely occur. Historical experience with ECWT calculations by the industry has shown that missing or excessive data occurs in the publicly available temperature data sources, especially for weather stations in remote areas of North America. That is, more complete datasets are typically found for locations such as large airports near major population centers. Because a percentile value is used to determine ECWT, that is, a positional data point location within the ranked data, both excessive and missing data may or may not affect the ECWT, depending on the dataset. Regardless, an examination of the data available, and an explanation of how excessive or missing data is treated should be part of determining the ECWT. This Implementation Guidance provides alternate methods that can be used to judge acceptable treatment of incomplete or excessive data.

"Where" the temperature data is missing or excessive within the raw dataset can be critically important to the ECWT value, followed by "how" much is missing or excessive. Determining a "raw" ECWT value based on data available is the first step in determining the validity of the ECWT. Simple data checks, using for example Microsoft Excel (Excel)[6], will help an entity document what, if any, next steps may need to be taken. The ECWT definition dictates how many values are expected to be available (number of days in the month for each year going back to 1/1/2000 for the months of December, January, and February, times 24 hours.) A simple check of the "raw" data will indicate if the dataset has the expected number of values, is missing values, or has more than the expected number of values. Excel can find holes in a dataset or "extra" data through simple comparisons of the timestamps provided and flagging accordingly. Simply stating, "statistically the number of values missing is irrelevant" without examining the raw data is not a

[6] Note this Implementation Guidance assumes that the user has some capability to use spreadsheet software (and embedded functions), such as Excel. The ECWT calculation document has some examples on how to process an hourly temperature dataset, but Excel also has excellent support materials online.

sufficient justification for accepting the raw data. These examples require review of the data to validate the ECWT is reasonable, including documenting the results. Such examination is not considered overly burdensome, given the ECWT is calculated every five calendar years. It is important to build simple data checks, such as the number of hourly temperature values expected (fewer or more hourly temperature values can occur) or checking for the lowest recorded hourly temperature, into the ECWT determination efforts and to document the results accordingly.

The use of "percentile" incorporates statistics into the determination of the ECWT. Webster's dictionary definition of percentile is "The value below which a certain percent of data falls." Using this statistical approach, the ECWT simply becomes a value in the list of temperature data when the dataset is arranged in numerical order from lowest to highest. For example, if there were 50,000 hourly data values, the 0.2 percentile value is the 100th value (100/50000 = 0.002 = 0.2 percentile) in the list. Any missing hourly data BELOW that ECWT value could impact the ECWT determined value. (Excel is able to determine the percentile without sorting the data. However, in some cases, arranging the data in this manner may help an entity understand the data better).

The examples provided below are considered acceptable methods to demonstrate compliance with EOP-012 (subject to CEA review of documentation.) Other examples may exist and would need to be explained to the CEA as the need arises. The Standard requires ECWT to be calculated for each generating unit. Locations where multiple generating units exist and a single ECWT was determined should be reflected within the documentation as the Reliability Standard language uses "generating unit." Additionally, there are terms that require professional judgement such as "representative of the generating unit location" when discussing use of different weather stations. Documenting what an entity considered "representative of the generating unit location" will be important when compliance evaluations are being made. What considerations an entity provides when using data from other sources (not necessarily the closest source due to a variety of reasons as noted by industry) is important to document.

Need for ECWT review when close to 32 degrees Fahrenheit

Consider a general case of missing hourly data when the ECWT was determined to be a few degrees above 32 degrees Fahrenheit. Using the 50,000 hourly data values example described above, if a Generator Owner is missing the 90th through the 99th hourly temperature values, the ECWT would essentially move to the 110th value on the list. It is possible that the 100th value and 110th value are equivalent. If so, the ECWT remains unchanged. If the 100th value and 110th values are different, the ECWT would change to the 110th value. If the ECWT is close to 32 degrees Fahrenheit and if there is missing temperature data below 32 degrees Fahrenheit, this missing data could determine whether some Requirements in EOP-012 (e.g., R2 or R3) are applicable. This is why when a determined ECWT is "close" (i.e., within several degrees) to 32 degrees Fahrenheit, a very thorough review is a prudent approach. If an ECWT is well below 32 degrees Fahrenheit, the amount of missing data may not be significant enough to approach 32 degrees Fahrenheit (as shown by some of the examples below).

	30		30
	30		
	30		
	31		31
	31		31
	31		31
	31		31
ECWT	31	ECWT	31
32	31	33	31
	31		31
	32		32
	32		32
	32		32
	32		32
	33		33

Table 1 Sample ECWT dataset near 32 degrees Fahrenheit

As shown in Table 1 above, two missing hourly values caused the ECWT to drift above 32 degrees Fahrenheit.

A similar detailed examination should also occur in the case of “excess data”, i.e., those datasets containing more than one temperature value per hour. For those datasets which are consistent, that is, every hour contains the same number of temperature values, the presence of excess data will not skew the results because every hour will carry the same “weight” in the statistical ranking. However, when excess data appears only in some hours, these “heavier” hours will influence the percentile ranking. One solution is to remove the excess data from the raw dataset resulting in only one temperature value per hour for every hour (see example below). Alternately the location of the excess temperature data within the dataset can be examined to determine if it is preferentially above *or* below 32 degrees Fahrenheit. It is assumed that the multiple readings per hour may continue, but that may not always be the case. It may be easier to trim the excess data to a single value to remain consistent over time. Excess data can be sufficient to move the ECWT above or below 32 degrees Fahrenheit depending upon the dataset and the approach to the dataset.

When combining data from different weather sources, care must be taken so that the sites sample temperature data with the same frequency. For example, if one site measures data three times per hour and the second site measures data one time per hour, this will bias the 0.2 percentile to the more frequently sampled site. An entity may consider a couple of approaches that could be utilized here if an entity sees this data discrepancy. The entity could simply average each hour in the more frequently sampled site to create a single value for each hour (versus three) to be utilized in the determination of ECWT. Another approach is to consider requiring the use of the single data value information for a certain percentage of the overall points. The entity could also trim excessive hourly temperature data to a single

data point for each hour. The entity would document the efforts in the Excel document where the ECWT was determined (dates/sources included).

The table below lists some general options with corresponding examples provided to help illustrate approaches to demonstrate compliance. Documentation is the key to demonstrate compliance with EOP-012.

Option	Suggested Analysis	Corresponding Examples
Accept the "raw" data	• Determine ECWT using "raw" data from the primary weather station. • Determine that any missing data would not materially change the ECWT (e.g., missing data did not occur during known locally significant extreme cold events.)	• Example 1 • Example 2 • Example 3 • Example 4
Find the next most representative weather station with a more complete record	• Determine ECWT using the "raw" data from the primary weather station and the dataset is missing a significant amount of data. • Determine that the next most representative weather station record is in substantial agreement with the available "raw" data and it is more complete than the primary weather station. • Determine the ECWT using the next most representative weather station.	• Example 5
Fill-in missing data from secondary source	• Determine ECWT using the "raw" data from the primary weather station. • Determine that the secondary source (e.g., ASOS) is in substantial agreement with the available "raw" data. • Fill-in missing data in the "raw" dataset using the secondary source. Determine the ECWT using augmented "raw" data.	• Example 6
Multiple values per hour (i.e., excessive data values)	• Determine ECWT using "raw" data from the primary weather station. • Address multiple hourly temperature values by using a consistent treatment for all hours with multiple values (e.g., first value of every hour, averaging the multiple values) for each hour in the dataset with multiple readings. OR • Determine ECWT using the "raw" data from the primary weather station. Noted that	• Example 7 • Example 8

	multiple readings per hour were included for several larger periods of time. • Determine that the secondary source (e.g., ASOS) is in substantial agreement with the available "raw" data for those hours without multiple temperature values. • Override multiple temperature data periods in the "raw" dataset using the secondary source with singular hourly temperature data points for those temperature data periods.	
Comparison when missing data	• Determine ECWT using the "raw" data from the primary weather station. • Show that the secondary source (e.g., ASOS) is in substantial agreement with the available "raw" data. • Show that the next most representative weather station record is in substantial agreement with the "raw" data. • Show that loss of data in the primary and secondary temperature data source does not affect the ECWT when compared.	• Example 9

Table 2 General Options

Example 1

Entity A downloads temperature data from a publicly available data source. The data source for the single location provides 50,000 unique hourly measured temperature values (i.e., no hour contains more than one reading) out of an expected number of 55,584 (the number of hours between January 1, 2000, through February 28, 2025, using January, February, and December hours). The ECWT determined from this dataset is 10 degrees Fahrenheit. Entity A uses 168 consecutive hours of missing data in a single block as criteria to review the dataset closer. Entity A reviews the data and determines there is no single large block greater than 168 hours of hourly data missing. The compliance obligations are unchanged by the missing data and Entity A documented the analysis efforts in the Excel document where the ECWT was determined (dates/sources included).

Example 2

Entity B attempted to download NOAA/NWS and ASOS temperature data for its generating unit to determine the ECWT per the Calculating Extreme Cold Weather Temperature document referenced in footnote 5. There were no weather stations available within a short distance of the generating unit(s). The entity chose the closest weather station that represented a similar geophysical setup of the generating site (e.g., similar altitude, no mountain ranges between sites, etc.) and determined the ECWT. Entity B documented the analysis efforts in the Excel document where the ECWT was determined (dates/sources included).

Example 3

Entity C downloaded NOAA/NWS temperature data from a weather station close to the generating unit to determine the ECWT per the Calculating Extreme Cold Weather Temperature document referenced in footnote 5. Using Excel, the entity noted a minimal amount of missing hourly temperature values (e.g., 500). Entity C determined that mathematically, the number of missing values do not affect the ECWT. This is done by capturing the count of hourly temperature values below and just above the ECWT and comparing the number of missing values. The ECWT was determined to be 37 degrees Fahrenheit. Using Excel, the entity flagged and filtered on the missing hourly data and noted that most of the missing hourly data points were "sandwiched" by other temperature values above the ECWT (e.g., 50 degrees Fahrenheit for hour one, hour two missing, 49 degrees Fahrenheit for hour three). The remaining number of temperature data values at or below the ECWT do not move the ECWT by five degrees. There were more temperature values between 37 and 32 degrees Fahrenheit then there were missing values. Entity C documented the analysis efforts in the Excel document where the ECWT was determined (dates/sources included).

Example 4

Entity D downloaded NOAA/NWS temperature data from a weather station close to the generating unit(s) to determine the ECWT. Using Excel, Entity D noted six years of missing data. A check of ASOS temperature data at a nearby weather station determined the issue was not present for the same six years and ASOS data was significantly more complete. Entity D used the ASOS data for the ECWT determination. Entity D documented the analysis efforts in the Excel document where the ECWT was determined (dates/sources included).

Example 5

Entity E downloaded NOAA/NWS temperature data from a weather station close to the generating unit to determine the ECWT per the Calculating Extreme Cold Weather Temperature document referenced in footnote 5. Using Excel, Entity E noted that the number of values expected based on the ECWT definition was significantly higher than the number in the extracted dataset, indicating that approximately 10,000 temperature values were missing. No reason(s) for the missing values were provided on the NOAA/NWS site. Entity E decided to use another NOAA/NWS site five miles further away from the generating unit and found that only 500 values were missing. The ECWT was determined to be 37 degrees Fahrenheit using the second dataset, which is well above 32 degrees Fahrenheit. Using Excel, the entity flagged and filtered on the missing hourly data and noted that those points were dispersed randomly throughout the dataset. Entity E also noted that most of the missing hourly data points were "sandwiched" by data values above the ECWT (e.g., 50 degrees Fahrenheit for hour one, hour two missing, 49 degrees Fahrenheit for hour three). Entity E reviewed the number of remaining hourly values and determined the number of temperature values sandwiched by other temperature values at or below the ECWT (even after an attempt at interpolation) does not change the ECWT by five degrees. There were more values between 37 and 32 degrees Fahrenheit than there were missing values. Entity E documented the analysis efforts in the Excel document where the ECWT was determined (dates/sources included).

Example 6

Entity F downloaded NOAA/NWS temperature data from a weather station close to the generating unit to determine the ECWT. Using Excel, Entity F noted six years of missing data. A check of ASOS temperature data at a nearby weather station determined the issue was not present for the same six years but was missing data in other years that were present in the NOAA/NWS dataset. Entity F combined the two weather website's temperature data to determine its ECWT by including the six years of ASOS data with the NOAA/NWS missing data. Entity F documented the analysis efforts in the Excel document where the ECWT was determined (dates/sources included).

Example 7

Entity G downloaded temperature data from NOAA/NWS and noted that the majority of the hours included multiple hourly readings (e.g., three temperature readings for the 2:00 a.m. to 3:00 a.m. hour at 2:12, 2:36, and 2:58 respectively). Entity G determined the ECWT by selecting the first reading of each hour for every hour within the dataset. Entity G documented the analysis efforts in the Excel document where the ECWT was determined (dates/sources included).

Example 8

Entity H downloaded temperature data from NOAA/NWS and noted that several years of the data included multiple hourly readings (e.g., three temperature readings for the 2:00 a.m. to 3:00 a.m. hour at 2:12, 2:36, and 2:58 respectively). In an effort to retrieve singular hourly data, Entity H downloaded temperature data from ASOS and noticed singular temperature data values were noted in the NOAA/NWS years with multiple hourly readings. However, the ASOS data was missing several years of temperature data. Entity H combined the two datasets using the singular temperature data values from the NOAA/NWS and ASOS sites to determine an ECWT (ensuring no overlap of timeframes existed). Entity H documented the analysis efforts in the Excel document where the ECWT was determined (dates/sources included).

Example 9

Entity I downloaded NOAA/NWS temperature data from a weather station close to the generating unit to determine the ECWT per the Calculating Extreme Cold Weather Temperature document referenced in footnote 5. Using Excel, Entity I noted six years of missing data (approximately 13,000 hourly temperature values). A check of ASOS temperature data determined the issue was still present. No other weather stations close to the generating site were available in NOAA/NWS, and therefore ASOS temperature data was determined to adequately represent the generation site. However, Entity I did look at the next closest weather station to compare weather patterns for the years where data was available. Weather patterns were similar in nature including known events (e.g., cold snap occurred, and temperature changes could be seen although they differed in time and temperature). When analyzing the data, as a test, the entity removed the same six years of data from the farther weather station data. This resulted in no change to the ECWT at the next closest weather station when compared to the nearer weather station information (both NOAA/NWS and ASOS). Based on this analysis Entity I concluded the ECWT determination for the closest weather station was adequate to utilize.

If there was a change, based on the comparison, that did lower the ECWT to below 32 degrees Fahrenheit, Entity I should address the change (i.e., recognize the ECWT below 32 degrees Fahrenheit and act accordingly). Entity I documented the analysis efforts in the Excel document where the ECWT was determined (dates/sources included).

Periodic Review

The NAGF and the Project 2024-03 DT submitted the initial version of this Implementation Guidance document to NERC. When the Project 2024-03 DT disbands assuming no further changes to EOP-012 are required by FERC or the industry under this Project, the obligation to periodically review this document should fall to the NAGF. At a minimum, periodic reviews should occur every five (5) calendar years to align with the ECWT recalculation Requirement with EOP-012. If there are trends noted in the compliance monitoring process, the NAGF or RSTC may consider more frequent ad hoc reviews. If a change to the ECWT definition occurs, the drafting team considering the definition change should update the Implementation Guidance if impacted. Periodic reviews may also occur when there are updates or revisions to documents such as relevant Reliability Standards, FERC Orders, FERC Interpretations, Reliability Standard Audit Worksheets (RSAW), Endorsed Implementation Guidance, Endorsed Practice Guides, Compliance Bulletins and Directives, Reliability Standard Implementation Plans, Reliability Standard Guidelines and Technical Basis, Technical Rationale, or new technology for source data becomes readily available.

NERC is collecting data per the 'Cold Weather Generator Data Collection Request for Data or Information' directive from FERC to evaluate the ECWT determinations. Specifically, the Commission directed NERC to develop a plan that included, at a minimum, data that will help the Commission understand what portion of a generator's fleet is capable of performing at the Extreme Cold Weather Temperature for the location, what portion is under a Corrective Action Plan (and until when), and what portion will not be winterized due to declared constraints. When NERC provides feedback based on the data collection effort, a change may be required to this Implementation Guidance. Industry should be cognizant of those type of impacts and request reviews as needed from the RSTC, a drafting team or other Pre-Qualified Organization. The periodic reviews are to ensure the Implementation Guidance, if endorsed, will remain current and valid.

Reviewed By	Title	Comments / Notes	Review Date	Next Scheduled Review Date
Project 2024-03 DT	Various	Project 2024-03 DT members	3/6/2025	n/a
NAGF	Various	NAGF members	XXX/2025	Xxx/2030

Year	Expected Data				Actual Data									
	Start Date	End Date	Num. of Days	Num. of Hours	Actual Readings	Max Temp (°F)	Min Temp (°F)	Avg Temp (°F)	Excessive Data (Dt < 1 hr)	Hourly Data (Dt = 1 hr)	Missing Data (Dt > 1 hr)	Dt Max (hrs)	Dt Min (hrs)	Dt Avg (hrs)
1	1/1/00	2/29/00	60	1,440	1,439	76	7	39	261	959	219	2.000	0.067	1.001
2	12/1/00	2/28/01	90	2,160	2,220	70	3	33	474	1,406	340	5.067	0.067	0.973
3	12/1/01	2/28/02	90	2,160	2,193	73	14	41	429	1,414	350	6.000	0.067	0.985
4	12/1/02	2/28/03	90	2,160	2,141	63	3	33	337	1,453	351	5.067	0.933	1.009
5	12/1/03	2/29/04	91	2,184	2,159	68	0	37	349	1,441	369	5.067	0.933	1.012
6	12/1/04	2/28/05	90	2,160	2,161	70	2	39	259	1,660	242	2.000	0.067	1.000
7	12/1/05	2/28/06	90	2,160	2,156	71	9	39	16	2,120	20	2.000	0.933	1.002
8	12/1/06	2/28/07	90	2,160	1,968	69	5	37	1	1,776	191	3.000	1.000	1.098
9	12/1/07	2/29/08	91	2,184	2,168	73	7	38	3	2,148	17	2.067	0.933	1.007
10	12/1/08	2/28/09	90	2,160	2,144	71	-1	35	2	2,125	17	2.000	0.917	1.007
11	12/1/09	2/28/10	90	2,160	1,560	63	7	32	14	939	607	2.000	0.067	1.384
12	12/1/10	2/28/11	90	2,160	1,543	70	7	34	13	907	623	2.067	0.067	1.399
13	12/1/11	2/29/12	91	2,184	1,688	70	17	41	6	1,183	499	2.000	0.067	1.293
14	12/1/12	2/28/13	90	2,160	2,077	74	9	40	3	1,990	84	2.000	0.183	1.040
15	12/1/13	2/28/14	90	2,160	2,156	72	-3	33	1	2,151	4	2.000	1.000	1.002
16	12/1/14	2/28/15	90	2,160	2,160	63	-5	34	1	2,159	0	1.000	1.000	1.000
17	12/1/15	2/29/16	91	2,184	2,179	75	7	41	1	2,173	5	2.000	1.000	1.002
18	12/1/16	2/28/17	90	2,160	2,157	81	9	43	1	2,153	3	2.000	1.000	1.001
19	12/1/17	2/28/18	90	2,160	2,161	81	0	38	3	2,158	0	1.000	0.050	1.000
20	12/1/18	2/28/19	90	2,160	2,160	70	3	40	3	2,156	1	2.000	0.033	1.000
21	12/1/19	2/29/20	91	2,184	2,182	72	16	42	4	2,173	5	2.000	0.950	1.001
22	12/1/20	2/28/21	90	2,160	2,158	67	11	37	2	2,153	3	2.000	0.950	1.001
23	12/1/21	2/28/22	90	2,160	2,159	73	8	41	5	2,149	5	2.000	0.917	1.000
24	12/1/22	2/28/23	90	2,160	2,159	76	-5	44	1	2,157	1	2.000	1.000	1.000
25	12/1/23	2/29/24	91	2,184	2,183	76	3	42	3	2,178	2	2.000	0.250	1.000
Full Record	1/1/00	2/29/24	2,226	53,424	51,431	81	-5	38	2,192	45,281	3,958	6.000	0.033	1.039

Table 3 Example of Summarized Data Evaluation

The intent of Table 3 is just to provide some concepts on evaluating the quality of the temperature data being considered. For context, the ECWT determined for this weather station using the data values was 3 degrees Fahrenheit. The examples provided in the body of the Implementation Guidance may then be applicable.

In Table 3 “Dt” represents the time interval between datapoints (i.e., timestamp of readings). Most years “Dt” is only “2 hrs” meaning there was only one consecutive missing value (e.g., 1:00 a.m., 3:00 a.m. results in a “Dt” of “2 hrs”). “Dt” may be considered as an indicator of how excessive or missing data may

affect the ECWT determination. For years where the average "Dt" is close to "1", the analysis efforts may be minimal. When "Dt" is significantly higher or lower than "1", additional analysis efforts may be required.

The row labeled "Full Record" represents a summary of the data gathered for analysis (e.g., in this case 25 years). For the "Temp" columns, the values in the "Full Record" row represent the maximum temperature value, the minimum temperature value, and the average temperature value for the entire dataset. For the "Data" columns the values in each of the rows (including the "Full Record" row) represent the number of data points where there are "Excessive" temperature values within an hour (e.g., instances where there were more than one temperature reading within an hour which equates to the value for "Dt < 1"), where there is exactly one hour between readings ("Hourly"), and the number of "Missing" data points values (i.e. equates to "Dt > 1"). You will note that if you add the "Excessive", "Hourly", and "Missing" cells you will equal the value of "Actual Readings" early in the Table. The "Dt" max, min, and average columns are simply that value within a given year (as well as for the "Full Record" row considering all the years.)

Appendix – Sources and Resources

Project 2024-03 Revisions to EOP-012-2
Calculating Extreme Cold Weather Temperature