ConocoPhillips Alaska

ConocoPhillips Alaska, Inc.

Nuiqsut Air Quality Monitoring Station
Annual Trends Analysis Report

January 1, 2020 through December 31, 2020

Table of Contents

APPENDIX A

Table of Figures

Table of Tables

Acronyms:

AQMS: Air Quality Monitoring Station
AQI: Air Quality Index
CPAI: ConocoPhillips Alaska Inc.
CO: Carbon Monoxide
NO_2: Nitrogen Dioxide
O_3: Ozone
PSD: Prevention of Significant Deterioration
$PM_{2.5}$: Particulate Matter ≤ 2.5µm
PM_{10}: Particulate Matter ≤ 10µm
SO_2: Sulfur Dioxide
µg/m^3: microgram per cubic meter

Revisions:

Revision 1.0: March 2021 – Submittal SLR

I. Introduction

1. Project Summary

ConocoPhillips Alaska Inc. (CPAI) operates an ambient air quality and meteorology monitoring station in Nuiqsut, Alaska, which is located on the Alaska North Slope. The station is located at the northern edge of Nuiqsut, approximately 400 meters north-northwest of the community electrical generators, and comprises the Nuiqsut Ambient Air Quality and Meteorological Monitoring Program. Currently, the Nuiqsut Monitoring Program is being conducted to document air quality in Nuiqsut and the data may also be used to support various ambient air quality impact analyses conducted for oil field development in the nearby areas.

The monitoring program consists of an ambient air quality monitoring station and a meteorological monitoring tower directly mounted to the air quality monitoring structure. The program is designed and operated in accordance with applicable Prevention of Significant Deterioration (PSD) regulations and guidance documents. The specific project objectives of the Monitoring Program are to:

- Collect data to document Nuiqsut air quality and address community concerns related to regional oilfield development.
- Establish a monitoring system to measure, with known accuracy and precision, meteorological parameters at the project site from ground level up to 10 meters.
- Provide required and relevant optional meteorological data for American Meteorological Society/Environmental Protection Agency (EPA) Regulatory Model Improvement Committee Model (AERMOD) modeling system.
- Establish a monitoring system to measure, with known bias and precision, the ambient concentrations of the criteria air quality pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM) with an aerodynamic diameter of 10 microns or less (PM_{10}), and particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$) to establish National Ambient Air Quality Standards (NAAQS) compliance status for the monitoring location.

Data review and validation procedures and monitoring program data and measurement quality objectives (MQO's) are provided in the Nuiqsut Ambient Air Quality and Meteorological Monitoring Station Quality Assurance Project Plan Revision 2.1 approved by Alaska Department of Environmental Conservation in September 2012.

Figure 1 shows a map of the Nuiqsut Air Quality Monitoring Station (AQMS) location and Figure 2 displays an aerial view of the village of Nuiqsut with the AQMS.

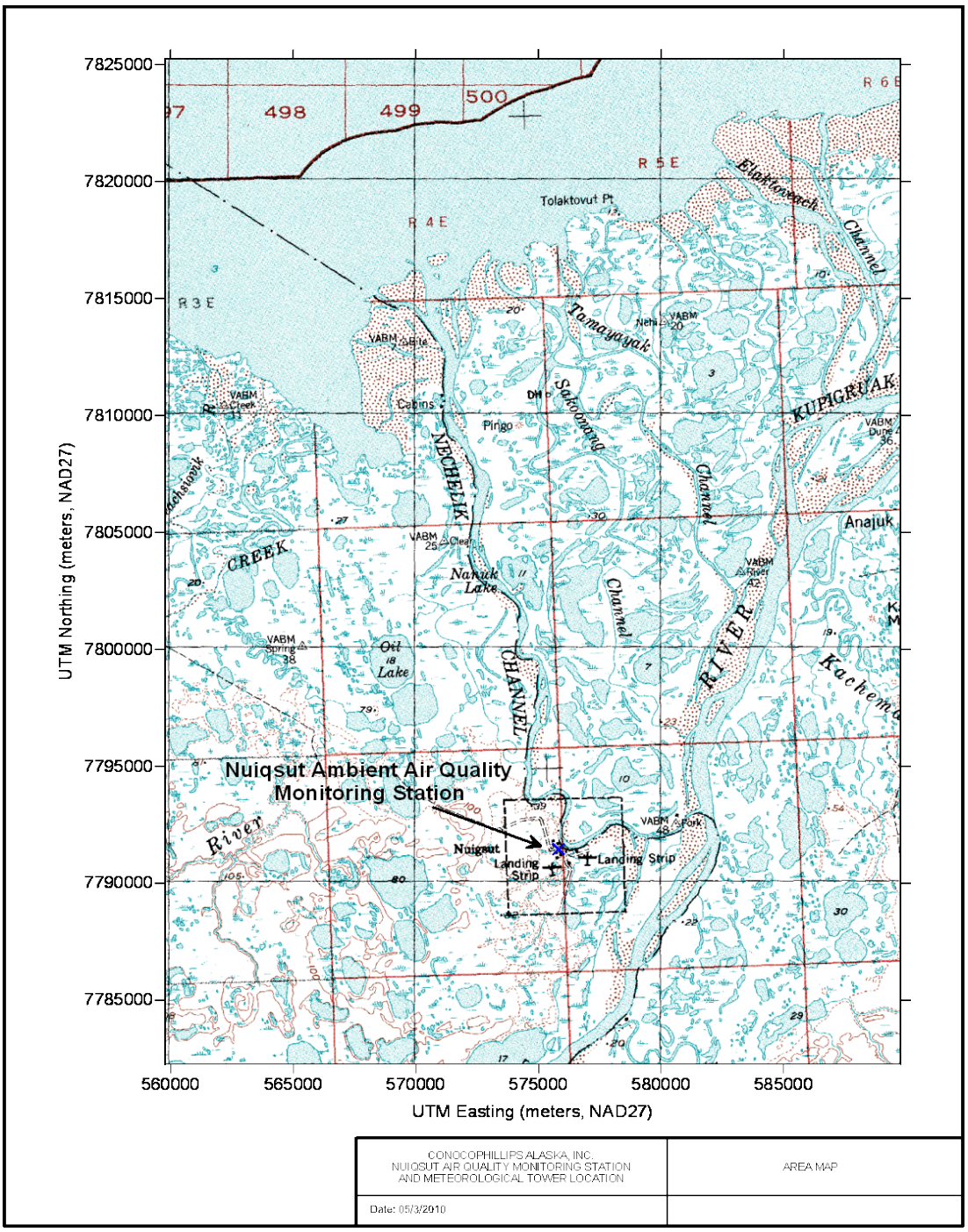


Figure 1: Map of Nuiqsut AQMS location

Figure 2: Aerial view of Nuiqsut village with AQMS location

2. Air Quality Index (AQI)

The Air Quality Index (AQI) is converted from actual observed concentrations to a 0 to 500 scale meant to represent effects on human health. The higher the AQI value, the greater the level of pollutants in the air, and the greater the health concerns. For example, an AQI value of 50 represents good air quality with little potential to affect public health, while an AQI value over 300 represents hazardous air quality. An AQI value of 100 directly corresponds to the national air quality standard (NAAQS) for the pollutant, which is the level EPA has set to protect public health. NAAQS information is present on the following website: https://www.epa.gov/criteria-air-pollutants/naaqs-table.

AQI values below 100 are generally thought of as acceptable. When AQI values are above 100, air quality is considered to be unhealthy – between 101 and 150, unhealthy for sensitive groups of people, then as AQI values get above 150, unhealthy for everyone. Table 1 provides a view of the EPA AQI levels of health concern.

Table 1: EPA Air Quality Index Levels of Health Concern

Level	Range	Description
Good	0 to 50	Air Quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	Air Quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects: members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health alert; everyone may experience more serious health effects.
Hazardous	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected

The AQI is designed to describe the quality of the air, and what associated health effects might be a concern. When used in a predictive, or forecasting, manner, the AQI calculation weighs higher concentration individual hourly measurements greater and uses those hourly values when determining a daily AQI. This focuses on potential worst-case health effects that may be experienced within a few hours or days after breathing the air. As a result, predictive AQI is often higher than what would be determined if AQI is assigned after calculating the averaging period associated with the NAAQS (i.e. –24-hour average $PM_{2.5}$ or 8-hour average CO for example). More information on AQI is presented in Appendix A.

II. Nuiqsut Monitoring Trends Summary

3. Quarterly Air Quality Index (AQI) Trends

Figure 3 through Figure 6 present quarterly actual AQI trends for year 2020 at the Nuiqsut AQMS. Actual AQI represents AQI values directly measured by the AQMS after calculating the averaging period associated with the NAAQS (i.e. – 24-hour average $PM_{2.5}$ or 8-hour average CO for example). Each pollutant is plotted with a different marker, so that the reader may interpret which pollutants drive the AQI at various intervals. “Daily” and “24-hour” are used throughout the report to match the definitions established for the calculations of the NAAQS and AQI. The daily AQI is defined as the highest of the day, which corresponds to the highest marker on the plot. Pollutants are not plotted if data is not available for at least 75% of the day. Colors corresponding to AQI levels are displayed in the background and actual AQI values on the left axis. Because the AQI at Nuiqsut was not measured above 150 in 2020, some AQI regions are not graphed. AQI levels from good to moderate included are considered satisfactory. Additional AQI information is presented in Appendix A.

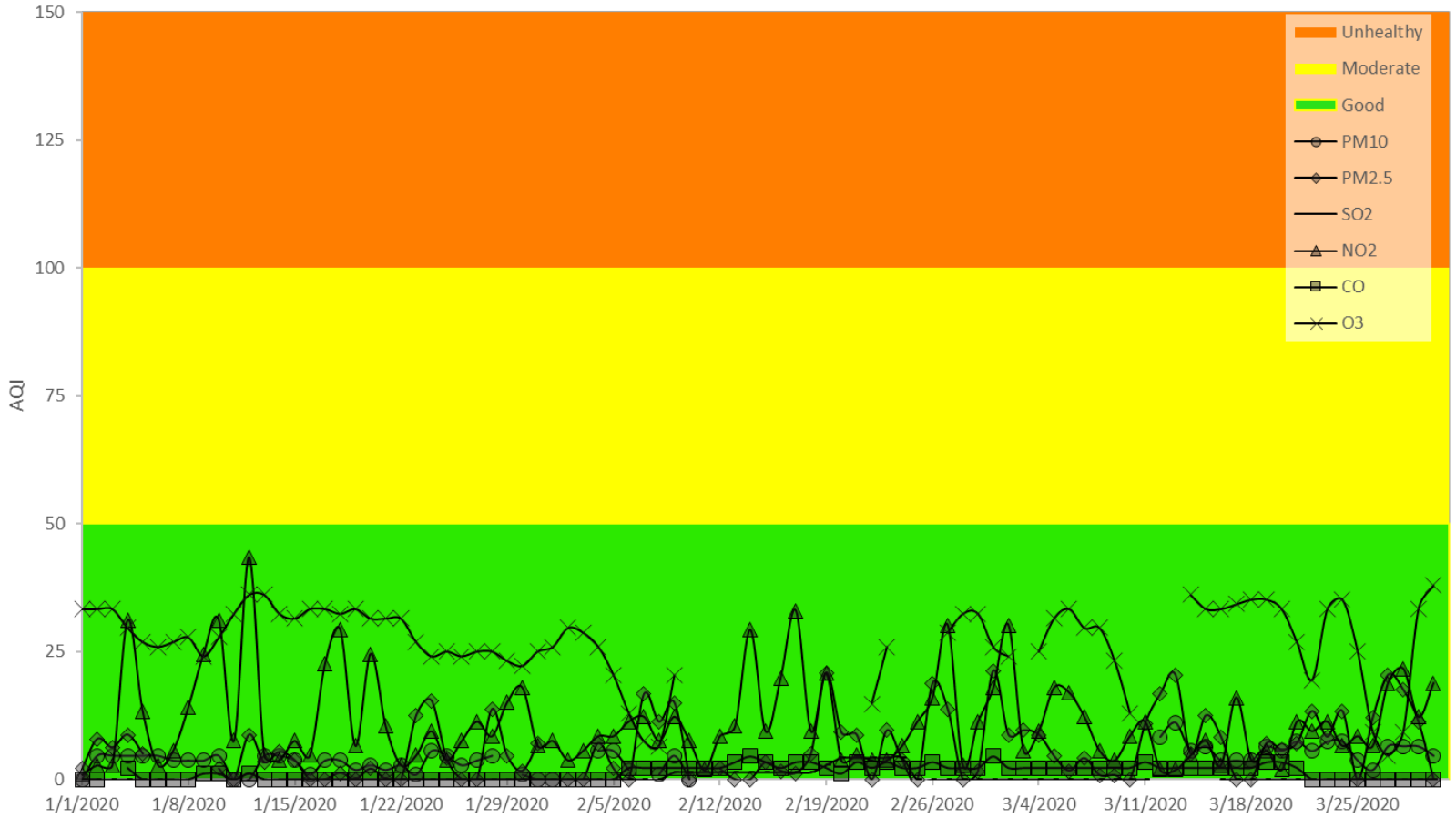


Figure 3: First Quarter 2020 Nuiqsut AQMS Daily Reported AQI Summary

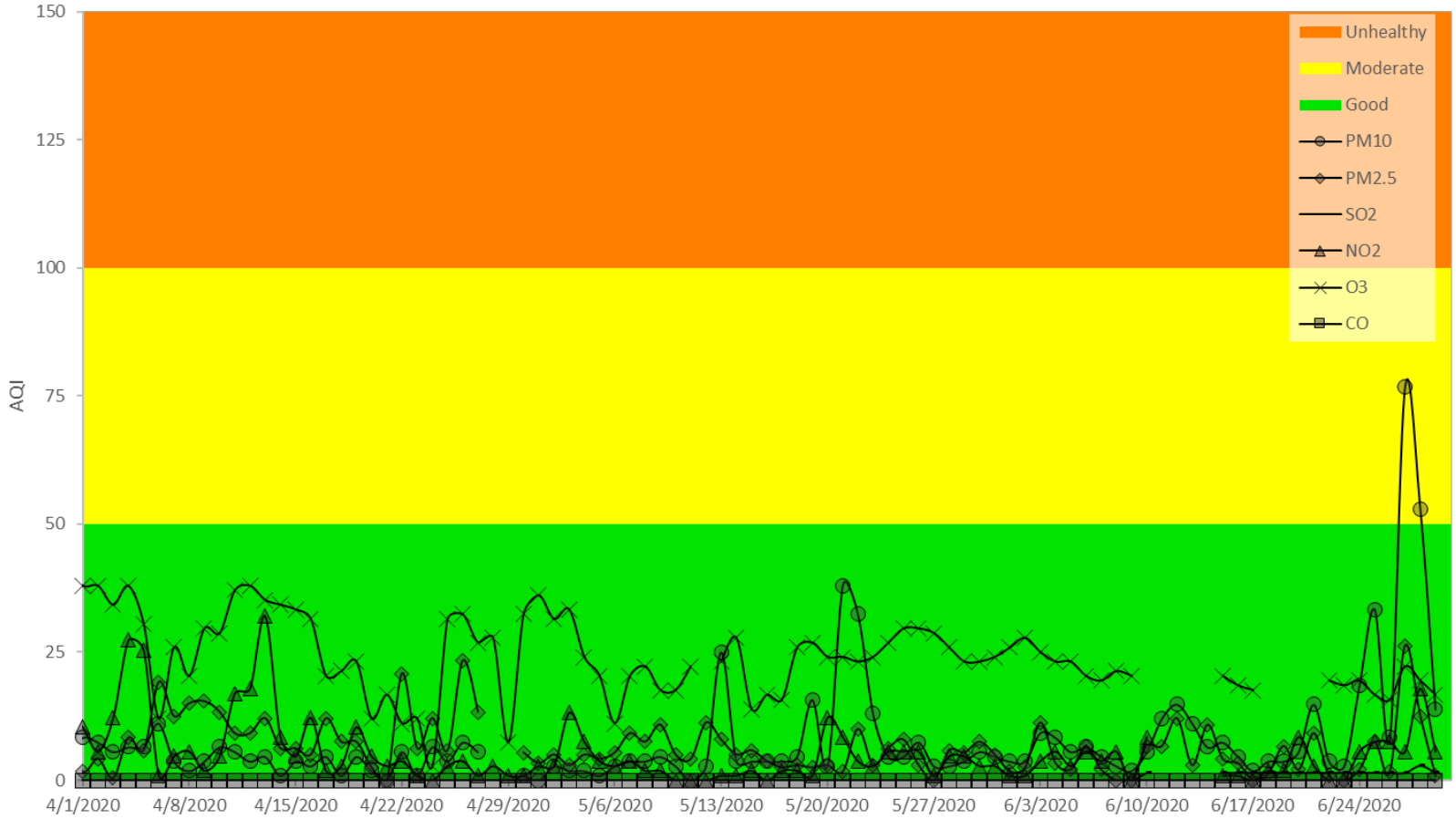


Figure 4: Second Quarter 2020 Nuiqsut AQMS Daily Reported AQI Summary

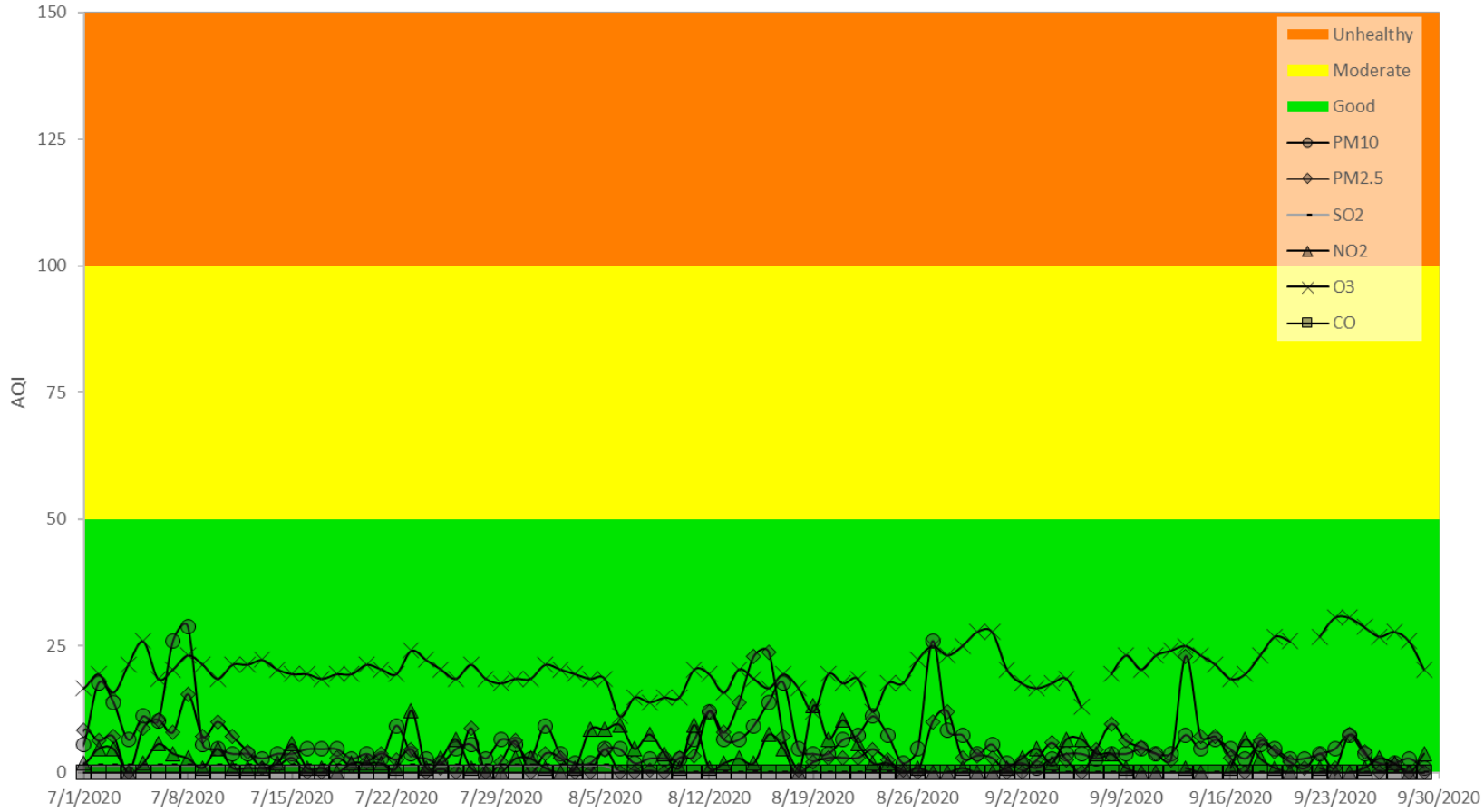


Figure 5: Third Quarter 2020 Nuiqsut AQMS Reported AQI Summary

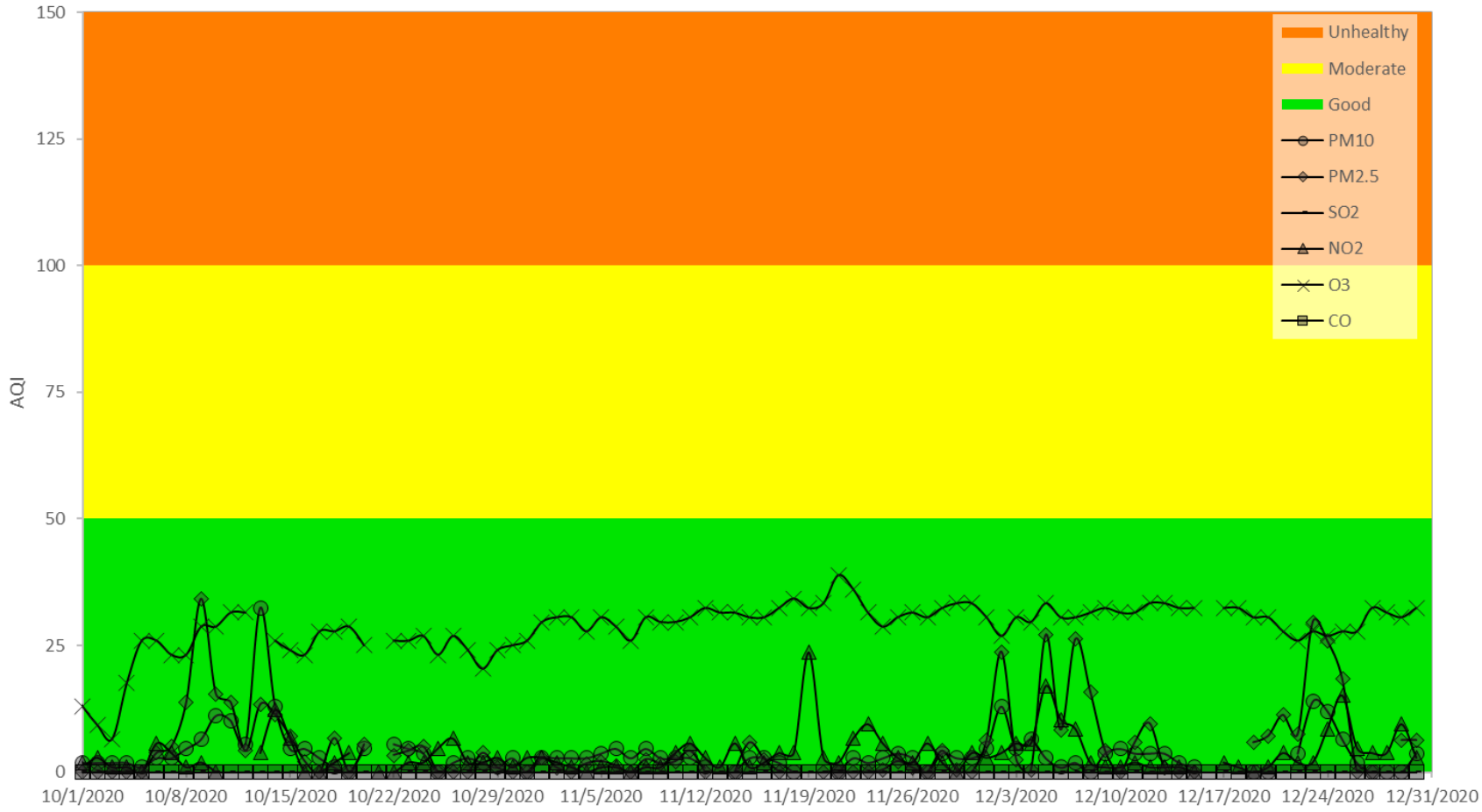


Figure 6: Fourth Quarter 2020 Nuiqsut AQMS Reported AQI Summary

Figure 7 through Figure 12 present annual pollutant concentrations for year 2020 at the Nuiqsut AQMS with AQI color levels in the background. The graphs may display blank portions which correspond to data invalidated after quality assurance and quality control process. Instruments drift values below zero are not displayed on the figures.

Figure 7 displays actual 24-hour average $PM_{2.5}$ concentration in micrograms per cubic meter ($\mu g/m^3$) to follow the 24-hour averaging period required to determine the NAAQS level for $PM_{2.5}$. Daily NAAQS $PM_{2.5}$ level is 35 $\mu g/m^3$ using a 24-hour averaging period, 98th percentile, averaged over 3 years.

Figure 7: Nuiqsut 2020 Air Quality Station 24-hour Average $PM_{2.5}$ concentration

Figure 8 displays actual 24-hour average PM_{10} concentration in micrograms per cubic meter ($\mu g/m^3$). NAAQS PM_{10} level is 150 $\mu g/m^3$ using a 24-hour averaging period, not to be exceeded more than once per year on average over 3 years. Elevated PM_{10} concentration is a known issue in the Colville River Delta. This naturally occurring phenomenon is emphasized during periods of high winds which transport silt and dust from the riverbanks and surrounding areas.

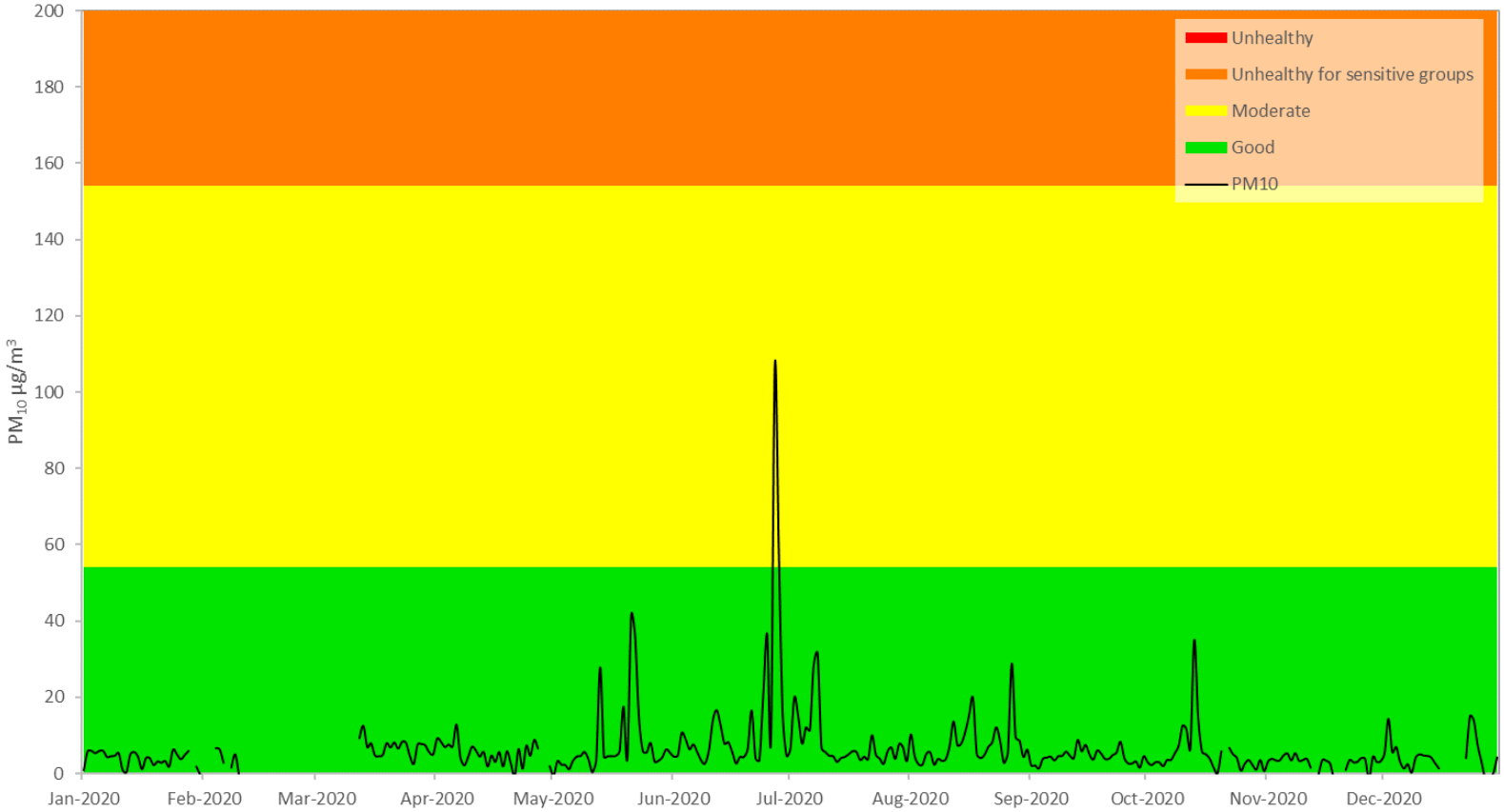


Figure 8: Nuiqsut 2020 Air Quality Station 24-hour Average PM_{10} concentration

Figure 9 displays actual 1-hour daily maximum NO_2 concentration in parts per billion (ppb). NAAQS NO_2 level is 100 ppb for the 98th percentile of hourly average daily maximum concentrations over 3 years.

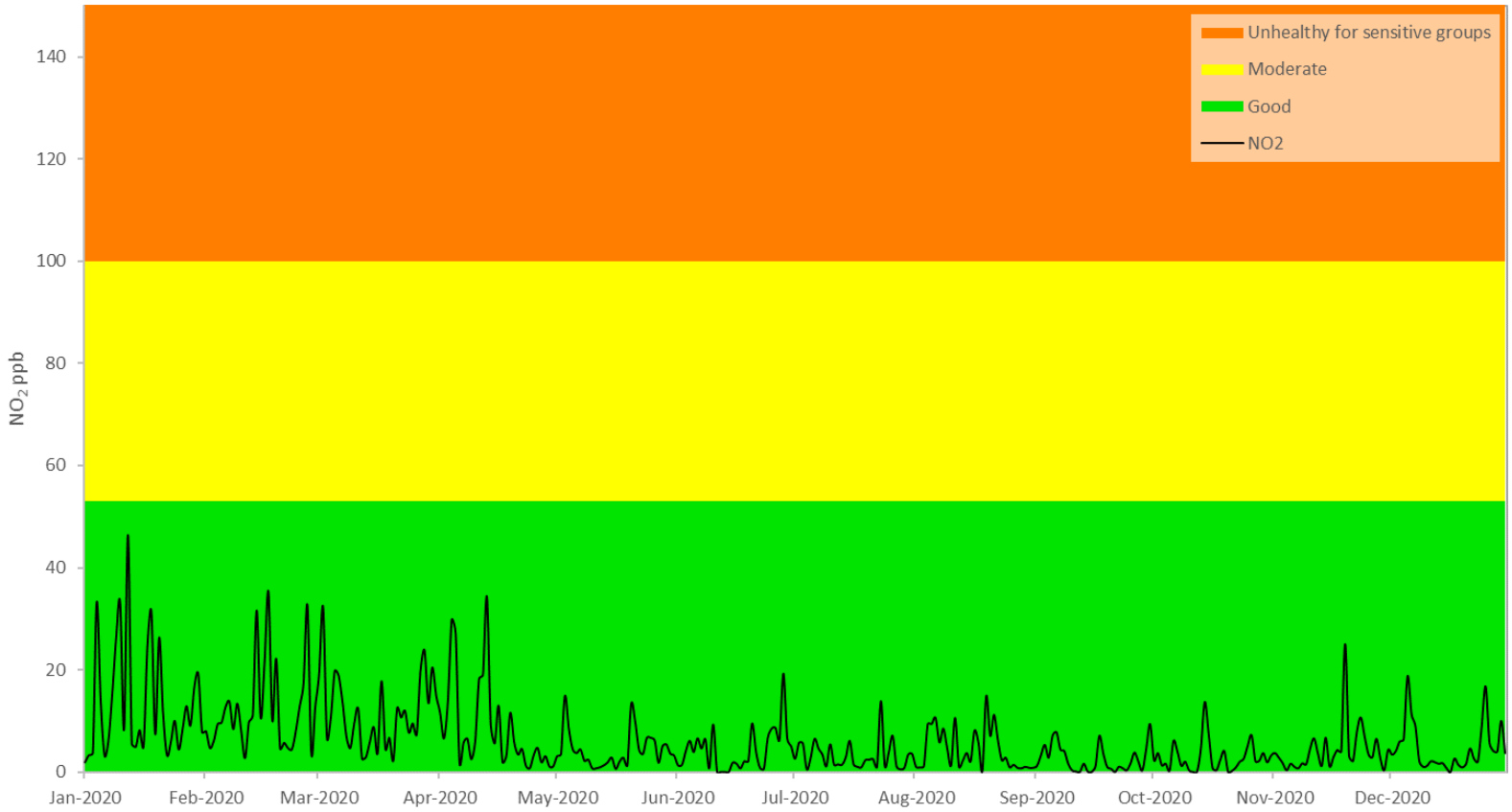


Figure 9: Nuiqsut 2020 Air Quality Station 1-hour Daily Maximum NO_2 concentration

Figure 10 displays the daily maximum of eight-hour rolling average CO concentrations in parts per million (ppm). NAAQS CO level is 9 ppm using an 8-hour rolling averaging period, not to be exceeded more than once per year.

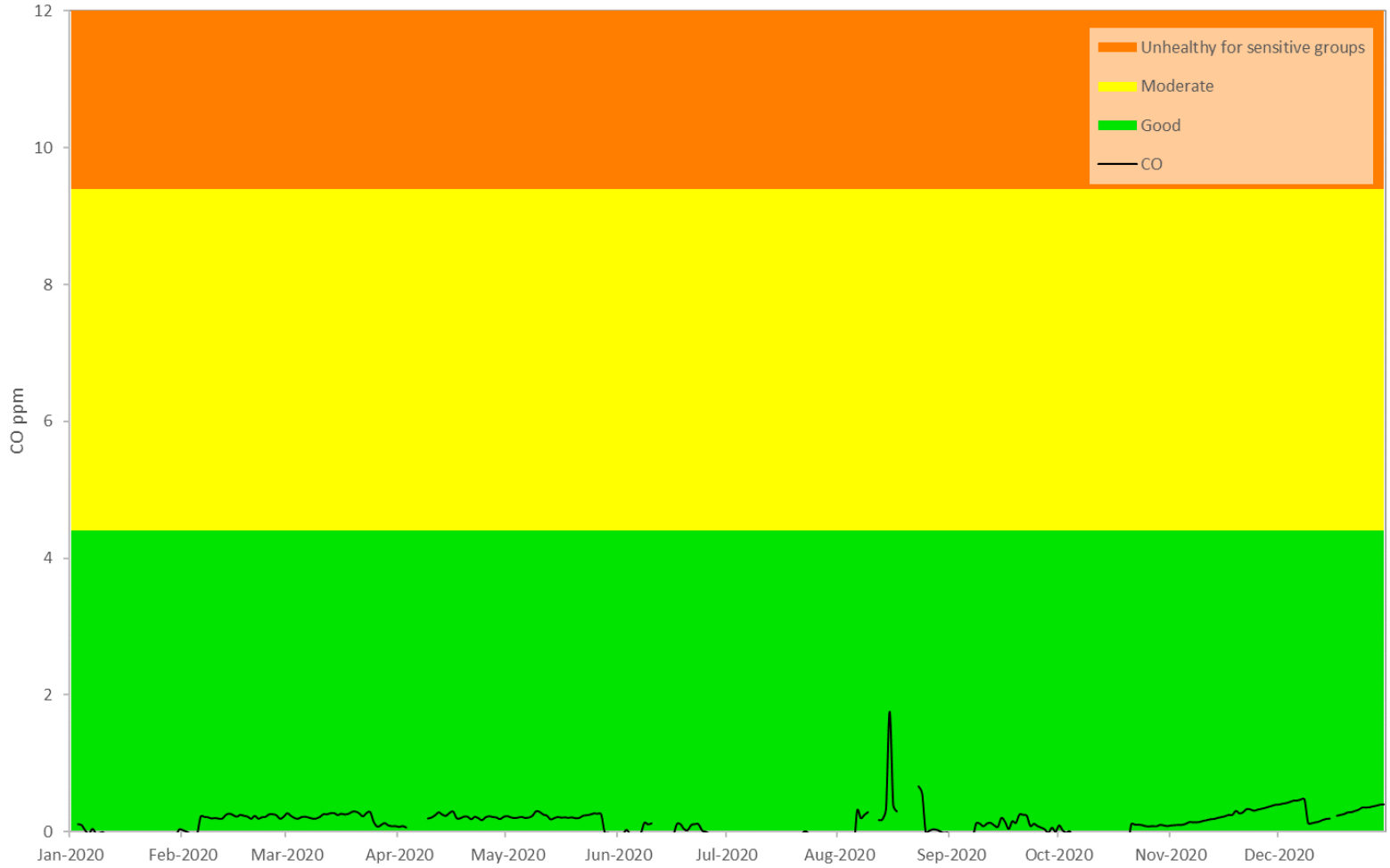


Figure 10: Nuiqsut 2020 Air Quality Station 8-Hour Rolling Average CO concentration

Figure 11 displays actual 1-hour daily maximum SO_2 concentration in parts per billion (ppb). NAAQS SO_2 level is 75 ppb daily max of one-hour averages, not to be exceeded more than once per year.

Figure 11: Nuiqsut 2020 Air Quality Station 1-hour Daily Maximum SO_2 concentration

Figure 12 displays actual daily maximum of 8-hour rolling average O_3 concentration in parts per million (ppm). NAAQS O_3 level is 0.070 ppm annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years. O_3 is naturally occurring in ambient air and ranges from zero to more than 50 ppb throughout the year.

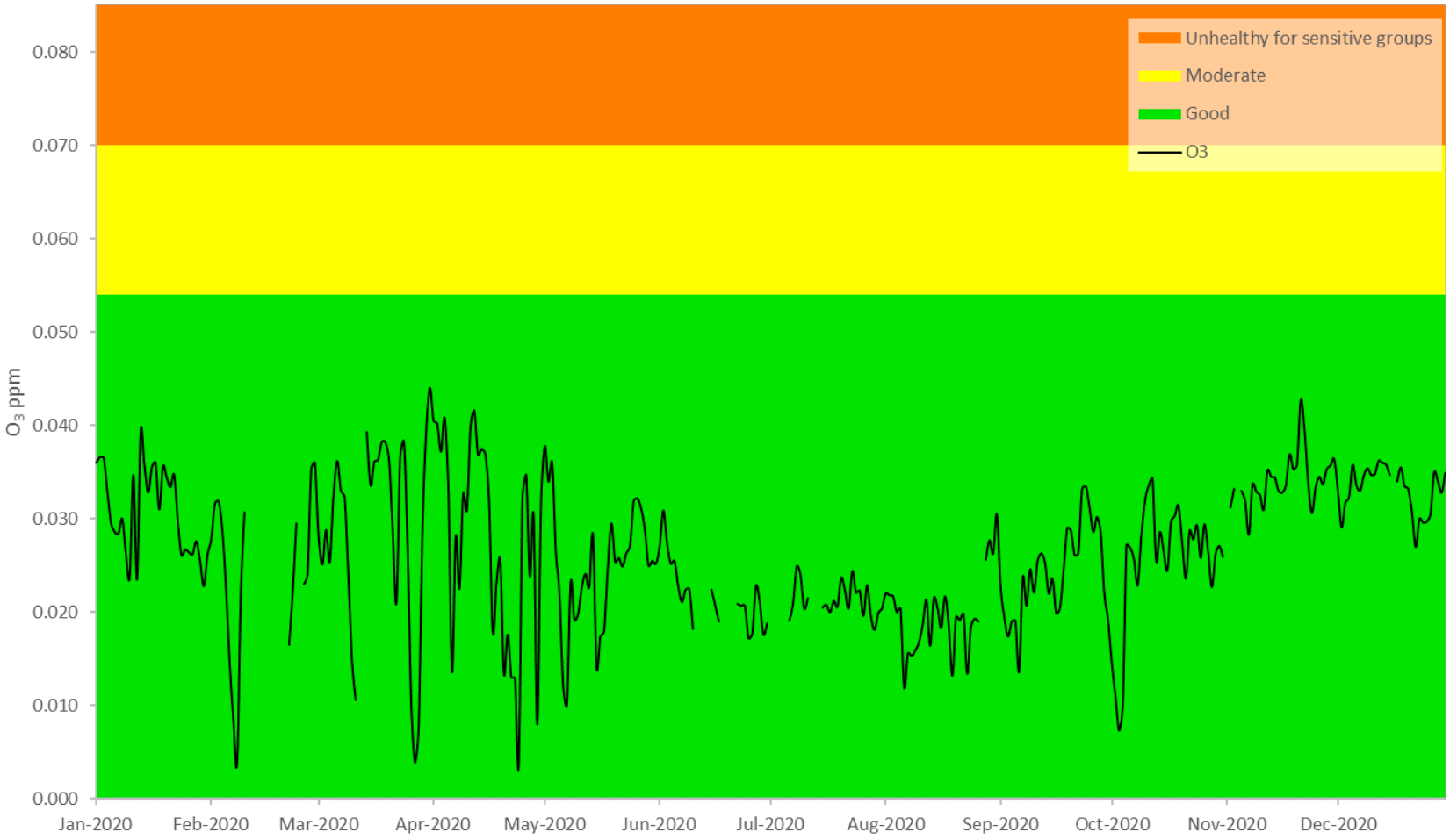


Figure 12: Nuiqsut 2020 Air Quality Station Daily maximum 8-hour O_3 concentration

4. Annual Meteorological Trends

Wind Classes **(m/s)**

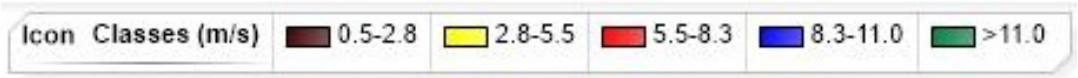
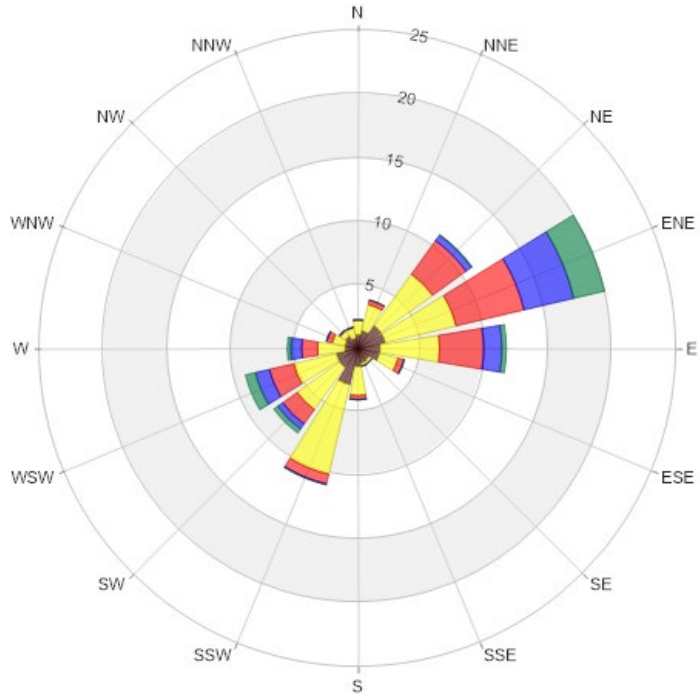


Figure 13 provides the annual wind rose for the Nuiqsut AQMS. The wind direction represents from where the wind is blowing. The center of the wind rose represents the AQMS. A wind rose gives a succinct view of how wind speed and direction are typically distributed at a specific location. Presented in a circular format, the wind rose shows the frequency of winds blowing from particular directions. The length of each "spoke" around the circle is related to the frequency of time that the wind blows from a particular direction. Each concentric circle represents a different frequency, emanating from zero at the center to increasing frequencies at the outer circles.



Wind Classes (m/s)

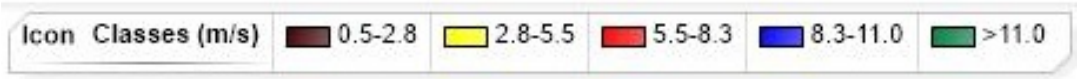


Figure 13: Nuiqsut 2020 Annual Hourly Average Wind Rose

Figure 14 provides annual wind speed data in miles per hour (mph).

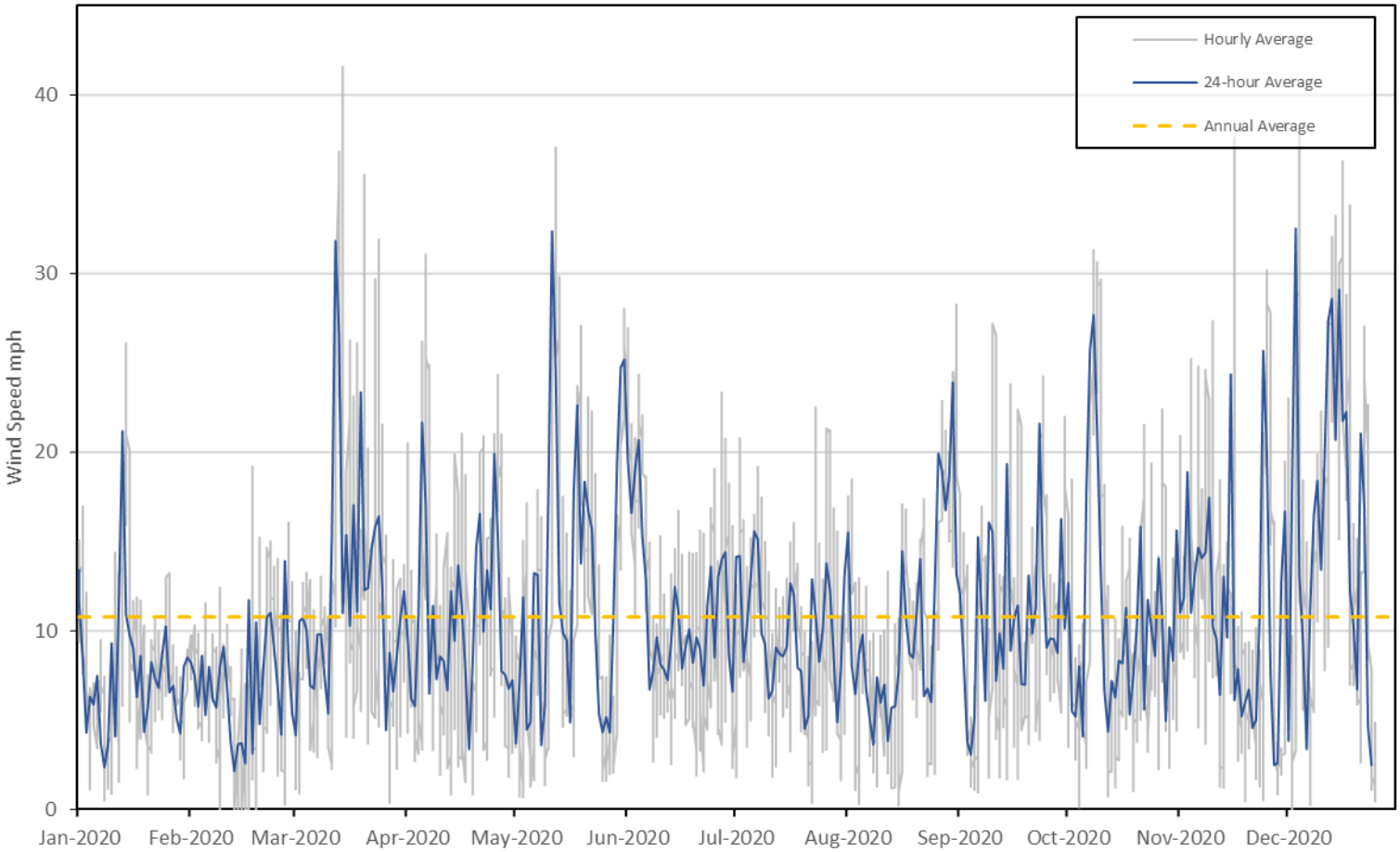


Figure 14: Nuiqsut 2020 Annual Average Wind Speed

Figure 15 displays annual temperature data in degrees Fahrenheit (°F) for the Nuiqsut AQMS.

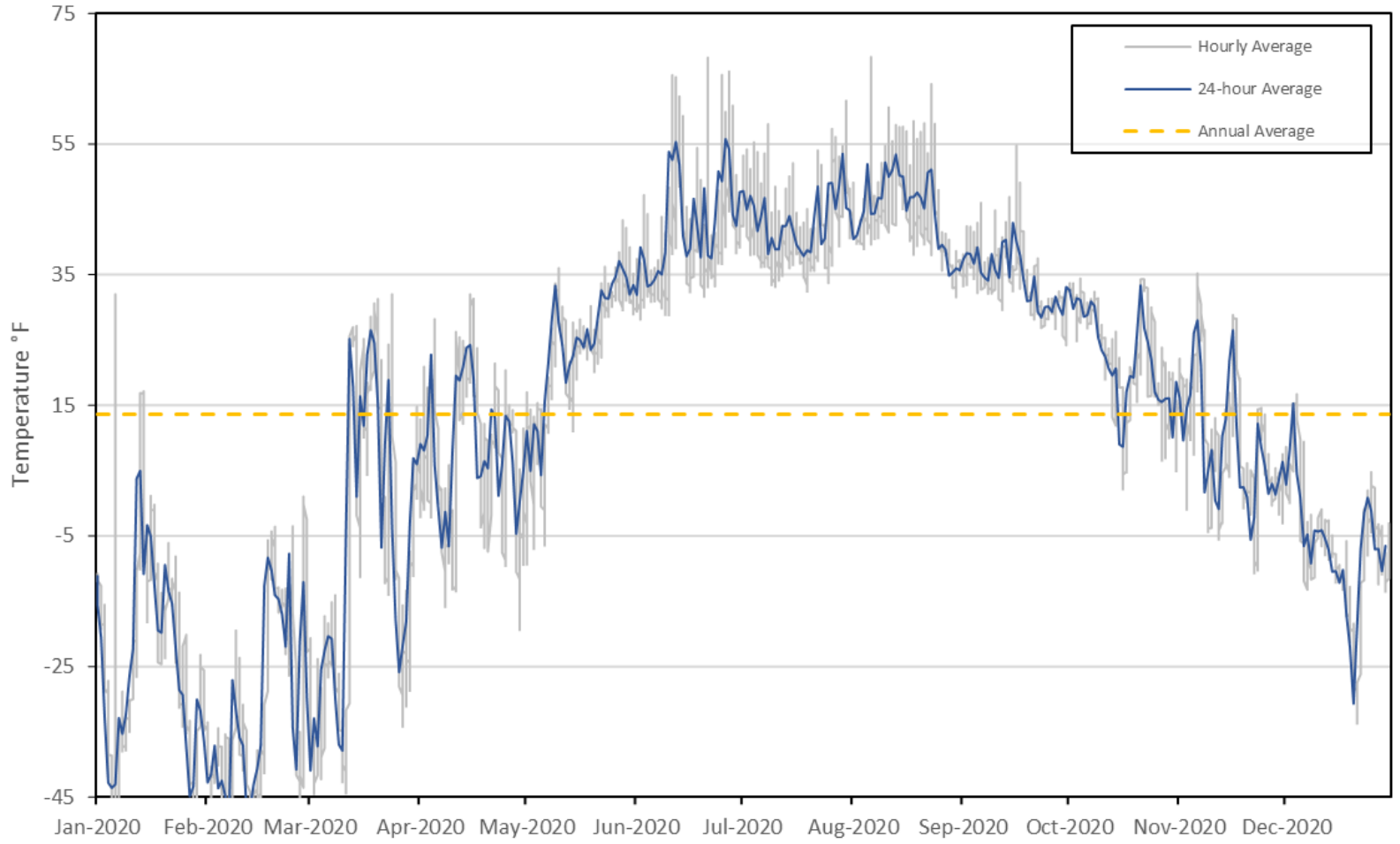


Figure 15: Nuiqsut 2020 Annual Average Ambient Temperature

APPENDIX A

Technical Assistance Document for the Reporting of Daily Air Quality – the Air Quality Index (AQI)

EPA 454/B-18-007
September 2018

Technical Assistance Document for the Reporting of Daily Air Quality – the Air Quality Index (AQI)

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Air Quality Assessment Division
Research Triangle Park, NC

CONTENTS

LIST OF TABLES

LIST OF FIGURES

This guidance is designed to aid local agencies in reporting air quality using the Air Quality Index (AQI) as required in 40 CFR Part 58.50 and according to 40 CFR Appendix G to Part 58.

I. REPORTING THE AQI

Do I have to report the AQI?

Metropolitan Statistical Areas (MSAs) with a population of more than 350,000 are required to report the AQI daily to the general public. The population of an MSA for purposes of index reporting is based on the latest available U.S. census population.

How often do I report the AQI?

MSAs must report the AQI daily, which is defined as at least five days each week. This definition allows for days when personnel are not available to provide the AQI report or for equipment failures.

What goes in my AQI report?

Required reporting:
It takes a full 24 hours to obtain an AQI value (that's 24 hourly values for PM or the max 1-hour or 8-hour value in a 24-hour period for other pollutants), so you are in effect required to report yesterday's AQI, including:

- the reporting area
- the reporting period
- the critical pollutant (the pollutant with the highest AQI value)
- the AQI value
- the category descriptor and color (if your report uses color) shown in Table 1
- the sensitive groups for all pollutants with an AQI over 100, as shown in Table 3

Voluntary reporting:
To make AQI reporting more useful to the public, most agencies also choose to report some or all of the following:

- Forecast and current AQI values
- Health effects and cautionary statements
- Causes for unusual AQI values
- The AQI for sub-areas of the reporting area
- Pollutant concentrations
- The name and AQI for other pollutants, particularly those with an AQI greater than 100
- Statements that "blend" health effects and cautionary information for more than one pollutant, if there is more than one pollutant with an AQI greater than 100

Table 1. Names and colors for the six AQI categories

For this AQI…	use this descriptor…	and this color
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Note: Values above 500 are considered "Beyond the AQI." Follow recommendations for the Hazardous category.

How are the AQI colors defined?

The colors are defined by the formulas RGB (red, green, blue) and CMYK (cyan, magenta, yellow, black) as shown in Table 2.

Table 2. AQI color formulas

Color	R	G	B	C	M	Y	K
Green	0	228	0	40	0	100	0
Yellow	255	255	0	0	0	100	0
Orange	255	126	0	0	52	100	0
Red	255	0	0	0	100	100	0
Purple	143	63	151	51	89	0	0
Maroon	126	0	35	30	100	100	30

Notes: RGB is traditionally used for screen colors, while CMYK is traditionally used for printing. The color models are based on a 0 - 255 scale (e.g. 50% is 126).

Table 3. Pollutant-Specific Sensitive Groups

When this pollutant has an AQI above 100…	Report these Sensitive Groups
Ozone	People with lung disease, children, older adults, people who are active outdoors (including outdoor workers), people with certain genetic variants, and people with diets limited in certain nutrients are the groups most at risk
PM2.5	People with heart or lung disease, older adults, children, and people of lower socioeconomic status are the groups most at risk
PM10	People with heart or lung disease, older adults, children, and people of lower socioeconomic status are the groups most at risk
CO	People with heart disease is the group most at risk
NO2	People with asthma, children, and older adults are the groups most at risk
SO2	People with asthma, children, and older adults are the groups most at risk

Notes: Statements may be combined so that each group is mentioned only once.

What cautionary statements should I use in my AQI report?

Table 4 lists cautionary statements for each pollutant.

Table 4. Pollutant-Specific Sub-indices and Cautionary Statements
for Guidance on the Air Quality Index (AQI)

AQI Categories (Index Values)	Ozone (ppm)		Particulate Matter (µg/m^3)		Carbon Monoxide (ppm) [8-hour]	Sulfur Dioxide (ppb) [1-hour]	Nitrogen Dioxide (ppb) [1-hour]
	[8-hour]	[1-hour]	$PM_{2.5}$ [24-hour]	PM_{10} [24-hour]			
Good (Up to 50)	0 - 0.054 None		0 – 12.0 None	0 - 54 None	0 – 4.4 None	0 - 35 None	0 - 53 None
Moderate (51 - 100)	0.055 - 0.070 Unusually sensitive people should consider reducing prolonged or heavy outdoor exertion.		12.1 – 35.4 Unusually sensitive people should consider reducing prolonged or heavy exertion.	55 – 154	4.5 – 9.4 None	36 - 75 None	54 - 100 Unusually sensitive individuals should consider limiting prolonged exertion especially near busy roads.
Unhealthy for Sensitive Groups (101 - 150)	0.071 - 0.085 People with lung disease (such as asthma), children, older adults, people who are active outdoors (including outdoor workers), people with certain genetic variants, and people with diets limited in certain nutrients should reduce prolonged or heavy outdoor exertion.	0.125 - 0.164	35.5 – 55.4 People with heart or lung disease, older adults, children, and people of lower socioeconomic status should reduce prolonged or heavy exertion.	155 – 254	9.5 – 12.4 People with heart disease, such as angina, should limit heavy exertion and avoid sources of CO, such as heavy traffic.	76 - 185 People with asthma should consider limiting outdoor exertion.	101 - 360 People with asthma, children and older adults should limit prolonged exertion especially near busy roads.

Unhealthy (151 - 200)	0.086 - 0.105	0.165 - 0.204	55.5 – 150.4	255 – 354	12.5 – 15.4	186 – 304	361 - 649
	People with lung disease (such as asthma), children, older adults, people who are active outdoors (including outdoor workers), people with certain genetic variants, and people with diets limited in certain nutrients should avoid prolonged or heavy outdoor exertion; everyone else should reduce prolonged or heavy outdoor exertion.		People with heart or lung disease, older adults, children, and people of lower socioeconomic status should avoid prolonged or heavy exertion; everyone else should reduce prolonged or heavy exertion.		People with heart disease, such as angina, should limit moderate exertion and avoid sources of CO, such as heavy traffic.	Children, people with asthma, or other lung diseases, should limit outdoor exertion.	People with asthma, children and older adults should avoid prolonged exertion near roadways; everyone else should limit prolonged exertion especially near busy roads.
Very Unhealthy (201 - 300)	0.106 - 0.200	0.205 - 0.404	150.5 – 250.4	355 – 424	15.5 – 30.4 People with heart disease, such as angina, should avoid exertion and sources of CO, such as heavy traffic.	305 – 604 [24-hour] Children, people with asthma, or other lung diseases should avoid outdoor exertion; everyone else should reduce outdoor exertion.	650 - 1249 People with asthma, children and older adults should avoid all outdoor exertion; everyone else should avoid prolonged exertion especially near busy roads.
	People with lung disease (such as asthma), children, older adults, people who are active outdoors (including outdoor workers), people with certain genetic variants, and people with diets limited in certain nutrients should avoid all outdoor exertion; everyone else should reduce outdoor exertion.		People with heart or lung disease, older adults, children, and people of lower socioeconomic status should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.				
Hazardous (301 - 500)	-	0.405 - 0.604	250.5 – 500.4	425 – 604	30.5 – 50.4 People with heart disease, such as angina, should avoid exertion and sources of CO, such as heavy traffic; everyone else should limit heavy exertion.	605 – 1004 [24-hour] Children, people with asthma, or other lung diseases, should remain indoors; everyone else should avoid outdoor exertion.	1250 - 2049 People with asthma, children and older adults should remain indoors; everyone else should avoid all outdoor exertion.
	Everyone should avoid all outdoor exertion.		Everyone should avoid all physical activity outdoors; people with heart or lung disease, older adults, children, and people of lower socioeconomic status should remain indoors and keep activity levels low.				

What health effects and cautionary statements should I use if the AQI goes above 500?

If the AQI is higher than 500, it is called "Beyond the AQI." Use the same information that is for the Hazardous category.

Do I have to report the AQI if my values are low?

If the AQI values for all of the pollutants remain below 50 for a year, then you may report the AQI at your discretion. In subsequent years, if any pollutant level rises to where the AQI would be above 50, then you must report the AQI.

If a specific pollutant remains below 50 for an extended period of time (a season or a year), you may exclude that pollutant from your AQI calculation.

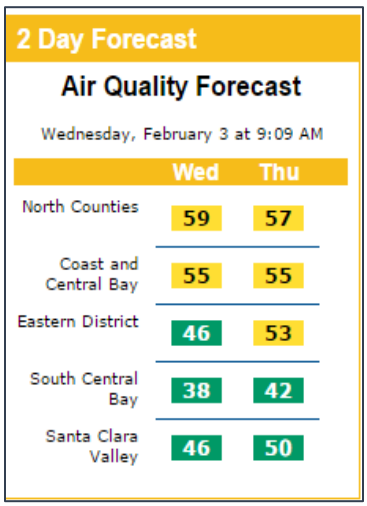
How is the AQI reported?

AQI reports take many forms – from traditional media like television, newspaper, radio, and phone, to more digital forms such as widgets, apps, web pages, and social media.

The purpose of the AQI is to inform people about their air quality so they can take steps to protect their health. This is especially important whenever the AQI exceeds 100. To reach the most people, try to deliver the AQI in as many ways as possible.

Figure 1. The AQI is reported in many formats.

Do I have to forecast the AQI?



Forecasting is encouraged, but it is not required. A prediction for the next day or several days allows people to plan their activities so that they can reduce or avoid exposure to air pollution. Good forecasts require data, computational resources, and expertise. EPA provides guidance if you are interested in starting a forecasting program. For more information, see *Guidelines for Developing an Air Quality Forecasting Program* in the Resources section.

Figure 2. Display of AQI forecast

Do I need to have air quality action days as part of my program?

No. The use of air quality action days or community action programs, which are usually based on AQI forecasts, is voluntary. However, action days and similar programs can provide significant benefits, especially when they directly and effectively communicate to at-risk groups about air quality and associated health effects. Air quality action days may be called by state or local air agencies when the AQI will get into the unhealthy ranges. Different agencies call them at different levels, such as Orange or Red or sometimes Yellow.

How is the AQI reported in real time?

EPA uses the NowCast to approximate the complete daily AQI during any given hour. Even on days when the AQI forecast predicts unhealthy conditions, pollution levels may be lower and better for outdoor activities during some parts of the day. Providing current conditions gives people the power to take action to reduce outdoor activities and exposure when necessary and protect their health.

The NowCast calculation uses longer averages during periods of stable air quality and shorter averages when air quality is changing rapidly, such as during a fire. The NowCast allows current conditions maps to align more closely with what people are actually seeing or experiencing.

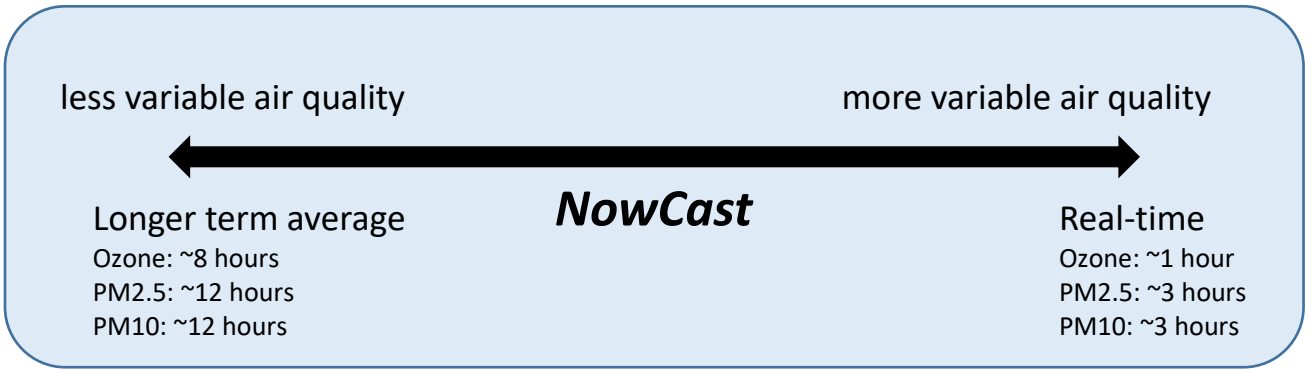


Figure 3. The NowCast

How can AirNow help?

EPA's AirNow accepts, stores, and displays air quality data from state and local air quality agencies.

Here's some of what you'll find at airnow.gov:

- National, regional, and local air quality maps
- AQI forecasts and current conditions
- Yesterday's AQI and archives of AQI data
- Health and educational information
- AirNow Application Program Interface (API) for access to real-time data and forecasts. The API can be used to feed apps, web sites, and other data systems
- Access to AirNow app and widgets
- Enviroflash - sign up to get air quality info by email
- The AQI from both regulatory and temporary monitors located near current fires
- The AQI reported abroad at U.S. embassies and consulates, courtesy of the U.S. Department of State

Figure 4. Airnow.gov page showing the AQI at U.S. Embassies and Consulates

Figure 5. The AQI on AirNow's *Fires: Current Conditions* page

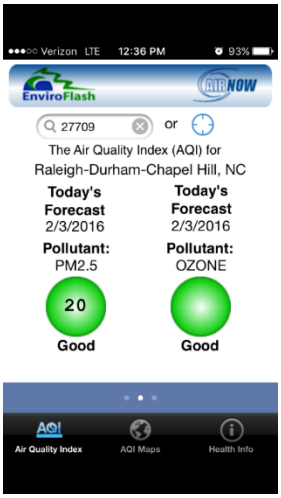


Figure 6. The AirNow widget

II. CALCULATING THE AQI

How do I calculate the AQI from pollutant concentration data?

The AQI is the highest value calculated for each pollutant as follows:

a. Identify the highest concentration among all of the monitors within each reporting area and truncate as follows:

Ozone (ppm) – truncate to 3 decimal places

$PM_{2.5}$ ($\mu g/m^3$) – truncate to 1 decimal place

PM_{10} ($\mu g/m^3$) – truncate to integer

CO (ppm) – truncate to 1 decimal place

SO2 (ppb) – truncate to integer

NO2 (ppb) – truncate to integer

b. Using Table 5, find the two breakpoints that contain the concentration.

c. Using Equation 1, calculate the index.

d. Round the index to the nearest integer.

Equation 1:

$$I_p = \frac{I_{Hi} - I_{Lo}}{BP_{HI} - BP_{Lo}}(C_p - BP_{Lo}) + I_{Lo}.$$

Where I_p = the index for pollutant p

C_p = the truncated concentration of pollutant p

BP_{Hi} = the concentration breakpoint that is greater than or equal to C_p

BP_{Lo} = the concentration breakpoint that is less than or equal to C_p

I_{Hi} = the AQI value corresponding to BP_{Hi}

I_{Lo} = the AQI value corresponding to BP_{Lo}

Table 5: Breakpoints for the AQI

These Breakpoints...							...equal this AQI	…and this category
O_3 (ppm) 8-hour	O_3 (ppm) 1-hour[1]	$PM_{2.5}$ ($\mu g/m^3$) 24-hour	PM_{10} ($\mu g/m^3$) 24-hour	CO (ppm) 8-hour	SO_2 (ppb) 1-hour	NO_2 (ppb) 1-hour	AQI	
0.000 - 0.054	-	0.0 – 12.0	0 - 54	0.0 - 4.4	0 - 35	0 - 53	0 - 50	Good
0.055 - 0.070	-	12.1 – 35.4	55 - 154	4.5 - 9.4	36 - 75	54 - 100	51 - 100	Moderate
0.071 - 0.085	0.125 - 0.164	35.5 – 55.4	155 - 254	9.5 - 12.4	76 - 185	101 - 360	101 - 150	Unhealthy for Sensitive Groups
0.086 - 0.105	0.165 - 0.204	(55.5 - 150.4)[3]	255 - 354	12.5 - 15.4	(186 - 304)[4]	361 - 649	151 - 200	Unhealthy
0.106 - 0.200	0.205 - 0.404	(150.5 - (250.4)[3]	355 - 424	15.5 - 30.4	(305 - 604)[4]	650 - 1249	201 - 300	Very unhealthy
([2])	0.405 - 0.504	(250.5 - (350.4)[3]	425 - 504	30.5 - 40.4	(605 - 804)[4]	1250 - 1649	301 - 400	Hazardous
([2])	0.505 - 0.604	(350.5 - 500.4)[3]	505 - 604	40.5 - 50.4	(805 - 1004)[4]	1650 - 2049	401 - 500	Hazardous

[1] Areas are generally required to report the AQI based on 8-hour ozone values. However, there are a small number of areas where an AQI based on 1-hour ozone values would be more precautionary. In these cases, in addition to calculating the 8-hour ozone index value, the 1-hour ozone value may be calculated, and the maximum of the two values reported.

[2] 8-hour O_3 values do not define higher AQI values (≥ 301). AQI values of 301 or higher are calculated with 1-hour O_3 concentrations.

[3] If a different SHL for PM2.5 is promulgated, these numbers will change accordingly.

[4] 1-hour SO_2 values do not define higher AQI values (≥ 200). AQI values of 200 or greater are calculated with 24-hour SO_2 concentrations.

How do I use the table and the equation and my concentration data to calculate the AQI?

Suppose you have an 8-hour ozone value of 0.07853333. First, truncate the value to 0.078. Then refer to the 8-hour ozone in table 5 for the values that fall above and below your value (0.071-0.085). In this case, the 0.078 value falls within the index values of 101 to 150. Now you have all the numbers needed to use the equation.

$$\frac{(150-101)}{(.085-.071)}(.078-.071)+101=\frac{49}{.014}.007+101=125.5 \quad =126$$

So an 8-hour value of 0.07853333 corresponds to an index value of 126.

What if I have values for more pollutants?

Suppose you have an 8-hour ozone value of 0.078 ppm, a $PM_{2.5}$ value of 35.9 µg/m^3, and a CO value of 8.4 ppm. You apply the equation 3-times:

$$O_3: \quad \frac{(150-101)}{(.085-.071)}(.078-.071)+101=126$$

$$PM: \quad \frac{(150-101)}{(55.4-35.5)}(35.9-35.5)+101=102$$

$$CO: \quad \frac{(100-51)}{(9.4-4.5)}(8.4-4.5)+51=90$$

The AQI is 126, with ozone as the responsible pollutant.

How do I use both ozone 1-hour and 8-hour values?

You must calculate the 8-hour values, and you may also calculate the 1-hour values. If you calculate both, you must report the higher AQI value.

Suppose you had a 1-hour value of 0.162 ppm and an 8-hour value of 0.078 ppm. Then you apply the equation twice:

$$1-hr: \quad \frac{(150-101)}{(.164-.125)}(.162-.125)+101=148$$

$$8-hr: \quad \frac{(150-101)}{(.085-.071)}(.078-.071)+101=126$$

In this case, the index is 148 (the maximum of 148 and 126) and the responsible pollutant is ozone.

How do I calculate AQI values for SO2?

EPA strengthened the primary standard for SO2 in 2010. Because there was not enough health information to inform changing the upper end of the AQI for SO2, the upper end continues to use the 24-hour average SO2 concentration. The lower end of the AQI uses the daily max 1-hour SO2 concentration.

If you have a daily max 1-hour SO2 concentration below 305 ppb, then use the breakpoints in Table 5 to calculate the AQI value.

If you have a 24-hour average SO2 concentration greater than or equal to 305 ppb, then use the breakpoints in Table 5 to calculate the AQI value. If you have a 24-hour value in this range, it will always result in a higher AQI value than a 1-hour value would.

On rare occasions, you could have a day where the daily max 1-hour concentration is at or above 305 ppb but when you try to use the 24-hour average to calculate the AQI value, you find that the 24-hour concentration is not above 305 ppb. If this happens, use 200 for the lower and upper AQI breakpoints (ILo and IHi) in Equation 1 to calculate the AQI value based on the daily max 1-hour value. This effectively fixes the AQI value at 200 exactly, which ensures that you get the highest possible AQI value associated with your 1-hour concentration on such days.

What do I do with concentrations for pollutants that have blank places in the table for Breakpoints for the AQI?

Disregard those numbers. Suppose you had a 1-hour ozone value of 0.104 ppm and an 8-hour ozone value of 0.078 ppm. First you disregard the 1-hour ozone value because it is less than 0.125ppm. Then you calculate the index for the 8-hour ozone value as before:

$$\frac{(150-101)}{(.085-.071)}(.078-.071)+101=126$$

III. Frequently Asked Questions

Q. Why doesn't my area report an Air Quality Index value?

A. Towns and cities with 350,000 or fewer inhabitants are not required to report the AQI. Some may not have monitors. In addition, AirNow is a voluntary program and some state or local air quality monitoring agencies may not submit data to AirNow.

Q. The other day, the air quality in my area was reported as green, or good air quality. However, it was pretty hazy outside. Why didn't the AQI report this accurately?

A. If this was an AQI forecast, there are still a few areas of the United States that only forecast for ozone and not particle pollution. It is possible that the ozone AQI forecast was "GOOD" while the hazy conditions experienced were due to particle pollution. In this instance, the reported AQI forecast may have only represented ozone.

There are also occasions where hazy conditions may be due primarily to high humidity and not pollution. On these days, it is still good to check the AQI maps and forecasts to make sure that pollution is not the primary cause of the haze.

Q. How do I get my local media outlets to show the AQI?

A. Many local media outlets choose to display the AQI as part of their weather reports. The text and graphics they use are usually developed and produced by private weather service companies, who have access to air quality data through AirNow. Try approaching the media person who is the customer of the weather service provider. This could be a newspaper editor or the television or radio station manager.

In general, media outlets want to provide more health-based information to their readers. However, it may take some effort to establish a relationship and educate decision makers about the importance of providing air quality information to the public. When you meet with them, bring along this guidance document or several examples showing how other media outlets publish the AQI. Emphasize that air quality is weather, news and health all in one. Make sure they have the proper software to access and display the data from the weather service company. Keep in mind that they may want to display air quality information only during periods of high pollution levels, when it is considered more newsworthy.

Q. If the AQI reported in the local media is incorrect, what should I do?

A. Common problems with AQI reporting in the local media include either reporting data values that are wrong or reporting pollutant concentrations instead of the AQI. Another frequent mistake is to report inconsistent AQI colors or terminology, as well as incorrect pollutant names. Establishing a good working relationship with the local media and educating them about how misleading or erroneous AQI information can impact their followers could help minimize potential problems. We recommend that you first notify the media outlet directly about any error so they can relay discrepancies to their weather service provider as a paying customer. If you have difficulty getting the media outlet to correct the issue, you could team with other health and nongovernmental organizations to approach them with a united message and request.

Q. Can AirNow help me meet the reporting requirements for the AQI?

A. AirNow is one way you can submit, store, and display your AQI values. This includes the required elements of AQI reporting and the voluntary elements. The information you submit to airnow.gov is reported in national and state/local pages on the website. It is available to anyone through the airnow app and widget and Enviroflash emails. It is also available for distribution to media and weather service provider companies.

Q. Why doesn't the AQI cover toxic air pollutants or air toxics?

A. While the AQI is an excellent indicator of the air quality resulting from ozone and particulate matter, it does not directly include health implications from air pollutants such as air toxics. Adverse health effects from air toxics are generally not believed to be episodic in nature like ozone and particulate matter, and are usually evaluated on a longer term, or chronic, basis. For information on concentrations of air toxics, refer to EPA's National Air Toxics Assessment (NATA) Website at: http://www.epa.gov/ttn/atw/nata/.

Q. Why does EPA issue AQI forecasts only for ozone and particle pollution?

A. AQI reporting is required for all criteria pollutants when they have an index value of 50 or above. Most cities forecast for ozone and particle pollution as these pollutants are the major sources of unhealthy air quality around 99% of the time. However, several cities forecast for all five pollutants-ground-level ozone, particle pollution, carbon monoxide, sulfur dioxide, and nitrogen dioxide.

Q. What is the NowCast and what does it have to do with the AQI?

A. The Air Quality Index is based on *daily* air quality summaries, specifically daily maximums or daily averages. It is not valid to use shorter-term (e.g. hourly) data to calculate an AQI value. However, real-time reporting requires shorter-term data to caution people in time for them to reduce their 24-hour exposure. The NowCast is EPA's endorsed method for relating short-term (less than 24-hour) data to the Air Quality Index for the purposes of real-time reporting.

Q. How is the AQI computed when the pollutant concentrations are beyond the Hazardous category (AQI above 500)?

A. When concentrations are above the range of the Hazardous category, they are called "Beyond the AQI". However, an AQI value can still be computed to indicate relative magnitude. To do this, use the same linear relationship that is used for the Hazardous category. Use the regular formula for computing an AQI value and use the Hazardous category breakpoints in the calculation.

Q. How are "Beyond the AQI" values (AQI above 500) handled in the NowCast?

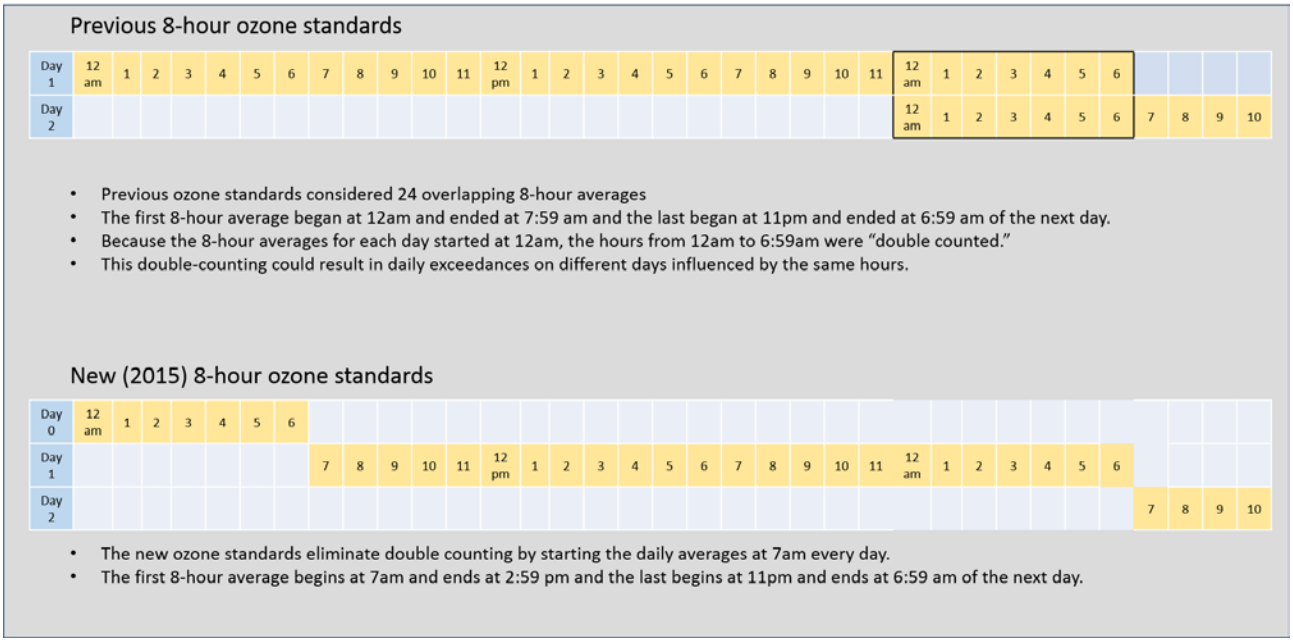
A. They are not handled differently. Compute the NowCast concentration as you normally would and use the Hazardous category breakpoints to compute the NowCast AQI value.

Q. What should people do if the AQI is above 500?

A. If the AQI is higher than 500, it is called “Beyond the AQI.” Follow the recommendations for the Hazardous category. Everyone should take steps to reduce their exposure. Stay indoors – in a room or building with filtered air – and reduce activity levels to reduce the amount of pollution you breathe into your lungs.

Q. How is the ozone AQI calculation affected by the revision of the ozone standard?

A. When the ozone standard was revised in 2015, the data handling for the daily max was modified to use only the 8-hour averages starting at 7am. This was done to avoid double-counting an exceedance from a single, short-term episode that spans the nighttime hours of the first day into the early hours of the second day. The daily maximum 8-hour average used for computing the AQI value is the same daily maximum 8-hour average described in the data handling for the revised ozone standard (i.e. it is based on the 17 consecutive moving 8-hour periods in each day, beginning with the 8-hour period from 7am to 3pm, and ending with the 8-hour period from 11pm to 7am).



Q. Should I use particulate matter or particle pollution when speaking with the public?

A. Based on focus group testing by EPA, people better understand and prefer the term “particle pollution” than "particulate matter."

Q. Why are some people using low-cost, compact sensors to measure air quality?

A. Many citizens are interested in learning more about local air quality where they live, work, and play. Low-cost, compact, sometimes-portable sensors are becoming more popular for collecting real-time

(usually 1-minute) air quality data. EPA scientists created the *Air Sensor Toolbox for Citizen Scientists* to provide information about sensor performance and how to interpret the data from sensors.
Learn more at http://www.epa.gov/air-research/air-sensor-toolbox-citizen-scientists

Q. Can I apply the AQI colors to 1-minute data from low-cost air quality sensors?

A. No. Sensors generally report 1-minute data, and health studies do not tell us what a single minute of exposure to a pollutant may mean. The AQI is based on EPA's national air quality standards, which come from health studies that show the effects of longer exposures.

Q. What does the Village Green Project do?

A. The Village Green Project is an innovative prototype air and weather measurement system built into a park bench. The station engages communities in air pollution awareness at a local level. The pilot station in Durham, North Carolina monitors several common air pollutants in real-time and makes the data available online and by smartphone. The solar and wind powered station provides minute-to-minute air measurements for ozone, particle pollution and weather conditions. The Village Green Project is expanding to other communities across the U.S.
Learn more at http://www.epa.gov/air-research/village-green-project

Q. What is the ozone monitoring season for each state?

A. EPA requires ozone monitoring during the time of year when weather conditions are most favorable for ozone formation. This season varies by state. In some states with warmer climates, monitoring is required year-round. In states where the climate is colder, ozone monitoring is required for as little as five months during the summertime. You can find a list of ozone monitoring seasons by state in 40 CFR Part 58 Appendix D, Table D-3.

IV. RESOURCES

AQI Final Rule 64 FR 42530, August 4 1999**:** http://www3.epa.gov/ttn/oarpg/t1/fr_notices/airqual.pdf

Guidelines for Developing an Air Quality Forecasting Program:
http://www3.epa.gov/airnow/aq_forecasting_guidance-1016.pdf.

Air Sensor Toolbox for Citizen Scientists:

http://www.epa.gov/air-research/air-sensor-toolbox-citizen-scientists

EPA's National Air Toxics Assessment (NATA): https://www.epa.gov/national-air-toxics-assessment

Fires and Your Health: https://www.airnow.gov/index.cfm?action=topics.smoke_events

Air quality outreach materials in English and Spanish:

https://airnow.gov/index.cfm?action=pubs.index

https://airnow.gov/index.cfm?action=pubs_spanish.index

Basic information on the AQI in Spanish:

https://www.airnow.gov/index.cfm?action=aqibasics.aqi_sp

List of monitoring season by state in 40 CFR Part 58 Appendix D, Table D-3:

http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&r=PART&n=40y6.0.1.1.6

EPA's Air Quality Flag Program: https://www.airnow.gov/index.cfm?action=flag_program.index

Village Green Project: http://www.epa.gov/air-research/village-green-project

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