Guidelines for the Reporting of Daily Air Quality – the Air Quality Index (AQI)

Guideline for Reporting of Daily Air Quality –
Air Quality Index (AQI)

Contact:
David Mintz
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina

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

Do I have to report the AQI?

Part 58.50 states that Metropolitan Statistical Areas (MSAs) with a population of more than 350,000 are required to report the AQI daily to the general public. The U.S. Office of Management and Budget defines MSAs according to the 2000 census. Table A-1 in the Appendix lists all metropolitan areas with a population of more than 350,000.

How often do I report the AQI?

Appendix G states that MSAs must report the AQI on a daily basis. The appendix further defines daily as at least five times each week. This definition allows for days when personnel are not available to provide the AQI report or for equipment failures.

How do I provide the AQI report to the general public?

You may distribute the report to the local media (newspapers, radio, television), provide a recorded telephone message, or publish the report on a publicly accessible Internet site. Other efforts, including real-time data reporting and community action programs (e.g., ozone action day programs) that provide timely air quality information to the public, may be used to meet reporting requirements.

What is in my AQI report?

Your AQI report must contain:

- The reporting area(s),
- The reporting period,
- The critical pollutant,
- The AQI,
- The category descriptor and, if reported in a color format, the associated color.[1] Use only the following 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 and above	"Hazardous"	Maroon

- Statements cautioning sensitive groups for all pollutants with an index value over 100. Use Table 1 on page on the following page to caution sensitive groups. Statements may be combined so that each group is mentioned only once.

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[1] Although a recorded phone message or a radio broadcast can't show colors, it can name a color in the report (e.g. this is a "red" air quality day).

Table 1: Pollutant Specific Sensitive Groups

<u>When this pollutant has an index above 100…</u>   <u>Report these Sensitive Groups</u>

When this pollutant has an index above 100…	Report these Sensitive Groups
Ozone	People with lung disease, children, older adults, and people who are active outdoors are the groups most at risk
PM2.5	People with heart or lung disease, older adults, and children are the groups most at risk
PM10	People with heart or lung disease, older adults, and children and the groups most at risk
CO	People with heart disease are the group most at risk
SO2	People with asthma are the group most at risk

An AQI report may also contain, but does not require:
- The name and index value for other pollutants, particularly those with an index value greater than 100,
- The index for sub-areas of the reporting area,
- Actual pollutant concentrations,
- Causes for unusual AQI values,
- Health effects and cautionary language,
- Statements that "blend" health effects and cautionary information for more than one pollutant, if there is more than one pollutant with an index value greater than 100.

It is important to inform the public when the AQI is above 100. This is why EPA strengthened the reporting provisions in section 6 of Appendix G in 1999. In particular, whenever the AQI exceeds 100, reporting agencies should expand reporting to all major news media, and at a minimum, should include notification to the media with the largest market coverage for the area in question.

What does an AQI report look like?

<u>**NEWSPAPER**</u>

Example 1. Newspaper short form in color

Air Quality for Raleigh, N.C.

Air Quality Index
Yesterday's report: **76**
Main pollutant: **Particulate Matter**

0-50 Good	51-100 Moderate	101-150 Unhealthy, Sensitive groups	151-200 Unhealthy	201-300 Very unhealthy

Today's ozone forecast : **38**

Example 2. Newspaper short form in black and white

Chicago Tribune

AIR QUALITY
Illinois EPA's air quality index (AQI):
0-50 is good; 51-100 moderate; 101-150 unhealthy
for sensitive groups; 151-200 unhealthy; 200+
very unhealthy

Tuesday's reading	na
Wednesday's forecast	**Good**
Critical pollutant	**Particulate Matter**

Example 3. Newspaper longer form

The Air Quality in Baltimore Yesterday

The AIR QUALITY yesterday in Northeast Baltimore was Unhealthy for Sensitive Groups due to ozone. Groups likely to be sensitive to ozone include active children and adults, and people with respiratory disease such as asthma. The Air Quality Index was 110, resulting from an ozone concentration of 0.088 ppm. Elsewhere in Baltimore, the air quality index was 87 or Moderate. Since today's air quality is expected to be much the same, sensitive groups should consider limiting prolonged or heavy outdoor exertion.

➡

GOOD
MODERATE
UNHEALTHY for SENSITIVE GROUPS
UNHEALTHY
VERY UNHEALTHY
HAZARDOUS
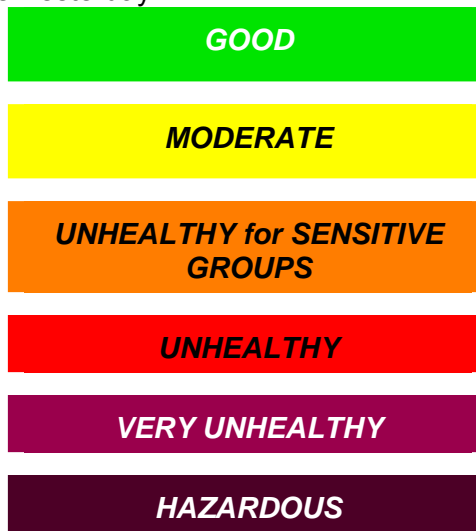
TELEVISION

The following is a short script that could be used for a television evening news/weather report. The graphics used in the report could be much the same as the graphics used in newspaper reports. The weathercaster must use the descriptors and, if a color format is used, colors for the categories that are listed above.

Example 4. A short form for television (morning)

"Yesterday the air quality was unhealthy due to ozone, and we expect similar air quality today – in the red range or around an index of 160, which is unhealthy. Active adults and children and people with asthma or other respiratory diseases should avoid prolonged physical exertion outside today. In fact, everyone should consider limiting the time they spend on outdoor exercise or those outside jobs..."

Example 5. A short form for television (evening)

"The air quality index today was 156, a red air quality day. The air stagnation caused a buildup of ozone to unhealthy levels."

Example 6. Two long forms for television (evening)

"Air quality today was unhealthy due to ozone, with an index value of 156. The cool front we expected to come through here tomorrow and blow all this ozone away isn't going to make it, so the stagnant air will still be here, making air quality unhealthy. Active children and adults and people with asthma or other respiratory diseases should avoid prolonged exertion outside tomorrow. In fact, everyone should consider limiting the time they spend on outdoor exercise or those outside jobs..."

"Tomorrow will be a code red air quality day for Center City. The cold winter air, morning traffic, and wood smoke are expected to cause particle pollution to rise to unhealthy levels. People with heart or lung disease, older adults, and children should avoid strenuous activities."

TELEPHONE

Recorded telephone messages can be used to give more up-to-date information on the air quality. For example, the following script has been used:

Example 7. A script for telephone

"As of 10:00 a.m., the air quality index is 45 which is a good or "green" air quality day. The responsible pollutant is ozone."

INTERNET

Most State and local agencies report the AQI on their public Web sites. The data available on the Web site are typically up to the most recent hour. Links to these sites can be found in the "Where I Live" section of the AIRNow Web site, at www.airnow.gov.

Example 8. A short form for a Web page

Air Quality Index for St. Louis, MO

Time of this report:	1:00PM	**AQI:**	110	**Code:**	Orange
Responsible pollutant:	Ozone	**Category:**		Unhealthy for Sensitive Groups	

Example 9. A long form for a Web page- ozone

Air Quality Index for Chicago, IL for August 2

Report as of:	2:00PM	**AQI:** 162	**Responsible pollutant:**	Ozone

Code:	Red	**Category:**	Unhealthy

|	
Sensitive groups:	Active children and adults, and people with lung disease, such as asthma, should reduce prolonged or heavy outdoor exertion.
Health effects:	Greater likelihood of respiratory symptoms and breathing difficulty in sensitive groups, possible respiratory effects in the general population.
HEALTH ADVISORY	Children and adults who are active outdoors, and people with lung disease, such as asthma should avoid moderate exertion outdoors, everyone else (especially children) should limit prolonged or heavy outdoor exertion.

Air Quality in South Chicago - Gary, IL	AQI: 122	(Unhealthy for Sensitive Groups)

Tomorrow's air quality in Chicago is predicted to be:	Unhealthy for Sensitive Groups	Code:	Orange

Example 10. A long form for a Web page- particulate matter

Anchorage, Alaska
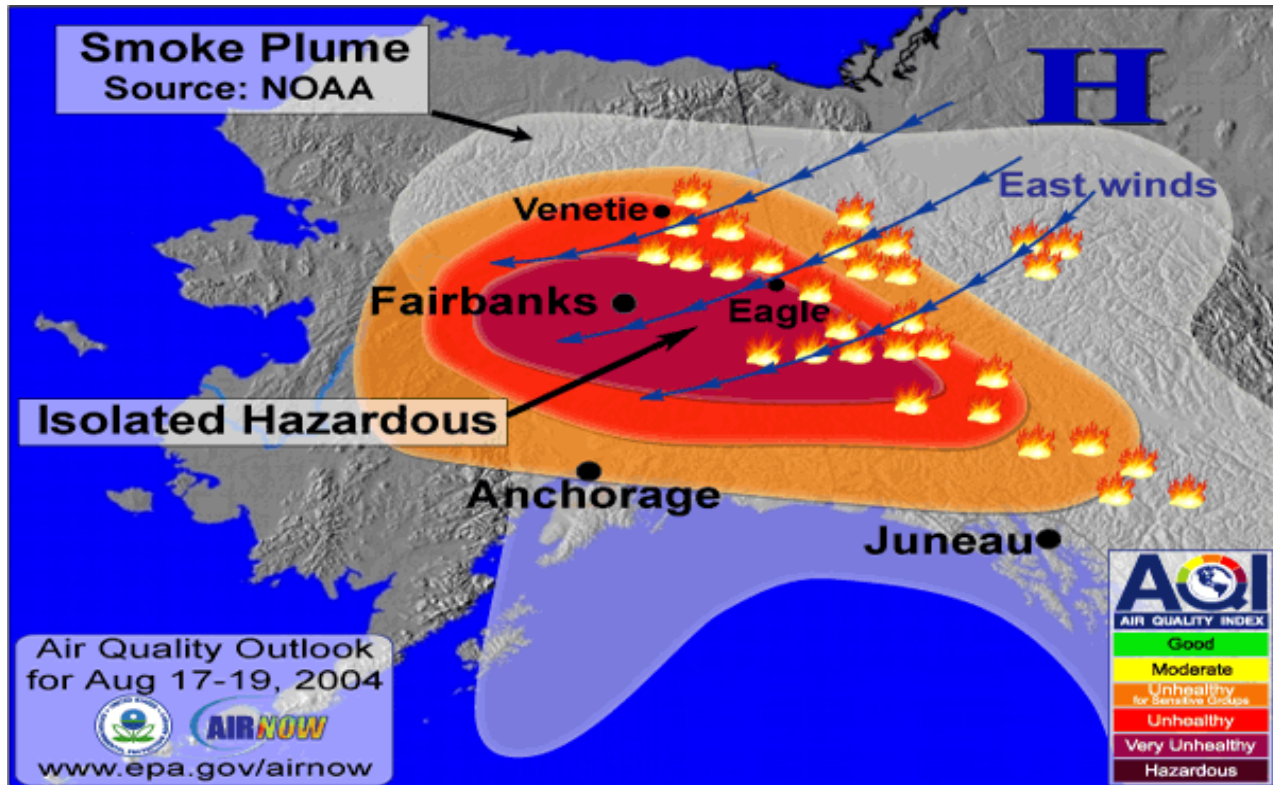
Alaska Department of Environmental Conservation (DEC) Issues Statewide Air Quality Advisory-

The AQI levels have been steadily increasing from Moderate to Unhealthy. Dense smoke advisory has been issued by the National Weather Service for the Fairbanks area for today and tonight. Poor air quality conditions are expected to persist for the next several days as a high pressure system to the northeast drives easterly winds and smoke to the Fairbanks area.

Health Tip: Everyone should avoid any outdoor exertion; people with respiratory or heart disease, the elderly, and children should remain indoors.

Source: Alaska Department of Environmental Conservation and United States Environmental Protection Agency.

What colors do I use in my AQI report?

If you report the Air Quality Index in a color format, the appropriate colors are specified in Appendix G as the following:

For this category ...	... use this color
Good	Green
Moderate	Yellow
Unhealthy for Sensitive Groups	Orange
Unhealthy	Red
Very Unhealthy	Purple
Hazardous	Maroon

Specific colors are defined in the table below[20] for red, green, blue (RGB) and cyan, magenta, yellow, and black (CMYK) 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	153	0	76	10	100	40	30
Maroon	126	0	35	30	100	100	30

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

What health effects and cautionary statements should I use in my report?

The most recent health effect information used with the AQI is pollutant-specific. The following table lists the different health effects messages, sensitive groups, and cautionary statements for each pollutant in the AQI.

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[2] Future revisions to Appendix G will include the updated color variables.

Pollutant-Specific Sub-indices and Health Effects 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 (ppm) [24-hour]
	[8-hour]	[1-hour]	PM$_{2.5}$ [24-hour]	PM10 [24-hour]		
Good (Up to 50)	0 - 0.064 None		0 - 15 None	0 - 50 None	0 - 4 None	0 - 0.03 None
Moderate (51 - 100)	0.065 - 0.084 Unusually sensitive individuals may experience respiratory symptoms.		>15 - 40 Respiratory symptoms possible in unusually sensitive individuals, possible aggravation of heart or lung disease in people with cardiopulmonary disease and older adults.	>50 - 150	>4 - 9 None	>0.03 - 0.14 None
Unhealthy for Sensitive Groups (101 - 150)	0.085 - 0.104 Increasing likelihood of respiratory symptoms and breathing discomfort in active children and adults and people with lung disease, such as asthma.	0.125 - 0.164	>40 - 65 Increasing likelihood of respiratory symptoms in sensitive individuals, aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and older adults.	>150 - 250	>9 - 12 Increasing likelihood of reduced exercise tolerance due to increased cardiovascular symptoms, such as chest pain, in people with heart disease.	>0.14 - 0.22 Increasing likelihood of respiratory symptoms, such as chest tightness and breathing discomfort, in people with asthma.
Unhealthy (151 - 200)	0.105 - 0.124 Greater likelihood of respiratory symptoms and breathing difficulty in active children and adults and people with lung disease, such as asthma; possible respiratory effects in general population.	0.165 - 0.194	>65 - 150 Increased aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and older adults; increased respiratory effects in general population.	>250 - 350	>12 - 15 Reduced exercise tolerance due to increased cardiovascular symptoms, such as chest pain, in people with heart disease.	>0.22 - 0.30 Increased respiratory symptoms, such as chest tightness and wheezing in people with asthma; possible aggravation of heart or lung disease.

Category						
Very Unhealthy (201 - 300)	0.125 [8-hr] - 0.404 [1-hr]	0.195 - 0.404	>150 - 250	>350 - 420	>15 - 30 Significant aggravation of cardiovascular symptoms, such as chest pain, in people with heart disease.	>0.30 - 0.60 Significant increase in respiratory symptoms, such as wheezing and shortness of breath, in people with asthma; aggravation of heart or lung disease.
	Increasingly severe symptoms and impaired breathing likely in active children and adults and people with lung disease, such as asthma; increasing likelihood of respiratory effects in general population.		Significant aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and older adults; significant increase in respiratory effects in general population.			
Hazardous (301 - 500)	0.405 [1-hr] - 0.60 [1-hr]	0.405 - 0.60	>250 - 500	>420 - 600	>30 - 50 Serious aggravation of cardiovascular symptoms, such as chest pain, in people with heart disease; impairment of strenuous activities in general population.	>0.60 - 1.0 Severe respiratory symptoms, such as wheezing and shortness of breath, in people with asthma; increased aggravation of heart or lung disease; possible respiratory effects in general population.
	Severe respiratory effects and impaired breathing likely in active children and adults and people with lung disease, such as asthma; increasingly severe respiratory effects likely in general population.		Serious aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and older adults; serious risk of respiratory effects in general population.			

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 (ppm) [24-hour]
	[8-hour]	[1-hour]	PM$_{2.5}$ [24-hour]	PM10 [24-hour]		
Good (Up to 50)	0 - 0.064 None		0 - 15 None	0 - 50 None	0 - 4 None	0 - 0.03 None
Moderate (51 - 100)	0.065 - 0.084 Unusually sensitive people should consider reducing prolonged or heavy outdoor exertion.		>15 - 40 Unusually sensitive people should consider reducing prolonged or heavy exertion.	>50 - 150	>4 - 9 None	>0.03 - 0.14 None
Unhealthy for Sensitive Groups (101 - 150)	0.085 - 0.104 Active children and adults, and people with lung disease, such as asthma, should reduce prolonged or heavy outdoor exertion.	0.125 - 0.164	>40 - 65 People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.	>150 - 250	>9 - 12 People with heart disease, such as angina, should limit heavy exertion and avoid sources of CO, such as heavy traffic.	>0.14 - 0.22 People with asthma should consider limiting outdoor exertion.

Unhealthy (151 - 200)	0.105 - 0.124	0.165 - 0.194	>65 - 150	>250 - 350	>12 - 15	>0.22 - 0.30
	Active children and adults, and people with lung disease, such as asthma, should avoid prolonged or heavy outdoor exertion; everyone else, especially children, should reduce prolonged or heavy outdoor exertion.		People with heart or lung disease, older adults, and children 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, asthmatics, and people with heart or lung disease should limit outdoor exertion.
Very Unhealthy (201 - 300)	0.125 [8-hr] - 0.404 [1-hr]	0.195 - 0.404	>150 - 250	>350 - 420	>15 - 30	>0.30 - 0.60
	Active children and adults, and people with lung disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should reduce outdoor exertion.		People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.		People with heart disease, such as angina, should avoid exertion and sources of CO, such as heavy traffic.	Children, asthmatics, and people with heart or lung disease should avoid outdoor exertion; everyone else should reduce outdoor exertion.
Hazardous (301 - 500)	0.405 [1-hr] - 0.60 [1-hr]	0.405 - 0.60	>250 - 500	>420 - 600	>30 - 50	>0.60 - 1.0
	Everyone should avoid all outdoor exertion.		Everyone should avoid all physical activity outdoors; people with heart or lung disease, older adults, and children should remain indoors and keep activity levels low.		People with heart disease, such as angina, should avoid exertion and sources of CO, such as heavy traffic; everyone else should limit heavy exertion	Children, asthmatics, and people with heart or lung disease should remain indoors; everyone else should avoid outdoor exertion.

Classifications and cautionary statements in Spanish:

Use estas tarjetas para entender los efectos de la contaminación del aire cuando escuche las noticias del Indice de la Calidad del Aire.

Valores del Índice	Clasificación	Precauciones para Protegerse del Ozono
0 a 50	Buena	Ninguna.
51 a 100	Moderada	Las personas extraordinariamente sensitivas deben considerar limitar los esfuerzos prolongados al aire libre.
101 a 150	Dañina a la Salud de los Grupos Sensitivos	Los niños y adultos activos, y las personas con enfermedades respiratorias, tales como el asthma, deben limitar los esfuerzos prolongados al aire libre.
151 a 200	Dañina a la Salud	Los niños y adultos activos, y las personas con enfermedades respiratorias, tales como el asthma, deben evitar el esfuerzo prolongado al aire libre; todos los demás, especialmente los niños, deben limitar el esfuerzo prolongado al aire libre.
201 a 300	Muy Dañina a la Salud	Los niños y adultos activos, y las personas con enfermedades respiratorias tales como el asthma, deben evitar cualquier esfuerzo al aire libre; todos los demás, especialmente los niños, deben limitar los esfuerzos al aire libre.

Se ha asignado un color específico a cada categoría de AQI. Por ejemplo, el rojo significa condiciones "dañinas a la salud" y el púrpura significa condiciones "muy dañinas a la salud". Este esquema de colores puede ayudarle a determinar rápidamente si los contaminantes del aire están alcanzando niveles muy dañinos a la salud en su zona.

How do I calculate the AQI from pollutant concentration data?

You calculate the AQI by using your pollutant concentration data, the following table, and the following equation (linear interpolation):

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

Where I_p = the index for pollutant p

C_p = the rounded concentration of pollutant p

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

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

BP_{Hi} = the breakpoint that is greater 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 2: Breakpoints for the AQI

This Breakpoint...							...equal this AQI	…and this category
o$_3$ (ppm) 8-hour	O$_3$ (ppm) 1-hour1	PM$_{10}$ (µg/m^3)	PM$_{2.5}$ (µg/m^3)	CO (ppm)	SO$_2$ (ppm)	NO$_2$ (ppm)	AQI	
0.000 - 0.064	-	0 - 54	0.0 - 15.4	0.0 - 4.4	0.000 - 0.034	(^{2})	0 - 50	Good
0.065 - 0.084	-	55 - 154	15.5 -40.4	4.5 - 9.4	0.035 - 0.144	(^{2})	51 - 100	Moderate
0.085 - 0.104	0.125 - 0.164	155 - 254	40.5 - 65.4	9.5 - 12.4	0.145 - 0.224	(^{2})	101 - 150	Unhealthy for Sensitive Groups
0.105 - 0.124	0.165 - 0.204	255 - 354	65.5 - 150.4	12.5 - 15.4	0.225 - 0.304	(^{2})	151 - 200	Unhealthy
0.125 - 0.374 (0.155 - 0.404)^4	0.205 - 0.404	355 - 424	150.5 - 250.4	15.5 - 30.4	0.305 - 0.604	0.65 - 1.24	201 - 300	Very unhealthy
(^{3})	0.405 - 0.504	425 - 504	250.5 - 350.4	30.5 - 40.4	0.605 - 0.804	1.25 - 1.64	301 - 400	Hazardous
(^{3})	0.505 - 0.604	505 - 604	350.5 - 500.4	40.5 - 50.4	0.805 - 1.004	1.65 - 2.04	401 - 500	Hazardous

[1] Areas are required to report the AQI based on 8-hour ozone values. However, there are areas where an AQI based on 1-hour ozone values would be more protective. In these cases the index for both the 8-hour and the 1-hour ozone values may be calculated and the maximum AQI reported.

[2] NO$_2$ has no short-term NAAQS and can generate an AQI only above a value of 200.

[3] 8-hour O$_3$ values do not define higher AQI values ($\geq$ 301). AQI values of 301 or higher are calculated with 1-hour O$_3$ concentrations.

[4] The numbers in parentheses are associated 1-hour values to be used in this overlapping category only.

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 0.08753333. First, round off the value to 0.087. Then refer to the 8-hour ozone in table 2 for the values that fall above and below your value (0.085 - 0.104). In this case, the 0.087 value falls within the index values of 101 to 150. Now you have all the numbers needed to use the equation.

$$\frac{(150-101)}{(.104-.085)}(.087-.085)+101 = \frac{49}{.019}.002+101 = 106.157 = 106$$

So an 8-hour value of 0.08753333 corresponds to an index value of 106.

What if I have values for more pollutants?

Suppose you have an 8-hour ozone value of 0.077 ppm, a $PM_{2.5}$ value of 54.4µg/m³, and a CO value of 8.4ppm. You apply the equation 3-times:

$$O_3: \quad \frac{(100-75)}{(.084-.075)}(.077-.075)+75 = 81$$

$$PM: \quad \frac{(100-75)}{(65.4-50.5)}(54.4-50.5)+75 = 82$$

$$CO: \quad \frac{(100-75)}{(9.4-7.5)}(8.4-7.5)+75 = 87$$

The AQI is 87, with CO 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 0.162ppm and an 8-hour value of 14.13333. Then you apply the equation twice:

$$1-hr: \quad \frac{(300-201)}{(.404-.155)}(.162-.155)+201 = 204$$

$$8-hr: \quad \frac{(300-201)}{(.374-.125)}(.141-.125)+201 = 207$$

In this case, the index is 207 (the maximum of 204 and 207) and the responsible pollutant is ozone.

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 0.104ppm, an 8-hour ozone value of 0.087ppm and an NO$_2$ value of 0.54ppm. First you disregard the 1-hour ozone value because it is less than 0.125ppm and the NO$_2$ value because it is less than 0.65ppm. Then you calculate the index for the 8-hour ozone value as before:

$$\frac{(150-101)}{(.104-.085)}(.087-.085) + 101 = 106.15789$$

This value rounds to 106.

Are there exceptions to these reporting requirements?

Yes. When you have low index values that meet the following criteria, you do not have to meet all the requirements. If the index for a specific pollutant remains below 50 for an extended period of time (for example, for that particular season), then you are not required to include this pollutant in the calculation of the AQI.

The final rule allows agencies to discontinue reporting for any pollutant if index values for that pollutant have been below 50 for an entire season or a year. However, this does not hold if in subsequent years' pollutant levels rise so that index values for that pollutant would be above 50 and the criteria for an exemption are no longer met. In these cases, section 8 of appendix G now requires that the responsible agency must again report the AQI.

Do I have to forecast pollutant concentrations for the AQI report?

Although not required, you are encouraged to forecast values at least 24 hours in advance. The AQI is designed to inform members of sensitive groups and the general population so that they may choose to reduce or avoid exposure to certain levels and types of air pollution. If the information is not timely, the public cannot make this choice. However, good forecasts may require data, computational resources and expertise that may be unavailable to you. The EPA provides guidance if you are interested in starting a forecasting program for AQI reporting in your Metropolitan Statistical Area (MSA).

Since ozone is a dominant pollutant in AQI reporting and the form of the ozone standard is an 8-hour average, the timing of how the public is informed is an important issue, even if you have decided not to forecast 24 hours in advance. In order for potentially affected people to take advantage of this information, it is necessary to consider at least a short term forecast or prediction of 8-hour ozone levels for the purposes of reporting the AQI. You can do this with very little additional resources; the method you can use relies on the high correlation between daily maximum of 8-hour ozone and 1-hour ozone values. A simple linear regression can be calculated on daily max data at any site. From this regression, you can predict that the 8-hour ozone maximum for a day will be at least the corresponding maximum 8-hour value, given the present 1-hour value. From this information, you can estimate the AQI without having to wait for the full 8-hour maximum to be observed.

What if the correlation at my site is low- can I still forecast the AQI?

The lowest observed correlation at any site reporting to AIRS data was 0.86, which is adequate to predict the maximum 8-hour values from the maximum 1-hour for reporting the AQI. However, if you feel uncomfortable from either a public health or cost viewpoint, you may want to use a confidence interval for the decision you make based on the predicted 8-hour maximum. For example, if your ozone action day is declared when you reach the unhealthy category and you predict an unhealthy day but are unsure whether or not you should call an "ozone action day" based on this prediction, you can use the confidence interval of the predicted value to trigger your decision. If you are concerned about public health, you might consider calling an "ozone action day" as soon as the upper bound of the confidence interval is greater than the AQI cut-point for the unhealthy category. If you are concerned with the cost of calling an "ozone action day" unnecessarily, then you might consider calling an ozone action day only when the lower bound of the confidence interval is above the cut-point for the unhealthy category.

Is there anything else I should know about reporting the AQI?

For further information, go to **www.epa.gov/airnow.** Under "Publications," there are several informative documents to help you report the AQI, including the ones listed:

♦ AQI brochure	♦ Pamphlets:
♦ AQI calculator program	-Ozone Pollution and your Health
♦ Forecasting guidance	-Particle Pollution and your Health
♦ Air quality guides for:	-Smog: Who does it Hurt?
-Ozone	♦ Medical poster
-Particle pollution	♦ Ozone web course for health care providers

How do I calculate the upper and lower bounds of the confidence interval for the predicted maximum 8-hour ozone value?

Most computer regression programs include the error variance, or the residual variance, or the variance of "Y given X" as part of the output. Call this S_e^2. Then you calculate the upper and lower bounds of the predicted value as:

$$upper: \quad \hat{Y} + t_{1-\alpha/2, n-2} \sqrt{S_e^2 \left(1 + \frac{1}{n} + \frac{(x' - \bar{x})^2}{(n-1)S_x^2}\right)}$$

$$lower: \quad \hat{Y} - t_{1-\alpha/2, n-2} \sqrt{S_e^2 \left(1 + \frac{1}{n} + \frac{(x' - \bar{x})^2}{(n-1)S_x^2}\right)}$$

Where:

$\hat{Y}$ is the predicted 8-hour ozone maximum,

$t_{1-\alpha/2,n-2}$ is a tabulated Student's-T value corresponding to a two sided $(1-\alpha)100\%$ confidence interval with n-2 degrees of freedom,

S_e^2 is the error variance described above,

x' is the 1-hour value used to predict the 8-hour value,

$\bar{x}$ is the average of the 1-hour values, and

S_x^2 is the variance of the 1-hour values.

The value α is arbitrary, but conventionally it is set to 0.05 corresponding to a 95% confidence interval.

APPENDIX

Table 3: Metropolitan Statistical Areas with over 350,000 population (2000 Census)

MSA	NAME	STATE	POPULATION
1000	Birmingham, AL MSA	AL	921,106
5160	Mobile, AL MSA	AL	540,258
4400	Little Rock--North Little Rock, AR MSA	AR	583,845
6200	Phoenix--Mesa, AZ MSA	AZ	3,251,876
8520	Tucson, AZ MSA	AZ	843,746
680	Bakersfield, CA MSA	CA	661,645
2840	Fresno, CA MSA	CA	922,516
4480	Los Angeles--Long Beach, CA PMSA	CA	9,519,338
5170	Modesto, CA MSA	CA	446,997
5775	Oakland, CA PMSA	CA	2,392,557
5945	Orange County, CA PMSA	CA	2,846,289
6780	Riverside--San Bernardino, CA PMSA	CA	3,254,821
6920	Sacramento, CA PMSA	CA	1,628,197
7120	Salinas, CA MSA	CA	401,762
7320	San Diego, CA MSA	CA	2,813,833
7360	San Francisco, CA PMSA	CA	1,731,183
7400	San Jose, CA PMSA	CA	1,682,585
7480	Santa Barbara--Santa Maria--Lompoc, CA MSA	CA	399,347
7500	Santa Rosa, CA PMSA	CA	458,614
8120	Stockton--Lodi, CA MSA	CA	563,598
8720	Vallejo--Fairfield--Napa, CA PMSA	CA	518,821
8735	Ventura, CA PMSA	CA	753,197
8780	Visalia--Tulare--Porterville, CA MSA	CA	368,021
1720	Colorado Springs, CO MSA	CO	516,929
2080	Denver, CO PMSA	CO	2,109,282
1160	Bridgeport, CT PMSA	CT	459,479
3280	Hartford, CT MSA	CT	1,183,110
5480	New Haven--Meriden, CT PMSA	CT	542,149
8040	Stamford--Norwalk, CT PMSA	CT	353,556
8840	Washington, DC--MD--VA--WV PMSA	DC/MD/VA/WV	4,923,153
9160	Wilmington--Newark, DE--MD PMSA	DE/MD	586,216
2020	Daytona Beach, FL MSA	FL	493,175
2680	Fort Lauderdale, FL PMSA	FL	1,623,018
2700	Fort Myers--Cape Coral, FL MSA	FL	440,888

3600	Jacksonville, FL MSA	FL	1,100,491
3980	Lakeland--Winter Haven, FL MSA	FL	483,924
4900	Melbourne--Titusville--Palm Bay, FL MSA	FL	476,230
5000	Miami, FL PMSA	FL	2,253,362
5960	Orlando, FL MSA	FL	1,644,561
6080	Pensacola, FL MSA	FL	412,153
7510	Sarasota--Bradenton, FL MSA	FL	589,959
8280	Tampa--St. Petersburg--Clearwater, FL MSA	FL	2,395,997
8960	West Palm Beach--Boca Raton, FL MSA	FL	1,131,184
520	Atlanta, GA MSA	GA	4,112,198
600	Augusta--Aiken, GA--SC MSA	GA/SC	477,441
3320	Honolulu, HI MSA	HI	876,156
2120	Des Moines, IA MSA	IA	456,022
1960	Davenport--Moline--Rock Island, IA--IL MSA	IA/IL	359,062
1080	Boise City, ID MSA	ID	432,345
1600	Chicago, IL PMSA	IL	8,272,768
6880	Rockford, IL MSA	IL	371,236
2760	Fort Wayne, IN MSA	IN	502,141
2960	Gary, IN PMSA	IN	631,362
3480	Indianapolis, IN MSA	IN	1,607,486
9040	Wichita, KS MSA	KS	545,220
4280	Lexington, KY MSA	KY	479,198
4520	Louisville, KY--IN MSA	KY	1,025,598
760	Baton Rouge, LA MSA	LA	602,894
3880	Lafayette, LA MSA	LA	385,647
5560	New Orleans, LA MSA	LA	1,337,726
7680	Shreveport--Bossier City, LA MSA	LA	392,302
1120	Boston, MA--NH PMSA	MA	3,406,829
8000	Springfield, MA MSA	MA	591,932
9240	Worcester, MA--CT PMSA	MA/CT	511,389
4160	Lawrence, MA--NH PMSA	MA/NH	396,230
720	Baltimore, MD PMSA	MD	2,552,994
440	Ann Arbor, MI PMSA	MI	578,736
2160	Detroit, MI PMSA	MI	4,441,551
2640	Flint, MI PMSA	MI	436,141
3000	Grand Rapids--Muskegon--Holland, MI MSA	MI	1,088,514

3720	Kalamazoo--Battle Creek, MI MSA	MI	452,851
4040	Lansing--East Lansing, MI MSA	MI	447,728
6960	Saginaw--Bay City--Midland, MI MSA	MI	403,070
5120	Minneapolis--St. Paul, MN--WI MSA	MN/WI	2,968,806
7040	St. Louis, MO--IL MSA	MO/IL	2,603,607
3760	Kansas City, MO--KS MSA	MO/KS	1,776,062
920	Biloxi--Gulfport--Pascagoula, MS MSA	MS	363,988
3560	Jackson, MS MSA	MS	440,801
3120	Greensboro--Winston-Salem--High Point, NC MSA	NC	1,251,509
6640	Raleigh--Durham--Chapel Hill, NC MSA	NC	1,187,941
1520	Charlotte--Gastonia--Rock Hill, NC--SC MSA	NC/SC	1,499,293
5920	Omaha, NE--IA MSA	NE/IA	716,998
560	Atlantic--Cape May, NJ PMSA	NJ	354,878
875	Bergen--Passaic, NJ PMSA	NJ	1,373,167
3640	Jersey City, NJ PMSA	NJ	608,975
5015	Middlesex--Somerset--Hunterdon, NJ PMSA	NJ	1,169,641
5190	Monmouth--Ocean, NJ PMSA	NJ	1,126,217
5640	Newark, NJ PMSA	NJ	2,032,989
8480	Trenton, NJ PMSA	NJ	350,761
200	Albuquerque, NM MSA	NM	712,738
4120	Las Vegas, NV--AZ MSA	NV/AZ	1,563,282
160	Albany--Schenectady--Troy, NY MSA	NY	875,583
1280	Buffalo--Niagara Falls, NY MSA	NY	1,170,111
5380	Nassau--Suffolk, NY PMSA	NY	2,753,913
5600	New York, NY PMSA	NY	9,314,235
6840	Rochester, NY MSA	NY	1,098,201
8160	Syracuse, NY MSA	NY	732,117
5660	Newburgh, NY--PA PMSA	NY/PA	387,669
80	Akron, OH PMSA	OH	694,960
1320	Canton--Massillon, OH MSA	OH	406,934
1680	Cleveland--Lorain--Elyria, OH PMSA	OH	2,250,871
1840	Columbus, OH MSA	OH	1,540,157
2000	Dayton--Springfield, OH MSA	OH	950,558
8400	Toledo, OH MSA	OH	618,203
9320	Youngstown--Warren, OH MSA	OH	594,746
1640	Cincinnati, OH--KY--IN PMSA	OH/KY/IN	1,646,395

5880	Oklahoma City, OK MSA	OK	1,083,346
8560	Tulsa, OK MSA	OK	803,235
6440	Portland--Vancouver, OR--WA PMSA	OR/WA	1,918,009
240	Allentown--Bethlehem--Easton, PA MSA	PA	637,958
3240	Harrisburg--Lebanon--Carlisle, PA MSA	PA	629,401
4000	Lancaster, PA MSA	PA	470,658
6280	Pittsburgh, PA MSA	PA	2,358,695
6680	Reading, PA MSA	PA	373,638
7560	Scranton--Wilkes-Barre--Hazleton, PA MSA	PA	624,776
9280	York, PA MSA	PA	381,751
6160	Philadelphia, PA--NJ PMSA	PA/NJ	5,100,931
6360	Ponce, PR MSA	PR	361,094
7440	San Juan--Bayamon, PR PMSA	PR	1,967,627
6480	Providence--Fall River--Warwick, RI--MA MSA	RI/MA	1,188,613
1440	Charleston--North Charleston, SC MSA	SC	549,033
1760	Columbia, SC MSA	SC	536,691
3160	Greenville--Spartanburg--Anderson, SC MSA	SC	962,441
3840	Knoxville, TN MSA	TN	687,249
5360	Nashville, TN MSA	TN	1,231,311
4920	Memphis, TN--AR--MS MSA	TN/AR/MS	1,135,614
1560	Chattanooga, TN--GA MSA	TN/GA	465,161
3660	Johnson City--Kingsport--Bristol, TN--VA MSA	TN/VA	480,091
640	Austin--San Marcos, TX MSA	TX	1,249,763
840	Beaumont--Port Arthur, TX MSA	TX	385,090
1880	Corpus Christi, TX MSA	TX	380,783
1920	Dallas, TX PMSA	TX	3,519,176
2320	El Paso, TX MSA	TX	679,622
2800	Fort Worth--Arlington, TX PMSA	TX	1,702,625
3360	Houston, TX PMSA	TX	4,177,646
4880	McAllen--Edinburg--Mission, TX MSA	TX	569,463
7240	San Antonio, TX MSA	TX	1,592,383
6520	Provo--Orem, UT MSA	UT	368,536
7160	Salt Lake City--Ogden, UT MSA	UT	1,333,914
5720	Norfolk--Virginia Beach--Newport News, VA--NC MSA	VA/NC	1,569,541
6760	Richmond--Petersburg, VA MSA	VA/NC	996,512
7600	Seattle--Bellevue--Everett, WA PMSA	WA	2,414,616

7840	Spokane, WA MSA	WA	417,939
8200	Tacoma, WA PMSA	WA	700,820
460	Appleton--Oshkosh--Neenah, WI	WI	358,365
4720	Madison, WI MSA	WI	426,526
5080	Milwaukee--Waukesha, WI PMSA	WI	1,500,741

I want to buy an air purifier.   Are the purifiers that produce ozone helpful to my indoor air quality?

Some air cleaning devices, such as ozone generators and ionic air purifiers, can generate significant levels of ozone. Even at low levels, ozone triggers a variety of health problems, including aggravated asthma and increased susceptibility to respiratory illnesses. Additional information on the assessment of the effectiveness and health consequences of ozone generators that are sold as air cleaners can be found at http://www.epa.gov/iaq/pubs/ozonegen.html, and also at the California Air Resources Board Web site at http://www.arb.ca.gov/research/indoor/ozone_gen_fact_sheet-a.pdf.

If you're having issues with mold and moisture, solutions and preventative tips are offered at http://www.epa.gov/mold/index.html.   For additional questions about indoor air quality, please use the EPA Office of Indoor Air Quality hotline at 1-800-438-4318.

Why is my area not covered in the Air Quality Index?

Towns and cities with 350,000 or fewer inhabitants are not required to report the AQI. Also, AIRNow is a voluntary program based upon state and local air quality monitoring networks. Some networks don't submit their data, or don't have any monitors in the area.

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?

There are a couple of reasons why this may have occurred, depending on what was "reported." If this was an AQI forecast, there are still some parts of the United States that only forecast for ozone and not particle pollution. It is possible that the forecast ozone AQI was "GOOD" and the hazy conditions experienced were due to particle pollution. In this instance, the "reported" AQI forecast may have only represented ozone. As more and more areas begin forecasting for PM2.5 and ozone together, this discrepancy should diminish.

In the case of real-time data, the AIRNow program provides separate maps for ozone and PM2.5 AQI. It is possible that the ozone AQI maps were showing "GOOD" conditions and the PM2.5 maps showing "MODERATE" or above conditions. It is important to check both maps for a specific geographical area to cover both primary pollutants. In the future, AIRNow plans to have combined AQI maps of both ozone and PM2.5 that will eliminate this problem, but will continue to provide the separate pollutant AQI maps to allow for people to identify the pollutant of concern.

Finally, it should be noted that there are 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.

How do I get my newspaper to publish the AQI?

Most newspaper weather pages and graphics are developed and produced by private weather service providers. We recommend that you direct your initial approach to the newspaper editors, since they are the customers of the weather provider company. In general, newspapers want to provide more health-based information to their readers. However, it may take some effort to educate decisionmakers about the importance of providing air quality information to the public. When you meet with the newspaper staff, bring along this guidance document or several examples showing how

other newspapers publish the AQI. In addition, most weather service providers already have access to the air quality data through AIRNow, which makes it easier for them to acquire and publish the information. Space on weather pages is limited, so a small, compact graphic might be a better choice for a crowded weather page.

If the AQI reported in the newspaper is incorrect, what should I do?

Common problems with AQI reporting in newspapers 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 newspaper and educating them about how misleading or erroneous AQI information can impact their readers could help minimize potential problems. We recommend that you first notify the newspaper directly about any error so they can relay discrepancies to their weather service provider as a paying customer. If you have difficulty getting the newspaper to correct the issue, you could team with other health and nongovernmental organizations to approach the newspaper editor with a united message and request.

Should I report yesterday's observed value, today's forecast, or tomorrow's forecast to the newspaper?

Let's assume that today is Monday, and you are submitting data for Tuesday morning's paper. Let's also assume that the paper is willing to carry both the observed AQI and the forecast. In such a case:
- Send the paper the most recent observed AQI. If it's midnight to midnight, that means Sunday's data.
- Send the Tuesday forecast so there is a "day-of" forecast in the Tuesday paper.
- If you have the Wednesday forecast and they're willing to carry that, include it too.

My local newspaper has a deadline of 2 pm for the next day's paper. Should I report the AQI value through 1 pm, or report the forecast?

Again, since the true AQI is a midnight to midnight calculation, we recommend that you report tomorrow's forecast. If this is not possible, then report the AQI value through a certain time, but make sure the newspaper includes the reporting period to avoid confusion.

How do I get my local TV station to show the AQI?

Similar to the newspaper industry, television reporting reflects the culture of the local community and what competing stations show. Television stations use weather service providers to provide graphics and data support for their weathercasts. All of the weather service companies have access to the air quality data through AIRNow, which makes it easy for them to acquire and provide these data to their television station customers. There are several questions that need to be addressed: Does the station want to show air quality information? Do other stations in your market show air quality information? Is the station news director on board with providing this information? Does the station have the proper software to access the air quality data?

For stations that have never shown these data on the air, you will need to establish a relationship and educate them about the benefits of providing air quality information to their viewers. Air quality is weather, news and health all in one. Once a station in your market begins to provide air quality information, chances are good that other stations will follow suit. However, even if the weathercasters want to provide this information in their weathercasts, the station news director controls the content of

what goes on the air. In addition, if the station wants to show the AQI on the air, they need to have the proper software version of weather graphics products to access and display the AQI. Keep in mind that air quality information could be displayed only during periods of high pollution levels, when it is considered more "newsworthy."

Can we still use the Pollutant Standards Index?

No. The Air Quality Index is required by law.

Does providing our data and forecasts to AIRNow meet the AQI reporting requirements?

No. Even though the air quality information that you provide to AIRNow is distributed on a national basis to the media and weather service provider companies, there is no guarantee that this information ends up within the media (newspaper, radio, or web site) in your local community as required.

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

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/.

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

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.

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

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

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