

## Air Quality Index (AQI)

The AQI was developed by the U. S. Environmental Protection Agency (EPA) to provide a simple, uniform way to report daily air quality conditions. Minnesota AQI numbers are determined by hourly measurements of four pollutants: ground-level fine particles (PM<sub>2.5</sub>), ozone, sulfur dioxide (SO<sub>2</sub>), and carbon monoxide (CO). The pollutant with the highest value determines the AQI for that hour. The most common pollutants to drive the AQI are PM<sub>2.5</sub> and ozone.

Air quality is ranked as good, moderate, unhealthy for sensitive groups, or unhealthy for all. If it is suspected through forecasting or monitoring that one of the four pollutants may be unhealthy for sensitive groups or higher, the Minnesota Pollution Control Agency (MPCA) issues an Air Pollution Health Alert to the media and to individuals who have signed up to receive e-mail alerts.



## AQI Monitoring Network

The MPCA reports the AQI for nine regions across the state. The number and type of monitors vary from region to region, with the most monitors in the Twin Cities Metro area. Figure 1 describes the network of air monitors the MPCA operates to collect hourly air quality data.

In 2008, the MPCA made minor modifications to the AQI monitoring network. CO and SO<sub>2</sub> monitors were removed from the Twin Cities network due to the elimination of the monitoring site in Fridley and instrument changes at Blaine. For more information on MPCA's air monitoring network see the *Air Monitoring Network Plan*.

**2008 Operational Network**  
Figure 1

REGION	SITES	MONITORS				Total
Brainerd Area	2	O3 2	PM2.5 1			3
Detroit Lakes	1	O3 1	PM2.5 1			2
Duluth Area	4	O3 2	PM2.5 2	CO 1		5
Ely	1	O3 1	PM2.5 1			2
Grand Portage	1		PM2.5 1			1
Marshall	1	O3 1	PM2.5 1			2
St. Cloud	2	O3 1	PM2.5 1	CO 1		3
Rochester	1	O3 1	PM2.5 1			2
Twin Cities	12	O3 6	PM2.5 6	CO 2	SO2 1	15
<b>TOTALS</b>						
9	25	15	15	4	1	35

O3  
Ozone

PM2.5  
Particulate Matter

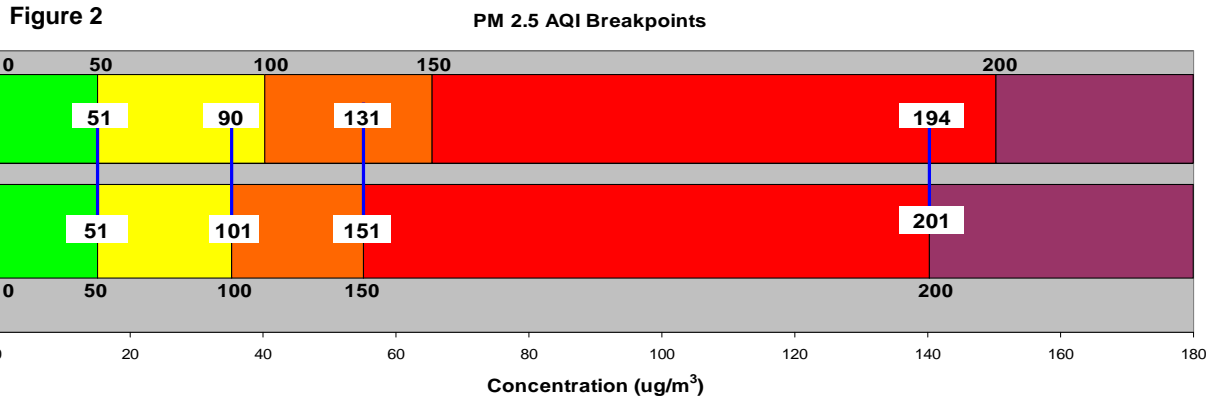
CO  
Carbon Monoxide

SO2  
Sulfur Dioxide

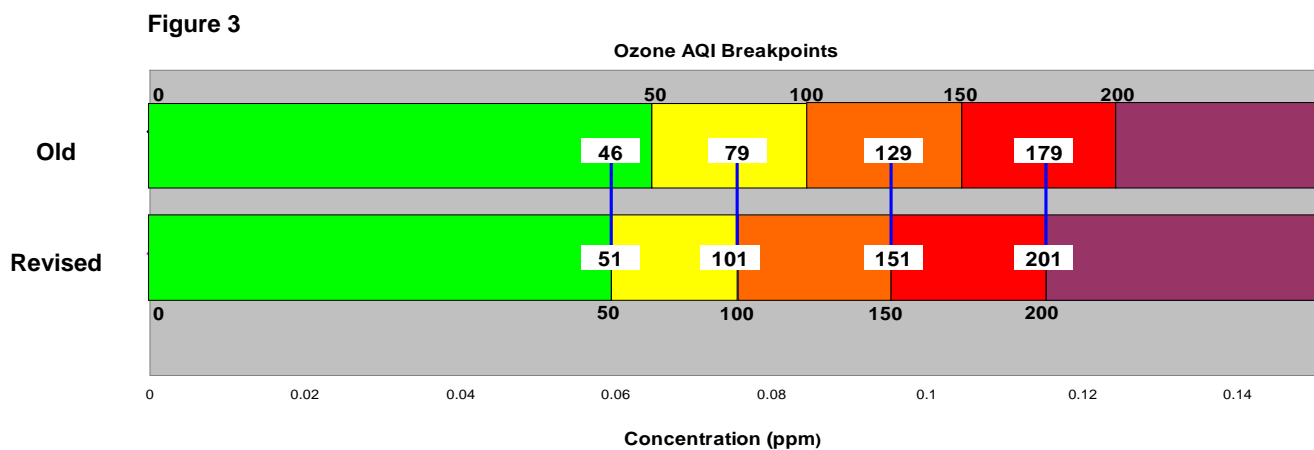
## Changes to the Air Quality Index

Beginning May 1, 2008, the pollutant concentration breakpoints delineating the AQI categories (i.e. good, moderate, unhealthy for sensitive groups, etc) were adjusted to reflect revisions to the National Ambient Air Quality Standards (NAAQS) for ozone and fine particles.

The 2006, Fine Particle NAAQS revision reduced the health standard from 65 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) to 35  $\mu\text{g}/\text{m}^3$  for a 24-hour sampling period. However, at the time of the rulemaking, EPA did not establish revised breakpoints for the AQI categories, maintaining the existing “unhealthy for sensitive groups” threshold (AQI 101) at 40.5  $\mu\text{g}/\text{m}^3$ .<sup>1</sup> While revised  $\text{PM}_{2.5}$  AQI breakpoints have yet to be promulgated by EPA, state and local air quality agencies were encouraged by EPA to begin utilizing revised AQI breakpoints in May of 2008. Figure 2 describes the changes to the  $\text{PM}_{2.5}$  AQI breakpoints. As a result of these changes,  $\text{PM}_{2.5}$  concentrations which were previously associated with an AQI of 90 are now equal to an AQI of 101, the threshold for issuance of an air pollution health alert.



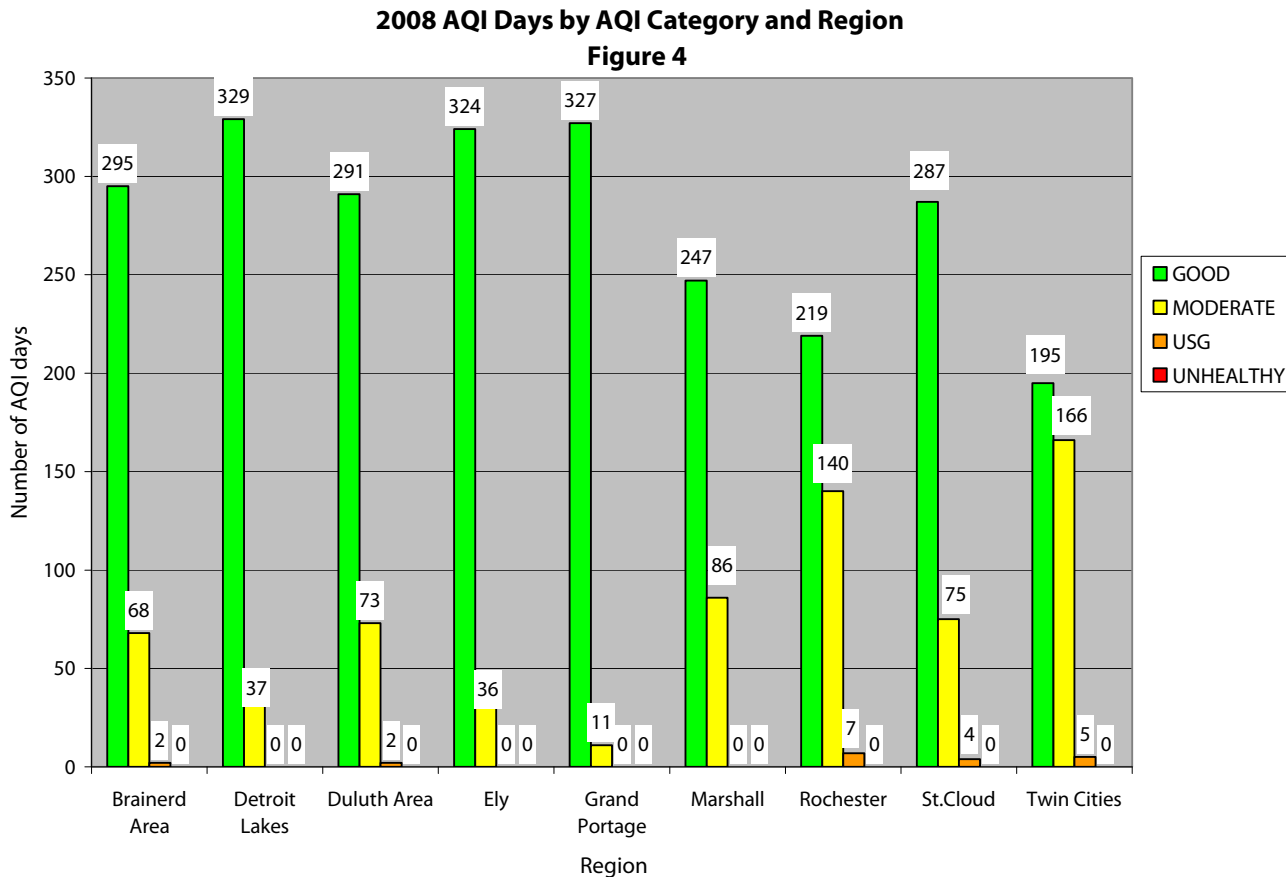
On March 12, 2008, EPA revised the NAAQS for ozone, reducing the health standard from .08 parts per million (ppm) to .075 ppm over an eight-hour sampling period. At the time of this rulemaking, the AQI breakpoints for ozone were also revised to be more protective of human health. Figure 3 describes the changes to the ozone AQI breakpoints. As a result of these changes, ozone concentrations which were previously associated with an AQI of 79 are now equal to an AQI of 101, the threshold for issuance of an air pollution health alert.



<sup>1</sup> Typically, EPA sets the AQI value of 100 at the level of the short-term standard for a pollutant (in this case, the 24-hour  $\text{PM}_{2.5}$  standard) and the AQI value of 50 at the level of the annual standard, if there is one, or at one-half the level of the short-term standard. EPA did not utilize this method when establishing the  $\text{PM}_{2.5}$  AQI breakpoints, rather the AQI of 100 was set at the mid-point of the range between the annual and the 24-hour standards ( $40\mu\text{g}/\text{m}^3$ ).

## 2008 AQI days by category and region

Figure 4 summarizes the number of days in each of four health categories (good, moderate, unhealthy for sensitive groups, and unhealthy) in each of the nine current reporting regions (Brainerd Area, Detroit Lakes, Duluth Area, Ely, Grand Portage, Marshall, Rochester, St. Cloud, and the Twin Cities). Each day's AQI is calculated by using the highest hourly AQI value that day for all sites and measured pollutants in a particular region. Some regions do not show a total of 365 days because of monitoring problems or non operational days.



The variability of the AQI readings across the nine reporting regions is described in Figure 5 in terms of the ratio of good/moderate days, annual average AQI, and annual median AQI.

2008 AQI Variability Figure 5			
Region	Good/Moderate Ratio	Average AQI	Median AQI
Grand Portage	29.73	13.35	9
Ely	9.00	30.39	29
Detroit Lakes	8.89	33.77	35
Brainerd Area	4.34	39.15	38
Duluth Area	3.99	40.06	38
St. Cloud	3.83	39.05	37
Marshall	2.87	42.63	42
Rochester	1.56	47.22	45
Twin Cities	1.17	51.19	48

## 2008 days with an AQI greater than 100

Figure 6 shows the days the AQI reached a value over 100 in 2008. The majority of days with AQI values over 100 occurred in the month of February and all high AQI days in 2008 were due to fine particle pollution. Consistent with the nature of fine particle formation and transport, the 2008 high AQI days can be described as three individual multi-day air pollution events. While the duration of these events varies, consecutive days of poor air quality are typically the result of persistent environmental conditions such as air stagnation, wind direction, flow, and temperature.

Despite changes to the AQI breakpoints as described above, the number of AQI days greater than 100 decreased in all reporting regions in 2008. Rochester had the highest number of days (seven days), followed by the Twin Cities (five days), St. Cloud (four days), and Brainerd and Duluth (two days). Ely, Grand Portage, Marshall and Detroit Lakes did not exceed 100 in 2008.

2008 Days with AQI Greater than 100

Figure 6

Date	Brainerd Area	Detroit Lakes	Duluth Area	Ely	Grand Portage	Marshall	Rochester	St. Cloud	Twin Cities		
2/3/2008							109				
2/4/2008							105				
2/22/2008							101				<b>Legend</b>
2/23/2008							145		117		PM <sub>2.5</sub>
2/24/2008	103		121				149	125	123		Ozone
2/25/2008	107		123				109	139	121		
2/26/2008							105				
12/18/2008								104	104		
12/19/2008								107	109		
<b>Totals</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>4</b>	<b>5</b>		

## 2008 air pollution health alerts and advisories

The MPCA issues an air pollution health alert when forecasted or actual AQI values exceed 100. An air pollution health advisory is issued when the AQI exceeds or is expected to exceed 90. MPCA issued air pollution health alerts and advisories for 2008 are summarized in Figure 7.

2008 MPCA Issued Air Pollution Health Alerts and Advisories

Figure 7

Date Issued	Date Expired	Regions Affected	Pollutant of Concern	Advisory/Alert	Canceled	AQI > 100
2/4/2008	2/5/2008	Southern two-thirds of Minnesota	Fine Particles	Advisory	No	Yes
2/22/2008	2/25/2008	Southern two-thirds of Minnesota	Fine Particles	Alert	No	Yes
7/28/2008	8/2/2008	Southern two-thirds of Minnesota	Fine Particles & Ozone	Advisory	Yes on 7/30/2008	No
11/3/2008	11/4/2008	Twin Cities and Rochester	Fine Particles	Alert	Yes on 11/4/2008	No