Air quality

May 2026

2025 Minnesota Air Monitoring Data Report

Draft 2027 Minnesota Air Monitoring Network Plan

MINNESOTA POLLUTION CONTROL AGENCY

2025 Minnesota Air Monitoring Data Report

Draft 2027 Minnesota Air Monitoring Network Plan

Authors

Kellie Gavin
Sanna Mairet
Margaret McCourtney
Tesheena Singh
Maria Takahashi
Nicholas Witcraft

Contributors/acknowledgements

Kurt Anderson
Yong Cai
Jerrod Eppen
Jeff Laren
Chloe Meyer
Nate Niebeling
Jacob Nelson
Binh Nguyen
Ashley Olson
Luke Salisbury
Mike Schneider
Sydney Schultz
Kristin Siewert
Joseph Smith
Michael Smith
Owen Seltz
Daniel Steltz
Matthew Taraldsen
Eric Wilcox Freeburg
David Wischnack

Editing

Jennifer Holstad

Minnesota Pollution Control Agency

520 Lafayette Road North | Saint Paul, MN 55155-4194 |

651-296-6300 | 800-657-3864 | Or use your preferred relay service | Info.pca@state.mn.us

This report is available in alternative formats upon request, and online at www.pca.state.mn.us.

Document number: aq10-27e

Table of contents

List of tables

List of figures

Acronyms, abbreviations, and definitions

AIRNow – air quality forecasting program
Air toxics – suite of parameters that includes VOCs, carbonyls, and metals
AQI – Air Quality Index
AQS – Air Quality System: EPA's repository of ambient air quality data
CAA – Clean Air Act
CAS – Chemical Abstracts Service
CFR – Code of Federal Regulations
Class I area – remote area with pristine air quality
CO – carbon monoxide
Criteria pollutants – the six pollutants regulated by the 1970 Clean Air Act (particulate matter, ozone, nitrogen dioxide, sulfur dioxide, carbon monoxide, and lead)
IMP – Chemical Speciation Network
Design Value – a statistic that describes the air quality status of a given location relative to the level of the National Ambient Air Quality Standards (NAAQS)
EPA – U.S. Environmental Protection Agency
Exceptional Events – unusual or naturally occurring events that can affect air quality but are not reasonably controllable using techniques that tribal, state or local air agencies may implement in order to attain and maintain the National Ambient Air Quality Standards.

FEM – Federal Equivalent Method
FRM – Federal Reference Method
IMPROVE – Interagency Monitoring of Protected Visual Environments
MAAQS – Minnesota Ambient Air Quality Standard
MDH – Minnesota Department of Health
MDN – Mercury Deposition Network
μg/m3 (ug/m3) – micrograms per cubic meter
MOA – Memorandum of Agreement
MPCA – Minnesota Pollution Control Agency
MSA – Metropolitan Statistical Area
NAAQS – National Ambient Air Quality Standard
NADP – National Atmospheric Deposition Program
NCore – National Core Monitoring Network
NDDN – National Dry Deposition Network
NO – nitric oxide
NO_2 – nitrogen dioxide
NO_x – oxides of nitrogen
NO_y – total reactive nitrogen
NTN – National Trends Network
O_3 – ozone
PAMS – Photochemical Assessment Monitoring Stations
Pb – lead
$PM_{2.5}$ – particulate matter less than 2.5 microns in diameter (fine particulate matter)
$PM_{10-2.5}$ – particulate matter between 2.5 and 10 microns in diameter (coarse particulate matter)
PM_{10} – particulate matter less than 10 microns in diameter
ppb – parts per billion by volume
ppm – parts per million by volume
PQAO – Primary Quality Assurance Organization
Primary Standard - NAAQS set to protect public health
QAPP – Quality Assurance Project Plans
QA/QC – Quality Assurance/Quality Control
QMP – Quality Management Plan
Secondary Standard - NAAQS set to protect the environment and public welfare (i.e. visibility, crops, animals, vegetation, and buildings)
SIP – State Implementation Plan
SLAMS – State and Local Air Monitoring Stations
SO_2 – sulfur dioxide
SPM – special purpose monitoring
TPY – tons per year
TRS – total reduced sulfur
TSP – total suspended particulate matter
U of M – University of Minnesota
UFP – ultrafine particles (particulate matter less than 0.1 microns in diameter)
USDA – United States Department of Agriculture
USDOI – United States Department of the Interior
USG – unhealthy for sensitive groups
VOC – volatile organic compound

Introduction

The Minnesota Pollution Control Agency's (MPCA) air quality data are used to determine compliance with NAAQS and Minnesota Ambient Air Quality Standards (MAAQS). In 1970, the Clean Air Act (CAA) established NAAQS for six pollutants known to cause harm to human health and the environment. The CAA requires the MPCA to monitor these pollutants, called criteria pollutants, and report the findings to the U.S. Environmental Protection Agency (EPA). The criteria pollutants are particulate matter, lead, ozone, nitrogen dioxide, sulfur dioxide, and carbon monoxide. The MPCA monitors criteria pollutants to comply with the CAA. All criteria pollutants also have MAAQS. In addition, there are also MAAQS for total suspended particulate matter (TSP) and hydrogen sulfide (H_2S).

The MPCA also monitors Minnesota's air for other pollutants, called air toxics. Air toxics include a wide range of chemicals that are known or suspected of affecting human health. These pollutants do not have federal standards; however, levels found in Minnesota are compared to health benchmarks established by the Minnesota Department of Health (MDH), the EPA, and the State of California.

More information including current air quality, forecasts, tools to explore data from our monitoring network, and this plan can be found on the MPCA's Air Quality website (https://www.pca.state.mn.us/air).

1. Pollutants with standards (criteria pollutants)

In 1970, the CAA authorized the EPA to establish standards for six pollutants known to cause harm to human health and the environment; these were given the name criteria pollutants. The criteria pollutants are particulate matter (currently $PM_{2.5}$ and PM_{10}), lead (Pb), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and carbon monoxide (CO).

1.1. Air quality design values

A design value is a statistic that describes the air quality status of a given monitoring location relative to the level of the National Ambient Air Quality Standards (NAAQS). Design values are defined to be consistent with the individual NAAQS as described in 40 CFR Part 50 (https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-50?toc=1). They are typically used to designate and classify nonattainment areas, as well as to assess progress towards meeting the NAAQS. Areas of the country where air pollution levels persistently exceed the national ambient air quality standards may be designated "nonattainment." The EPA Green Book (https://www.epa.gov/green-book) provides current information on nonattainment areas by state and pollutant.

Design values are computed and published annually by EPA's Office of Air Quality Planning and Standards and reviewed in conjunction with the EPA Regional Offices. More information can be found on EPA's Design Values webpage (https://www.epa.gov/air-trends/air-quality-design-values).

1.2. National Ambient Air Quality Standards

For each criteria pollutant, the EPA has developed national ambient air monitoring quality standards (NAAQS). Primary standards are set to protect public health, while secondary standards are set to protect the environment and public welfare (i.e. visibility, crops, animals, vegetation, and buildings).

The CAA requires the EPA to review the scientific basis of these standards every five years to ensure they are protective of public health and the environment. The latest updates to the standards can be found at [EPA's NAAQS webpage (https://www.epa.gov/criteria-air-pollutants/naaqs-table)](https://www.epa.gov/criteria-air-pollutants/naaqs-table), also shown in Table 1.

Table 1. National Ambient Air Quality Standards (NAAQS).

Pollutant [final rule citation]		Primary/ Secondary	Averaging time	Level	Form
Carbon monoxide (CO) [76 FR 54294, Aug 31, 2011]		Primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb) [73 FR 66964, Nov 12, 2008]		Primary and secondary	Rolling 3-month average	0.15 µg/m³ (1)	Not to be exceeded
Nitrogen dioxide (NO_2) [75 FR 6474, Feb 9, 2010] [77 FR 20218, April 3, 2012]		Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3) [80 FR 65292, Oct 26, 2015]		Primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM) 78 FR 3086, Jan 15, 2013	$PM_{2.5}$	Primary	1 year	9.0 µg/m³	Annual mean, averaged over 3 years
		Secondary	1 year	15.0 µg/m³	Annual mean, averaged over 3 years
		Primary and secondary	24 hours	35 µg/m³	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24 hours	150 µg/m³	Not to be exceeded more than once per year on average over 3 years
Sulfur dioxide (SO_2) [75 FR 35520, Jun 22, 2010] [89 FR 105692 Dec 27, 2024]		Primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	1 year	10 ppb	Not to be exceeded more than once on average over 3 years

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current **(2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m³ as a calendar quarter average) also remain in effect.**

(2) The level of the annual NO_2 **standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.**

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 **standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.**

(4) The previous SO_2 **standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.**

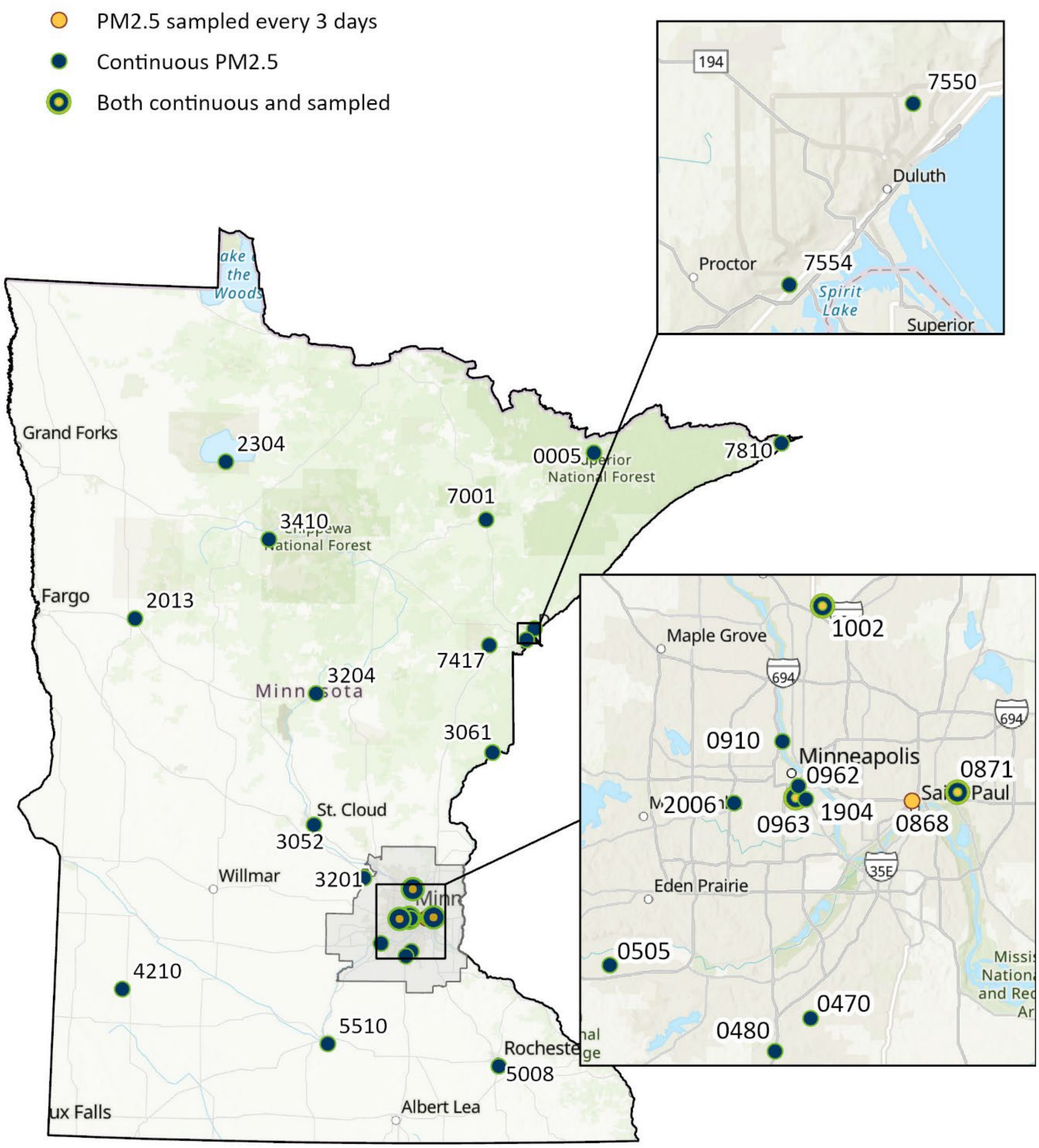
1.3. Particulate Matter

The MPCA monitors four different sizes of particulates: fine particulate matter ($PM_{2.5}$), coarse particulate matter ($PM_{10-2.5}$), PM_{10}, and TSP. $PM_{2.5}$ and PM_{10} are regulated by the NAAQS and TSP is regulated by the MAAQS. There are currently no state or federal air quality standards for $PM_{10-2.5}$.

1.3.1. $PM_{2.5}$ - Fine particulate matter

There were 27 FRM and FEM $PM_{2.5}$ sites in Minnesota in 2025, 11 in the Twin Cities metropolitan area.

Figure 1. 2025 $PM_{2.5}$ monitoring sites in Minnesota.



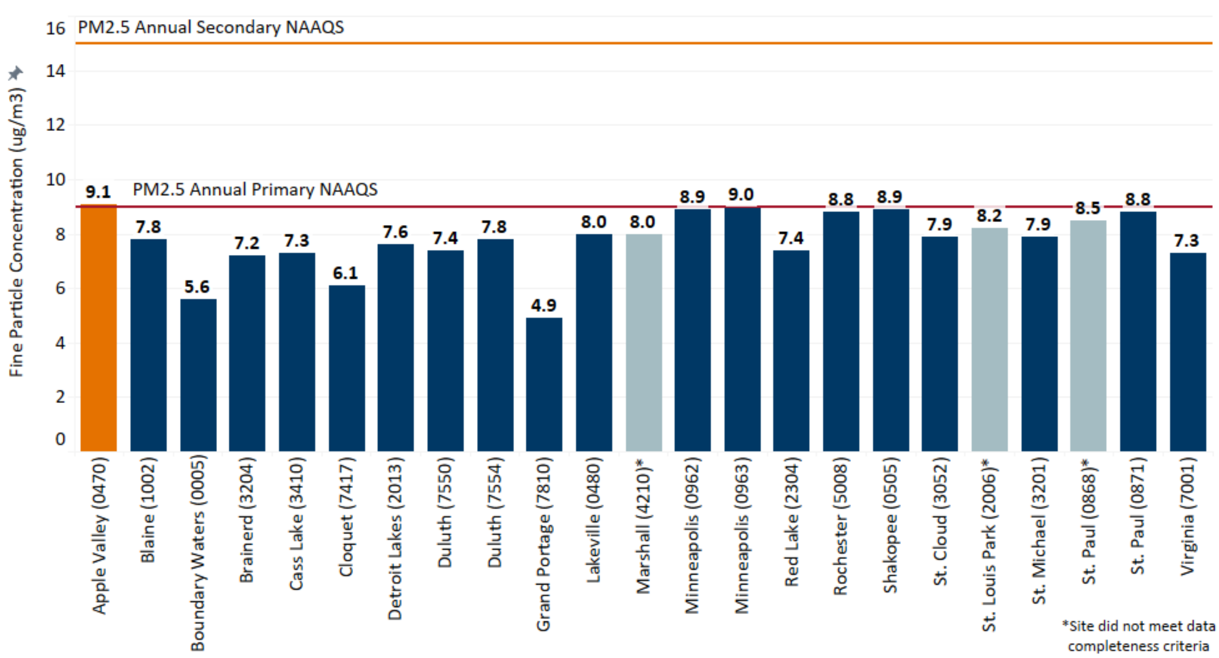
$PM_{2.5}$ Regulatory network overview

The $PM_{2.5}$ regulatory network includes FRM and FEM monitors. Currently, the MPCA operated FRM samplers at five sites and FEM monitors at 27 sites in 2025 (Figure 1). Since $PM_{2.5}$ NAAQS are based on three years of data and Mankato (5510) and Minneapolis (1904) were established in 2024; those sites are not included the NAAQS charts below.

On February 7, 2024, EPA strengthened the NAAQS for $PM_{2.5}$. EPA changed the level of the primary (health-based) annual $PM_{2.5}$ standard from 12.0 micrograms per cubic meter to 9.0 micrograms per cubic meter to provide increased public health protection, consistent with the available health science. EPA did not change the current secondary annual $PM_{2.5}$ standard nor the daily $PM_{2.5}$ standard. For more information, visit https://www.epa.gov/pm-pollution/final-reconsideration-national-ambient-air-quality-standards-particulate-matter-pm.

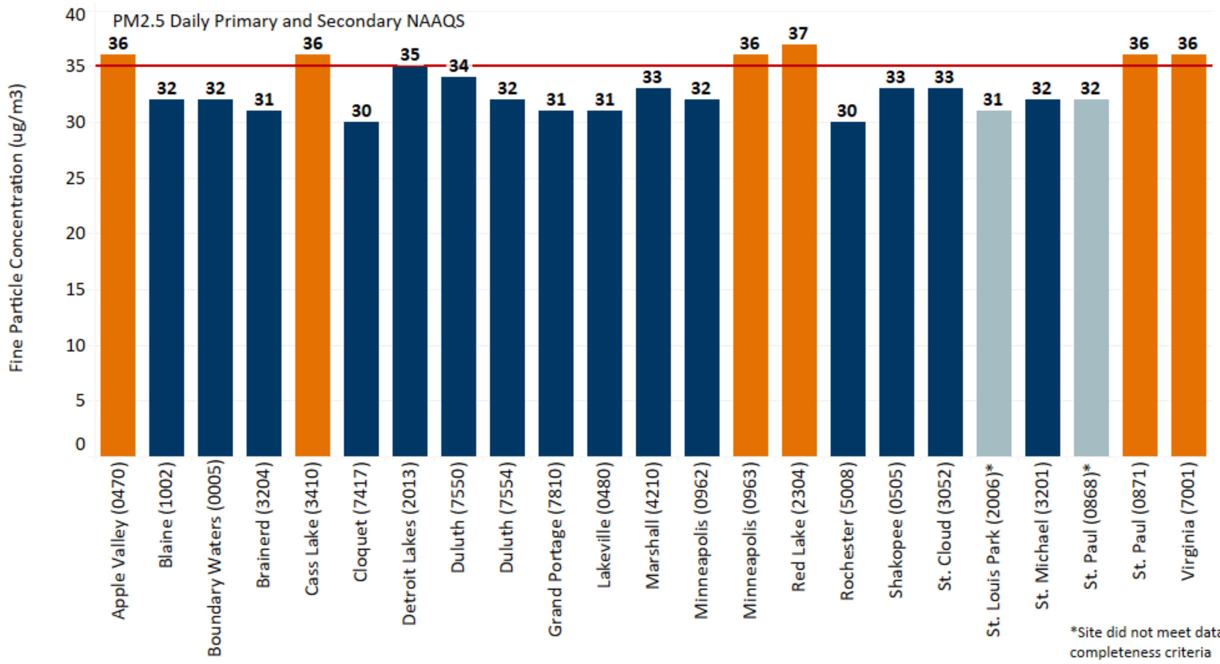
A monitoring site meets the annual $PM_{2.5}$ NAAQS if the three-year average of the seasonally-weighted annual average $PM_{2.5}$ concentration is less than or equal to 9.0 µg/m³. Results from $PM_{2.5}$ monitors in 2023-2025 show Minnesota annual average $PM_{2.5}$ concentrations ranged from 4.9 µg/m³ in Grand Portage (7810) to 9.1 µg/m³ in Apple Valley (0470); all but one site are below the current annual standard of 9.0 µg/m³ (Figure 2). 2025 design values have increased relative to previous years because the calculations include data from both the 2025 and 2023 wildfire smoke season. See the attached Draft Wildfire impacts fine particulate in Minnesota's ambient air appendix for further analysis on the impacts of wildfire on $PM_{2.5}$. Mankato (5510), Minneapolis (1904), and Minneapolis (0910) started monitoring recently with less than three years of data and is not included in this chart.

Figure 2. 2025 $PM_{2.5}$ design values compared to the annual NAAQS



A monitoring site meets the 24-hour NAAQS if the 98th percentile of the 24-hour $PM_{2.5}$ concentrations in a year, averaged over three years, is less than or equal to 35 µg/m³. Results from FEM monitors in 2023-2025 show the 98th percentile of the daily $PM_{2.5}$ averages in Minnesota ranged from 30 µg/m³ in Cloquet (7417) and Rochester (5008) to 37 µg/m³ in Red Lake (2304); six sites are above the 24-hour standard of 35 µg/m³: Apple Valley (0470), Cass Lake (3410), Minneapolis (0963), Red Lake (2304), St. Paul (0871), and Virginia (7001) (Figure 3). See the attached Draft Wildfire impacts fine particulate in Minnesota's ambient air appendix for further analysis on the impacts of wildfire on $PM_{2.5}$. Mankato (5510), Minneapolis (1904), and Minneapolis (0910) started monitoring recently with less than three years of data and is not included in this chart.

Figure 3. 2025 $PM_{2.5}$ design values compared to the 24-hour NAAQS.

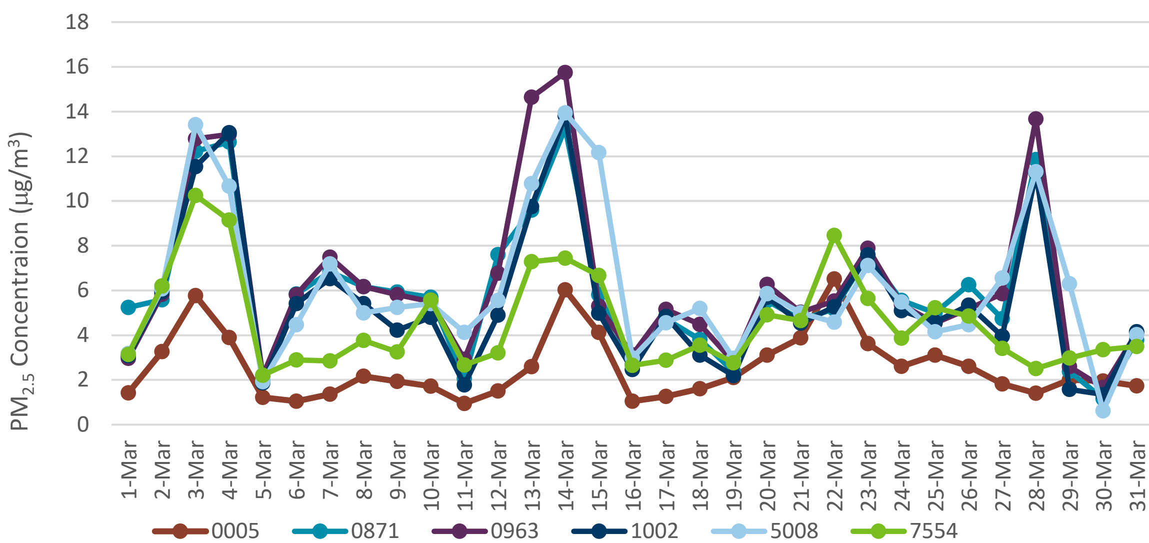


$PM_{2.5}$ Continuous network

The MPCA currently supports 27 FEM $PM_{2.5}$ sites in Minnesota. In addition to providing NAAQS comparable data, the $PM_{2.5}$ continuous (FEM) data provide two key types of information that are not available from the FRM network. First, continuous data capture high concentration days that might be missed in the one-in-three-day FRM sampling schedule. Second, daily monitoring allows for temporal contrasts between sites on an ongoing basis, providing better, more informative comparisons. Additionally, continuous $PM_{2.5}$ monitoring provides hourly data that assist in understanding how concentrations vary throughout the day. Understanding such daily fluctuations helps determine sources of $PM_{2.5}$ and when health risks from fine particles are greatest. Increased understanding of concentrations and risks aids in prioritizing emission reduction efforts.

$PM_{2.5}$ is a regional pollutant, with some addition from local sources; therefore, concentrations tend to rise and fall in unison across the state. There is considerable variability between sites, however, even as the general trend stays uniform. Such differences in concentrations tend to be driven by local sources, especially those in closer proximity to large urban areas. Disparities between urban and rural areas demonstrate the effect of man-made emission sources on fine particulate concentrations (Figure 4).

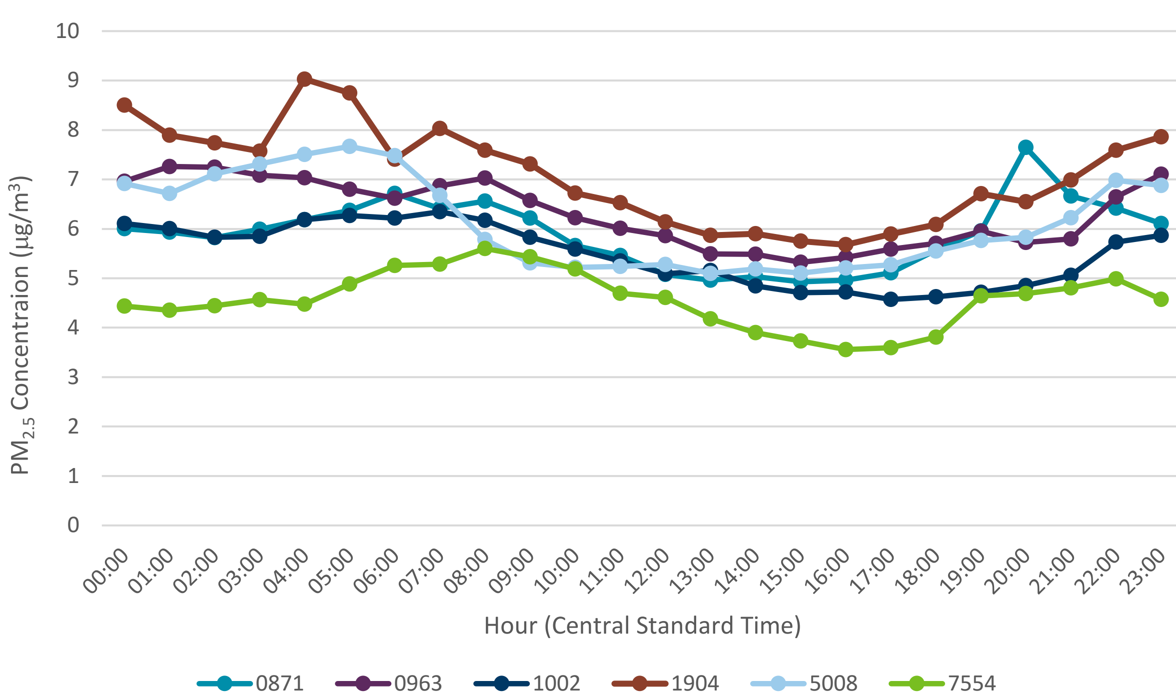
Figure 4. Daily average of hourly $PM_{2.5}$ concentrations at several Minnesota sites, weekdays in March 2025



Sites 0871, 0963, and 1002 are in the Twin Cities metro area, sites 5008 and 7554 are in smaller urban areas, and site 0005 is in a rural area.

$PM_{2.5}$ emissions in urban areas tend to follow a daily pattern (Figure 5). The mid-morning peak concentration results from traffic. As temperatures rise in the day, the atmospheric mixing height increases. This allows for dilution of fine particle concentrations and lowered concentrations throughout the afternoon. Temperatures fall in the evening, lowering the mixing height and trapping the particles, including those emitted during evening rush hour. This results in elevated concentrations throughout the night.

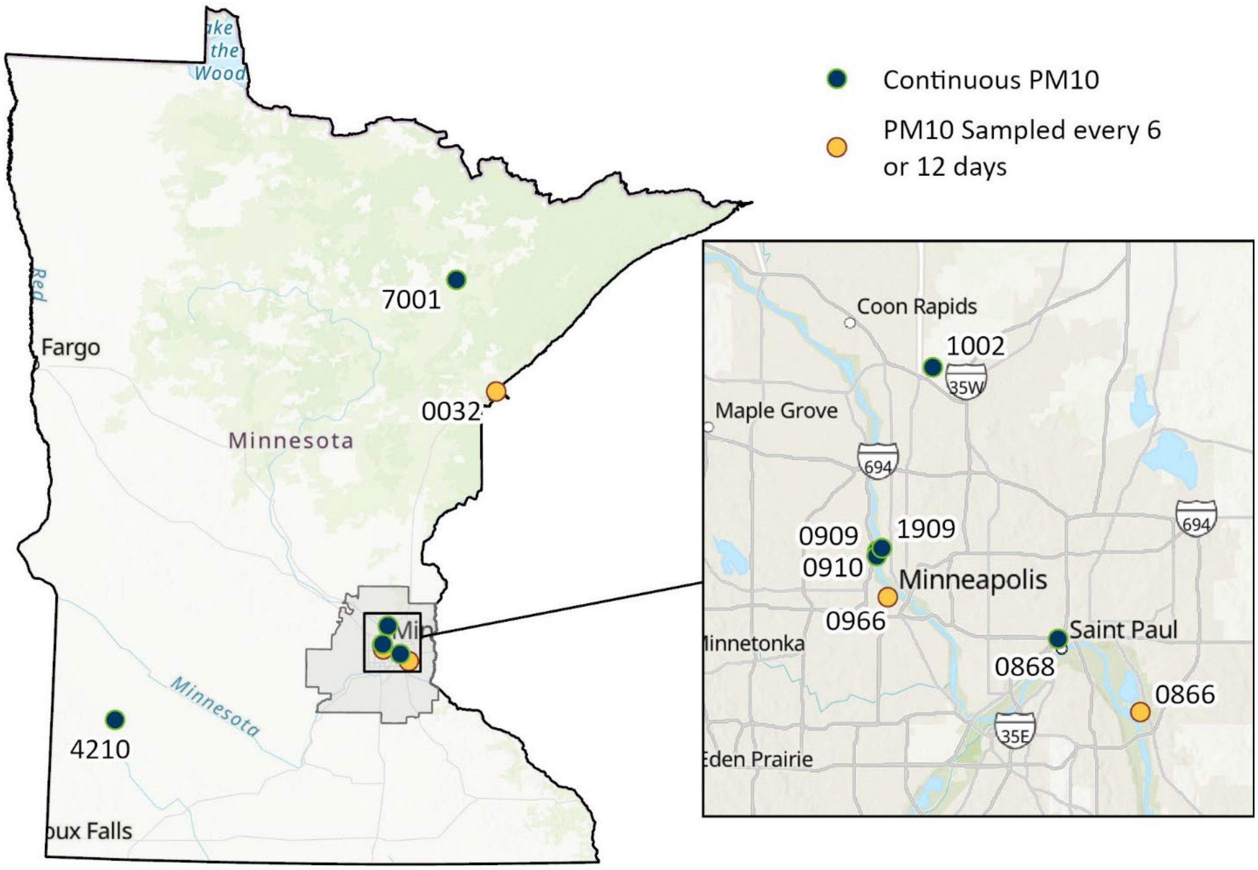
Figure 5. Average $PM_{2.5}$ concentrations per hour of the day at several Minnesota sites, May 2025



1.3.2. PM_{10}

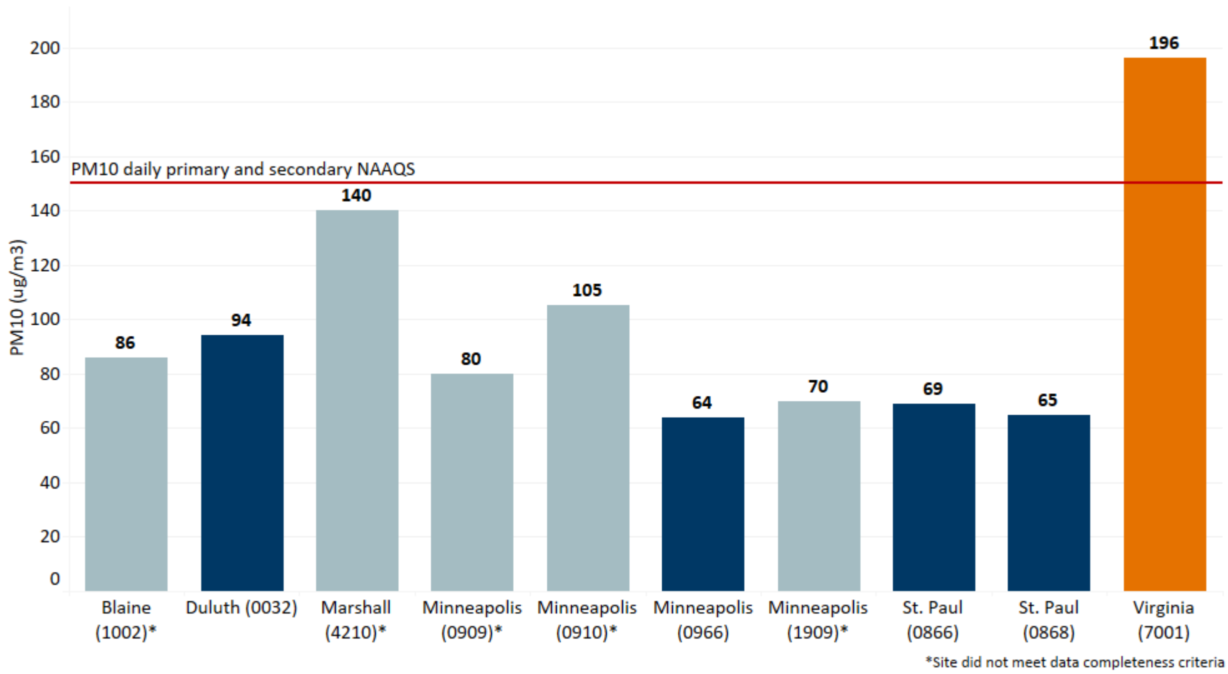
In 2025, the MPCA currently operated PM_{10} FRM samplers in St Paul (0866), Minneapolis (0966), and Duluth (0032). The FRM method collects mass samples of PM_{10} over a 24-hour period once every six days. There are also continuous PM_{10} FEM monitors that measure hourly PM_{10} concentrations at sites: St. Paul (0868), Minneapolis (0909), Minneapolis (0910), Minneapolis (1909), Blaine (1002), Marshall (4210), and Virginia (7001) (Figure 6).

Figure 6. 2025 PM_{10} monitoring sites in Minnesota.



While these values are not design values and cannot be used to determine compliance with the NAAQS, the MPCA reports the daily PM_{10} background concentration to describe the magnitude of PM_{10} concentrations. These are calculated following the methodology established in EPA's "PM_{10} SIP Development Guidance" (EPA-450/2-86-001, June 1987, Table 6-1). Depending on the total number of samples collected over a three-year period, the daily PM_{10} background concentration is calculated as the 1st, 2nd, 3rd, or 4th highest daily average PM_{10} concentration measured over three years. PM_{10} concentrations ranged from 64 µg/m^3 at Minneapolis (0966) to 196 µg/m^3 at Virginia (7001) in 2025 (Figure 7).

Figure 7. 2025 PM_{10} background concentrations compared to the daily NAAQS.



A monitoring site meets the 24-hour PM_{10} NAAQS when the level of 150 µg/m^3 is not exceeded more than once per year, on average, over three years. The standards are attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m^3 is equal to or less than one. Minnesota currently meets applicable NAAQS at nine out of ten sites. In 2023-2025, there were no expected exceedances for all sites except Virginia (7001), where the three-year design value was 2 expected exceedances (Table 2).

Table 2. 2025 PM_{10} estimated exceedances

Site ID	PM_{10} 3-year estimated exceedances	Completeness criteria met
27-003-1002	0	No
27-053-0909	0	No
27-053-0910	0	No
27-053-0966	0	Yes
27-053-1909	0	No
27-083-4210	0.3	No
27-123-0866	0	Yes
27-137-0868	0.4	Yes
27-137-0032	0	Yes
27-137-7001	2	Yes

1.3.3. Total Suspended Particulate matter (TSP)

TSP was one of the original NAAQS pollutants but was replaced by the PM_{10} standard in 1987. Generally, smaller particles, such as PM_{10} and $PM_{2.5}$, are expected to have greater health impacts than TSP. Today, TSP levels are regulated at the state level by the MAAQS. The MAAQS includes four distinct standards for TSP (Table 3).

Table 3. Minnesota Ambient Air Quality Standards for TSP

Standard type	Time interval	Level of standard	A monitoring site meets the standard if…
Primary[1]	Daily (24-hour)	260 µg/m^3	…the annual 2nd highest daily TSP concentration is less than or equal to 260 µg/m^3
	Annual	75 µg/m^3	...the annual geometric mean is less than or equal to 75 µg/m^3
Secondary[2]	Daily (24-hour)	150 µg/m^3	...the annual 2nd highest daily TSP concentration is less than or equal to 150 µg/m^3
	Annual	60 µg/m^3	...the annual geometric mean is less than or equal to 60 µg/m^3

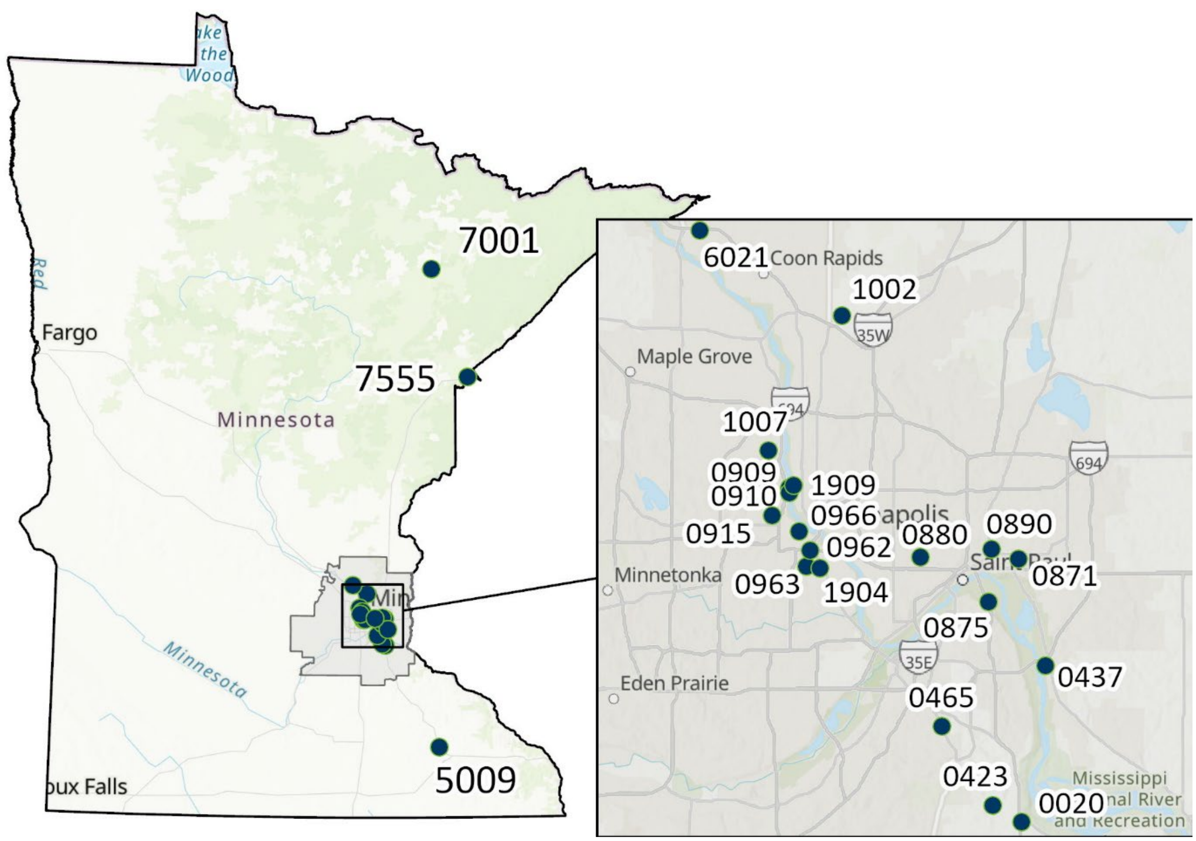
[1] primary standard is set to protect against human health effects associated with exposure to an air pollutant.

[2] secondary standard is set to protect against environmental or public welfare effects associated with exposure to an air pollutant.

In addition to TSP, the filters are analyzed for metals as part of the air toxics program, using the ICP/MS method. Metals are discussed further in the air toxics section of this report.

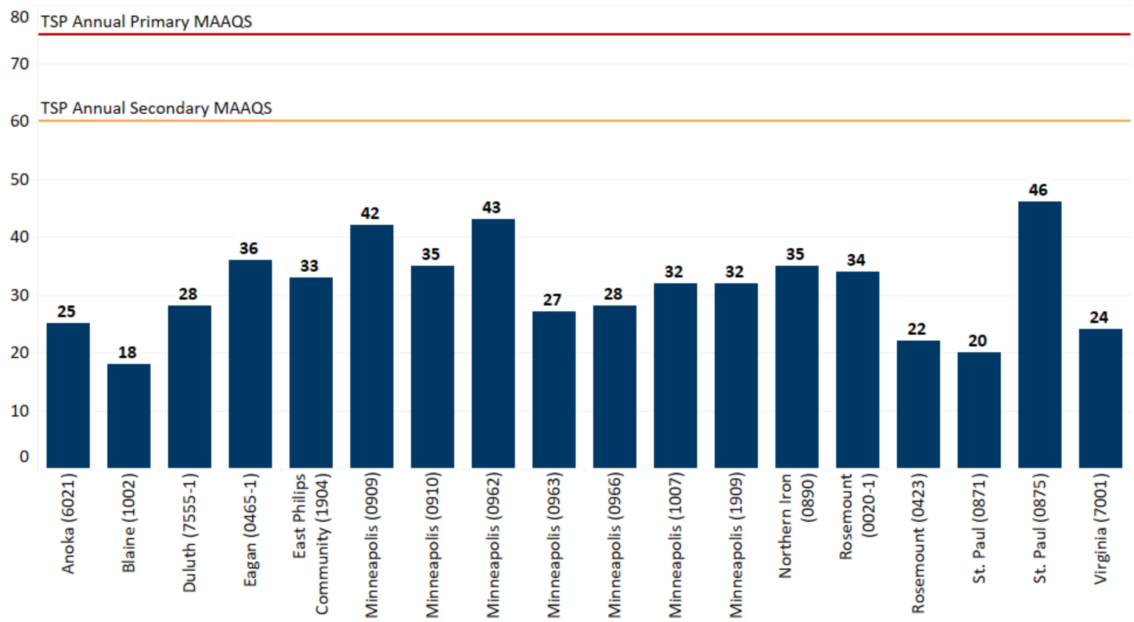
The MPCA currently operates 22 TSP monitoring sites (Figure 8). Mass samples of TSP are collected over a 24-hour period once every six days.

Figure 8. 2025 TSP monitoring sites in Minnesota



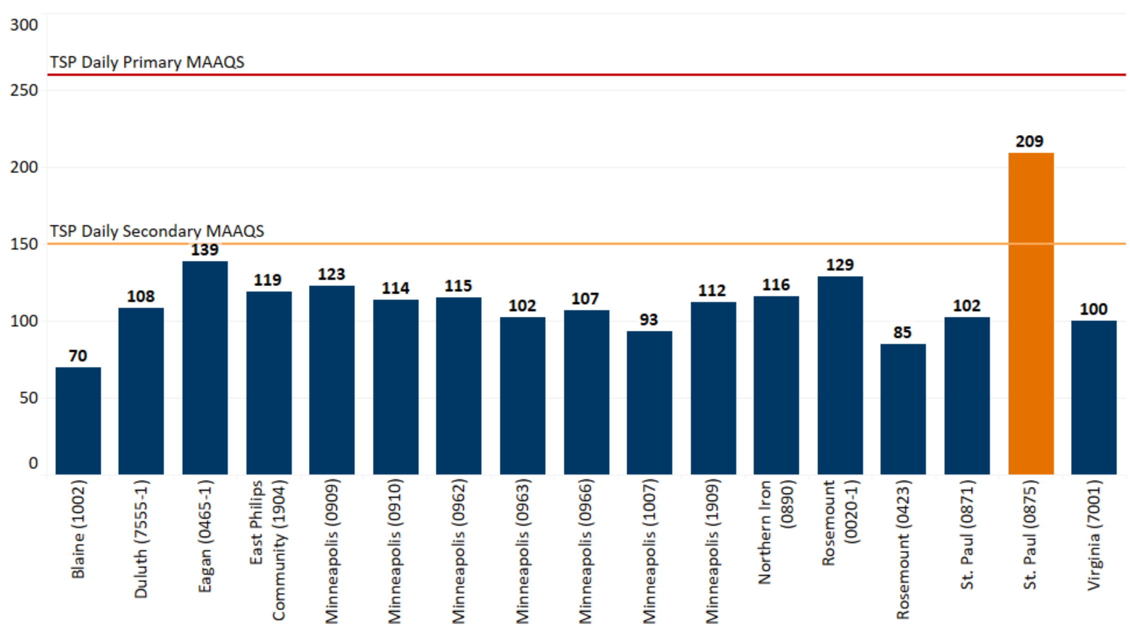
In 2025, Minnesota annual TSP averages ranged from 18 µg/m³ in Blaine (1002) to 46 µg/m³ in St. Paul (0875) (Figure 9). All sites met the annual primary MAAQS in 2025. Minneapolis Public School Maintenance (0915), Folwell School (5009), Frogtown (0880), and Bayport (0437) started monitoring recently with less than three years of data and is not included in this chart.

Figure 9. 2025 TSP concentrations compared to the annual primary and secondary MAAQS.



In 2025, daily TSP values in Minnesota ranged from 70 µg/m³ at Blaine (1002) to 209 µg/m³ at St. Paul (0875) (Figure 10). St. Paul (0875) violated the daily secondary TSP MAAQS; all other sites met the TSP standards. Minneapolis Public School Maintenance (0915), Folwell School (5009), Frogtown (0880), and Bayport (0437) started monitoring recently with less than three years of data and is not included in this chart.

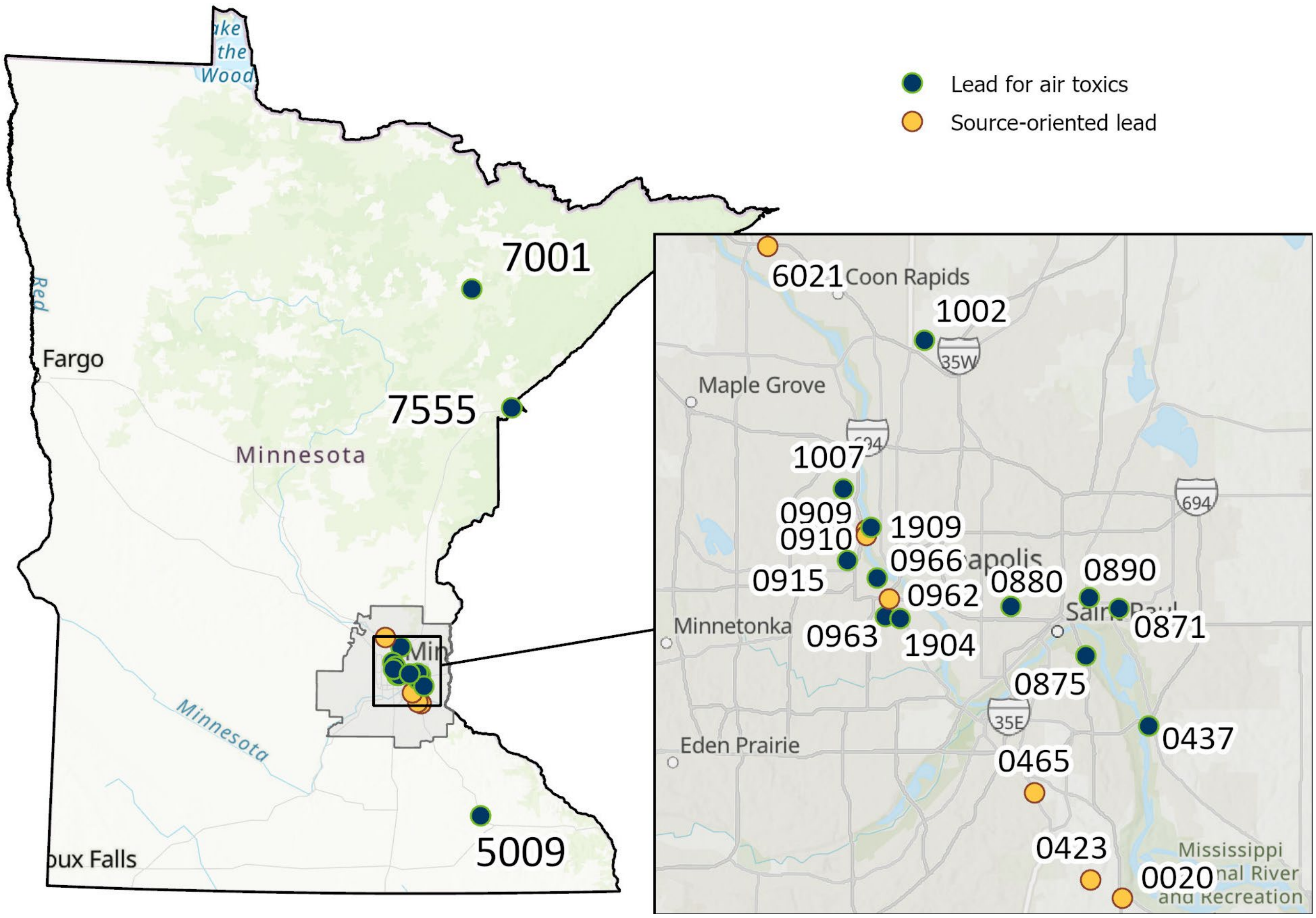
Figure 10. 2025 TSP concentrations compared to the 24-hour primary and secondary MAAQS.



1.4. Lead (Pb)

The MPCA monitored lead at 22 sites in 2025 (Figure 11), including NCore (1002). Eight lead monitoring sites are considered source-oriented: Gopher Resource Corporation in Eagan (0465), Federal Ammunition in Anoka, MN (6021), Flint Hills (0020 and 0423), North Minneapolis near a former Northern Metals Recycling location (0909 and 0910), and Near Road I-94/I-35 (0962). The remaining sites are part of the air toxics program.

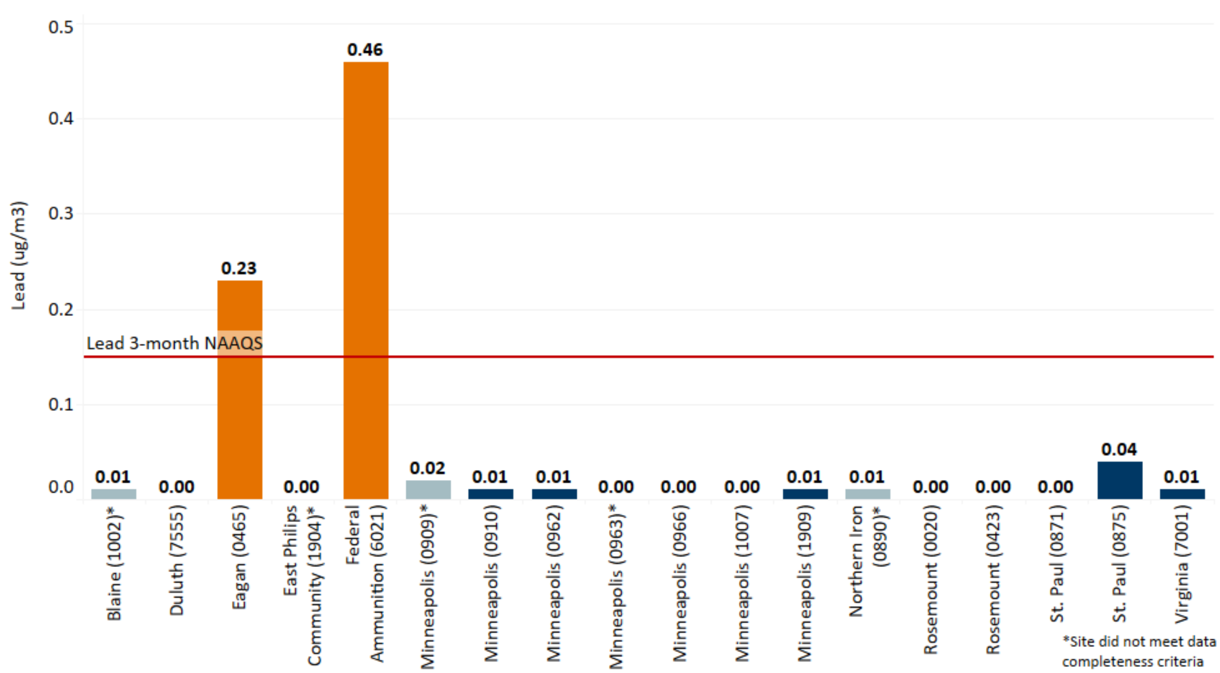
Figure 11. 2025 lead monitoring sites in Minnesota.



20 out of 22 lead monitoring sites in Minnesota met the 2008 lead NAAQS of 0.15 µg/m^3 in 2025 based on the most recent data, which show the three-year maximum 3-month rolling average concentration at monitored sites from 2023-2025. The highest monitored lead design value was 0.46 µg/m^3 at Federal Ammunition (6021) followed by 0.23 µg/m^3 at Gopher Resources (0465) in Eagan. For more information on the exceedance at Federal Ammunition (6021), go to the MPCA's Anoka – Federal Ammunition webpage. For more information on the exceedance at Gopher Resource, go to the MPCA's Eagan – Gopher Resource webpage. 16 sites were at levels equal to or less than 0.04 µg/m^3 (Figure 12). Minneapolis Public School Maintenance (0915), Folwell School (5009), Frogtown (0880), and Bayport (0437) started monitoring recently with less than three years of data and is not included in this chart.

The TSP/metals sampler was deployed near Federal Ammunition in Anoka, MN (27-003-6021) in December 2022 to meet the requirement of Appendix D of 40 CFR Part 58, section 4.5. This requirement identifies there must be one source-oriented SLAMS site located to measure the maximum Pb concentration in ambient air resulting from each non-airport Pb source which emits 0.50 or more tons per year. Federal Ammunition identified emissions above the 0.5 tons lead on their annually air emission inventory for 2019 - 2022.

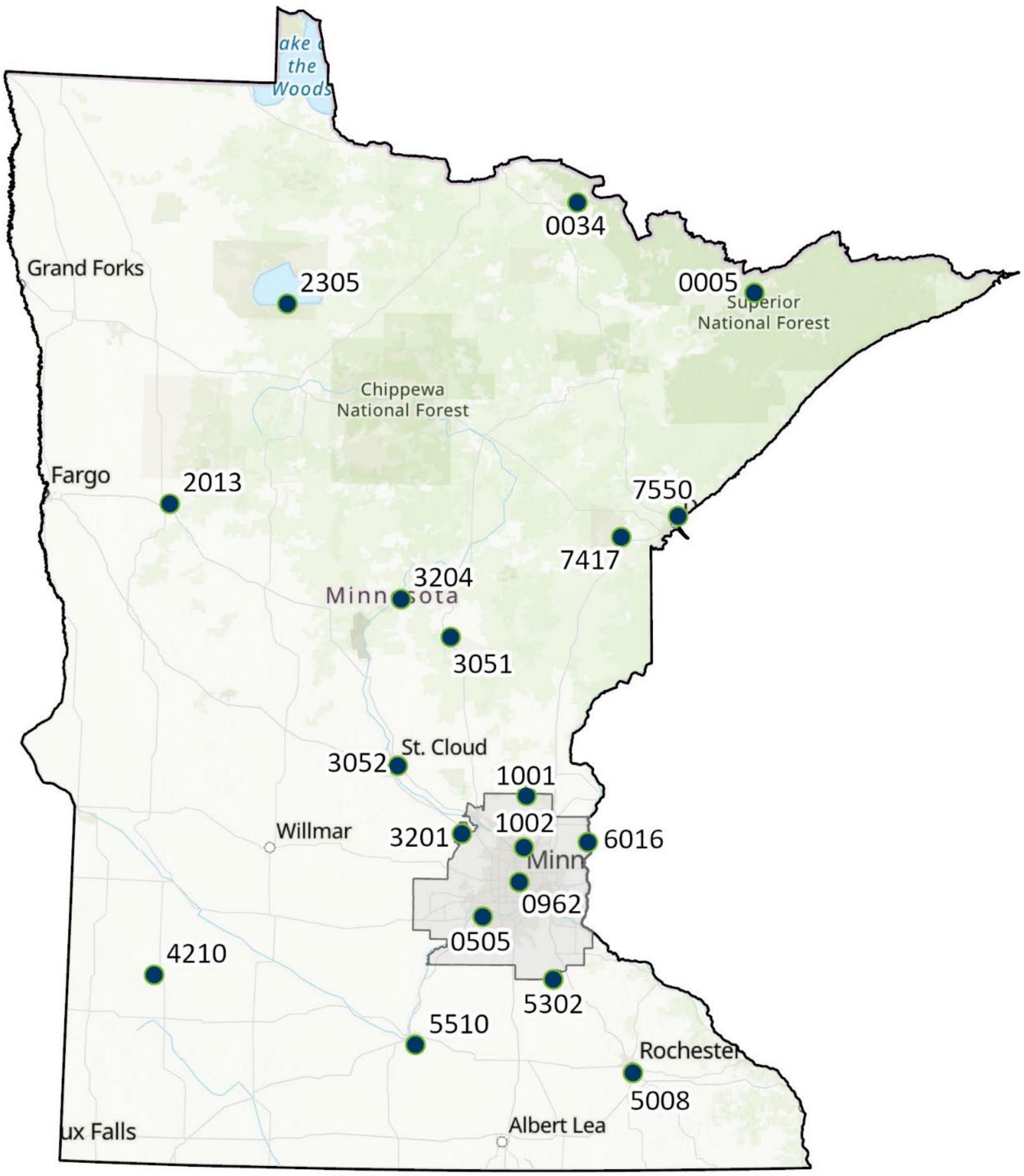
Figure 12. 2025 lead design values compared to the 3-month NAAQS.



1.5. Ozone (O_3)

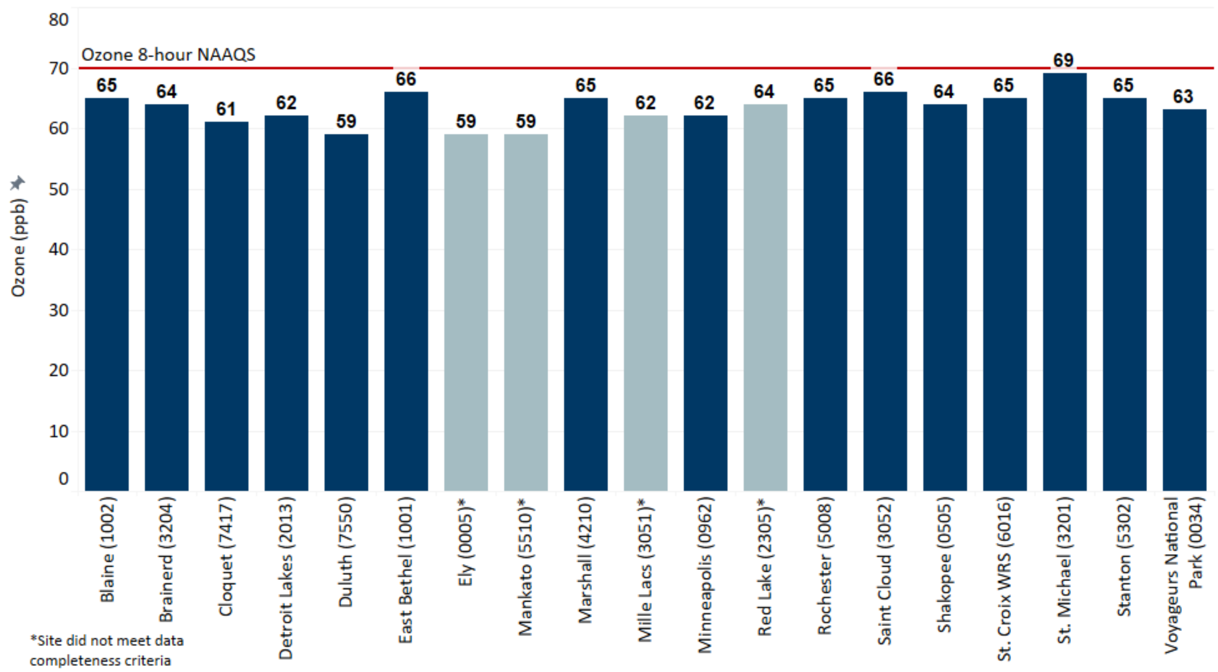
The MPCA monitors ozone at 18 monitoring sites. An additional monitor, located at Voyageurs National Park (0034), is operated by the National Park Service (Figure 13). Since the MPCA does not have any role in the maintenance or use of this monitor, it is not included in our SLAMS or AQI monitoring networks.

Figure 13. 2025 ozone monitoring sites in Minnesota.



A monitoring site meets the primary ozone NAAQS if the three-year average of the fourth highest daily maximum 8-hour concentration is less than or equal to 70 ppb. From 2023-2025, Minnesota eight-hour averages ranged from 59 ppb in Ely (0005) and Mankato (5510) to 69 ppb in St. Michael (3021). All sites were below the eight-hour standard (Figure 14).

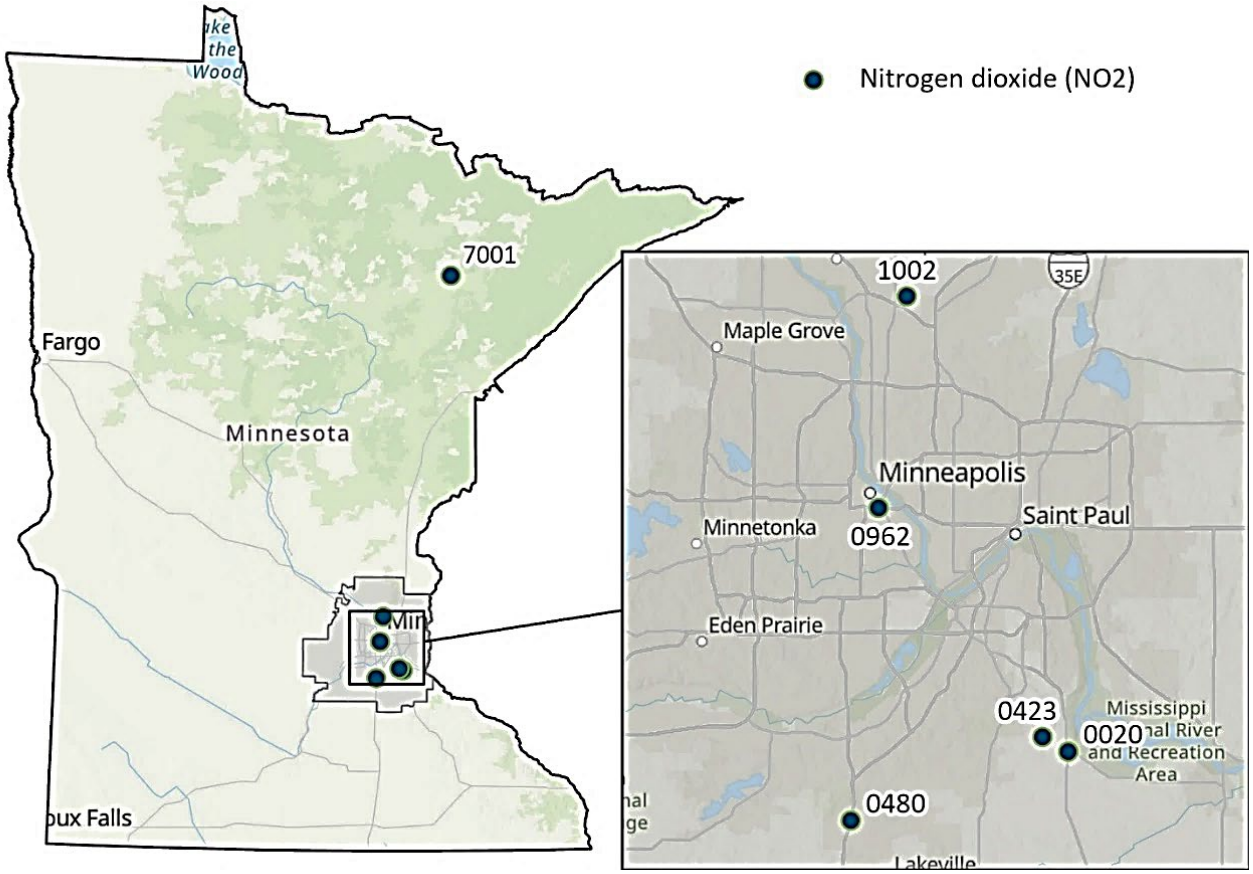
Figure 14. 2025 ozone design values compared to the 8-hour average NAAQS.



1.6. Nitrogen Dioxide (NO_2)

Currently, the MPCA monitors NO_2 at six sites in Minnesota (Figure 15).

Figure 15. 2025 NO_x monitoring sites in Minnesota.



A monitoring site meets the annual NAAQS for NO_2 if the annual average is less than or equal to 53 ppb. Minnesota averages ranged from 3 ppb in Virginia (7001) to 10 ppb at the Minneapolis near-road site (0962); therefore, Minnesota met the annual NAAQS for NO_2 (Figure 16).

In addition to the annual standard, there is also a one-hour standard for NO_2. The one-hour NAAQS is intended to protect against adverse health effects associated with short-term exposures to elevated NO_2. To meet this standard, the three-year average of the annual 98th percentile daily maximum one-hour NO_2 concentration must not exceed 100 ppb. Minnesota averages ranged from 24 ppb at Rosemount (0423) to 41 ppb at Minneapolis (0962); therefore, all sites met the one-hour NAAQS for NO_2 (Figure 17).

Figure 16. 2025 NO_2 design values compared to the annual NAAQS.

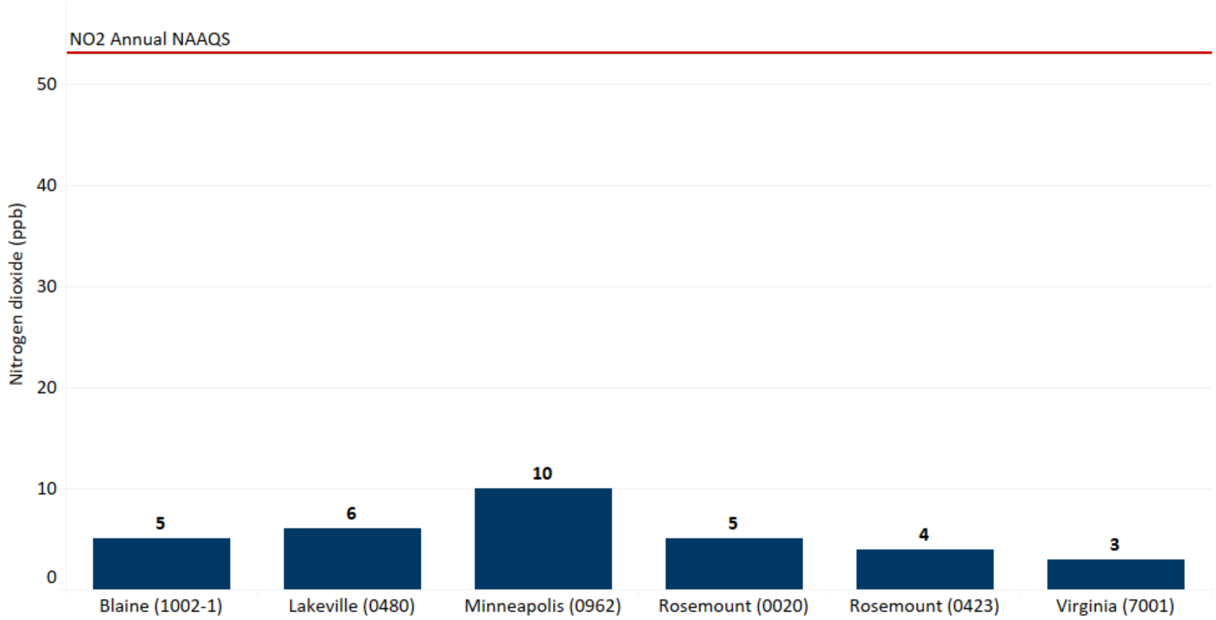
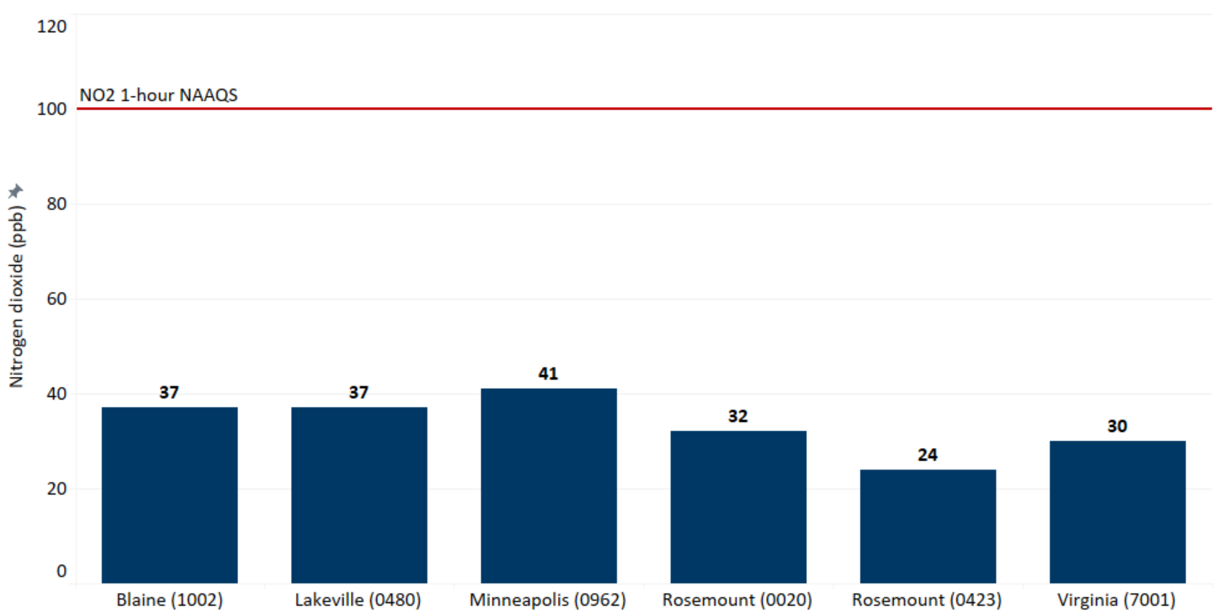


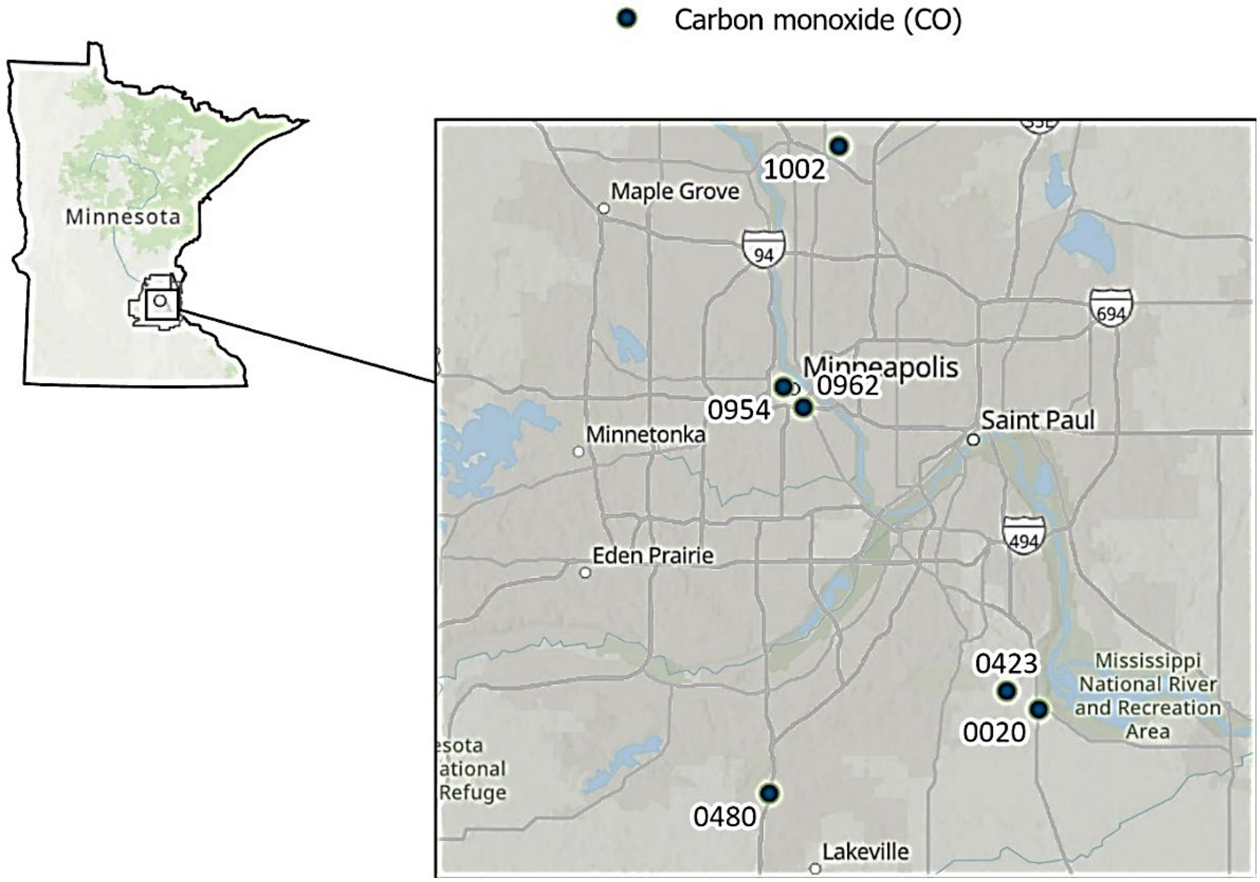
Figure 17. 2025 NO_2 design values compared to the 1-hour NAAQS.



1.7. Carbon monoxide (CO)

The MPCA monitors CO at six sites in Minnesota, all in the Twin Cities metropolitan area (Figure 18).

Figure 18. 2025 CO monitoring sites in Minnesota.



Minnesota currently meets applicable eight-hour NAAQS for CO. A monitoring site meets the 8-hour CO NAAQS when the level of 9 ppm is not exceeded more than once per year. The design value for CO is evaluated over a two-year period. Specifically, the design value is the second highest 8-hour average over two years of data. Minnesota CO design values for 2025 ranged from 0.7 ppm at Blaine (1002), Rosemount (0020), and Rosemount (0423) to 2.3 ppm at Minneapolis (0962) (Figure 19).

The one-hour CO NAAQS is met when the level of 35 ppm is not exceeded more than once per year. The design value for CO is evaluated over a two-year period. Specifically, the design value is the higher of each year's annual second maximum, non-overlapping 1-hour average. Minnesota values for 2025 ranged from 0.9 ppm at Blaine (1002), Rosemount (0020), and Rosemount (0423) to 2.5 ppm at Minneapolis (0962) (Figure 20).

Figure 19. 2025 design values for CO compared to the 8-hour NAAQS.

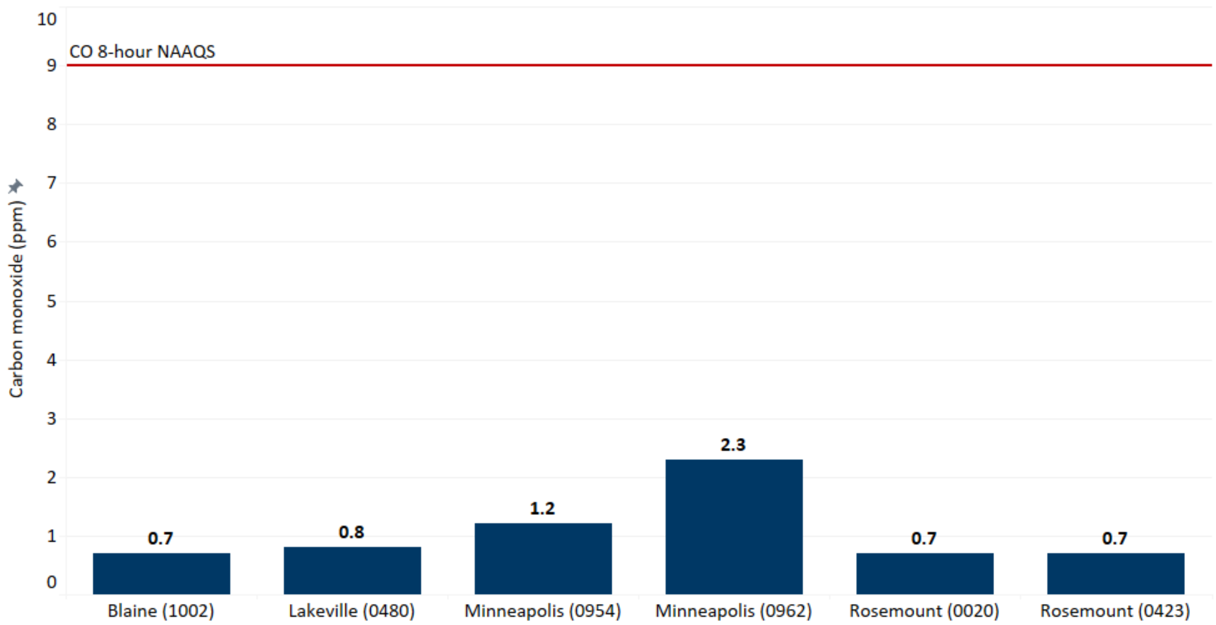
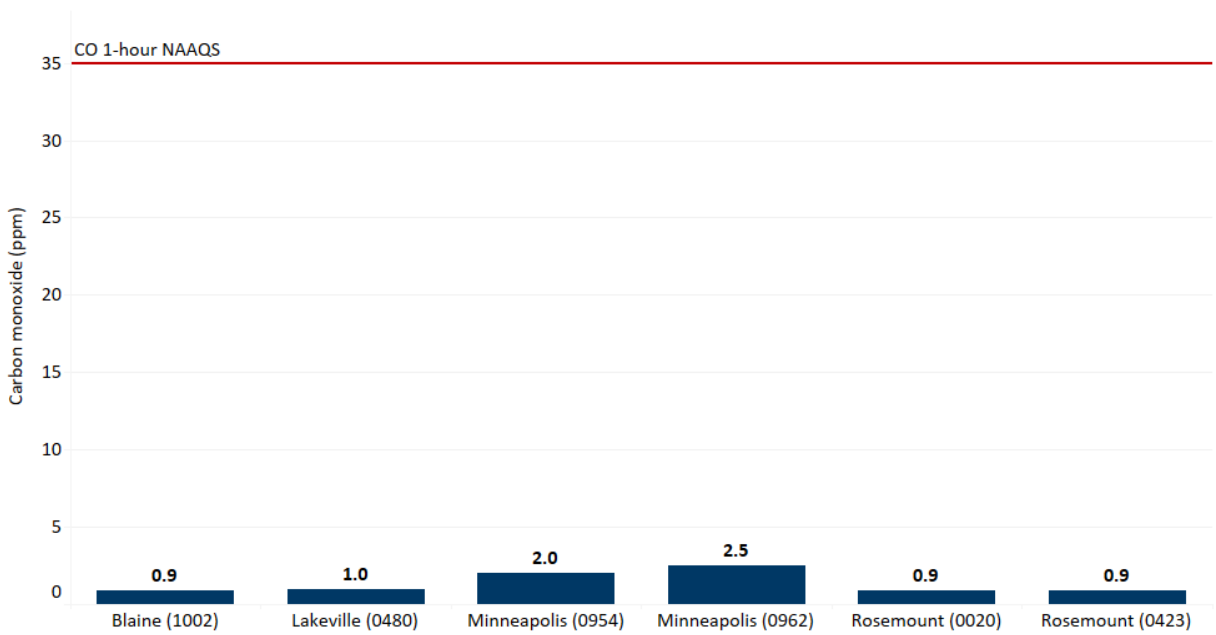


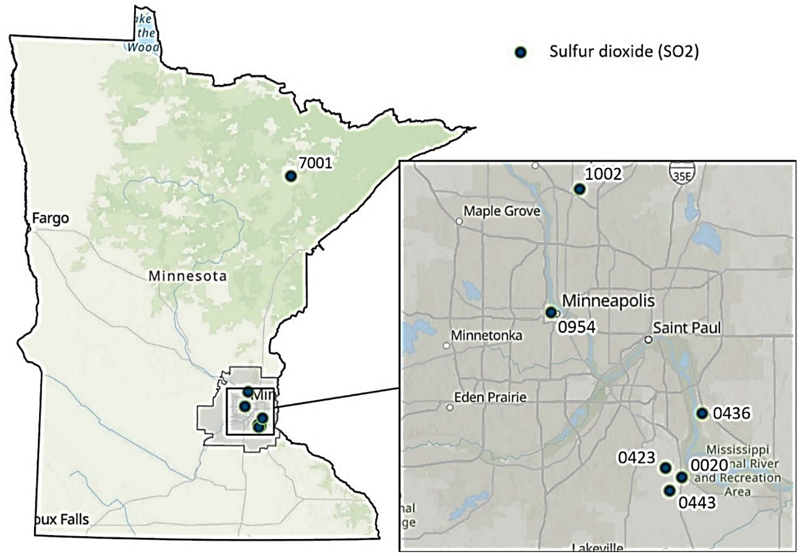
Figure 20. 2025 CO design values compared to the 1-hour average NAAQS.



1.8. Sulfur dioxide (SO_2)

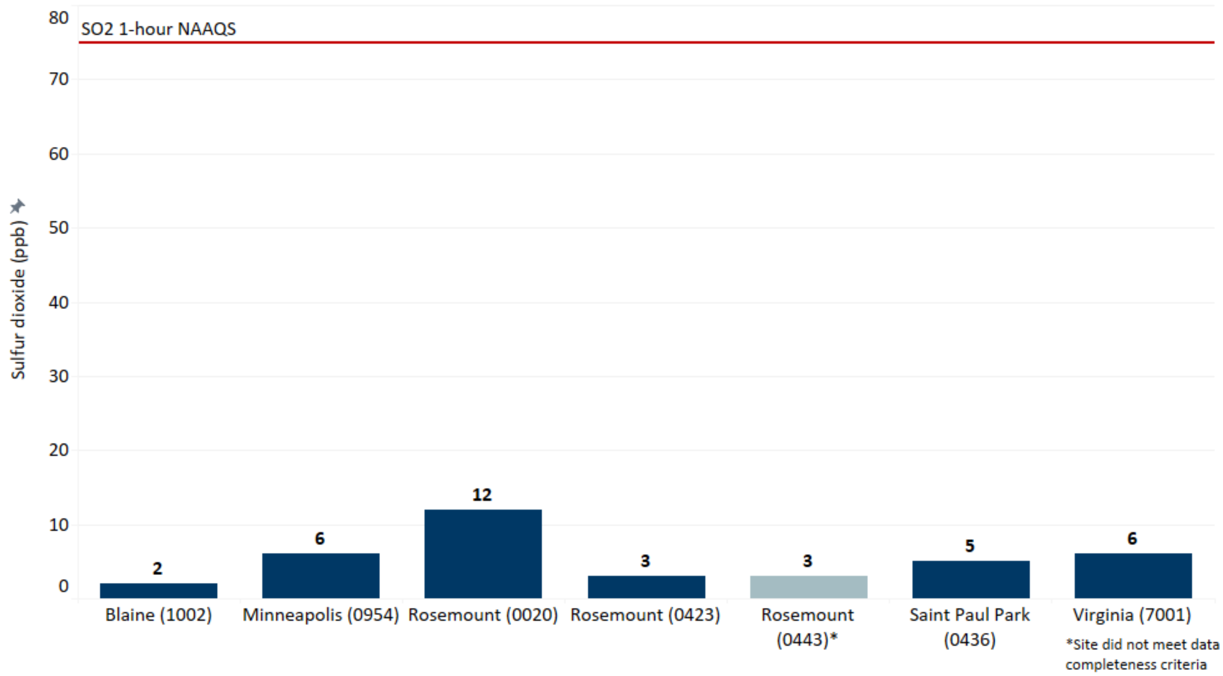
The MPCA monitors SO_2 at six sites in the Twin Cities metropolitan area (Figure 21) and one site in Virginia (7001). Trace level SO_2 at the NCore site in Blaine (1002) will help us understand the role of SO_2 at levels far below the NAAQS. The annual secondary NAAQS was revised to be an annual standard in 2024 [89 FR 105692 Dec 27, 2024].

Figure 21. 2025 SO_2 monitoring sites in Minnesota.



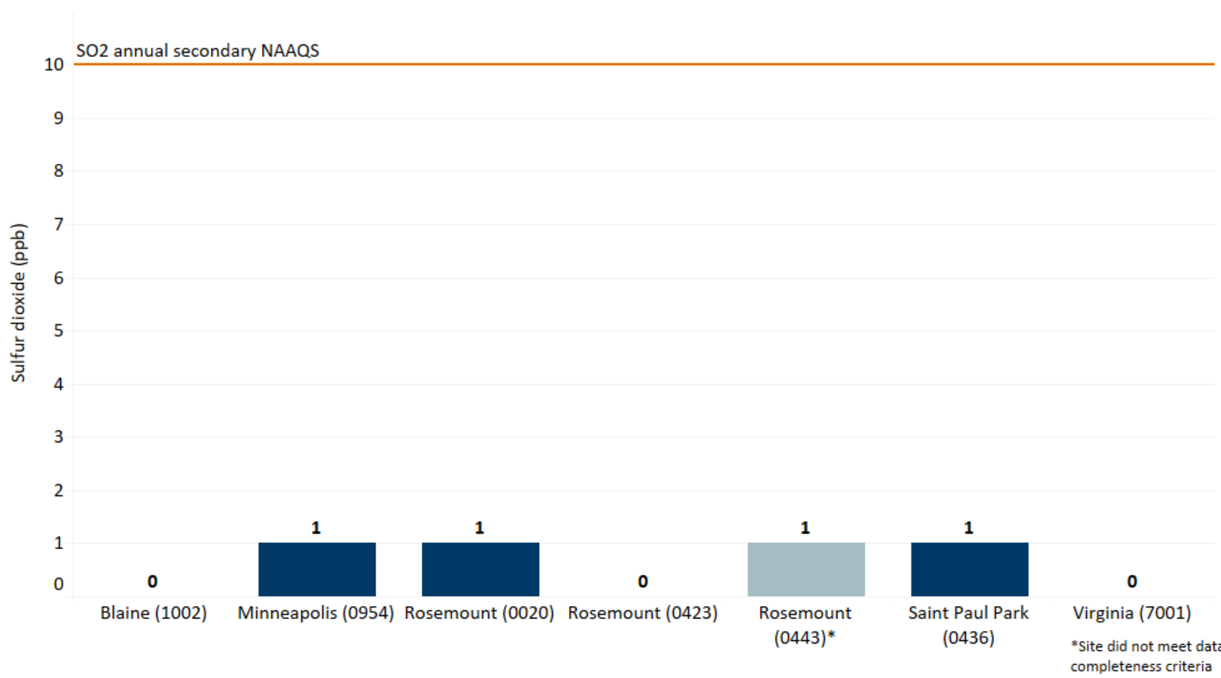
The primary SO_2 NAAQS is a one-hour standard; it is met if the three-year average of the annual 99th percentile daily maximum one-hour SO_2 concentration is less than 75 ppb. Minnesota averages from 2023-2025 ranged from 2 ppb at Blaine (1002) to 12 ppb at Rosemount (0020); therefore, all Minnesota sites met the one-hour NAAQS for SO_2 (Figure 22).

Figure 22. 2025 SO_2 design values compared to the 1-hour NAAQS.



The secondary SO_2 NAAQS is an annual standard; it is met if the three-year average of the average is less than 10 ppb. Minnesota averages from 2023-2025 ranged from 0 ppb at Blaine (1002), Rosemount (0423), Virginia (7001) to 1 ppb at Minneapolis (0954), Rosemount (0020), Rosemount (0443), and Saint Paul Park (0436); therefore, all Minnesota sites met the annual secondary NAAQS for SO_2 (Figure 23).

Figure 23. 2025 SO_2 design values compared to the annual secondary NAAQS.



2. AQI

The AQI categories developed by the EPA are green (good), yellow (moderate), orange (unhealthy for sensitive groups or USG), red (unhealthy), purple (very unhealthy), and maroon (hazardous). Each category is assigned a color and corresponds to a different level of health concern (Figure 24). In the past, MPCA offered AQI forecasts for only the Twin Cities and Rochester. The MPCA issues daily forecasts for the majority of its AQI monitor locations through MPCA's AQI website, the Minnesota Air mobile app, Twitter, and to individuals who have signed up to receive e-mailed forecasts. If it is suspected through forecasting or monitoring that the daily AQI will be over 100, the MPCA will issue an Air Quality Alert to be disseminated by the National Weather Service, GovDelivery, the AirNow mobile app, Twitter, the media, and to individuals who have signed up to receive email alerts. Forecasts and alerts allow the public to be proactive about protecting their health and reducing their own contributions to emissions and exposure to air pollution. At no cost, the public can download the Minnesota Air mobile app and sign up for emailed forecasts and alerts from MPCA's AQI website (https://www.pca.state.mn.us/air/current-air-quality).

Figure 24. The Air Quality Index categories and respective levels of health concern.

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory and air pollution poses little or no risk.
Moderate	51 to 100	Air quality is accepable; 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 Sensitve 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 emvergency conditions. The entire population is more likely to be affected.

Minnesota experienced a fairly active year with respect to Orange or worse AQI days for $PM_{2.5}$ during 2025 (Figure 25). A dry spring led to early wildfire activity in northern Minnesota, and prevalent drought in much of western Canada led to another active fire season north of the border. There were 26 days with an AQI of orange or worse in 2025, rivaling 2021 and 2023 for the number of days with poor air quality. Northern portions of the state experienced more periods of smoke (Figure 26). The vast majority of days in 2025 were Green at any single monitor.

Figure 27 shows the maximum daily $PM_{2.5}$ AQI throughout Minnesota in 2025. Yellow AQI winter stagnation episodes occurred in January and February, and again in November and December. Prescribed fire led to a few marginal yellow days during the spring. The worst air quality of the year was associated with several intrusions of wildfire smoke from Canada. AQIs reached Red and Purple during smoke intrusions in early June, mid-July, and early August. Orange was a fairly common occurrence throughout the summer.

Figure 25. Annual statewide $PM_{2.5}$ AQI category counts, 2001-2025.

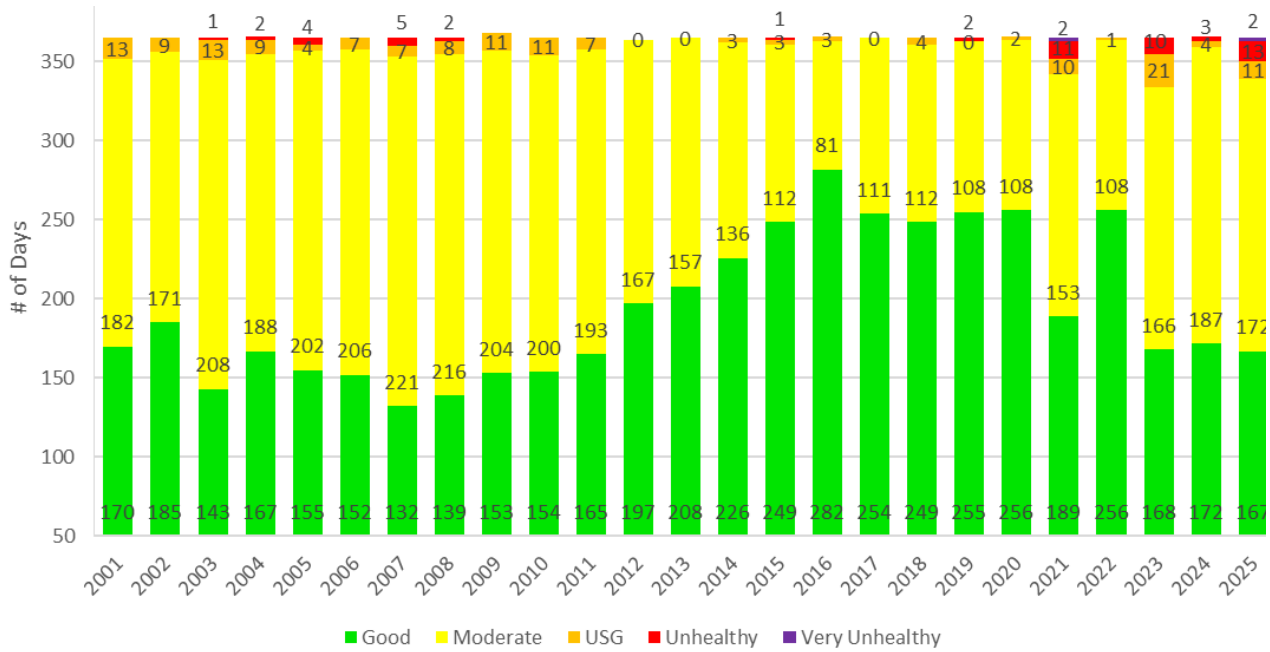


Figure 26. 2025 daily observed AQI category counts for $PM_{2.5}$ in Minnesota.

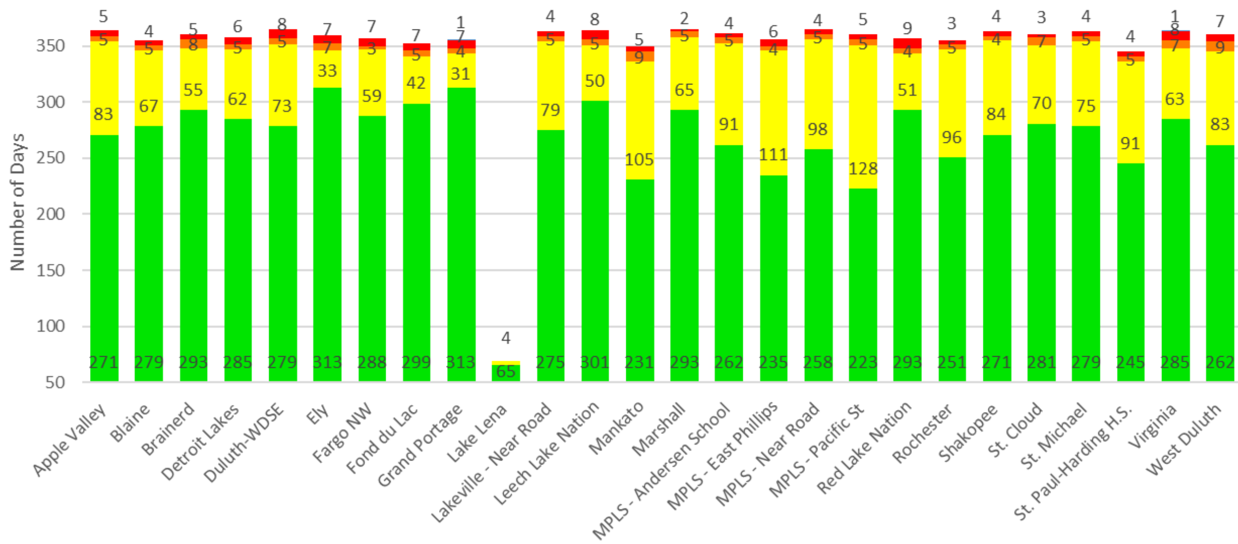
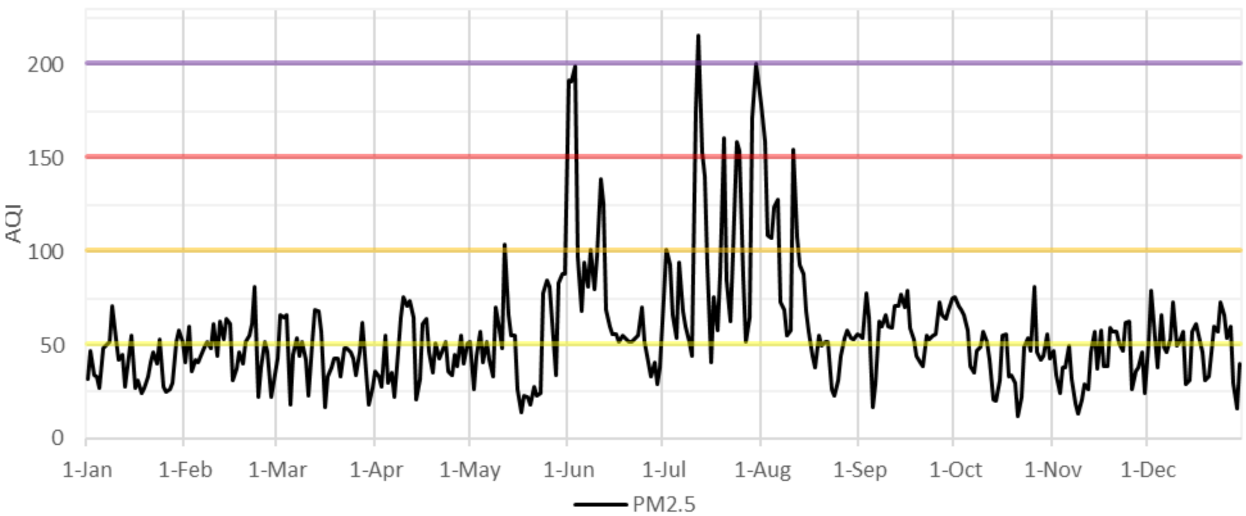


Figure 27. Peak daily $PM_{2.5}$ AQI for Minnesota in 2025.



AQIs with respect to ozone were higher in 2025 compared to 2024 (Figure 28). The spatial extent of ozone followed the typical pattern, with higher ozone tending to be found near and downwind of the Twin Cities (Figure 29). Warm and dry conditions combined with southerly flow produced a “traditional” Orange AQI in much of central and northern Minnesota during mid-May (Figure 28). High ozone in early June was likely enhanced by ozone precursors present in a smoke plume. The majority of Yellow-Orange days occurred from early May to the end of July, which is typical for Minnesota (Figure 3030).

Figure 28. Annual statewide ozone AQI category counts, 2001-2025.

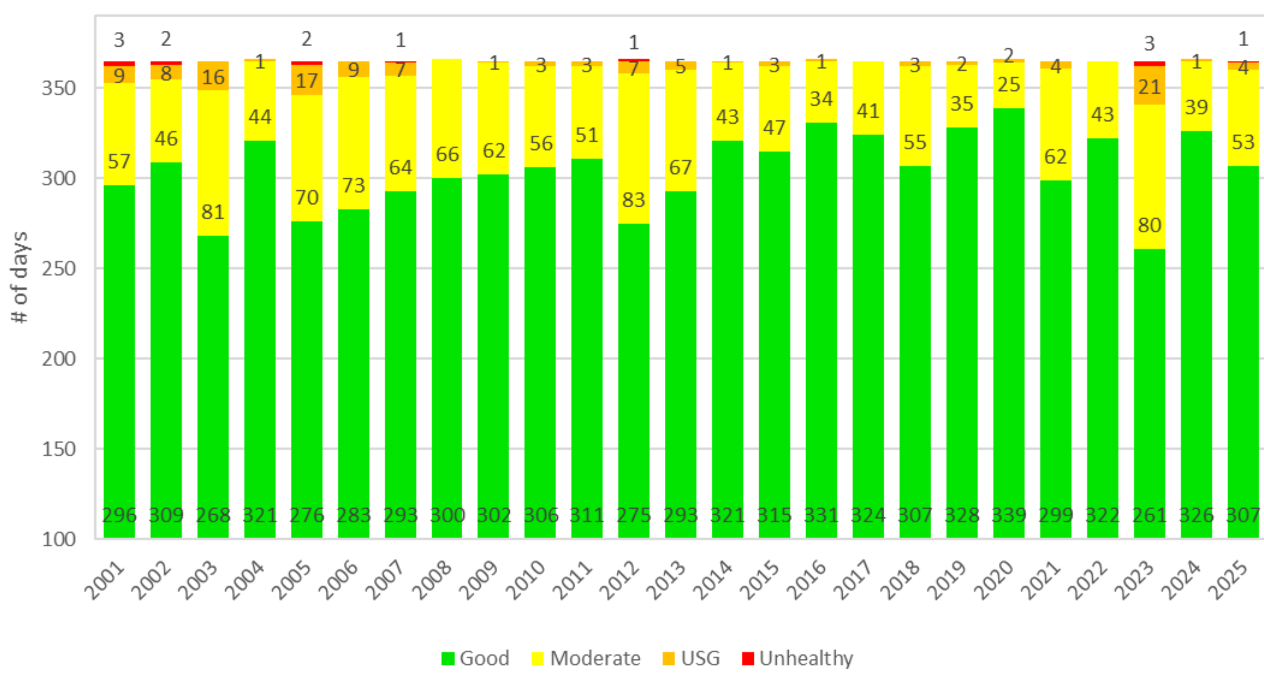


Figure 29. 2025 daily observed AQI category counts for ozone in Minnesota (during the official ozone season from March 1 to October 31).

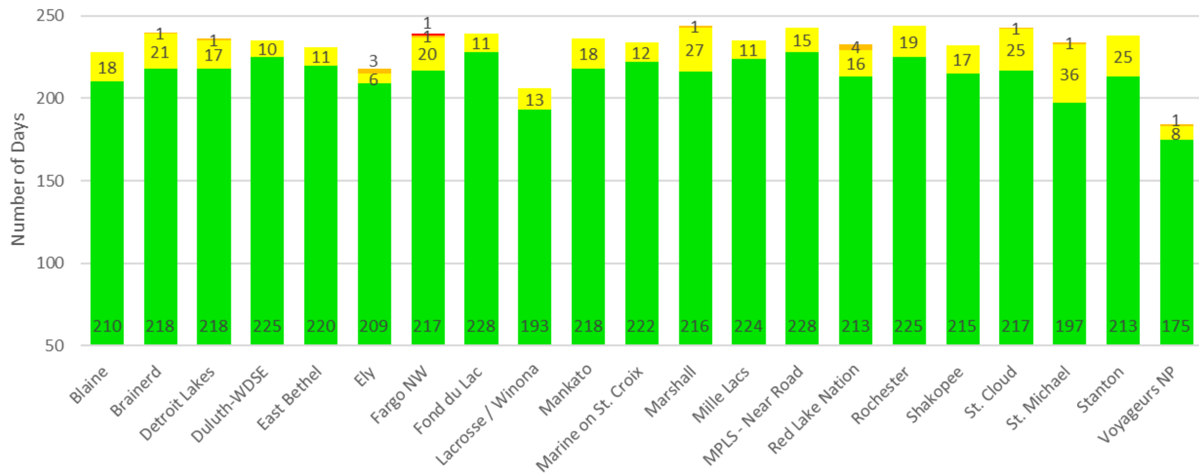
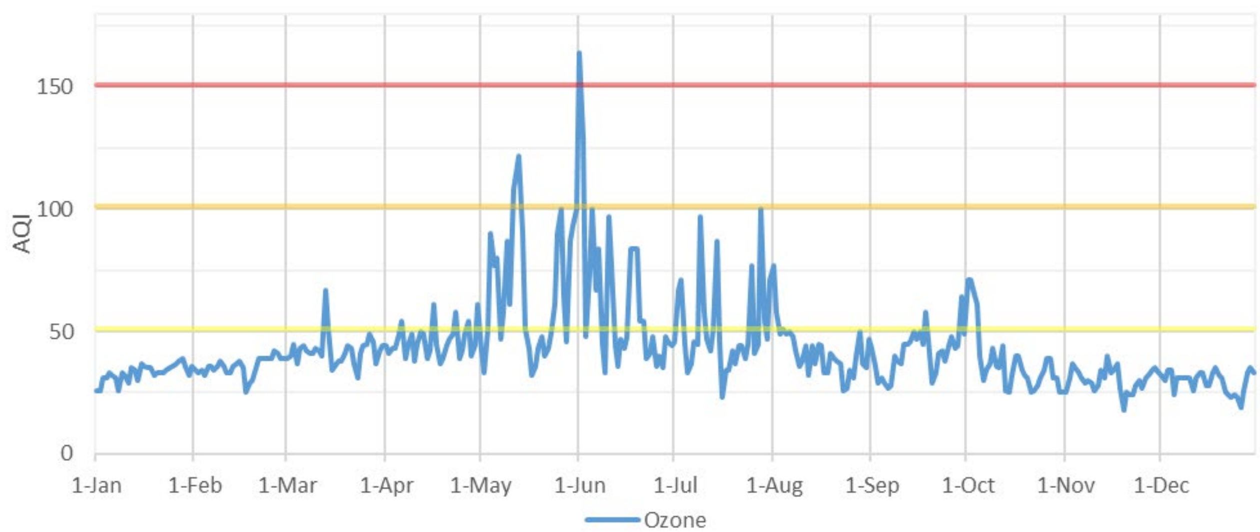


Figure 30. Peak daily ozone AQI for Minnesota in 2025.



The MPCA issued 19 air quality alerts covering 43 days during 2025 (Figures 31 and 32). Two alerts were due to ozone, with the remainder being attributed to wildfire smoke.

Figure 31. Total count and causes of air quality alert forecasts issued in Minnesota counties, 2010-2025.

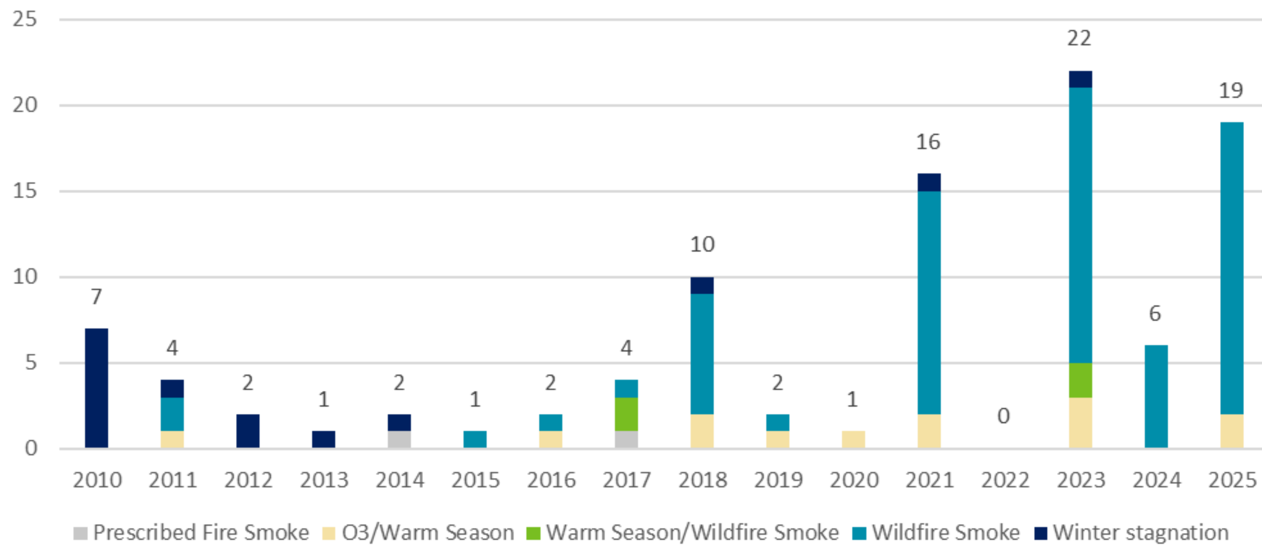
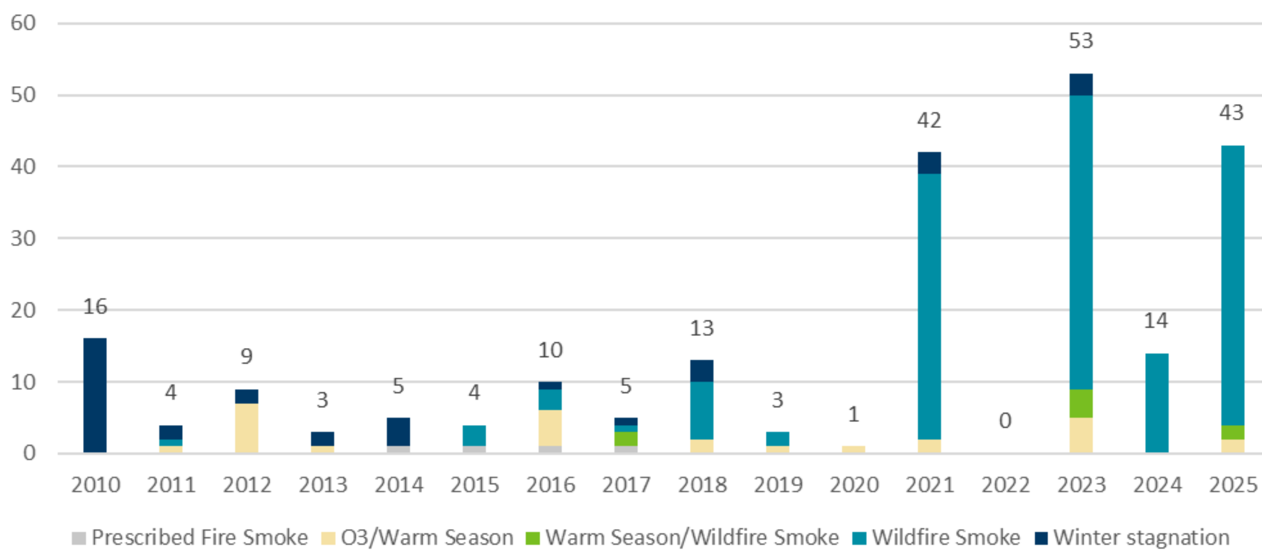


Figure 32. Total count and causes of air quality forecast alert days issued in Minnesota counties, 2010-2025.



3. Air Toxics

Air toxics are routinely monitored in Minnesota as part of the MPCA's ambient air toxics monitoring program. The MPCA monitors three types of air toxics: VOCs, carbonyls, and metals. To determine the health risk of the measured air toxics concentrations, the MPCA uses guidelines, called inhalation health benchmarks.

A compiled list of the health benchmarks can be found in the Ambient air toxicity values workbook (https://data.pca.state.mn.us/views/Airtoxicityvalues/Airtoxicityvalues?%3Aembed=y&%3AisGuestRedirectFromVizportal=y).

These health benchmarks come from a variety of sources, including the following:

- Minnesota Department of Health air risk guidance (https://www.health.state.mn.us/communities/environment/risk/guidance/air/table.html)
- EPA's Integrated Risk Information System (IRIS) (https:/www.epa.gov/iris)
- California's Office of Health Hazard Assessment (OEHHA) (https:/www.oehha.ca.gov/air.html)
- EPA's Superfund Program (https://www.epa.gov/superfund)

MPCA is currently in the process of updating the state-wide air toxics monitoring results.

There are select monitoring sites where measured concentrations are shared publicly. Data explorers for the following sites are available on MPCA's Data visualizations webpage (https://www.pca.state.mn.us/about-mpca/mpca-data-visualizations).

- Metals at Saint Paul West Side community
- Lead at Federal Ammunition
- Air toxics at Otter Lake Technologies

4. Visibility

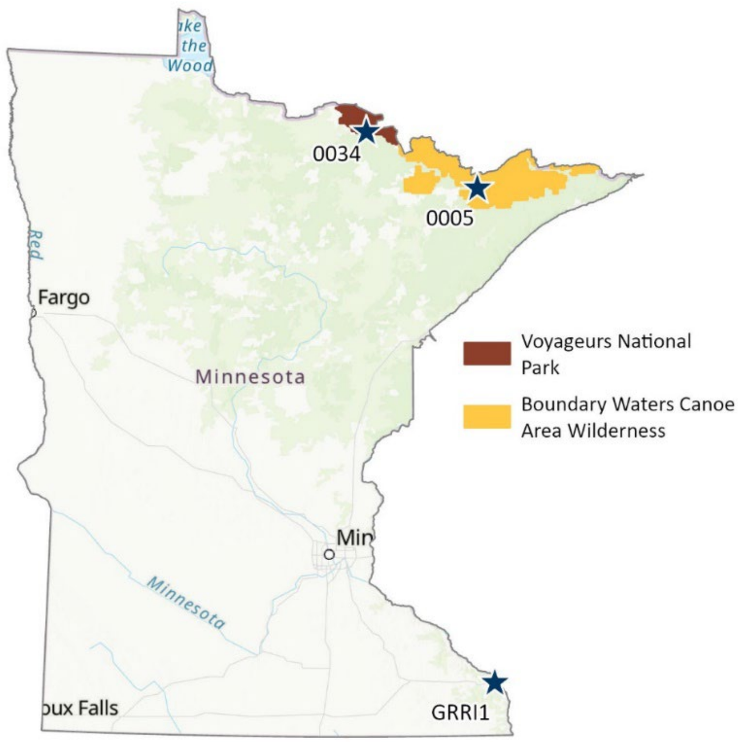
Air pollution can reduce visibility over wide areas, a phenomenon called regional haze. Haze occurs when sunlight encounters fine particles in the air, which absorb and scatter light. Haze-causing pollutants come from a variety of sources, both natural and human-made, including motor vehicles, electric utilities, taconite processing facilities, agricultural activities, and wildfires.

In 1999, the EPA established a regulatory program to reduce haze caused by human-made air pollution at national parks and wilderness (Class I) areas. The goal of the regional haze rule is to achieve natural visibility conditions in Class I areas by 2064, with interim progress goals set every 10 years. The first interim progress goal was set for 2018.

Minnesota has two Class I areas, both located in Northern Minnesota—the Boundary Waters Canoe Area Wilderness and Voyageurs National Park.

Visibility is calculated from $PM_{2.5}$ species measurements through the IMPROVE Aerosol Network website (http://vista.cira.colostate.edu/IMPROVE/). Figure 33 shows the location of Minnesota sites in the network. Minnesota has an IMPROVE site in each of the two Class I areas. An additional site was installed at the Great River Bluffs State Park in southeastern Minnesota to help better understand the regional transport of pollutants that impair visibility into Minnesota from the Southeast.

Figure 33. Class I areas in Minnesota impacted by regional haze.



The IMPROVE network $PM_{2.5}$ speciation measurements are mathematically processed to express visibility as a five-year rolling average deciview (dv) value. A human observer is thought to be able to visually perceive a one to two deciview difference in scene appearance. The MPCA aims to see calculated deciview values on the most impaired visibility days reach natural conditions by 2064. Interim goals are set for every ten years. Both the Boundary Waters and Voyageurs sites achieved the 2018 interim goal by 2012 and reached the 2028 interim goal in 2023. Visibility on the clearest days at both sites has not degraded over time and have actually improved (Figure 34).

Figure 34. Visibility progress measured at Boundary Waters and Voyageurs (2004-2024) and the estimated interim progress goals for 2018 and 2028.