

Air pollution monitoring results for North Minneapolis

Total Suspended Particulates violations report for Lowry Avenue (909) and Pacific Street (910)

Violation of the Minnesota TSP Standards

The Lowry Avenue (909) monitoring site has violated:

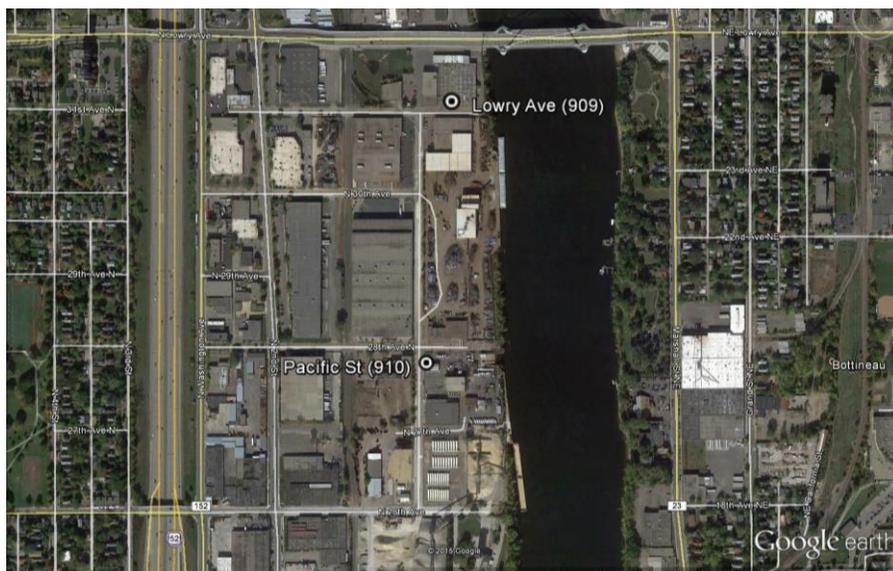
- **2014:** secondary daily TSP standard
- **2015:** primary and secondary daily TSP standards; primary and secondary annual TSP standards
- **2016:** secondary daily TSP standard; secondary annual TSP standard
- **2017:** secondary daily TSP standard

The Pacific Street (910) monitoring site has violated:

- **2015:** secondary daily TSP standard
- **2016:** primary and secondary daily TSP standards; primary and secondary annual TSP standards
- **2017:** primary and secondary daily TSP standards; primary and secondary annual TSP standards

On October 1, 2014, the Minnesota Pollution Control Agency (MPCA) began monitoring for Total Suspended Particulates (TSP) in an industrial area of North Minneapolis. This monitoring site is known as Lowry Avenue (909). In response to frequent exceedances of the state TSP standard at the Lowry Avenue site, on June 23, 2015, the MPCA began operating a second monitoring site, called Pacific Street (910), in the area approximately ¼ mile south of the existing monitor at Lowry Avenue. The addition of a second air-monitoring site in the area of the existing site provides important upwind/downwind pollution information that will help identify sources contributing to the exceedances and violations of the state TSP standard.

Both sites are located in an area that contains a mix of land uses including metals recyclers, manufacturing facilities, and retail. The nearest residential area is located approximately ¼ mile from the monitoring sites.



Monitoring site history

Lowry Avenue (909)

- The Lowry Avenue (909) monitoring site began operating on January 1, 2013 as a special purpose monitoring study to measure fine particle (PM_{2.5}) levels in North Minneapolis. In addition to measuring fine particles, the site also measured hourly wind direction and wind speed. The special purpose fine particle study concluded on December 30, 2014. Monitoring results are available on the MPCA's website, <https://www.pca.state.mn.us/air/north-minneapolis-air-monitoring-project>.
- On October 2, 2014, the MPCA added an air toxics monitoring platform to the Lowry Avenue site as part of the Community Air Monitoring Project. The air toxics monitoring platform includes 24-hour average measurements of TSP, metals, volatile organic compounds (VOCs), and carbonyls, which are collected once every six days. The Community Air Monitoring Project measures air pollution concentrations for a three-month period in communities that are a concern for environmental justice.
- Within the first month of running the air toxics monitoring platform at the Lowry Avenue site, the site measured exceedances of the state TSP standard. By the end of 2014, the Lowry Avenue site violated the secondary daily TSP standard. Due to the violations of the TSP standard, the MPCA has continued the operations of the air toxics monitoring platform at the Lowry Avenue site beyond the planned three-month period.
- Due to ongoing concerns with TSP levels at the Lowry Avenue site, in January 2015, the MPCA replaced the hourly PM_{2.5} monitor with an hourly PM₁₀ monitor. The hourly PM₁₀ monitor provides more time resolved data on larger particle levels near the monitoring site. On April 1, 2015 and September 15, 2015, the Lowry Avenue monitor exceeded the daily PM₁₀ standard.
- The Lowry Avenue monitoring site violated the secondary daily TSP standard in 2014, 2015, and 2016. The site also violated the primary daily TSP standard in 2015.
- The Lowry Avenue monitoring site violated the primary and secondary annual TSP standard in 2015 and the secondary annual TSP standard in 2016.

Exceedance history at Lowry Avenue (909)

- The primary daily TSP standard was exceeded on:
 - 11/1/2014, 3/19/2015, 7/23/2015, 8/28/2015, 9/15/2015, 3/7/2016, and 11/27/2017
- The secondary daily TSP standard was exceeded on:
 - 2014: 10/26, 11/1
 - 2015: 1/30, 2/23, 3/19, 7/11, 7/23, 8/22, 8/28, 9/9, 9/15, 9/21,
 - 2016: 2/18, 3/7, 3/31, 4/12, 4/18, 5/6, 6/17, 7/11, 8/22, and 10/3
 - 2017: 4/7, 9/22, 11/27, and 12/3
- The daily PM₁₀ standard was exceeded on 4/1/2015 and 9/15/2015
- The Lowry Avenue site violated the secondary daily TSP standard in 2014, 2015, 2016, and 2017, and the primary daily TSP standard in 2015.
- The Lowry Avenue site violated the primary and secondary annual TSP standards in 2015, and the secondary annual TSP standard in 2016.

Pacific Street (910)

- The Pacific Street (910) monitoring site began operating on June 23, 2015 and includes hourly measurements of PM₁₀ and 24-hour average measurements of TSP and metals, which are collected once every six days.
- Within the first two months of running the monitoring site at Pacific Street, the site had measured exceedances of the state TSP standard.
- The Pacific Street monitoring site violated the secondary daily TSP standard in 2015, 2016 and 2017. The primary daily TSP standard was violated in 2016 and 2017.

Exceedance history at Pacific Street (910)

- The primary daily TSP standard was exceeded on 10/15/2015, 2/12/2016, 2/24/2016, 3/1/2016, 3/25/2016, 5/6/2016, 5/12/2016, 5/18/2016, 5/24/2016, 2/24/2017, 4/7/2017, 5/31/2017, 6/30/2017, 7/6/2017, 7/12/2017, and 11/9/2017.
- The secondary daily TSP standard was exceeded on:
 - 2015: 6/29, 7/17, 7/23, 8/4, 8/10, 8/28, 9/9, 9/15, 10/15, 10/21, 11/21
 - 2016: 1/19, 2/12, 2/24, 3/1, 3/25, 3/31, 4/12, 4/18, 5/6, 5/12, 5/18, 5/24, 6/23, 6/29, 7/5, 7/29, 8/10, 8/22, 10/21, 11/2, 11/8, 11/14, and 12/2.
 - 2017: 2/24, 3/2, 3/14, 3/20, 4/7, 4/25, 5/31, 6/30, 7/6, 7/12, 7/18, 7/24, 8/11, 8/23, 9/28, 10/16, 11/9, and 11/21/
- The daily PM₁₀ standard was exceeded on 5/6/2016 and 8/1/2017.
- The Pacific Street site violated the secondary daily TSP standard in 2015, 2016 and 2017; and the primary daily TSP standard in 2016 and 2017.
- The Pacific Street site violated the primary and secondary annual TSP standard in 2016 and 2017.

Background on the TSP standards

In Minnesota, TSP levels in the air are regulated through the Minnesota Ambient Air Quality Standards (MAAQS), which are established by Minn. R. 7009.0080. The MAAQS includes four distinct standards for TSP. These standards include:

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 micrograms per cubic meter	...the annual 2 nd highest daily TSP concentration is less than or equal to 260 µg/m ³
	Annual	75 micrograms per cubic meter	...the annual geometric mean is less than or equal to 75 µg/m ³
Secondary ²	Daily (24-hour)	150 micrograms per cubic meter	...the annual 2 nd highest daily TSP concentration is less than or equal to 150 µg/m ³
	Annual	60 micrograms per cubic meter	...the annual geometric mean is less than or equal to 60 µg/m ³

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

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

What is the difference between an exceedance and a violation?

- An **exceedance** occurs when an air concentration is greater than the level of the air quality standard. A monitor can have measured exceedances of the air quality standard without violating the standard.
- A **violation** occurs when a monitoring site fails the “attainment test” associated with an air quality standard. The “attainment test” includes a metric that incorporates the level and form of the standard. For example, for the primary daily TSP standard, the attainment test specifies that a monitoring site meets the standard if the annual second highest daily TSP concentration is less than or equal to 260 $\mu\text{g}/\text{m}^3$. Therefore, a monitoring site would meet or “attain” the standard if it recorded one exceedance in a calendar year, but it would violate the standard if the monitor recorded two or more exceedances in a year.

Monitoring results compared to the TSP standards

Annual TSP standards

A monitoring site meets the primary annual TSP standard when the annual geometric mean of measured TSP concentrations is less than or equal to 75 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). A primary standard is set to protect against human health effects associated with exposure to an air pollutant.

A monitoring site meets the secondary annual TSP standard when the annual geometric mean of measured TSP concentrations is less than or equal to 60 $\mu\text{g}/\text{m}^3$. A secondary standard is set to protect against environmental or public welfare effects associated with exposure to an air pollutant.

To assess compliance with the annual TSP standards, a monitoring site must have a complete year of monitoring data. Compliance with the annual TSP standards at the Lowry Avenue and Pacific Street sites is summarized in the table below.

TSP concentrations at Lowry Avenue and Pacific Street compared to the annual TSP standards

Site	Year	Annual geometric mean TSP concentration	Secondary standard (60 $\mu\text{g}/\text{m}^3$)	Primary standard (75 $\mu\text{g}/\text{m}^3$)
Lowry Avenue (909)	2015	80 $\mu\text{g}/\text{m}^3$	violates	violates
	2016	73 $\mu\text{g}/\text{m}^3$	violates	meets
	2017	60 $\mu\text{g}/\text{m}^3$	meets	meets
Pacific Street (910)	2016	104 $\mu\text{g}/\text{m}^3$	violates	violates
	2017	109 $\mu\text{g}/\text{m}^3$	violates	violates

Daily TSP standards

A monitoring site meets the primary daily TSP standard when the second highest daily average TSP concentration is less than or equal to 260 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). A primary standard is set to protect against human health effects associated with exposure to an air pollutant.

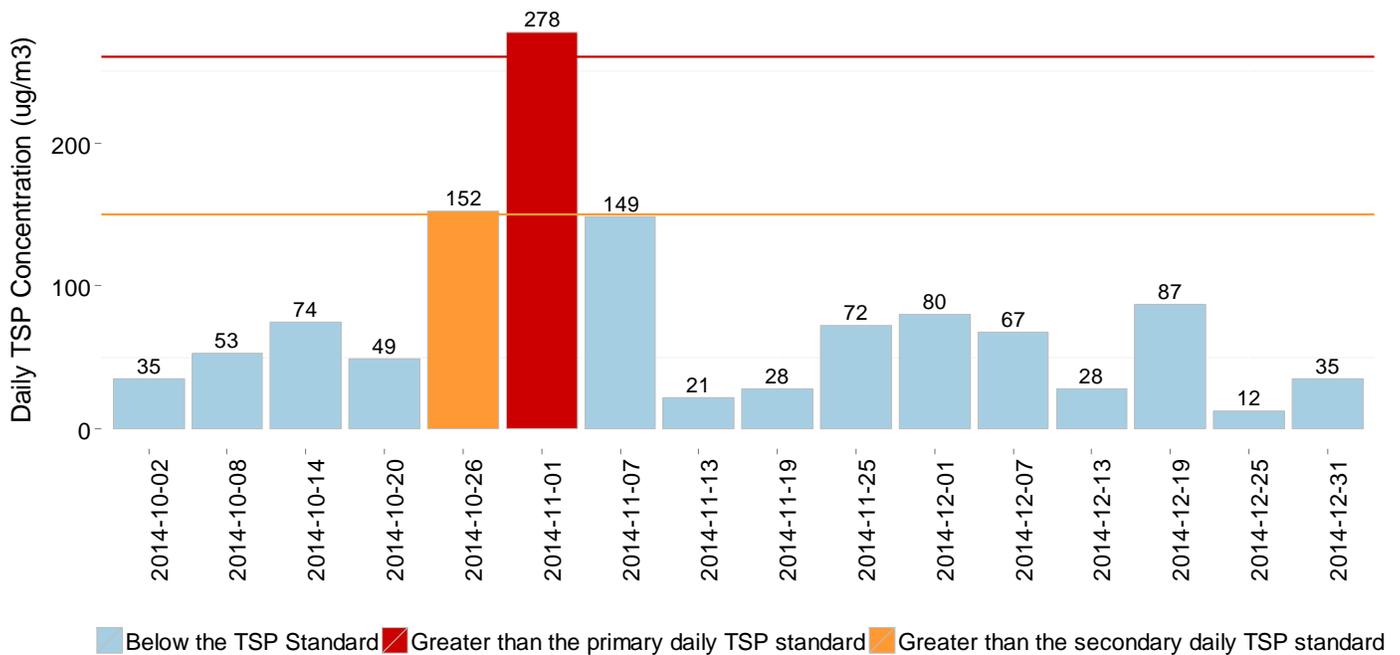
A monitoring site meets the secondary daily TSP standard when the second highest daily average TSP concentration is less than or equal to 150 $\mu\text{g}/\text{m}^3$. A secondary standard is set to protect against environmental or public welfare effects associated with exposure to an air pollutant.

Compliance with the daily TSP standards at the Lowry Avenue and Pacific Street sites is summarized in the table below. In addition, the charts on the following pages identify samples that exceed the level of the primary and secondary daily TSP standards. If a sample exceeds the primary daily TSP standard, it also exceeds the secondary daily TSP standard. If a monitoring site measures two exceedances of the daily TSP standard in a calendar year, that site has violated that standard.

TSP concentrations at Lowry Avenue and Pacific Street compared to the daily TSP standards

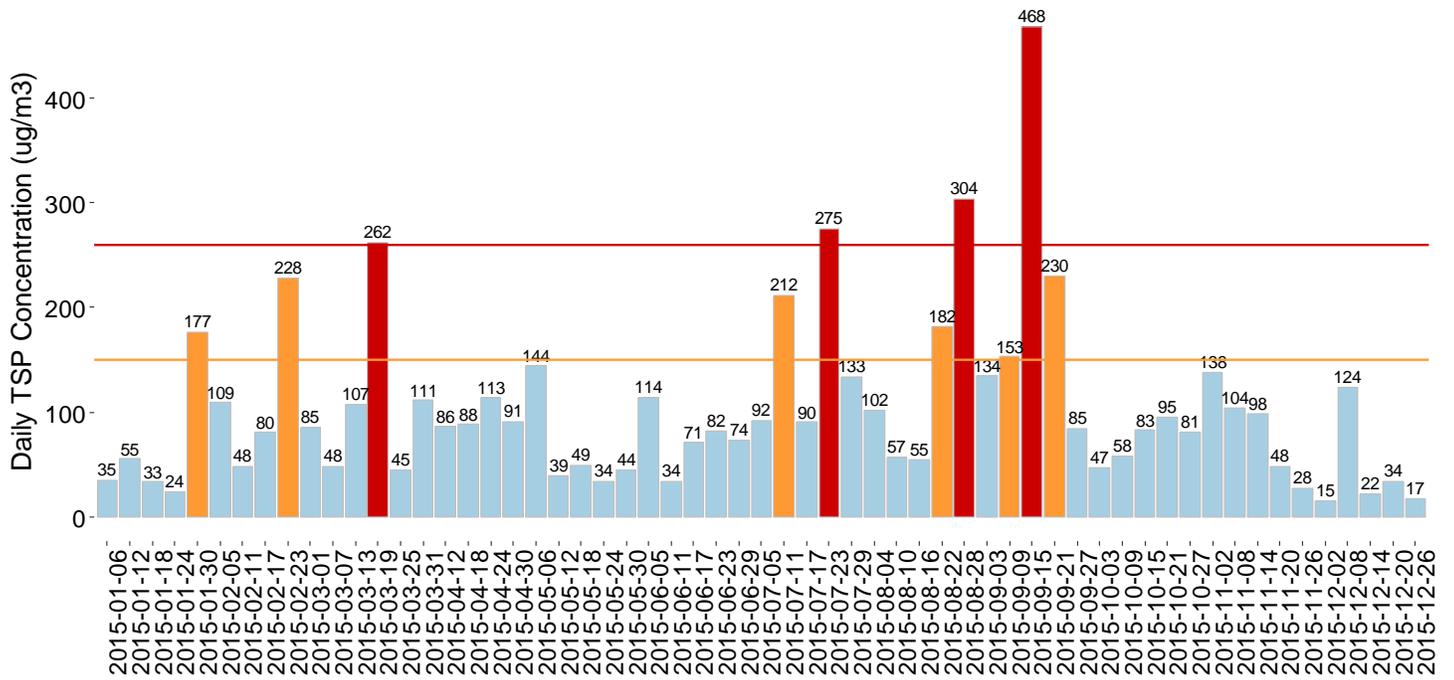
Site	Year	2 nd highest 24-hour average TSP concentration	Secondary standard (150 $\mu\text{g}/\text{m}^3$)	Primary standard (260 $\mu\text{g}/\text{m}^3$)
Lowry Avenue (909)	2014	152 $\mu\text{g}/\text{m}^3$	violates	meets
	2015	304 $\mu\text{g}/\text{m}^3$	violates	violates
	2016	209 $\mu\text{g}/\text{m}^3$	violates	meets
	2017	213 $\mu\text{g}/\text{m}^3$	violates	meets
Pacific Street (910)	2015	249 $\mu\text{g}/\text{m}^3$	violates	meets
	2016	455 $\mu\text{g}/\text{m}^3$	violates	violates
	2017	329 $\mu\text{g}/\text{m}^3$	violates	violates

Daily TSP concentrations at the Lowry Avenue site compared to the daily TSP standards, 2014



In 2014, the Lowry Avenue monitoring site had two measured exceedances of the secondary daily TSP standard and one exceedance of the primary daily TSP standard. In 2014, the Lowry Avenue monitor violated the secondary daily TSP Standard.

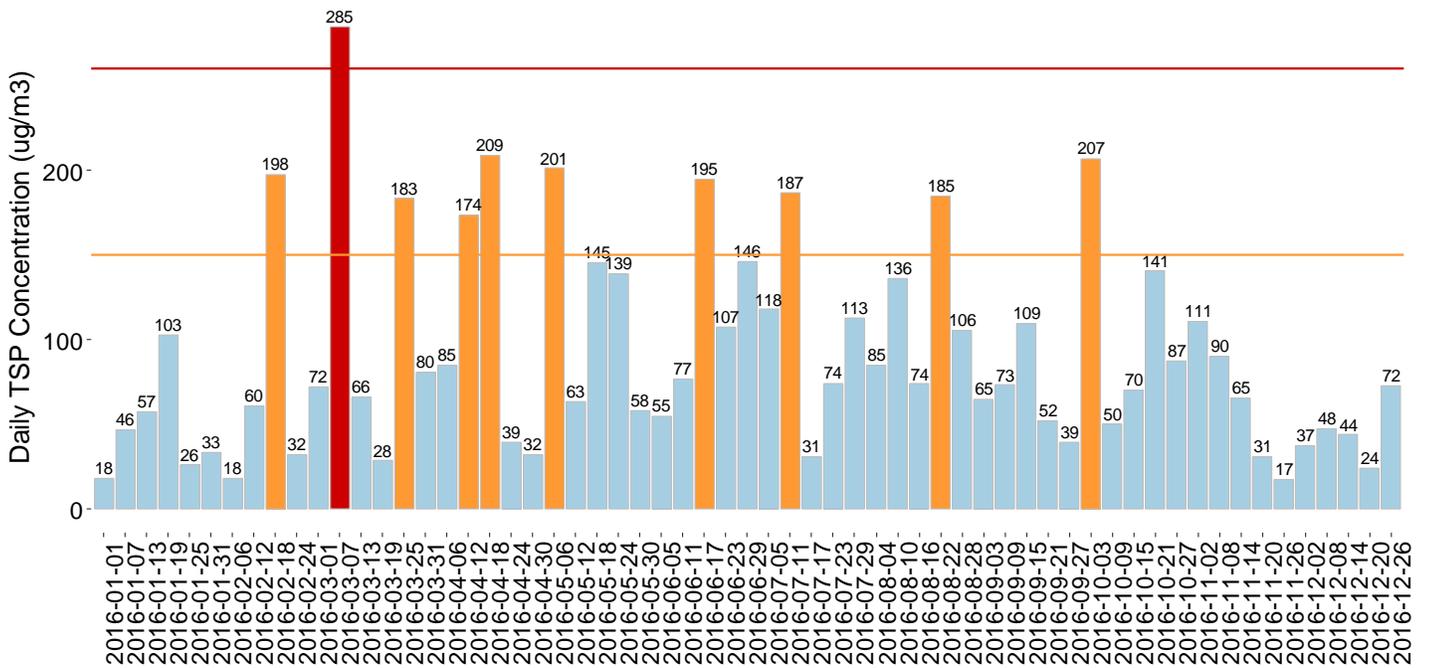
Daily TSP concentrations at the Lowry Avenue site compared to the daily TSP standards, 2015



Below the TSP Standard Greater than the primary daily TSP standard Greater than the secondary daily TSP standard

In 2015, the Lowry Avenue monitoring site measured ten exceedances of the secondary daily TSP standard and four exceedances of the primary daily TSP standard. In 2015, the Lowry Avenue monitor violated the primary and secondary daily TSP standards.

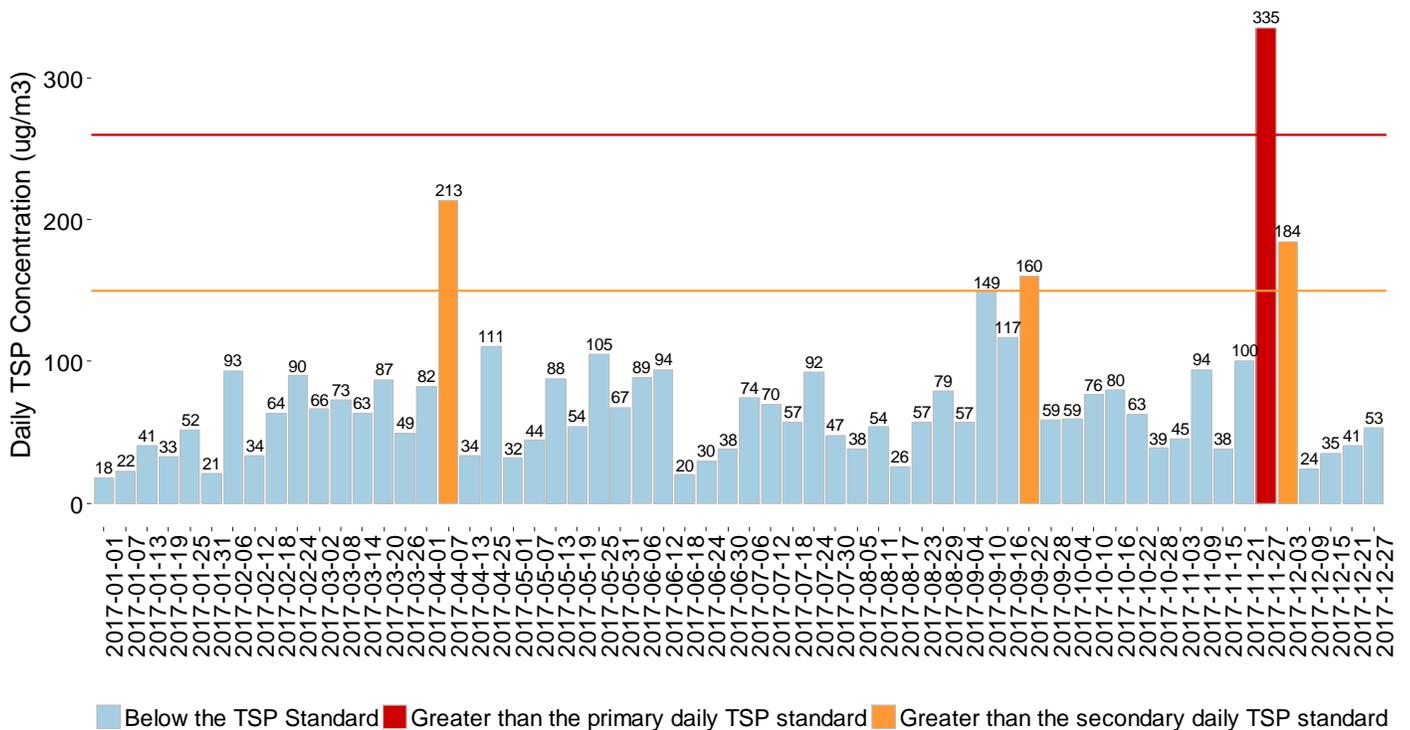
Daily TSP concentrations at the Lowry Avenue site compared to the daily TSP standards, 2016



Below the TSP Standard Greater than the primary daily TSP standard Greater than the secondary daily TSP standard

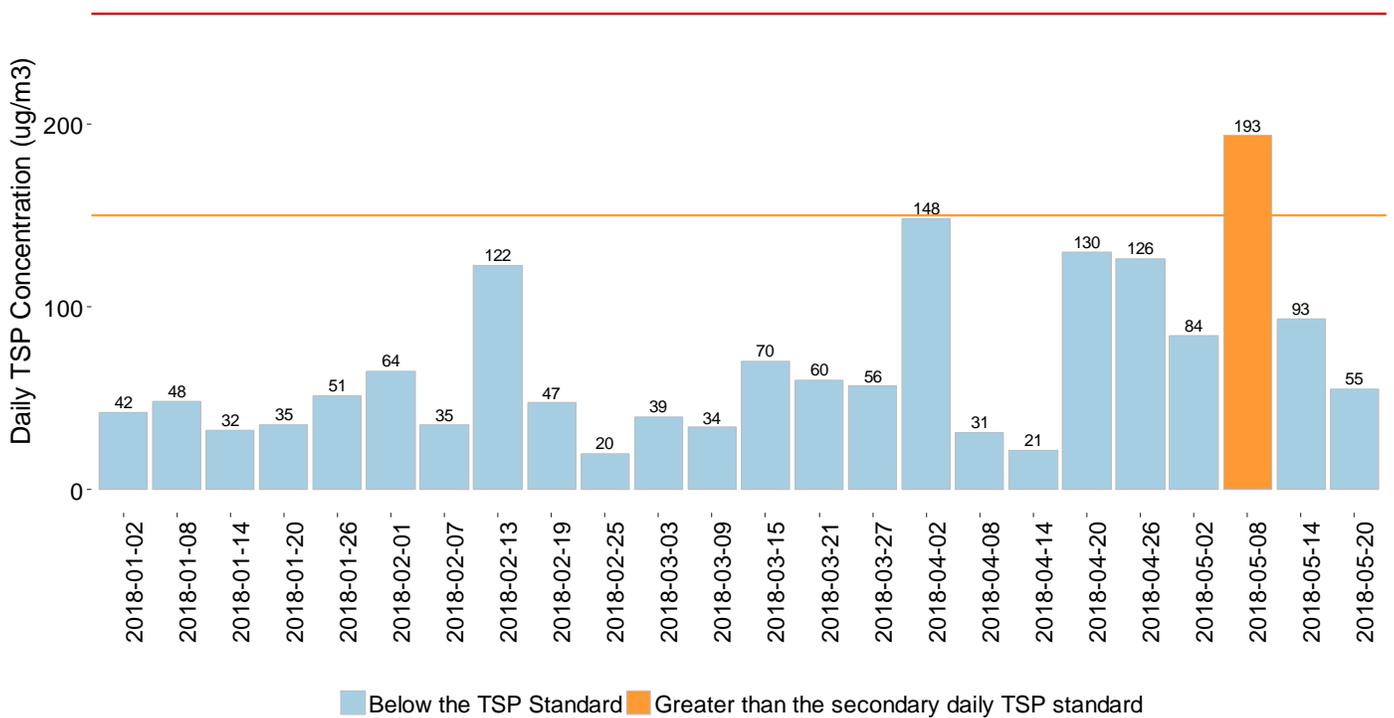
In 2016, the Lowry Avenue monitoring site measured ten exceedances of the secondary daily TSP standard and one exceedance of the primary daily TSP standard. In 2016, the Lowry Avenue monitor violated the secondary daily TSP standard.

Daily TSP concentrations at the Lowry Avenue site compared to the daily TSP standards, 2017



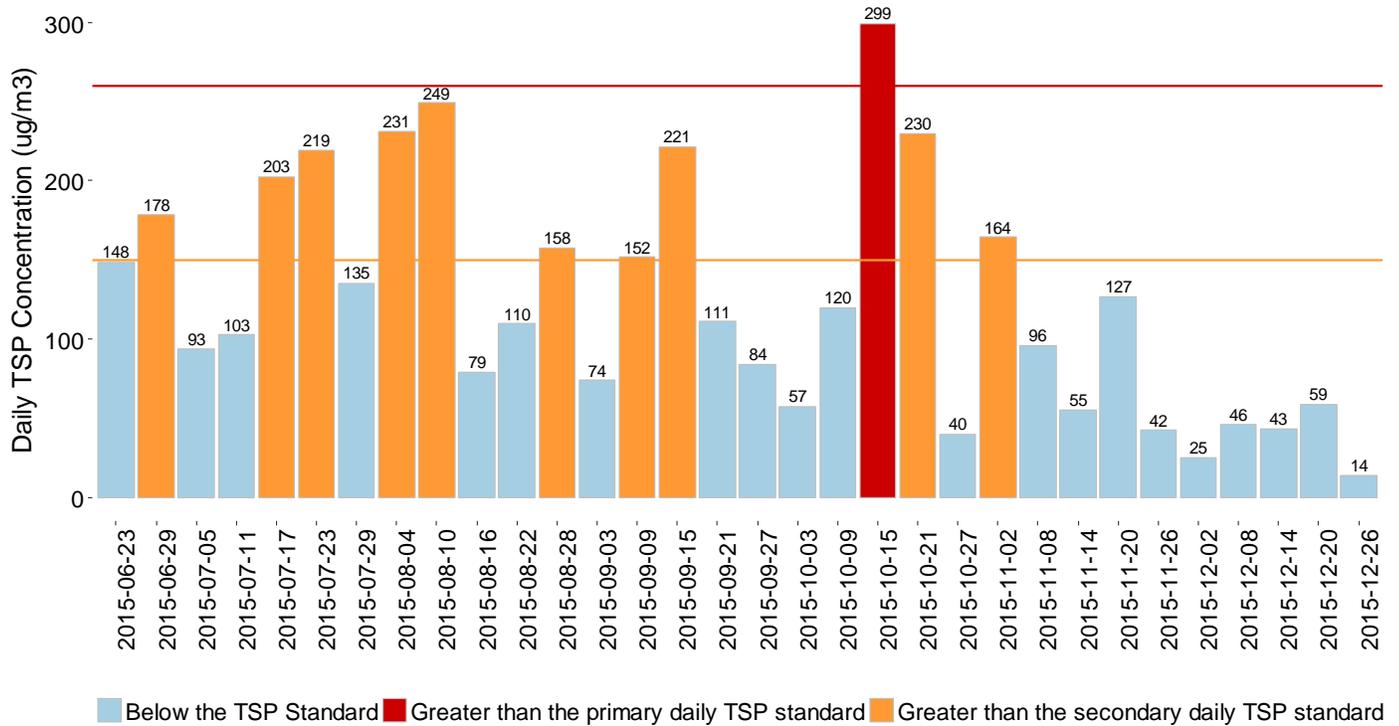
In 2017, the Lowry Avenue monitoring site has measured four exceedances of the secondary daily TSP standard and one exceedance of the primary daily TSP standard. In 2017, the Lowry Avenue monitor has violated the secondary daily TSP standard.

Daily TSP concentrations at the Lowry Avenue site compared to the daily TSP standards, 2018



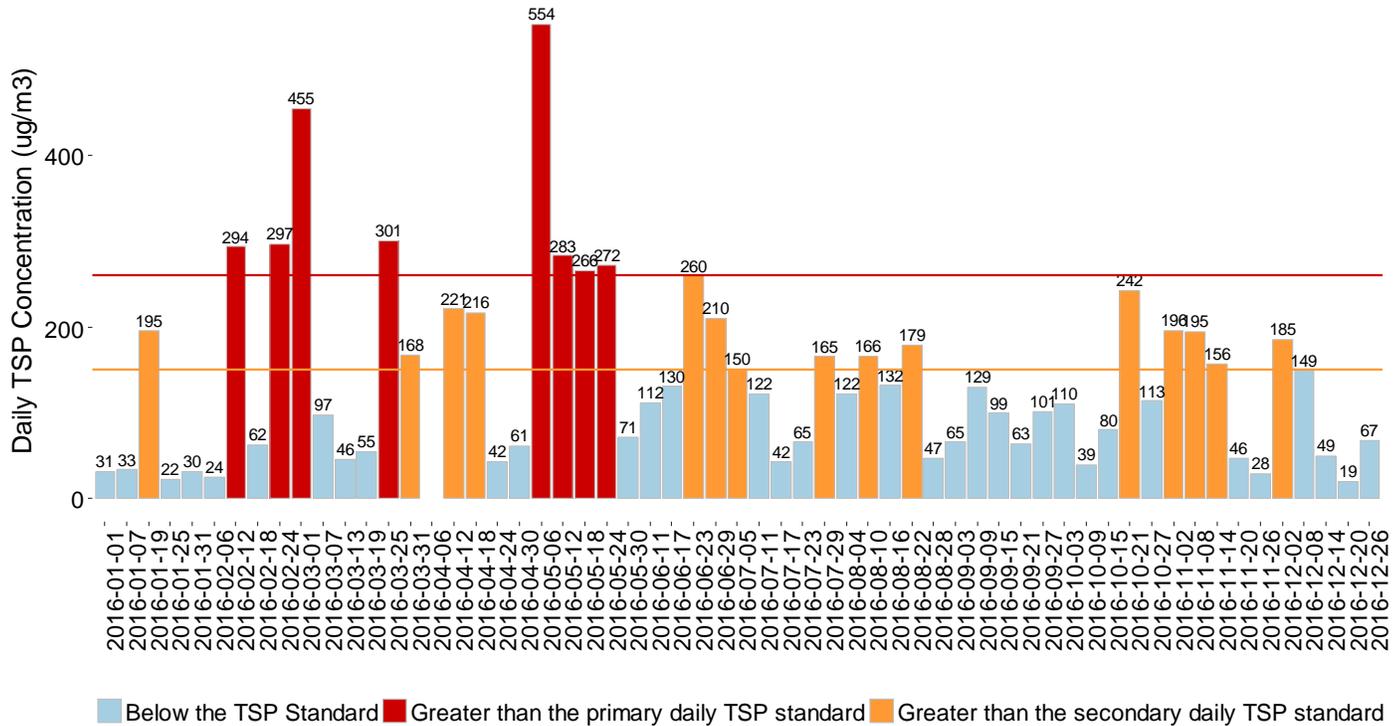
In 2018, the Lowry Avenue monitoring has one measured exceedance of the secondary daily TSP standard.

Daily TSP concentrations at the Pacific Street site compared to the daily TSP standards, 2015



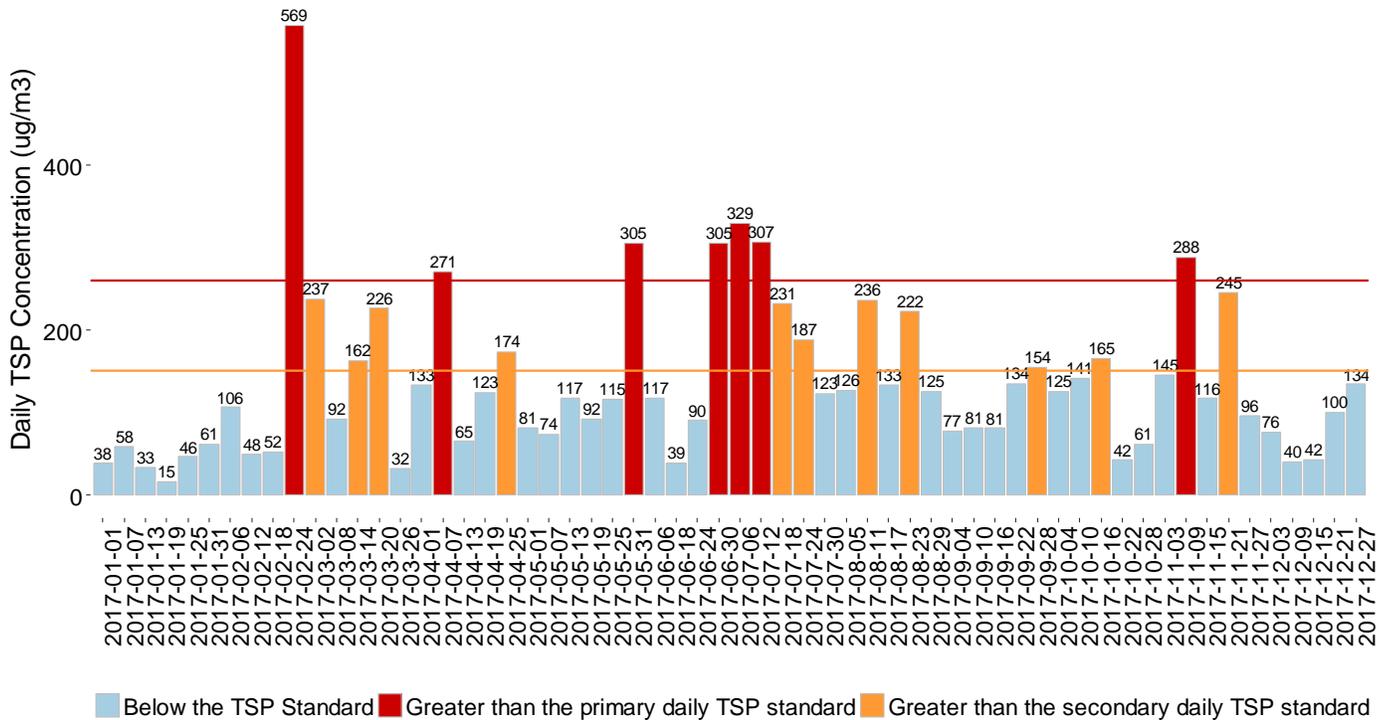
In 2015, the Pacific Street monitoring site measured eleven exceedances of the secondary daily TSP standard and one exceedance of the primary daily TSP standard. In 2015, the Pacific Street monitor violated the secondary daily TSP standard.

Daily TSP concentrations at the Pacific Street site compared to the daily TSP standards, 2016



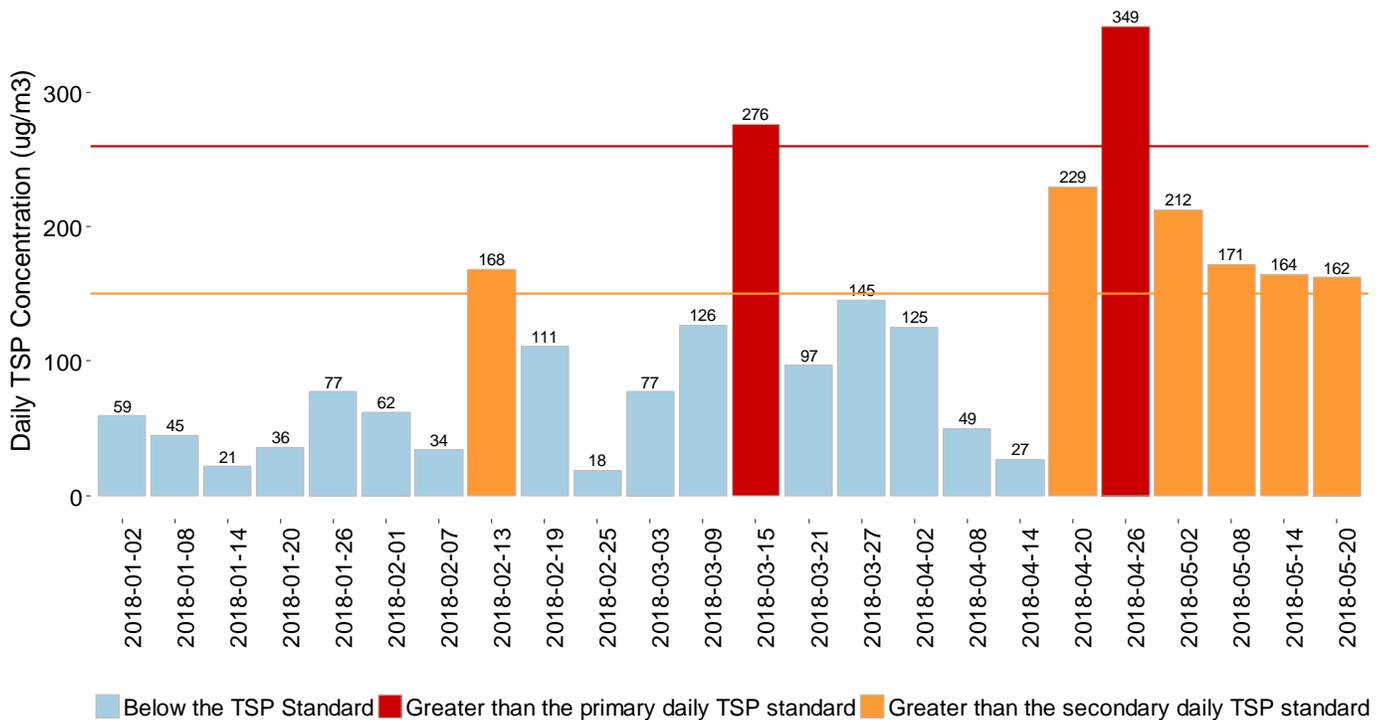
In 2016, the Pacific Street monitoring site measured 23 exceedances of the secondary daily TSP standard and eight exceedances of the primary daily TSP standard. In 2016, the Pacific Street monitoring site violated the primary and secondary daily TSP standards.

Daily TSP concentrations at the Pacific Street site compared to the daily TSP standards, 2017



In 2017, the Pacific Street monitoring site measured 18 exceedances of the secondary daily TSP standard and seven exceedances of the primary daily TSP standard. In 2017, the Pacific Street monitoring site violated the primary and secondary daily TSP standards.

Daily TSP concentrations at the Pacific Street site compared to the daily TSP standards, 2018



In 2018, the Pacific Street monitoring site has measured eight exceedances of the secondary daily TSP standard and two exceedances of the primary daily TSP standard. In 2018, the Pacific Street monitoring site has violated the primary and secondary daily TSP standard.

Monitoring results compared to the PM₁₀ standard

In Minnesota, PM₁₀ levels in the air are regulated through the National Ambient Air Quality Standards and the MAAQS. The MAAQS are defined in Minn.R. 7009.0080. The PM₁₀ standards include:

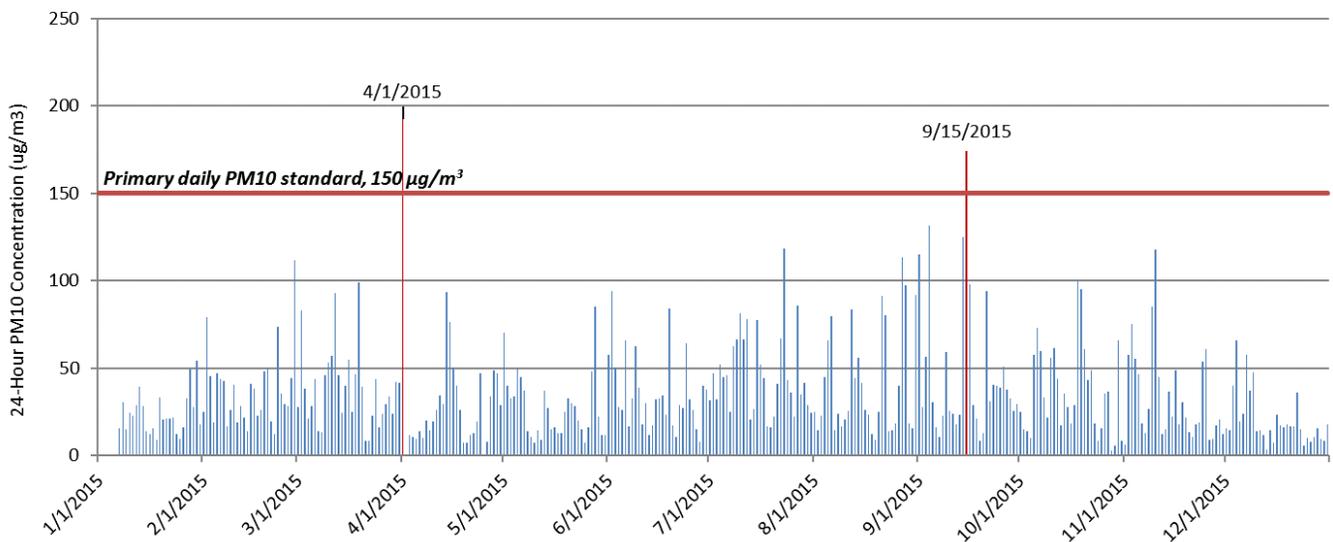
Ambient air quality standards for PM₁₀

Standard Type	Time Interval	Level of Standard	A monitoring site meets the standard if...
National and State Standard	Daily (24-hour)	150 micrograms per cubic meter	...the standard is not exceeded more than once per year, on average, over 3-years

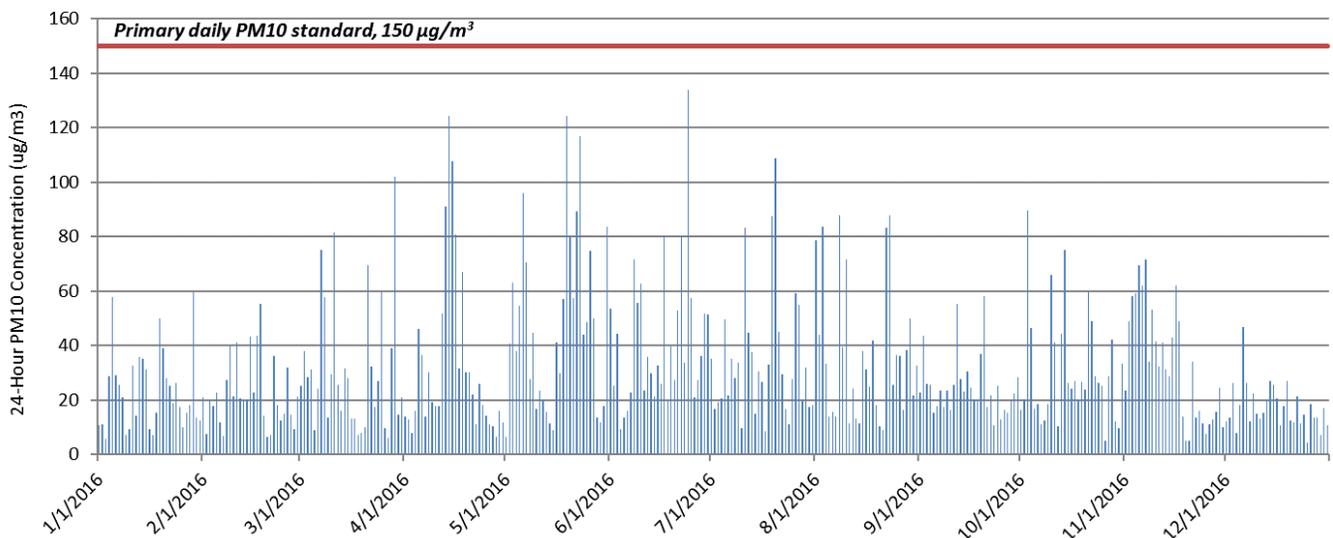
Daily PM₁₀ standard

A monitoring site meets the daily PM₁₀ standard when the level of the standard is not exceeded more than once per year, on average, over three years. Since monitoring began in January 2015, the Lowry Avenue site has measured two exceedances of the daily PM₁₀ standard. Based on monitoring data collected from 2015-2017, the Lowry Avenue monitoring site meets the daily PM₁₀ standard.

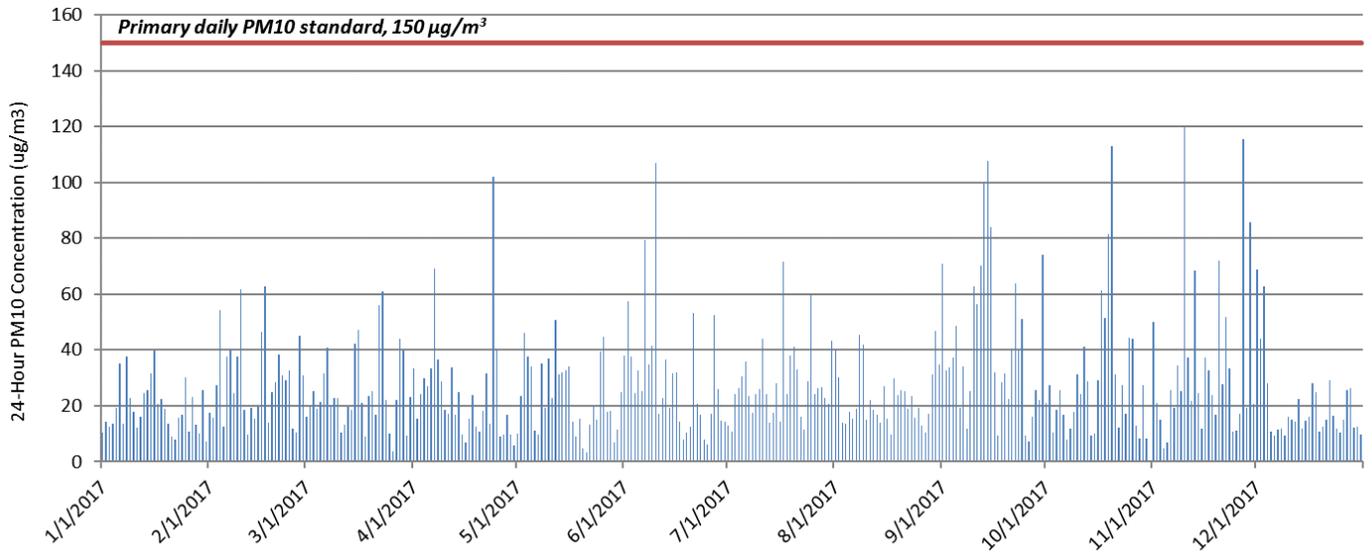
Daily PM₁₀ concentrations at the Lowry Avenue site compared to the daily PM₁₀ standards, 2015



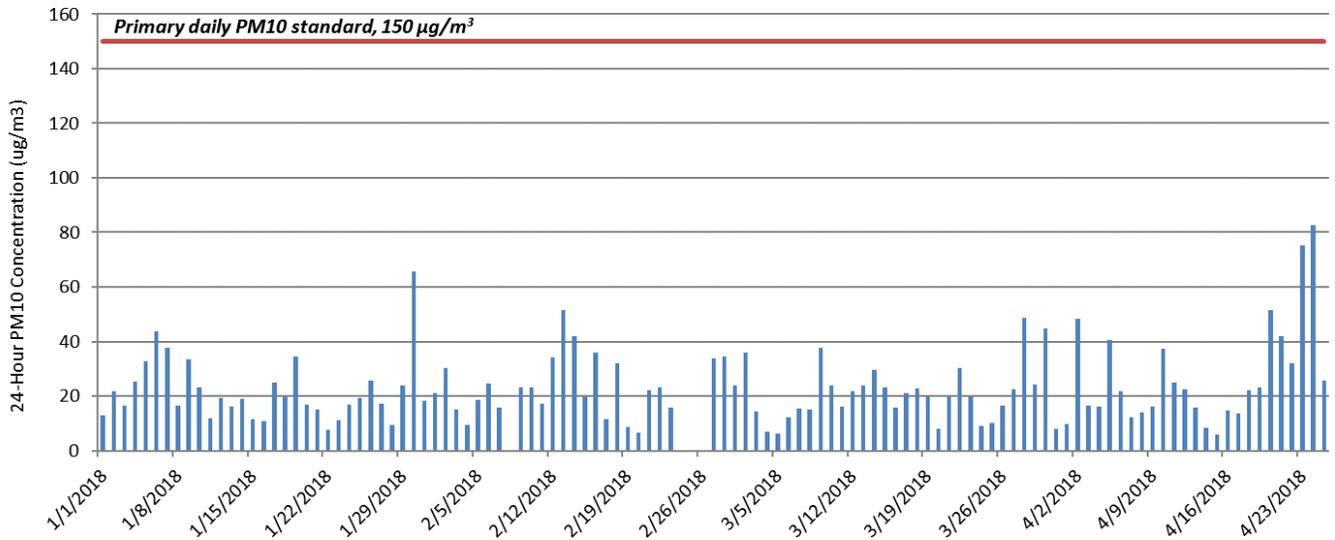
Daily PM₁₀ concentrations at the Lowry Avenue site compared to the daily PM₁₀ standards, 2016



Daily PM₁₀ concentrations at the Lowry Avenue site compared to the daily PM₁₀ standards, 2017

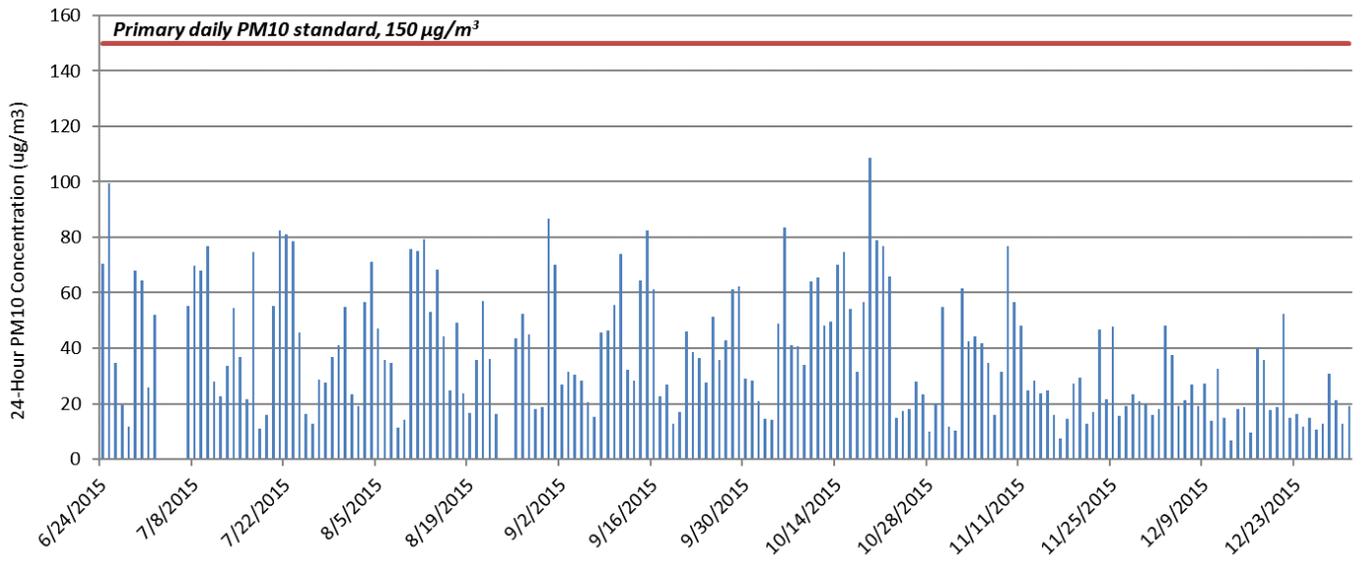


Daily PM₁₀ concentrations at the Lowry Avenue site compared to the daily PM₁₀ standards, 2018

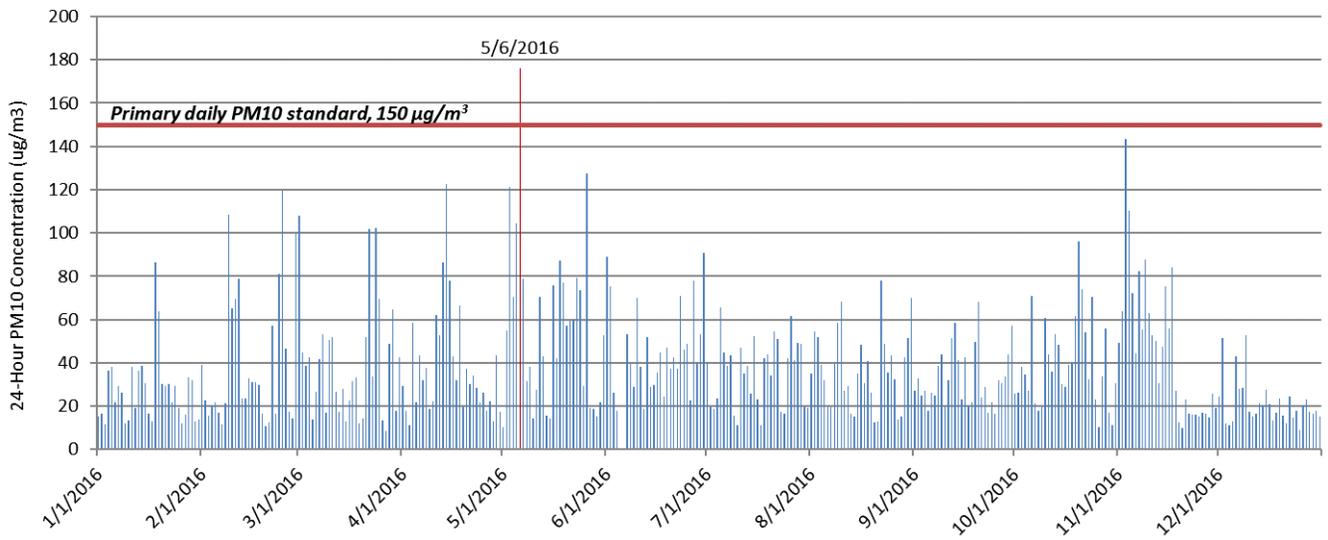


Since monitoring began in July 2015, the Pacific Street site has three measured exceedances of the daily PM₁₀ standard. For the 2015-2017 three-year compliance period, the Pacific Street site had two measured exceedances of the daily PM₁₀ standard. For the 2016-2018 three-year compliance period, the Pacific Street site has two measured exceedances of the daily PM₁₀ standard. If the Pacific Street monitor measures one additional PM₁₀ exceedance in 2018, the Pacific Street site will violate the daily PM₁₀ standard.

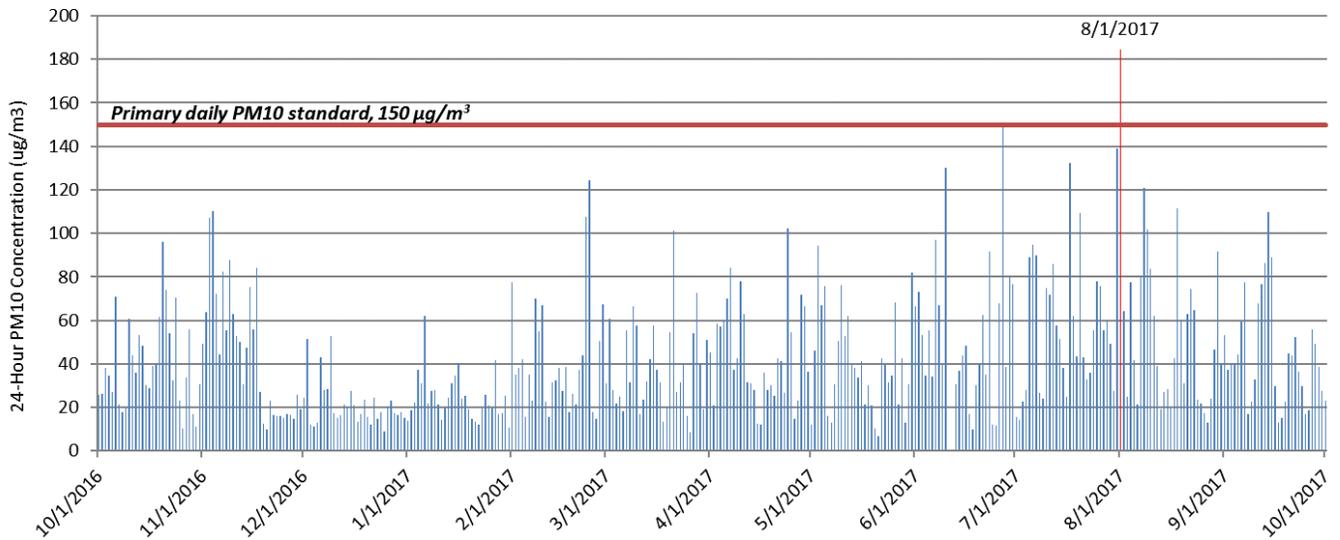
Daily PM₁₀ concentrations at the Pacific Street site compared to the daily PM₁₀ standards, 2015



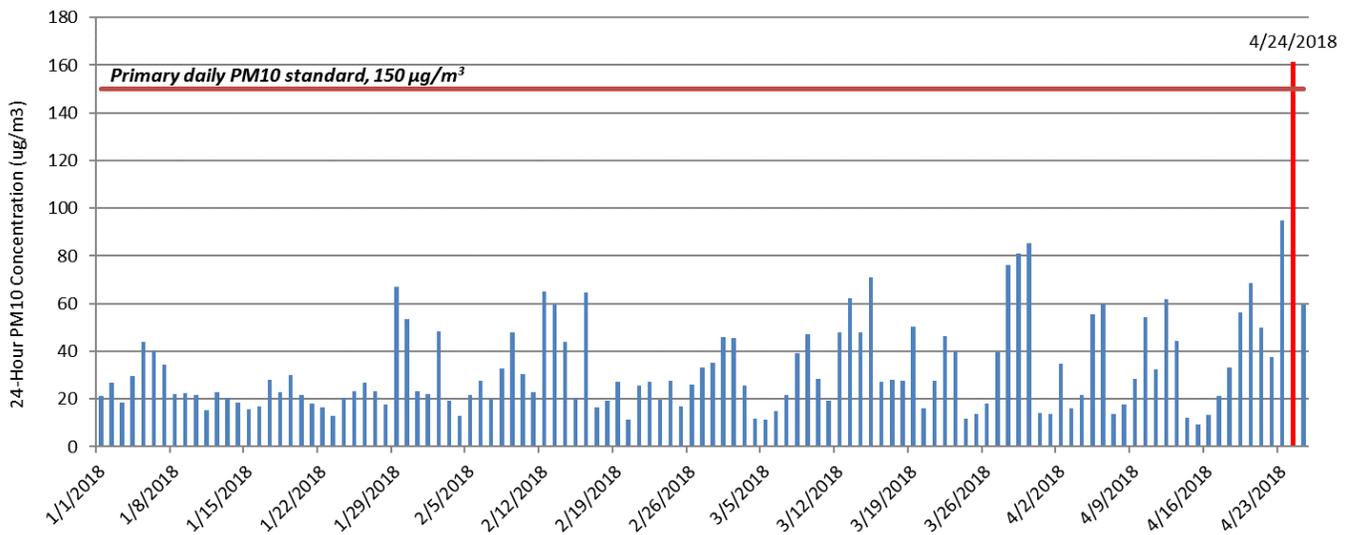
Daily PM₁₀ concentrations at the Pacific Street site compared to the daily PM₁₀ standards, 2016



Daily PM₁₀ concentrations at the Pacific Street site compared to the daily PM₁₀ standards, 2017



Daily PM₁₀ concentrations at the Pacific Street site compared to the daily PM₁₀ standards, 2018



Monitoring results compared to the lead standard

In Minnesota, lead levels in the air are regulated through the National Ambient Air Quality Standards and the MAAQS.

Ambient Air Quality Standards for Lead

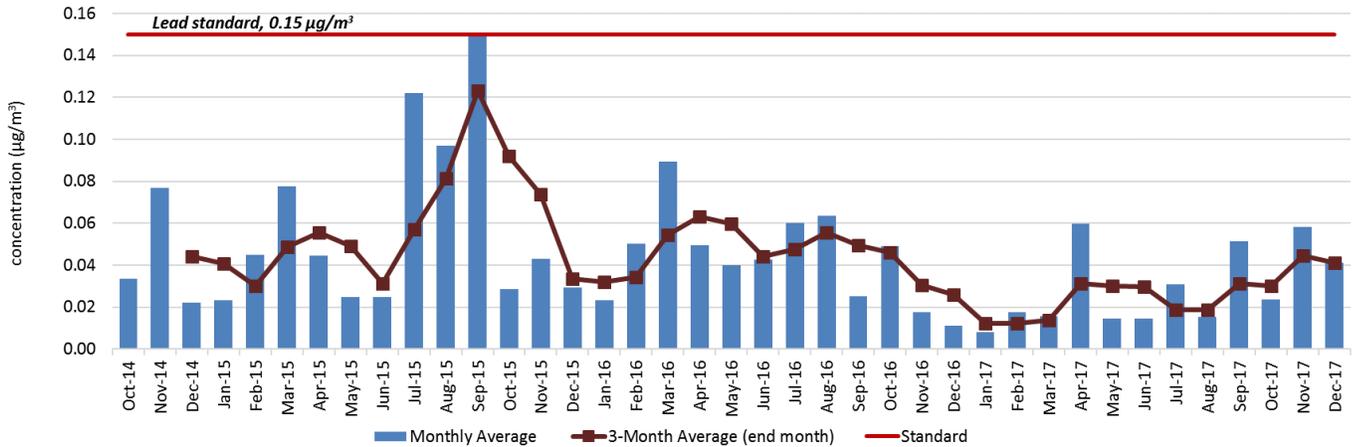
Standard type	Time interval	Level of standard	A monitoring site meets the standard if...
National and State standard	Rolling three-month	0.15 micrograms per cubic meter	...the three-month rolling average does not exceed the level of the standard, over three years.

Note: For lead, the primary and secondary standards are identical.

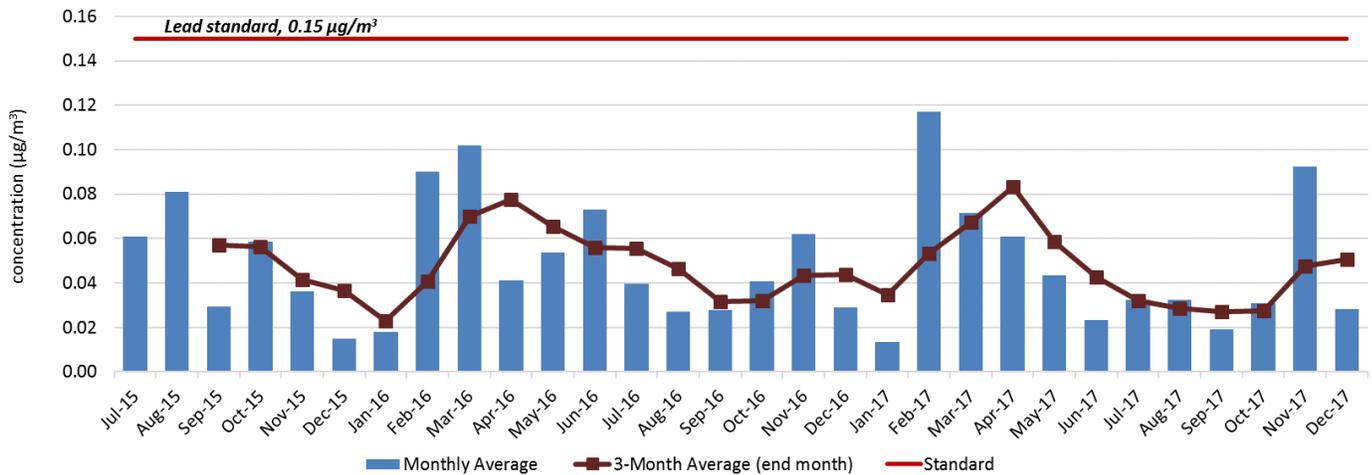
Rolling three-month lead standard

A monitoring site meets the rolling three-month lead standard when the maximum three-month rolling average lead concentration is less than or equal to the level of the standard, over three years. The current maximum three-month rolling average lead concentration at the Lowry Avenue site is $0.12 \mu\text{g}/\text{m}^3$, which is 80% of the lead standard. The maximum three-month rolling average lead concentration at Pacific Street is $0.08 \mu\text{g}/\text{m}^3$, which is 53% of the lead standard. To date, both sites meet the three-month rolling average lead standard.

Rolling three-month average lead concentrations at Lowry Avenue compared to the lead standard



Rolling three-month average lead concentrations at Pacific Street compared to the lead standard



Pollution rose analysis

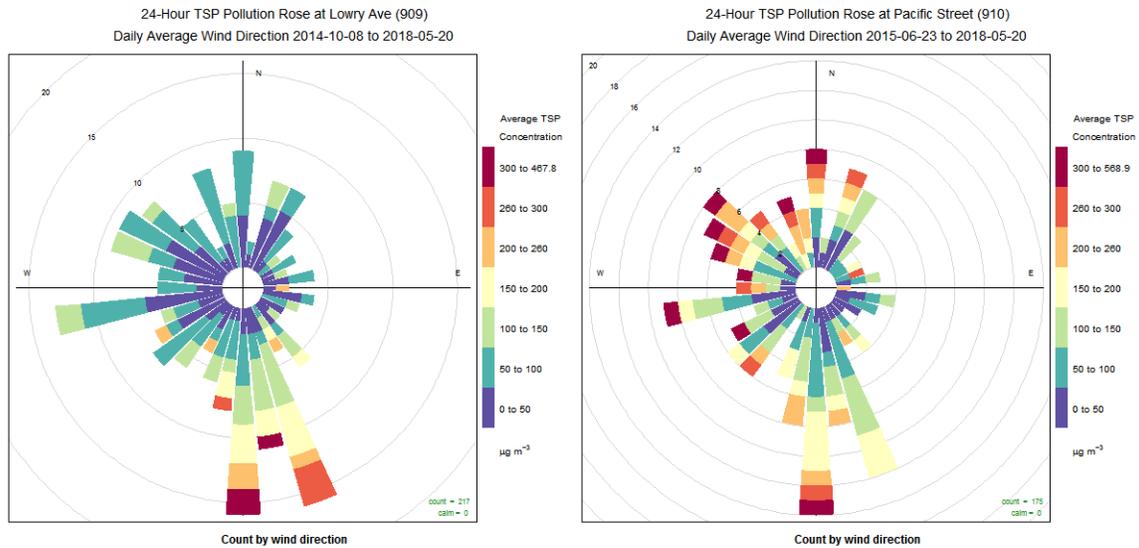
A pollution rose combines air pollution concentrations with wind direction information to identify the direction the air moved while the air sample was collected. A pollution rose can be used to help identify sources contributing to elevated pollutant concentrations.

Total suspended particulate pollution roses

The pollution roses for TSP includes daily average TSP concentrations from the Lowry Avenue and Pacific Street sites and the 24-hour vector averaged wind direction collected at the Lowry Avenue site. The Lowry Avenue pollution rose (left) suggests that elevated TSP concentrations occur on days when the wind is primarily blowing

from the south, southeast, or southwest. The Pacific Street pollution rose (right) suggests that elevated TSP concentrations occur on days when the wind is blowing primarily from any direction other than the northeast and the southwest. Due to the ground level site location and relatively low wind speeds, it is more difficult to identify the direction and sources that may have contributed to the high TSP concentrations at the Pacific Street monitor.

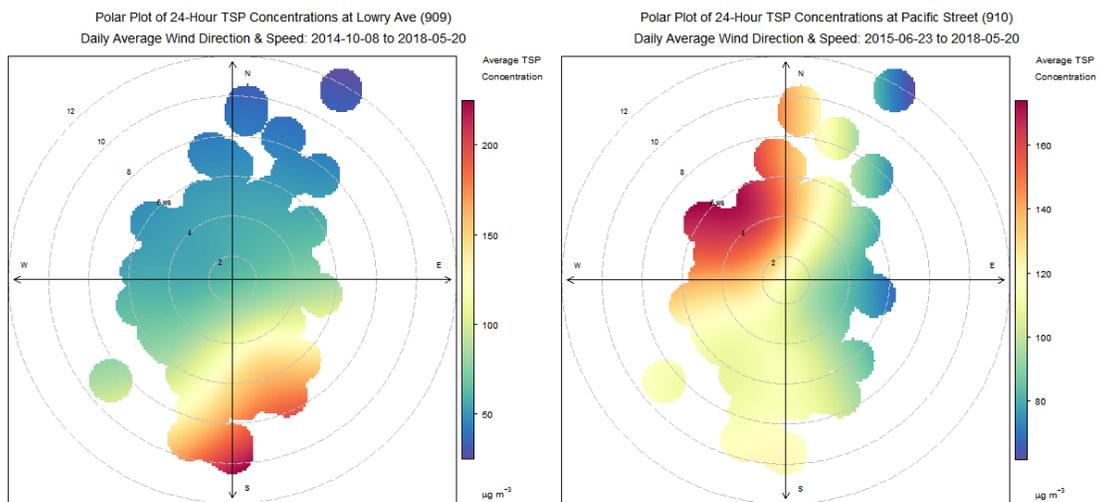
Daily average TSP pollution rose: Lowry Avenue (left) and Pacific Street (right)



These TSP pollution roses describe daily average TSP concentrations as a function of the daily average wind direction on the day the TSP sample was collected.

A polar plot combines air pollution concentrations with wind direction and wind speeds to identify the wind direction and speeds associated with elevated TSP concentrations. The TSP polar plot for Lowry Avenue, shown on the left side of the next page, suggests that the highest TSP concentrations tend to occur at the Lowry Avenue site when the daily average wind direction is from the south and when the daily average wind speeds range from 5-10 miles per hour. The TSP polar plot for the Pacific Street monitor, shown on the right side of the next page, suggests that the highest TSP concentrations tend to occur when the daily average wind direction is from the north, northwest, west, southwest, or south and when the daily average wind speed ranges from 2-6 miles per hour. The Pacific Street monitor is near ground level. Based on the data, ground level sources are influencing the results recorded by this monitor. These sources may include roadway emissions generated by vehicles or other ground level dust sources.

Daily average TSP polar plot: Lowry Avenue (left) and Pacific Street (right)



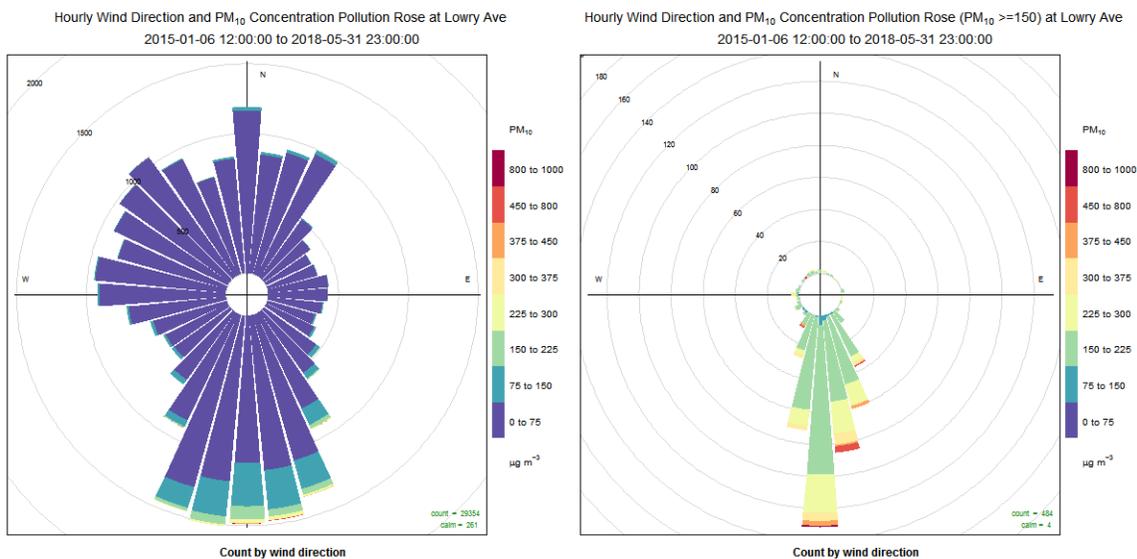
TSP polar plots describe daily average TSP concentrations as a function of the daily average wind direction and wind speed.

PM₁₀ pollution roses

Because TSP is collected once every six days and air pollution concentrations and wind direction can change frequently, a TSP pollution rose may not fully characterize the prominent wind directions associated with elevated air pollution concentrations. A PM₁₀ pollution rose can help fill in this gap. While TSP includes larger particles than PM₁₀, PM₁₀ pollution is included in TSP measurements. Therefore, the PM₁₀ results can be an indicator of TSP concentrations.

The Lowry Avenue pollution rose for PM₁₀ includes hourly PM₁₀ concentrations and hourly wind direction results collected at the Lowry Avenue site. The pollution rose on the left includes all hourly PM₁₀ concentration and wind direction results collected between January 6, 2015 and May 31, 2018. The pollution rose on the right includes all hourly PM₁₀ concentrations greater than or equal to 150 µg/m³ collected during the same period. The hourly PM₁₀ pollution rose for the Lowry Avenue site shows that the highest hourly PM₁₀ concentrations are found during hours when the wind is blowing from the south.

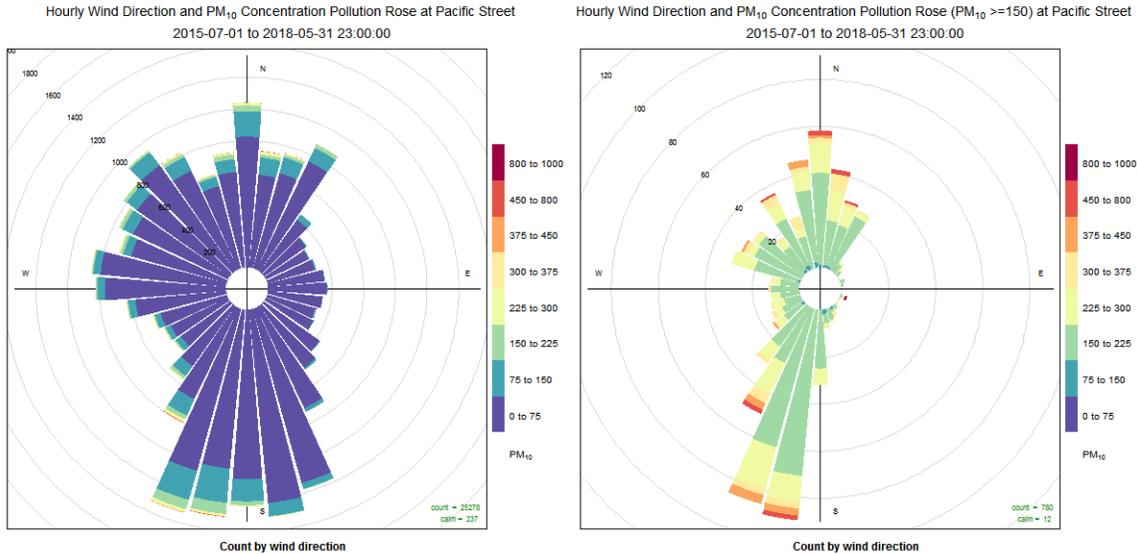
Hourly average PM₁₀ pollution rose: Lowry Avenue (909)



PM₁₀ pollution roses describe hourly average PM₁₀ concentrations as a function of the hourly average wind direction during the hour the PM₁₀ sample was collected at the Lowry Avenue monitoring site.

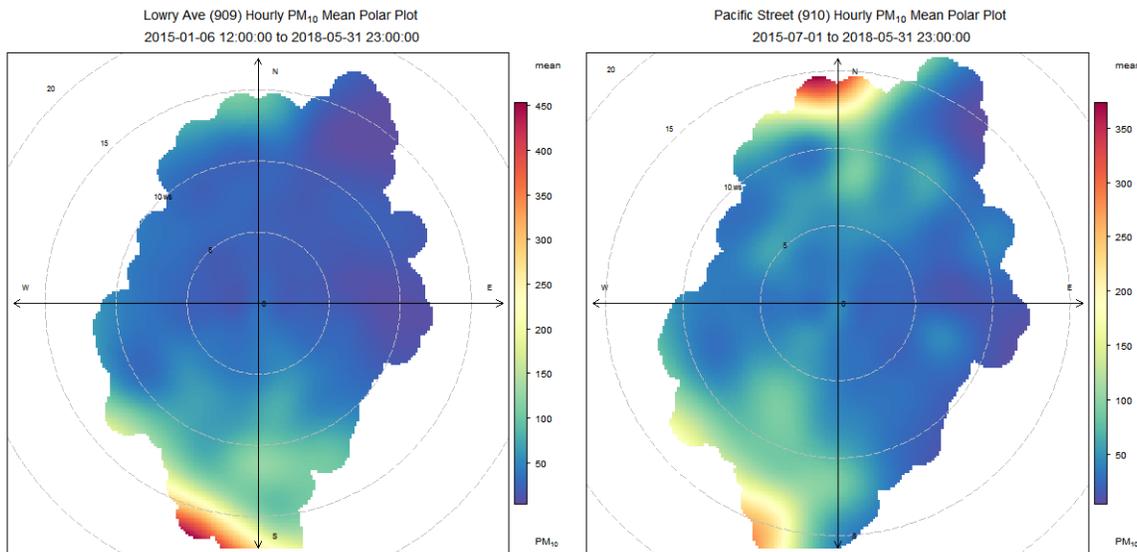
The Pacific Street pollution rose for PM₁₀ includes hourly PM₁₀ concentrations collected at the Pacific Street site and hourly wind direction results collected at the Lowry Avenue site. The pollution rose on the left includes all hourly PM₁₀ concentration and wind direction results collected between June 24, 2015 and May 31, 2018. The pollution rose on the right includes all hourly PM₁₀ concentrations greater than or equal to 150 µg/m³ collected during the same period. The hourly PM₁₀ pollution rose for the Pacific Street site shows that the highest hourly PM₁₀ concentrations are found during hours when the wind is blowing from north, northwest, and southwest.

Hourly average PM₁₀ pollution rose: Pacific Street (910)



These PM₁₀ pollution roses describe hourly average PM₁₀ concentrations as a function of the hourly average wind direction during the hour the PM₁₀ sample was collected at the Pacific Street site. Note: the wind direction data included in these charts was collected at the Lowry Avenue monitoring site.

Hourly average PM₁₀ polar plot: Lowry Avenue (left) and Pacific Street (right)



These PM₁₀ polar plots describe hourly average PM₁₀ concentrations as a function of the hourly average wind direction and wind speed. The Lowry Avenue PM₁₀ polar plot (left), shows elevated PM₁₀ concentrations when the wind direction is from the south and southeast and when wind speeds range from 5-20 miles per hour. The Pacific Street PM₁₀ polar plot (right), shows elevated PM₁₀ concentrations when the wind direction is from the north, northwest, southwest or south and when wind speeds range from 4-14 miles per hour.

Detailed analysis of TSP exceedance days

Previous versions of this document included a detailed description of each TSP exceedance day measured at the Lowry Avenue (909) and Pacific Street (910) monitoring sites. To improve the accessibility of this document, the detailed analysis of TSP exceedance days is now available upon request. To request a copy of the TSP exceedance day analysis, please call 651-296-6300 or 800-657-3864 and ask for the Air Data Analysis Staff.