

# North Minneapolis Air Monitoring Study: 2015 Data Summary



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# Executive summary

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## What are the results?

Elevated levels of airborne particulate and heavy metals have been measured at monitors located near the west side of the Lowry Avenue bridge in North Minneapolis. Air monitoring results have identified:

- Violations of the daily and annual Total Suspended Particulate (TSP) standards
- Exceedances of the daily PM<sub>10</sub> standard
- Elevated lead concentrations, measured at 80% of the national lead standard
- Elevated heavy metal concentrations including three metals (chromium, cobalt, and nickel) measured above chronic inhalation health risk guidelines

## What do these results mean?

These results indicate that air pollution in the area surrounding the monitors may contribute to adverse health effects and degraded environmental quality.

- Elevated TSP concentrations may contribute to respiratory irritation and nuisance dust. The majority of the particles in this size range are removed by the body, through coughing or protective mucus, before reaching the lungs.
- Elevated PM<sub>10</sub> concentrations may contribute to respiratory irritation, damage to lung tissue, and premature death. These smaller particles can reach lower regions of the respiratory tract.
- Elevated lead concentrations may contribute to developmental problems in young children (behavioral problems, learning deficits, and lowered IQ) and cardiovascular effects in adults.
- Elevated metals concentrations may contribute to increased population risks for adverse health outcomes including cancer and non-cancer conditions. With respect to carcinogenic effects, the health guidelines are developed so the additional lifetime risk of developing cancer is less than or equal to 1 additional chance in 100,000 for continuous exposure to the inhalation health benchmark concentration for a lifetime.
- The Minnesota Department of Health (MDH) has reviewed these results and has expressed concerns about the findings. While the results in this report do not indicate a short-term health risk, MDH is concerned about the overall impact on air quality in this area and the potential for harm over the long term, particularly for those who work in the immediate area.

## What is the MPCA doing to address the problem?

The MPCA is actively working to address the elevated air pollution levels in the area surrounding these monitors. Ongoing activities include:

- Working with facilities in the surrounding area and the city of Minneapolis to identify the source(s) that contribute to the elevated air pollution concentrations and to identify and implement pollution reduction activities to improve air quality. Specifically:
  - Northern Metals completed a facility audit in February 2016 to identify operational or maintenance opportunities for reducing emissions. The MPCA is evaluating the facility to determine overall emissions.
  - Other potential sources of particulate pollution in the area have been identified. The MPCA has asked these facilities to implement short- and long-term operational and maintenance changes at their sites that will reduce particulate pollution. These activities include increasing the frequency of site and street spraying and sweeping, moving activities indoors, and changing material handling practices.
- Continuing air monitoring at the Lowry Avenue and Pacific Street sites and providing timely public access to results, [www.pca.state.mn.us/air/north-minneapolis-air-monitoring-project](http://www.pca.state.mn.us/air/north-minneapolis-air-monitoring-project).

## How can I stay informed?

Information related to the North Minneapolis Air Monitoring Project is updated frequently at the following sources:

- The North Minneapolis Air Monitoring Project website is updated monthly with air pollution monitoring results from the Lowry Avenue and Pacific Street monitoring sites, [www.pca.state.mn.us/air/north-minneapolis-air-monitoring-project](http://www.pca.state.mn.us/air/north-minneapolis-air-monitoring-project).
- Real-time PM10 monitoring results from the Lowry Avenue and Pacific Street monitoring sites are available from the Current Conditions Details page of the Air Quality Index website, [www.pca.state.mn.us/aqi](http://www.pca.state.mn.us/aqi).
- If you would like to be included on a mailing list for future updates about the project, please sign up for our GovDelivery email notification, [https://public.govdelivery.com/accounts/MNPCA/subscriber/new?topic\\_id=MNPCA\\_144](https://public.govdelivery.com/accounts/MNPCA/subscriber/new?topic_id=MNPCA_144).

# Results compared to air quality standards

Three pollutants measured at the Lowry Avenue and Pacific Street sites have state or federal regulatory standards. These pollutants include: Total Suspended Particulate (TSP), particulate with an aerodynamic diameter less than 10 micrometers (PM10), and lead.

## Total Suspended Particulate (TSP)

In 2015

- The Lowry Avenue monitor violated the primary and secondary annual TSP standards.
- The Lowry Avenue monitor violated the primary and secondary daily TSP standards.
- The Pacific Street monitor violated the secondary daily TSP standard.
- Due to insufficient data, the Pacific Street monitor cannot be compared to the annual TSP standards.

In Minnesota, TSP levels in the air are regulated through the Minnesota Ambient Air Quality Standards (MAAQS), which are established by Minnesota Rule 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 <sup>1</sup>	Daily (24-hour)	260 micrograms per cubic meter	...the annual 2 <sup>nd</sup> highest daily TSP concentration is less than or equal to 260 µg/m <sup>3</sup>
	Annual	75 micrograms per cubic meter	...the annual geometric mean is less than or equal to 75 µg/m <sup>3</sup>
Secondary <sup>2</sup>	Daily (24-hour)	150 micrograms per cubic meter	...the annual 2 <sup>nd</sup> highest daily TSP concentration is less than or equal to 150 µg/m <sup>3</sup>
	Annual	60 micrograms per cubic meter	...the annual geometric mean is less than or equal to 60 µg/m <sup>3</sup>

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

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

### 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 (µg/m<sup>3</sup>). 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 µg/m<sup>3</sup>. 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. Currently, only TSP results collected at the Lowry Avenue site in 2015 are sufficient for comparisons to the annual TSP standards. The annual geometric mean TSP concentration at the Lowry Avenue site in 2015 is equal to 80  $\mu\text{g}/\text{m}^3$ . The Lowry Avenue site has violated the primary and secondary annual TSP standards in 2015.

### 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.

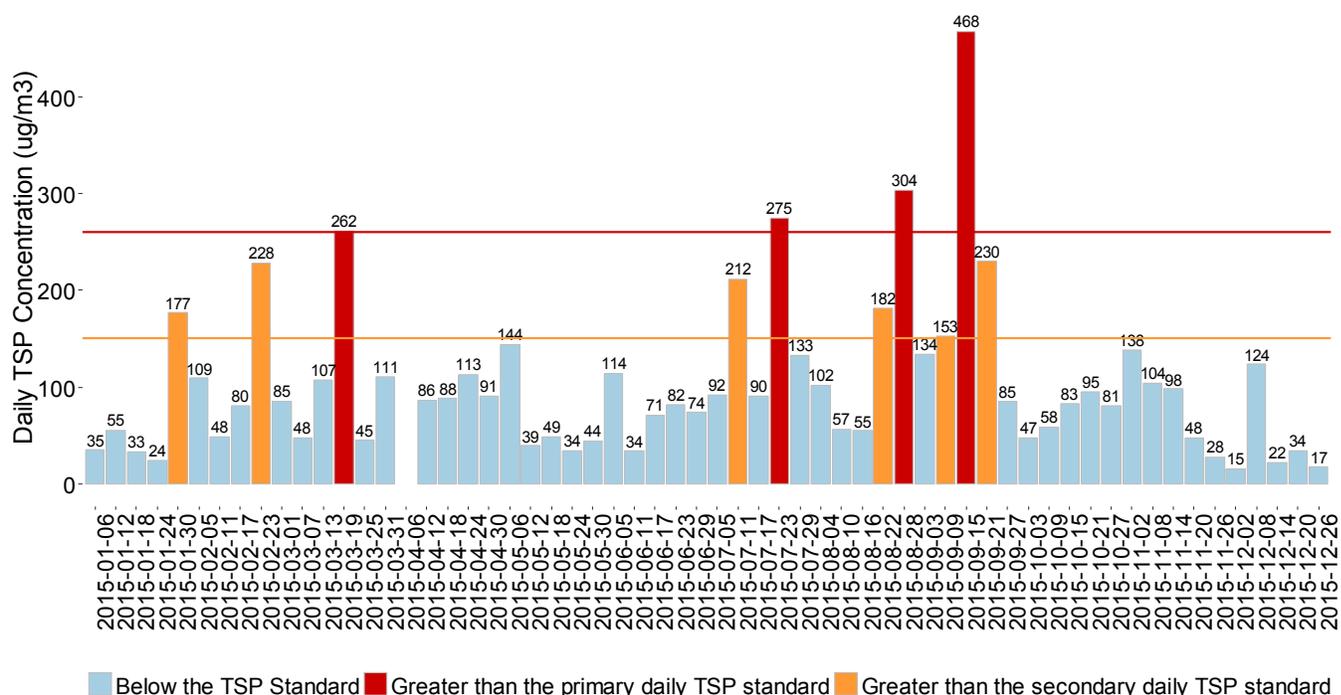
A monitoring site meets the secondary daily TSP standard when the second highest daily average TSP concentration is less than or equal to 150  $\mu\text{g}/\text{m}^3$ . A secondary standard is set to protect against environmental or public welfare effects associated with exposure to an air pollutant.

At the Lowry Avenue site, in 2015, the second highest daily average TSP concentration was 304  $\mu\text{g}/\text{m}^3$ . As a result, the Lowry Avenue site has violated both the primary and secondary daily TSP standards. The Lowry Avenue site measured ten exceedances of the secondary daily TSP standard and four exceedances of the primary daily TSP standard.

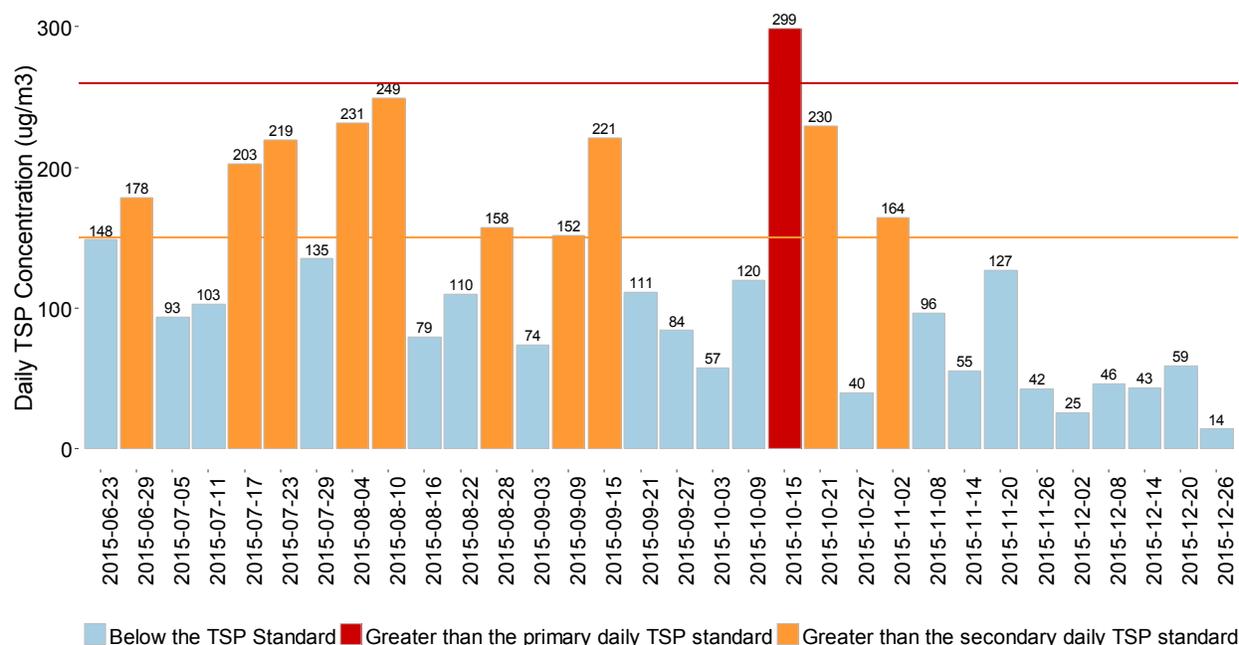
At the Pacific Street site, in 2015, the second highest daily average TSP concentration was 299  $\mu\text{g}/\text{m}^3$ . As a result, the Pacific street site has violated the secondary daily TSP standard, but met the primary daily TSP standard. The Pacific Street site has measured eleven exceedances of the secondary daily TSP standard and one exceedance of the primary daily TSP standard.

The charts on the following pages describe the daily TSP results collected at the Lowry Avenue and Pacific Street sites in 2015. These charts identify samples that exceed the primary and secondary daily TSP standards. Please note that if a sample exceeds the primary daily TSP standard it also exceeds the secondary daily TSP standard.

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



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



## PM10

In 2015

- The Lowry Avenue monitor met the annual PM10 standard. Due to insufficient data, the Pacific Street monitor cannot be compared to the annual PM10 standard.
- The Lowry Avenue monitor measured two exceedances of the daily PM10 standard, but has not violated the daily PM10 standard.
- The Pacific Street monitor has no measured exceedances of the daily PM10 standard.

In Minnesota, PM10 levels in the air are regulated through the National Ambient Air Quality Standards and the Minnesota Ambient Air Quality Standards (MAAQS). The MAAQS are defined in Minnesota Administrative Rules 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 Standard	Daily (24-hour)	150 micrograms per cubic meter	...the standard is not exceeded more than once per year, on average, over 3-years
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
	Annual	50 micrograms per cubic meter	...the annual average concentration is less than or equal to 50 µg/m <sup>3</sup>

Note: For PM10, the primary and secondary standards are identical.

## Annual PM10 standards

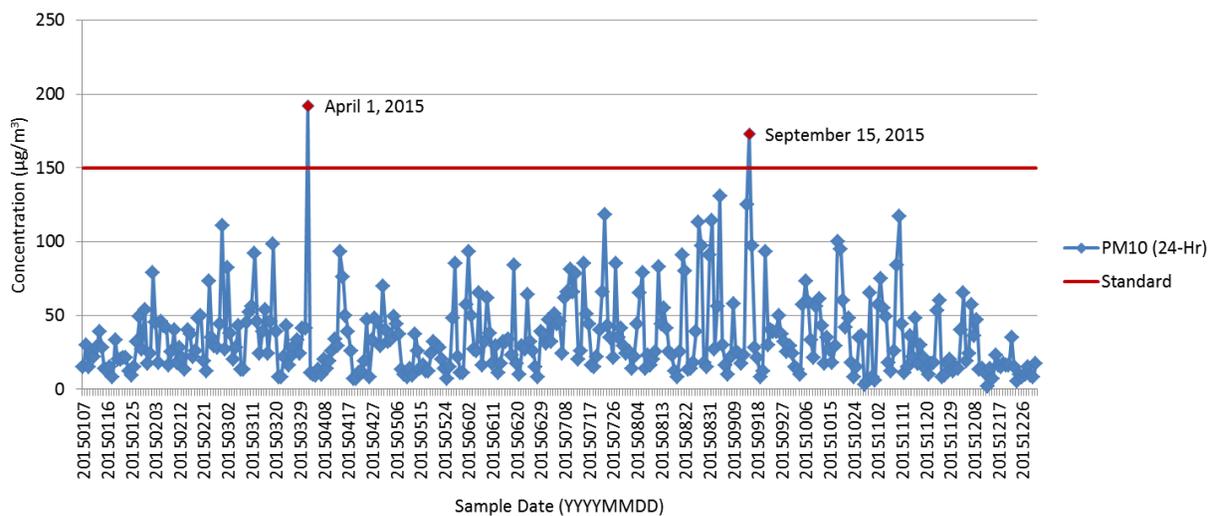
A monitoring site meets the annual PM10 standard when the annual average PM10 concentrations is less than or equal to 60 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ).

To assess compliance with the annual PM10 standards, a monitoring site must have a complete year of monitoring data. Currently, only PM10 results collected at the Lowry Avenue site in 2015 are sufficient for comparisons to the annual PM10 standards. The annual average PM10 concentration at the Lowry Avenue site in 2015 is  $35 \mu\text{g}/\text{m}^3$ . The Lowry Avenue site has met the annual PM10 standard in 2015.

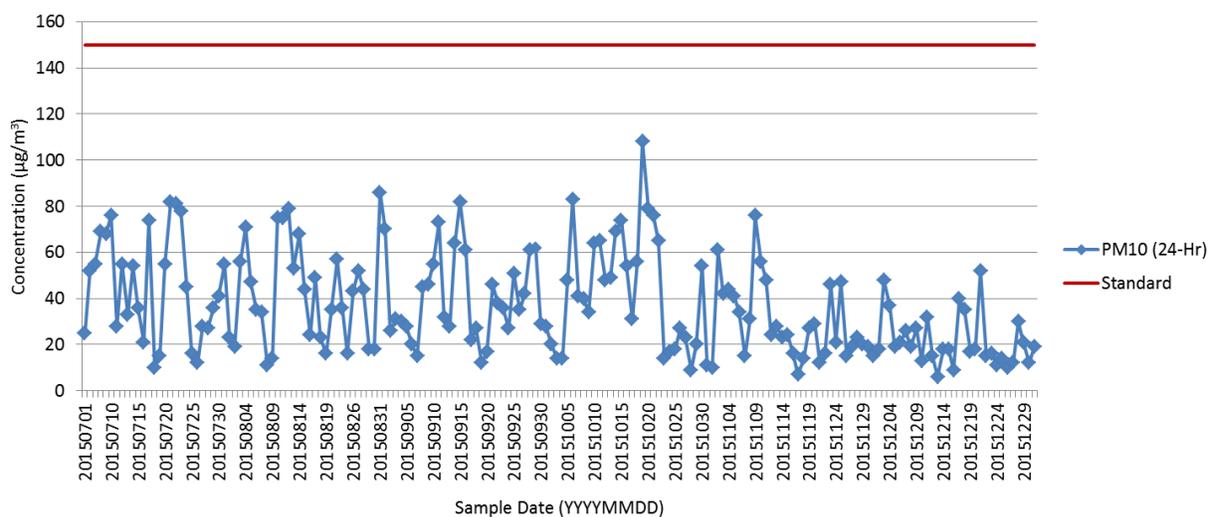
## Daily PM10 standards

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. To date, the Lowry Avenue site has measured two exceedances of the daily PM10 standard. If the Lowry Avenue site measures two additional exceedances by December 31, 2017, the site will violate the daily PM10 standard. To date, the Pacific Street site has no measured exceedances of the daily PM10 standard.

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



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



# Lead

In 2015

- The Lowry Avenue and Pacific Street monitors did not exceed the rolling 3-month lead standard.
- The Lowry Avenue and Pacific Street monitors did not exceed the cancer and non-cancer lead inhalation health benchmarks.
- The Lowry Avenue and Pacific Street sites had elevated lead concentrations compared to other non-source oriented lead monitoring sites. Lead results at Lowry Avenue and Pacific Street were similar to measured results near a lead-battery recycler in Eagan.

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

## Ambient Air Quality Standards for Lead

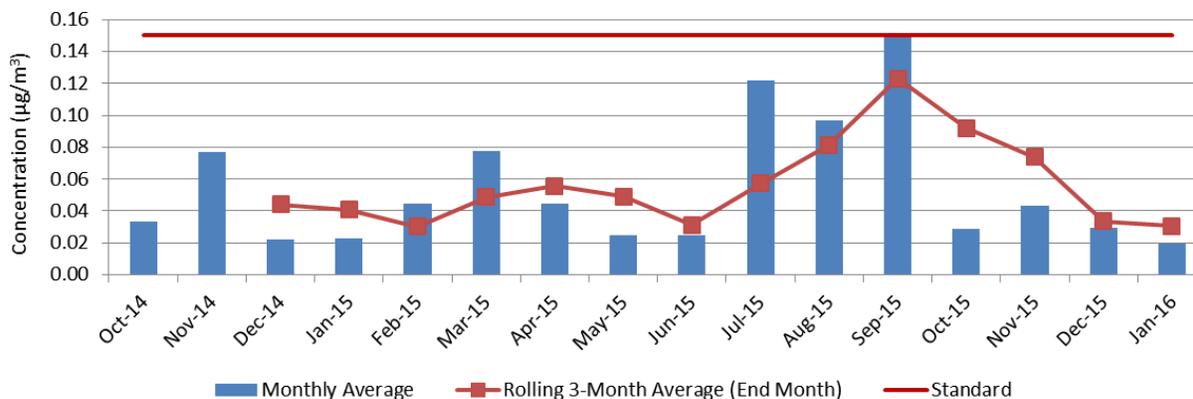
Standard Type	Time Interval	Level of Standard	A monitoring site meets the standard if...
National and State Standard	Rolling 3-month	0.15 micrograms per cubic meter	...the 3-month rolling average does not exceed the level of the standard, over 3-years.

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

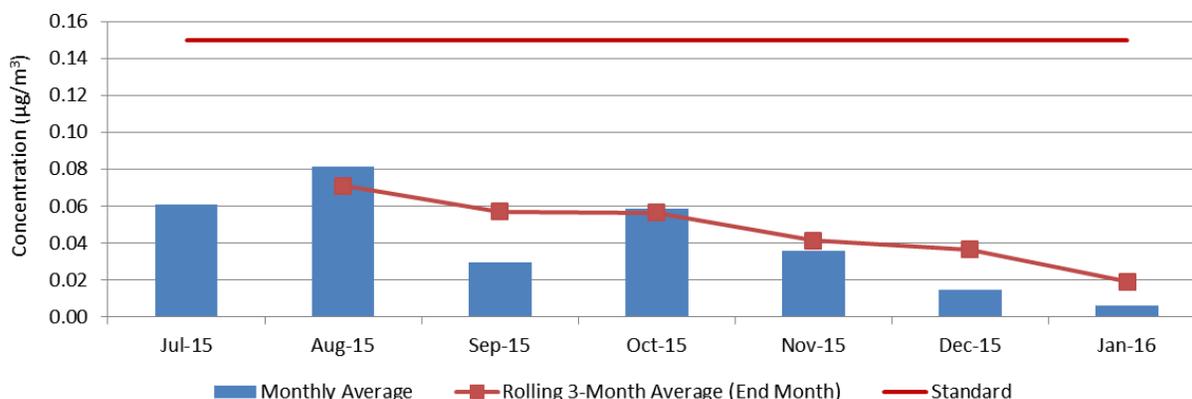
## Rolling 3-month lead standard

A monitoring site meets the rolling 3-month lead standard when the maximum 3-month rolling average lead concentration is less than or equal to the level of the standard, over three-years. The current maximum 3-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 3-month rolling average lead concentration at Pacific Street is  $0.07 \mu\text{g}/\text{m}^3$ , which is 47% of the lead standard. To date, both sites meet the 3-month rolling average lead standard.

## Rolling 3-month average lead concentrations at Lowry Avenue compared to the lead standard



## Rolling 3-month average lead concentrations at Pacific Street compared to the lead standard



## Air Toxics Results

The EPA defines air toxics as those pollutants that cause or may cause cancer or other serious health effects (such as reproductive or birth defects), or adverse environmental and ecological effects. Air toxics include, but are not limited to, the 188 Hazardous Air Pollutants (HAPs) specified in the 1990 Clean Air Act Amendments, <http://www.epa.gov/ttn/atw/orig189.html>.

The MPCA's air toxics monitoring network analyzes air samples for 54 volatile organic compounds (VOCs), 7 carbonyls, and 13 metals. Air toxics do not have standards. Instead, the MPCA uses guidelines called health benchmarks. However, many air toxic pollutants have no established health benchmarks. Pollutant benchmarks come from a variety of sources including:

- Minnesota Department of Health's Health Risk Values (HRVs), Health Based Values (HBVs), and other Risk Assessment Advice, <http://www.health.state.mn.us/divs/eh/risk/guidance/air/table.html>
- EPA's Integrated Risk Information System (IRIS), <http://www.epa.gov/iris/>
- California's Office of Health Hazard Assessment, <http://www.oehha.ca.gov/air.html>.
- Provisional Peer Reviewed Toxicity Values for Superfund (PPRTV), <http://hhprrtv.ornl.gov/>

Inhalation health benchmarks are established to protect against both short and long-term exposures to air pollutants. An acute inhalation health benchmark is a concentration in ambient air at or below which a chemical is unlikely to cause an adverse health effect to sensitive populations when exposure occurs for one-hour. A chronic health benchmark is a concentration in ambient air at or below which a chemical is unlikely to cause an adverse health effect to sensitive populations when exposure occurs over a lifetime. Chronic health benchmarks are set separately for cancer (carcinogenic) and noncancer related health outcomes. With respect to carcinogenic effects, the health benchmarks are developed so the additional lifetime risk of developing cancer is less than or equal to 1 additional chance in 100,000 for continuous exposure to the inhalation health benchmark concentration for a lifetime.

The Lowry Avenue site began collecting air toxic pollutants, including metals, VOCs, and carbonyls in October 2014. The Pacific Street site began collecting air toxic metals in June 2015. A complete year of monitoring data is required to compare air toxics results to chronic inhalation health benchmarks. As a result, in this report, only air toxics results collected at Lowry Avenue in 2015 are compared to available inhalation health benchmarks.

## Air toxics compared to inhalation health benchmarks

In 2015, at the Lowry Avenue site, four air toxic pollutants were measured at concentrations above a chronic inhalation health benchmark. These pollutants include three metals, chromium, cobalt, and nickel; and one carbonyl, formaldehyde. The elevated chromium, cobalt and nickel results at Lowry Avenue are unique in the Twin Cities metropolitan area and indicate a local source may be contributing to the elevated concentrations. Formaldehyde is an air toxic pollutant that is above the inhalation health benchmark at all urban air toxics monitoring sites.

### Air toxics pollutants above inhalation health benchmarks at Lowry Avenue, 2015

	Annual Mean	95% UCL of Annual Mean	Chronic Cancer IHB	Chronic Non-Cancer IHB	Percent of Lowest IHB
<b>Metals</b>	micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )				
Chromium <sup>1</sup>	0.015	0.019	0.0083	0.08	228%
Cobalt <sup>2</sup>	0.003	0.003	0.001	0.006	312%
Nickel <sup>3</sup>	0.013	0.016	0.0208	0.014	114%
<b>Carbonyls</b>					
Formaldehyde	2.8	3.0	2.0	9.0	152%

<sup>1</sup>. The chromium inhalation health benchmarks are based on risks associated with exposure to Hexavalent Chromium ( $\text{Cr}6^+$ ). The MPCA air toxics monitoring network measures total chromium. To assess health risks, we assume that hexavalent chromium is 10% of total chromium measurements. The chronic health benchmarks have been adjusted to allow comparisons to the measured total chromium concentrations.

<sup>2</sup>. Cobalt was detected in 15% of samples. The MPCA typically requires 20% of samples to be above the detection limit to report an annual mean.

<sup>3</sup>. The nickel inhalation health benchmarks are based on risks associated with exposure to nickel sub-sulfide. The MPCA air toxics monitoring network measures total nickel. This data has not been adjusted to reflect the likely nickel sub-sulfide contribution to the total nickel measurements.

The following tables summarize all air toxics monitoring results by pollutant group which includes: carbonyls, metals, and VOCs. Due to uncertainty associated with instrument detection limits, a mean is not calculated for pollutants with less than 20% of samples above the detection limit. To assess risks, the 95% UCL of the annual mean is divided by the lowest chronic health benchmark. Pollutants with a “Percent of Lowest IHB” greater than 100% exceed the associated inhalation health benchmark.

### Annual carbonyls results at Lowry Avenue compared to Inhalation Health Benchmarks (IHBs), 2015

	Annual Mean	95% UCL of Annual Mean	Chronic Cancer IHB	Chronic Non-Cancer IHB	Percent of Lowest IHB
	micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )				
Acetaldehyde	1.3	1.4	4.5	9.0	31%
Benzaldehyde	0.1	0.1	No IHB	20.0	1%
Butyraldehyde	0.2	0.2	No IHB	70.0	0.3%
Formaldehyde	2.8	3.0	2.0	9.0	152%
Propionaldehyde	0.3	0.3	No IHB	8.0	4%
Trans-Crotonaldehyde	Below the detection limit		No IHB		

## Annual metals results at Lowry Avenue compared to Inhalation Health Benchmarks (IHBs), 2015

	Annual Mean	95% UCL of Annual Mean	Chronic Cancer IHB	Chronic Non-Cancer IHB	Percent of Lowest IHB
	micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )				
Aluminum <sup>1</sup>	0.8	1.0	No IHB	5.0	19%
Antimony	0.0	0.0	No IHB	0.2	3%
Arsenic	Below the detection limit		0.002	0.015	
Barium	0.1	0.1	No IHB		
Beryllium	Below the detection limit		0.004	0.020	
Cadmium	Below the detection limit		0.006	0.020	
Chromium <sup>2</sup>	0.015	0.019	0.0083	0.0800	228%
Cobalt <sup>3</sup>	0.0031	0.0035	0.0011	0.0060	312%
Iron	7.3	9.0	No IHB		
Lead	0.06	0.08	0.83	0.15	50%
Manganese	0.12	0.14	No IHB	0.2	72%
Nickel <sup>4</sup>	0.013	0.016	0.021	0.014	114%
Selenium	Below the detection limit		No IHB		
Zinc	0.9	1.2	No IHB		

<sup>1</sup> Due to potential contamination from sampling equipment, the MPCA does not typically report aluminum results. However, because aluminum results at Lowry Avenue and Pacific Street are significantly higher than all other metals monitoring sites in the MPCA's air monitoring network, those results are included here.

<sup>2</sup> The chromium inhalation health benchmarks are based on risks associated with exposure to Hexavalent Chromium ( $\text{Cr}^{6+}$ ). The MPCA air toxics monitoring network measures total chromium. To assess health risks, we assume that hexavalent chromium is 10% of total chromium measurements. The chronic health benchmarks have been adjusted to allow comparisons to the measured total chromium concentrations.

<sup>3</sup> Cobalt was detected in 15% of samples. The MPCA typically requires 20% of samples to be above the detection limit to report an annual mean.

<sup>4</sup> The nickel inhalation health benchmarks are based on risks associated with exposure to nickel sub-sulfide. The MPCA air toxics monitoring network measures total nickel. This data has not been adjusted to reflect the likely nickel sub-sulfide contribution to the total nickel measurements.

## Annual VOC results at Lowry Avenue compared to Inhalation Health Benchmarks (IHBs), 2015

	Annual Mean	95% UCL of Annual Mean	Chronic Cancer IHB	Chronic Non-Cancer IHB	Percent of Lowest IHB
	micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )				
1,1,2,2-Tetrachloroethane	Below the detection limit		0.2	No IHB	
1,1,2-Trichloroethane	Below the detection limit		0.6	No IHB	
1,1-Dichloroethane	Below the detection limit		6.3	No IHB	
1,1-Dichloroethylene	Below the detection limit		No IHB	200.0	
1,2,4-Trichlorobenzene	Below the detection limit		No IHB	2.0	
1,2,4-Trimethylbenzene	0.7	0.8	No IHB	7.0	12%
1,2-Dichlorobenzene	Below the detection limit		No IHB		
1,2-Dichloropropane	Below the detection limit		No IHB	4.0	
1,3,5-Trimethylbenzene	0.2	0.3	No IHB		

	Annual Mean	95% UCL of Annual Mean	Chronic Cancer IHB	Chronic Non-Cancer IHB	Percent of Lowest IHB
	micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )				
1,3-Butadiene	0.1	0.2	0.2	2.0	95%
1,3-Dichlorobenzene	Below the detection limit		No IHB		
1,4-Dichlorobenzene	Below the detection limit		0.9	800.0	
Benzene	0.7	0.7	1.3	30.0	58%
Benzene, 1-Ethenyl-4-Methyl	0.2	0.3	No IHB		
Benzyl Chloride	Below the detection limit		0.2	1.0	
Bromodichloromethane	Below the detection limit		No IHB		
Bromoform	Below the detection limit		9.1	No IHB	
Bromomethane	Below the detection limit		No IHB	5.0	
Carbon Disulfide	0.2	0.2	0.0	700.0	0%
Carbon Tetrachloride	0.5	0.6	1.7	100.0	34%
Chlorobenzene	Below the detection limit		0.0	1000.0	
Chloroethane	Below the detection limit		No IHB	10000.0	
Chloroform	0.3	0.4	0.4	300.0	96%
Chloromethane	0.3	0.4	No IHB	90.0	0.5%
Cis-1,2-Dichloroethene	Below the detection limit		No IHB		
Cis-1,3-Dichloropropene	Below the detection limit		No IHB		
Cyclohexane	0.3	0.4	No IHB	6000.0	0.01%
Dibromochloromethane	Below the detection limit		No IHB		
Dichlorodifluoromethane	2.5	2.7	No IHB		
Dichloromethane	0.5	0.6	21.3	600.0	3%
Ethylbenzene	0.3	0.4	4.0	1000.0	10%
Ethylene Dibromide	Below the detection limit		0.046	9.0	
Ethylene Dichloride	0.1	0.1	0.4	400.0	26%
Freon 113	0.6	0.7	No IHB		
Freon 114	Below the detection limit		No IHB		
Furan, Tetrahydro-	0.3	0.3	No IHB	2000.0	
M/P Xylene	1.4	1.6	No IHB	100.0	2%
Methyl Butyl Ketone	0.4	0.4	No IHB	30.0	1%
Methyl Chloroform	0.1	0.2	No IHB	5000.0	0.003%
Methyl Tert-Butyl Ether	Below the detection limit		38.5	3000.0	
N-Heptane	0.4	0.5	No IHB		
N-Hexane	0.9	1.0	50.0	2000.0	2%
O-Xylene	0.5	0.6	0.0	100.0	1%
Styrene	0.4	0.6	No IHB	1000.0	0.1%
Tetrachloroethylene	Below the detection limit		2.0	100.0	
Toluene	1.6	1.9	No IHB	400.0	0.5%
Trans-1,2-Dichloroethylene	0.1	0.1	No IHB	60.0	0.2%
Trans-1,3-Dichloropropene	Below the detection limit		No IHB		
Trichloroethylene	0.1	0.2	2.0	2.0	8%

	Annual Mean	95% UCL of Annual Mean	Chronic Cancer IHB	Chronic Non-Cancer IHB	Percent of Lowest IHB
	micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )				
Trichlorofluoromethane	2.4	3.2	No IHB		
Vinyl Chloride	Below the detection limit		1.1	100.0	

## Pacific Street metals results

The Pacific Street site began collecting metals results in July 2015. A complete year of data is required to compare air toxics monitoring results to inhalation health benchmarks. The table below summarizes the 6-month average metals results at Pacific Street.

### 6-month average metals results at Pacific Street, July 2015 – December 2015

	Average, micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )
Aluminum <sup>1</sup>	0.9
Antimony	0.006
Arsenic	Below the detection limit
Barium	0.06
Beryllium	Below the detection limit
Cadmium	Below the detection limit
Chromium <sup>2</sup>	0.016
Cobalt	Below the detection limit
Iron	7.4
Lead	0.05
Manganese	0.14
Nickel <sup>3</sup>	0.016
Selenium	Below the detection limit
Zinc	0.5

<sup>1</sup> The MPCA does not typically report aluminum results due to potential contamination from sampling equipment. However, because aluminum results at Lowry Avenue and Pacific Street are significantly higher than all other metals monitoring sites in the MPCA's air monitoring network, those results are included here.

<sup>2</sup> The chromium inhalation health benchmarks are based on risks associated with exposure to Hexavalent Chromium ( $\text{Cr}6^+$ ). The MPCA air toxics monitoring network measures total chromium. To assess health risks, we assume that hexavalent chromium is 10% of total chromium measurements. The chronic health benchmarks have been adjusted to allow comparisons to the measured total chromium concentrations.

<sup>3</sup> The nickel inhalation health benchmarks are based on risks associated with exposure to nickel sub-sulfide. The MPCA air toxics monitoring network measures total nickel. This data has not been adjusted to reflect the likely nickel sub-sulfide contribution to the total nickel measurements.