Community Air Monitoring Project

Summary Report – St. Paul West Side Neighborhood

St Paul West Side Air Monitoring Site

Project overview

In 2013, the Minnesota Legislature funded a two-year air monitoring study to measure air quality in Minnesota communities where low income or communities of color might be disproportionately impacted by pollution from highway traffic, air traffic, and industrial sources. This legislation funds one monitor to be moved to seven locations in a two-year period.

The project began on October 1, 2013, with monitoring in the East Phillips neighborhood of Minneapolis. The monitor moved to the Thomas-Dale neighborhood, then the St. Paul West Side neighborhood. This area is a mix of residential and business interlaced with heavily used roadways. Monitoring ran from April 1-June 30, 2014.

What we monitored

Air was monitored for specific chemicals that are associated with adverse public health effects (Attachment A). These chemicals are classified as fine particles ($PM_{2.5}$) or air toxic pollutants (carbonyls, metals or volatile organic compounds [VOCs]). Although only a three-month study, for comparison purposes, we compared the average daily $PM_{2.5}$ monitored data to the daily fine particle standard and the air toxic pollutants to the available long-term health benchmarks. These comparisons are used for informational purposes only and should not be used to determine compliance with standards or health risks. The data were also compared with other data collected in the same time period at other monitors in Minnesota.

Findings at a glance:

- All average daily $PM_{2.5}$ values were below the daily $PM_{2.5}$ standard of 35 micrograms per cubic meter ($\mu g/m^3$) but were generally higher than the values seen at other sites for a majority of the monitoring days.
- Of the 74 air toxic pollutants measured for this project, 46 pollutants were so low that they were not detected by the monitor.
- All average VOC and carbonyl values were below health benchmarks except for formaldehyde. The average values of formaldehyde at most monitoring sites in the Twin Cities metro were slightly above health benchmarks. Higher formaldehyde values are expected in warmer months and are lower in winter months.
- Of the detected metals, average metal values were higher at this site than the other Twin Cities metro sites, but all were below health benchmarks except for arsenic. The Minnesota Pollution Control Agency (MPCA) is working to better understand these results.

Summary of results

Fine Particles ($PM_{2.5}$)

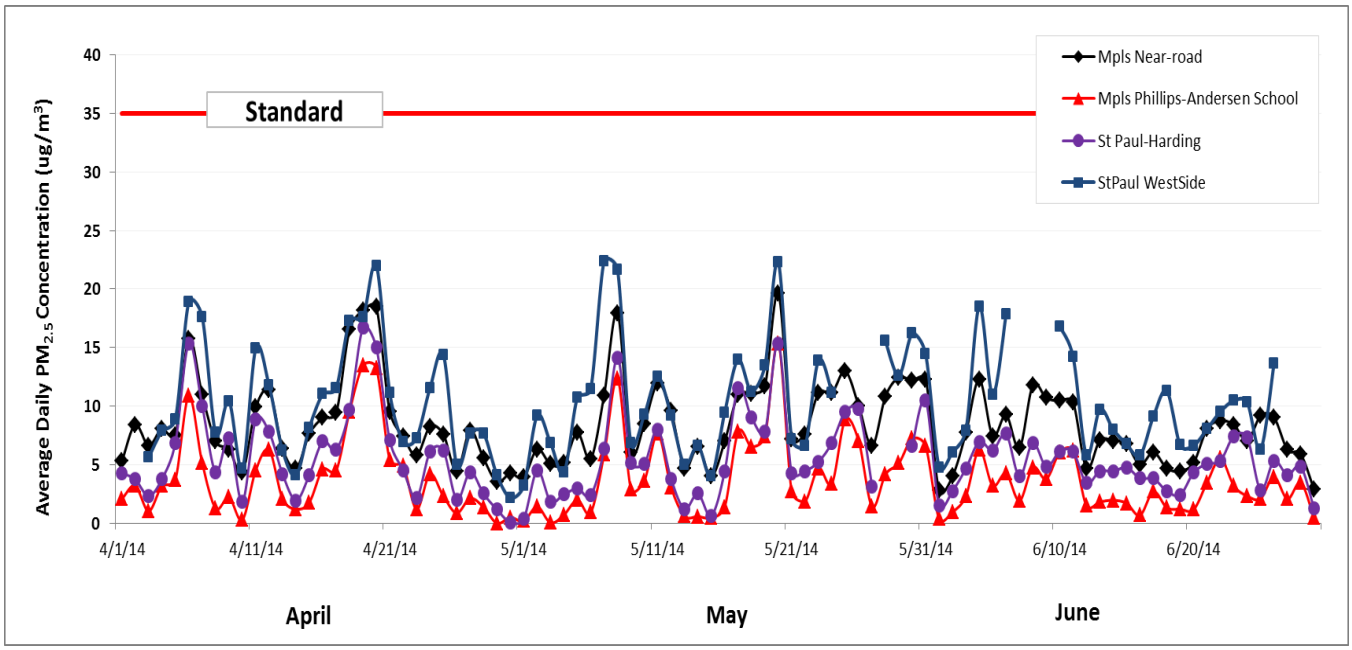
Fine particles are a complex mixture of extremely small particles and liquid droplets that are created during combustion when coal, gasoline, diesel, wood and other fuels are burned, and are also created in the air by chemical reactions among other pollutants. Because of their small size, $PM_{2.5}$ can be inhaled deeply into the lungs and can enter the blood stream. Exposure to fine particle pollution can contribute to respiratory and cardiovascular health effects.

Fine particles are regulated on an annual and daily basis to guard against long-term and short-term health effects linked to fine particle exposure. To test compliance with these standards, a minimum of three-years of monitoring data is required. The monitoring period for this project is too short to determine whether the project sites meet the fine particle standards. However, as an informal comparison, we have compared daily fine particle results to the short term fine particle standards of 35 micrograms per cubic meter ($\mu g/m^3$).

U.S. Environmental Protection Agency (EPA) regulations state that a monitored site meets daily $PM_{2.5}$ regulatory requirements if the 98th percentile of the 24-hour $PM_{2.5}$ concentrations in a year, averaged over 3 years, is less than or equal to 35 $\mu g/m^3$. For more information: http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html

The average daily trends (**Figure 1**) over the three month period were similar between the St. Paul West Side monitor and other Twin Cities monitoring sites (locations shown in **Figure 2**). While all average daily $PM_{2.5}$ values were below the daily $PM_{2.5}$ standard of 35 $\mu g/m^3$, average daily values measured at the St. Paul West Side monitor were generally higher than those seen at most other sites for a majority of the monitoring days (**Table 1**) but followed a similar daily trend as other metro sites.

Figure 1. Average daily $PM_{2.5}$ values at several St. Paul-Minneapolis sites from April 1-June 30, 2014.



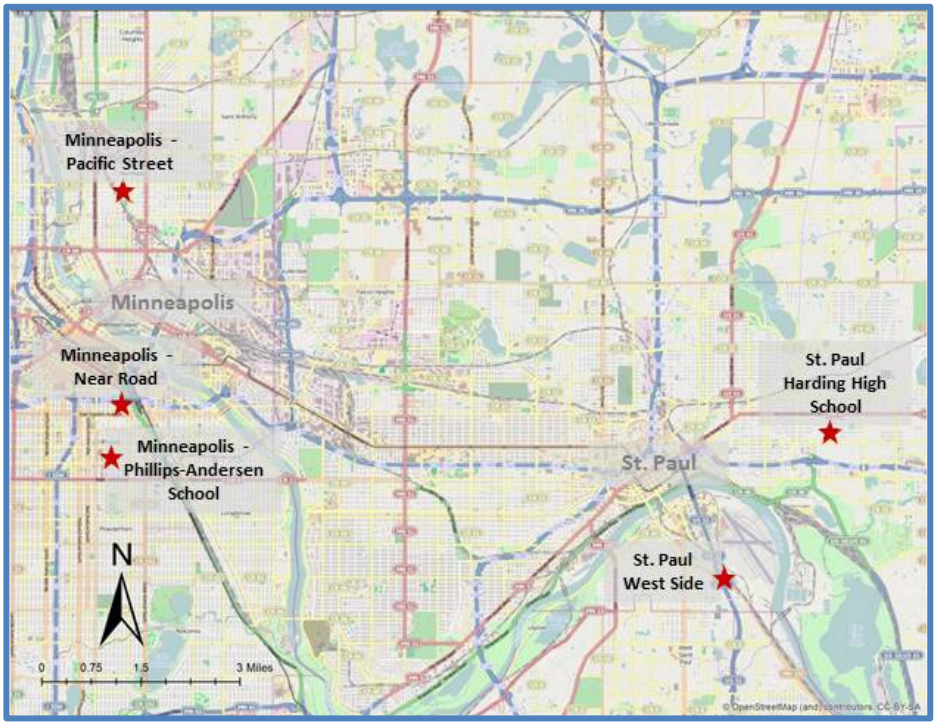


Figure 2. Location of the St. Paul West Side community air monitor in relation to other $PM_{2.5}$ air monitors in the St. Paul-Minneapolis metro area. For more information about the individual sites, please visit the MPCA Air Monitoring Network Plan website (www.pca.state.mn.us/pyrifa3).

Table 1. Summary information describing average daily $PM_{2.5}$ values found at MPCA monitors during the monitoring period of April 1-June 30, 2014.

						Number of days that concentration values at St. Paul-West Side were		Total Number of Comparison
Site	Min $\mu g/m^3$	Max $\mu g/m^3$	Mean[1] $\mu g/m^3$	Median[2] $\mu g/m^3$	Standard Deviation* $\mu g/m^3$	higher	lower	Days[+]
St. Paul-West Side	2.2	22.4	10.4	9.5	4.8			
Mpls NearRoad	2.8	19.6	8.3	7.6	3.6	63	16	79
Mpls Pacific Street	0.0	16.5	5.0	4.2	3.9	75	4	79
Mpls Phillips	0.0	15.4	3.7	2.7	3.2	79	0	79
St. Paul-Harding H.S.	0.1	16.7	5.4	4.5	3.5	77	0	77
Anoka Airport	0.4	15.5	4.5	3.9	2.9	70	0	70
Apple Valley	0.3	18.0	4.7	4.1	3.3	79	0	79
Virginia	5.2	15.6	8.5	7.9	2.1	49	30	79
Rochester	0.7	13.1	5.2	4.6	3.2	73	2	75
Talahi School	0.8	16.8	5.0	4.5	2.8	79	0	79
St Michael	0.2	21.0	5.3	4.5	4.0	74	1	75
Detroit Lakes	2.3	13.5	6.5	6.1	2.1	64	11	75
Marshall	1.8	14.5	5.3	4.8	2.6	68	8	76
Duluth	0.6	16.5	5.0	4.6	3.1	75	4	79
Ely	0.7	9.2	2.8	2.5	1.5	71	0	71
Brainerd Airport	0.0	7.6	1.7	1.0	1.7	79	0	79
Winona	1.0	15.7	6.1	5.3	3.2	72	4	76

[1]Mean value is the arithmetic average value of all of the average daily PM2.5 measurements

[2]Median value is the middle value of the set of average daily PM2.5 measurements

*Standard Deviation of the average daily PM2.5 measurements

[+]St. Paul West Side monitor had only 79 days of complete data available for comparisons. Other sites had fewer days.

Summary of results (cont'd)

Air toxics

Air toxic pollutants are those chemicals known or suspected to cause serious human health effects or adverse environmental effects. Example pollutants include *methylene chloride*, used as a solvent and paint stripper, *perchloroethylene*, emitted by some dry cleaning facilities and *benzene*, which is found in gasoline. Some air toxic pollutants are metals such as *cadmium*, *chromium*, or *lead* compounds.

Air toxics health benchmarks

Existing air quality standards and health benchmarks come from a variety of sources. However, these are not available for all chemicals. For air toxics, the MPCA uses available published health benchmarks. Specific information about standards and health benchmarks can be found at: http://www.pca.state.mn.us/bkzq4b0.

Of the 74 air toxic pollutants measured (**Attachment A**), there were 28 pollutants detected at the St. Paul West Side monitor. Compared to values at other fixed monitoring sites (sites shown in **Figure 3**), the majority of these chemicals did not significantly* differ in measured values (**Figure 4**).

*Kaplan-Meier non-parametric non-detects data analysis

MDH

Minnesota Public Health Data can be found at https://apps.health.state.mn.us/mndata/home

This data can be searched by county to help you find public health information relevant to your local area.

Figure 3. Location of the community air monitor in relation to other fixed site air toxics monitors in the St. Paul-Minneapolis metropolitan area.

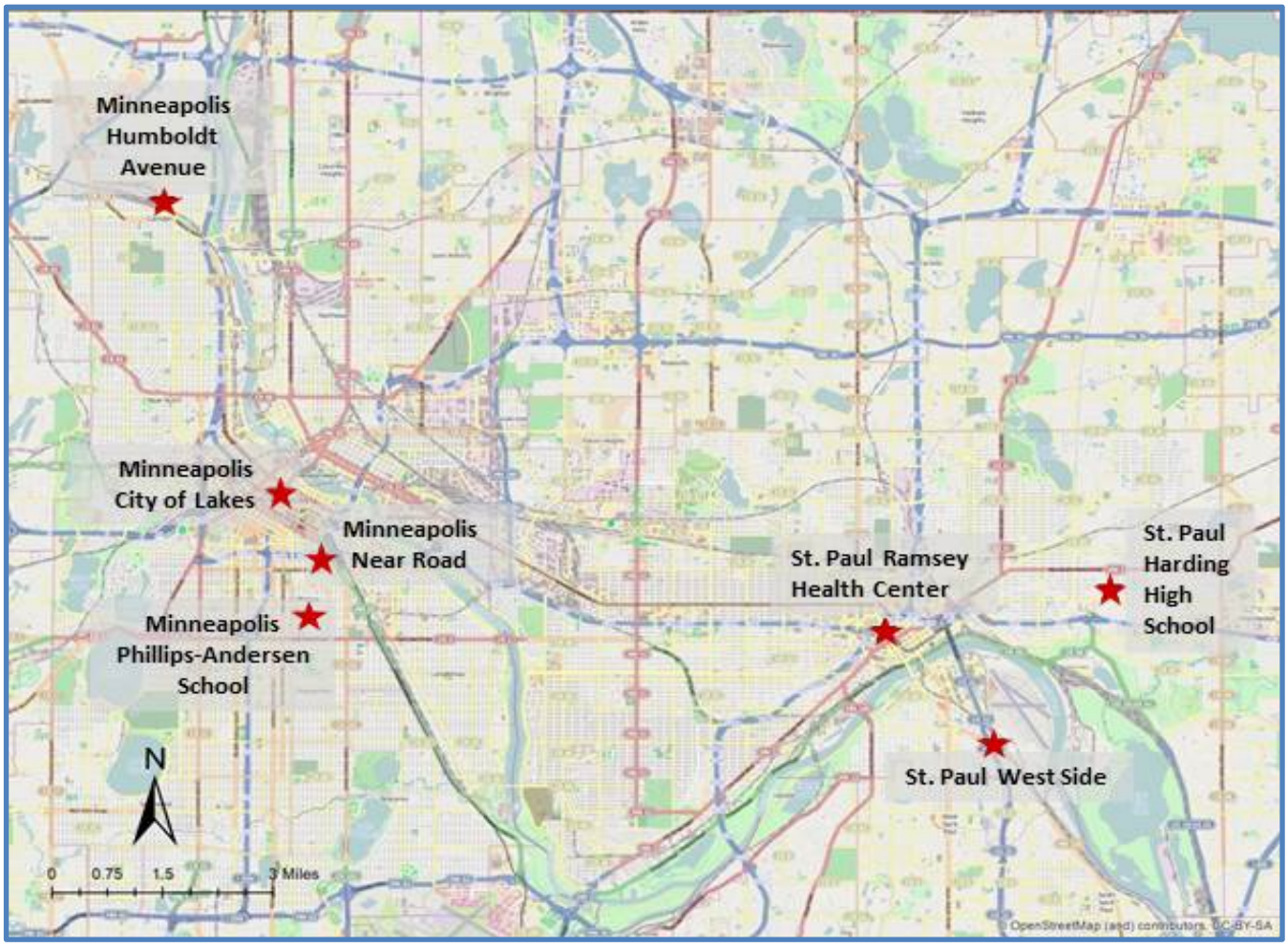
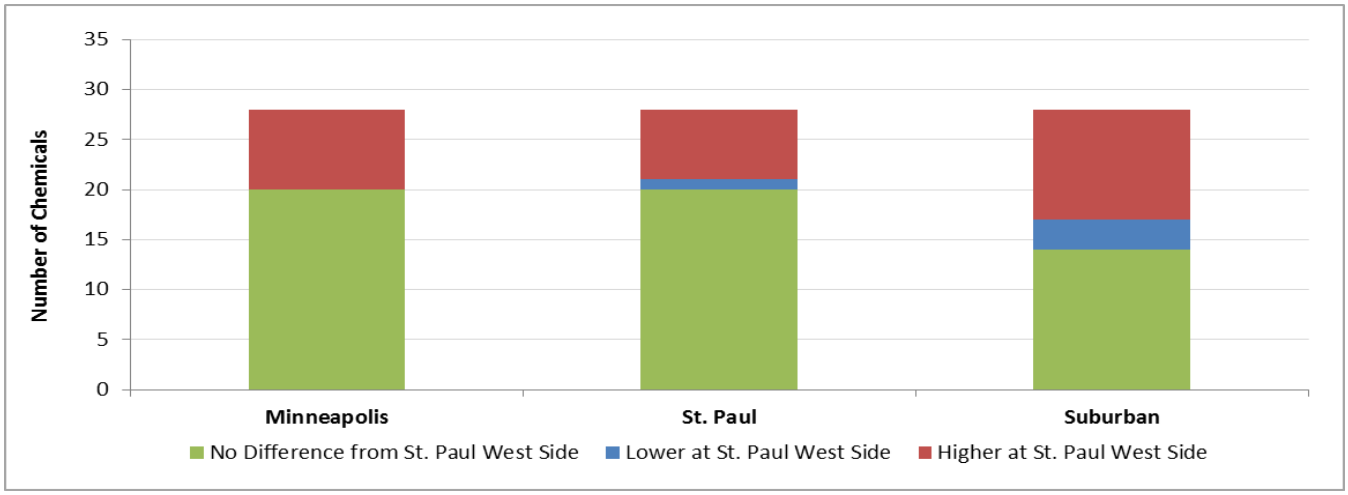


Figure 4. The number of air toxic pollutants that differed from other monitors around the Twin Cities.



Compared to measurements in Minneapolis and St. Paul, most of the pollutants that were higher at the community monitor were metals (**Attachment A**). Of the detected metals, average* metal values were higher at this site than the other Twin Cities metro sites, but all were below health benchmarks except for arsenic.

Compared to measurements from suburban Twin Cities monitors, most of the pollutants that were higher at the community monitor were VOCs (**Attachment A**). Of all of the carbonyls and VOCs monitored, only formaldehyde was found to be above health benchmark.

*Kaplan-Meier non-parametric non-detects data analysis

Formaldehyde

Formaldehyde is produced from human-made and natural sources. A variety of VOCs also react in the atmosphere to indirectly form formaldehyde. Direct emissions of formaldehyde in Minnesota come primarily from wildfires, prescribed burning, gasoline and diesel burning, highway and off-highway vehicles, residential fuel combustion and industrial processes.

As temperatures increase in the spring and summer, the production of formaldehyde increases and average values of formaldehyde typically go up. The St. Paul West Side community monitor operated from April 1 to June 30, which coincides with the elevated formaldehyde season. This increase in formaldehyde was seen at this community monitor as well as other Twin Cities monitoring sites (**Figure 5**). The three month formaldehyde average (3.5 $\mu g/m^3$) was over the long-term health benchmark of 2 $\mu g/m^3$ for the three month monitoring period at most metro sites (**Table 2**). The MPCA is working to better understand the sources of formaldehyde in Twin Cities air.

Figure 5. Formaldehyde values measured during the three month monitoring period.

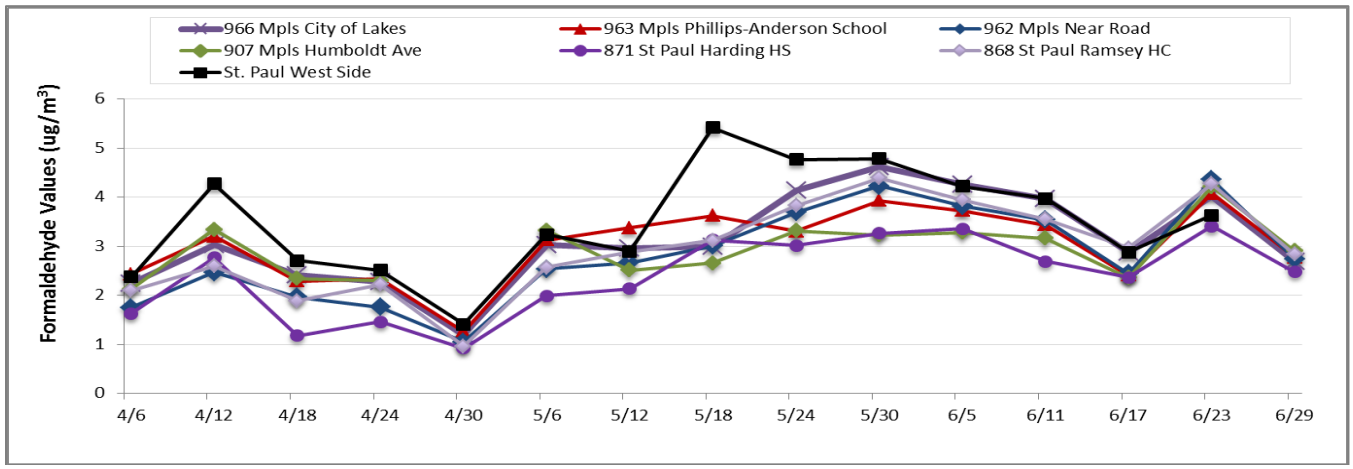


Table 2. Formaldehyde values ($\mu g/m^3$) measured at the St. Paul West Side community monitor and metro area fixed air monitors during the monitoring period of April 1–June 30, 2014.

		St. Paul		Minneapolis			
	St. Paul West Side	Ramsey County Health Center	Harding High School	Humboldt Avenue	Near Road	Phillips-Anderson School	City of Lakes
4/5/2014	2.4	2.1	1.6	2.1	1.7	2.4	2.2
4/11/2014	4.3	2.6	2.8	3.3	2.5	3.2	3.0
4/17/2014	2.7	1.9	1.2	2.3	2.0	2.3	2.4
4/23/2014	2.5	2.2	1.5	2.3	1.8	2.3	2.3
4/29/2014	1.4	1.0	0.9	*	1.0	1.3	1.2
5/5/2014	3.2	2.6	2.0	3.3	2.5	3.1	3.0
5/11/2014	2.9	2.9	2.1	2.5	2.7	3.4	3.0
5/17/2014	5.4	3.1	3.1	2.7	3.0	3.6	3.0
5/23/2014	4.8	3.8	3.0	3.3	3.7	3.3	4.1
5/29/2014	4.8	4.4	3.3	3.2	4.2	3.9	4.6
6/4/2014	4.2	3.9	3.4	3.3	3.8	3.7	4.3
6/10/2014	4.0	3.5	2.7	3.2	3.5	3.4	4.0
6/16/2014	2.9	3.0	2.4	2.4	2.4	2.4	2.9
6/22/2014	3.6	4.3	3.4	4.2	4.4	4.1	4.0
6/28/2014	*	2.8	2.5	2.9	2.7	2.8	2.7
Mean[+]	3.5	2.9	2.4	2.9	2.8	3.0	3.1

*Data not collected these days

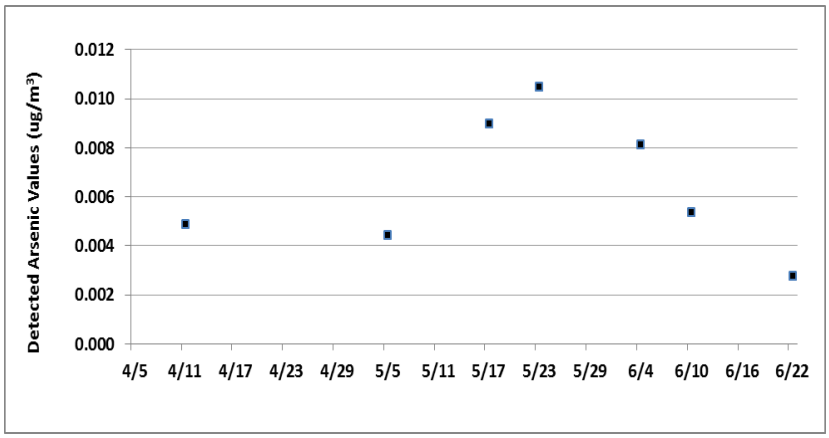
[+]The mean value is the arithmetic average value of all of the values in the respective column

Arsenic

Arsenic has no discernable odor or taste. It can be present in the physical environment in air, rocks, soil and groundwater, and is known to occur in different areas of Minnesota, most commonly in groundwater.

Out of 14 measurement dates, arsenic values above the long-term health benchmark value (0.00233 mg/m^3) were detected on seven of those dates (**Figure 6; Table 3**). The MPCA is working to better understand these results.

Figure 6. Arsenic measurements at the community air monitor.



33
As
74.9215
Arsenic

Health Benchmarks

A long-term health benchmark – also called a chronic health risk value or chronic HRV – is a level of a pollutant in the air that is unlikely to result in a health effect if sensitive populations are exposed at that level for a lifetime.

Since chronic HRVs reflect a lifetime exposure, they are compared to air measurement summaries from long term studies (generally a year or more). The CAMP project resulted in three-months of measurements; however, we compared the monitored data with these health benchmarks for informational purposes.

For arsenic, the HRV is 0.00233 mg/m^3.

HRV values are set by the Minnesota Department of Health (MDH).

Table 3. Arsenic values (mg/m^3) measured at the St. Paul West Side monitor and other metro area fixed air monitors during the three month monitoring period.

	St. Paul[+]	Minneapolis			
	St Paul West Side	Harding High School	Humboldt Avenue	Near-Road	Phillips-Anderson School	City of Lakes
4/5/2014	*	*	*	*	*	*
4/11/2014	0.0049	*	*	*	*	*
4/17/2014	*	*	*	*	*	*
4/23/2014	*	*	*	*	*	*
4/29/2014	*	*	*	*	*	*
5/5/2014	0.0044	*	*	*	*	*
5/11/2014	*	0.0026	*	*	*	*
5/17/2014	0.0090	0.0054	0.0022	*	0.0021	*
5/23/2014	0.0105	0.0061	*	*	*	*
5/29/2014	*	*	*	*	*	*
6/4/2014	0.0081	0.0028	0.0019	0.0024	0.0019	0.0019
6/10/2014	0.0054	*	0.0022	0.0021	0.0018	*
6/16/2014	*	*	*	*	*	*
6/22/2014	0.0028	0.0025	0.0020	*	0.0020	0.0020
6/28/2014		*	*	*	*	*

[+]Metals are not measured at the St. Paul Ramsey County Health Center

*Value below detection limit (0.00181 mg/m^3)

What you can do to reduce your exposure to air pollutants

To reduce your risk of developing bad health from exposures to air pollution:

- Avoid exposure to tobacco smoke, wood smoke, vehicle exhaust, and other sources of airborne particles.
- Avoid prolonged outdoor exertion near high-traffic areas.
- Stay informed about air pollution alerts and advisories in your area by visiting the MPCA Air Quality Index website (www.pca.state.mn.us/d8dcwpp), calling the AQI Information Line (651-297-1630) or subscribing to the MPCA Air Quality Forecast Alert system (http://mn.enviroflash.info/).
- If you experience respiratory or cardiovascular symptoms (e.g., persistent cough, burning eyes, wheezing, shortness of breath, tightness of chest, or chest pain) on air quality alert days, consult with a health care professional, as needed. Pay particular attention if you are an athlete, or if you or your children have a respiratory or cardiovascular condition.
- Work together with others in your community to improve air quality (see website links below for more information).

Links to other information

Information about other environmental hazards, health outcomes, and socioeconomic indicators is available from the U.S. EPA at http://epamap14.epa.gov/ejmap/entry.html. You can search for information by address at this website.

For tips on how to reduce air pollution, please visit http://epa.gov/oaqps001/peg_caa/reduce.html.

For more information about commonly found air pollutants and their sources, please visit http://epa.gov/airquality/peg_caa/cleanup.html.

For more information on the air monitoring results from the Thomas-Dale monitoring site or other air quality monitoring studies, please call 651-296-6300 or 1-800-657-3864 and ask for air data analysis staff. For more information and to view updates about the Community Air Monitoring Project, please visit www.pca.state.mn.us/9xc4ahc.

More information about the MPCA's air monitoring program is available on the website: http://www.pca.state.mn.us/ruu6fhw.

For more information about arsenic and related health issues, visit the Minnesota Health Department website: http://www.health.state.mn.us/divs/eh/hazardous/topics/arsenic.html.

Attachment A. Community Air Monitoring Project - **Monitored Air Quality Pollutants**

Carbonyls
Acetaldehyde[U]
Benzaldehyde
Butyraldehyde
Formaldehyde[A,C]
Propionaldehyde
Trans-Crotonaldehyde[2]

Metals
Antimony
Arsenic
Barium[A,B,U]
Beryllium[1]
Cadmium[1]
Chromium[B]
Cobalt[1]
Iron[A,B,C]
Lead[A,B,C]
Manganese[A,B,C]
Nickel[B]
Selenium[1]
Zinc[A,B,C]

$PM_{2.5}$ Continuous
$PM_{2.5}$ Concentration

Volatile Organic Compounds
1,1,2,2-Tetrachloroethane[1]
1,1,2-Trichloroethane[1]
1,1-Dichloroethane[1]
1,1-Dichloroethylene[1]
1,2,4-Trichlorobenzene[1]
1,2,4-Trimethylbenzene[2]
1,2-Dichlorobenzene[1]
1,2-Dichloropropane[1]
1,3,5-Trimethylbenzene[1]
1,3-Butadiene
1,3-Dichlorobenzene[1]
1,4-Dichlorobenzene[1]
Benzene[C]
Benzene, 1-Ethenyl-4-Methyl[1]
Benzyl Chloride[1]
Bromodichloromethane[1]
Bromoform[1]
Bromomethane[1]
Carbon Disulfide[2]
Carbon Tetrachloride
Chlorobenzene[1]
Chloroethane[1]
Chloroform[1]
Chloromethane
Cis-1,2-Dichloroethene[1]
Cis-1,3-Dichloropropene[1]
Cyclohexane[2]
Dibromochloromethane[1]
Dichlorodifluoromethane[U]
Dichloromethane
Ethylbenzene[2]
Ethylene Dibromide[1]
Ethylene Dichloride[1]
Freon 113[T]
Freon 114[2]
Furan, Tetrahydro-[1]
Hexachlorobutadiene[1]
M/P Xylene[C]
Methyl Butyl Ketone[1]
Methyl Chloroform[1]
Methyl Ethyl Ketone[2]
Methyl Tert-Butyl Ether[1]
N-Heptane
N-Hexane[C]
O-Xylene
Propylene[C]
Styrene[1]
Tetrachloroethylene[1]
Toluene[C]
Trans-1,2-Dichloroethylene[1]
Trans-1,3-Dichloropropene[1]
Trichloroethylene[1]
Trichlorofluoromethane[A,B,C]
Vinyl Acetate[2]
Vinyl Chloride[1]

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[1]Indicates chemicals that were below detection limits at all monitors in Minnesota, including the St. Paul West Side monitor, for this three month monitoring time.
[2]Indicates chemicals that were below detection limits at the St. Paul West Side monitor, but were detected at one or more monitoring sites in Minnesota.

[A]Indicates chemicals that were higher* at the St. Paul West Side monitor than at St. Paul fixed monitors.
(7 chemicals higher: 5 metals, 1 carbonyl, 1 VOC)
[B]Indicates chemicals that were higher* at the St. Paul West Side monitor than at Minneapolis fixed monitors.
(8 chemicals higher: 7 metals, 1 VOC)
[C]Indicates chemicals that were higher* at the St. Paul West Side monitor than at suburban Twin Cities fixed monitors.
(11 chemicals higher: 4 metals, 6 VOCs, 1 carbonyls)

[T]Indicates chemicals that were lower* at the St. Paul West Side monitor than at St. Paul fixed monitors.
(1 chemical lower: 1 metal)
[U]Indicates chemicals that were lower* at the St. Paul West Side monitor than at suburban Twin Cities fixed monitors.
(3 chemicals lower: 1 metal, 1 VOC, 1 carbonyl)

*Kaplan-Meier non-parametric NADA averaged values