Legislative charge

In 2013, the Minnesota Pollution Control Agency was given a statutory requirement (Laws 2013, chapter 114, article 3, section 3, subdivision 3) to monitor ambient air for hazardous pollutants in areas where low-income, indigenous American Indians and communities of color are disproportionately impacted from highway traffic, air traffic and industrial sources.

This summary report presents an overview of the interim results of this project.

Authors
Mary A. Williams
Kristie Ellickson
Cassie McMahon
Kari Palmer

Contributors/Acknowledgements
Kurt Anderson
Ned Brooks
Frank Kohlash
Ralph Pribble
Rick Strassman
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1. Background

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. We monitored seven locations in a two-year period.

Communities to be monitored are chosen based on the criteria identified in the funding legislation. Within the community, actual monitoring locations are selected based on community input and ability to meet monitor siting requirements. Identified communities are monitored for three months, after which the monitoring equipment moves to the next site.

Project objectives are to: 1) sample ambient air at seven locations, giving priority to criteria listed in legislation, 2) analyze and compare results to data from the agency’s existing air monitoring network, 3) compare pollutant concentrations between the community monitor locations and MPCA’s existing stationary monitors and 4) share results with legislators, neighborhood groups, and the general public.

2. Result and Discussion

2.1 Results to date

To date, results and lessons learned include:

- Comparisons with benchmarks/standards
  - Nothing over short-term standards
  - Compared to annual standards, formaldehyde was elevated at two sites (St. Paul Thomas-Dale and St. Paul West Side), arsenic was elevated at one site (St. Paul West Side)

- Comparisons to Twin Cities area fixed monitoring sites
  - Fine particle (PM$_{2.5}$) values tended to be higher at the community sites, possibly due to:
    - equipment installed at ground-level sites which samples a smaller area than those that are installed on roof tops
    - effects on instrument readings because instruments were moved every three months
    - slightly higher fine particle concentrations in community neighborhoods
  - PM$_{2.5}$ daily behavior was similar between the community monitor and fixed monitors
  - Normal formaldehyde seasonal concentration variations were seen at the community monitor and fixed monitors

- Limitations of three-month monitoring
  - Cannot compare results between community monitoring sites because measurements were made at different times of the year. Many pollutant concentrations vary with temperature and other weather changes.
  - Large uncertainties exist when comparing the short-term community monitor results to long-term standards and benchmarks
• Overall results
  o with the few stated exceptions above, no large differences in air pollutant concentrations were seen between the community monitored areas and fixed monitors. This confirms that current monitoring sites appear to provide reasonable estimates of overall air quality.

2.2 Discussion
Over each three-month monitoring period, fine particle (PM$_{2.5}$) behavior was similar between the community monitor and other Twin Cities area monitors. When average daily PM$_{2.5}$ concentrations went up or down at the community monitor, they usually changed in the same direction at other Twin Cities monitors. This suggests that there was a uniform influence on fine particle production that occurs across the Twin Cities and was seen in identified environmental justice neighborhoods.

Although the average daily fine particle values were all below the daily PM$_{2.5}$ standard of 35 µg/m$^3$, a majority of the average daily fine particle values were higher at each community monitor site than seen at other Twin Cities monitors during the respective monitoring period. These higher readings at the community monitor site could be attributed to several factors. First, due to the need to find a temporary monitoring site that meets federal siting criteria, with the exception of the Little Earth monitoring site, the community monitor sites were installed at ground-level rather than on a rooftop. This ground-level siting results in both a spatially smaller sampling area and more restricted airflow conditions which could result in increased ambient air concentration measurements. Second, due to the three month, periodic movement and installation in the temporary locations, there could be effects on instrument measurements introduced into resulting measurement values. Lastly, slightly higher fine particle averages in the community monitor sites could indicate that these areas are closer to, or, are more impacted by sources of fine particle production.

Expected pollutant behavior was seen at the community monitor. For example, formaldehyde is known to increase in warmer months. This behavior was seen at Twin Cities fixed monitor sites and in the community monitor data. Average annual formaldehyde is frequently over the health benchmark at Twin Cities monitors. MPCA is working to better understand what contributes to the formation of formaldehyde.

With noted exceptions, most air toxic pollutant values were not different between the community monitor site and other Twin Cities monitors. As expected, average formaldehyde levels increased with increasing temperatures in all of the Twin Cities monitors. At the St. Paul West Side monitoring site, most of the three-month average air toxics metals values were higher than any of the other sites around the Twin Cities. This suggests that this site was being more impacted by a source of air toxic metals. At this site, within the monitored metals, the three-month average arsenic value was above the long-term health benchmark. The MPCA is working to better understand these results.

3. Community Outreach
One goal of this project is to inform community organizations about this project at the beginning, during and after the community monitoring. To this end, we have interacted and communicated with Twin Cities environmental justice groups, neighborhood organizations, concerned citizens, and municipal community staff. Two project team members, Ned Brooks and Mary A. Williams, attended a community meeting at the Little Earth Residential Complex to present and discuss findings in that neighborhood.

Two summary reports have been produced for each monitoring site: a short two-page summary overview of the project and the neighborhood results and a longer summary overview providing
summary tables of air monitoring results. These reports are shared with community contacts and posted on the dedicated MPCA website. MPCA has offered to meet with any interested community groups to discuss the findings.

Project information has been published in multiple neighborhood newspapers and on a dedicated MPCA website: [www.pca.state.mn.us/9xc4ahc](http://www.pca.state.mn.us/9xc4ahc). MPCA continues to work to promote project information via media outlets such as the newly created MPCA AirMails listerv ([www.pca.state.mn.us/6xa9cq3](http://www.pca.state.mn.us/6xa9cq3)), Facebook and Twitter.

4. Community Monitor Sites

4.1 Community Monitor Locations

The project began on October 1, 2013 with a three month monitoring period in the East Phillips, Little Earth neighborhood of Minneapolis. The monitor was subsequently moved to the Thomas-Dale neighborhood in St. Paul. Between the project start date and the end of 2014, five community sites have been monitored (Table 1; Figure 1).

**Table 1.** 2013-2014 Community Air Monitoring Project monitor locations.

<table>
<thead>
<tr>
<th>MPCA Site ID</th>
<th>Dates of Monitoring</th>
<th>Location Description</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1901</td>
<td>Oct-Dec 2013</td>
<td>Minneapolis - Little Earth Community</td>
<td>2438 18th Avenue South, Minneapolis, MN</td>
</tr>
<tr>
<td>1902</td>
<td>Jan-Mar 2014</td>
<td>St. Paul - Thomas-Dale Frogtown Community</td>
<td>533 North Dale Street, St. Paul, MN</td>
</tr>
<tr>
<td>1903</td>
<td>Apr-Jun 2014</td>
<td>St. Paul - West side Neighborhood</td>
<td>401 Concord Street, St. Paul, MN</td>
</tr>
<tr>
<td>1905</td>
<td>Oct-Dec 2014*</td>
<td>Minneapolis - Harrison Neighborhood</td>
<td>1600 Glenwood Avenue, Minneapolis, MN</td>
</tr>
</tbody>
</table>

*Data are currently being analyzed and are not part of this report.

**Figure 1.** Spatial locations of the 2013-2014 Community Air Monitoring Project monitors.
4.2 How sites were chosen
Multiple factors were used in deciding what community and where in the community the monitor should be placed.

- **Mapping from Legislative Language**
  MPCA staff compiled a list of data sources from the legislative language:
  
  "Low income": (median household income, US Census 2010)
  "Communities of color": (percent non-white, US Census 2010)
  "American Indian": (percent American Indian Non-Hispanic, US Census 2010)
  "Highway traffic": (MNRiskS results for on-road air pollution sources)
  "Air traffic": (MNRiskS results for all sources including airport vehicles, airplane related emissions, and minor and major roadways in and around the airports)
  "Industrial sources": (MNRiskS results for all sources)

  MPCA staff ranked results from the Minnesota Cumulative Risk Model (MNRiskS) for air pollution estimates. All air pollutant sources were included. Next we ranked median household income, American Indian non-Hispanic, and non-white populations from the US Census. The air pollution and socioeconomic status were combined into one index. Air pollution was given equal weight as socioeconomic status. Finally, we mapped these indices to illustrate priority areas for placing monitors. The top 100 locations were given highest priority. The top 100 final summed ranks included locations in Duluth and the Twin Cities.

- **Air Monitoring Platform Considerations**
  As part of the data analysis for the community monitor measurements, the results are compared with measurements from existing ambient air monitoring sites. In order for this to be possible, the community air monitoring sites, like existing sites, must meet all siting criteria established by the U.S. Environmental Protection Agency (U.S. EPA) which are described in U.S. EPA document CFR 40 Part 58 Appendix E.

- **Stated Concern and Interest from Community Leaders and Members**
  MPCA staff and management have heard comments at public meetings, and read written comments, of areas of concern for higher levels of air pollution. This existing knowledge was used in siting decisions.

- **Community Input**
  Community neighborhoods and local government input and assistance were requested in determining final siting locations for monitors.

5. Air Quality Standards and Health Benchmarks
Pollution concentrations are typically compared to standards and benchmark values designed to relate concentrations with human health risks. These standards and benchmarks are designed to be compared with pollution concentration measurements that have been measured over one or more years. Therefore, because each monitoring period is conducted over a three-month time frame, direct comparisons between monitoring results and standards or benchmarks cannot be made. Instead, we made comparisons with standards and benchmarks to provide a sense of what monitoring results might mean if those results had been seen over a couple of years or more of monitoring.
5.1 U.S. EPA National Ambient Air Quality Standards (NAAQS)

The Clean Air Act requires the U.S. EPA to set primary and secondary air quality standards. Primary health standards provide public health protection including sensitive populations. Secondary standards include protection against decreased visibility and damage to vegetation, animals and buildings. In response, the U.S. EPA developed the National Ambient Air Quality Standards (NAAQS) for a set of six principal pollutants including lead and fine particles (PM$_{2.5}$). Each standard requires local conditions to be averaged over a specific time. For fine particles, there are different standards dependent upon the averaging time (Table 2).

Table 2. U.S. EPA National Ambient Air Quality Standards (NAAQS) for fine particle monitoring.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Time</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{2.5}$</td>
<td>Primary Annual</td>
<td>12 μg/m$^3$ annual mean, averaged over 3 years</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>Secondary Annual</td>
<td>15 μg/m$^3$ annual mean, averaged over 3 years</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>Primary and Secondary 24-hour</td>
<td>35 μg/m$^3$ 98th percentile, averaged over 3 years</td>
</tr>
</tbody>
</table>

For lead, the primary and secondary standard is the same. The averaging time is a rolling three-month average period with a “maximum, not to be exceeded value” of 0.15 mg/m$^3$, evaluated over a three-year period.

5.2 Inhalation Health Benchmark Values

Inhalation health benchmark (IHB) values are established standards that are designed to protect public health against short and long-term air pollution exposure. An acute (short-term) IHB is a level of chemical concentration in ambient air at or below which that chemical is unlikely to cause an adverse health effect when exposure occurs for one hour. A chronic (long-term) IHB is a level of chemical concentration in ambient air at or below which the chemical is unlikely to cause an adverse health effect if exposed to this concentration over a lifetime. Chronic IHBs are set for cancer and non-cancer health effects. In this project, for those pollutants with a non-cancer and chronic cancer health benchmark, the most stringent health benchmark was used for comparisons. Note that not all pollutants have health benchmark values.

Air quality standards and public health benchmarks come from a variety of sources including the Minnesota Department of Health, the U.S. EPA and the California Office of Health Hazard Assessment. 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](http://www.pca.state.mn.us/bkzq4b0).
6. Monitored Pollutants

Air was monitored for specific chemicals that are associated with adverse public health effects (Appendix A). These chemicals are classified as fine particles (PM$_{2.5}$) or air toxic pollutants (carbonyls, metals or volatile organic compounds). For each individual monitored site, the data collected were examined to see if any results were above air quality standards or health benchmarks and were then compared with other data collected in the same time period at other monitors in Minnesota.

6.1 Fine Particles (PM$_{2.5}$)

Fine particulate matter (PM$_{2.5}$) is a mixture of very small particles and liquid droplets that are created during combustion when coal, gasoline and other fuels are burned. They are also created in the air by chemical reactions between other pollutants. Because of their small size, fine particles can become inhaled into the lungs, possibly lodged in the lungs and can contribute to respiratory and cardiovascular health problems.

Regulatory standards exist for PM$_{2.5}$ measurements, but these standards require a monitoring period of three years or greater. Each monitoring period for this project was too short to consider whether the community monitor results meet fine particle standards. However, as an informal comparison only, the average daily PM$_{2.5}$ values were compared to the daily regulatory PM$_{2.5}$ standard of 35 mg/m$^3$.

Average daily fine particle measurements were compared to measurements from fixed monitoring sites in the Twin Cites (Figure 2) and from other monitoring sites around greater Minnesota.

Figure 2. Twin Cities PM$_{2.5}$ fixed PM$_{2.5}$ (●) and community air monitoring (★) sites.
6.2 Air toxics
Toxic air 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 toxic air pollutants are metals such as *cadmium, chromium, or lead* compounds.

Air toxic measurements from the community monitor were compared to measurements from fixed monitoring sites in the Twin Cities (Figure 3) and from other monitoring sites around greater Minnesota.

**Figure 3.** Twin Cities fixed air toxics (●) and community air monitoring (★) sites.

An overview of results is reported earlier in this report. More detailed information about the results, the community sites, the monitored pollutants, standards and health benchmarks are found in the appendices.

For more information on the community air monitoring project, please visit [www.pca.state.mn.us/9xc4ahc](http://www.pca.state.mn.us/9xc4ahc) or call either 651-296-6300 or 1-800-657-3864 and ask for air data analysis staff.

More information about the MPCA’s air monitoring program is available on the web at [http://www.pca.state.mn.us/ruu6fhw](http://www.pca.state.mn.us/ruu6fhw).
Appendix A
Community Air Monitoring Project - **Monitored Air Quality Pollutants**

### Carbonyls
- Acetaldehyde
- Benzaldehyde
- Butyraldehyde
- Formaldehyde
- Propionaldehyde
- Trans-Crotonaldehyde

### Metals
- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Iron
- Lead
- Manganese
- Nickel
- Selenium
- Zinc

### PM2.5 Continuous

### PM2.5 Concentration

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

<table>
<thead>
<tr>
<th>Pollutant*</th>
<th>Inhalation Health Benchmark*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-Butadiene</td>
<td>0.17</td>
</tr>
<tr>
<td>Acetaldehyde</td>
<td>4.5</td>
</tr>
<tr>
<td>Antimony (Tsp) Stp</td>
<td>0.2</td>
</tr>
<tr>
<td>Arsenic (Tsp) Stp</td>
<td>0.00233</td>
</tr>
<tr>
<td>Benzaldehyde</td>
<td>20</td>
</tr>
<tr>
<td>Benzene</td>
<td>1.3</td>
</tr>
<tr>
<td>Bromomethane</td>
<td>5</td>
</tr>
<tr>
<td>Butyraldehyde</td>
<td>70</td>
</tr>
<tr>
<td>Cadmium (Tsp) Stp</td>
<td>0.01</td>
</tr>
<tr>
<td>Carbon Disulfide</td>
<td>700</td>
</tr>
<tr>
<td>Carbon Tetrachloride</td>
<td>1.7</td>
</tr>
<tr>
<td>Chlorobenzene</td>
<td>1000</td>
</tr>
<tr>
<td>Chloroethane</td>
<td>10000</td>
</tr>
<tr>
<td>Chloroform</td>
<td>0.43</td>
</tr>
<tr>
<td>Chloromethane</td>
<td>90</td>
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<tr>
<td>Chromium (Tsp) Stp</td>
<td>0.008</td>
</tr>
<tr>
<td>Cobalt (Tsp) Stp</td>
<td>0.001</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>6000</td>
</tr>
<tr>
<td>Dichlorobenzene(p), 1,4-</td>
<td>0.91</td>
</tr>
<tr>
<td>Dichloromethane</td>
<td>21</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>4</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>2</td>
</tr>
<tr>
<td>Furan, Tetrahydro-</td>
<td>2000</td>
</tr>
<tr>
<td>Lead</td>
<td>0.15</td>
</tr>
<tr>
<td>M/P Xylene</td>
<td>100</td>
</tr>
<tr>
<td>Manganese (Tsp) Stp</td>
<td>0.2</td>
</tr>
<tr>
<td>Methyl Ethyl Ketone</td>
<td>5000</td>
</tr>
<tr>
<td>N-Hexane</td>
<td>2000</td>
</tr>
<tr>
<td>Nickel (Tsp) Stp</td>
<td>0.014</td>
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<tr>
<td>O-Xylene</td>
<td>100</td>
</tr>
<tr>
<td>Propionaldehyde</td>
<td>8</td>
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<tr>
<td>Propylene</td>
<td>3000</td>
</tr>
<tr>
<td>Selenium (Tsp) Stp</td>
<td>20</td>
</tr>
<tr>
<td>Styrene</td>
<td>1000</td>
</tr>
<tr>
<td>Tetrachloroethylene</td>
<td>20</td>
</tr>
<tr>
<td>Toluene</td>
<td>400</td>
</tr>
<tr>
<td>Trichloroethylene</td>
<td>3</td>
</tr>
<tr>
<td>Vinyl Acetate</td>
<td>200</td>
</tr>
</tbody>
</table>

*Only pollutants with an IHB are listed.

*For this project, most stringent health standard used and reported.
Appendix C: Summary Site Report