



Community Air Monitoring Project

Summary Report – Duluth – Denfeld and Lincoln Park



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 Minneapolis East Phillips Neighborhood of Minneapolis. Afterwards, the community monitor has moved to and monitored air quality in multiple communities. Using and supplementing two existing Duluth air monitoring sites, air quality was then monitored in the Denfeld and Lincoln Park community areas from July 1, 2015 to December 31, 2015.

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). For comparison purposes only, 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 ($\mu\text{g}/\text{m}^3$) except for one day at the Lincoln Park site. On July 6, 2015, the average daily PM_{2.5} value was 37 $\mu\text{g}/\text{m}^3$. During this week, heavy smoke from fires in Canada contributed to elevated PM_{2.5} values at many air quality monitors.
- For the Lincoln Park community monitor, of the 70 air toxic chemicals measured for this project, the levels of 28 chemicals were so low that they were not detected by the monitor.
- For the Denfeld community monitor, of the 70 air toxic chemicals measured for this project, the levels of 34 chemicals were so low that they were not detected by the monitor.
- All air toxic values in both communities were below any associated standards or health benchmarks.

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, fine particles 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 (µg/m³).



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 three years**, is less than or equal to 35 µg/m³. For more information: http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html

The average daily trends (Figure 1) over the six month period were similar between the Duluth monitors and other regional monitoring sites. At the Duluth sites (Figure 2), all average daily PM_{2.5} values were below the daily PM_{2.5} standard of 35 µg/m³ except for one day at the Lincoln Park site. At this site, on July 6, 2015, the average daily PM_{2.5} value was 37 µg/m³. During this week, heavy smoke from fires in Canada contributed to elevated PM_{2.5} values at many air quality monitors. The average daily PM_{2.5} values were generally higher at the Lincoln Park site than the Denfeld site for a majority of the monitoring days. (Table 1).

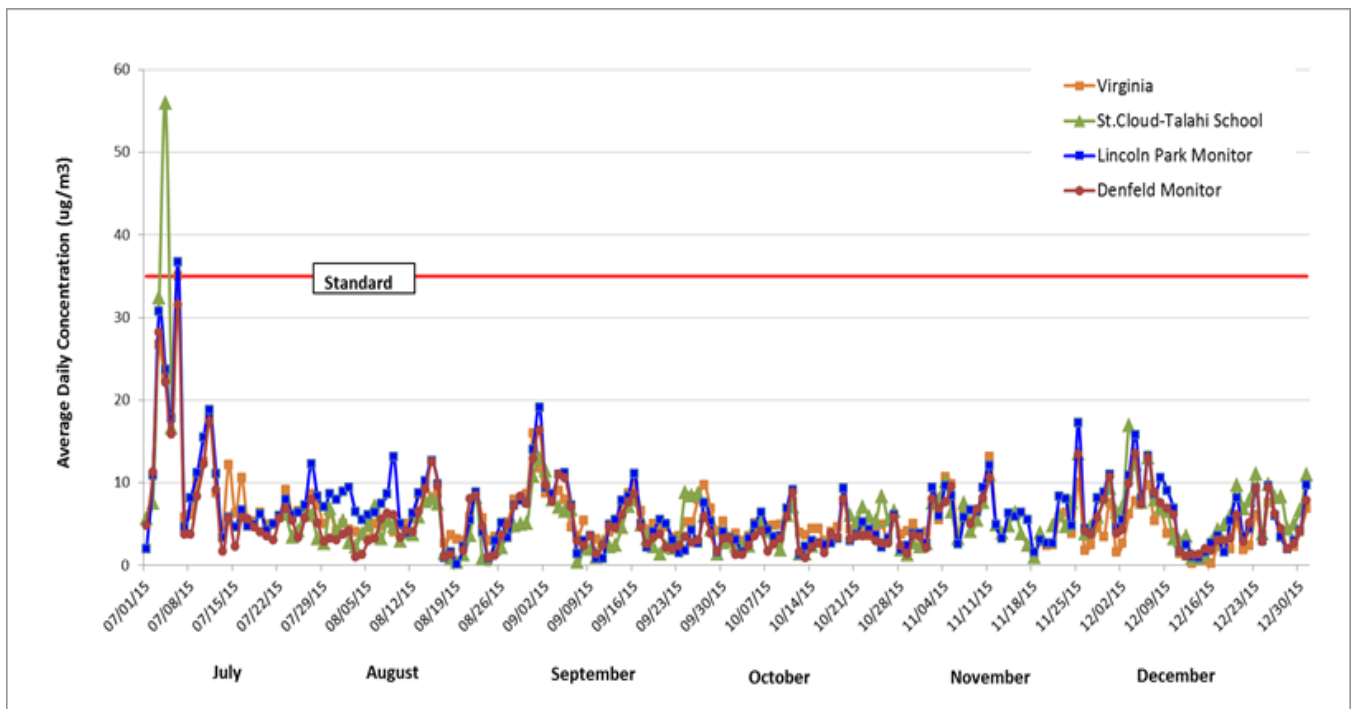


Figure 1. Average daily PM_{2.5} values at the Duluth sites and monitors located in Virginia and St. Cloud.



Figure 2. Location of the Duluth community air monitors. For more information about the individual sites, please visit the MPCA Air Monitoring Network Plan website (<https://www.pca.state.mn.us/air/air-monitoring-network-plan>).

Table 1. Summary information describing average daily PM_{2.5} values at MPCA monitors during the monitoring period of July 1-December 31, 2015.

Site	City	MPCA Site ID	Min	Max	Mean ¹	Median ²	Std Dev [*]	Number of days that values at Lincoln Park (7549) were			Number of Compared Monitoring Days ⁺	Number of days that values at Denfeld (7554) were			Number of Compared Monitoring Days ⁺
								lower	equal	higher		lower	equal	higher	
Lincoln Park Monitor	Duluth	7549	0.2	36.7	6.4	5.5	4.9								
Denfeld Monitor	Duluth	7554	0.9	31.5	5.6	4.1	4.5	38	3	127	168	127	3	38	168
Near Road I-35/I-94	Minneapolis	962	0.0	34.2	7.4	6.8	4.6	118	1	60	179	111	1	51	163
Harding High School	St. Paul	871	0.0	39.7	6.6	5.9	4.9	88	1	94	183	105	1	61	167
Anoka County Airport	Blaine	6010	0.0	37.1	5.3	4.5	4.6	65	0	117	182	73	2	91	166
Westview School	Apple Valley	470	0.0	32.7	6.5	6.1	4.0	80	0	83	163	68	2	79	149
Near Road I-35	Lakeville	480	0.0	33.3	6.8	6.2	4.5	93	3	83	179	122	0	41	163
City Hall	Virginia	1300	0.3	35.0	5.9	5.0	4.3	74	5	97	176	104	0	61	165
Ben Franklin School	Rochester	5008	1.0	41.6	6.5	5.7	4.3	89	1	84	174	106	2	50	158
Talahi School	St. Cloud	3052	0.0	56.0	5.8	4.9	5.5	57	2	102	161	75	1	70	146
St. Michael Elementary School	St. Michael	3201	0.2	32.1	6.1	5.4	4.3	72	3	81	156	80	0	60	140
FWS Wetland Mgmt District	Detroit Lakes	2013	0.0	47.1	4.9	3.5	5.5	56	1	124	181	67	0	98	165
Red Lake Nation	Red Lake	2304	0.0	47.8	5.1	3.9	5.2	62	1	121	184	77	2	89	168
Brainerd Lakes Regional Airport	Brainerd	3204	0.0	50.3	5.6	4.3	5.6	61	2	119	182	85	0	81	166
Southwest MN Regional Airport	Marshall	4210	0.0	31.8	5.8	4.9	4.7	78	0	97	175	80	0	79	159
Fernberg	Ely	7001	1.0	34.4	5.2	4.2	4.1	43	1	130	174	40	4	114	158
Fond du Lac Band	Cloquet	7417	1.7	31.8	6.6	5.6	4.2	105	1	67	173	132	1	25	158

¹Mean value is the arithmetic average value of all of the average daily PM_{2.5} measurements

²Median value is the middle value of the set of average daily PM_{2.5} measurements

*Standard Deviation of the mean values reported in this table

⁺Number of compared days can differ due to incomplete monitoring on varying days for each individual monitoring site.

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: <https://www.pca.state.mn.us/air/air-toxics-minnesota>.

Of the 70 air toxic pollutants measured, there were 42 pollutants detected at the Duluth Lincoln Park monitoring site (**Attachment A**) and 36 detected at the Duluth Denfeld site (**Attachment B**). The majority of these chemicals did not significantly* differ in measured values (**Figure 3**) compared to values at other air monitoring sites.

There were 35 pollutants that were detected at both the Denfeld and Lincoln Park monitors (**Attachment C**). Of these, one carbonyl (benzaldehyde) and one VOC (trichlorofluoromethane) were significantly* higher at the Denfeld monitoring site. Four metals (iron, barium, antimony and zinc) were significantly* lower at the Denfeld monitoring site.

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



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.

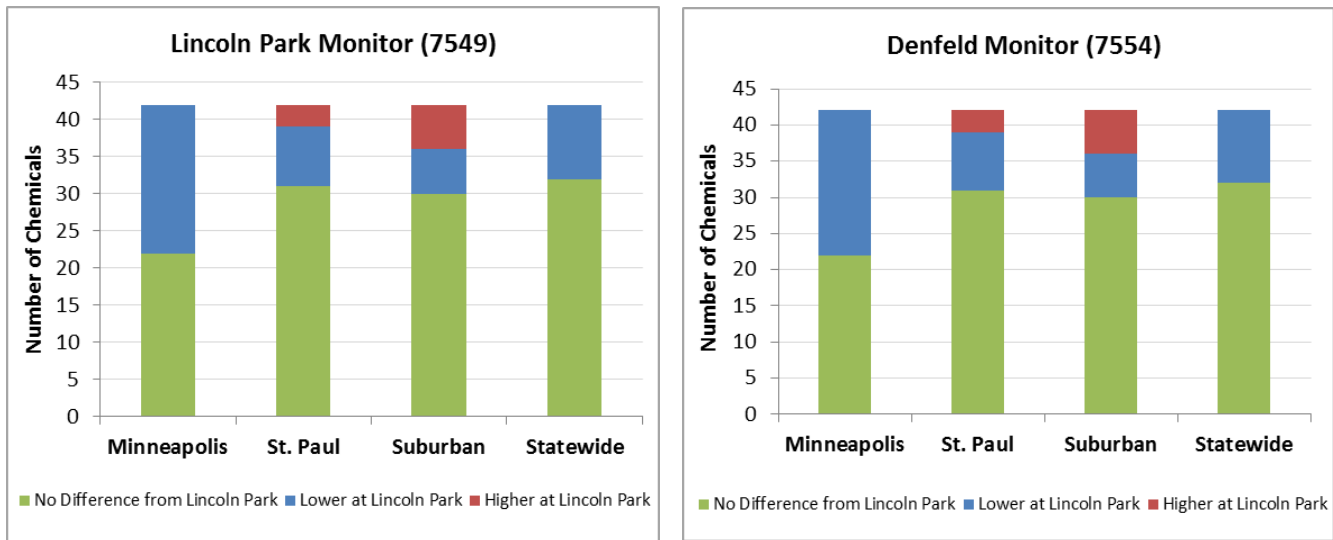


Figure 3. The number of pollutants that differed between the two sites and other monitors.

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 (<https://www.pca.state.mn.us/air/current-air-quality-index>), 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

For more information about commonly found air pollutants and their sources, please visit <https://www.epa.gov/learn-issues/learn-about-air>.

Be Air Aware is a website resource available for individuals, communities, and employers concerned about how air pollution affects health. The site offers information about air pollution in Minnesota, both outdoor and indoor, and steps that people can take to protect their health. <https://www.beairawaremn.org/>

For more information on the air monitoring results from 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 <https://www.pca.state.mn.us/air/community-air-monitoring-project>.

More information about the MPCA's air monitoring program is available on the web at <https://www.pca.state.mn.us/air/air-pollution-monitoring>.

Attachment A. Monitored Air Quality Pollutants – Duluth – Lincoln Park (7549 Michigan Street)

Carbonyls

Acetaldehyde^{T,U,V,W}
 Benzaldehyde^V
 Butyraldehyde^{T,U,V,W}
 Formaldehyde^{T,V,W}
 Propionaldehyde^{T,U,V,W}
 Trans-Crotonaldehyde¹

Metals

Antimony^C
 Arsenic¹
 Barium^{A,C,W}
 Beryllium¹
 Cadmium²
 Chromium²
 Cobalt²
 Iron^{A,C}
 Lead^V
 Manganese^C
 Nickel²
 Selenium²
 Zinc^{V,C}

PM_{2.5} Continuous
 PM_{2.5} Concentration

Volatile Organic Compounds

1,1,2,2-Tetrachloroethane¹
 1,1,2-Trichloroethane¹
 1,1-Dichloroethane
 1,1-Dichloroethylene
 1,2,4-Trichlorobenzene²
 1,2,4-Trimethylbenzene^V
 1,2-Dichlorobenzene¹
 1,2-Dichloropropane¹
 1,3,5-Trimethylbenzene
 1,3-Butadiene^{T,V,W}
 1,3-Dichlorobenzene¹
 1,4-Dichlorobenzene²
 Benzene
 Benzene, 1-Ethenyl-4-Methyl
 Benzyl Chloride²
 Bromodichloromethane¹
 Bromoform
 Bromomethane¹
 Carbon Tetrachloride
 Chlorobenzene²
 Chloroethane¹
 Chloroform
 Chloromethane^{T,U,V,W}
 Cis-1,2-Dichloroethene
 Cis-1,3-Dichloropropene¹
 Cyclohexane^{T,V}

Dibromochloromethane¹
 Dichlorodifluoromethane
 Dichloromethane
 Ethylbenzene^V
 Ethylene Dibromide¹
 Ethylene Dichloride
 Freon 113^{U,V,W}
 Freon 114
 Hexachlorobutadiene
 M/P Xylene^V
 Methyl Butyl Ketone^V
 Methyl Chloroform
 Methyl Tert-Butyl Ether
 N-Heptane
 N-Hexane^V
 O-Xylene^V
 Styrene
 Tetrachloroethylene²
 Toluene^V
 Trans-1,2-Dichloroethylene^C
 Trans-1,3-Dichloropropene¹
 Trichloroethylene²
 Trichlorofluoromethane^{T,U,V,W}
 Vinyl Acetate
 Vinyl Chloride²

¹Indicates chemicals that were below detection limits at all monitors in Minnesota, including the Duluth Lincoln Park monitor, for this six-month monitoring time.

²Indicates chemicals that were below the detection limit at the Duluth Lincoln Park monitor, but were detected at one or more monitoring sites in Minnesota.

^AIndicates chemicals that were higher at the Duluth Lincoln Park monitor than at St. Paul fixed monitors.
 (3 chemicals higher: 2 metals, 1 VOC)

^CIndicates chemicals that were higher at the Duluth Lincoln Park monitor than at Twin Cities Suburban fixed monitors.
 (6 chemicals higher: 5 metals, 1 VOC)

^TIndicates chemicals that were lower at the Duluth Lincoln Park monitor than at St. Paul fixed monitors.
 (8 chemicals lower: 4 carbonyls, 4 VOCs)

^UIndicates chemicals that were lower at the Duluth Lincoln Park monitor than at Twin Cities Suburban fixed monitors.
 (6 chemicals lower: 3 carbonyls, 3 VOCs)

^VIndicates chemicals that were lower at the Duluth Lincoln Park monitor than at Minneapolis fixed monitors.
 (20 chemicals lower: 2 metals, 5 carbonyls, 13 VOCs)

^WIndicates chemicals that were lower at the Duluth Lincoln Park monitor than statewide averaged values from monitors around the state.
 (10 chemicals higher: 1 metal, 4 carbonyls, 5 VOCs)

Attachment B. Monitored Air Quality Pollutants – Duluth – Denfeld (7554)

Carbonyls

Acetaldehyde^{T,V,W}
 Benzaldehyde^{C,D}
 Butyraldehyde^{T,V}
 Formaldehyde^{T,V}
 Propionaldehyde^{T,U,V,W}
 Trans-Crotonaldehyde¹

Metals

Antimony^{T,V,W}
 Arsenic¹
 Barium^{T,V,W}
 Beryllium¹
 Cadmium²
 Chromium²
 Cobalt²
 Iron^C
 Lead^{T,V,W}
 Manganese^{V,W}
 Nickel²
 Selenium²
 Zinc^{T,V,W}

PM_{2.5} Continuous

PM_{2.5} Concentration

Volatile Organic Compounds

1,1,2,2-Tetrachloroethane¹
 1,1,2-Trichloroethane¹
 1,1-Dichloroethane²
 1,1-Dichloroethylene²
 1,2,4-Trichlorobenzene²
 1,2,4-Trimethylbenzene^V
 1,2-Dichlorobenzene¹
 1,2-Dichloropropane¹
 1,3,5-Trimethylbenzene²
 1,3-Butadiene^{T,V,W}
 1,3-Dichlorobenzene¹
 1,4-Dichlorobenzene²
 Benzene^{T,V,W}
 Benzene, 1-Ethenyl-4-Methyl
 Benzyl Chloride²
 Bromodichloromethane¹
 Bromoform²
 Bromomethane¹
 Carbon Tetrachloride
 Chlorobenzene²
 Chloroethane¹
 Chloroform
 Chloromethane
 Cis-1,2-Dichloroethene²
 Cis-1,3-Dichloropropene¹

Cyclohexane^{T,V,W}
 Dibromochloromethane¹
 Dichlorodifluoromethane²
 Dichloromethane
 Ethylbenzene^V
 Ethylene Dibromide¹
 Ethylene Dichloride
 Freon 113^V
 Freon 114
 Hexachlorobutadiene
 M/P Xylene^V
 Methyl Butyl Ketone^B
 Methyl Chloroform
 Methyl Tert-Butyl Ether²
 N-Heptane^{V,W}
 N-Hexane
 O-Xylene^V
 Styrene²
 Tetrachloroethylene²
 Toluene^C
 Trans-1,2-Dichloroethylene
 Trans-1,3-Dichloropropene¹
 Trichloroethylene²
 Trichlorofluoromethane
 Vinyl Acetate^V
 Vinyl Chloride

¹Indicates chemicals that were below detection limits at all monitors in Minnesota, including the Duluth Denfeld monitor, for this three month monitoring time.

²Indicates chemicals that were below the detection limit at the Duluth Denfeld monitor, but were detected at one or more monitoring sites in Minnesota.

^BIndicates chemical that was higher at the Duluth Denfeld monitor than at Minneapolis fixed monitors.
 (1 chemical higher: 1 VOC)

^CIndicates chemicals that were higher at the Duluth Denfeld monitor than at Suburban Twin Cities fixed monitors.
 (3 chemicals higher: 1 metal, 1 VOC, 1 carbonyl)

^DIndicates chemical that was higher at the Duluth Denfeld monitor than State-wide averaged value.
 (1 chemical higher: 1 carbonyl)

^TIndicates chemicals that were lower at the Duluth Denfeld monitor than at St. Paul fixed monitors.
 (11 chemicals lower: 4 metals, 4 carbonyls, 3 VOCs)

^UIndicates chemical that was lower at the Duluth Denfeld monitor than at Suburban Twin Cities fixed monitors.
 (1 chemical lower: 1 carbonyl)

^VIndicates chemicals that were lower at the Duluth Denfeld monitor than at Minneapolis fixed monitors.
 (19 chemicals lower: 5 metals, 4 carbonyls, 10 VOCs)

^WIndicates chemicals that were lower at the Duluth Denfeld monitor than State-wide averaged values.
 (11 chemicals lower: 5 metals, 2 carbonyls, 4 VOCs)

Attachment C. Monitored Air Quality Pollutants at the Denfeld and Lincoln Park sites

Carbonyls

Acetaldehyde¹
 Benzaldehyde^{1,2}
 Butyraldehyde¹
 Formaldehyde¹
 Propionaldehyde¹
 Trans-Crotonaldehyde

Metals

Antimony^{1,3}
 Arsenic
 Barium^{1,3}
 Beryllium
 Cadmium
 Chromium
 Cobalt
 Iron^{1,3}
 Lead¹
 Manganese¹
 Nickel
 Selenium
 Zinc^{1,3}

PM_{2.5} Continuous

PM_{2.5} 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-Trimethylbenzene¹
 1,2-Dichlorobenzene
 1,2-Dichloropropane
 1,3,5-Trimethylbenzene
 1,3-Butadiene¹
 1,3-Dichlorobenzene
 1,4-Dichlorobenzene
 Benzene¹
 Benzene, 1-Ethenyl-4-Methyl¹
 Benzyl Chloride
 Bromodichloromethane
 Bromoform
 Bromomethane
 Carbon Tetrachloride¹
 Chlorobenzene
 Chloroethane
 Chloroform¹
 Chloromethane¹
 Cis-1,2-Dichloroethene
 Cis-1,3-Dichloropropene

Cyclohexane¹
 Dibromochloromethane
 Dichlorodifluoromethane
 Dichloromethane¹
 Ethylbenzene¹
 Ethylene Dibromide
 Ethylene Dichloride¹
 Freon 113¹
 Freon 114¹
 Hexachlorobutadiene¹
 M/P Xylene¹
 Methyl Butyl Ketone¹
 Methyl Chloroform¹
 Methyl Tert-Butyl Ether
 N-Heptane¹
 N-Hexane¹
 O-Xylene¹
 Styrene
 Tetrachloroethylene
 Toluene¹
 Trans-1,2-Dichloroethylene¹
 Trans-1,3-Dichloropropene
 Trichloroethylene
 Trichlorofluoromethane^{1,2}
 Vinyl Acetate¹
 Vinyl Chloride

¹Indicates chemicals that were detected at both the Denfeld and the Lincoln Park monitors.

²Indicates chemicals that were higher* at the Denfeld site (1 carbonyl, 1 VOC).

³Indicates chemicals that were lower* at the Denfeld site (4 metals).

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