

# The air we breathe

The state of Minnesota's air quality 2017



## Legislative charge

The Minnesota Pollution Control Agency has a statutory requirement (Minn. Stat. §115D.15 and §116.925) to report to the Minnesota Legislature biennially on the status of toxic air contaminants and the MPCA's strategies to reduce the emissions of air pollutants. The MPCA uses this report as an occasion to discuss the most pressing outdoor air quality issues facing Minnesota and to explore the opportunities available for emission reductions.

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# SUMMARY

Report to the  
Legislature

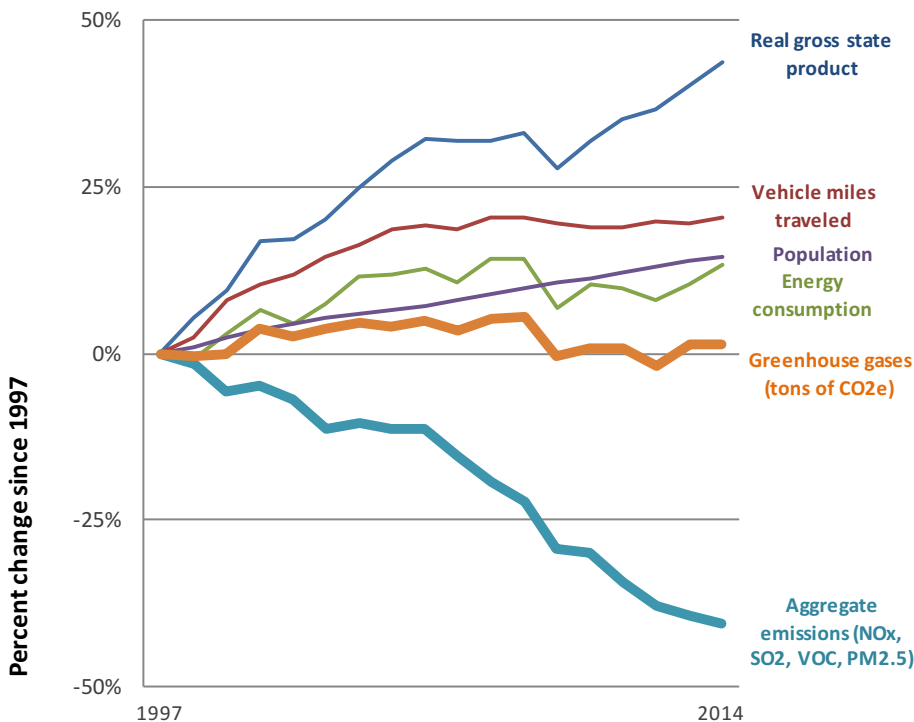


## The Air We Breathe

### The State of Minnesota's air quality in 2017

Despite growing population and increasing economic activity, Minnesota's air-pollution emissions continue to go down.

Over the past 30 years, the federal Clean Air Act has resulted in drastic reductions in air pollution across the country, while our economy has continued to grow. And Minnesotans consistently have shown by their support of clean air initiatives that they value clean, healthy air. As a result, Minnesota's air quality is better than all national standards and nearly all other health-related measures.



**Levels of pollution in outdoor air have been going down** for nearly all measured air pollutants. In general, the state of Minnesota's air quality is improving. Since 1990, annual air pollution emissions in Minnesota have fallen by nearly half. Like the rest of the nation, Minnesota has made great strides in reducing pollution from large "smokestack" facilities.

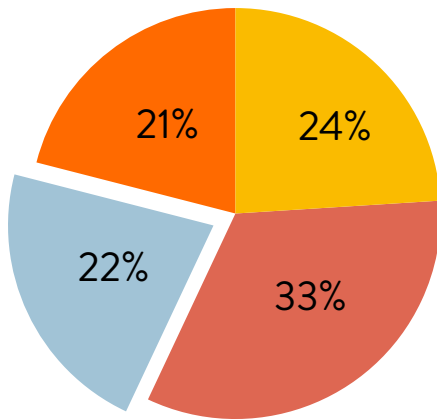
Nonetheless, challenges remain. Some people, such as **children, the elderly, and people with respiratory diseases, are more vulnerable** to the effects of air pollution. And lower-income communities and communities of color are disproportionately exposed to air



pollution. The MPCA works to reduce emissions from all sources of air pollution. We especially seek to reduce exposures in overburdened communities and work toward environmental justice.

Scientists are also learning that **air pollution is harmful at even lower levels than was previously understood**. As researchers continue to find health effects from smaller concentrations, federal air quality standards are getting tighter. The standards for lead, ozone, and particulates all were strengthened in the past few years. Yet even these revised standards may not be protective enough: There is evidence that some people suffer health effects from air pollution at concentrations below the national standards.

## Overall air pollution sources by type, 2011



- On-road vehicles 24%  
*Cars, trucks*
- Non-permitted sources 33%  
*Small businesses, heating, woodsmoke*
- Off-road vehicles and equipment 21%  
*Construction and agricultural*
- Permitted sources 22%  
*Power plants, factories*

**Small and widespread sources are the largest portion** of overall air pollution emissions in Minnesota

**Today, most of our air pollution comes from smaller, widespread sources in our neighborhoods.** Only about a quarter of the air pollution in Minnesota comes from smokestack facilities like power plants and factories. The rest comes from a wide variety of things we use in our daily lives: our vehicles, local businesses, heating and cooling, and yard and recreational equipment. An important part of the MPCA's work is with partners in the non-profit, for-profit, and governmental sectors to develop innovative, voluntary programs to help Minnesotans reduce their contributions to air pollution.

The MPCA will continue working to reduce air pollution from industrial and other large sources through our traditional regulatory methods, and by collaborating to find new ways to reduce emissions. **Our future success will depend on all of us making choices that help limit emissions.** Ensuring that all Minnesotans have clean air to breathe will mean we all need to take action to reduce our contributions to air pollution.

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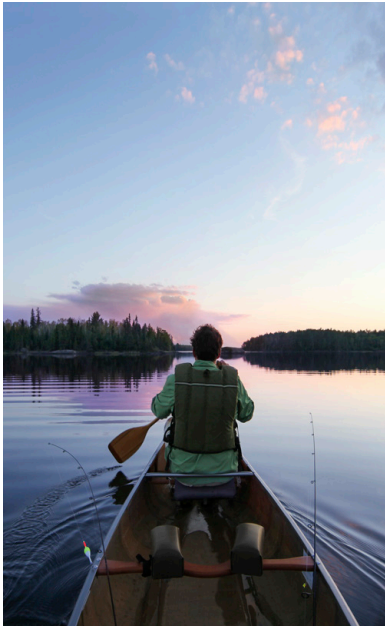
# Why we care about air pollution

## Clean air means healthier people

Air pollution affects all Minnesotans. Scientists are finding that lower and lower concentrations of air pollutants can still harm people and the environment, and that for some pollutants there may not be a safe level of exposure.

Breathing in polluted air can cause a range of problems, from itchy throats and burning eyes to triggering asthma and bronchitis attacks. It contributes to cancer and other serious illnesses, heart attacks, and premature death. Young children, the elderly, people of color, and lower-income people are more vulnerable to the effects of air pollution. Even healthy, athletic adults can be harmed by breathing air pollutants.

Some Minnesotans are disproportionately exposed to polluted air, which can contribute to inequitable health outcomes for certain vulnerable populations across the state. The relationships between air pollution and health inequities are multiple and complex, but striving for air that is healthy for all to breathe means looking for ways to understand and address these inequities.



## Clean air means healthier ecosystems

Air pollution affects the ecosystems that Minnesotans value. Pollutants in Minnesota's air reduce visibility, creating a haze that can affect scenic views in pristine places such as the Boundary Waters Canoe Area and Voyageurs National Park, as well as in the state's urban areas.

Reducing air pollution means protecting the wild places Minnesotans enjoy and the plants and animals that inhabit them. Minnesota's lakes and streams can be harmed by air pollution that causes acid rain, and fish can be affected by mercury that settles out of the air and into the water. In addition, emissions of greenhouse gases contribute to climate change, which will cause significant changes to Minnesota's ecosystems in the years to come.

## Clean air means a stronger economy

Cleaner air and a growing economy can go hand in hand. Since the Clean Air Act was passed in 1970, emissions of common air pollutants in the U.S. have dropped 70% while the U.S. gross domestic product has grown nearly 250%.<sup>1</sup>

Improving air quality is not without costs. As the federal government tightens air quality standards, Minnesota is increasingly at risk of not meeting the new standards. Failing to meet the standards would mean more stringent pollution control requirements, which would increase costs for businesses in the state. These costs vary widely depending on the pollutant, the type of control equipment needed, and how much pollution reduction is necessary. In 2013, Environmental Initiative (a Twin Cities-based nonprofit) updated a 1999 study commissioned by the Minnesota Chamber of Commerce to estimate the economic impact of violating the ozone standard in the Twin Cities. The updated study estimated the annual costs of the necessary emission reductions of ozone and fine particles to be between \$140 and \$240 million.<sup>2</sup>

However, as standards are lowered, regulators, regulated parties, and other stakeholders pay considerable attention to the costs and benefits of meeting the standards. In most instances, the benefits of meeting air quality standards outweigh the increased control costs. The money spent on reducing pollution in Minnesota often stays in Minnesota. Companies that design, install, maintain, and operate pollution-reducing processes and equipment create thousands of high-paying green jobs in engineering, manufacturing, construction, materials, operation, and maintenance. In the 2014 Green Jobs Report, the Minnesota Department of Employment and Economic Development found that clean energy employment in Minnesota surged 78% between January 2000 and the first quarter of 2014, growing steadily through the recession.<sup>3</sup>

1. See *Our Nation's Air* by U.S. EPA (<https://gispub.epa.gov/air/trendsreport/2016/>)

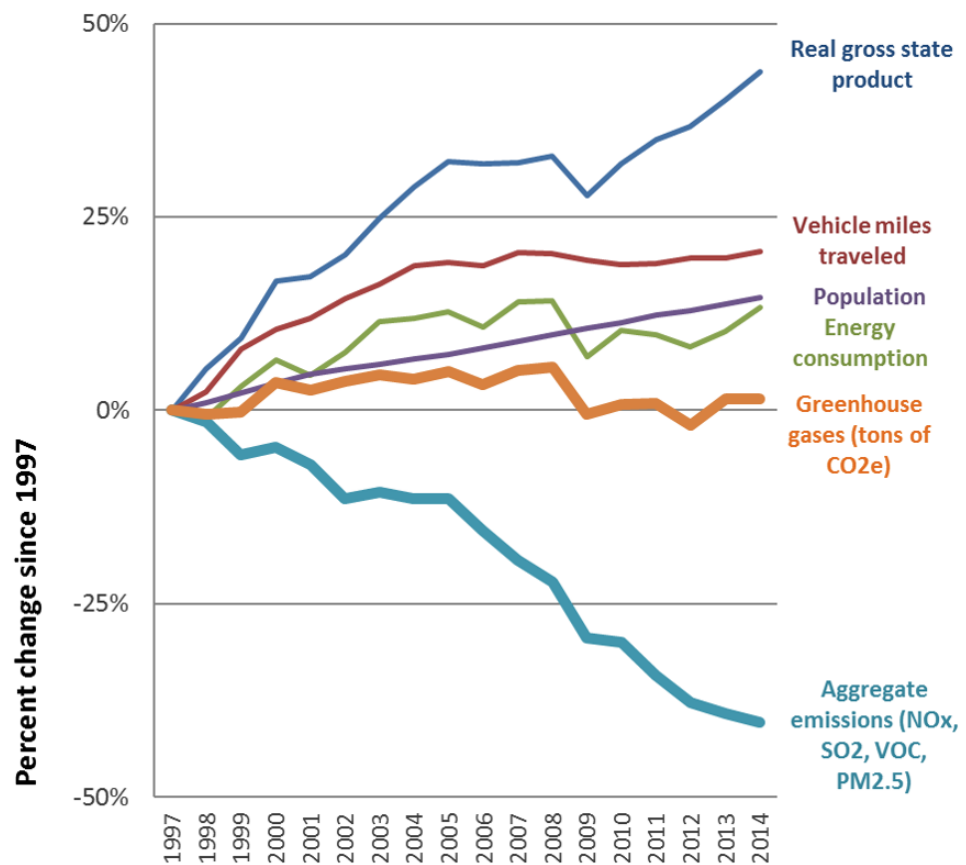
2. See <http://conservancy.umn.edu/handle/11299/150030>

3. See Minnesota Department of Employment and Economic Development (2014), *Minnesota Clean Energy Economy Profile*. <https://mn.gov/deed/data/research/clean-energy-economy/>

Clear skies, edible fish, and healthy crop and forest land are critical to Minnesota's economy. Cleaner air protects the fish and natural places that many Minnesotans rely on for their livelihoods. Air pollution can also cause damage to crops and forests.

Because cleaner air also improves our health, having good air quality means fewer missed work and school days and less spending on air pollution-related illness. The Minnesota Pollution Control Agency (MPCA) estimates the overall economic impact of health effects associated with exposure to current levels of air pollution in Minnesota may exceed \$30 billion per year.

### Comparison of growth areas and emissions in Minnesota



Minnesota's air quality is improving despite increases in population and economic activity.



# Air quality and health



## Cardiovascular

- Chest tightness
- Heart attacks
- Stroke



## Respiratory

- Wheezing
- Cough
- Asthma attacks
- Infections
- Reduced lung function



## Irritation

- Scratchy throat
- Runny nose
- Watery eyes
- Excess mucus



## Toxic effects

- Nerve damage
- Decreased organ function
- Birth defects
- Cancer

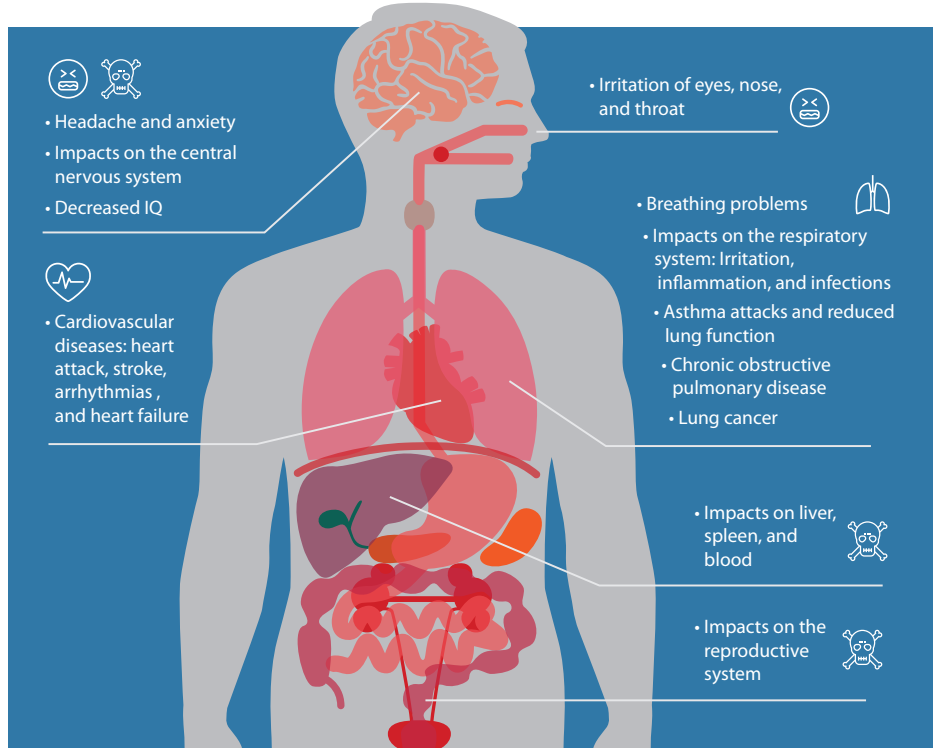
Our health is an outcome of multiple overlapping influences including environmental factors, as well as social and economic factors, individual behaviors, and biology. Exposure to air pollution can affect everyone's health, but it affects some people more than others. To protect public health, the U.S. Environmental Protection Agency (EPA) establishes national standards for six common air pollutants. Fortunately, Minnesota's air meets all the federal health-based standards (page 24). However, even levels of air pollution below the standards can affect people's health, including current levels found in the Twin Cities. The MPCA works to ensure the air is healthy to breathe for all Minnesotans.

## What are the health effects of air pollution?

With every breath, we are exposed to air pollution. Each of these pollutants can affect health in different ways. Some air pollutants have no demonstrated impact on health, but many others have been linked to health effects ranging from minor, such as scratchy throats or watery eyes, to more severe effects like heart and asthma attacks, stroke, or premature death.

## Health impacts of air pollution

Air pollutants can have a serious impact on human health. Children and the elderly are especially vulnerable.



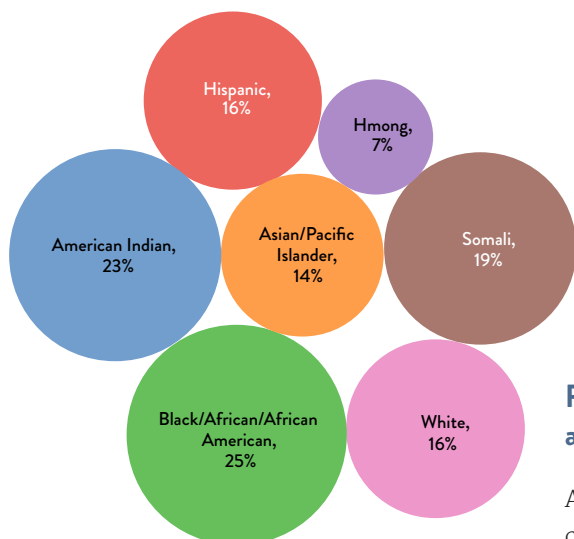
Both short-term and long-term exposure to air pollution can cause a variety of health problems. For people with asthma or chronic obstructive pulmonary disease (COPD), air pollution can make it harder to breathe, trigger asthma attacks, or cause wheezing and coughing. For everyone, air pollution also increases the risk of respiratory infections, heart disease, stroke, and cancer. Air pollution health effects can be broadly categorized into four different types: cardiovascular, respiratory, irritation, and toxic effects.



## Asthma in Minnesota

Asthma is one of the most common chronic diseases in the U.S. In Minnesota, 1 in 14 children and 1 in 13 adults has asthma. Symptoms of asthma include wheezing, breathlessness, and coughing. While the cause(s) of asthma remain unknown, many factors — air pollution, allergens, exercise, and stress — can bring on an attack in a person who has asthma. Breathing fine particles, sometimes called  $PM_{2.5}$ , and ozone can trigger asthma attacks.

The impacts of air pollution fall disproportionately on children under 18 who have higher rates of asthma. Children also experience much higher rates of emergency department visits for asthma due to air pollution than adults.



In Minnesota, disparities in asthma exist based on where you live and by gender, age, and race/ethnicity. Through efforts including the *Life and Breath Report* and environmental justice initiatives (pages 14-15), the MPCA works both to understand how these two pollutants contribute to the burden of asthma in Minnesota and to reduce exposures.

### Percentage of 8th graders diagnosed with asthma by race/ethnicity in Minnesota

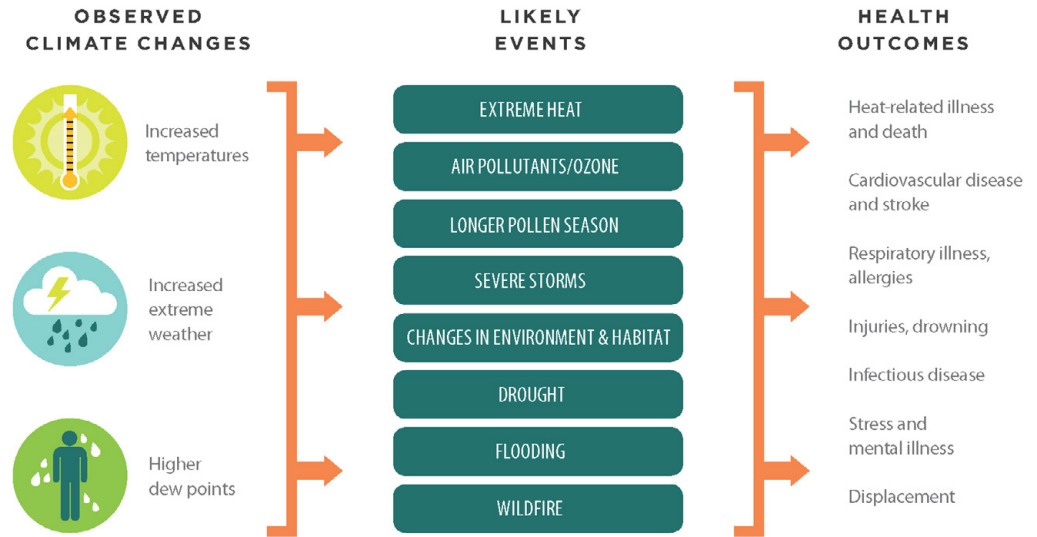
American Indian, Black, African, and African American children experience higher rates of asthma than their peers.

## Changing climate, air pollution, and health



Smoke from the Pagami Creek Fire in Boundary Waters Canoe Area, 2011

Minnesota’s climate is changing, and it’s already affecting our health, our environment, and our economy. Eight of the 10 warmest years in state history have occurred since 1998. Changes in climate affect nearly all parts of our environment, including the air we breathe.



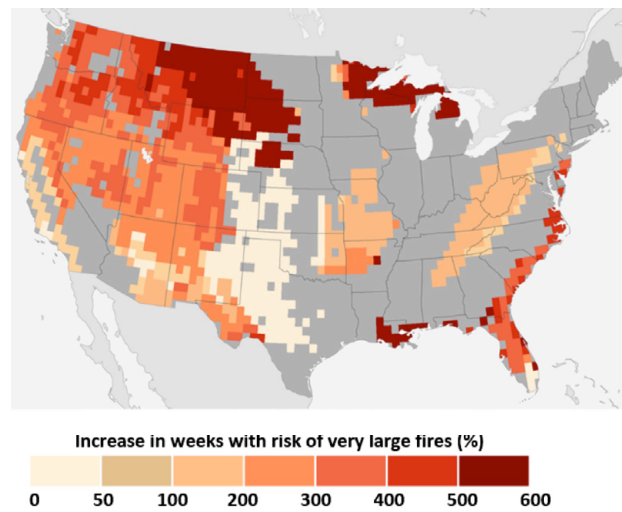
Source: Minnesota and Climate Change: Our Tomorrow Starts Today (Minnesota Environmental Quality Board, 2014)<sup>4</sup>

Researchers at the National Oceanic and Atmospheric Administration (NOAA) predict that climate change will contribute to a nearly six-fold increase in the risk of large wildfires for many regions of the U.S., including northeastern Minnesota. Exposure to smoke from wildfires is not only dangerous to those in the immediate vicinity of a fire, but can also affect people living far away from the fire if the wind carries the smoke to that area. Today, Minnesota is often affected by wildfire

smoke from the western U.S. and central Canada. Increases in wildfires in Canada and the western U.S. have the potential to increase the frequency of smoke-related “bad air” days in Minnesota.

### Projected increase in weeks with risk of very large fires 2041–2070 compared to 1971–2010

(NOAA, 2015)

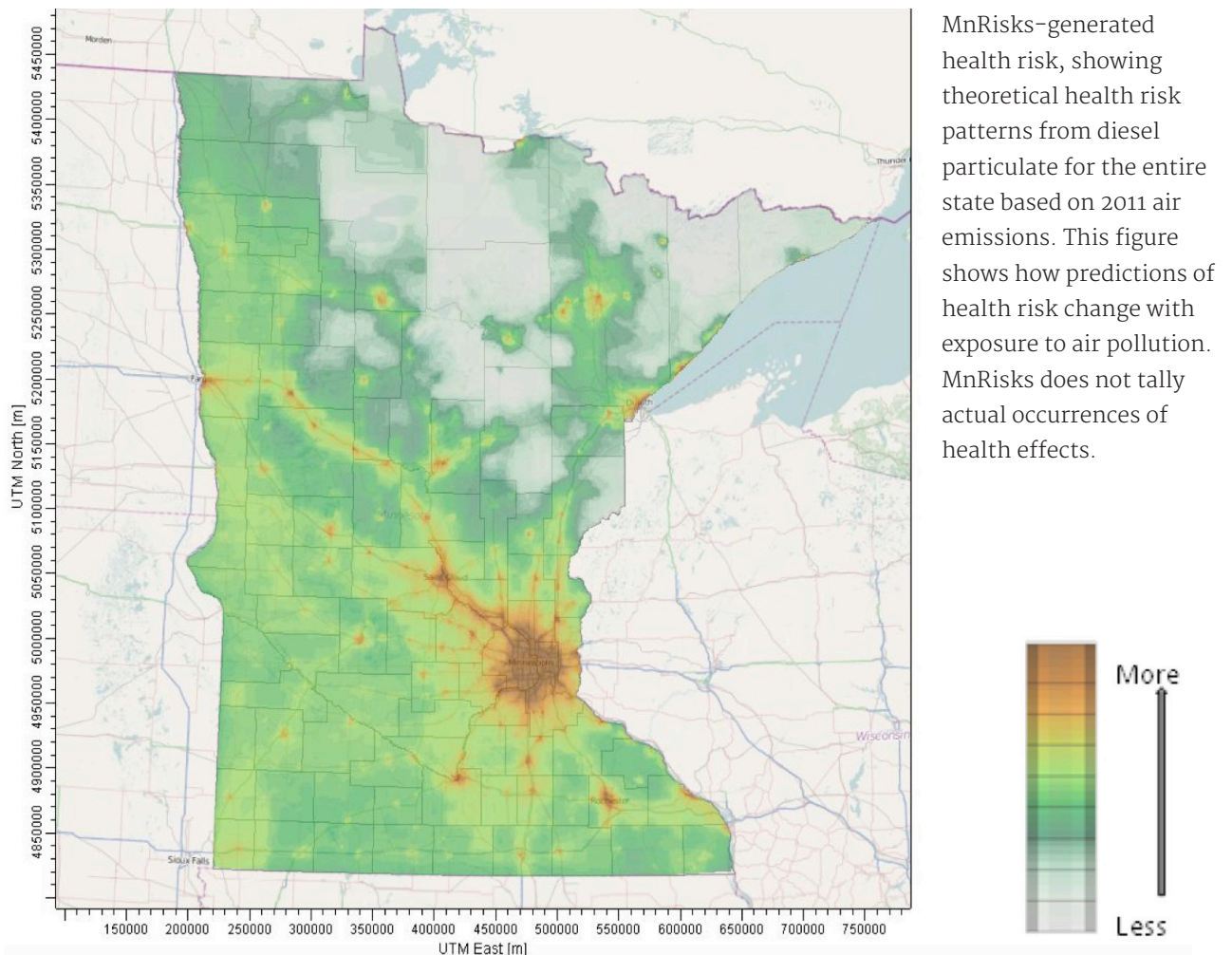


4. See <https://www.eqb.state.mn.us/sites/default/files/documents/EQB%20Climate%20Change%20Communications.pdf>

# Understanding air pollution and health risks

To help us better understand health risks to Minnesotans from air pollution, the MPCA developed a risk-screening tool called MnRiskS. The tool allows the MPCA to look at emissions from many different kinds of sources – factories, vehicles, wood fires, and more – across the entire state. MnRiskS helps predict which chemicals and sources of air pollution are likely to contribute the most to health risks. The MPCA uses MnRiskS data to prioritize its work. Those efforts include ensuring that facilities meet emission limits, monitoring pollution levels, and communicating about pollution concerns and how to address them.

The MPCA has focused on reducing emissions from diesel equipment (see page 48) in part because MnRiskS results indicate that diesel particulate is an important pollutant. Additionally, in 2012, the World Health Organization linked diesel particles with lung cancer. In Minnesota, some of the major sources of diesel particles are vehicles, construction equipment, boilers, and diesel generators. MnRiskS shows the majority of risks from diesel particulates occur along major roadways, with a higher concentration in the Twin Cities metro area.







## Who is affected by air pollution?

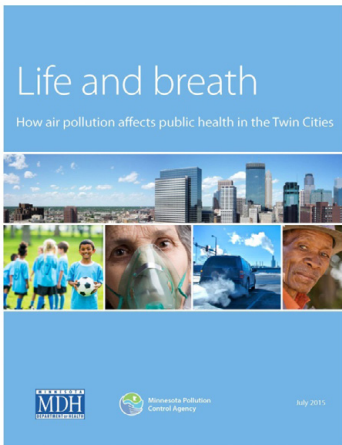
Breathing polluted air can affect anyone. On days when concentrations of air pollution are particularly high, almost everyone might experience coughing or itchy eyes. Some people are affected more by air pollution than others. People with pre-existing heart and lung conditions are at greater risk. So are the elderly. Children are more vulnerable to exposure to pollutants because their lungs are still developing, and they spend more time outdoors playing sports and at recess.

Air pollution can also trouble people who are active outdoors, even healthy adults. People who work or recreate outdoors can spend hours outside or breathe hard during a workout. Both increase their exposure to pollution.

Additionally, studies show that communities of lower socio-economic status and people of color are disproportionately exposed to air pollution and are more vulnerable to its adverse health impacts. The MPCA is working to better understand how air pollution intersects with other factors to produce health inequities across the state.

## Life and breath: How air pollution affects public health in the Twin Cities

In 2015, the MPCA and the Minnesota Department of Health (MDH) released a report: *Life and Breath: How air pollution affects public health in the Twin Cities*. The report looked at 2008 data, the most recent available at the time. Key findings included:



- Current air pollution levels contribute to a large number of health impacts. In the seven-county Twin Cities metro area, air pollution contributed to about 2,000 deaths and hundreds of hospital admissions and emergency department visits annually for respiratory and cardiovascular conditions.
- Air pollution disproportionately impacts the health of some communities. Areas with higher concentrations of people living in poverty and people of color tend to experience higher levels of air pollution-related health impacts, largely due to underlying health inequities.

The *Life and Breath* report shows air pollution-related health impacts result from a combination of exposure to air pollution and underlying health inequities. The report highlights that improving air quality can lead to substantial public health benefits. However, addressing the underlying causes of health disparities between demographic groups is also vitally important for reducing the health effects of air pollution. The MPCA continues to work with MDH and other partners to not only reduce air pollution, but also to better understand and foster conditions that strengthen the capacity of communities to create their own healthy future.

A first step in this ongoing work is the new multi-agency website called **BeAirAwareMN.org**, designed to provide information on outdoor and indoor air quality with tips on how people can better help protect their health and the environment.

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### Be Air Aware

MPCA and MDH launched **BeAirAwareMN.org** in July of 2015 to help build awareness of the connection between air quality and public health. BeAirAware is a convenient reference for individuals and families, businesses, and local units of government to find information about outdoor and indoor air quality and health.

The website features air quality data, current conditions, and tips on how to both protect our health from air pollution and minimize our contributions to it. Short articles on topics of interest are posted monthly to help keep the site fresh.



## Air pollution and environmental justice

The MPCA strives to ensure pollution does not have a disproportionate impact on any group of people. This principle, often referred to as environmental justice, also compels the agency to actively seek the involvement of lower-income residents and communities of color in decisions and actions that affect their communities.

Environmental justice concerns are multiple and complex. Not only do some communities experience higher levels of pollution, but these same communities may not have the same amenities, resources, and conditions to support healthy living. Everyone's health is influenced by individual choices such as eating well and staying active and also by the social conditions in which they live: whether they have access to social and economic opportunities, quality schooling, safe neighborhoods, a clean environment, and more. Some people have better access to the conditions that help people live healthy lives. One of the challenges of this

work is to understand different levels of air pollution exposure in the context of inequitable social conditions that contribute to health disparities.

Many studies in Minnesota and around the world are trying to better understand the relationships between pollution, social conditions, and health outcomes. Some, such as the *Life and Breath* report (page 14), indicate people of lower socio-economic status and people of color are more vulnerable to adverse health effects from exposure to air pollution. Other studies, including work by the MPCA and University of Minnesota,<sup>5</sup> indicate people of color and lower-income communities are also exposed to higher

levels of air pollution than those in predominantly white and higher-income areas. Historically, there have been more pollution sources, including busy roadways, located in lower-income neighborhoods and communities of color. Residents of these same neighborhoods also tend to have less access to clean and safe parks for recreation, healthy food, regular health care, and other conditions that support a healthy life. These and other multiple, interlinked factors contribute to worse health outcomes in neighborhoods of color and lower income.

There is much still to learn about the interaction between air pollution and health inequities and the disparities they produce. The MPCA is therefore increasing its efforts to better understand these complex issues and to actively promote environmental justice in Minnesota.

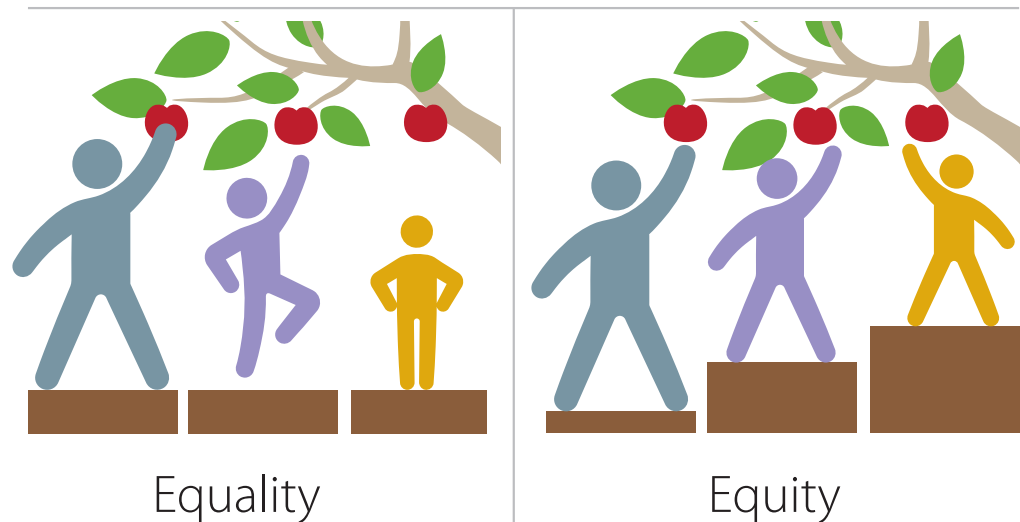


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5. Traffic, Air Pollution, Minority and Socio-Economic Status: Addressing Inequities in Exposure and Risk. Gregory C. Pratt, et al. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4454972/>

## Equality vs. equity

The concept of **equality** requires that everyone be provided the same things in order to succeed and live happy, healthy lives. **Equity**, in contrast, requires that we address the barriers to achieve the same outcomes and recognize that some groups or people are starting from a different place. Health equity means achieving the conditions in which all people have the opportunity to attain their highest possible level of health without limits imposed by inequitable policies, systems, and investments.



Addressing environmental injustice from an equity perspective requires the MPCA not only work to decrease disproportionate air pollution exposures and to increase opportunities for all Minnesotans to meaningfully participate in environmental decisions, but also to access the conditions that provide for a healthy life. The MPCA is working with a variety of community stakeholders and state, local, and national government partners to achieve environmental justice and advance health equity.

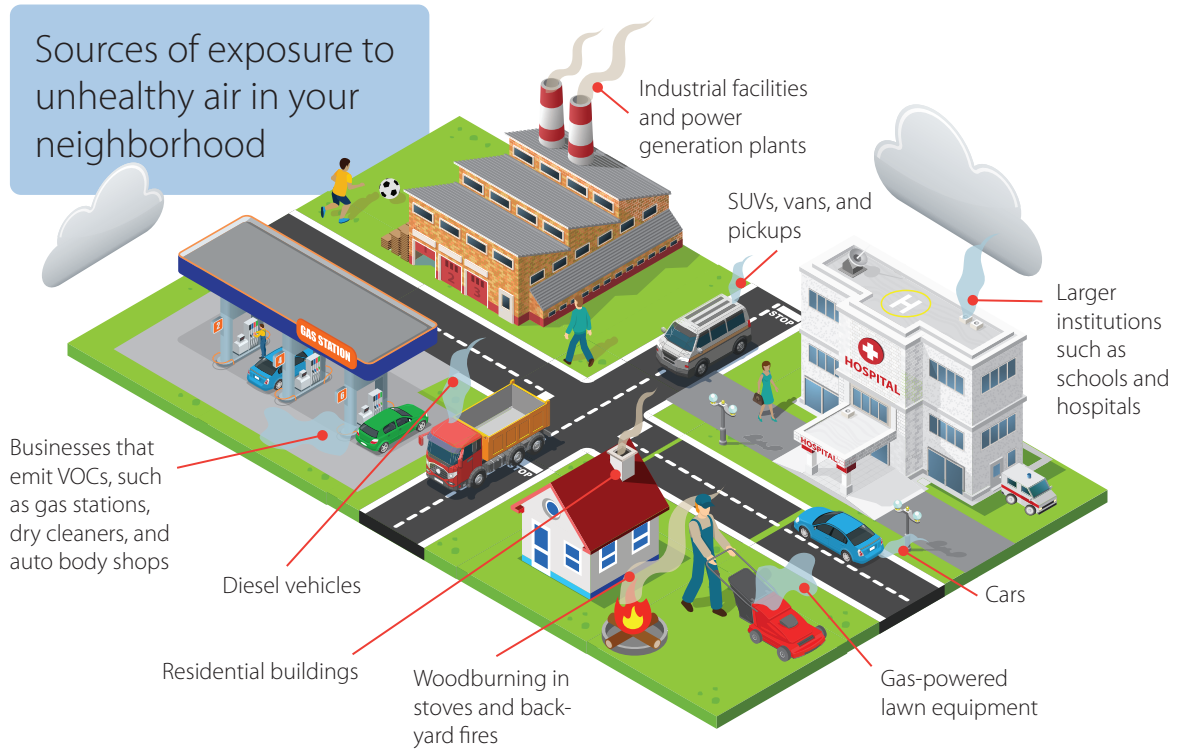
## How are people exposed to air pollution?

No matter where you live, you are exposed to air pollution. The type and amount of exposure varies depending on your location, the time of day, and even the weather. Exposure to air pollution is higher near pollution sources like busy roadways or wood-burning equipment. Many of our daily activities expose us to higher levels of air pollution. Idling cars, gas-fueled yard equipment, and chemicals we use in our homes all contribute to overall air pollution and expose us to harmful air pollutants. Some pollutants are more common in the afternoon and early evening during the summer, while others can be higher in the winter.

For some air pollutants, health effects may only occur if you are exposed to a very high amount of a pollutant, even for a short period of time. For others, health effects may occur after being exposed to even relatively small amounts over a very



long period of time. The MPCA works to ensure that air pollution levels in Minnesota are low enough to protect against health risks associated with both short- and long-term exposure to air pollution.

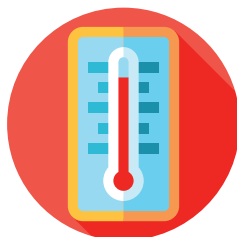


## Factors that affect air quality



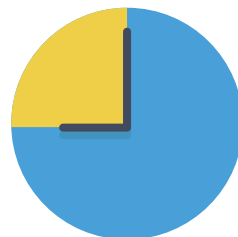
### Location

Air pollution levels are highest the closer you are to an emissions source. For most of us, our highest exposure occurs near busy roadways.



### Temperature

Fine-particle levels often increase on unseasonably warm winter days. Most unhealthy ozone days occur when day-time high temperatures exceed 90° F.



### Time of day

Fine-particle levels are often highest in the morning, but can be elevated at any time of day. Ozone is a summertime pollutant. Ozone levels are highest in the afternoon and evening.



### Weather

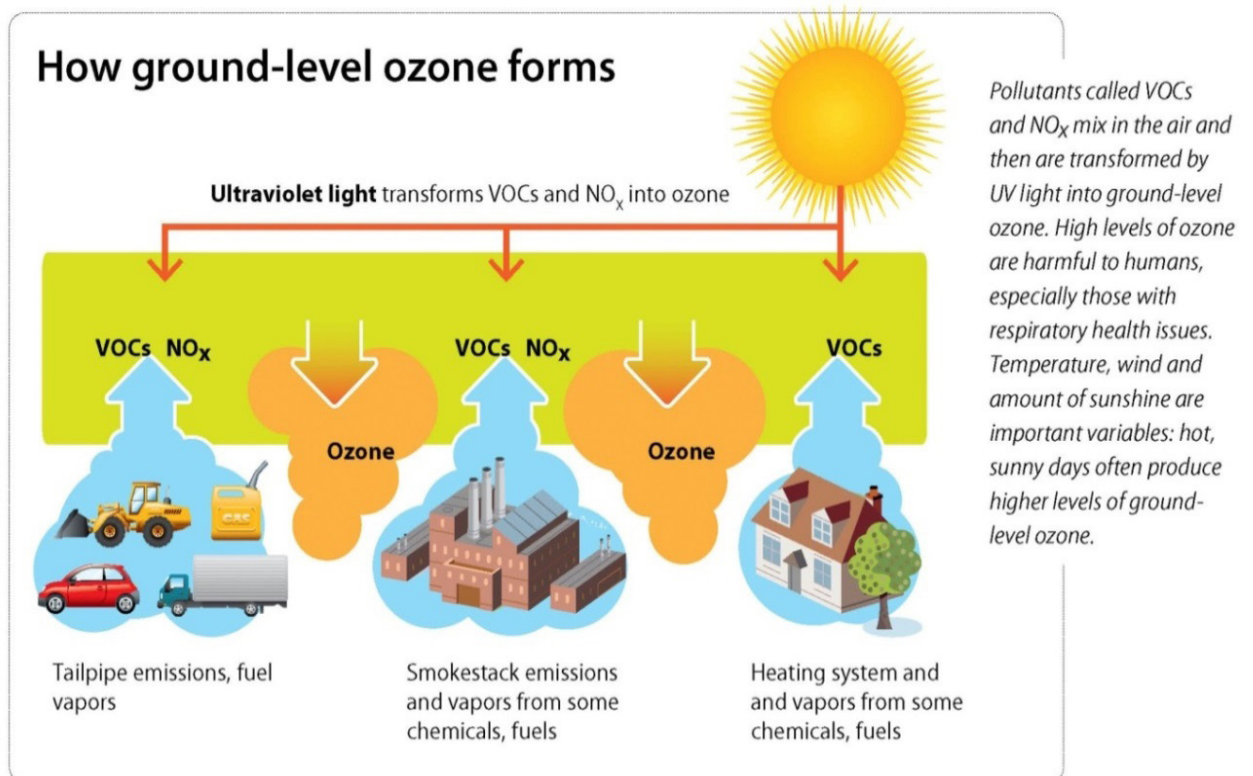
Minnesota's weather patterns usually help keep air pollution below unhealthy levels, but on days with fog, light winds, or temperature inversions, weather conditions can allow pollution to build to unhealthy levels.

# Types of air pollution in Minnesota

The MPCA works to reduce all air pollutants, but we have prioritized certain ones that are of particular concern in Minnesota. They may have potentially severe health effects, be present at levels close to national health- and welfare-based standards and benchmarks, or contribute to regional or global air quality concerns.

**Greenhouse gases** are gases in the atmosphere that trap heat from the sun and help keep the planet warm. Unlike many other pollutants, they do not have a direct effect on human health. However, man-made increases in the amount of these gases in the atmosphere are causing changes to the earth's climate. The primary greenhouse gas from human activities is carbon dioxide (CO<sub>2</sub>), but there are many others that contribute to climate change. For more information on progress toward reducing greenhouse gas emissions in the state, check out our Greenhouse Gas Emissions Reduction Report: <https://www.pca.state.mn.us/air/greenhouse-gas-emissions-minnesota-0>.

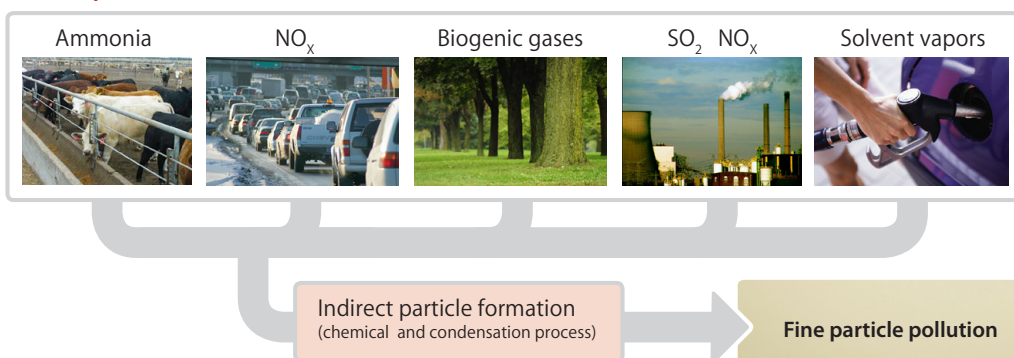
**Ground-level ozone** and **particulate matter** are both present in Minnesota at levels close to the national standards and can have serious health effects. While ozone in the upper layers of our atmosphere protects us, ozone at the ground level causes harm to people and plants. Ozone is not directly emitted, but rather only forms through atmospheric reactions. A portion of overall particulate matter, also sometimes called fine particles or PM<sub>2.5</sub>, is emitted directly from pollution sources, but much of it is formed through complex chemical reactions in the atmosphere.



## Where fine particles come from

PM<sub>2.5</sub> can be emitted directly or formed in the air from gases. On a typical day, roughly half of the concentration of fine particles in urban air is directly emitted from combustion sources as soot and the other half is formed from chemical reactions in the air. Particle pollution varies by time of year and location, and is affected by changes in weather such as temperature, humidity, and wind, which can transport particle pollution thousands of miles from where it was formed. Episodes of PM<sub>2.5</sub> pollution can result from high-pressure weather systems that are often combined with temperature inversion conditions and low wind speeds.

### Indirect particle sources



### Direct particle sources



**Air toxics** are a group of pollutants that cause or may cause cancer or other serious health effects or adverse environmental and ecological effects. The MPCA uses health benchmarks to assess the health risks associated with the concentrations of these pollutants in our air. Three of the categories of air toxics important for Minnesota are:

- **Volatile organic compounds (VOCs)** are emitted from many industrial and commercial processes used in businesses all around us. They are also emitted from many of our own daily activities. You may recognize them as the solvent-like fumes coming from paint, solvents, adhesives, gasoline, cleaning products, or other chemicals used in everyday activities. They are also released when fuels are burned in cars, trucks, generators, lawn mowers, machinery, and recreational equipment. VOCs can also be released from the storage and transportation of chemicals and fuels. When they are released into the air, they can be chemically transformed into ground-level ozone and particulate

matter. Some common business sectors that emit VOCs are trucking companies, dry cleaners, auto-body shops, print shops, and gas stations.

- **Metals** are naturally occurring elements that are emitted from many industrial processes and as a byproduct of fossil fuel combustion. Exposure to elevated levels of metals can affect the nervous and cardiovascular systems and damage the kidneys. Early childhood and prenatal exposures are associated with slower cognitive development and learning deficits. Large doses of some metals contribute to increased cancer risk.
- **Polycyclic aromatic hydrocarbons (PAHS)** are a class of more than 100 chemicals made of complex combinations of carbon and hydrogen atoms. As toxic air pollutants, PAHs are linked with health effects including respiratory irritation and cancer. PAHs come from sources like tobacco smoke, wood smoke, vehicles, asphalt roads, or smoke from prescribed burning.











































































Exhaust from gasoline powered cars and trucks contribute fine particle, nitrogen oxides, polycyclic aromatic hydrocarbons, and volatile organic compounds to our air pollution mix.















































# Pollutants of concern and their primary sources

Some of the MPCA's priority pollutants and their sources are summarized in the following table. The pollutants in this table are featured because they have been shown to contribute the most to adverse health effects in Minnesota.

Pollutants	Primary sources <sup>1</sup>	Potential health effects								
<b>Fine particles (PM2.5)</b> directly emitted from combustion sources <sup>2</sup>	 40%  20%     10%  10%	<table border="1"> <tr> <th>Cardio-vascular</th> <th>Respiratory</th> <th>Irritation</th> <th>Toxic Effects</th> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Cardio-vascular	Respiratory	Irritation	Toxic Effects				
Cardio-vascular	Respiratory	Irritation	Toxic Effects							
										
<b>Diesel exhaust</b> (a subset of fine particles)	 40%  35%  15%	<table border="1"> <tr> <th>Cardio-vascular</th> <th>Respiratory</th> <th>Irritation</th> <th>Toxic Effects</th> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Cardio-vascular	Respiratory	Irritation	Toxic Effects				
Cardio-vascular	Respiratory	Irritation	Toxic Effects							
										
<b>Nitrogen oxides</b> (contribute to forming ozone and fine particles)	 25%  25%  15%  10%	<table border="1"> <tr> <th>Cardio-vascular</th> <th>Respiratory</th> <th>Irritation</th> <th>Toxic Effects</th> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Cardio-vascular	Respiratory	Irritation	Toxic Effects				
Cardio-vascular	Respiratory	Irritation	Toxic Effects							
										
<b>Polycyclic aromatic hydrocarbons (PAHs)</b>	 25%  20%  15%  15%	<table border="1"> <tr> <th>Cardio-vascular</th> <th>Respiratory</th> <th>Irritation</th> <th>Toxic Effects</th> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Cardio-vascular	Respiratory	Irritation	Toxic Effects				
Cardio-vascular	Respiratory	Irritation	Toxic Effects							
										
<b>Volatile organic compounds</b> (contribute to forming ozone and fine particles)	 20%  20%  20%  10%  5%	<table border="1"> <tr> <th>Cardio-vascular</th> <th>Respiratory</th> <th>Irritation</th> <th>Toxic Effects</th> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Cardio-vascular	Respiratory	Irritation	Toxic Effects				
Cardio-vascular	Respiratory	Irritation	Toxic Effects							
										

<table border="0" style="width: 100%;"> <tr> <td style="text-align: center;"> Construction and mining equipment</td> <td style="text-align: center;"> Diesel on-road heavy-duty trucks, delivery trucks, buses</td> <td style="text-align: center;"> Gasoline light duty cars &amp; trucks</td> <td style="text-align: center;"> Recreational equipment and pleasure craft</td> <td style="text-align: center;"> Agricultural equipment</td> </tr> <tr> <td style="text-align: center;"> Point sources (emissions from facilities)</td> <td style="text-align: center;"> Residential woodburning (wood stoves, boilers, campfires)</td> <td style="text-align: center;"> Prescribed fire and wildfire</td> <td style="text-align: center;"> Solvent use (e.g. gas stations, autobody shops)</td> <td style="text-align: center;"> Industrial, commercial, and institutional fuel combustion</td> </tr> </table>	 Construction and mining equipment	 Diesel on-road heavy-duty trucks, delivery trucks, buses	 Gasoline light duty cars & trucks	 Recreational equipment and pleasure craft	 Agricultural equipment	 Point sources (emissions from facilities)	 Residential woodburning (wood stoves, boilers, campfires)	 Prescribed fire and wildfire	 Solvent use (e.g. gas stations, autobody shops)	 Industrial, commercial, and institutional fuel combustion	<table border="0" style="width: 100%;"> <tr> <td style="text-align: center;"> <b>Cardiovascular</b> • Chest tightness • Heart attacks • Stroke</td> <td style="text-align: center;"> <b>Respiratory</b> • Wheezing • Cough • Asthma attacks • Infections • Reduced lung function</td> </tr> <tr> <td style="text-align: center;"> <b>Irritation</b> • Scratchy throat • Runny nose • Watery eyes • Excess mucus</td> <td style="text-align: center;"> <b>Toxic effects</b> • Nerve damage • Decreased organ function • Birth defects • Cancer</td> </tr> </table>	 <b>Cardiovascular</b> • Chest tightness • Heart attacks • Stroke	 <b>Respiratory</b> • Wheezing • Cough • Asthma attacks • Infections • Reduced lung function	 <b>Irritation</b> • Scratchy throat • Runny nose • Watery eyes • Excess mucus	 <b>Toxic effects</b> • Nerve damage • Decreased organ function • Birth defects • Cancer
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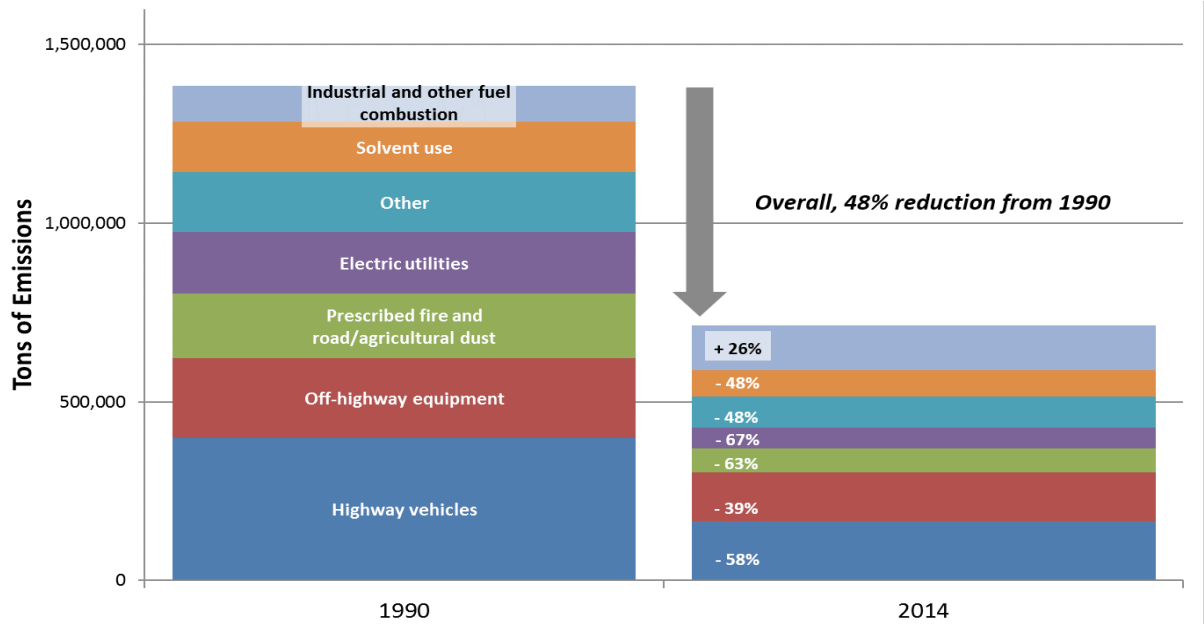
1. From Minnesota's 2011 emissions inventory. Percentages indicate the approximate amount of total emissions of pollutant of concern emitted by primary source categories in Minnesota; for simplicity, sources contributing less than 5% are not listed. Results are rounded to the nearest 5%. Except for PAHs, emissions from wildfires, agricultural and prescribed burning are not included.

2. Sources shown here emit PM2.5 directly; a large amount of PM2.5 in Minnesota's air is formed indirectly in the atmosphere from reaction of gases.

# Sources of air pollution in Minnesota

Over the last 20 years, as a result of controls put in place under the Clean Air Act, annual air pollution emissions in Minnesota have decreased by nearly 50%. Among all sources, the greatest reductions have been achieved by power plants, with emissions falling by nearly 70% between 1990 and 2014.

## Trends in air pollution emissions by source category, 1990-2014

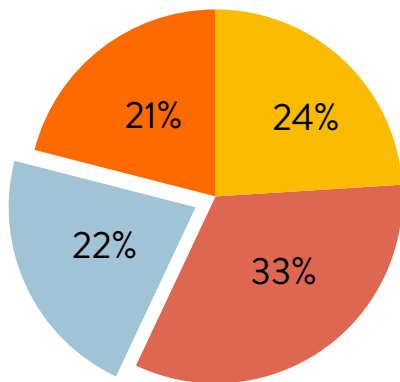


Includes emissions of VOCs, SO<sub>2</sub>, NO<sub>x</sub>, and directly emitted fine particles (PM<sub>2.5</sub>)

Source: EPA National Emissions Inventory (2016): <https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data>

Typically, when people think of sources of air pollution, they think about buildings with big smoke stacks like power plants and factories. Yet these sources make up a relatively small proportion of air pollution emissions in Minnesota. Today, most of the air pollution in Minnesota comes from smaller, more widespread sources. Minnesota's emissions inventory shows traditionally permitted sources of air pollution only contribute about a quarter of overall emissions of several of the regulated air pollutants of major concern in the state.

## Overall air pollution sources by type, 2011



- On-road vehicles 24%  
Cars, trucks
- Non-permitted sources 33%  
Small businesses, heating, woodsmoke
- Off-road vehicles and equipment 21%  
Construction and agricultural
- Permitted sources 22%  
Power plants, factories

**Small and widespread sources are the largest portion** of overall air pollution emissions in Minnesota

Most of the air pollution in Minnesota comes from activities at our homes and local businesses. These smaller, more widespread sources include a wide variety of activities, businesses, and equipment. Individually, sources like auto-body shops, gas stations, and home heating and air conditioning systems may not produce much pollution, but combined, they make up a third of all air pollution emitted in Minnesota.

Minnesotans also use many vehicles and equipment for recreation, agriculture, construction, and other work. And they often emit pollution, meaning we may be exposed to high levels of pollution from these sources. Vehicles and other equipment each make up about a quarter of the emissions in Minnesota.

Because of the large number of these sources and the small size of their individual emissions, it is difficult to regulate them through traditional permitting. To meet this challenge, the MPCA works with a variety of partners including industry, communities, and non-governmental organizations to achieve voluntary emissions reductions from these small, widespread sources, both vehicles and equipment, and homes and businesses. The sections starting on pages 36 and 45 detail what the MPCA and our partners are doing to address air pollution from these sources.

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### Small and widespread sources

Gas stations and small businesses like autobody shops and dry cleaners are a big source of VOCs.



Diesel construction equipment and wood burning contribute particulate emissions.



Buildings and on-road vehicles are a major source of air pollution due to their sheer numbers.





# How is Minnesota's air quality?

Over the past 30 years, the Clean Air Act has resulted in drastic reductions in air pollution across the country. Regulations on the biggest polluters and emission standards on technologies such as boilers and vehicles have been very successful in lowering overall levels of air pollution. Today, Minnesota's air quality is better than all national standards and nearly all health benchmarks.

To make Minnesota's air healthy for all to breathe, the MPCA works to achieve air pollution levels that are better than the minimum needed to meet national standards and health benchmarks. Because some people are more vulnerable to the effects of air pollution than others, and there is evidence that people suffer health impacts from air pollution at levels below these standards and benchmarks, there is still much to be done.

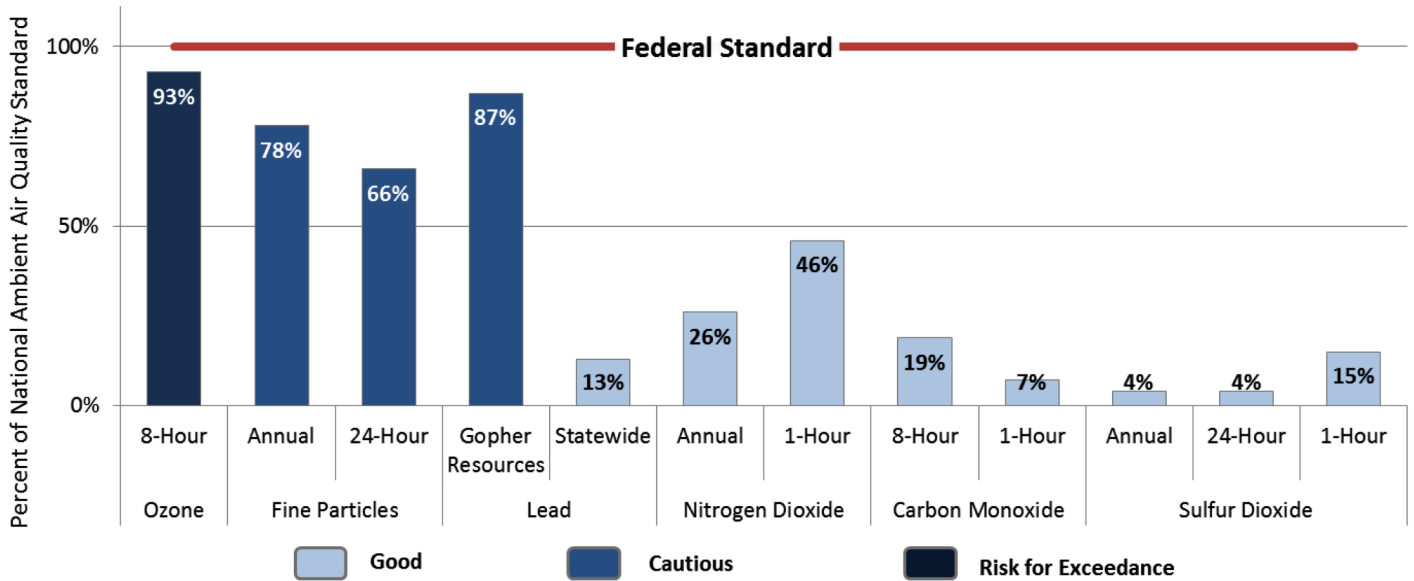
The MPCA is responsible for understanding the condition of Minnesota's air, and there are many ways of looking at and measuring air quality. Each provides a piece of the puzzle to understand how we are doing and where we need to focus in the future.

## **National air quality standards**

The federal Clean Air Act requires the EPA to set national air quality standards for pollutants that are considered harmful to public health and the environment. The EPA sets standards for six common air pollutants — ozone, fine particles, lead, nitrogen dioxide, carbon monoxide, and sulfur dioxide. The MPCA monitors air quality across the state and compares the results to these national standards. In 2015, monitoring showed all areas of the state were better than air quality standards — but not by much in some cases.



## Minnesota's air quality compared to National Ambient Air Quality Standards (2015)

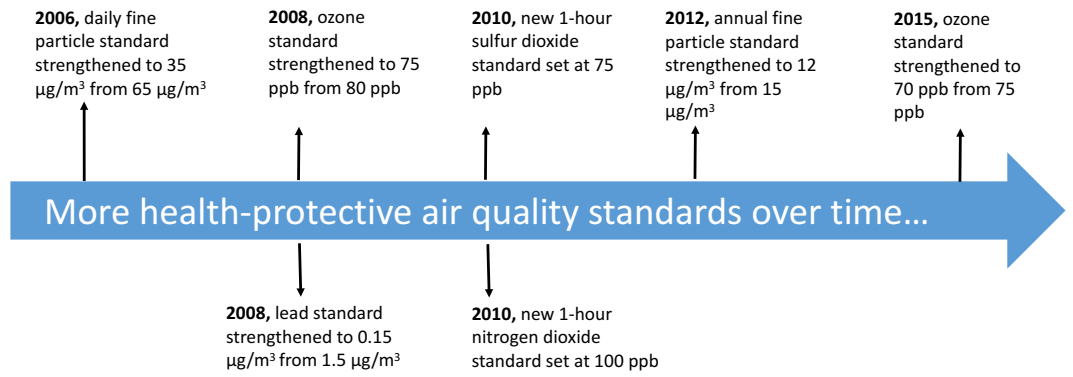


This chart compares statewide air monitoring results to the federal standards (each represented by a column). The percentage shown describes the statewide maximum pollutant concentration as a percentage of the national standard. Values less than or equal to 100% meet the applicable standard. Note that in the case of lead, in addition to the statewide comparison, Gopher Resources is shown. Gopher Resources is a lead battery recycler in Eagan that previously violated the lead standard.

The national standards are designed to protect human health and the environment. However, studies show that health effects occur even at levels below current standards and disproportionately impact disadvantaged communities (see page 13). To help protect the health of all Minnesotans, including our most vulnerable populations, the MPCA works to reduce air pollution below the national standards.

### Strengthening standards to protect human health

The Clean Air Act requires EPA to review the science related to the environmental and health effects associated with six common air pollutants (ozone, fine particles, lead, nitrogen dioxide, carbon monoxide, and sulfur dioxide) every five years. If new research indicates an existing standard is not protective, the EPA must strengthen the standard. Over the years, as scientists have found health effects at lower and lower levels of air pollution, EPA has regularly tightened the national standards (see graphic next page). To protect human health and continue to comply with national standards that get ever more stringent, Minnesota must stay proactive in reducing emissions and air pollution levels in the state.

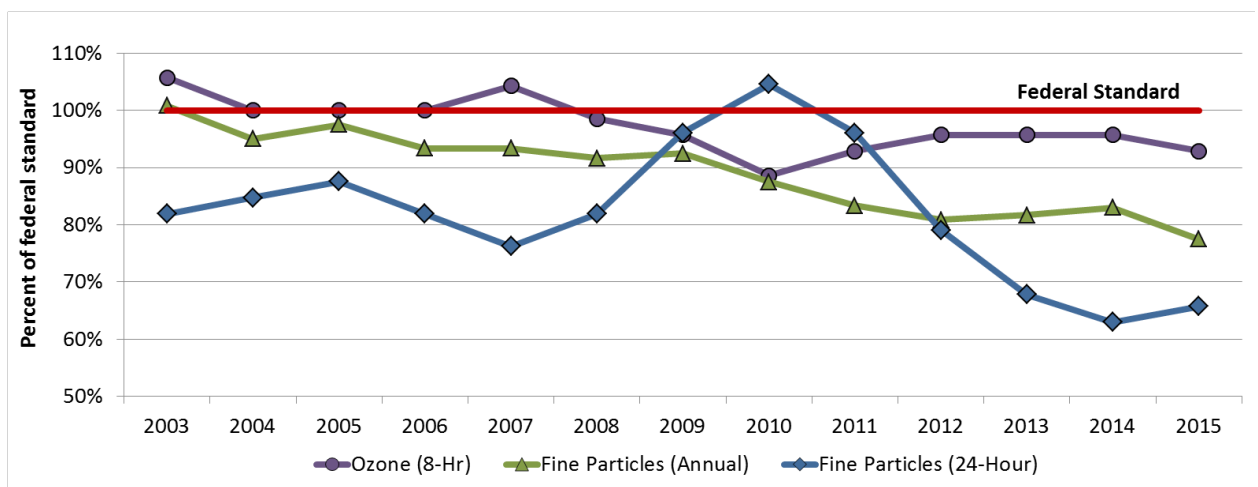


## Targeting further reductions in ozone and fine-particle pollution in Minnesota

The MPCA continues to focus on further reducing ozone and fine-particle pollution because they are the two pollutants closest to potentially violating the national standards and, as the *Life and Breath* report (page 14) revealed, current levels contribute to a large number of health impacts across Minnesota, especially in vulnerable areas in the Twin Cities. Continuing to reduce the level of these pollutants will not only improve public health and reduce pollution-related health costs like medical expenses and productivity losses due to missed school or work days, but will also help us avoid costly, more stringent regulations.

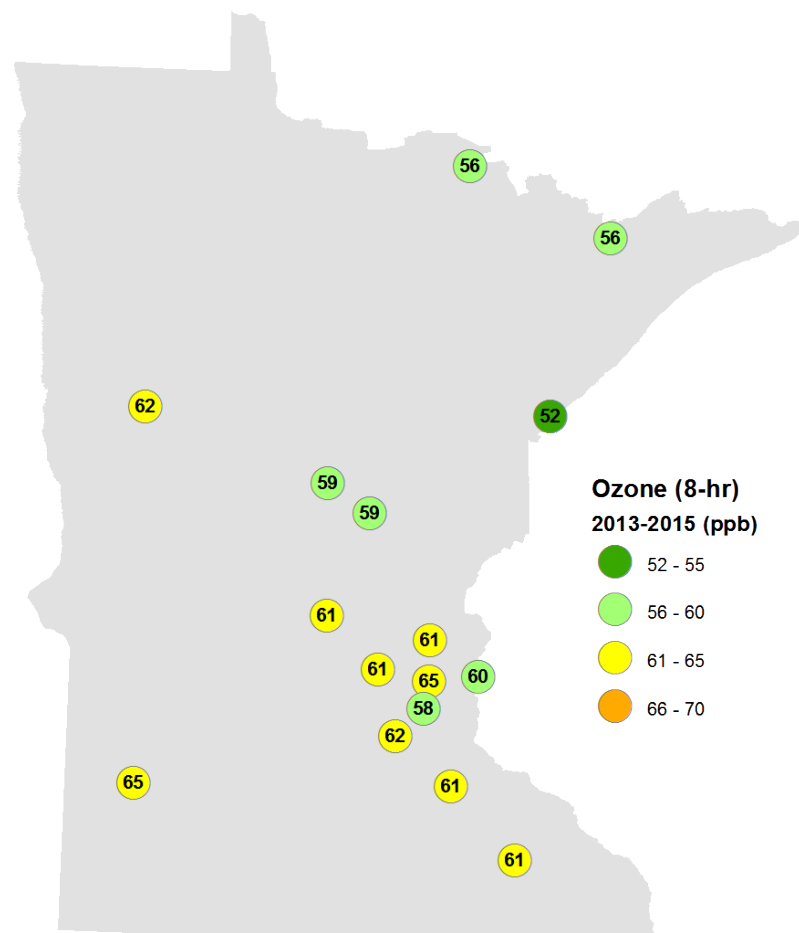
Ozone and fine-particle pollution levels in Minnesota have been steadily improving since 2003. However, progress in reducing both pollutants has been affected by year-to-year variability in the weather.

### Trends in ozone and fine-particle pollution levels (2003-2015)



## EPA strengthens ozone standard

On October 1, 2015, the EPA strengthened the ozone standard to 70 parts per billion (ppb), down from the 2008 standard of 75 ppb. All areas of Minnesota currently meet the new standard – but some parts of the state are close. Measured ozone levels in some areas of the state are now within 85% or more of the level of the ozone standard, placing these areas at greater risk for violating the standard in the future. While emissions that help form ozone are decreasing, warmer summers and more frequent wildfires may cause both fine-particle levels and ozone levels to rise.

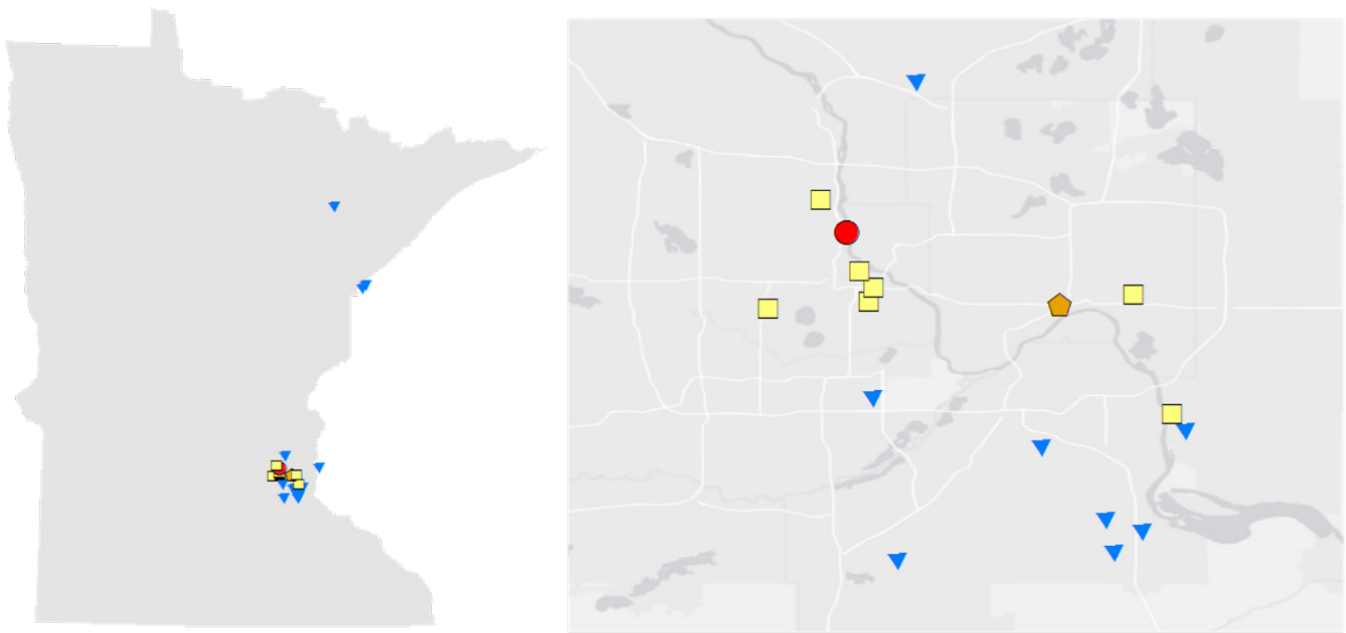


## Health benchmarks for toxic air pollutants

Toxic air pollutants, or air toxics, are pollutants that cause or may cause cancer or other serious health effects but do not have enforceable air quality standards. Minnesota relies on guidelines called health benchmarks to evaluate the health risks from exposures to air toxics. The MPCA uses health benchmarks from MDH, EPA, or other similar government agencies to evaluate air toxics in Minnesota.

The MPCA works to ensure that concentrations of all air toxics in Minnesota are below health benchmarks. MPCA monitors air toxics at nearly 20 locations in the state, with the majority located in the Twin Cities metro area. Each of these monitors measures over 70 air toxic pollutants. In 2015, the majority of monitoring sites showed air toxics concentrations are below acute (short-term exposure) and chronic (lifetime exposure) health benchmarks. Formaldehyde continues to be found above the chronic health benchmark at monitoring sites in the urban core of Minneapolis and St. Paul.

**Locations with air toxics concentrations above a chronic health benchmark, 2015**



**Pollutants above a chronic health benchmark at air monitoring sites**

- ▼ all below
- formaldehyde
- ⬠ formaldehyde, benzene
- chromium, cobalt, formaldehyde, nickel

This map describes air-monitoring locations with air toxics concentrations above a chronic health benchmark. The majority of monitoring sites measure all air toxics below the health benchmarks. Formaldehyde has been consistently measured above the chronic health benchmarks in the urban core. New in 2015, two sites measured additional air toxic pollutants above health benchmarks, including benzene in downtown St. Paul and several metals in North Minneapolis near the Northern Metals recycling facility (see page 60).



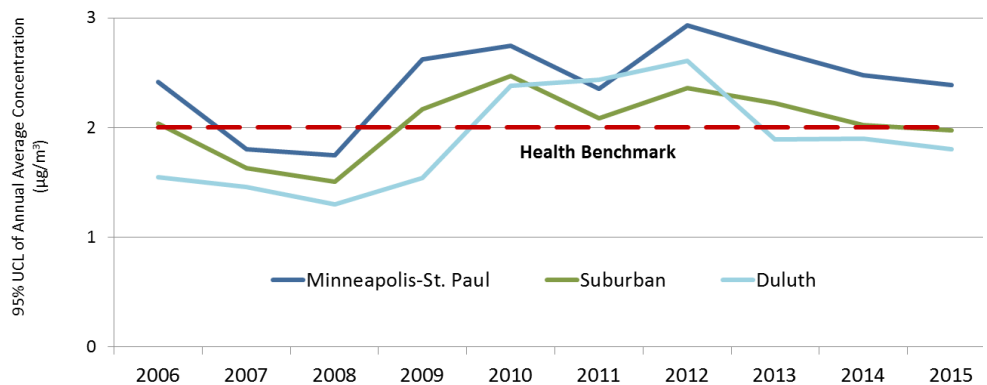
## Formaldehyde above the health benchmark

Formaldehyde is a common pollutant found in indoor and outdoor air. It's used in the production of particleboard and as an intermediary in the production of other chemicals. Formaldehyde is also produced in the environment when other pollutants react in the air. Exposure to high levels of formaldehyde can result in respiratory symptoms and eye, nose, and throat irritation.

Since 2009, formaldehyde levels in Minnesota have been measured above the chronic inhalation health benchmark. Similar to ozone pollution, formaldehyde levels rise on hot and sunny days. From 2013 through 2015, formaldehyde levels started to decline, but they still remain above the health benchmark in Minneapolis and St. Paul. The declines are likely due, in part, to below-average to normal summertime temperatures.

The MPCA is working to better understand what sources are contributing to elevated formaldehyde concentrations so that strategies to reduce formaldehyde pollution can be developed.

### Annual formaldehyde trends in Minnesota, 2006-2015



## “Bad air” days

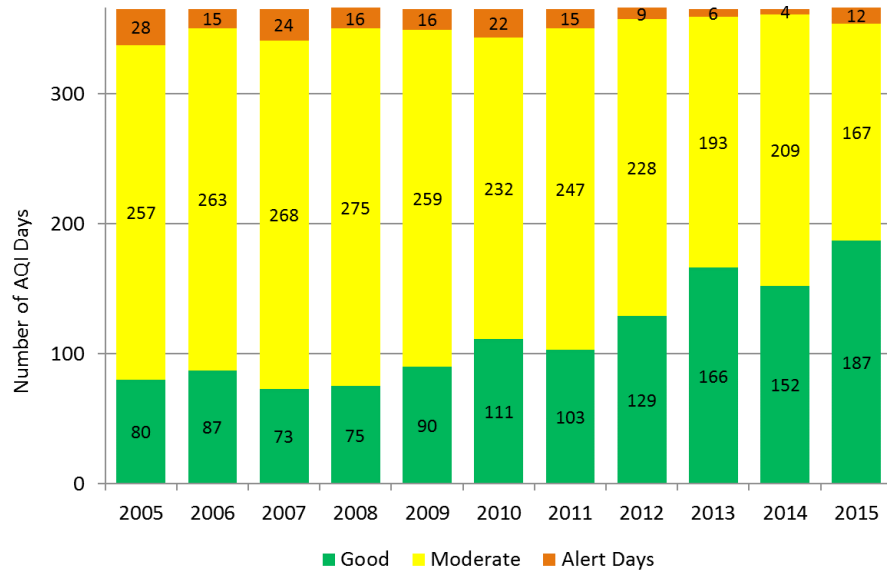
On most days, air across Minnesota is healthy to breathe, but on some days each year pollutants such as ozone and fine particles can reach unhealthy levels. The MPCA uses the Air Quality Index (AQI) to rank daily air quality. Air quality is ranked as **good, moderate, unhealthy for sensitive groups, or unhealthy for everyone**. The MPCA issues an air-pollution health alert when daily air quality reaches **unhealthy for sensitive groups** or worse.

## How can you reduce your contribution and exposure to air pollution?

- Drive smarter – combine trips, avoid unnecessary idling, carpool. Or walk, bike, or take the bus.
- Avoid backyard fires – especially in the city.
- Use electric- or human-powered yard equipment.

The statewide trend in AQI shows improvements in air quality over time. Since 2003, the number of days with good air quality has nearly doubled. In 2005, air quality was considered good in all areas of the state on less than 25% of all days that year. In 2015, it was good in all areas of the state on more than 50% of all days.

Statewide trend in Air Quality Index days, 2005-2015



Despite consistent improvements in the number of good air quality days, the number of days with poor air quality varies from year to year. In 2015, across Minnesota, there were 12 bad air days, primarily due to elevated fine-particle (PM<sub>2.5</sub>) pollution resulting from wildfire smoke transported into Minnesota.

For current air quality conditions and forecasts, to download the AQI Mobile App, or to sign up to receive air quality advisories and alerts, visit <https://www.pca.state.mn.us/aqi>.



## Recent smoke events

Several significant smoke events have occurred over the last two years, causing reductions in visibility as well as potential health effects. On Mother's Day weekend in 2016, for example, many woke up wondering why their neighbors had backyard fires before brewing their morning coffee. In reality, the fires were much larger and farther away. Smoke from wildfires in southwestern Ontario combined with local wildfire smoke from a fire near Park Rapids, Minnesota, to raise regional AQI values to unhealthy levels. MPCA meteorologists are working to improve the agency's ability to provide advanced notice of such events to the public to prepare for potential effects when skies turn smoky (page 62).

# Improving visibility at our most pristine places

Fine-particle pollution can reduce visibility over wide areas. This phenomenon is called regional haze. Haze occurs when sunlight encounters fine particles in the air, which absorb and scatter light. Haze-causing pollutants come from a variety of sources, both natural and man-made, including motor vehicles, electric utilities, taconite processing facilities, agriculture, and wildfires.

## Visibility at Boundary Waters Canoe Area near Ely

Pristine conditions



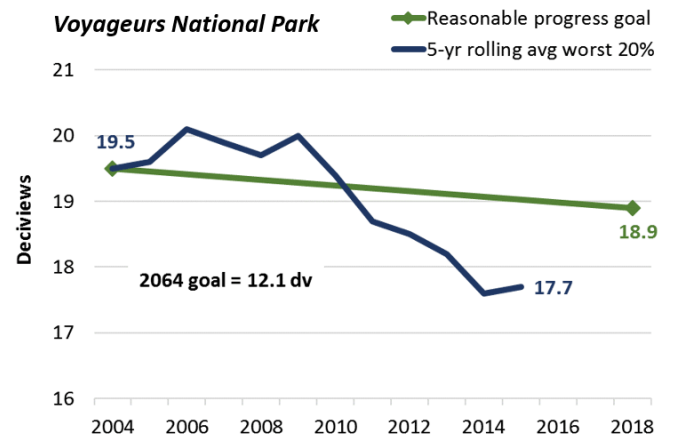
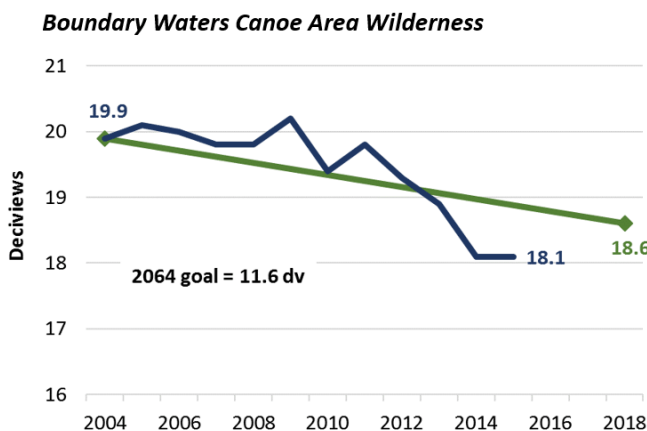
Visible haze



In 1999, EPA established a regulatory program to reduce haze caused by man-made air pollution at national parks and wilderness (Class I) areas. The goal of the regional haze rule is to achieve natural visibility conditions in Class I areas by 2064, with interim progress goals every 10 years. The first interim progress goal is set for 2018.

The regional haze interim progress goals are set separately for each location. Based on monitoring conducted through 2014, both the Boundary Waters Canoe Area Wilderness and Voyageurs National Park have already achieved the 2018 interim progress goals toward natural visibility conditions.

## Reducing haze in national parks and wilderness areas (lower numbers are better)



# Greenhouse gas emission reduction goals

Greenhouse gases (GHGs), such as carbon dioxide and methane, contribute to climate change. Climate trends already seen in Minnesota include rising temperatures, extreme storms, and higher dew points driving the frequency and intensity of extreme weather in Minnesota. The MPCA and our partners are working to reduce GHG emissions in Minnesota to lower our contribution to this international problem.

In 2007, the Minnesota Legislature enacted the Next Generation Energy Act. The act set statewide GHG reduction goals of 15% below 2005 emissions by 2015, 30% below by 2025, and 80% by 2050. Minnesota has also adopted one of the strongest renewable energy standards in the nation, which requires 25% of power consumed in Minnesota to come from renewable energy sources by 2025.

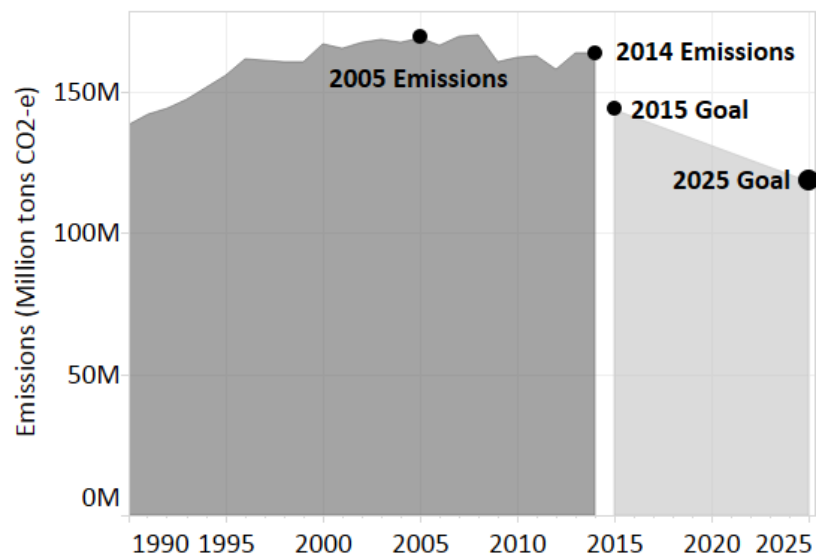
## Next Generation Energy Act GHG emission reduction goals



Since the act was passed in 2007, Minnesota has made progress in establishing policies and programs to achieve the GHG reduction goals over the long term. Between 2005 and 2014, Minnesota GHG emissions declined by 3%. While we don't have complete data for 2015, it is unlikely that we met the 2015 goal. As a state, we have taken important actions to prevent the increase in emissions that was projected when the act was passed. Without significant additional effort, Minnesota will not achieve the second Next Generation Energy Act milestone – a 30% reduction in GHG emissions by 2025.

## Tracking progress on reducing Minnesota GHG emissions

This chart shows the trend in GHG emissions in Minnesota since 1990. The dark grey shows annual GHG emissions since 1990. The light grey area describes the emission reduction path needed to achieve the Next Generation Energy Act milestone of a 30% reduction (from 2005) in GHG emissions by 2025.





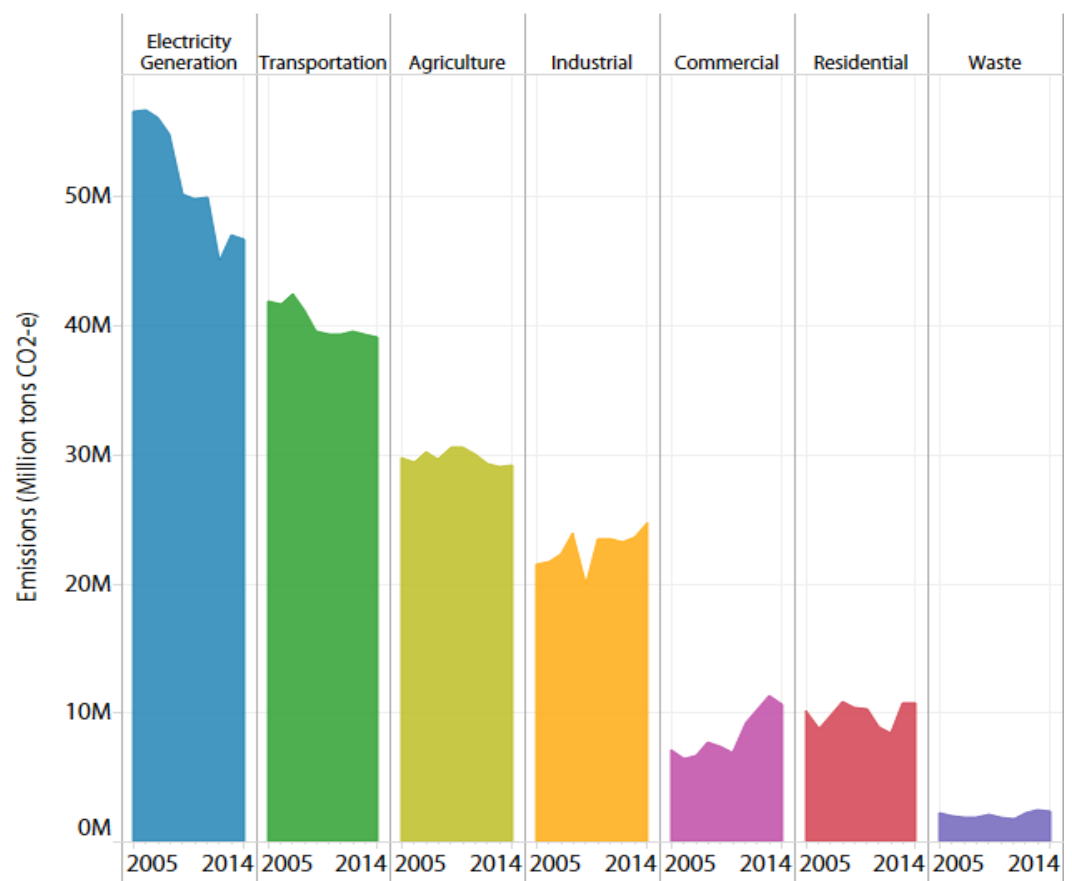
## Under 2 MOU

In 2015, Governor Mark Dayton reaffirmed the state’s climate goals by signing what’s called the “Under 2 MOU” (memorandum of understanding). This non-binding international agreement has been signed by local governments that represent over 780 million people and \$21 trillion in GDP worldwide. The agreement focuses on keeping the changes in global temperature below 2 degrees Celsius, which is consistent with the magnitude of the goals of the 2007 Next Generation Energy Act.

There is evidence of progress in some areas. Since 2005, GHG emissions from electricity generation have decreased by 17% due to reduced coal use. Coal is being replaced by renewable wind and solar power and by switching to cleaner fuels such as natural gas. Electricity generation remains the biggest emitter of GHGs in the state, emitting 29% of the state’s GHGs.

Transportation GHG emissions are about 24% of the state’s total GHG emissions, and have decreased about 7% since 2005. While vehicles are more efficient and biofuels are more widely used, consumers have been choosing to replace smaller cars with larger vehicles (see pages 45-47).

Changes in greenhouse gas emissions by economic sector: 2005-2014



The chart above describes the trend in GHG emissions in Minnesota by economic sector since 2005. The electric utility sector has achieved the greatest GHG reductions, yet remains the largest contributor to GHG emissions in the state. The transportation and agricultural sectors have also experienced reductions in GHG emissions, while the industrial, commercial, residential, and waste sectors have experienced increases in GHG emissions since 2005.

These results demonstrate that Minnesota’s progressive energy laws and programs are working, but more must be done to reduce GHG emissions across all sources in the state. Minnesota needs to remain a leader in GHG reductions, particularly

in the next 10 years, to meet the goals in the Next Generation Energy Act and to do our part to help forestall the worst effects of climate change in Minnesota.

For more information on greenhouse gas emission trends in Minnesota, visit <https://www.pca.state.mn.us/air/greenhouse-gas-emissions-minnesota-0>.

## A consumption-based GHG emissions inventory for Minnesota

In early 2017, the MPCA will complete its first-ever Consumption-Based Emissions Inventory (CBEI) for greenhouse gases. Until now, the MPCA has only looked at an “in-boundary” GHG inventory, which only considers the emissions that take place **within** Minnesota’s borders. The CBEI instead accounts for all the emissions associated with the goods and services **consumed** in Minnesota, whether those emissions occurred within the state or elsewhere. The CBEI includes the full lifecycle emissions associated with the goods and services consumed in the state, including emissions resulting from their production, transport, use, and disposal.



### Consumption inventory

Global approach

Emissions anywhere in service of things consumed in Minnesota



### In-boundary inventory

Snow globe approach

Emissions produced in Minnesota, regardless of where things are consumed

GHG emissions are a global problem. When they are reduced anywhere, it helps everywhere. Having a more complete picture of how consumption of products contributes to emissions allows for a wider array of behavioral initiatives and policy options to reduce emissions. The goal is not for the CBEI to replace the in-boundary inventory, but rather for it to be complementary information for the public and for policy-makers to both inform personal consumption choices and influence policy.



# What we're doing to improve air quality

Sources of air pollution are all around us. Each source type has its own challenges and requires different strategies for reducing emissions. The following sections explore the work that the MPCA and our partners are doing to reduce pollution from a wide variety of sources. The MPCA works to both regulate facilities as directed by the Clean Air Act and find creative ways for reducing emissions from the smaller, more widespread sources across the state.

## **Environmental justice**

To address disparities in exposures to air pollution and related health effects, the MPCA is working with a variety of stakeholders and state, local, and national government partners to move toward addressing inequitable policies, systems, and investments. This means creating opportunities for communities who have been disproportionately impacted by health and environmental disparities to participate in MPCA decision making and working to reduce disparities in air pollution exposures. Areas that have larger proportions of lower-income residents or communities of color have been identified as potential areas of concern for environmental justice and are the focus of this work.

In 2015, the MPCA finalized its Environmental Justice Framework. This framework provides direction to the agency for integrating environmental justice and equity into all aspects of the agency's work. In the fall of 2016, the MPCA established an Environmental Justice Advisory Group as a way to ensure accountability — a key component of the framework. The advisory group will advise the MPCA on improvements to policies and procedures to ensure integration of environmental justice principles into the agency's work, provide feedback on the effectiveness of the MPCA's environmental justice efforts, and collaborate with the agency to improve engagement with communities of environmental justice concern.

The MPCA is trying to consider environmental justice in all areas of its work, including permitting, inspections, outreach, and grants. As the MPCA works to reduce emissions from all sources of air pollution, we especially seek to reduce exposures in communities of environmental justice concern.

## **Air pollution from our homes and businesses**

There are many small, but critical sources of air pollution in our homes and neighborhoods. Sources such as lawn mowers, dry cleaners, backyard fires, and auto-body shops are located where we live and work, which means we are frequently exposed to their emissions, sometimes for long periods of time. As discussed on page 22, total emissions from these smaller but widespread sources are significantly greater than all the industrial sources in the state combined.

Addressing these sources is challenging. Because of the large number of these sources and the often small size of their individual emissions, it is difficult to regulate them through traditional air permitting. However, together they contribute to harmful levels of air pollution that can affect the health of Minnesotans. For some types of equipment, the EPA or the states may require manufacturers to produce lower-emitting equipment. However, older equipment can last a long time, continuing to operate with higher emissions.

All Minnesotans can take actions to cut emissions from these activities. Using electric yard equipment, choosing more efficient appliances and heating systems, minimizing recreational wood burning in densely populated areas, or using lower-emitting chemicals in our homes are things that we can all choose to do to reduce our contributions to Minnesota's air pollution.

Voluntary actions are central to reducing emissions from these small sources. Voluntary actions allow people and businesses to choose the strategies that work best for them. Forming partnerships with nonprofits, other levels of government, for-profit companies, and communities is critical to developing voluntary emissions reduction programs. To foster these relationships, the MPCA is a part of two principal collaborative programs: Clean Air Minnesota and Particulate Matter and Ozone Advance.

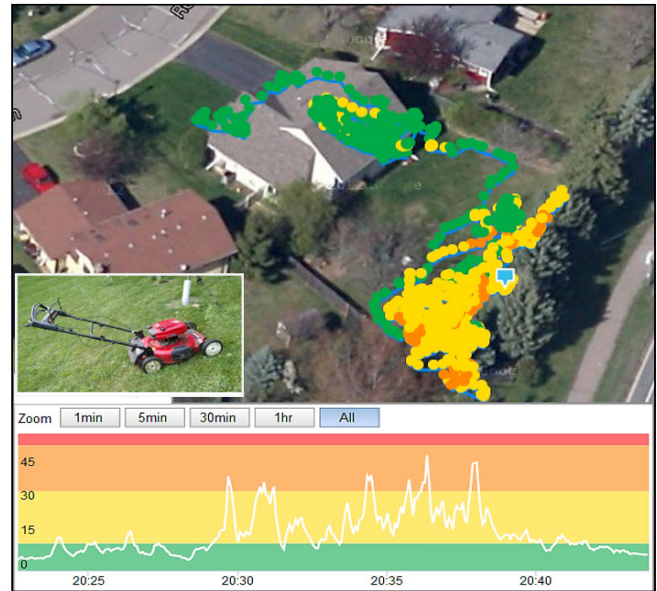


## Measured air pollution levels from an electric and a gas-powered lawn mower

Electric



Gas



Air pollution measured using the AirBeam fine particle (PM<sub>2.5</sub>) air quality sensor

Using the AirBeam PM<sub>2.5</sub> sensor, MPCA staff tested the relative difference in air pollution levels from an electric lawn mower and a gas-powered mower. Pollution levels are ranked as good (green), moderate (yellow), or unhealthy for sensitive groups (orange). When using the electric mower, the vast majority of readings were ranked as good. In contrast, readings from the gas-powered mower were mostly ranked moderate or unhealthy for sensitive groups. When purchasing a new or replacing an existing gas-powered mower, consider switching to human- or electric-powered options. The switch can help reduce your overall exposure to air pollution.

### Clean Air Minnesota

In 2003, the MPCA collaborated to form a public-private partnership to help us work toward reducing air pollution to better protect public health while continuing to meet federal air quality standards. This partnership, called Clean Air Minnesota (CAM), was founded through the joint efforts of the Minnesota Pollution Control Agency, the Minnesota Center for Environmental Advocacy, the Minnesota Chamber of Commerce, and Environmental Initiative to address these shared goals. The partnership helps gather stakeholder input, prioritize strategies, connect projects with funding, increase communication about initiatives, and track emissions reductions. CAM partners have committed to reducing man-made fine particulate matter (PM<sub>2.5</sub>) and ozone precursor emissions by 10% from 2001 levels.

CAM focuses on identifying and implementing voluntary strategies and education opportunities to reduce health risks related to air pollution and improve environmental justice in Minnesota. The CAM collaboration has been a critical part of

many of the MPCA's efforts to reduce air pollution from small, diffuse sources around the state. Many of these key efforts are discussed in more detail later in this section and in the section on vehicles and heavy-duty equipment (page 45) following.

For more information, visit [www.environmental-initiative.org/our-work/clean-air/clean-air-minnesota](http://www.environmental-initiative.org/our-work/clean-air/clean-air-minnesota).

## Particulate matter and ozone advance

In 2012, the MPCA enrolled in EPA's voluntary Advance Programs for both particulate matter and ozone. These programs help the states achieve voluntary emission reductions to lower concentrations of these two pollutants. The programs aim at helping state and local governments reduce air pollution in areas that currently meet federal standards for ozone and fine particles. As researchers better understand the health impacts of air pollutants, EPA reviews and strengthens national air quality standards. These programs help the states stay ahead of changes to the national standards. Without continued improvements in air quality, Minnesota is at risk for violating air quality standards in the future.

Clean Air Minnesota serves as the stakeholder group for the Advance Program in Minnesota. The Advance Program provides an opportunity to get input from federal and local partners on programs that are working elsewhere in the country and on how we might implement similar programs here in Minnesota. For more information on EPA's Advance Program, visit [www.epa.gov/advance](http://www.epa.gov/advance).

## How we're doing

<b>CAM project reductions 2014-2015</b>	<b>CAM Goal: 10% reduction from 2011 levels</b>
154 tons of particulate matter	6,000 tons of particulate matter
297 tons of VOC emissions	27,000 tons of VOC emissions

The MPCA and our partners in CAM have a goal to reduce emissions of certain key pollutants by 10% from 2011 levels through voluntary emission reduction efforts. Achieving this goal would mean avoiding over 6,000 tons of particulate matter emissions and nearly 27,000 tons of VOC emissions every year. With relatively small initial investments in projects like those featured in this section and diesel emission reduction efforts described on page 48, the MPCA and our CAM partners have taken important first steps toward our goal.

CAM and the MPCA have so far implemented smaller-scale projects that reduce emissions and exposures. These projects have helped us better understand which types of efforts are most effective at lowering emissions and which achieve the most emissions reductions for each dollar spent. These projects have paved the way for scaling up to larger efforts that will achieve even greater emissions reductions.

## What we're doing about it

Voluntary programs and outreach campaigns are important tools to cut emissions from these smaller sources. Voluntary programs can offer flexibility for businesses and individuals to reduce emissions in ways that are most efficient and cost-effective for them. For this reason, they are often less expensive and more cost-effective for both the MPCA and businesses or individuals. Voluntary programs also provide opportunities for small businesses to reinvest in their operations by upgrading equipment, adopting more sustainable practices, and being better neighbors and employers.



### **Air Mail: Communicating about air quality**

In 2014, the MPCA launched a newsletter called *Air Mail* to improve communication about air quality in Minnesota and the work of the MPCA and our partners. *Air Mail* provides quarterly updates on air quality news from around the state. The MPCA also sends bulletins on single topics to the subscriber list to provide timely announcements on important regulatory requirements, events, and grant opportunities. To subscribe to *Air Mail* and read past issues, visit the MPCA's website: [www.pca.state.mn.us/airmail](http://www.pca.state.mn.us/airmail)



### **Small business VOC reductions**

Every day, employees at facilities around the state breathe in fumes from chemicals that contain VOCs. Released to the outdoors, VOCs also react with other pollutants to form ground-level ozone and particulate matter. VOC emissions can be reduced by using different chemicals in industrial processes and upgrading to low-emitting equipment. Many small businesses might like to upgrade their equipment and change their chemicals and fuels to protect the health of their employees and neighbors, but don't have the ability to pay for upgrades or retraining employees on new equipment and processes. To help businesses take the leap and improve their environmental stewardship, the MPCA and its CAM partners (the City of Minneapolis, Minnesota Technical Assistance Program (MnTAP), and Environmental Initiative) offer grants, loans, and trainings for small businesses.

In 2014 and 2015, 13 small businesses received grants from the MPCA to upgrade their equipment, 10 participated in the Minneapolis Green Business Cost Sharing Program to convert to cleaner technology, and MnTAP offered three "virtual painting" trainings to teach best practices that reduce paint waste. The

MPCA and its partners targeted funds and outreach to businesses located in areas of environmental justice concern to help reduce exposure to harmful VOCs for people in those neighborhoods.

### Targeting outreach and programs in environmental justice areas

In communities of potential concern for environmental justice, the MPCA is increasing outreach and assistance to reduce air pollution that could affect already overburdened areas. These communities have often had less access to decision-makers and less of a voice in decisions that impact their health. To help address some of these disparities, the MPCA takes extra steps to reach out to members of these communities about upcoming decisions and to let them know about opportunities for funding and programming to help reduce air pollution in their areas.

For example, the MPCA uses ethnic newspapers and foreign-language media to advertise its grant program to help small businesses reduce VOC emissions, and gives businesses located in areas with high concentrations of residents with lower incomes or in communities of color special consideration in selecting grantees. Minnesota GreenCorps is a program coordinated by the MPCA that places members with organizations around the state to address environmental issues, including air quality. In selecting host organizations and projects for GreenCorps, the MPCA gives priority consideration to proposals for work in areas where environmental justice is a concern. Staff members do additional targeted outreach for both the MPCA's Environmental Assistance Grants and the EPA's Collaborative Problem Solving Grants to organizations serving these communities. The MPCA also participates in events and forums in communities presenting information about its work.

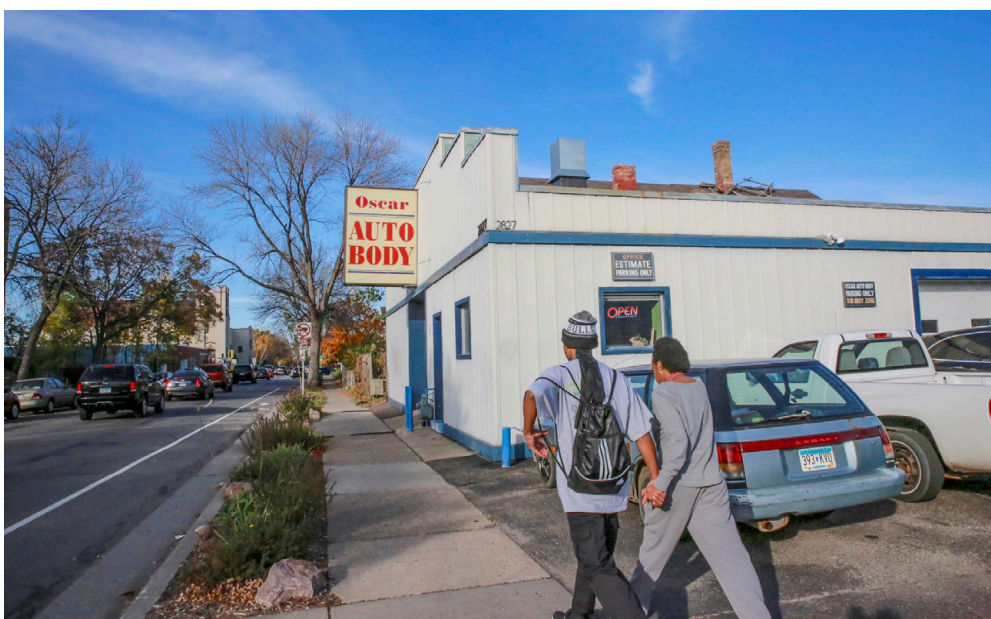
Building on the success of the 2014 and 2015 grants, in 2016 and 2017 the MPCA will award \$160,000 in grant funding to small businesses, for projects that will cut 9 to 10 tons of VOCs every year. This grant round will continue to target emissions reductions in areas of environmental justice concern.

After analyzing data from the last grant round, the MPCA has identified certain industries and projects that are particu-





larly effective at reducing significant amounts of pollution per dollar spent. The MPCA is also stretching its dollars through an innovative pilot project that partners directly with a parts-washer supplier to help switch small businesses that are currently using solvent-based parts washers, which emit a lot of VOCs, to water-based parts washers. The MPCA believes this strategy will be an even more cost-effective way to reduce emissions. This project could change the way we do business moving forward and allow these efforts to be scaled up effectively.



### Spotlight on Oscar Auto Body

Oscar Auto Body of Minneapolis recently purchased a new paint booth that allowed them to switch from using a VOC-emitting, solvent-based paint to a water-based paint through the help of a diverse partnership including financial assistance from the MPCA and City of Minneapolis along with technical help from Environmental Initiative and MnTAP. This project reduced the shop's VOC emissions by about 570 pounds per year, which is especially important because the shop is in a residential area of the Whittier community, one of the most populous and diverse neighborhoods in the state, and sits along the busy Midtown Greenway cycling and pedestrian path. Reducing their VOC emissions is better for business and lets the employees, the residents of Whittier, and the several thousand people that bike and walk along the Midtown Greenway each year breathe easier.





## Residential wood smoke

Smoke from burning wood contains particles and toxic chemicals that can be hazardous to human health. These emissions can be particularly harmful because people are often very close to the source of the smoke, whether it's a backyard fire wafting over to a neighbor's yard or sitting close to a fire for warmth. Being close to the source means people breathe a lot of pollutants directly into their lungs before the pollutants dissipate in the air.

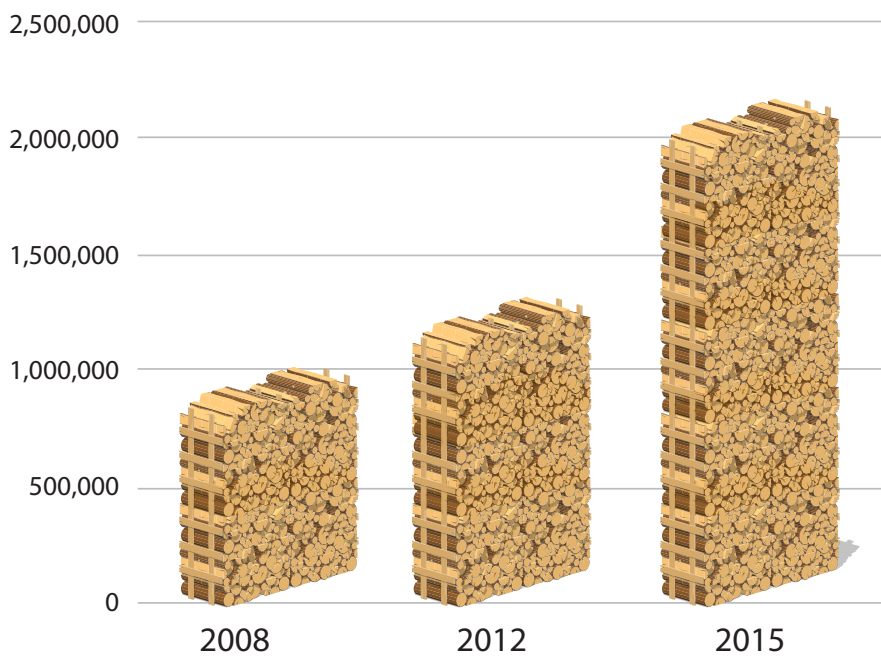
A 2015 survey conducted by MPCA in partnership with the Minnesota Department of Natural Resources and the U.S. Forest Service shows emissions from residential wood burning continue to increase in Minnesota as more wood is burned for home heating and in residential backyard fire pits.<sup>6</sup>

As past surveys have found, in the Twin Cities metro area, most people who burn wood do so simply for enjoyment, while in Greater Minnesota most people burn wood for heating. Emissions from many other sources of particulate pollution are going down, but residential wood burning has been rising.

Minnesota's current residential wood-burning equipment produces substantially more air pollution per cord of wood burned than would occur by heating with gas, oil, or newer, more efficient wood stoves. To lessen the air pollution impacts of newly manufactured residential wood heating equipment, EPA established

new standards for wood boilers (hydronic heaters), wood stoves, and other wood-burning heating equipment. These new standards will require new wood-burning devices on the market to operate more efficiently and produce less particle pollution. These EPA standards do not affect existing appliances in Minnesota homes, but over time, as existing residential wood heating appliances are replaced with newer models, the emissions from wood heating should go down.

Estimated cords of wood burned annually in Minnesota



6. See Wilder Research (2015). Minnesota Residential Wood Fuel Use. Minnesota Residential Wood Fuel Survey: Results from 2014-2015 Survey. (<https://www.pca.state.mn.us/sites/default/files/aq-ei4-46.pdf>).

# Woodsmoke: Not all fires are equal

Pounds fine particles per MMBtu heat output



## How can you help reduce the impacts of wood smoke?

- Burn only well-seasoned, dry wood. Better yet, switch to natural gas or propane.
- If you use your own firewood, split it so it can dry better.
- Cover stacked wood to keep it dry.
- Avoid having recreational fires on bad air days.

### Project Stove Swap

To encourage use of cleaner-burning equipment, Clean Air Minnesota partners Environmental Initiative and Minnesota Power are coordinating with the MPCA on Project Stove Swap, a wood heater change-out initiative that provides financial incentives for residents and businesses with older, dirtier wood-burning equipment to purchase new, cleaner wood-burning equipment that meets the new EPA standards, or gas equipment that is Energy Star certified. Swapping out just one old, outdated wood stove used to heat a home all winter for a new, more efficient model reduces particulate emissions by the same amount as removing over 700 cars from the road. The funding will help change-out at least 130 wood-burning appliances, and 20% of the funds will be targeted specifically at low-income individuals. For more information, visit <http://www.environmental-initiative.org/our-work/clean-air/project-stove-swap>.



The MPCA and our Clean Air Minnesota partners are collaborating to reduce exposure to air pollution from wood burning. In response to citizen complaints about wood smoke, the MPCA worked with local governments to develop model zoning and nuisance ordinances that local governments can customize and adopt to address both nuisance and health concerns stemming from the smoke emitted by outdoor wood boilers.<sup>7</sup>

To encourage the use of cleaner burning equipment and alternative fuels, the MPCA assisted Clean Air Minnesota partners, the Minnesota Department of

7. See <https://www.pca.state.mn.us/air/problems-and-complaints>



Health and the American Lung Association, in developing an education campaign to motivate emission reductions by explaining the negative health impacts of wood smoke and promoting cleaner alternatives. The campaign developed educational bookmarks, radio ads, bus ads, and billboards.

## Increasing awareness of bad air days

Most days in Minnesota the air is clear and healthy for most people to breathe. However, on some days, factors such as weather and wild fires can combine to cause bad air days. On these days, the air can be unhealthy for some people, especially those who are particularly vulnerable to the effects of air pollution. Through coordinated outreach and education, the MPCA and its partners are working to promote awareness of the MPCA's air alert system and increase the number of people and organizations receiving air alerts. The effort also aims to help educate people on what they can do to avoid exposure to unhealthy air and reduce their contributions to air pollution.



The Air Aware Employer Partnership is a program for employers committed to raising awareness of air quality and its health effects. Employers sign up to receive air quality alerts, which they pass on to their employees along with tips on reducing emissions and avoiding exposure on bad air days. The Minnesota Department of Transportation has also committed to including air quality messages on its traffic signs when air alerts or advisories are in effect. To become an Air Aware Employer, visit <http://www.beairawaremn.org/employer-pledge>.



## Air pollution from vehicles and heavy-duty diesel equipment

Most vehicles and equipment, such as that used for construction or agriculture, may not pollute much individually, but together they emit more air pollution in Minnesota than all of our permitted facilities combined. The federal government regulates the fuel efficiency and tailpipe emissions of new vehicles, as well as the makeup of the fuel they burn. These efforts have been steadily reducing vehicle emissions over the past 40 years. Emissions of particulate matter and nitrogen oxides from new diesel vehicles have greatly improved, and removing lead from gasoline and most of the sulfur from diesel fuel have greatly reduced the levels of these pollutants in our air.



Pollution from vehicles is an important environmental justice concern. A 2015 study by MPCA researchers found that while communities of color and lower socio-economic status tend to own fewer vehicles, do less driving, and use public transit more often than other groups, they are also exposed to higher levels of traffic-related pollution. This is because busy roadways, and their associated air pollution, often run through communities of color. Many communities of color therefore bear a disproportionate burden of traffic-related health impacts while contributing less to vehicle pollution.

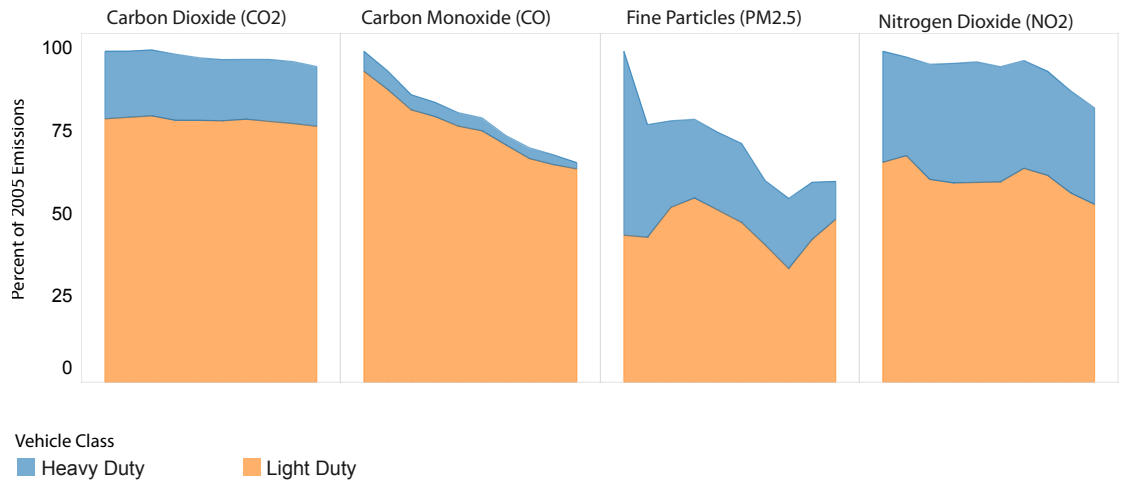
Despite new cars, trucks, and equipment operating more efficiently, much still needs to be done. On-road vehicles emit nearly a quarter of all air pollution in the state, and they continue to be a primary source of pollution that we are exposed to every day.

### How we're doing

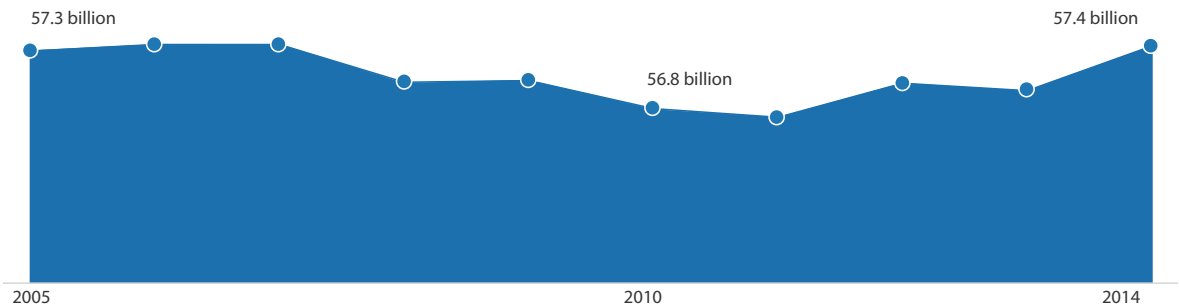
Federal vehicle regulations have been making steady progress in reducing emissions from both light duty and heavy-duty vehicles. Pollution-control requirements have had a big effect on reducing emissions of carbon monoxide, fine particles, and nitrogen dioxide, but so far have had less effect on carbon dioxide.



## Emission trends in Minnesota for major vehicle-related pollutants 2005 to 2014



## Trend in vehicle miles traveled in Minnesota from 2005 to 2014



Source: Minnesota Department of Transportation

But federal vehicle regulations cannot reduce vehicle emissions alone. These regulations are slowed in reaching their full impact by the driving and buying patterns of consumers. Minnesotans' driving and vehicle-purchasing patterns depend a lot on the strength of the economy and the price of gas. During the Great Recession (2007-2009), the price of gas was high and Minnesotans drove less. In recent years, as the economy has recovered and the price of gas has dropped, we have begun to drive more.

During the recession, many families delayed the purchase of a new vehicle, keeping less efficient vehicles on the road long after new standards came into effect. In 2014, the statewide average age of passenger vehicles was about nine years — two years older than the average in 2005.

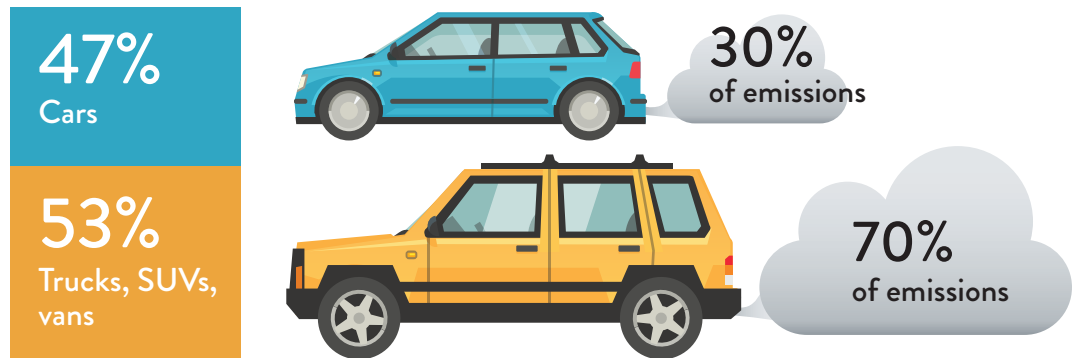
An important trend impacting vehicle emissions in Minnesota is the number of cars on the road versus sports utility vehicles (SUVs), crossovers, and pickup trucks, which pollute more per mile traveled than smaller, lighter cars. In 2011, the number of crossovers, SUVs, and trucks surpassed the number of cars on the



road in Minnesota and became the majority of the passenger fleet. Today, these heavier vehicles make up over 53% of all passenger vehicles and emit 70% of the passenger-vehicle related pollution. Changes in consumer trends such as these are slowing Minnesota's progress toward reducing vehicle emissions.

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**Heavier vehicles such as trucks, SUVs, and vans now make up the majority of passenger vehicles.**



Even more than cars, heavy-duty diesel vehicles and equipment can last for years, even decades. So even though recent federal regulations have made diesel engines much cleaner than they used to be, it can take a long time for the older, dirtier equipment to be retired and replaced with cleaner options. The MPCA and its partners work to encourage owners of diesel vehicles and equipment to retrofit or upgrade their engines. The combined efforts of the MPCA Clean Diesel Program and Project Green Fleet have reduced fine-particle pollution from diesel emissions equivalent to taking 750,000 cars off the road since 2006.

The MPCA works with partners around the state to achieve a cleaner transportation system. Minnesotans can also do a lot individually to reduce our contributions to vehicle air pollution by taking actions such as choosing to walk or bike for shorter trips or considering gas mileage when purchasing a vehicle.

### **What we're doing about it**

Vehicles are one of the largest sources of air pollution in Minnesota and they pose a particular challenge for the MPCA and our partners. Minnesota must rely on the federal government to set fuel-efficiency and fuel-type standards and requirements on vehicle manufacturers and refineries. Vehicle-related emissions are reduced when Minnesotans drive less and operate more efficient vehicles. Much can be accomplished locally to reduce emissions by developing necessary infrastructure for public transit and electric vehicles, designing our roadways to reduce congestion, and structuring our communities to make it easier for people to walk and bike rather than drive.



### What you can do to reduce vehicle emissions

- Drive less: choose to walk or bike to nearby destinations.
- Commute to work on public transit a few days a week.
- Prioritize fuel efficiency when choosing a new vehicle.
- Link errands and other necessary trips.
- Avoid idling.
- Keep tires inflated to vehicle manufacturer's recommended levels.

## Regional planning

The MPCA serves as an advisor and technical resource for a wide range of transportation planning and funding efforts across the state to ensure that transportation planning in Minnesota supports air quality improvements. Transportation planning can have a big impact on vehicle emissions by promoting investment in infrastructure that supports alternative modes of transportation and by developing roadways and traffic controls that reduce congestion and idling. The MPCA works closely with the Minnesota Department of Transportation, the Twin Cities Metropolitan Council, local governments, and others to ensure that plans for transportation investments will not cause or contribute to violations of the national air quality standards and that they work toward our mutual goals of reducing congestion and improving air quality.

Cars that are idling or get stuck for long periods of time in congestion burn more fuel and emit more pollution. Vehicles such as trains, buses, and carpools that carry multiple passengers reduce the amount of emissions per person per trip and also reduce overall congestion by reducing the number of vehicles on the road. The MPCA works with its regional partners to develop innovative ways to lower the number of vehicles on the road. Programs that make more efficient use of the regional transportation system such as encouraging flexible work hours, telecommuting, and ridesharing reduce the number of vehicles at peak travel times.

Walking and biking create no emissions. The MPCA works with our transportation planning partners to encourage land-use planning that provides the opportunity for people to live within walking or biking distance of the places they need to get to every day — work, shops, schools, parks, and transit stops. Planning mixed-use development allows people to live where they work, shop, and play.

## Diesel trucks and equipment

Diesel engines are the workhorses of our economy because of their power, efficiency, and longevity. However, older heavy-duty diesel vehicles and equipment can produce massive amounts of harmful air pollution, while modern equipment and engines are much cleaner and can drastically reduce emissions. A modern diesel truck produces over 97% less fine particulate matter than an old truck. Diesel equipment can last for decades, though, so it can take a long time for the older, dirtier equipment to be retired and replaced with cleaner options. Diesel emissions are a particular concern, too, because of their toxic properties (see page 12).

According to the EPA, diesel retrofits, “repowers,” and replacements are some of the most cost-effective methods for reducing air pollution and gaining health benefits. However, small businesses often don’t have the up-front funds to invest in a new vehicle or piece of equipment.

For this reason, the MPCA offers grants to offset part of the cost of replacing and retrofitting diesel vehicles and heavy-duty equipment. Grants can make it afford-



According to the EPA, diesel retrofits, “repowers,” and replacements are some of the most cost-effective methods for reducing air pollution and gaining health benefits.

able for small businesses to upgrade their equipment, and the substantial emission reductions benefit the health of all Minnesotans.

Since 2006, the MPCA Clean Diesel Grants Program has leveraged state and federal funds and partnered with Environmental Initiative, a Clean Air Minnesota partner, on Project Green Fleet to reduce diesel emissions across the state. Among other diesel retrofit efforts, Project Green Fleet used state and private funding to retrofit all 3,108 eligible school buses in Minnesota, drastically reducing the exposure of children to harmful fine particles by 20 to 25%. The combined efforts of the MPCA Clean Diesel Program and Project Green Fleet have supported approximately 4,700 engine improvements or replacements in Minnesota to help eliminate 45 tons of fine-particle pollution per year.

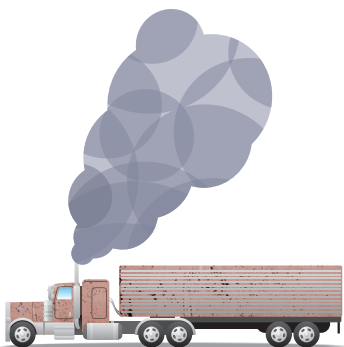
Through Project Green Fleet, the MPCA and its partners have made significant strides in upgrading diesel trucks across the state and are now specifically targeting construction equipment for upgrades. Diesel construction equipment can be especially old and dirty, and often operates 24 hours a day near homes and businesses during a construction project.

In the last two years, MPCA has replaced 12 heavy-duty diesel engines and will be doing even more with increased funding from EPA in 2017. For 2017, MPCA has \$400,000 in federal grant funding for diesel-emission reduction projects. MPCA is working to spread the word in hopes of attracting a mix of both on-road diesel vehicles and off-road diesel equipment such as construction equipment, boats, and rail equipment.

Minnesota will have \$43.6 million available over a 10-year period from Volkswagen as part of the national lawsuit to address VW’s emission-control violations. Minnesota will be able to use these funds for projects to replace and retrofit diesel

## One old truck can pollute more than 30 new diesel trucks

Depending on factors such as the age of the truck, how far it travels, and how much it idles, one old diesel truck can produce as much particle pollution as 25-50 modern trucks under the same operating conditions.



**vs.**



vehicles and develop electric-vehicle infrastructure to mitigate damage done to the state's air quality due to the violations. The MPCA will convene a group of stakeholders to help determine how these funds should be used, and will focus investments in areas most impacted by and most vulnerable to the excess emissions from VW vehicles. The MPCA expects learn more about the implementation timeline and other program details in early 2017.

See the MPCA Clean Diesel web pages ([www.pca.state.mn.us/cleandiesel](http://www.pca.state.mn.us/cleandiesel)) for more information on our clean diesel work.

### Spotlight on Caledonia Haulers



Driver Dan Hund with Caledonia Haulers poses with their new tanker truck near a dairy farm in Southern Minnesota. *Photo by Dale Heintz, Land O'Lakes.*

This is not your grandpa's milk truck — this class-8 truck has a 6,500-gallon milk tank and picks up milk from several large dairy farms in southern Minnesota. The milk is then delivered to the metro area to be processed at Dean Foods for use in Land O'Lakes dairy products. Caledonia Haulers received a grant from MPCA's Clean Diesel Program in May 2015, which helped fund 25% of the new truck cost.

The new truck is much cleaner than its predecessor, reducing emissions in the Twin Cities and all along its route. Based on EPA estimates, Caledonia Haulers' new truck—compared with their old one—will reduce fine-particle emissions by 97%, NO<sub>x</sub> by 80%, and carbon dioxide by 3.6%.

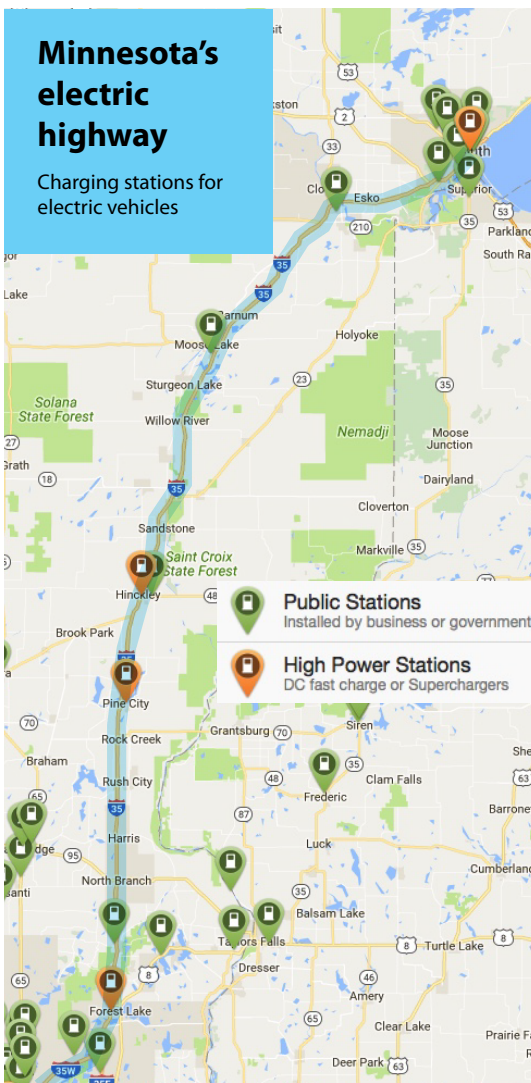
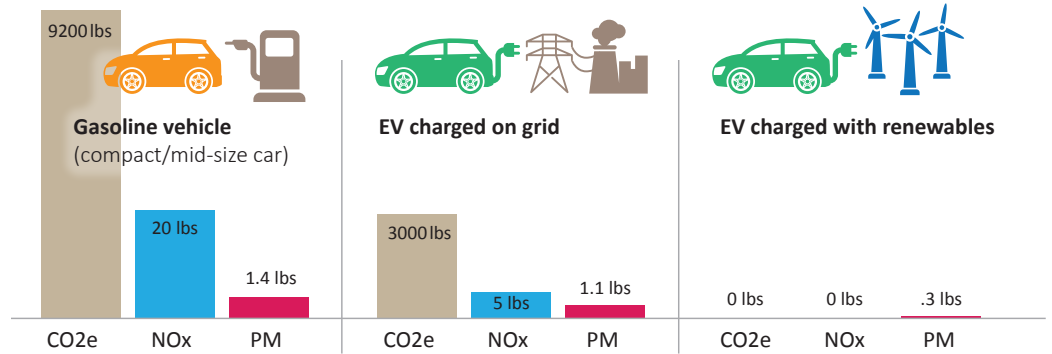
After 9 months and 113,000 miles, Dan Hund still loves driving the new truck. And Caledonia saves on fuel costs and maintenance — more than \$11,000 in the first year alone. Clean diesel projects mean savings for businesses and air pollution reductions that benefit all Minnesotans.



## Electric vehicles

The newest generation of electric vehicles (EVs) offers a promising opportunity for reducing pollution from vehicles. Battery-powered, plug-in EVs have no tailpipe emissions. Especially in communities with busy roadways, replacing many gas-powered cars with EVs could significantly improve local air quality.

### Annual vehicle emissions by fuel type (12,000 miles)



Even EVs charged on Minnesota's electric power grid produce less emissions than standard gas-powered cars, and as the electric grid gets cleaner and more efficient and relies more on renewable energy, EVs cause an even bigger reduction in vehicle emissions. EVs charged with renewable energy, such as wind or solar, are zero-emitting vehicles.

The MPCA partners with Drive Electric Minnesota (a partnership of Minnesota EV champion organizations), local governments, and others to build public charging stations and other electric-vehicle infrastructure to make it easier to use these lower-emitting cars.

Fast chargers installed near highways, at 30- to 50-mile increments, create "electric highways" which allow EV drivers to travel longer distances.

The first electric highway in Minnesota supports EV travel along I-35 from the Twin Cities metro area to Duluth. Future extensions of this route beyond Duluth along the north shore of Lake Superior will allow electric cars to reach popular tourism destinations.

The MPCA is working with its transportation partners and neighboring states to develop electric highways along major travel corridors throughout the state and around the region.



## High-emitting vehicles

We have all seen and smelled vehicles on the road that spew smoky plumes from their tailpipes. Federal vehicle standards have greatly improved vehicle efficiency and reduced the amount of pollution they produce. However, if pollution control devices on a vehicle break, that vehicle can produce a disproportionate amount of pollution.

One recent study from the University of Toronto<sup>8</sup> found that 25% of the worst-polluting passenger vehicles may emit up to 90% of vehicle-related air pollution.

Often emission controls on these higher-emitting vehicles are not repaired because their owners cannot afford to make the needed repairs. The vehicles are also, therefore, more frequently driven in low-income neighborhoods. These vehicles are one of many factors that contribute to disproportionate vehicle emissions in communities of low-income and people of color. To help address this inequity, the MPCA is partnering with Environmental Initiative, the Lift Garage, and Cars for Neighbors on a pilot program to bring free emission-control repairs to low-income Minnesotans. The project will track emission reductions and cost effectiveness, and if the results are positive, the MPCA hopes to grow the program to repair even more vehicles across the state.

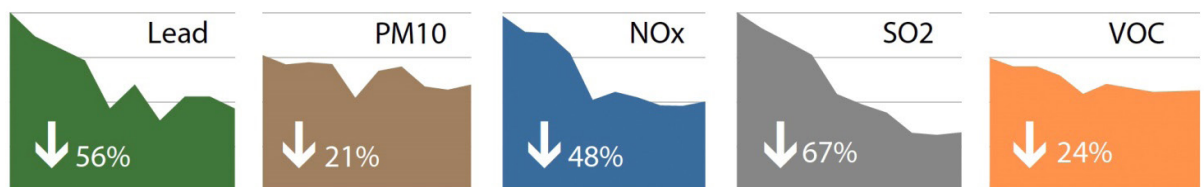
## Air pollution from industrial facilities

Large facilities with smokestacks, such as factories and electric generating units, must apply for and comply with air pollution permits issued by the MPCA. Permitted facilities still make up 22% of the total emissions in the state, but they have achieved significant reductions in the past 20 years.

### How we're doing

National and local efforts to reduce pollution from industrial facilities, electric utilities, and other large facilities have made significant improvements in our environment since the passage of the Clean Air Act in 1963. These reductions are largely due to government and industry efforts to reduce smokestack emissions. The Clean Air Act brought about these major emissions reductions by requiring process changes, new equipment, and pollution control devices.

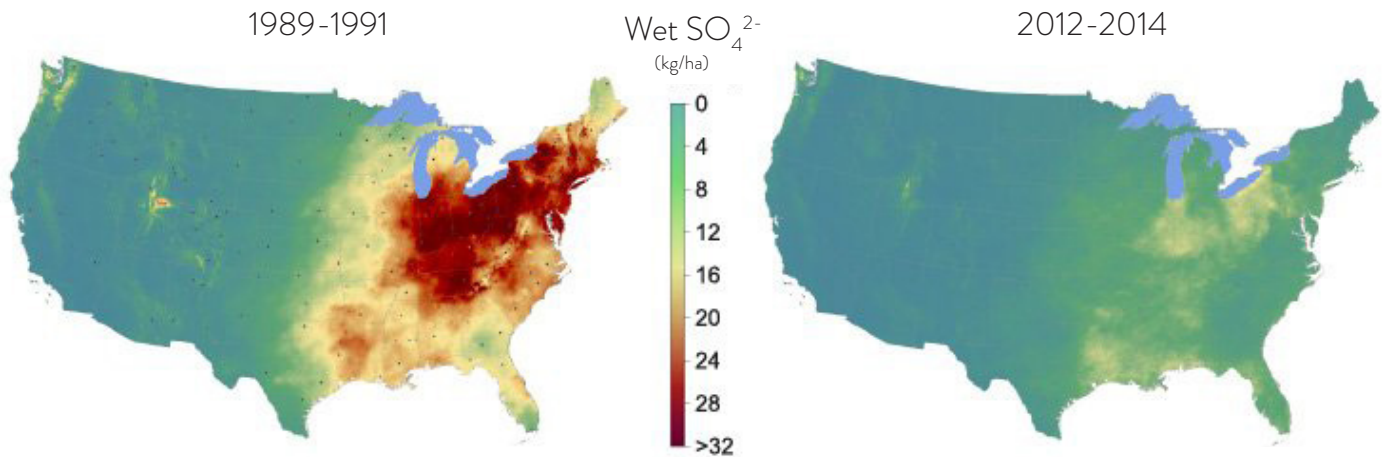
Point source emissions 2005–2014



8. J. M. Wang, et al. "Plume-based analysis of vehicle fleet air pollutant emissions and the contribution from high emitters" (<http://www.atmos-meas-tech.net/8/3263/2015/amt-8-3263-2015-discussion.html>)

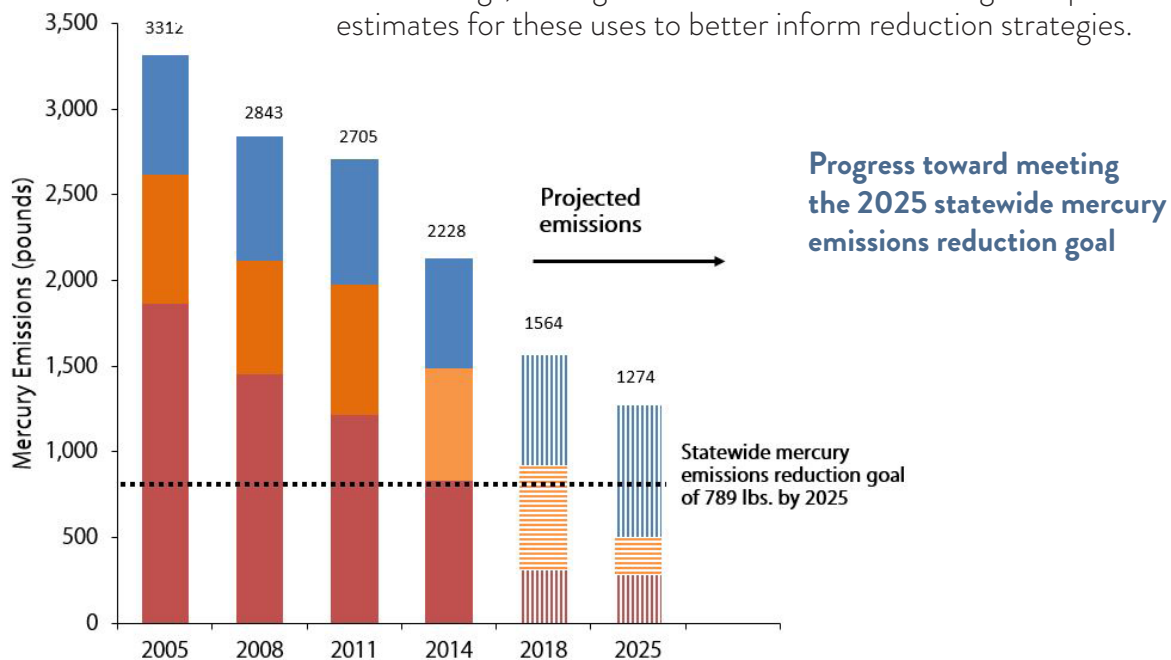
For instance, acid rain was a major environmental problem in the 1980s and 1990s, but with the national implementation of the Acid Rain Program to reduce emissions of pollutants that cause acid rain, it has become a much less severe problem in this country. From 1981 to 2015, wet sulfate deposition, a key measure of acid rain, decreased by nearly 70% in Minnesota.

### Three-year wet sulphate deposition



Source: EPA 2016

In recent years, both the MPCA and EPA have increased focus on reducing mercury air emissions. Both Minnesota and EPA require mercury reductions from power plants. Additionally, the MPCA developed a plan to meet water-quality standards by reducing mercury emissions released into the air. Despite significant mercury reductions from some sectors, the MPCA projects it will not meet the 2025 statewide mercury emissions reduction goal. Emissions from the Products sector category are holding steady or even increasing. Products that contain mercury include fluorescent lights, certain switches, thermometers, and “silver” dental fillings, among others. The MPCA is working to improve the accuracy of its estimates for these uses to better inform reduction strategies.



## What we're doing about it

The MPCA continues its long-standing work to reduce air pollution from stationary sources. Traditional regulatory activities such as permitting, compliance, and enforcement are well suited to reduce emissions from large stationary facilities such as mining operations and power plants. The MPCA and, at the federal level, the EPA work to review and update rules that govern these facilities as both the science to understand pollutants and the technology to control them advance. Some of these new rules, efforts, and points of emphasis are highlighted here.

### How do MPCA air permits improve air quality?

Air quality permits are an important tool to control pollution from traditional air pollution sources like factories and electric utilities. The goal of an air quality permit is to protect human health and the environment by ensuring large sources of air pollution properly install, operate, and maintain pollution-control equipment.

Individual operating permits compile the requirements related to control equipment into one document to ensure compliance with air pollution law, reduce violations, and improve enforcement. Some types of air pollution controls can reduce pollution from a source by over 99%.

For example, permits require that facilities:

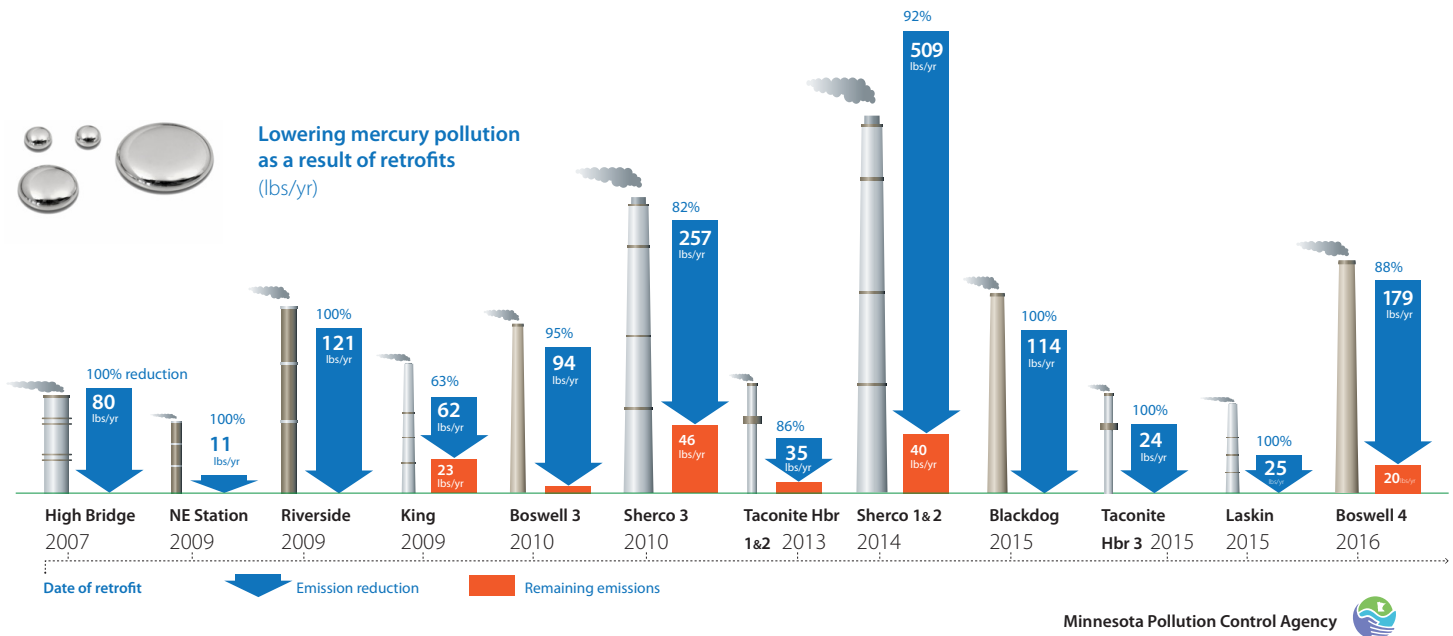
- Always operate pollution-control equipment when the process it is controlling is operating.
- Conduct daily monitoring of control equipment to make sure it is working properly.
- Conduct periodic inspections of the integrity of the control-equipment components.
- Operate and maintain control equipment according to the manufacturer's specifications.
- Test the efficiency of control equipment to ensure it is achieving the control needed.

## Reducing mercury in our air and water

Mercury exposure can harm organs and the nervous system in people and mammals. Minnesota has led the nation in efforts to reduce mercury air emissions. Since 2006, state statutes and MPCA rules, along with national emissions standards for mercury and air toxics from coal-fired utility boilers, have resulted in mercury reductions.

## Power plants: a mercury reduction success story

In December 2015, with the startup of new pollution control equipment at Minnesota Power’s Boswell Energy Center power plant in Northern Minnesota, Minnesota utilities achieved a major milestone: full compliance with Minnesota’s Mercury Emissions Reduction Act of 2006. This statute required and set a schedule for the largest coal-fired boilers in Minnesota to reduce mercury emissions by 90% from 2005 levels. The schedule, and reduction, placed Minnesota’s utilities at the forefront of the nation in achieving mercury reductions, well ahead of the schedule for and to a larger degree than EPA’s Mercury and Air Toxics Standard. The changes made at these facilities for reducing mercury emissions also resulted in major reductions of other pollutants. Sulfur dioxide emissions from power plants have been reduced by 80% and nitrogen oxides have been reduced by 76% in the same timeframe.



Minnesota’s statewide mercury emissions reduction plan was developed to reduce levels in our waters and protect people from consuming mercury-contaminated fish. All of the waters in the state will benefit from the statewide mercury reduction implementation plan. However, not all waters respond the same to reduced emissions. About 10% of the waters in Minnesota will make significant progress toward the goal, but will not reach it. An additional plan is needed to deal with these waters that are still high in mercury despite lower emissions. Efforts are underway to research why mercury is processed differently in these waters.

To meet the emissions reduction goal, the MPCA adopted a new set of rules in 2014 for sectors that emit mercury. Facilities with mercury emissions over a threshold amount must develop reductions plans and submit an annual mercury emissions inventory. When this rule was finalized, the MPCA estimated that 17 facilities would need to complete mercury reduction plans. Since 2014, many facilities retested their emissions and made changes to reduce emissions, resulting in only two facilities having to submit plans to meet the 2015 deadline. The next set of reduction plans, for taconite mining, are due in December 2018.

## How can you help reduce mercury air emissions?

- Properly recycle compact fluorescent light (CFL) bulbs. Switch to LEDs when possible.
- Ask your dentist about using composite if you need a filling.
- Ask your utility if it uses natural gas and renewable sources to generate electricity.

Mercury reductions plans are posted on MPCA's mercury webpages at [www.pca.state.mn.us/quick-links/plan-reduce-mercury-releases-2025](http://www.pca.state.mn.us/quick-links/plan-reduce-mercury-releases-2025).

In 2012, EPA adopted the Mercury and Air Toxics Standard (MATS), limiting mercury, acid gases, and other toxic pollution from existing coal- and oil-fired power plants. The standards for new power plants were updated in March 2013 and require substantial reductions by 2016. These standards will not only reduce emissions of toxic pollutants, but also of fine particles, sulfur dioxide, and nitrogen oxides. The MATS rule is expected to achieve significant health benefits. Estimated reductions of sulfur dioxide, mercury, and fine particles could save Minnesota an estimated \$880 million to \$1.6 billion annually in avoided health costs.<sup>9</sup>

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### Mercury in dental fillings

In addition to reducing mercury emissions from sources such as power plants, the MPCA works to address mercury emissions from smaller, more diffuse sources. One source of particular interest is the continued presence of mercury in dental amalgam (“silver dental fillings”). Mercury fillings become a concern in the cremation process when the mercury is vaporized and released into the air.

The MPCA partnered with the University of Minnesota, local funeral directors, and the Department of Health to quantify how much mercury is emitted from cremation of dental fillings in Minnesota.<sup>10</sup> The study found that cremation produced 95 pounds of mercury emissions. This is less than originally predicted, but it is still a concern because this number is expected to increase as cremation continues to become more popular in Minnesota.



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### Clean Power Plan

In 2015, the EPA finalized the Clean Power Plan, which requires states to draw up plans for reducing emissions of CO<sub>2</sub> from coal- and gas-fired power plants, currently the nation's largest single source of CO<sub>2</sub> emissions. The rule provides states with a great deal of flexibility in determining how to meet emission reduction targets, including making existing plants more efficient, transitioning from coal- to gas-fired plants, relying more on renewable energy, and reducing energy demand. Minnesota has already made great strides in transitioning to cleaner energy, and is well on its way toward meeting the rule's requirements.

States were originally expected to submit final plans to EPA no later than September 2018, but on February 9, 2016, the U.S. Supreme Court temporarily halted implementation of the Clean Power Plan while legal challenges to the rule are decided. In response to the lawsuit against EPA, Minnesota, along with 24 other states, municipalities, and the District of Columbia entered the lawsuit in

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9. See <https://www.epa.gov/mats/healthier-americans>

10. Myers, Sandra, “Quantifying Mercury Emissions Resulting from the Cremation of Dental Amalgam in Minnesota,” 2015 (<https://www.pca.state.mn.us/sites/default/files/aq-ei2-07a.pdf>)



support of EPA and the Clean Power Plan. Governor Dayton also committed Minnesota to continuing its clean energy initiatives and working to develop a plan that will be best for all Minnesotans.

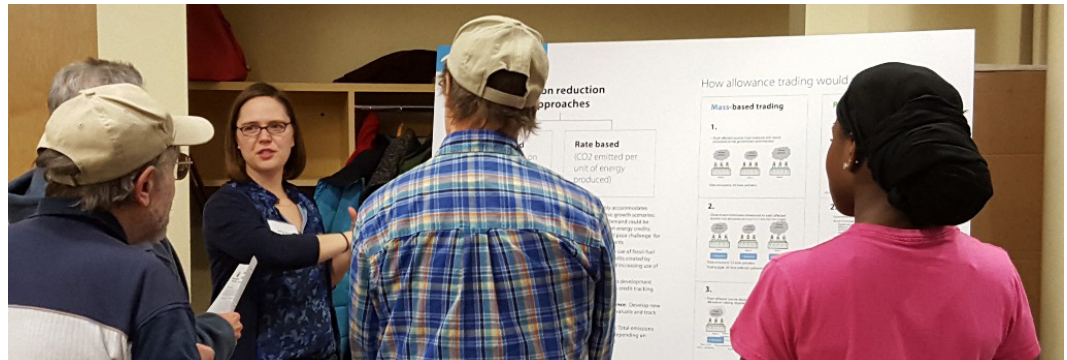
While the case works its way through the courts, the MPCA has taken time to hear from Minnesotans on what is important to them in the development of the Clean Power Plan for our state. In early 2016, the MPCA held eight listening sessions around the state to hear from Minnesotans on what matters most to them as the state moves toward its clean energy future. The MPCA continues to talk with stakeholders to assess technical information and understand how Minnesota's current energy planning supports the Clean Power Plan and the Next Generation Energy Act. We are also working with our partners to explore ways to help Minnesotans transition from current energy-sector jobs to the clean-energy jobs to take advantage of opportunities from the clean energy infrastructure being developed across the state. The agency is now working to understand how the state can both avoid possible disproportionate impacts on vulnerable communities and bring the benefits of clean energy to communities that have historically not had access to clean energy opportunities. The MPCA's current work aims to ensure that Minnesota is well-positioned to respond to any possible outcomes when lawsuits on the Clean Power Plan are resolved and supports efforts to meet the state's broader greenhouse gas reduction goals.

To find out more about the Clean Power Plan in Minnesota, visit [www.pca.state.mn.us/cleanpowerplan](http://www.pca.state.mn.us/cleanpowerplan).

### Reduce energy use to reduce air pollution

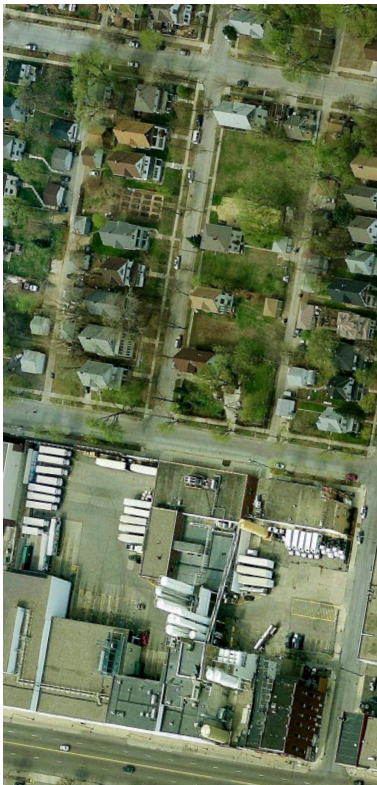
- Use a programmable thermostat to reduce heating and cooling when you are not home. Set home temperature to 68°F in winter and 78°F in summer.
- Replace lightbulbs with energy-saving LEDs.
- Unplug electronics chargers when not in use.
- Turn off lights and electronics when you leave a room.

The MPCA held eight listening sessions around the state to share information about the Clean Power Plan, and hear from Minnesotans.



## Climate Solutions and Economic Opportunities project

Minnesota's Next Generation Energy Act commits the state to cut its annual emissions of greenhouse gases by 80% between 2005 and 2050. While much progress has been made, achieving the 2050 goal will require policies well beyond what is currently in place at the federal or state level. In 2014, Minnesota began the Climate Solutions and Economic Opportunities (CSEO) project. This project analyzed policy options for their potential to reduce greenhouse gas emissions while bolstering Minnesota's economy. CSEO concluded in 2016 and released a report that offers many policy recommendations for Minnesota to be on track to achieve the 2050 goals. Strategies include short-term efforts such as relying



MPCA is working with 12 facilities in areas of concern for environmental justice in Minneapolis to better understand their impact on air quality in the urban core.

more on renewable energy sources and less on coal, and long-term efforts such as infrastructure development that will reduce our reliance on cars. To read the CSEO report, visit [www.eqb.state.mn.us/cseo-report-2016](http://www.eqb.state.mn.us/cseo-report-2016).

## Minneapolis comprehensive air pilot project

The MPCA has started a pilot project to experiment with a more comprehensive and proactive approach to working with facilities we regulate in areas of concern for environmental justice.

Air quality permits address emissions from facilities individually. In recognition of the potentially cumulative impact of neighboring sources of air pollution, the MPCA is working with 12 facilities in areas of concern for environmental justice in Minneapolis to better understand their impact on air quality in the urban core. Through this process, the MPCA will engage industry and the community to identify options for further reducing air pollution.

## Assessing cumulative impacts of air pollution

Our health is affected by many outside factors including multiple sources of pollution and other social conditions and stressors. Some people and communities are burdened by higher levels of pollution and more social stressors than others. When projects or rules are proposed that might affect pollution levels in an area, communities want to know what the cumulative impact of these stressors might be on their health. The MPCA has a range of ways to look at the different effects regulatory activities might have on communities, but these tools vary in their ability to quantitatively estimate impacts. Selecting the right analysis depends on the type of project and the conditions in the community involved.

Environmental rules and statutes related to environmental permitting assess one environmental medium at a time. An analysis for an air permit, for example, would include an assessment of all air pollutants from a facility and surrounding air quality, but there is no requirement to also include an assessment of water quality, soil contamination, or community health unless a larger environmental review analysis is triggered.

Under some circumstances, MPCA considers non-chemical stressors or community vulnerability when evaluating the potential cumulative impacts of a project. Although there currently are no quantitative methods to incorporate non-chemical stressors and community vulnerability into typical regulatory evaluations, this field is growing and some existing evaluations already incorporate these concepts.

The MPCA has had the opportunity to develop a methodology for analyzing and considering cumulative levels and effects as part of the air permitting process through a unique statute in Minnesota directed at a part of South Minneapolis. The MPCA's process screens for pollutants from the facility to determine if they are above levels of potential concern. We then identify possible negative health effects from those pollutants and examine related environmental and community health data. The facility impacts and the contextual environmental and health

conditions of the community are described in the analysis and considered during the permit decision.

As part of this process, the MPCA works to keep community members informed and included in the analysis. Community members are advised of the permit project and asked for input early in the cumulative levels and effects analysis process. They are also encouraged to continue providing input throughout the permitting process. The statute that requires consideration of cumulative levels and effects is unique to Minnesota, and has received national and international attention.

## Silica sand



The pollutants of concern for silica sand operations are related to dust and diesel emissions.

Mining, processing, and transportation of high-quality silica sand used in oil and gas extraction processes is big business in parts of Minnesota. While silica is a very common material found throughout the world, high-quality silica sand deposits are concentrated in southeastern Minnesota and the Minnesota River Valley. Some communities in the region are concerned about the growth of this industry in their counties, towns, and townships.

At the direction of the Legislature, the MPCA is undertaking rulemaking for the control of particulate emissions from silica sand mining projects. This is one of three silica sand rulemakings required by the Legislature. In 2014, the MPCA, Minnesota Department of Natural Resources, and Minnesota Environmental Quality Board convened an advisory panel to provide input to the agencies on developing all three silica sand rules. Panel members represented citizen, local government, and industry perspectives. The panel concluded in 2015, and the MPCA released a second discussion draft of the rule in early 2016. The MPCA anticipates a rule will be proposed in 2017. More information on the rulemaking process is available at [www.pca.state.mn.us/air/mpca-rulemaking-silica-sand](http://www.pca.state.mn.us/air/mpca-rulemaking-silica-sand).

### Silica sand and air pollution

The Minnesota Environmental Quality Board recommends that when permitting a silica sand mine or related facility, responsible governmental units require fence-line air monitoring at the facility.<sup>11</sup>

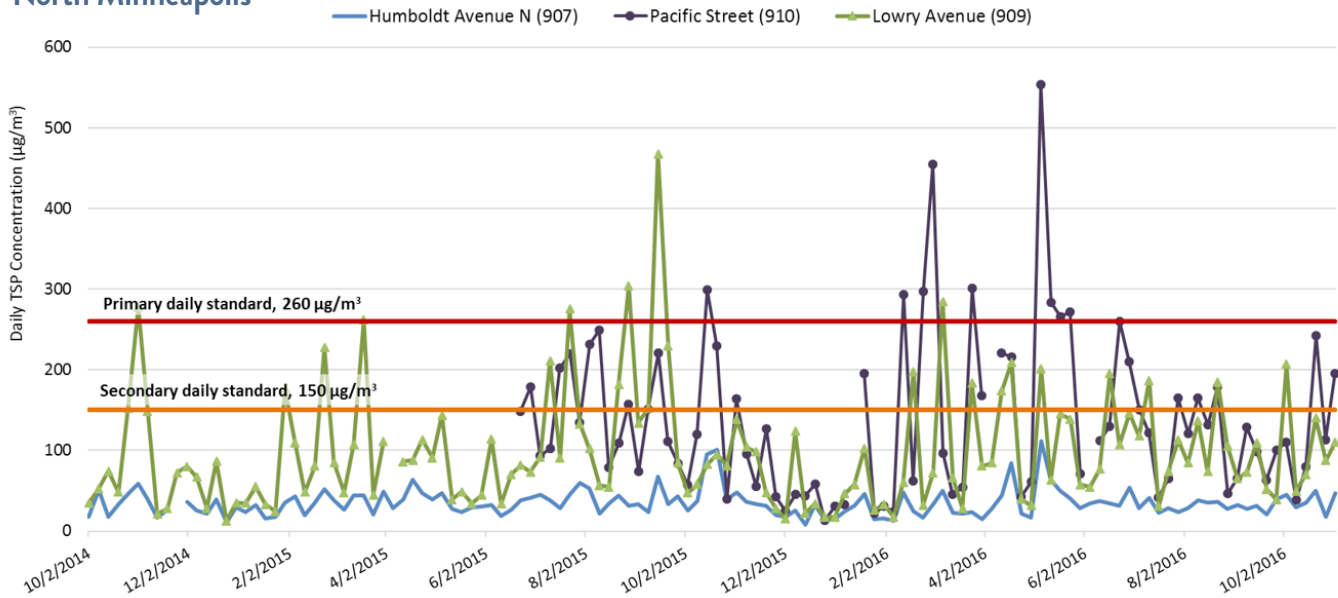
The pollutants of concern for silica sand operations are related to dust and diesel emissions. Facilities are encouraged to measure total suspended particulate (TSP), particulate matter less than 10 microns (PM<sub>10</sub>), fine particles (PM<sub>2.5</sub>), and respirable crystalline silica (PM<sub>4</sub>). To date, three silica sand facilities have conducted air monitoring. Results have been below the chronic health-based value for respirable crystalline silica set by the Minnesota Department of Health. However, the monitors have detected elevated TSP results near one facility. Detailed monitoring results are available at [www.pca.state.mn.us/air/air-monitoring-minnesota-silica-sand-facilities](http://www.pca.state.mn.us/air/air-monitoring-minnesota-silica-sand-facilities).

11. See Minnesota Environmental Quality Board (2014). Tools to Assist Local Governments in Planning for and Regulating Silica Sand Projects. [https://www.eqb.state.mn.us/sites/default/files/documents/Tools%20for%20Local%20Govt%20approved%20March%202019\\_with\\_Errata.pdf](https://www.eqb.state.mn.us/sites/default/files/documents/Tools%20for%20Local%20Govt%20approved%20March%202019_with_Errata.pdf)

## North Minneapolis air quality

The MPCA began monitoring total suspended particulates (TSP) off Lowry Avenue in an industrial area of North Minneapolis in the fall of 2014. In the first six months of operation, the monitor recorded six exceedances of the state TSP standard, violating both the primary (health) and secondary (welfare) state TSP standards. In response, in June 2015, the MPCA installed a second air monitoring site on Pacific Street about a quarter-mile south of the first monitor. These two monitors bookend the Northern Metal Recycling facility and are also located near other industrial facilities that may be sources of particulate matter.

### Exceedances of the state total suspended particulate standards in North Minneapolis



The Lowry Avenue and Pacific Street monitors have shown and continue to show elevated levels of airborne particulate and heavy metals, which are a concern for health and welfare. Measured pollutant levels are significantly higher than other North Minneapolis monitoring sites (such as Humboldt Avenue North, above). When combining air monitoring results with wind direction, it becomes clear that facilities in the area are contributing to the elevated pollution levels. The monitors have identified:

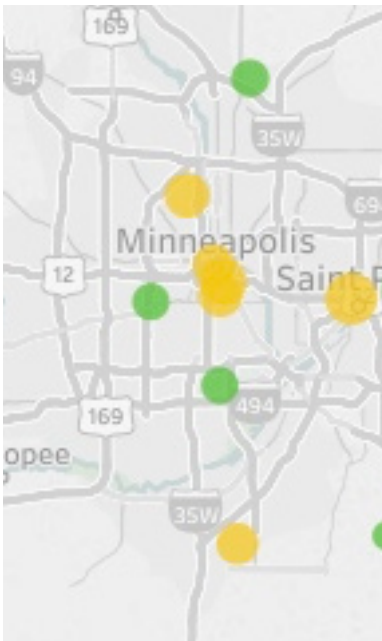
- Violations of the daily and annual TSP standards
- Exceedances of the daily PM10 standard
- Elevated lead concentrations, measured at 80 percent of the national lead standard
- Elevated heavy metal concentrations including chromium, cobalt, and nickel measured above chronic inhalation health-risk guidelines

The MPCA is working to address the elevated air pollution levels in the area surrounding these monitors. This includes working with Northern Metals and other facilities in the surrounding area to identify opportunities to reduce air pollution emissions, continuing monitoring at the Lowry Avenue and Pacific Street sites, and providing timely access to monitoring results at [www.pca.state.mn.us/air/north-minneapolis-air-monitoring-project](http://www.pca.state.mn.us/air/north-minneapolis-air-monitoring-project).



# Innovation

The MPCA's core values include being a data-driven learning organization. This means MPCA staff try to continuously improve how we do business and constantly learn from our past efforts. In many areas, the MPCA is on the cutting edge of efforts nationally to better understand air pollution and its impacts on people and the environment. We also work at improving how we communicate with the public and how we work with the facilities we regulate. The following section highlights just a few of the many areas of innovation at the MPCA.



## Data accessibility on the web

As an agency committed to data-driven decision making and transparency, the MPCA has been working to make its data more accessible and understandable for the public and interested stakeholders. As part of this effort, in May 2015, the MPCA launched its first air quality-related interactive data website, which allows users to explore the agency's air quality data through dynamic maps, charts, and tables. Since then, the number of webpages that allow Minnesotans to explore the MPCA's data has continued to grow. These interactive data websites highlight air monitoring, emissions, and special studies, and can be viewed from the interactive data menu at [www.pca.state.mn.us/data/air-quality-data](http://www.pca.state.mn.us/data/air-quality-data).

## Compliance and enforcement

The agency's compliance and enforcement section works to protect air quality by ensuring that facilities meet emission limits and comply with the requirements in permits and rules. A key element of this program includes conducting facility inspections. Beginning in the fall of 2014, the MPCA began inspecting Minnesota's industrial facilities in a different way.

Previously, air quality inspections were conducted at a set frequency based on the facility's potential emissions, not actual emissions, and regardless of their compliance history. A facility's potential emissions are calculated as though the facility is operating all day, every day, for an entire year. But many facilities have much lower actual emissions than their potentials, because they don't actually operate that way. The difference between actual and potential emissions can be large. Therefore, choosing which facilities to inspect based on their potential emissions may miss the ones that are actually polluting the most.

After discussions with the EPA, the MPCA tried something new. The MPCA developed a point system to determine which facilities should be inspected each year. The point system is based on the amount of pollution a facility actually emits and the number and type of enforcement actions they have been issued in the past. The more points a facility gets, the more likely they are to be on the upcoming year's inspection list. The MPCA still periodically inspects facilities even if no

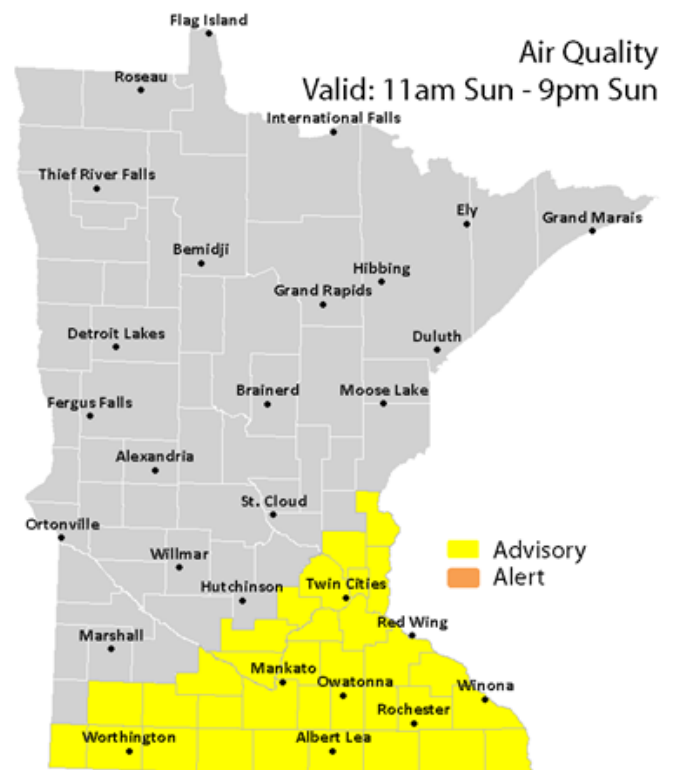


points are assessed. However, the point system allows the MPCA to spend more of our resources on facilities that may have a higher environmental risk. In the future, this point-based system may also allow us the flexibility to focus on emerging industry types, trending enforcement concerns, or sector-based approaches.

Our hope is that this new inspection strategy will help us work more efficiently across a broader set of facility types. Results from the first year have been promising — inspectors discovered violations that might have otherwise been undetected, or not discovered as quickly, which resulted in nearly 40 enforcement actions. Our experience is that working with the permit holders to resolve compliance issues builds trust and confidence both with them and the citizens of Minnesota.

## Air quality forecasting

Currently the MPCA contracts with a private vendor for air quality forecasting. However, staff meteorologists will take over the responsibility in the summer of 2017. This will improve communication of potential air quality-related health risks from ozone and fine particles, expand the coverage of current air quality forecasting services, and save the state money in the process. In the past, air quality forecasts were only issued for the Twin Cities and Rochester. As the MPCA's new forecast program goes online in 2017, forecasting services will be expanded to include all of Minnesota.



Earlier notifications will help Minnesotans plan to reduce their own contributions to poor air quality, and alert those whose health could be affected to allow them to take steps to reduce their exposure. MPCA meteorologists have already begun enhancing air quality notifications by reaching out to news outlets as well as the National Weather Service offices serving all parts of Minnesota, to help get the word out about bad air days.

# Monitoring

The MPCA’s air monitoring network measures air pollution in air at over 50 locations across Minnesota. The data collected from air monitoring sites are used to determine whether Minnesota meets federal and state air quality standards and health benchmarks, to forecast and report daily air quality through the Air Quality Index, and to track trends in air pollution levels over time. In addition to the permanent network of air quality monitors, the MPCA conducts special studies to understand specific air quality concerns in Minnesota and to explore the efficacy and possible uses of emerging technologies.

## Community Air Monitoring Project

With funding from the Minnesota Legislature, the MPCA has been conducting an air quality monitoring project to assess whether there are higher levels of air pollution from highways, air traffic, or industrial sources in low-income areas or communities of color. The project aims to sample air in multiple communities and then analyze and compare those results with the MPCA’s existing air monitoring network to better understand neighborhood-level differences in air quality.

Monitoring locations were selected based on the legislation’s direction to assess air quality in low-income areas and communities of color, along with community input and physical monitor-siting requirements. In the first phase of the project, each location was monitored for three months, after which the equipment was moved to the next community site. Beginning in 2016, the community air monitoring project stayed in one neighborhood for a year. Transitioning to a one-year study period will allow us to better characterize air quality in the neighborhood. Since the start of the project, 10 communities have hosted the monitors.

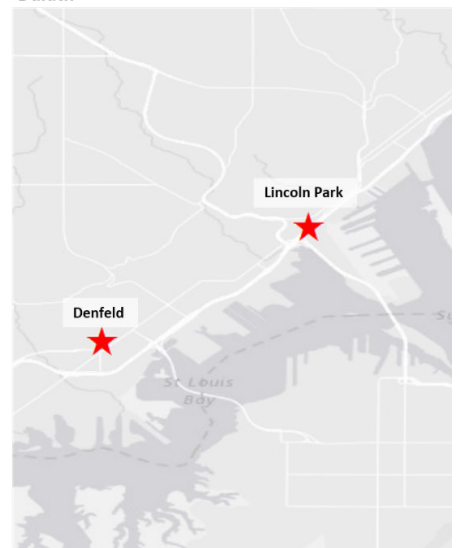
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### Locations of community air monitoring and follow-up community monitoring sites

Minneapolis-St. Paul



Duluth



Overall, the project has found that fine-particle ( $PM_{2.5}$ ) pollution tends to be slightly higher at community sites. At one site, in the St. Paul West Side community, average metals levels were higher than other sites. In response, in January 2016, the MPCA began a yearlong metals monitoring study at the St. Paul airport. Results to date have not reproduced the elevated metals results found during the three-month Community Air Monitoring Project monitoring period.

Monitoring results from the Community Air Monitoring Project are available at <https://www.pca.state.mn.us/air/community-air-monitoring-project>.

## New monitoring technologies

Minnesotans are increasingly interested in knowing more about air pollution levels where they live, work, or attend school. The MPCA's air monitoring network is designed to measure air pollution that is representative of the levels seen across a community, but are not designed to measure differences between neighborhoods or blocks. Recent advances in monitoring technology have introduced new low-cost sensors that can measure air quality on a much more local scale.



The AirBeam is a low-cost air pollution sensor that measures, maps, and graphs pollution levels in real time.

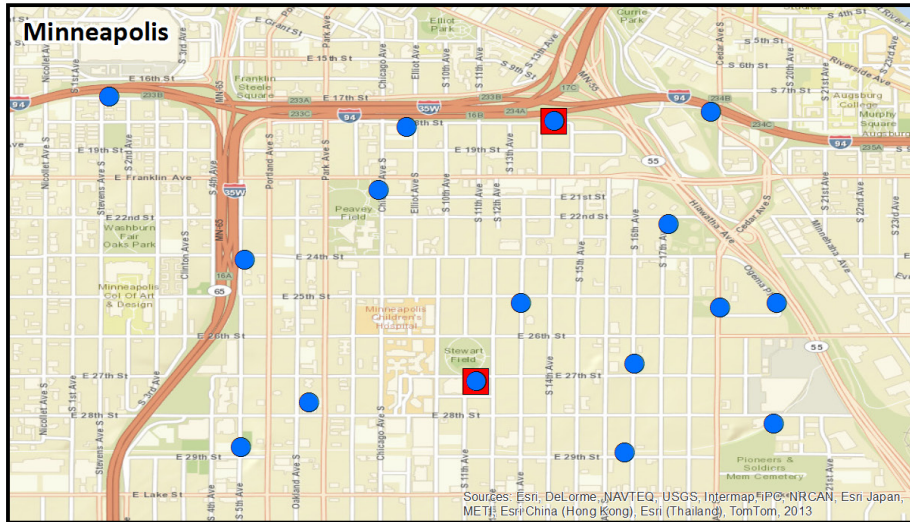
Because they're an emerging technology, we still have a lot to learn about the quality and usefulness of these sensors. Many sensors on the market today do not accurately measure air pollution at levels seen in outdoor air, and no sensor has been able to replicate the quality of traditional monitoring equipment. But technology is improving every day, and many of today's sensors may be good enough to help us understand how air pollution varies from place to place or by time of day.

To respond to public interest for more localized air quality information and to become more familiar with new sensor technologies, the MPCA is pilot testing small, portable monitoring devices called AirBeams that measure fine particles in the air. The AirBeam is a low-cost air pollution sensor that measures, maps, and graphs pollution levels in real time. The AirBeam connects to an app in any mobile Android device, allowing users to explore air quality wherever they go. Users can upload their results to a "crowdsourced" map that aggregates the results from all users to estimate air quality across an entire city.

## Measuring PAHs

The MPCA, in collaboration with MDH and the Mille Lacs Band of Ojibwe, was awarded EPA grant funding in 2012 to measure polycyclic aromatic hydrocarbons (PAHs) in outdoor air. PAHs are a group of chemicals that come from combustion. When people are exposed to high levels of them for long periods of time, PAHs are associated with health conditions such as respiratory irritation and lung cancer. The MPCA was interested in conducting this monitoring, because although there are computer models that estimate concentrations of PAHs, there have not been any recent air measurements to confirm those estimates. These measurements will allow the MPCA to better understand the sources of PAH air pollution and prioritize future emission reduction efforts.

## PAH Monitoring Locations



- Passive PAH Monitor
- Active PAH Monitor

Sampling concluded in June of 2015, and data analysis is ongoing. So far, the measurements are not above health benchmarks or risk guidelines. The monitors picked up higher concentrations of pollutants in certain locations related to particular events and land uses. For instance, measured concentrations were higher at a bus stop, during a large apartment fire, along heavily trafficked roadways, and at a pow wow celebration with many ceremonial and recreational fires.

The MPCA is still looking at the data collected for this project and is working to determine how the findings might be used in the future. Project staff members have talked to neighborhood groups in the sampling areas about the results, which are also available in a data visualization tool at [www.pca.state.mn.us/air/air-monitoring-polycyclic-aromatic-hydrocarbons-urban-and-rural-sites](http://www.pca.state.mn.us/air/air-monitoring-polycyclic-aromatic-hydrocarbons-urban-and-rural-sites).

### Near-road monitoring



To address concerns about air-pollution levels near roadways, the MPCA is now monitoring within 50 meters of the roadway along the I-94 and I-35W freeway commons in downtown Minneapolis and along I-35 in Lakeville. The Minneapolis site was chosen because it captures the road segment with the highest traffic count in the state. The Lakeville site was chosen because it is a traffic corridor that MnDOT expects to experience sizable traffic growth in the coming years.

The near-road monitoring sites measure a variety of pollutants, (nitrogen oxides, carbon monoxide, fine particles) and wind direction and speed. The Minneapolis site also monitors for ozone, total suspended particulates, air toxics, black carbon, and ultrafine particles (smaller than 1 micron, or  $PM_{1.0}$ ). To date, the near-road monitoring sites have shown that air quality near roadways meets applicable standards, but in many cases pollutants are elevated compared to air monitors farther from the road. The Centers for Disease Control estimates that about 4% to 6% of



Minnesotans live within 150 meters of a major roadway, disproportionately comprising communities of color.<sup>12</sup> The results from this project support findings that living or working near roadways contributes to elevated exposure to air pollution.



12 See <https://www.cdc.gov/mmwr/preview/mmwrhtml/su6203a8.htm>





## Conclusion

Overall, Minnesota's air quality is good and improving. Over the past 20 years, we have made major strides in cleaning up our air. Minnesota's air quality is better than nearly all the national standards and benchmarks designed to protect human health and the environment.

However, more can and must be done to protect our state's most vulnerable people: the elderly, children, and people who suffer from health conditions such as asthma and heart disease. We must also direct our efforts to supporting those Minnesotans who deal with the stresses of higher levels of pollution, lack of economic opportunity, unsafe neighborhoods, lack of adequate healthcare, and more every day. The MPCA works to ensure that air quality in Minnesota is clean and healthy for everyone, and that we support the conditions Minnesotans need to live healthy lives.

All of us can do our part to reduce air pollution by making smart choices about how we travel, what products we purchase, and how we dispose of our waste. With the help of our partners in communities and the nonprofit, for-profit, and governmental sectors, the MPCA is trying to find innovative ways to reduce air pollution while supporting a strong economy for all Minnesotans. Programs to help small businesses and communities afford the equipment and implement the processes they need to reduce their emissions can help improve our air and protect our health while supporting Minnesota's economy. Learn more about what you can do to protect your health and reduce your contribution to air pollution by visiting [BeAirAwareMN.org](http://BeAirAwareMN.org).

The MPCA looks forward to continuing our collaborative efforts to reduce air pollution to protect and improve our environment and the health of Minnesotans.

# Appendix A

## Mercury emissions associated with electricity production and consumption in Minnesota, 2012 -2015

In accordance with Minnesota Statute §116.925, this appendix reports mercury emissions associated with electricity production. In 2007, the MPCA established an emissions reduction goal and is now implementing stakeholder recommendations to meet the goal. The electric utility sector has made changes to reduce mercury and is on track to meet the interim mercury emission reduction goals in 2018. More information about Minnesota's mercury emissions and reduction strategies can be found at <https://www.pca.state.mn.us/quick-links/mercury> and on pages 54-56 of this report.

### **Mercury emissions from electricity generation**

Minnesota Statute §116.925 requires producers and retailers of electricity to report the amount of mercury emitted through the generation of electricity. This law also requires MPCA to summarize this information in its biennial air toxics report to the Legislature.

Minnesota law exempts certain electric-generation facilities from reporting mercury emissions: (1) those that operate less than 240 hours per year, (2) combustion units that generate fewer than 150 British thermal units (Btu) per hour, (3) generation units with a maximum output of 15 megawatts or less, and (4) combustion facilities that emit less than three pounds of mercury in a given year. Therefore, generation facilities that do not emit any mercury, such as nuclear, wind, and hydroelectric, are not reported here.

Due to variation in operating conditions, some facilities may emit more than three pounds one year and less than three pounds in another. When emissions are less than three pounds, the actual emissions are either given or listed as exempt, depending on the wishes of the facility's management.

The following table shows mercury emissions from electric utilities in years 2012 through 2015. Note that 2015 emissions are considered draft and under quality review by the MPCA.

## Mercury emissions from electric utilities, 2012 through 2015

Company	Mercury emissions (pounds)			
	2012	2013	2014	2015 (draft)
Benson Power Biomass Plant	1.01	0.78	0.89	1.11
Blandin Paper Co/MN Power - Rapids Energy Center	4.16	5.33	5.21	4.92
District Energy St Paul Inc.-Hans O Nyman	0.00	9.53	9.50	8.31
Duluth Steam Plant 1	4.58	3.94	4.98	4.14
Hibbing Public Utilities Commission	9.14	10.68	13.73	13.68
Koda Energy LLC	1.73	0.56	1.62	0.73
Minnesota Power - Laskin Energy Center	22.43	28.20	21.63	5.42
Minnesota Power - Taconite Harbor Energy Center	52.95	40.20	44.59	15.82
Minnesota Power Inc. - Boswell Energy Center	252.16	274.83	249.30	176.77
Minnesota Power Inc. - Hibbard Renewable Energy Center	11.80	11.73	3.79	2.60
Northshore Mining - Silver Bay	27.28	39.50	37.72	23.05
Otter Tail Power Co - Hoot Lake Plant	25.56	29.19	25.80	3.21
Rochester Public Utilities - Silver Lake	0.45	1.09	0.00	0.00
Virginia Department of Public Utilities	4.38	12.41	10.20	4.92
Willmar Municipal Utilities	2.89	1.24	1.41	1.19
Xcel Energy - Allen S King Generating Plant	18.00	13.00	17.80	20.60
Xcel Energy - Black Dog	74.20	70.66	85.32	21.78
Xcel Energy - Sherburne Generating Plant	418.00	338.00	316.40	77.90
<b>Grand total</b>	<b>930.73</b>	<b>890.88</b>	<b>849.91</b>	<b>386.15</b>