



REPORT TO THE
LEGISLATURE

JANUARY 2025



The air we breathe

The state of Minnesota's air quality

m MINNESOTA POLLUTION
CONTROL AGENCY

Legislative charge

The Minnesota Pollution Control Agency (MPCA) is required by [Minn. Stat. § 115D.15](#) and [§ 116.925](#) to report to the Minnesota Legislature biennially on the status of toxic air contaminants, mercury emissions, and 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 opportunities for emission reductions.

Lead authors

Aneka Swanson
Hassan Bouchareb

Contributing authors, analysts, and designers

Scott Andre
Erin Hertog
Azra Kovacevic
Sanna Mairet
Eric Wilcox Freeburg
Nick Witcraft

Editors and reviewers

Kurt Anderson
Kirsten Baker
Ned Brooks
Katie Burns
Eric David
Nate Edel
Tyler Ellis
Troy Johnson
Derek King
Faith Krogstad
Megan Kuhl-Stennes
Lexie Lyng
Margaret McCourtney
Lori McLain
Andrew Place
Kathy Raleigh
Hannah Sabroski
Owen Seltz
Anna Sienko
Rocky Sisk
Matt Taraldsen

Estimated cost of preparing this report (as required by Minn. Stat. § 3.197)

Total staff time: 387 hrs.	\$32,560
Production/duplication	\$0
Total	<u>\$32,560</u>

Minnesota Pollution Control Agency

520 Lafayette Road North | Saint Paul, MN 55155-4194 |

651-296-6300 | 800-657-3864 | Or use your preferred relay service | Info.pca@state.mn.us

This report is available in alternative formats upon request, and online at www.pca.state.mn.us.

Document number: Iraq-1sy25

Contents

Contents	i
The Air We Breathe: Where we came from, where we’re headed	1
Scope: What’s in this report	3
Air pollution regulatory foundations	4
Health	4
Regulation	6
Understanding MPCA’s work	7
Air pollution in Minnesota	16
Criteria pollutants.....	16
Air toxics.....	20
Disproportionate impacts of pollution.....	21
Some air toxics are worse than others.....	23
Reducing pollution starts by burning less	25
Actions	26
Reducing mercury in our air and water	35
Minnesota’s statewide mercury reduction goal	35
Reducing mercury at the source	37
Regional, national, and international efforts	39
Appendix A: Mercury emissions, 2020 - 2023	41
Mercury emissions from electricity generation	41
Mercury emissions from industrial facilities	42
Mercury emissions from mercury use in products	44

The Air We Breathe: Where we came from, where we're headed

A message from MPCA division director Todd Biewen

Thirty-five years ago, I began my air quality career as an inspector at the MPCA. As I traveled from town to town inspecting incinerators, I often saw smoke rising in the distance as I approached the next town. I could follow the smoke to either the hospital or grocery store incinerator where I would start my inspection by measuring the level of smoke coming from the smokestack. Visible emissions from businesses and smoke billowing from vehicles tailpipes were more common in those days.



Air quality is better now. Not only is smoke from industries and vehicles less obvious to us, but it is also measurably reduced. Concentrations of fine particles and other pollutants are lower than they were twenty, thirty, forty years ago. Regulation and voluntary actions have helped clear the air. Some notable changes in Minnesota include cleaner cars and trucks using cleaner fuels, reductions in the amount of coal and fuel oil used for power production, a ban on small incinerators like those I used to inspect, and a variety of other pollution reduction efforts implemented by government, industry, businesses, and residents.

Figure 1: This photo from 1990 shows a medical waste incinerator, and similar ones were used at grocery stores. Practices like this are now banned in Minnesota to reduce exposures to the harmful air pollutants that were released.

As a result, Minnesota has generally remained in compliance with national ambient air quality standards (NAAQS), even though standards have been tightened by the U.S. Environmental Protection Agency (EPA) over this time. The EPA tightens standards to keep pace with scientific understanding of how air pollutants impact human health. An example of this important work by the EPA is for the fine particle (PM_{2.5}) standard, which is about 40% lower than in 1997. The good news is that Minnesota has achieved the needed reductions in PM_{2.5} that allow us to continue to meet this standard. Over many years, the Air Quality Index (AQI) showed an encouraging, positive trend, but a concerning picture has emerged in recent years. Wildfire smoke is more often interrupting our clear skies, coming into Minnesota from the western U.S. and Canada, driven by changes in our climate. And, while smoky tailpipes are less common, vehicle pollution is still a significant contributor to overall air emissions.



Efforts by MPCA and its partners to protect air quality and human health must continue. The Clean Air Act is a good foundation for air quality protection, but has remained mostly focused on emissions from large facilities. Thankfully, new strategies are coming. The MPCA is developing rules that will improve our understanding of air toxics emissions, reduce these air toxics, and consider cumulative impacts during permitting. We are using data in new ways – modeling to identify hot spots of pollution, and using air quality forecasting to warn Minnesotans when wildfires might threaten air quality.

The most important change in our work today is the increased focus on where pollution is most concentrated and who the people are that are most burdened. This means prioritizing environmental justice communities, where people are disproportionately affected by air pollution, and focusing on how local emissions affect their daily lives.

While air pollution is less visible today than it was decades ago, one thing hasn't changed: everyone cares about air quality. We all want to know what might be harmful in the air around us, and we expect easy access to information on air quality and air pollution sources in our neighborhoods. After all, what is more important to us than the quality of the air we breathe? These expectations are justified and should serve as our guide for future work to protect air quality. As we work with partners to develop new strategies for cleaner air, we must prioritize data transparency and engage with communities about the unique factors that affect their air quality.

Todd Biewen

Director, MPCA Environmental Analysis and Outcomes Division

Scope: What's in this report

The Minnesota Pollution Control Agency (MPCA) is required to provide the Minnesota Legislature with a biennial status report on emissions of toxic air pollutants and mercury in Minnesota and MPCA's strategies to reduce them.

Clean air is critical for everyone across the entire state. It affects our health and the environment around us. More and more, Minnesotans want to know about their local air quality, how it impacts their health, and how it got that way. As it has in the past, this report discusses the air toxics that most affect our health, their sources, and the actions MPCA is taking to reduce air pollution across Minnesota. This edition also provides background about the regulations that underpin MPCA's work and the methods the agency uses to track and understand air pollution.

[Previous editions of this report](#)¹ included sections dedicated to the connections between environmental injustice and air pollution. In this edition, environmental justice is addressed throughout the report. This better reflects the agency's goal to integrate environmental justice principles throughout our work.



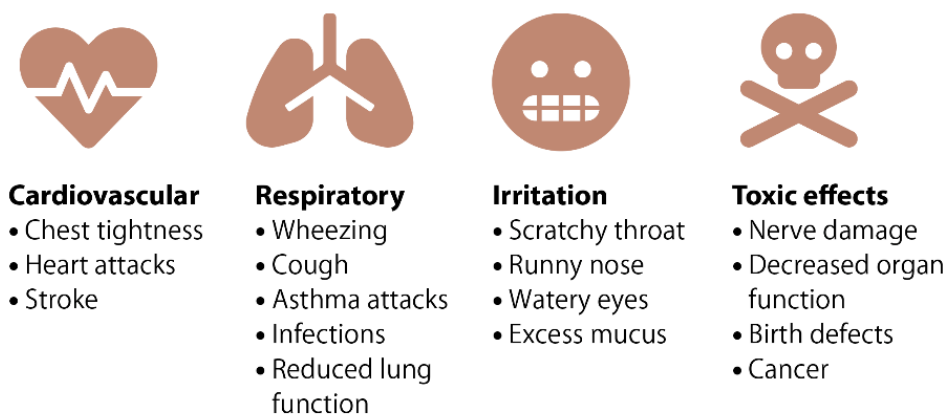
¹ Previous editions of this report are available from the Minnesota Legislative Reference Library at <https://www.lrl.mn.gov/edocs/edocs?oclcnumber=60688313>

Air pollution regulatory foundations

Health

Air pollution affects everyone's health. Pollution in the air we breathe can cause or worsen chronic diseases involving the lungs and heart, such as asthma, bronchitis, heart attacks, pneumonia, and stroke, as well as increase the risk of certain cancers. It can contribute to annoyances like itchy eyes, coughing, and a sore or scratchy throat. Even low levels can impact health, contribute to serious illness, or lead to early death. When we breathe, air pollution enters our lungs and tiny particles of it can move into our bloodstream. Those tiny particles can move beyond the lungs and heart to impact less obvious body systems such as our immune, nervous, and reproductive systems.

Figure 2: Health effects of air pollution.



Understanding the relationship between air pollution exposure and disease can be challenging – we live, work, and play in many different places and the amount of pollution we breathe varies over time and place. In addition, our health is influenced by our family health history, environmental conditions such as access to green space, and community conditions such as access to health care. Despite this complexity, we know that some people's health is more likely to be impacted by air pollution, including children, the elderly, and people who already have diseases that affect the lungs or heart. Children are more susceptible to the effects of air pollution because their lungs are still developing, they are more likely to be outside playing or exercising, and they breathe in more air than adults do for their body size and weight.

We also know that people in some areas are unfairly burdened with more air pollution. Most pollution comes from human activities such as transportation, making energy and heat, products we use at our businesses and homes, and industry. But the impacts of pollution vary across Minnesota because of past practices that have continuing repercussions today, including the placement of freeways through Black neighborhoods², discriminatory housing practices such as redlining and racial covenants, and zoning and permitting decisions that led to people of color and low-income residents being concentrated together with pollution sources. The [Life and Breath studies](https://data.web.health.state.mn.us/life_and_breath)³ by MPCA and the Minnesota Department of Health found that air pollution played a role in 10% of all deaths in the Twin Cities metro area in 2015, and

² <https://talk.dot.state.mn.us/rethinking-i94>

³ *Life and Breath studies*: https://data.web.health.state.mn.us/life_and_breath

nearly 9% of deaths in Duluth, Rochester, and Saint Cloud. The same studies found that rates of air-pollution related death and disease were higher in areas where more residents are Indigenous, people of color, low-income, uninsured, or living with a disability. Residents in these areas are more likely to be exposed to a heavier air pollution burden from high-traffic roads, residential wood smoke, and nearby industrial facilities in addition to impacts from long-standing social, economic, and health inequities. Furthermore, other studies^{4,5} have shown that people of color and low-income residents are more likely to be exposed to air pollution from vehicles and manufacturing even though they contribute less to those sources of air pollution.

Health impacts from air pollution continue to be researched and new connections are uncovered regularly, but we have known for a long time that air pollution has health effects, and those health effects drive air quality regulations at the state and federal level.

Resource you can use: Protecting kids' health during outdoor activities


To help adults make decisions that will protect children and young adults, the Minnesota Department of Health (MDH) has developed [outdoor activity guidance](#) linked to the Air Quality Index. The document provides guidance on when and how to adjust outdoor activities when air pollution levels are elevated, such as when wildfire smoke moves into the area. The goal is to help kids stay active while protecting their health.

Minnesota Outdoor Air Quality Guidance for Schools and Child Care
 The following recommendations will help schools and child care staff determine when and how to adjust outdoor activities when air quality starts to reach unhealthy levels. Adjust activities accordingly to help children stay active while protecting their health.

OUTDOOR ACTIVITY DURATION			
Air Quality Index	15 minutes to 1 hour	1 to 4 hours	4-plus hours
Good (0-50)	Good day to be outside!	Good day to be outside!	Good day to be outside!
Moderate (51-100)	No limitations for most children. For students with health conditions, consider alternatives or modified participation.	Be aware and monitor students with health conditions for changes in their health. Limit activities to light intensity.	Consider moving students inside or to an area with better air quality. Limit to less intense activities and/or limit duration of activity.
Unhealthy for Sensitive Groups* (101-150)	Limit activities to light intensity. Take breaks every 20 minutes. Make indoor space and activities available for sensitive children.	Limit activities to light intensity. Take breaks every 20 minutes. Activities with moderate to heavy exercise intensity should be canceled, rescheduled, or moved indoors.	Limit activities to light intensity and less than four hours in duration. Take breaks every 20 minutes. Activities with moderate to heavy exercise intensity should be canceled, rescheduled, or moved indoors.
Unhealthy (151-200)	Cancel or reschedule all outdoor activities. Keep all students indoors and activity levels light.	Cancel or reschedule all outdoor activities. Keep all students indoors and activity levels light.	Cancel or reschedule all outdoor activities. Keep all students indoors and activity levels light.
Very Unhealthy (201-300)			
Hazardous (301-500)			

*Unhealthy for Sensitive Groups: People with health conditions, or their caregivers, should manage conditions medically. Watch for symptoms, and for worsening symptoms, and have medications handy. Take action with a health care provider as needed.

Information adapted from the [Washington Children and Youth Activities Guide for Air Quality](https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs/336-332.pdf) (https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs/336-332.pdf). Washington State Department of Health. DOH 334-332 July 2023.

 DEPARTMENT OF HEALTH

⁴ *International Journal of Environmental Research and Public Health*, “[Traffic, Air Pollution, Minority and Socio-Economic Status: Addressing Inequities in Exposure and Risk](#),” Pratt, Vidali, Kvale, and Ellickson; 19 May 2015.

⁵ *Proceedings of the National Academy of Sciences (PNAS)*, “[Inequity in consumption of goods and services adds to racial-ethnic disparities in air pollution exposure](#),” Tessum et al; 11 March 2019.

Regulation

There are multiple layers of regulation governing air quality. The U.S. Environmental Protection Agency (EPA) sets and enforces federal environmental regulations. It can transfer responsibility for certain regulations to the states; this is known as delegation. In Minnesota, MPCA is the agency responsible for implementing most EPA-delegated air quality regulations as well as Minnesota-specific air quality rules and statutes.

Each state must have a formal plan for how they will implement the federal air regulations delegated to them. This is called a State Implementation Plan, and it must be approved by EPA. Once it has been approved, all the methods used to meet the federal regulations, such as requiring permits, placing air monitors, or prohibiting open burning of garbage, become legally binding and are enforceable at state and federal levels. Our list of requirements and actions are in [Minnesota's state implementation plan on the EPA website](#)⁶.

Foundational regulations are based on health impacts

The federal Clean Air Act was established in 1970 and is the basis for air quality regulation in the U.S. Because of the direct link between air pollution and human health, almost all air quality regulations are built to protect human health. Two sets of Clean Air Act standards underpin most air quality work: National Ambient Air Quality Standards (NAAQS) and National Emissions Standards for Hazardous Air Pollutants (NESHAPs). These two regulations provide the framework for much of MPCA's work to improve Minnesota's air quality.

Ambient air is outdoor air that is accessible to the public. The EPA sets National Ambient Air Quality Standards that limit the amount of six specific pollutants in the air: lead, ground-level ozone, particulate matter (PM₁₀ and PM_{2.5}, which is also referred to as fine particles), nitrogen dioxide, sulfur dioxide, and carbon monoxide. Because the limits are based on criteria that protect human health and the environment, these pollutants are referred to as criteria pollutants. Criteria pollutants in the ambient air in all parts of the country must be below the limits.

The NAAQS are updated by EPA regularly, based on scientific research on health and environmental impacts of air pollutants. Many of the criteria pollutants have different limits for short- and long-term exposure periods, to protect against the differing impacts of short-term (acute) and long-term (chronic) exposures. All the criteria pollutants have a primary standard set at pollution levels that will protect human health, including at-risk populations, with a margin of safety. Some of the standards also have a secondary standard to protect the environment, including the natural spaces we enjoy spending time in, the plants and animals that live there, the food we grow for ourselves and animals, and the buildings and infrastructure we rely on in our daily lives.

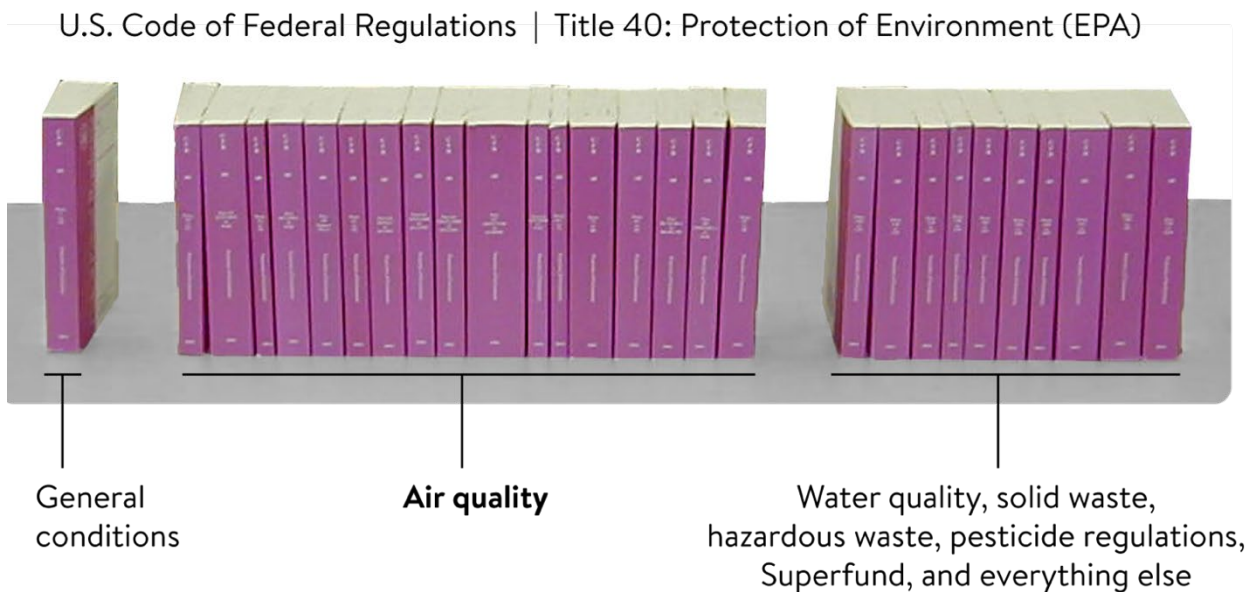
The NAAQS are federal regulations, but states have the responsibility to ensure their air quality meets the standards. In Minnesota, MPCA has this responsibility. A network of monitors is used to test the air, find out which criteria pollutants are present, and determine whether we are meeting the standards. Each time EPA updates a standard, states must determine whether the ambient air within their borders meets the new standard. If the new standard isn't met, the state must develop a plan to reduce pollution to meet the standard.

⁶ *Minnesota's state implementation plan on the EPA website:* <https://www.epa.gov/air-quality-implementation-plans/approved-air-quality-implementation-plans-region-5>

The EPA uses a different method to regulate air toxics. Air toxics are pollutants that are known or suspected to cause cancer or other serious health or environmental effects. When the Clean Air Act was amended in 1990, it established a list of nearly 200 air toxics called “hazardous air pollutants.” They are regulated by National Emission Standards for Hazardous Air Pollutants (NESHAPs). Instead of testing for amounts of pollution in the ambient air, which is the requirement for criteria pollutants, NESHAPs restrict the type and amount of certain air toxics that can be released from a source. The NESHAPs limit emissions, or releases of pollutants, by requiring facilities to use certain processes, technologies, equipment, or materials that have been determined to be less polluting.

There are over 100 NESHAPs that regulate emissions from different facility types and processes, such as auto body painting, industrial boilers, taconite processing, and many manufacturing processes, but they do not apply to mobile sources like vehicles or construction equipment. The EPA is required to review NESHAPs regularly to evaluate whether risks from the targeted pollutants have changed and determine if new options have become available that would do a better job of reducing pollution from targeted processes. NESHAPs must be followed even by facilities that aren’t required to have an air permit.

Figure 3: The Clean Air Act is extensive and complex. Air quality laws are a larger portion of federal environmental regulations than the laws for all other types of pollution put together.



Understanding MPCA’s work

Air pollution is usually invisible to the naked eye, though sometimes we can see evidence of it when haze fills the sky or snow near a busy road is dirty and grey. Our other senses can detect air pollution, too, by smelling smoke or chemical odors, or feeling grit on our skin from windblown dust. Because air pollution can be solid, liquid, or gas and is made up of a mixture of chemicals and substances, MPCA uses a variety of complementary and intersecting methods to understand and regulate it.

Facility reporting

One of the ways MPCA tracks air pollution in Minnesota is by getting information directly from the source. All facilities with air permits are required to report air emissions data to the MPCA annually, and some are required to provide additional data throughout the year.

Facility stack testing and continuous monitoring

Facilities with air permits may be required to conduct regular sampling and testing of the pollutants released by the facilities' process equipment. The various vents, chimneys, and smokestacks at a facility are referred to in air regulations as 'stacks', so these tests are often called stack tests or performance tests. They provide a snapshot of how much of a pollutant is being released over a certain period of time and are completed by a third-party testing company. Based on stack conditions and other circumstances, it isn't feasible to do stack tests or install monitors at every facility. About 180 facilities in Minnesota are required by their permit to do regular stack testing. This is around half of the facilities with individual permits – the type of permit required for facilities that release larger amounts of pollution – and about 10% of the nearly 2,000 facilities in the state with air permits. In some cases, facilities are required to conduct real-time monitoring of pollutants as they leave the stack. This is referred to as CEMS (continuous emissions monitoring systems). There are 74 facilities in Minnesota with CEMS.

The MPCA uses stack tests and continuous monitoring to determine whether facilities are within their permitted emissions limits and ensure facility equipment that controls pollution is working properly. If facility emissions are above limits, MPCA takes action and the facility is expected to make changes to fix the problem as soon it is discovered. Facilities use the data from stack testing and continuous monitoring to report total annual emissions and any deviations from the requirements of their permit during the year. Some of this data must be reported to MPCA every four or six months, which allows MPCA to take enforcement action and require changes at the facility if there is evidence of a permit violation.

Emissions inventories

Facilities with the potential to emit a certain amount of air pollution must have an air permit, and their permits require them to report their air pollutant emissions to the MPCA. Each year, all facilities with air permits must report their annual [emissions inventory](#)⁷. For the majority of permitted facilities, this entails reporting emissions of the six criteria pollutants: lead, particulate matter, nitrogen oxides, sulfur dioxide, carbon monoxide, and volatile organic compounds as a precursor to ground-level ozone, plus ammonia. Some facilities must also report greenhouse gas (GHG) emissions. Facilities pay annual fees based on the amount of certain air pollutants they release and there are penalties for reporting late or intentionally reporting incorrect amounts. Every three years, MPCA asks facilities with air permits to report their emissions of hazardous air pollutants, per- and polyfluoroalkyl substances (PFAS), and other air toxics. The air toxics inventories are voluntary. The air toxics inventory will become an annual requirement for facilities with an air permit in the seven-county Twin Cities metro area starting in 2027 for the 2026 reporting year (see more in the [rule overview](#) on page 29).

Submitted emissions inventory information is reviewed and vetted by MPCA staff, who flag and follow up with facilities that report significant changes in the amount or type of pollution they report. The MPCA uses emissions inventory data to support air quality modeling, assess health risks, and evaluate the effectiveness of our air quality work. The air emissions fees collected from the emissions inventory are used to fund MPCA air programs. The MPCA submits the inventory data to EPA every three years to be included in the National Emissions Inventory.

⁷Emissions inventory: <https://www.pca.state.mn.us/business-with-us/air-emission-reporting-and-fees>

Preferred data, available data

Stack testing and continuous monitoring are the preferred sources of data when facilities report their emissions inventories because the measurements are specific to a facility and its unique collection of equipment and materials. However, not all pollutants can be tested or monitored for at a stack, and not all stacks are configured in ways that can be tested or monitored. In addition, testing and monitoring are expensive for the facility to conduct and for MPCA to manage, quality assure, and review the data. So even though testing and continuous monitoring data are more precise, they can't always give us all the information we need.

For most pollutants at most facilities, releases are calculated by accounting for the amounts of pollutant-containing materials entering and leaving a facility, a process known as mass-balance, or by using emission factors developed by EPA. Emission factors are mathematical formulas that estimate the amounts and kinds of pollutants that will be released from an activity or process. They use information that is specific to the facility like how many hours they operate per day, how much and what kind of fuel they burn, or how much product they make. Together, mass-balance and emission factors give facilities the ability to estimate the amount of every pollutant that is being released, including those that can't be tested for. This means that emissions inventory data are generally a thorough and complete accounting of the amount and type of pollutants that have been released.

Ambient air monitoring

Another way MPCA gathers information about pollution in the air is by using air monitors. Air monitors are stationary equipment usually placed in protected areas on the ground or on rooftops. The EPA has specific, detailed requirements for air monitors and certifies certain instruments for use to determine compliance with National Ambient Air Quality Standards. The instruments are complex, expensive, and require staff to set up and maintain the equipment, retrieve and analyze the samples, confirm the quality and accuracy of the results, and manage the data – all of which restricts the number of air monitors MPCA can operate. Site locations depend on EPA requirements as well as logistics such as access, power, internet availability, and equipment security.

There are currently more than 50 [air quality monitoring sites in Minnesota](#)⁸, including seven operated by tribal partners. The MPCA monitors for:

- NAAQS criteria pollutants: lead, ground-level ozone, particulate matter, nitrogen dioxide, sulfur dioxide, and carbon monoxide
- Minnesota Ambient Air Quality Standards (MAAQS) pollutants: hydrogen sulfide and total suspended particulate
- Air toxics
 - Metals: arsenic, beryllium, cadmium, chromium, cobalt, iron, lead, manganese, nickel, and selenium
 - A group of chemicals called carbonyls, which include acetone and formaldehyde
 - Mercury, via partners as part of the national Mercury Deposition Network
 - Volatile organic compounds (VOCs), which can have direct effects on health as well as contribute to the formation of ground-level ozone.

⁸ *Air quality monitoring sites in Minnesota:* <https://data.pca.state.mn.us/views/Airmonitoring-Activestatewidemonitoringsites/Minnesotasairmonitoringsitelocations>

States are required to use air monitors to determine whether air pollution meets EPA’s National Ambient Air Quality Standards (NAAQS) and must follow strict EPA protocols for which pollutants are monitored, how samples are collected and tested, and where monitors are located. Compliance with a NAAQS is determined using a calculated value specified in federal regulations such as an average across time or locations rather than a direct, immediate reading from a single monitor. If monitoring data shows an area meets a NAAQS, EPA can go through a process to determine the area to be in attainment. If an area’s monitoring data shows levels above a NAAQS, EPA can go through a process to determine the area to be in nonattainment. States must develop and implement an EPA-approved plan to reduce pollution and bring nonattainment areas into compliance.

In addition to determining compliance with state and federal standards, MPCA uses the data from air monitors to determine pollutant trends, understand how pollution moves around and how much comes from local or distant sources, assess population exposure and risk, guide pollution reduction strategies, and forecast and report the air quality index (AQI).

Monitoring near facilities

Currently, nine facilities in Minnesota have conditions in their air permits that require them to monitor nearby air. Monitoring requirements have been added to permits at these facilities as a result of enforcement actions, recurring complaints about hydrogen sulfide odors, or to verify that air quality around the facility meets federal air quality standards. The MPCA helps these facilities evaluate where to place monitors, audit the monitors to ensure they are working properly, and verify data (see page 33 of the [2025 Air Monitoring Network Plan for Minnesota](#)⁹ for details).

Figure 4: Facilities required by their permits to monitor nearby ambient air quality.

Facility	Location	Pollutant
3M	Maplewood	PM _{2.5}
American Crystal Sugar Company	Moorhead, Crookston, and East Grand Forks	H ₂ S (hydrogen sulfide)
Anderson Corporation	Bayport	PM _{2.5} and PM ₁₀
ConAgra	Waseca	H ₂ S
Malt O Meal	Northfield	PM _{2.5}
Marvin Windows	Warroad	PM _{2.5}
Northshore Mining Company	Silver Bay	PM _{2.5} , PM ₁₀ , and TSP
Southern Minnesota Beet Sugar Cooperative	Renville	H ₂ S
Otter Lake Technologies (formerly Water Gremlin)	White Bear Lake	VOCs

The MPCA may place monitors at a facility when there are concerns that a facility’s emissions are potentially impacting the health of people near the facility. This monitoring is intentionally done at or beyond the property boundary, or “fenceline,” to understand the pollutant types and amounts that neighbors are likely exposed to. Fenceline monitoring allows us to track pollutant trends over time and make informed decisions about actions we should take at the facility, propose actions the facility can

⁹ 2025 Air Monitoring Network Plan for Minnesota: <https://www.pca.state.mn.us/sites/default/files/aq10-24a.pdf>

take, or work with colleagues at the Minnesota Department of Health to develop recommended actions for nearby communities.

In the past two years MPCA has conducted fenceline monitoring at three facilities, all of which are located in areas of concern for environmental justice:

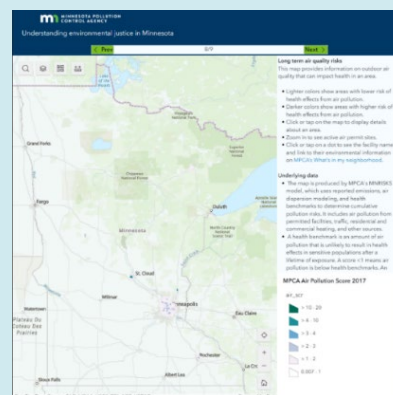
- [Federal Ammunition](#)¹⁰, Anoka. The MPCA’s air monitoring data confirm lead levels along the facility’s property boundary exceeded national ambient air quality standards several times during 2023, but fell below the national standard in January 2024 and have remained there since then. Monitoring continues. This is discussed in greater detail in the [Criteria pollutants section](#) of this report.
- [Northern Iron](#)¹¹, St Paul. The MPCA installed an air monitor near Northern Iron in 2024 to measure lead. Lead concentrations have been well below EPA’s action level.
- [Smith Foundry](#)¹², Minneapolis. The MPCA installed an air monitor across the street from Smith Foundry in January 2024 to track fine particles. Data show similar readings as at two nearby sites, which meet national standards for fine particles. Smith Foundry closed in August 2024.

Resource: Environmental justice and air pollution maps

To learn more about air pollution across the state, visit [MPCA’s Environmental Justice Maps](#)¹³ and check out the Air Pollution Score tab. You can find air pollution scores, the pollutants that pose the highest potential health risks, and types of air pollution sources for any location in Minnesota.

Minnesota statute defines environmental justice areas as census tracts that meet any of the following criteria:

- At least 40% of the population is people of color
- At least 35% of households have income at or below 200 percent of the federal poverty level
- At least 40% of the population has limited proficiency in English
- Located within Indian Country, which is defined as federally recognized reservations and other Indigenous lands.



¹⁰ Federal Ammunition: <https://www.pca.state.mn.us/local-sites-and-projects/anoka-federal-ammunition>

¹¹ Northern Iron: <https://www.pca.state.mn.us/local-sites-and-projects/st-paul-northern-iron>

¹² Smith Foundry: <https://www.pca.state.mn.us/local-sites-and-projects/minneapolis-smith-foundry>

¹³ MPCA’s Environmental Justice Maps: <https://experience.arcgis.com/experience/bff19459422443d0816b632be0c25228/page/Page/?views=Air-pollution-score>

Sensors

Air sensors are devices that can measure some air pollutants, and are often smaller, cheaper, more portable, and easier to operate than regulatory air monitors. Common brands of sensors include PurpleAir, AirBeam, or AQMesh. They have similar limitations as regulatory monitors such as the need for access to electricity and internet, and a secure place to put them where people and animals can't tamper with them. While sensors can provide useful information about the presence of air pollution in smaller geographic areas, they have limitations on their accuracy and reliability, as well as the types of air pollution they can measure. Sensor data cannot be used for determining compliance with NAAQS, which is dictated by EPA regulations.

The MPCA uses PM_{2.5} sensors to supplement our understanding of local air quality. For example, MPCA combines data from sensors and regulatory monitors to produce forecasts and alerts for the Air Quality Index (AQI). We can also use sensor data to help us understand which areas of the state to focus on as we develop grants and provide technical assistance to encourage voluntary air pollution reductions.

Resource you can use: Air Quality Index

The Air Quality Index (AQI) was developed by EPA to rank and report on daily air quality. Paying attention to daily AQI readings and the AQI forecast can provide you with the information you need to protect your health when air quality is unhealthy.

Minnesota's air quality can differ across the state and fluctuate often, sometimes quite quickly. Wildfire smoke, ground-level ozone on hot summer days, and temperature inversions that trap pollution on calm winter days can create areas of unhealthy air quality. The MPCA issues an air quality alert when current or forecasted air quality is unhealthy or worse. We work with local news media and agencies such as MnDOT, the Minnesota Department of Health, and the National Weather Service to spread the word when we issue an air quality alert. You can visit MPCA's website to [check daily AQI readings](#)¹⁴ and [read the air quality forecast](#)¹⁵, or download EPA's AirNow app for your mobile device.

There was a large increase in the number of days with air quality alerts due to unhealthy air quality in 2021 and 2023 (see Figure 6). These increases can largely be attributed to drought conditions in the upper Midwest. Ozone formation is typically more robust during drought conditions due to less precipitation and cloud cover. The drought conditions also contributed to wildfire activity in central Canada. Smoke from these fires made frequent incursions into Minnesota, leading to many days with high levels of fine particles (PM_{2.5}). Smaller but closer fires in Minnesota and Ontario also led to several alert days.

Wildfire smoke from Canada and the western U.S. has become increasingly common in Minnesota as wildfires get bigger, hotter, more frequent, and have a longer burning season. This trend is expected to continue in the future due to climate change and past practices of putting out fires as soon as they start, which has allowed fuel to build up.

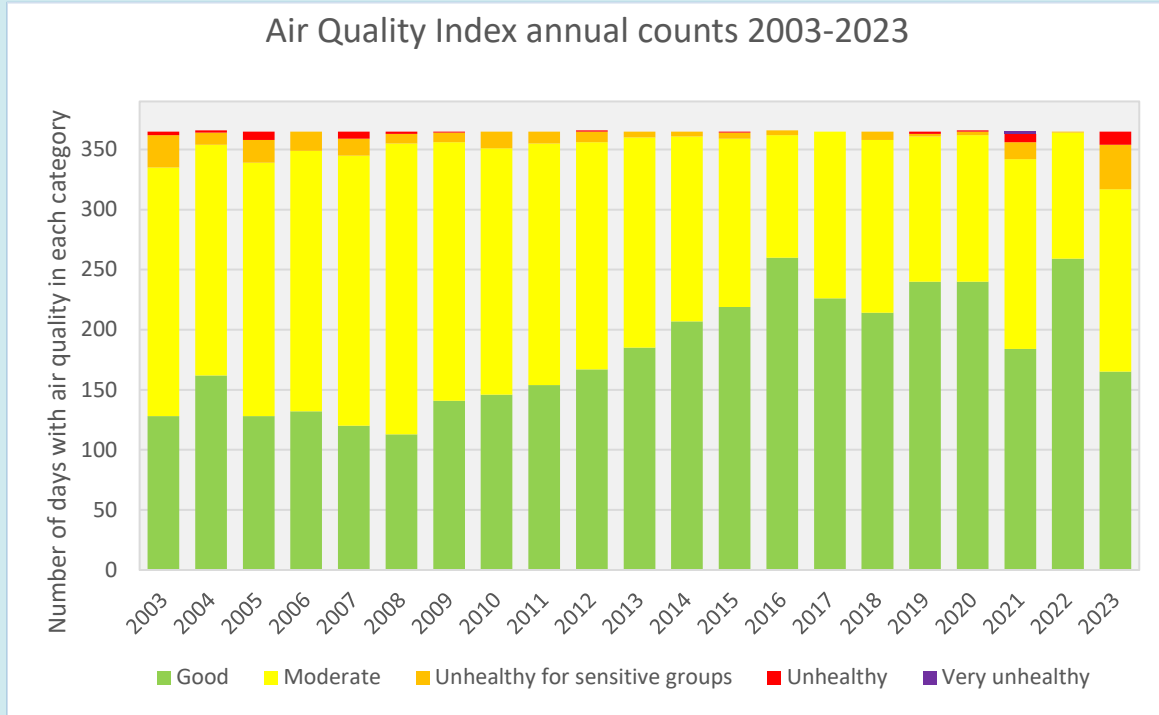
Continued on next page

¹⁴ Check daily AQI readings: <https://www.pca.state.mn.us/air-water-land-climate/current-air-quality-conditions>

¹⁵ Read the air quality forecast: <https://www.pca.state.mn.us/air-water-land-climate/air-quality-forecast>

Air Quality Index, continued

Figure 5: Wildfires and drought have increased the intensity and number of days with air quality alerts in Minnesota in recent years. Alerts are issued when the AQI will be in the orange, red, or purple categories. Learn more on [MPCA's interactive AQI data explorer](#)¹⁶.



You can expect fewer days in the 'good' air quality category and more days in the 'moderate' category in the future. The AQI is calculated by comparing pollutant concentrations to an index based on EPA's National Ambient Air Quality Standards. The EPA's standard for fine particles (PM_{2.5}) was made more stringent in 2024, so several of the AQI category thresholds have also been made more stringent. The orange category – unhealthy for sensitive groups – was not changed, though, so there won't be more AQI alerts because of the index adjustment.

Computer modeling

When large facilities apply for new or amended air permits, they must prove their emissions will not cause or contribute to air pollution exceeding National Ambient Air Quality Standards (NAAQS) or Minnesota Ambient Air Quality Standards (MAAQS). This is confirmed by computer modeling before a permit is issued. If the modeling indicates a facility's proposed emissions will likely contribute to ambient air exceeding limits, the facility must adjust its planned processes and restrict emissions of that pollutant to levels that keep ambient air within the standards.

¹⁶ MPCA's interactive AQI data explorer:
<https://data.pca.state.mn.us/views/Minnesotaairqualityindex/AQIExternal>

Facility-specific data used in the modeling analysis includes pollutant emission rates, temperatures, and velocities, stack heights, wind erosion from storage piles, dust from access roads and parking lots, emissions from delivery trucks, and the effects of nearby buildings and terrain. Modeling also takes into account background air pollution, other nearby sources of pollution, and meteorological data such as temperature, wind direction, and wind speed.

The MPCA can also use modeling to identify possible health impacts from the pollutants released by a facility. Modeling is used to represent the concentrations of hundreds of pollutants, including air toxics. The modeled concentrations are then compared to risk guidelines based on health benchmarks developed by the Minnesota Department of Health and EPA. Known as an [air emissions risk analysis](#)¹⁷, this process describes the potential risks posed to communities closest to the facility, which have the highest level of exposure to its emissions.

Another way MPCA uses computer modeling to understand potential risks of air pollution is with our [MNRISKS risk-screening tool](#)¹⁸, which aggregates air pollution risks from all sources, such as industrial facilities, traffic, residences, and businesses. Modeling combined risks means the tool takes into account the fact that risks go up when more sources of air pollution are near each other.

The MPCA uses computer modeling to evaluate where to put ambient air monitors, forecast daily air quality, understand which areas of the state are impacted more by air pollution, understand emissions from vehicles, calculate the potential cumulative health risks from air pollution, and study the way air pollution moves around the region and across state borders.

Permits

All facilities that emit air pollutants are required to determine if they need an air permit. Whether a permit is needed is determined by calculating the maximum amount of pollution the facility could possibly emit if it ran at maximum capacity, every day, all year. If this amount is over permitting thresholds for any regulated pollutant, a permit is required.

Permits are legally binding documents containing limits on air emissions and requirements for compliance. All facilities with air permits must follow the requirements in their air permit, submit an annual emissions inventory of criteria pollutants, and pay fees based on their annual emissions of certain air pollutants. Facilities with air permits may be required to conduct air modeling as part of their permit application, conduct regular testing of the pollutants coming out of their stacks, or conduct regular testing of the equipment they use to control how much pollution they emit.

The [type of air permit](#)¹⁹ a facility qualifies for is based on its actual or estimated emissions.

- The simplest permits are [registration permits](#)²⁰. Registration permits are for facilities with low actual emissions compared to their potential emissions. The requirements for these permits are outlined in state rule and are the same for all facilities that have this type of permit. Facilities can make changes to their equipment and activities as long as the facility continues to qualify for the permit.

¹⁷ Air emissions risk analysis: <https://www.pca.state.mn.us/business-with-us/air-emissions-risk-analysis-aera>

¹⁸ Risk-screening tool called MNRISKS: <https://www.pca.state.mn.us/air-water-land-climate/air-quality-and-health#:~:text=Cumulative%20health%20effects>

¹⁹ Type of air permit: <https://www.pca.state.mn.us/business-with-us/air-permit-types>

²⁰ Registration permits: <https://www.pca.state.mn.us/business-with-us/air-registration-permits>

- The most complicated permits are individual permits. Individual permits are customized for the facility, so facilities that want to make changes to their equipment or activities must apply for an amendment to their air permit. Federal NESHAP requirements are incorporated into individual air permits.

The public can search for facilities with pending air permit applications, including amendments, on MPCA's [Air permit applications webtool](#)²¹. You can look up existing facilities and find out what kind of air permit they have by using MPCA's [What's in My Neighborhood webtool](#)²².

Compliance and enforcement

Ensuring that permits and other requirements are followed is the job of MPCA's compliance and enforcement staff. These staff respond to complaints, conduct inspections and file reviews, determine appropriate penalties and fines when violations are discovered, and provide technical assistance and trainings to reduce pollution and avoid future permit violations. In 2024, MPCA sought and received legislative funding to add enforcement staff who will focus on inspections in environmental justice areas of concern. Inspections are prioritized in cooperation with EPA.

²¹ *Air permit applications webtool:*

<https://data.pca.state.mn.us/views/Airpermitapplicationsreceived/Permitapplications>

²² *What's in My Neighborhood webtool:* <https://www.pca.state.mn.us/about-mpca/whats-in-my-neighborhood>

Air pollution in Minnesota

Criteria pollutants

Criteria pollutants are those six specific pollutants that have federal limits restricting their concentrations in ambient air: lead, ground-level ozone, particulate matter (PM₁₀ and PM_{2.5}), nitrogen dioxide, sulfur dioxide, and carbon monoxide. Regulatory air monitors are used to determine compliance with the limits.

Minnesota generally meets federal standards for criteria pollutants, but exceeded lead standards in 2023 due to lead emissions at the Federal Ammunition facility in Anoka, and is close to exceeding federal standards for ozone and fine particles.

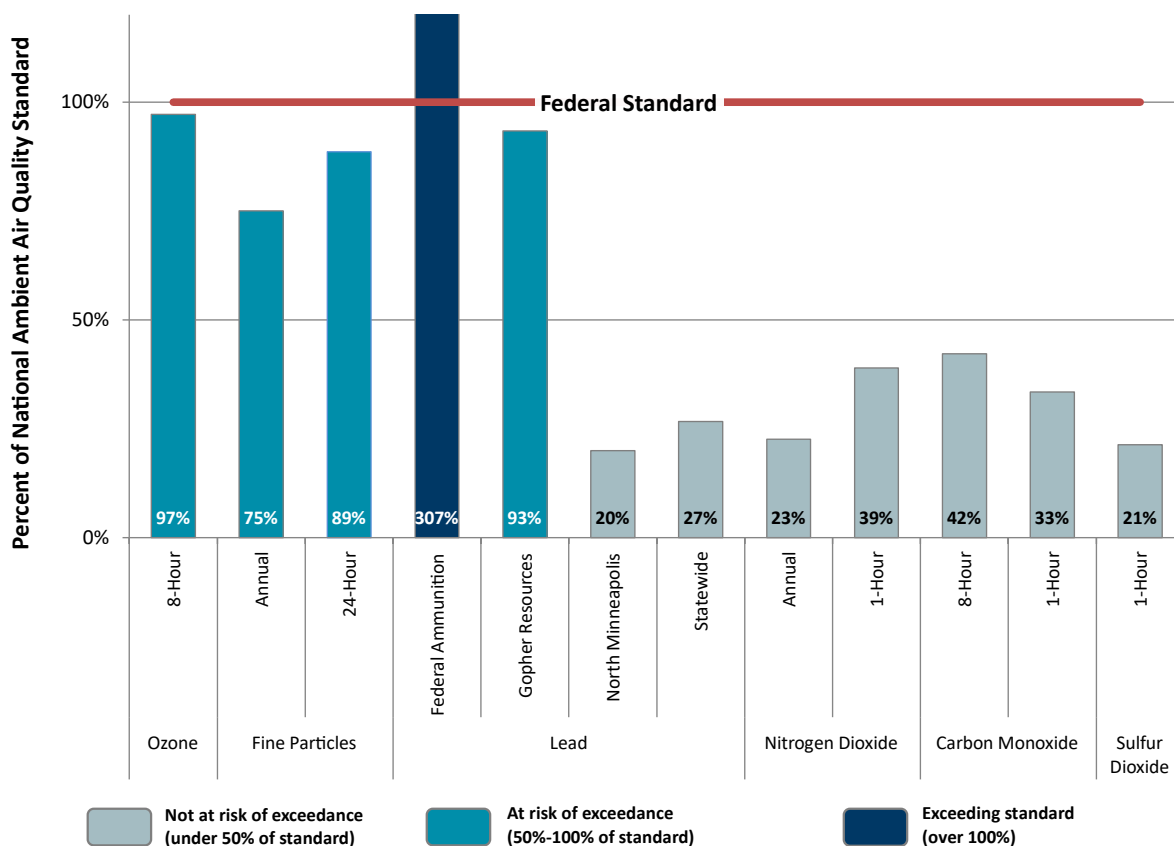


Figure 6: Minnesota met most federal standards for criteria pollutants statewide in 2023. However, lead emissions at the Federal Ammunition facility in Anoka caused Minnesota to exceed lead standards in 2023, and Minnesota is close to exceeding federal standards for ozone and fine particles. After regulatory action by EPA and MPCA, air monitors show that lead levels at Federal Ammunition have remained below federal standards since January 2024.

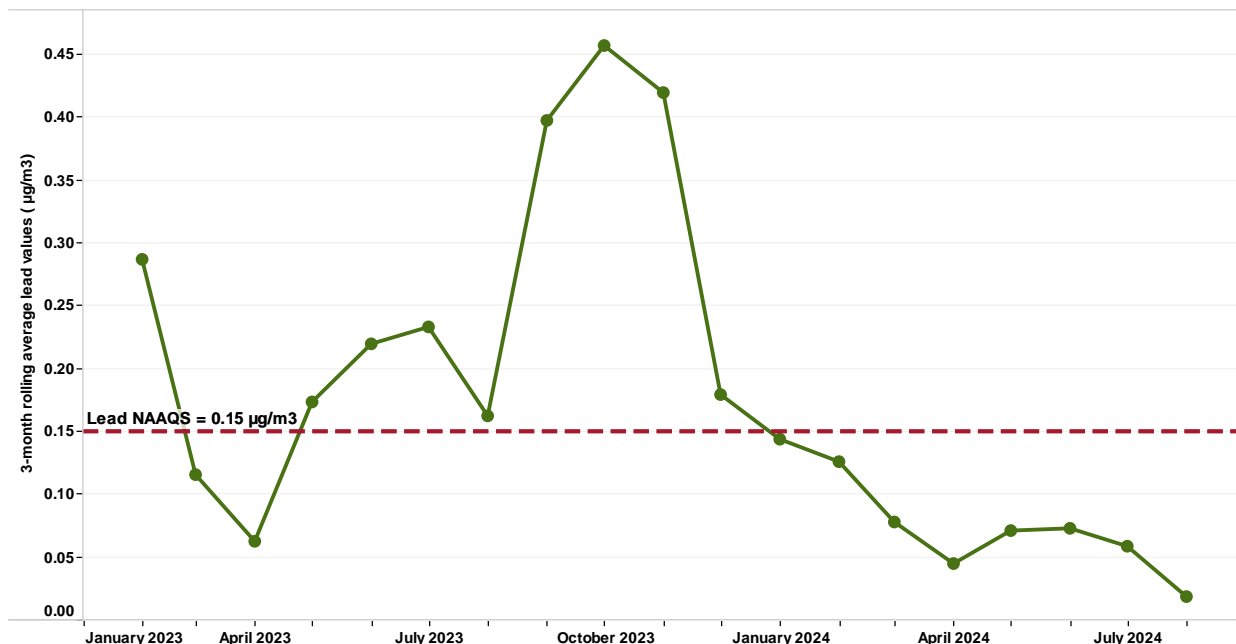
Lead

Lead levels in air monitors near Federal Ammunition, a known lead user and emitter in Anoka, caused Minnesota to exceed the federal standard for lead in 2023. The MPCA has been paying close attention to this facility since EPA tightened the National Ambient Air Quality Standard for lead in 2010. In 2021, MPCA staff reviewing emissions inventory submittals identified lead emissions at Federal Ammunition

over 0.5 tons per year. The MPCA, EPA, and Federal Ammunition developed plans to install regulatory air monitors at the facility fenceline, which is required by law when a facility exceeds 0.5 tons per year of lead emissions. The monitors confirmed elevated lead levels at the facility, which peaked in 2023 but have remained below the federal standard since January 2024 (see Figure 7). Most of the impacted area is on Federal Ammunition’s property and approximately 1,000 feet beyond the facility boundary. Federal Ammunition has been working directly with EPA and MPCA since 2023 to identify the causes and make changes at the facility to reduce lead emissions. EPA enforcement will require the facility to maintain those changes and keep levels below federal standards. The MPCA’s monitoring will continue at the facility to confirm that lead levels remain below the limit in the standard.

Figure 7: MPCA air monitoring data²³ show that high lead levels at Federal Ammunition, an ammunition manufacturer in Anoka, peaked in 2023, then fell below the federal standard in January 2024 and have remained there since then. Compliance with the standard is determined using a 3-month rolling average, which is the same measurement shown here. Federal Ammunition has been working with EPA and MPCA since early 2023 to identify the causes and make changes at the facility to reduce lead emissions.

3-Month Rolling Average Lead Values



Elevated lead levels and subsequent reductions at Federal Ammunition are an example of how pollution reduction efforts can get relatively quick results when the source is known and limited to a single facility. However, reductions are more challenging with pollutants such as ozone and particulate matter, which come from many sources and are influenced by complex interactions in the atmosphere.

Ozone and particulate matter

Minnesota is close to exceeding federal standards for ozone and particulate matter, and levels of both are expected to increase in the future due to climate change. At the same time, federal standards continue to be tightened as researchers uncover health impacts of air pollution at lower levels. The

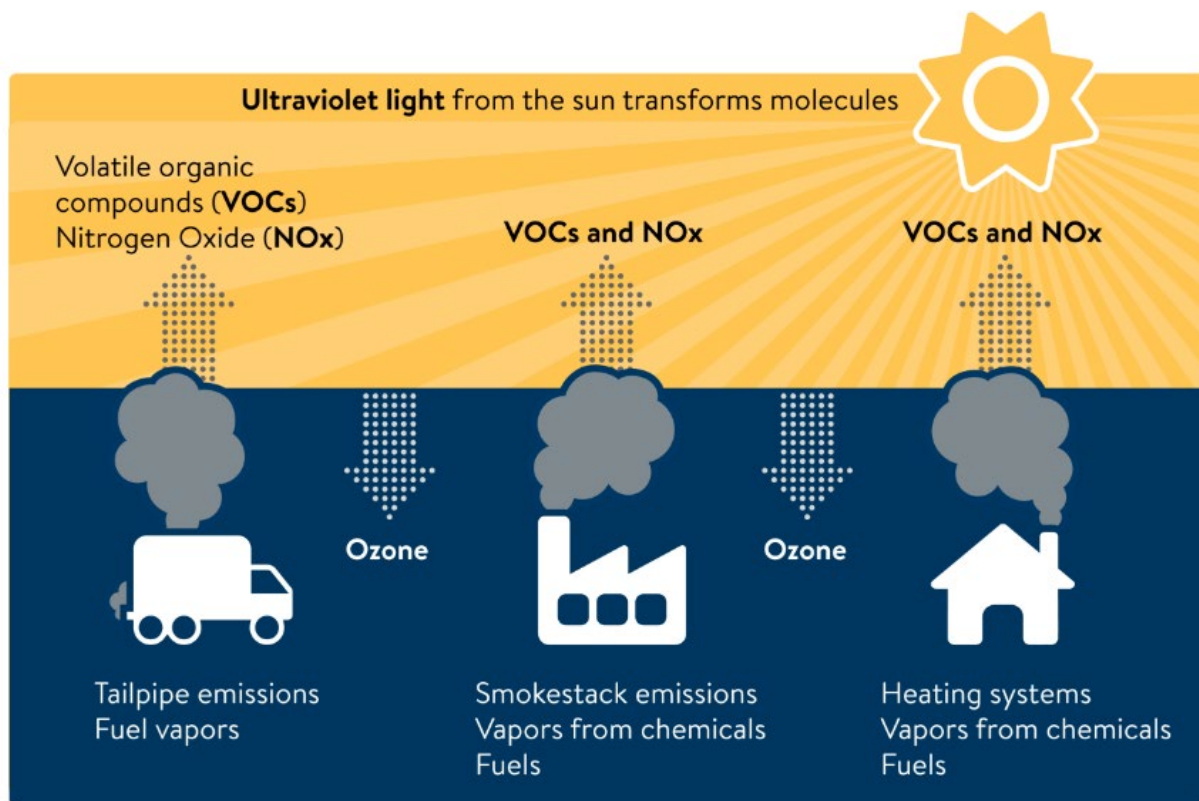
²³ Federal Ammunition lead monitoring results: <https://data.pca.state.mn.us/views/Airmonitoring-FederalAmmunition/FederalAmmunitionLeadAirMonitoringData>

federal standard for particulate matter was recently tightened by EPA, and the ozone standard is currently under review.

Particulate matter, which includes PM₁₀ and PM_{2.5}, is defined by the size of the particles, not by the specific pollutants. For PM_{2.5}, also called fine particles, pollutants that are 2.5 micrometers and smaller are regulated by the standard. Because fine particles are a mixture of all the pollutants of a certain size, they can be a solid or liquid and can be directly released or formed from chemical reactions in the atmosphere. They are particularly impactful to our health because they are made up of many pollutants, and their size is so small that they can bypass most of our bodies' defenses, affecting the ability to remove inhaled foreign materials, such as viruses and bacteria, from the lungs.

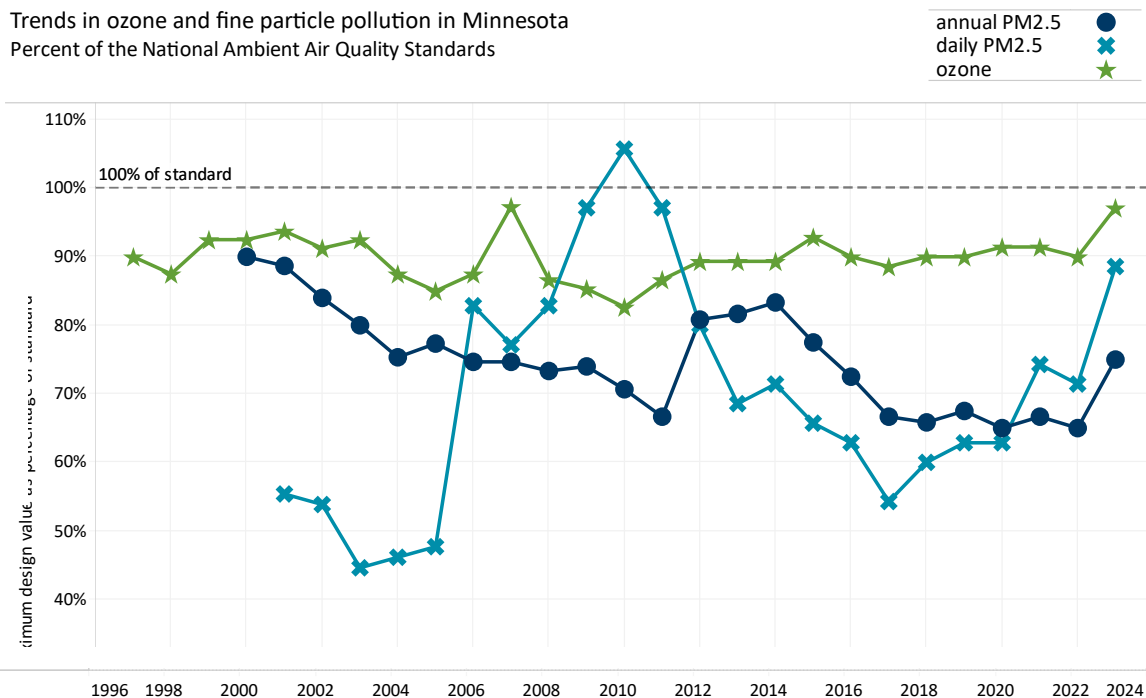
Ozone is not emitted directly into the air. It is formed from the chemical reaction of sunlight with VOCs and nitrogen oxides (NO_x). Unhealthy levels of ozone can develop on hot sunny days near urban areas where there are many sources of VOCs and NO_x. Ozone can irritate the eyes, nose, and throat, and can aggravate asthma, bronchitis, and other lung diseases.

Figure 8: Ground-level ozone forms when sunlight interacts with pollution from burning fuels or using chemicals .



Fine particles and the pollutants that form ozone come from a multitude of sources. This makes fine particle and ozone reduction strategies complex because the pollutants are not coming from a single facility or even a single sector. To ensure we continue to meet the standards for these pollutants in ambient air, we will need continued emission reduction efforts from all the sources that contribute fine particle or ozone-forming pollution across commercial, industrial, and residential sectors.

Figure 9: Ozone and particulate matter (PM_{2.5}) in Minnesota over the history of this report. Air pollution reduction efforts have kept Minnesota reliably below federal limits. Exceeding the limits is within the realm of possibility, though, as illustrated by the peak in 2010 driven by stagnant winter weather conditions and recent increases driven by wildfires.



Wildfire smoke is a growing source of particulate matter and the pollutants that form ozone in Minnesota, and that growth is expected to continue due to climate change. In 2023, smoke from Canadian wildfires prompted MPCA to issue its first-ever combined air quality alert for fine particles and ozone. Although pollution from wildfires is not included when determining whether an area has exceeded federal air quality standards, wildfire pollution is taken into account when MPCA considers health impacts from air pollution in the state. Efforts must be made to reduce the air pollution that we can so our health isn't overwhelmed by pollution from sources we have less control over, like wildfires.

Greenhouse gases (GHGs)

Minnesota's climate is changing rapidly, and these changes – driven largely by human-caused emissions of greenhouse gases (GHGs) – are affecting our health, communities, natural resources, and way of life. To learn more about GHG emissions in Minnesota, the state's reduction goals and strategies, and read the latest GHG emissions reduction report, visit [MPCA's Climate change trends and data webpage](https://www.pca.state.mn.us/air-water-land-climate/climate-change-trends-and-data)²⁴. Visit the [Our Minnesota Climate webpage](https://climate.state.mn.us/minnesotas-climate-action-framework)²⁵ to access Minnesota's Climate Action Framework.

²⁴ MPCA's Climate change trends and data webpage: <https://www.pca.state.mn.us/air-water-land-climate/climate-change-trends-and-data>

²⁵ Our Minnesota Climate: <https://climate.state.mn.us/minnesotas-climate-action-framework>

Air toxics

The term ‘air toxics’ is used to collectively refer to all the pollutants known or suspected to cause cancer or other serious health or environmental effects. Air toxics include metals, solvents, dioxins, PFAS, all the hazardous air pollutants (HAPs) listed in the Clean Air Act, and other chemicals. In total, MPCA tracks over 900 air toxics.

Sources of air toxics

Most of Minnesota’s air toxics pollution comes from sources we all contribute to every day. Though many sources may be small on their own, together they create a significant impact.

- **Neighborhood sources** contribute the largest portion of air toxics pollution in Minnesota (43%), from commercial and residential winter heating, backyard fires, yard equipment like lawnmowers and snowblowers, small businesses like gas stations, and more²⁶.
- **Transportation sources** are the second largest emitters of air toxics pollution, nearly equivalent to neighborhood sources (39%). Transportation includes vehicles we use to get around (cars, SUVs, vans, motorcycles, pickup trucks), vehicles we use to move things (diesel trucks and semis, trains, ships), recreational vehicles (ATVs, snowmobiles, boats), and airplanes.
- **Industrial sources** were responsible for more of Minnesota’s overall air pollution in the past, but their contribution has decreased due to regulation and improved technology. Permitted facilities are the third largest source of air toxics, emitting roughly one third as much air toxics pollution as neighborhood sources or transportation (13%).
- **Fires** are also a factor. They include wildfires as well as inadvertent or intentional agricultural burning and prescribed burns (5%).

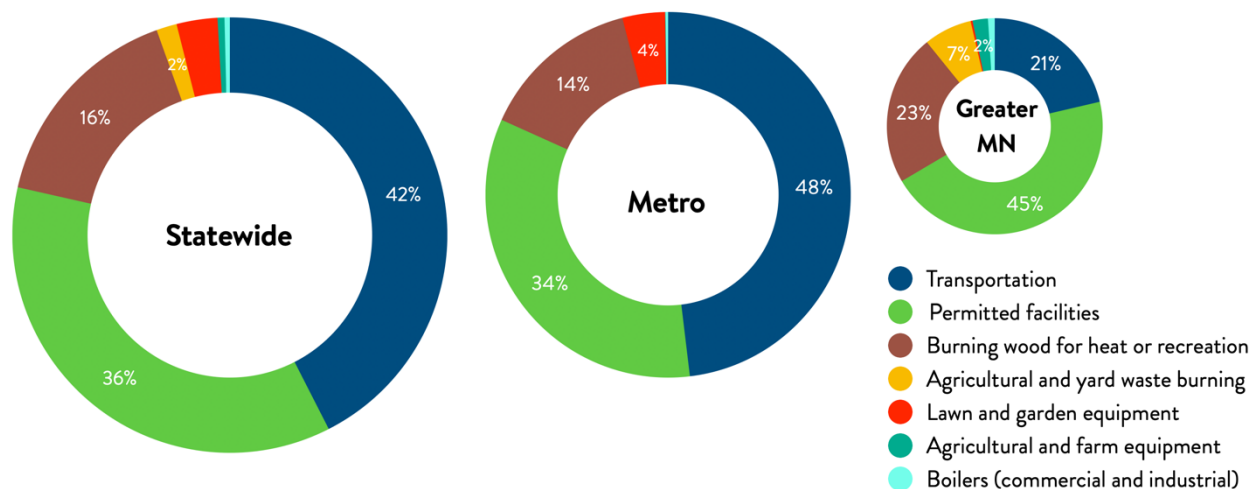
However, interpretation of these state-wide breakdowns is important to consider. Even if a source ranks low for statewide contribution, it can still have a big local impact. In addition, the specific pollutants people are exposed to are an important consideration when MPCA identifies areas of pollution to address. People are exposed to myriad pollutants at varying concentrations every day, and some pollutants have a greater potential for health effects than others or can cause health effects at a lower exposure. The MPCA uses our cumulative risk screening tool, MNRISKS, to take these factors into account. By comparing modeled concentrations of pollutants in the outdoor air to [health benchmarks](#)²⁷, MNRISKS can help us see which sources are more likely to contribute to potential health effects.

²⁶ Source: Statewide air emissions data, 2020, the most recent year with available air toxics data: <https://data.pca.state.mn.us/views/Airemissions-statewide/Emissions>

²⁷ Health benchmarks: <https://data.pca.state.mn.us/views/Airtoxicityvalues/Airtoxicityvalues>

Figure 10: Comparisons of source contributions to air pollution risk statewide, in the Twin Cities metro, and in Greater Minnesota. The sources contributing the most air pollutants that can lead to health effects are transportation, permitted facilities, and burning wood for heat or recreation. Transportation has a notably outsized contribution in the Twin Cities metro area compared to Greater Minnesota.

Air pollution risk sources in Minnesota



- Transportation sources contribute the largest portion of pollutants that pose health risks statewide. Most of the pollution from transportation is from combustion of gasoline or diesel fuel. Dust from brake pads and rubber from tires also contribute. The MPCA has limited authority to regulate emissions from transportation sources.
- Pollution from industrial permitted facilities that contributes to potential health risks falls into two broad categories: pollution from processes and pollution from combustion of fuels to heat or power those processes.
- The popularity of burning wood for home heating and recreation in greater Minnesota means wood smoke is a larger contributor to potential health risks from air pollution there, higher than the contribution from transportation. Based on MPCA’s regular wood burning survey, residential wood burning is increasing, and wood smoke pollution is increasing along with it. More than half (57%) of direct fine particle emissions in the state come from wood burning. Wood smoke also contains pollutants such as carbon monoxide, dioxins, and volatile organic compounds (VOCs). The 2020-2021 survey found that recreational wood fires are the most common reason people burn wood, but the largest volume of wood is burned for home heating. It also found that about one-third of wood stoves and 20 percent of fireplace inserts in use were older models that release significantly more pollution than newer versions. The MPCA does not regulate emissions from recreational burning.

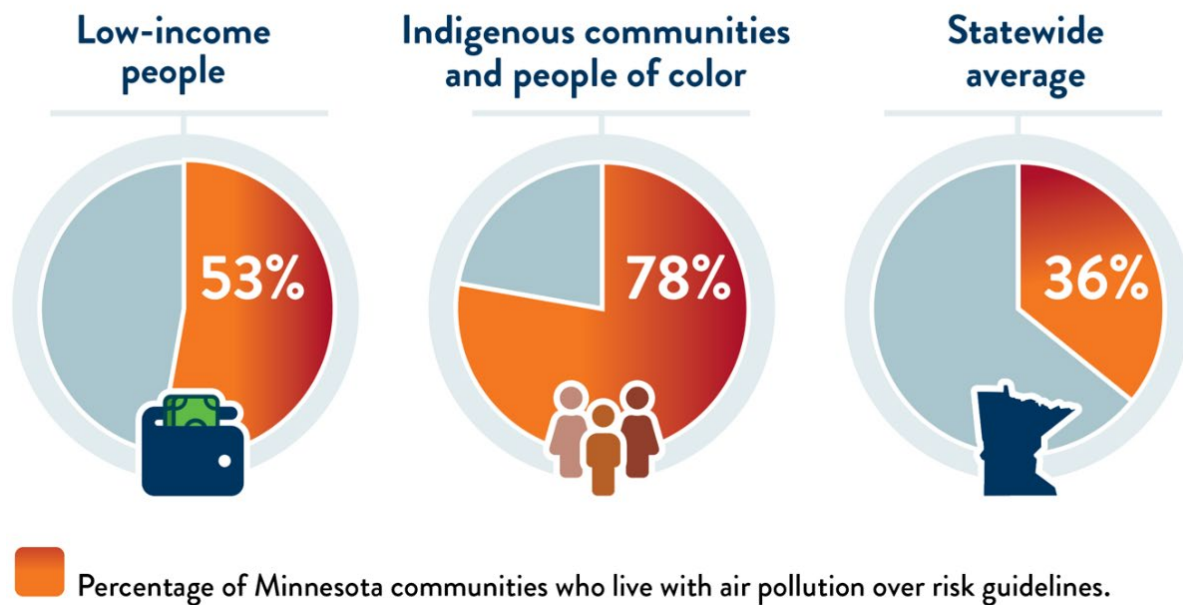
Disproportionate impacts of pollution

Demographics such as race, ethnicity, and income are consistent indicators of how much pollution people are exposed to from these sources. Due to the relationships between pollution exposure rates and demographics, environmental justice is an increasing focus of our air quality work and a priority for MPCA and the State of Minnesota to ensure all Minnesotans have clean air to breathe. Environmental justice is defined as the fair treatment and meaningful involvement of all people, regardless of race,

color, national origin, or income, concerning the development, implementation, and enforcement of environmental laws, regulations, and policies. Enduring environmental injustices were created in Minnesota when freeways were built through Black neighborhoods and redlining and zoning decisions concentrated people of color together with industrial pollution sources. The MPCA's environmental justice initiatives aim to reduce the elevated pollution burdens Indigenous, people of color, and low-income residents often face.

Figure 11: Indigenous, people of color, and low-income residents in Minnesota are more likely to have busy roadways, industrial facilities, and other sources of air pollution in their neighborhoods. This leads to higher pollution burdens in areas of concern for environmental justice and increases the possibility of health effects that are caused or made worse by air pollution. The numbers in this figure reflect the percentage of census block groups that are exposed to air pollution over health risk guidelines.

Some groups of people are more likely to be near higher levels of air pollution



Some air toxics are worse than others

The following section uses 2020 emissions inventory data to look more closely at the air toxics that drive health risks. Some pollutants, such as metals, VOCs, and polychlorinated biphenyls (PCBs), can cause health effects at lower levels than others. Whether an individual will experience health impacts depends on the amount and duration of exposure, individual susceptibility, underlying conditions, and cumulative exposures. Knowing the sources of these air toxics helps MPCA focus our efforts to reduce pollutant emissions and potential health impacts.

Metals

Health effects from metals in air pollution include lung irritation, skin allergies, nerve and brain damage, and diseases and cancers of the lungs, heart, liver, kidneys, and blood²⁸.

Most metal emissions in Minnesota come from industrial facilities that make or modify metal products. Fuel combustion at industrial facilities also contributes, especially at facilities that still burn coal, such as power plants. Metal emissions from fuel combustion have decreased over time as coal and oil use has declined. Transportation contributions come primarily from locomotives and from leaded fuel used by small airplanes. Methods for estimating statewide metal emissions have also become more precise over time, resulting in lower overall estimates.

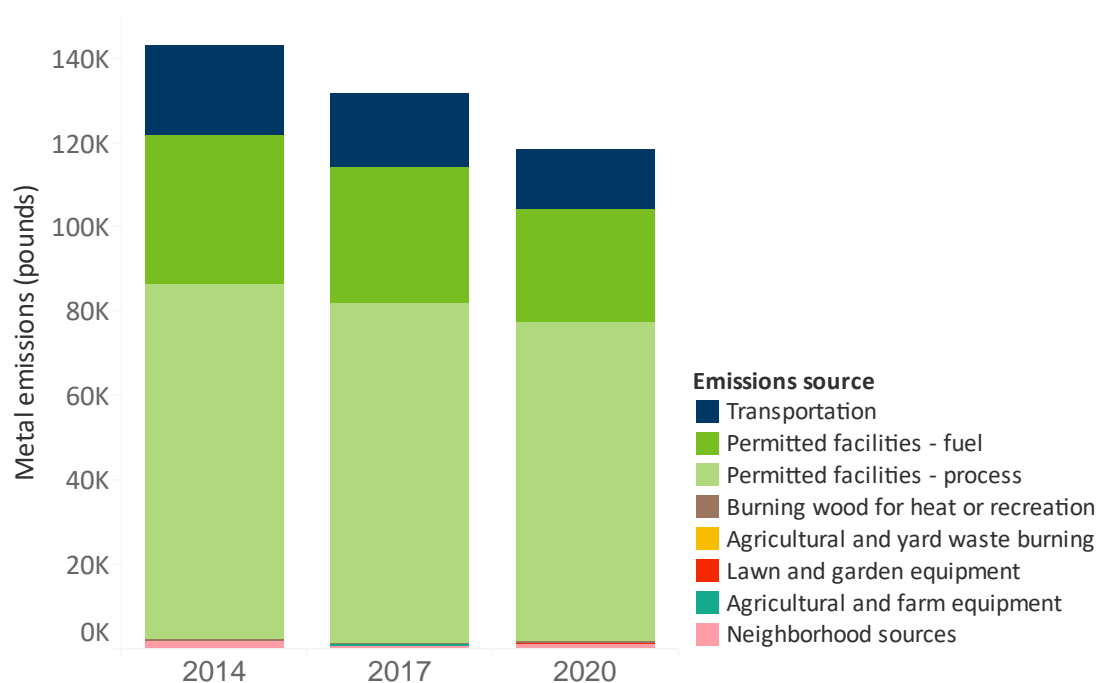


Figure 12: Metal emissions. Most metal emissions in Minnesota come from metal processing at industrial facilities and fuel combustion for industry and transportation²⁶Error! Bookmark not defined.

Volatile organic compounds

Volatile organic compounds (VOCs) are a group of air toxics emitted from industrial and commercial processes as well as many of our daily activities. You may recognize them as the fumes coming from paint,

²⁸ Source: <https://www.epa.gov/haps/health-effects-notebook-hazardous-air-pollutants>

solvents, glues, gasoline, and cleaning products. They are also released when fuel is burned in cars, trucks, lawn mowers, wood stoves, recreational equipment, generators, and industrial equipment.

Health effects linked to VOCs include eye, nose, and throat irritation, headaches, damage to the liver, kidneys, and central nervous system, and cancer²⁹. In addition to their direct impact on health, VOCs can combine with sunlight and nitrogen oxide (NO_x) pollution from combustion to form ground-level ozone, a known asthma trigger.

Figure 13 shows that a large amount of emissions come from neighborhood sources, which are small but common and widespread sources of pollution. Nearly one-third of neighborhood VOC emissions in Minnesota in 2020 came from commercial and residential use of products such as paint thinners and strippers, disinfectants and household cleaners, glues, air fresheners, permanent markers, scented products, and more. Since many of the products are used indoors, the Minnesota Department of Health has [information about reducing VOCs](#)³⁰ in your home or business and [EPA's Safer Choice](#)³¹ program can help you choose products that are less harmful to your health and the environment.

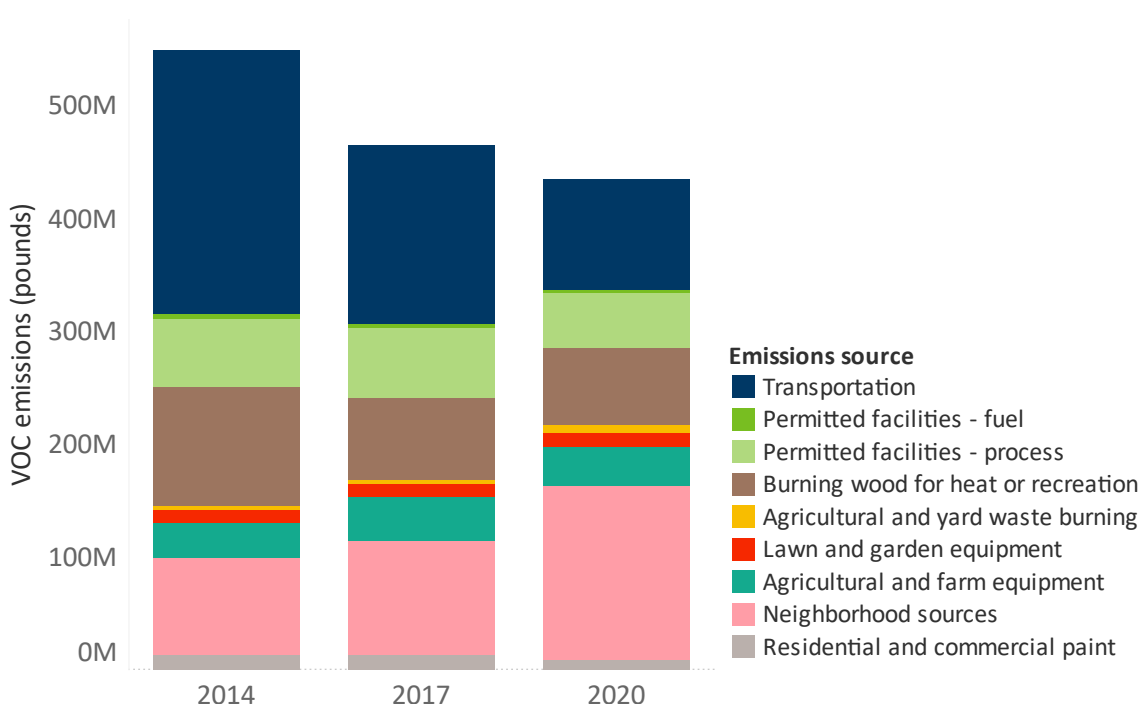


Figure 13: VOC emissions. Most VOCs in Minnesota come from combustion of fuels.

The second largest source of VOCs in 2020 was transportation. Nearly half of transportation VOC emissions came from recreational equipment, which includes snowmobiles, ATVs, dirt bikes, and other vehicles used for off-road recreation. Several factors likely contribute to the emissions from these types of vehicles, such as two-stroke engines and aging four-stroke engines not fully combusting the fuel they burn, and the fact that EPA emission standards for these types of engines have not been updated in over 15 years.

²⁹ <https://www.pca.state.mn.us/pollutants-and-contaminants/volatile-organic-compounds-vocs>

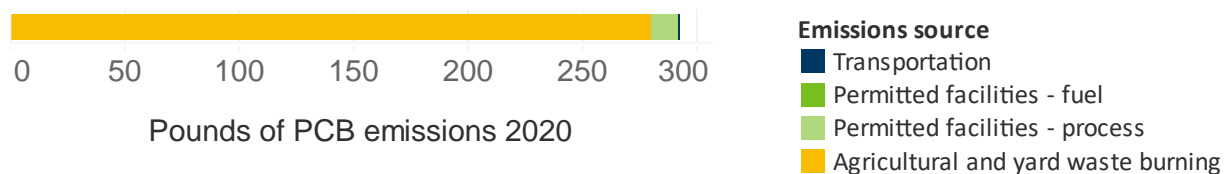
³⁰ *Information about reducing VOCs:*
<https://www.health.state.mn.us/communities/environment/air/toxins/voc.htm>

³¹ *EPA's Safer Choice:* <https://www.epa.gov/saferchoice>

Polychlorinated biphenyls

Before they were banned in 1979, polychlorinated biphenyls (PCBs) were frequently used in products because they are non-flammable, good electrical insulators, and chemically stable. Products from that era that may contain PCBs include electrical transformers, capacitors in appliances, fluorescent light ballasts, insulation, caulking, paint, hydraulic oil, and carbonless copy paper³². When these old materials are burned, the PCBs are released as air pollutants. After they are released, PCBs remain in the environment for a long time and bioaccumulate, which means they can build up in the body of people and animals over time. Health effects linked to PCB air pollution include impacts on the respiratory tract, digestive system, liver, and skin³³.

Figure 14: PCB emissions. PCBs have been banned, but remain in old products. More than 95% of PCB emissions in 2020 came from open burning of materials that contain PCBs.



Reducing pollution starts by burning less

There is a common thread connecting much of the air pollution in Minnesota: combustion. Half of the pollution released in Minnesota in 2020 came from burning fossil fuels for heat or power and burning wood for heat or recreation. Efforts to reduce pollution from these sources, such as by burning wood in newer equipment with pollution controls and using fossil fuels less overall, will have immediate positive impacts on human health and lasting impacts on the planet's health.

³² Source: <https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls>

³³ Source: <https://www.epa.gov/haps/health-effects-notebook-hazardous-air-pollutants>

Actions

The MPCA uses a mixture of strategies to reduce air pollution and its impacts. Across all our air pollution reduction work, we strive to take into account health risks, disproportionate impacts, gaps in regulation, climate impacts, and environmental justice, to ensure everyone has healthy air to breathe.



Cumulative impacts

There are many sources of pollution and stressors that impact health all at once. The MPCA has long sought to consider these cumulative effects.

Strategies

- **MNRISKS.** Since the early 2000s, MPCA has used our MNRISKS risk-screening tool to find areas where air pollution has the potential to lead to health effects. Information is modeled to represent air pollution concentrations across the state, and then compared to health benchmarks to help us better understand the cumulative risk presented by multiple sources of air pollution. Because MNRISKS is calculated at a relatively small scale (census block group), MPCA can use it to better understand air quality at a local level.
- **Cumulative levels and effects.** In 2008, the Legislature established the [cumulative levels and effects statute](#)³⁴. This law requires MPCA to consider the impact of past and current pollution when reviewing facility air permit applications in the East Phillips neighborhood in Minneapolis. MPCA worked with community members to develop the evaluation method. The method requires facilities and MPCA to consider nearby health data, community stressors and vulnerabilities, and pollution pathways other than air pollution, such as water and soil.

Next steps

- **Cumulative impacts rule.** The MPCA is in the process of developing a [cumulative impacts rule](#)³⁵ required by 2023 legislative action. For many neighborhoods and communities in Minnesota, decades-old permitting and zoning decisions by local, state, and federal governments have resulted in industrial and manufacturing facilities located near homes, schools, and parks. MPCA will use this rule to address Minnesotans' disproportionate exposure to pollutants and the cumulative impacts of pollution. See more in the Rule overview section on page 29.
- **Consider cumulative impacts agency-wide.** The MPCA's existing tools and regulations take into account certain aspects of cumulative effects, but all are constrained in some way. To address this, the agency is developing cumulative impacts analyses and tools that will help us be more holistic in our decision-making, whether the decisions affect permits, policy, or rules, and regardless of whether the impacts are from the air, water, or land.

³⁴ *Cumulative levels and effects statute:* <https://www.pca.state.mn.us/business-with-us/air-permitting-in-south-minneapolis>

³⁵ *Cumulative impacts rule:* <https://www.pca.state.mn.us/get-engaged/cumulative-impacts-rulemaking>



Industrial pollution and regulations

Strategies

Focus on facilities in environmental justice areas of concern

- **Inspection planning.** Since 2018, MPCA’s air compliance and enforcement inspectors have prioritized inspections of facilities located in areas of concern for environmental justice, and especially those in areas with the highest potential risk for health impacts from air pollution.
- **Targeted inspections.** In 2024, inspectors focused on inspecting 60 facilities located in environmental justice areas of concern in the Twin Cities metro that had not been inspected in the past 10 years, were among the top emitters of NO_x and PM_{2.5}, or had emissions that modeled above health benchmarks. Most of the facilities were meeting the requirements of their air permit and required no further action or had low-level violations that could be quickly corrected.
- **Prioritized permitting.** The MPCA continues to meet our EPA-agreed-upon goal to annually reissue 12 air quality permits in environmental justice areas of concern, ensuring facilities in these areas have up-to-date permits. In 2024, MPCA issued 26 such permits, with 22 permits issued in 2023, and 13 permits in 2022.

Use in-house risk modeling to screen facilities

- **Air toxics reductions at facilities.** The MPCA uses the MNRISKS air pollution risk model to look at permitted facilities in Minnesota and identify those where estimated emissions of air toxics may result in ambient air concentrations over health benchmarks. Prioritizing those in environmental justice areas of concern, MPCA works with these facilities to confirm their emission estimates and, if needed, asks them to develop a plan to reduce emissions of air toxics that are over health benchmarks.
- **Enhanced engagement at facilities.** The MPCA uses the MNRISKS air pollution model when facilities that are in or within one mile of an environmental justice area of concern apply for a new, amended, or reissued air permit, to identify those with air emissions that pose a greater risk to nearby residents. Air permitting staff invite these facilities to discuss [environmental improvements and community engagement ideas](#)³⁶.
- **Support for small facilities.** The MPCA’s [Small Business Environmental Assistance Program](#)³⁷ provides free technical assistance, 0% interest loans, and grants to encourage pollution reductions that go beyond regulatory requirements.

³⁶ *Environmental improvements and community engagement ideas:* <https://www.pca.state.mn.us/sites/default/files/aaq1-69.pdf>

³⁷ *Small Business Environmental Assistance Program:* <https://www.pca.state.mn.us/business-with-us/small-business-environmental-assistance>

Next steps

Follow up on federal and state actions

- **PM_{2.5} NAAQS.** Minnesota meets EPA’s recently revised annual standard for fine particles based on 2021-2023 data. Values are close to the standard, though, which EPA lowered from 12 micrograms per cubic meter to 9 micrograms per cubic meter in 2024.
- **New rules.** Develop and implement new rules related to air toxics reporting and regulation, cumulative impacts, and odor. See [Rule overview](#) on page 29 for details.

Implement new funding

- **Pollution reduction grants at facilities.** Offer grants that will reduce industrial pollution in environmental justice areas of concern by encouraging facilities to be innovative and reduce their emissions beyond what regulations require. Facilities can use the funds to purchase pollution control equipment or make process changes.
- **New staff.** Hire 15 new staff to focus on air quality in environmental justice areas of concern by monitoring air emissions, issuing air quality permits, responding to air pollution complaints, and conducting air quality enforcement actions.
- **Air monitoring.** Purchase a mobile air monitoring trailer, which will help MPCA respond quickly to air quality concerns at facilities in environmental justice areas. Determine placement of five new air toxics monitoring sites in environmental justice communities, taking into account community concerns and agency priorities.

Expand the ways we learn about and understand the impacts of industrial pollution on communities

- **Consider more perspectives.** [Incorporate lived experiences into the air permitting process](#)³⁸, and then apply it throughout the agency. Lived experiences are stories and testimonials gathered from community members in an area of interest to our regulatory work. These testimonials provide insight into the impact of pollution on communities in ways that might not be captured through epidemiological and toxicological reviews or other environmental evaluations currently used by MPCA.

Develop our understanding of PFAS chemicals in the air

- **PFAS sources.** Per- and polyfluoroalkyl substances (PFAS), also known as “forever chemicals,” are a group of more than 5,000 human-made chemicals that do not break down over time. Studies by MPCA^{39,40} have found PFAS in ambient air statewide. A better understanding of the sources of PFAS in the air will help us reduce exposures and PFAS in surface water.
- **PFAS snow sampling.** We are developing an innovative way of testing for PFAS in the air by sampling snow that has accumulated on rooftops or around buildings with suspected PFAS emissions.

³⁸ *Incorporate lived experiences into the air permitting process:* <https://www.pca.state.mn.us/business-with-us/permitting-and-lived-experience>

³⁹ MPCA “PFAS Air and Deposition Monitoring Report”, April 2022, <https://www.pca.state.mn.us/sites/default/files/tdr-g1-23.pdf>

⁴⁰ MPCA “PFAS Monitoring Plan: Initial findings and next steps,” May 2024, <https://www.pca.state.mn.us/sites/default/files/p-qen1-22h.pdf>

Coming soon: Four new rules

The 2023 Legislature directed MPCA to adopt four new air rules.

1. Air toxics reporting rule

Currently, Minnesota facilities with air permits voluntarily report emissions of hazardous air pollutants (HAPs, also known as air toxics) to MPCA every three years. This rule will require annual reporting on air toxics emissions from permitted facilities located in Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, or Washington counties.

Learn more on MPCA's [Air toxics emissions reporting rule webpage](#)⁴¹.

2. Air toxics regulatory rule

This rule will develop a way for MPCA to regulate air toxics at permitted facilities located in Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, or Washington counties. The rule will specify which air toxics and types of facilities are regulated, how facilities will be expected to measure their air toxics emissions, reporting and recordkeeping requirements, and inspection schedules. Rule requirements will take into account the different risks to human health and the environment posed by the specific air toxics and amounts emitted by a facility, so that facilities posing greater risks will be required to provide more frequent evidence of compliance.

Learn more on MPCA's [Air toxics regulations rule webpage](#)⁴².

3. Cumulative impacts rule

This rule will add cumulative impacts requirements to the air permit application process in and near environmental justice areas of concern across the Twin Cities seven-county metro, Duluth, and Rochester. It will require facilities to take a comprehensive look at past and current pollution burdens that could affect the health of people who live nearby and the facility's potential contribution. If a significant negative impact is identified, the facility must develop a legally binding community benefits agreement with the community before they can obtain a permit.

Learn more on MPCA's [Cumulative impacts rule webpage](#)⁴³.

4. Odor management rule

Minnesota does not currently have odor management rules for ambient air. This rule will require facilities that emit objectionable odors located in Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, or Washington counties to develop and submit an odor management plan to MPCA. The rule will include a process for investigating odor complaints and determining if an odor is objectionable, and criteria for determining the success or failure of an odor management plan. The rule will apply to facilities regardless of whether they have an air permit.

Learn more on MPCA's [Odor management rule webpage](#)⁴⁴.

⁴¹ Air toxics emissions reporting rule webpage: <https://www.pca.state.mn.us/get-engaged/air-toxics-emissions-reporting>

⁴² Air toxics regulations rule webpage: <https://www.pca.state.mn.us/get-engaged/air-toxics-regulations>

⁴³ Cumulative impacts rule webpage: <https://www.pca.state.mn.us/get-engaged/cumulative-impacts-rulemaking>

⁴⁴ Odor management rule webpage: <https://www.pca.state.mn.us/get-engaged/odor-management>



Transportation pollution

Strategies

- **Diesel replacements.** Use [Volkswagen settlement](#)⁴⁵ funds and federal [Diesel Emissions Reduction Act \(DERA\)](#)⁴⁶ funds to reduce pollution from vehicles. We invested \$23.5 million from 2020-2023, which funded the replacement of 275 older diesel vehicles and equipment with new, less-polluting versions. It also funded 150 new electric vehicle (EV) charging stations across Minnesota. Nearly half (48%) of the funds were invested in areas of concern for environmental justice.
- **Electric vehicles.** Raise awareness about the air quality benefits of electric vehicles at the State Fair's Eco Experience and by hosting or participating in electric vehicle showcases. Electric vehicles have zero tailpipe emissions and less overall emissions compared to combustion engine vehicles. Messaging at the Eco Experience reminds drivers that choosing electric means you have more choices over the source of power such as rooftop solar or a renewable energy subscription from your utility, electric motors have fewer moving parts than combustion engines so they use less power to get the same job done, and electric motors get cleaner as the electricity grid gets cleaner – the opposite is true of gasoline engines, which get less efficient as they age.
- **Share our expertise.** Continue to contribute our perspective and policy expertise to MnDOT and Met Council transportation infrastructure planning.

Next steps

- **Reduce diesel emissions.** Continue to use VW settlement funds and federal DERA funds to reduce diesel emissions across the state.
 - [VW Phase 3](#)⁴⁷ investments in 2024-2027 will total \$14 million, with at least 20% of funds invested in areas of concern for environmental justice in greater Minnesota, and another 20% invested in areas of concern for environmental justice in the Twin Cities metro.
 - The MPCA expects total reductions from VW Phase 3 investments of over 2,700 tons of nitrogen oxides (NO_x), over 150 tons of fine particles (PM_{2.5}), and over 32,000 tons of greenhouse gases (GHG).
 - Grants will fund electric vehicle charging stations, idle-reduction retrofits for locomotives, electric shore power for ships, and replacements for transit and school buses, heavy-duty delivery trucks, airport ground support equipment, and more. At least half of the funds will be used for electric vehicles – their lack of tailpipe emissions means that investing in them

⁴⁵ Volkswagen settlement: <https://www.pca.state.mn.us/air-water-land-climate/using-volkswagen-settlement-for-clean-transportation>

⁴⁶ Diesel Emissions Reduction Act (DERA): <https://www.epa.gov/dera>

⁴⁷ VW Phase 3: <https://www.pca.state.mn.us/sites/default/files/aq-mvp2-40c.pdf>

will have long-term positive impacts on human health and the climate. Offering a mix of fuel options allows businesses and communities to purchase vehicles that best fit their budget and local needs while also achieving significant emission reductions.

- **Electric school buses.** Build on what we learned from the [electric school bus pilot project](#)⁴⁸. After collecting data from eight buses across the state, our research shows that electric school buses can and do work in Minnesota. We will continue to share this information with school districts and electric school bus advocates around the state.
- **Gas stations.** Distribute grant funding for equipment to [capture gasoline vapors at filling stations](#)⁴⁹. Benzene, a cancer-causing air toxic, and other volatile organic compounds (VOCs) are released during the transfer of gasoline from a delivery vehicle into underground storage tanks, such as those at filling stations. A vapor recovery system can capture about 95 percent of the vapors.
- **Be ready.** Continue building relationships and being alert to funding opportunities that support transportation-related air pollution reductions in areas of concern for environmental justice, or are connected to disproportionate impacts such as pollution from the trucks, trains, barges, and ships used to move goods into and out of Minnesota at ports and on busy roads.



Neighborhood pollution and voluntary reductions

Strategies

- **Invest in disadvantaged areas.** Give preference to projects in areas of concern for environmental justice when awarding grants. This helps ensure that areas that have been chronically overlooked get the attention, air pollution reductions, and financial investments they need.
- **Burn dry wood.** Share messaging at the Eco Experience at the Minnesota State Fair and on MPCA's social media channels reminding everyone that wood smoke is air pollution, you can reduce it by only burning clean dry wood, and we recommend not burning wood during air quality alerts.
- **Keep wood dry.** To reduce wood smoke exposure on tribal lands, we have partnered with the Fond du Lac Band of Lake Superior Chippewa, Leech Lake Band of Ojibwe, Red Lake Nation, Grand Portage Band of Lake Superior Chippewa, and Prairie Island Indian Community to fund construction of woodsheds to keep firewood dry.
- **Stove swaps.** Fund programs to replace old wood-burning stoves with newer, less-polluting models. Old wood stoves and other wood-burning appliances made before 1989 release far more pollution than newer versions. The MPCA estimates there are over 77,000 wood stoves and 5,000 fireplace inserts of that vintage in Minnesota.

⁴⁸ *Electric school bus pilot project:* <https://www.pca.state.mn.us/sites/default/files/p-gen4-23.pdf>

⁴⁹ *Capture gasoline vapors at filling stations:* <https://www.pca.state.mn.us/business-with-us/gas-stations>

Next steps

- **Community air monitoring.** Distribute and support community air monitoring grants that were funded by the 2023 legislature. These grants will help groups in the Twin Cities metro set up sensor networks, collect data, and communicate the information to residents.
- **Electric lawn and garden equipment.** Use \$1 million in legislative funding to establish a program that will provide financial assistance to help residents switch to electric lawn and snow equipment, giving preference to those in environmental justice areas of concern.
- **Fire pit studies.** Participate in studies to compare emissions from low-smoke outdoor fire pits and traditional fire rings. Results from these studies will be used to make recommendations for best practices when burning wood for recreation.



Build strong relationships

Reducing pollution and preventing disparities are long-standing, multifaceted issues. Addressing them will take a sustained effort by the agency in collaboration with partners in community, industry, business, and government.

Strategies

- **Tribal nations.** Continue to seek input from tribes early and often through cooperation and consultation on topics such as air permit applications in each tribal nation's counties of interest, and collaborate on air pollution reductions efforts related to wood smoke and mercury.
- **Environmental Justice Advisory Group.** Continue to convene the agency's [Environmental Justice Advisory Group](#)⁵⁰. Members advise MPCA on the best ways to integrate environmental justice principles into agency work, collaborate with us to improve civic engagement with environmental justice communities, act as liaisons to strengthen communication and relationships between environmental justice communities and the agency, and share oral history and community experiences so MPCA can better understand the communities it serves and build community-based solutions.
- **Community connections.** The MPCA has expanded its ability to develop partnerships and maintain relationships in community and hear and respond to community ideas and concerns by adding a Community Affairs Unit and hiring more staff in our Office of Equity and Environmental Justice.
- **GreenStep and GreenCorps.** Coordinate and support programs that help other organizations make air pollution reductions, including [GreenStep Cities](#)⁵¹, [GreenStep Tribal Nations](#)⁵²,

⁵⁰ *Environmental Justice Advisory Group:* <https://www.pca.state.mn.us/about-mpca/environmental-justice-advisory-group>

⁵¹ *GreenStep Cities:* <https://greenstep.pca.state.mn.us/>

⁵² *GreenStep Tribal Nations:* <https://greenstep.pca.state.mn.us/page/minnesota-greenstep-tribal-nations>

[GreenStep Schools](#)⁵³, [Minnesota GreenCorps](#)⁵⁴, and the [Minnesota Technical Assistance Program \(MnTAP\)](#)⁵⁵.

- **Clean Air Minnesota.** Continue to participate in the Clean Air Minnesota partnership and support its projects to encourage voluntary air pollution reductions. For example, ProjectCAR covers the cost of repairing emission controls and exhaust systems for low-income drivers, reducing vehicle emissions in areas that are disproportionately impacted by transportation pollution.
- **Quarterly updates.** Continue to send out the *Air Mail* newsletter quarterly to those interested in reducing air pollution. The newsletter provides news and information on air quality regulatory changes, grants opportunities, upcoming events, and more. Anyone can [sign up for MPCA's email updates](#)⁵⁶.

Next steps

- **Air sensor data.** Develop an air sensor database to support our partners in collecting and using sensor data. Conduct research comparing data from sensors and regulatory monitors to determine best practices for using sensors.
- **Work together for the common good.** Continue to foster an understanding that everyone – government, industry, businesses, and residents – contributes to air pollution, and therefore everyone should make efforts to reduce their contribution. The MPCA will continue to build partnerships, fund incentive programs, and lead information campaigns to make this happen.



Leverage co-benefits from other agency actions

Many actions can have indirect, positive impacts on air quality. This is true for collaborative work within the agency, or actions accomplished with partners, all of which can have co-benefits for air quality across the state.

Strategies

Communities across Minnesota are taking climate action, often supported by MPCA grants and technical or planning assistance.

- **Transportation.** Supplying more public transit and increasing opportunities for biking and walking reduces emissions of greenhouse gases as well as air pollutants that directly affect our health. Installing charging stations encourages more people to switch to electric vehicles, reducing tailpipe emissions of greenhouse gases and other air pollutants.

⁵³ *GreenStep Schools*: <https://sites.google.com/umn.edu/mngreenstepschools/home>

⁵⁴ *Minnesota GreenCorps*: <https://www.pca.state.mn.us/business-with-us/minnesota-greencorps>

⁵⁵ *Minnesota Technical Assistance Program (MnTAP)*: <http://www.mntap.umn.edu/>

⁵⁶ *Sign up for MPCA's email updates*:
https://public.govdelivery.com/accounts/MNPCA/subscriber/new?gsp=MNPCA_1

- **Extreme heat.** Planting leafy trees helps reduce climate heat impacts by creating shade, maintaining green space keeps surface temperatures cooler compared to paved areas, and installing reflective or green roofs keeps buildings cooler. All have positive impacts on air quality by reducing the amount of energy used for air conditioning.
- **Energy sources.** Supporting the 100% Carbon-free Electricity by 2040 law and the development of renewable energy sources such as wind, solar, and electricity storage.

Next steps

- **Continued support.** Continue to encourage community climate action that reduces local contributions of greenhouse gases and other air pollutants with grants, planning support, and technical assistance.
- **Reduce pollution from food systems.** Implement the Climate Smart Food Systems Initiative, funded by a \$200 million Climate Pollution Reduction Grant from EPA to reduce greenhouse gases and other air pollutant emissions across Minnesota’s food system. Highlights include grants to replace vehicles and equipment used to grow and transport food with alternatives that run on electricity or advanced clean fuels (\$20 million), a new industrial decarbonization grant program for food and organic materials processing sites (\$50 million), and funding for Tribal and local food system decarbonization projects (\$30 million). Sign up for the [Climate Smart Food System initiative email list](#)⁵⁷ to receive updates.

⁵⁷ *Climate Smart Food System initiative email list:* <https://www.pca.state.mn.us/air-water-land-climate/minnesota-climate-smart-food-systems>

Reducing mercury in our air and water

This section of the report provides the biannual update on progress towards Minnesota's mercury emission goals.

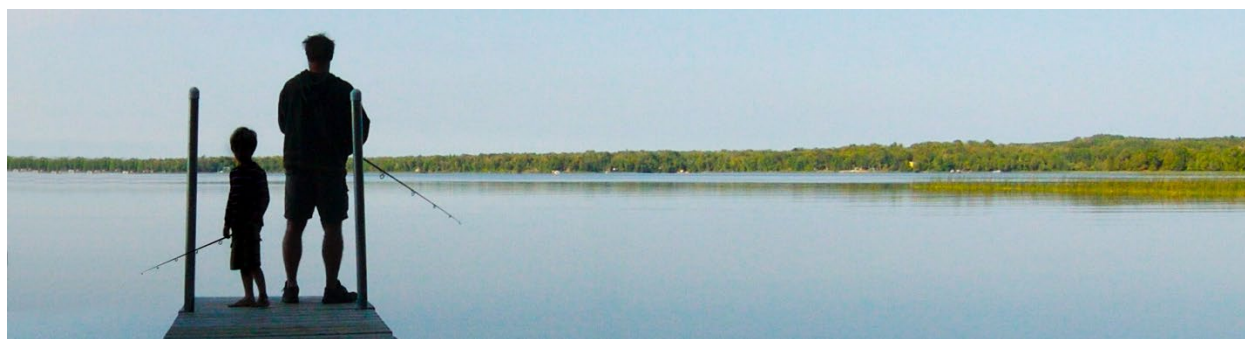
Minnesota has led the nation in efforts to reduce mercury air emissions, but challenges remain. Despite significant reductions in previous years, MPCA projects that the state will not meet its 2025 statewide reduction goal. The emissions reduction goal remains within reach but achieving it will require greater emissions reductions and action in the coming years.

Mercury released into the air from human sources around the world settles into water and accumulates in fish, making them unsafe for people to eat and damaging the ecosystem. Mercury is a well-known neurotoxin and exposure can harm the organs and nervous systems of people, especially children, and wildlife. Fish consumption is the primary source of mercury exposure for people and wildlife. Fishing is an important cultural, recreational, and economic resource to the state and is a hallmark component of several tribal treaty rights. Self-caught fish are a major component of many Minnesotans' diets – from tribal nation communities to the Twin Cities Metro area – especially Minnesotans in environmental justice communities.

Minnesota's statewide mercury reduction goal

In 2007, MPCA finalized a statewide mercury total maximum daily load (TMDL) study that determined the air emissions reductions necessary to meet water quality standards and protect people from consuming mercury-contaminated fish. The TMDL set a goal of 93% reduction in mercury from all human sources including air emissions from outside of Minnesota using 1990 as the baseline. Reaching the 93% emissions reduction goal in the TMDL would substantially lower mercury in fish and make them safer to eat in about 75% of our waters. For the remaining 25%, more work is needed to understand why these waters remain high in mercury despite lower emissions.

To accomplish the air emission reductions specified in the mercury TMDL, the MPCA and stakeholders created an implementation plan that set a 2025 mercury emission target of 789 pounds per year for mercury emission sources in Minnesota. The emission reduction goal for Minnesota sources led the MPCA to adopt [rules that established mercury emissions reductions](https://www.revisor.mn.gov/rules/7007.0502/)⁵⁸ for certain sources in Minnesota. Mercury emissions inventories have been developed to track progress. The MPCA also conducts fish tissue analysis to understand how mercury levels in fish are changing over time. The MPCA cannot control or regulate emission sources outside the state and continues to work with EPA on reductions across the nation and around the world.



⁵⁸ *Rules that established mercury emissions reductions:* <https://www.revisor.mn.gov/rules/7007.0502/>

Figure 15: Lakes and rivers impaired for mercury. Minnesota’s 2024 Impaired Waters List includes 6,338 water quality impairments in 2,847 different bodies of water. Of the waters tested, mercury is the cause of 1,696 impairments in 814 different lakes and rivers. Minnesotans and all the waters in the state will benefit from meeting the mercury TMDL reduction goal, but not all waters respond the same to reduced mercury emissions.

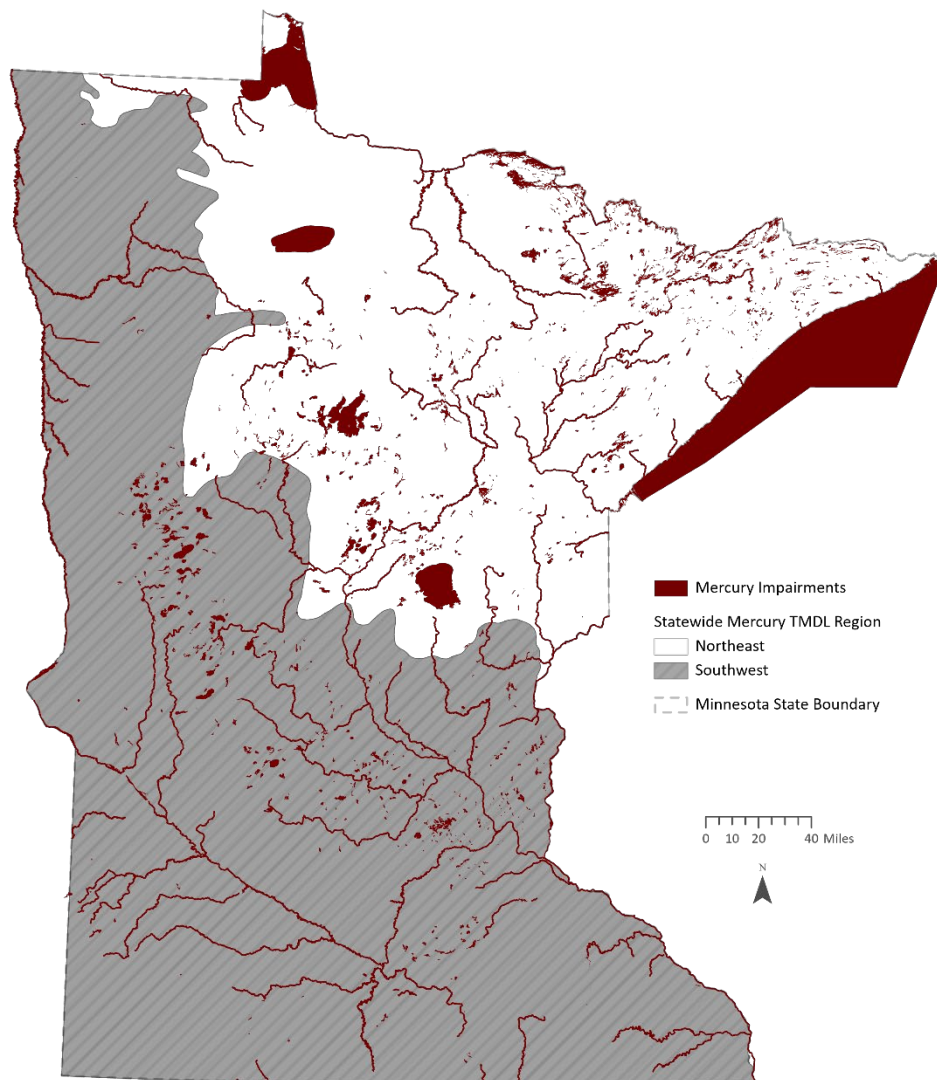
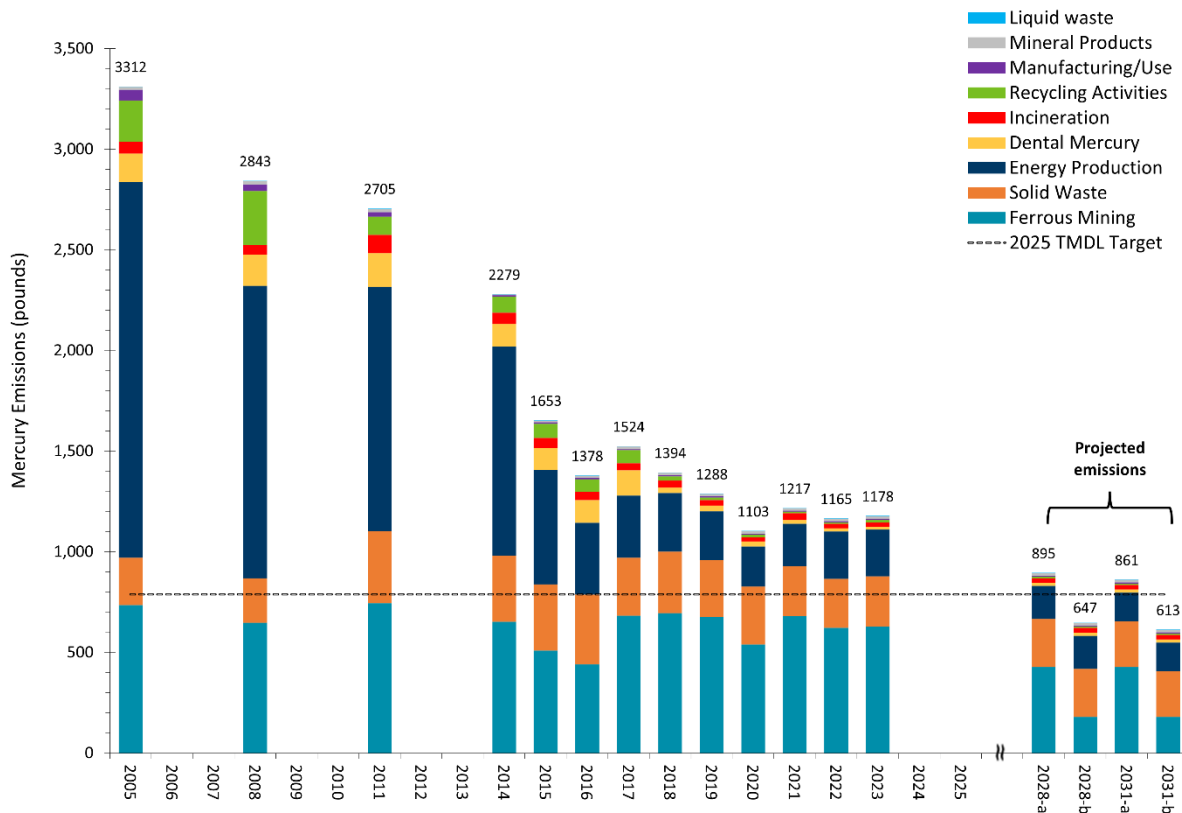


Figure 16 displays the annual mercury emissions from sources in Minnesota broken down by sector and year, and projections for two future years and scenarios based on expected future reduction actions. The largest reductions in upcoming years are expected in energy production and ferrous mining (taconite). Energy production reductions are expected due to planned retirement of coal-fired electricity generating units through 2031. Ferrous mining reductions are expected from the implementation of mercury control technologies in 2027 as required by EPA’s new mercury limits in the national emission standards for taconite iron ore processing.

Despite these anticipated reductions, MPCA projects the state will not meet the mercury TMDL implementation plan’s 2025 statewide reduction goal. Meeting that goal will require significant

reduction of mercury emissions from the taconite mining sector and further reductions from mercury use in products.

Figure 16. Minnesota mercury air emissions and projections. The largest reductions come from the energy production sector as utilities retire coal-fired electricity generating units. To meet state goals for mercury emission reductions that are expected to lower mercury in fish and make them safer to eat, reductions will also be needed from taconite (ferrous) mining and from mercury in commercial products.



a - These projections are based on the taconite industry meeting the new mercury limits in EPA’s national standards.
 b - These projections are based on the taconite industry meeting the required 72% reduction specified in Minn. R. 7007.0502.

Reducing mercury at the source

Mercury emissions from energy production

State regulations and national standards for mercury and air toxics emissions from coal-fired utility boilers have resulted in significant reductions of mercury emissions in Minnesota. In 2006, Minnesota passed the Mercury Emissions Reduction Act (MERA), which set a schedule for coal-fired utility boilers in the state to reduce mercury emissions by 90% compared to 2005 levels. As of 2015, all Minnesota utilities had achieved this reduction. To achieve the reductions, coal plants were retrofitted with improved pollution controls, switched to natural gas, or shut down. The changes also reduced emissions of haze-forming pollutants by 75-80% and significantly reduced greenhouse gas emissions. Utilities continue to shut down coal plants in Minnesota as they shift to renewable energy and natural gas. Future mercury emission reductions from electricity production will occur as Xcel Energy will retire all of its coal-fired power plants by 2030, and Minnesota Power will stop using coal at its remaining plants by 2035.

Emissions inventory data shows that electric utilities emitted approximately 118 pounds of mercury in 2023. This is an increase from 2021's 105 pounds of mercury emissions, but in line with emissions from 2022 (121 pounds). Emissions from industrial facilities that produce their own energy have also remained relatively consistent, ranging between 105-115 pounds of mercury in 2020 through 2023. In total, energy production continues to emit less mercury than material processing at taconite facilities or mercury used in products.

Mercury emissions from mercury in products

Emissions from mercury use in various products have generally decreased, dropping from 353 pounds in 2020 to 304 pounds in 2023. Within this category the two largest contributors are mercury in solid waste and dental mercury from dental preparations or cremation.

There has been a general downward trend in the mercury content of solid waste, with mercury emissions decreasing from 289 pounds in 2020 to 249 pounds in 2023, despite the amount of solid waste produced and collected going up roughly 8% over the same time period.

Minnesota recently became the latest state to enact stringent regulations to phase out the sale of mercury-containing fluorescent lightbulbs beginning January 1, 2025. Fluorescent lightbulbs are the latest addition to the list of products like older thermostats, thermometers, and other mercury-containing products that are banned in Minnesota. The MPCA has been conducting outreach and social media campaigns to raise awareness that these household items contain mercury to prevent these items from ending up in the trash. Ending the sale of mercury-containing lightbulbs and encouraging Minnesotans to bring these types of items to their nearest household hazardous waste collection site should lead to reduced mercury emissions from products.

Recent research indicates that mercury emissions from cremation and dental fillings is lower than previously thought and is trending down due to a large decrease in the percentage of dental fillings that contain mercury. The MPCA revised our calculation methodology based on this new research. Recalculations with this new methodology significantly decreased estimated emissions for 2018 through 2023. Under the old calculation method, mercury emissions from cremation ranged from 120-150 pounds annually. The recalculated emissions are less than 25 pounds annually since 2018 and are trending down. Mercury emission from cremation totaled 12 pounds in 2023.

The MPCA continues to improve the mercury emissions inventory through partnerships and research.

Mercury emissions from material processing

Nearly all mercury emissions from material processing are associated with taconite mining. Emissions from the taconite mining sector have remained generally the same over the last several years. Although a large production decrease associated with the Covid-19 pandemic led to a temporary drop to 539 pounds of mercury emissions in 2020, emissions have ranged from 600-700 pounds for an average year, with 629 pounds emitted in 2023.

The rules adopted in 2014 that required certain mercury-emitting sources to reduce their mercury emissions had specific requirements for taconite facilities: to prepare and submit a mercury emissions reduction plan by December 30, 2018, for approval and inclusion in an air emissions permit or other enforceable document. The taconite industry was given the longest timeline to develop and submit reduction plans; other mercury emitting facilities in Minnesota were required to submit plans or make mercury-reducing changes at their facilities by June 30, 2015.

Two taconite facilities submitted plans with proposed reductions that would meet the 72% reduction required in the rule, two facilities submitted alternative plans with proposed reductions that would not

meet the 72% reduction, and four facilities submitted alternative plans with no proposed reductions but planned further evaluation beginning in mid-2020. The MPCA reviewed each submitted plan in 2019-2020 and conducted additional analyses on costs, benefits, and affordability of mercury control technologies in 2021-2022. In January 2023, after lengthy review and discussions with each taconite facility, MPCA issued deficiency letters to each of the taconite facilities that submitted alternative plans, having found that each facility's conclusion that a 72% reduction was not technically achievable had not been adequately demonstrated and that their submitted plan was deficient. In these letters, MPCA required that the facilities submit a revised mercury reduction plan by September 2024.

At the federal level, EPA revised the national standards for taconite iron ore processing in 2024, setting a new mercury emissions limit that facilities must meet by March 2027.

- EPA's new mercury emissions limit represents a 0%-47% reduction for the taconite industry, depending on the individual indurating furnace.
- EPA expects taconite facilities could meet the new limit by using activated carbon injection with high efficiency wet scrubbers.

The projections on the right-hand side of Figure 16 (above) compare anticipated mercury emissions from taconite facilities under EPA's new standards versus Minnesota's existing rules. While EPA's national standards for taconite iron ore processing achieve a moderate reduction in mercury emissions, they don't go far enough for Minnesota to reach its statewide mercury reduction goal. Achieving this goal will require greater reductions, like those contemplated in the state rule, from the taconite mining sector in particular.

To accelerate development of mercury controls at taconite facilities, MPCA sought and received funding in 2023 to find innovative solutions to protect our environment and support Minnesota mining. The funding provides \$16.7 million to taconite facilities in the state to support pollution reduction actions and research on mercury emissions, sulfate discharges, and greenhouse gas emissions. The funding is available to taconite facilities through June 2027.

Regional, national, and international efforts

Since we know mercury pollution comes from in-state and out-of-state sources, Minnesota continues to promote mercury emission reductions regionally, nationally, and globally.

While emission inventories indicate global increases in mercury emissions, ambient air mercury concentrations across the United States have fallen due to federal and state regulatory actions and market forces. Our data shows that increases in global mercury emissions are being offset by decreases in local emissions, indicating that local mercury reductions continue to be important. More reductions are needed globally and locally to reduce fish mercury concentrations for the long term.

Minnesota works with multi-state partnerships to review and comment on EPA actions, including the EPA's most recent revisions to the Mercury and Air Toxics Standards (MATS) for power plants. The EPA's 2024 revisions to the MATS rule finalized more stringent emission limits that will reduce mercury emissions from the top-emitting units at power plants across the U.S. The EPA identified the top 20 emitting units, eight of which are located in North Dakota and likely contribute to mercury deposition in our region.

Since 2017, the Minamata Convention on Mercury has provided the foundation for mercury emissions reductions globally, with reductions negotiated by the United Nations Environment Program. Minnesota is doing its part and has taken significant steps towards achieving mercury emission reductions.

Minnesota also continues to work with others through partnerships such as the Great Lakes Commission. At its 2021 annual meeting, the Great Lakes Commission adopted an updated policy resolution supporting mercury pollution monitoring, research, and reduction in the Great Lakes-St. Lawrence River basin. The resolution was unanimously passed by all commission member states and provinces: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Ontario, Pennsylvania, Québec, and Wisconsin. The resolution:

- States the multiple ecological, social, and economic benefits of the Great Lakes and St. Lawrence River for the United States and Canada.
- Asserts that mercury pollution harms these benefits and the health of communities throughout the region, specifically noting that disadvantaged communities and other vulnerable populations are at higher risk and generally experience disproportionate effects from mercury contamination.
- Acknowledges that while governments in the United States and Canada at all levels – tribes, states, provinces, and federal governments – are acting to reduce mercury use and emissions, there is more that can be done. In addition, changes in climate and weather patterns are likely to impact where mercury comes from and where it ends up.
- Offers suggestions and support for actions to understand and reduce mercury pollution.

The resolution is available in full on the commission's [policy resolution webpage](#)⁵⁹. An [issue brief](#)⁶⁰ was also prepared to accompany the resolution and is available on the commission's webpage.

⁵⁹ Policy resolution webpage: <https://www.glc.org/work/advocacy/resolutions/>

⁶⁰ Issue brief: <https://www.glc.org/library/2021-glc-issue-brief-mercury>

Appendix A: Mercury emissions, 2020 - 2023

In accordance with Minnesota Statute § 116.925, this appendix reports mercury emissions associated with electricity production. In 2007, 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 met interim mercury emission reduction goals for 2018. More information about Minnesota’s mercury emissions and reduction strategies can be found on [MPCA’s Reducing mercury releases webpage](#)⁶¹, including a full [table of emission inventory estimates and reports](#)⁶².

Mercury emissions from electricity generation

Minnesota Statute § 116.925 requires producers and retailers of electricity to report the amount of mercury emitted from 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 2020 through 2023. Note that 2023 emissions are considered draft and under quality review by the MPCA.

Table 1. Mercury emissions from electric utilities, 2020 - 2023

Company	Mercury emissions (pounds)			
	2020	2021	2022	2023 (draft)
Blandin Paper Co / MN Power - Rapids Energy Center	0	0	0	0
District Energy St Paul Inc. - Hans O Nyman	1	1	1	1
Great River Energy	0	0	0	0
Hennepin Energy Recovery Center	3	19	3	3
Hibbing Public Utilities Commission	2	1	0	0
Minnesota Power - Boswell Energy Center	7	15	26	26

⁶¹ MPCA’s Reducing mercury releases webpage: <https://pca.state.mn.us/air-water-land-climate/reducing-mercury-releases>

⁶² Table of emission inventory estimates and reports: <https://www.pca.state.mn.us/sites/default/files/wg-iw4-02k5.pdf>

Company	Mercury emissions (pounds)			
	2020	2021	2022	2023 (draft)
Minnesota Power - Hibbard Renewable Energy Center	2	2	3	5
Minnesota Power - Laskin Energy Center	0	0	0	0
Minnesota Power - Taconite Harbor Energy Center	0	0	0	0
Northshore Mining - Silver Bay	0	0	0	0
Otter Tail Power Co - Hoot Lake Plant	3	0	0	0
Virginia Department of Public Utilities	1	0	2	0
Xcel Energy - Allen S King Generating Plant	4	9	5	5
Xcel Energy - Black Dog Generating Plant	0	0	0	0
Xcel Energy - Key City/Wilmarth	1	0	2	2
Xcel Energy - Red Wing Generating Plant	4	1	3	2
Xcel Energy - Sherburne Generating Plant	79	79	87	87
Grand Total	105	127	132	131

Mercury emissions from industrial facilities

The emissions reduction goal that MPCA established in 2007 also included milestones for industrial facilities:

- Ferrous mining or processing facilities are required to reduce mercury emissions by 72% from 2008/2010 emission levels by January 1, 2025.
- Facilities with large boilers that had individual emissions greater than 5 pounds were required to comply with the applicable federal regulations and achieve a reduction of at least 70% by January 1, 2018.
- Iron and steel melters were required to reduce mercury emissions to less than 35 milligrams per ton of iron/steel produced by June 30, 2018.
- Other mercury emission sources with processes that individually emit three or more pounds of mercury per year were required to reduce emission emissions by at least 70% by January 1, 2025.

Minn. R. 7019.3000 requires owners and operators of facilities in Minnesota to report the amount of mercury emitted from their facility annually if the facility emits three pounds or more of mercury in a given year. Facilities that emit less than three pounds of mercury must report every three years.

The following tables shows mercury emissions from ferrous mining and processing facilities and other industrial facilities in years 2020 through 2023. Note that 2023 emissions are considered draft and under quality review by MPCA.

Table 2. Mercury emissions from ferrous mining & processing facilities, 2020 - 2023

Company	Mercury emissions (pounds)			
	2020	2021	2022	2023 (draft)
Cleveland Cliffs Minorca Mine Inc.	45	44	43	50
Hibbing Taconite Company	139	193	149	146
Mesabi Metallica Company LLC*	0	0	0	0
Mesabi Nugget Delaware LLC**	0	0	0	0
Northshore Mining Company - Silver Bay	3	5	1	3
Northshore Mining Company - Babbitt	0	0	0	0
United Taconite LLC - Fairlane Plant	129	128	116	126
United Taconite LLC - Thunderbird Mine	1	0	0	0
US Steel Corp - Keetac	36	107	136	126
US Steel Corp - Minntac	188	207	179	181
Grand Total	542	684	624	631

*Mesabi Metallica Company LLC has not started operating as of today.

**Mesabi Nugget Delaware LLC has been idled since roughly December 2015.

Table 3. Mercury emissions from other industrial facilities, 2020 - 2023

Company	Mercury emissions (pounds)			
	2020	2021	2022	2023 (draft)
Alliance Pipeline - Albert Lea 25-A	3	3	3	0
American Crystal Sugar - East Grand Forks	15	12	16	16
American Crystal Sugar - Moorhead	6	8	10	12
American Crystal Sugar Co - Crookston	7	9	11	11
Badger Foundry Co	1	1	1	1
Boise Paper LLC	3	3	3	3
Enviro-Chem Inc - Plant 1	1	1	1	1
Gerdau Ameristeel US Inc - Saint Paul Mill	6	0	0	0
Met Council - Seneca WWTP	7	6	7	6
Norbord Minnesota	2	0	0	0
Perham Resource Recovery Facility	0	0	0	1
Prospect Foundry LLC	1	1	1	1
Saint Paul Park Refining Co LLC	1	1	1	1
Sappi Cloquet LLC	2	0	4	3
Southern Minnesota Beet Sugar Coop	15	14	14	15
Grand Total	70	60	73	71

Mercury emissions from mercury use in products

The emissions reduction goal that MPCA established in 2007 also included milestones for mercury use in products. The MPCA keeps track of information, such as the amount of household waste generated in the state, alongside information tracked by other local, state, and federal partners to estimate the amount of mercury emissions from smaller, widespread sources in Minnesota. These estimates are typically prepared every three years for EPA's national emissions inventory, but MPCA has prepared emission estimates for the off-cycle years to provide additional insight into this category.

Table 4: Mercury emissions from mercury use in products 2020-2023. Note that 2023 emissions are considered draft and under quality review by MPCA.

Category	Mercury emissions (pounds)			
	2020	2021	2022	2023 (draft)
<i>Mercury in solid waste</i>				
Solid waste collection & processing	217	184	181	186
On-site household incineration	27	21	19	19
Spill / land dumping	34	34	34	34
Landfills	2	2	2	3
Land application of compost	8	7	8	8
<i>Mercury in liquid waste</i>				
Land application of sludge	0	0	0	0
<i>Recycling activities</i>				
Smelters / electric arc furnaces	4	2	2	2
Shredders that recycle cars & appliances	5	2	1	8
Recycling mercury from products within Minnesota	1	1	1	1
Non-ferrous metal recycling	2	2	2	2
<i>Dental mercury</i>				
Dental preparations	3	3	3	3
Cremation	22	16	12	12
<i>Incineration</i>				
Solid waste combustion	13	23	13	12
Incineration (sewage sludge)	8	9	9	6
Incineration (industrial sludge)	0	0	0	0
Incineration (medical waste)	0	1	1	1
Incineration (hazardous waste)	1	1	0	0
Incineration (industrial)	1	1	1	1

Category	Mercury emissions (pounds)			
	2020	2021	2022	2023 (draft)
<i>Manufacturing / use of mercury-containing products</i>				
Mercury product manufacturing	0	0	0	0
General laboratory use	5	5	5	5
Dissipative use (cosmetics)	0	0	0	0
Grand Total	353	313	295	304