

November 19, 2008

The Honorable Ellen Anderson  
Chair, Senate Environment, Energy and  
Natural Resources Budget Division  
120 State Capitol

The Honorable Kent Eken  
Chair, House Environment and Natural  
Resources Committee  
575 State Office Building

The Honorable Satveer Chaudhary  
Chair, Senate Environment and Natural  
Resources Committee  
205 State Capitol

The Honorable Jean Wagenius  
Chair, House Environment and Natural  
Resources Finance Committee  
449 State Office Building

Dear Senator Chaudhary:

The Minnesota Pollution Control Agency (MPCA) is pleased to provide you with the following information to satisfy the requirement in Minn. Stat. 116.1 to report to the Legislature in even-numbered years on the Agency's long-range plans relative to air and land pollution and also the requirement in Minn. Stat. 115.42 to report to the Legislature in even-numbered years on the Agency's long-range plans relative to water pollution.

1. The MPCA 2008 Strategic Plan, which establishes the Agency's guiding principles and five vision areas to guide the agency's work. Three of the five vision areas are the familiar air, land and water media. A fourth vision enhances the Agency's focus on helping Minnesotans take responsibility to protect our environment through the purchase of green products and services, the expansion of Minnesota businesses into green products and services, and the increase of Minnesotan's environmental knowledge. The fifth vision pertains to a well-managed organization. Each vision statement is supported by three to five goals and three to ten objectives most of which have measurable results and dates. These goals and objectives constitute the Agency's long-range plan and program.
2. An overview of environmental conditions in Minnesota. The excerpt is from the Environmental Performance Partnership Agreement between the MPCA and the U.S. Environmental Protection Agency, which covers the period from October 1, 2008 through September 30, 2012.
3. The report "Minnesota's Environment 2005: How Are We Doing?" provides a broad overview of eight key environmental indicators related to air quality, water quality and waste generation. The report describes how the state is doing overall in the area of environmental protection and is not intended to specifically track the MPCA's progress. The report is updated every four years and, therefore, will be updated in 2009.

The MPCA Strategic Plan and EnPPA are integral to the agency's focus on environmental results. These documents are part of the agency's efforts to plan, implement, measure, evaluate and adjust its performance in achieving desired environmental results.

The Honorable Satveer Chaudhary  
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The following links are also useful in looking at the MPCA's long range plans for water, air and land:

The report Minnesota's Water Quality Monitoring Strategy describing a ten-year plan for surface and ground water monitoring. The plan includes information on all types of monitoring, condition monitoring, problem investigation monitoring and effectiveness monitoring along with a timeline for implementation. Under the plan, Minnesota will completely assess its lakes and streams on a 10-year cycle and will re-establish its ground water monitoring network in cooperation with the Minnesota Departments of Agriculture and Health. The report is available on the internet site at:  
[www.pca.state.mn.us/publications/reports/p-gen1-10.pdf](http://www.pca.state.mn.us/publications/reports/p-gen1-10.pdf).

The first edition of the MPCA's Environmental Information Report (EIR) which contains assessments of a wide variety of environmental stresses facing Minnesota, and identifies and compares their causes. Current environmental programs are taken into account; the analysis examines the health and ecological stresses that remain. The EIR provides an assessment of our confidence in these measurements, as well as an indication of current trends of the various stressors and sources that contribute to environmental risks. Extensive documentation and additional background is included in the nine technical support appendices. This report is currently being updated and should be available within the year.  
[www.pca.state.mn.us/publications/reports/eir-03.pdf](http://www.pca.state.mn.us/publications/reports/eir-03.pdf)

Additional information on the MPCA's Strategic Plan can be found at:  
[www.pca.state.mn.us/publications/reports/strategicplan.html](http://www.pca.state.mn.us/publications/reports/strategicplan.html)

Additional information on the EnPPA can be found at: [www.pca.state.mn.us/programs/enppa.html](http://www.pca.state.mn.us/programs/enppa.html)

The Minnesota Environment 2005 report can be found at: [www.pca.state.mn.us/publications/reports/mne-2005.html](http://www.pca.state.mn.us/publications/reports/mne-2005.html)

If you have questions about the enclosed information, please feel free to contact me at 651-296-7301.

Sincerely,

Brad Moore  
Commissioner

BM/:km:cmbg

Enclosure



# Strategic Plan 2008



Minnesota Pollution  
Control Agency

# Minnesota Pollution Control Agency

## 2008 Strategic Plan

Welcome to the revised Minnesota Pollution Control Agency strategic plan, finalized in May 2008.

The plan serves to chart the strategic direction of the agency for the next several years. As such, it contains a balance of goals and objectives reflecting the agency's "core" work as well as agency aspirations — strategic efforts we believe are needed to better align results with our mission. It also contains "stretch" goals and objectives intended to challenge the agency in improving the environment.

This strategic plan is not an agency work plan. It does not directly reflect all of the MPCA's work. Nor does it contain much information about the strategies used to accomplish the goals and objectives. These strategies are expressed in our annual work planning efforts.

The plan contains many new and revised goals and objectives. A few important examples follow:

- Increased focus on addressing the challenges of global climate change. Objectives A3b, L1a, R4a and R4b all reflect efforts to reduce greenhouse gas emissions.
- A new Goal E5 representing the agency's intention to continue to build on the state's capacity to address emerging environmental issues. Emerging issues are those issues not currently part of regular environmental protection activities in Minnesota, such as endocrine disrupting compounds and nanotechnology.
- Significant changes in the agency's responsibility goals (Minnesotans Take Responsibility to Protect Our Environment) to focus on creating sustainable behaviors and processes to encourage conservation of resources and a healthy environment.

As you read the plan, you may note that not all of the goals and objectives are expressed at the same strategic level. Some are more reflective of program outputs or productivity measures than environmental improvement measures. Also, general differences in strategic level may exist between the vision statements in the plan (Air Vision vs. Water Vision, for example). The MPCA needs to retain such differences in this iteration of the plan because of varying stages of program evolution and limitations on the agency's ability to measure progress in some areas.

## ***Vision: Minnesotans Take Responsibility to Protect Our Environment***

### **Goal R.1 Minnesotans buy green products and services.**

Objective R1a) By January 1, 2013, provide green building assistance targeted at new or substantially reconstructed buildings to achieve a 25 percent reduction in greenhouse gas emissions using 2003 as a baseline.

Objective R1b) By January 1, 2012, each household participating in a collection program produces 15 percent less household hazardous waste than in 2005.

Objective R1c) By January 1, 2013, state and local governments increase the purchase of environmentally preferable products and services by 30 percent over 2006 levels.

### **Goal R.2 Minnesota businesses produce green products and provide green services by reducing or eliminating the use of environmentally harmful substances.**

Objective R2a) By 2013 the amount of problem materials in the mixed municipal waste stream will be reduced by 20 percent from 1999 levels.

Objective R2b) By January 1, 2013, increase sustainable industrial manufacturing jobs from 9000 to 9600 and gross economic activity from this sector by 20 percent over 2004 levels, which are estimated at \$2.98 billion.

See this supporting information: [Minnesota's Recycling Industries: Economic Activity Summary](#)

Objective R2c) By January 1, 2013, technical assistance at specific facilities will reduce the amount of pollution generated by 10 percent from 2008 levels.

See this supporting information: [Pollution Prevention Evaluation Report](#)

### **Goal R. 3 Minnesotans act on their environmental knowledge to support healthy ecosystems.**

Objective R3a) Minnesotans maintain or increase their general environmental knowledge and environmental behavior scores from the baseline data presented in the [2002 Minnesota Report Card on Environmental Literacy](#).

Objective R3b) To achieve MPCA environmental outcomes, increase the number of citizens volunteering at, or for the MPCA by at least 10 percent annually from 2007 to 2013.

Objective R3c) By 2013, Minnesota residents reduce their individual contribution to greenhouse gas emissions to 2005 levels.

### **Goal R. 4 MPCA leads the way to minimize its environmental footprint and assist other public entities to do the same.**

Objective R4a) By 2015, greenhouse gas emissions from MPCA facilities and its operations are reduced by at least 15 percent from 2005 levels.

Objective R4b) MPCA catalyzes public entities to take actions to reduce greenhouse gas emissions by 15 percent between 2005 and 2015.

See this supporting information: [Next Generation Act](#), [Interagency Pollution Prevention Advisory Team Annual Report](#), [Climate/Energy Citizen Partnership Grant Request for Proposals](#), and [Signers of the U. S. Mayor's Climate Protection Agreement](#).

## ***Vision: Minnesota's Air Is Clean and Clear***

### **Goal A.1 Minnesota's outdoor air will meet or improve upon all environmental and human health-related federal and state ambient air quality standards.**

Objective A1a) Reduce risks to humans and the environment by meeting all ambient air quality standards.

Objective A1b) Reduce overall emissions in Minnesota of sulfur dioxide and nitrogen oxides (pollutants that contribute to fine particle formation) by 30 percent from 2002 levels by January 1, 2012, and by 40 percent by January 1, 2018.

Objective A1c) Reduce direct man-made emissions of fine particulate (PM<sub>2.5</sub>) by 15 percent from 2002 levels by January 1, 2012 and by 25 percent by January 1, 2018.

Objective A1d) Reduce overall emissions in Minnesota of volatile organic compounds (pollutants that are toxic and contribute to ozone formation) by 20 percent from 2002 levels by January 1, 2012, and by 30 percent by January 1, 2018.

### **Goal A.2 Minnesota's outdoor air quality will meet environmental and human health benchmarks for toxic and other air pollutants.**

Objective A2a) The MPCA will target reductions in statewide risk from air toxics by:

- Calculating cancer and non-cancer risks in statewide ambient air using modeling and ambient monitoring by July 1, 2009.
- Identify the pollutants that largely contribute to cancer and non-cancer risk by July 1, 2009.
- Developing strategies to reduce emissions and concentrations of these risk drivers by July 1, 2010.

### **Goal A.3 Minnesota reduces its contribution to regional, national and global air pollution.**

Objective A3a) Reduce mercury emissions from Minnesota air sources to meet TMDL air emission target of 789 lbs/year. Track concentrations of mercury in fish tissue to better understand how changes in state, national and international mercury emissions affect fish mercury concentrations.

Objective A3b) Reduce greenhouse gas emissions in Minnesota by 15 percent from 2005 levels by January 1, 2015 and by 30 percent by January 1, 2025 as set in the *Next Generation Energy Act of 2007*.

Objective A3c) Reduce visibility impairment in the Boundary Waters Canoe Area Wilderness by three percent from the 2000-2004 baseline conditions by January 1, 2012 and by six percent by January 1, 2018.

## ***Vision: Minnesota's Land Supports Healthy Ecosystems and Sustainable Land Uses***

### **Goal L.1 Ensure solid waste is managed to conserve materials, resources, and energy.**

Objective L1a) By January 1, 2025, achieve a total reduction of 75 million metric tons of greenhouse gas attributed to changes in waste generation, materials conservation, and resource management practices.

Objective L1b) Reduce the number of households who burn their waste on-site (and the resulting dioxin and other pollutants and associated wildfire risks) by 75 percent from the 2005 baseline by January 1, 2013.

### **Goal L.2 Minimize or reduce the release of contaminants to or from the land.**

Objective L2a) Significant Compliance is achieved annually at 90 percent of solid waste facilities.

Objective L2b) On an annual basis, 90 percent of above and underground storage tanks will be in significant operational compliance.

Objective L2c) On an annual basis, 90 percent of hazardous waste generators and facilities will be in significant compliance.

Objective L2d) By 2011, household hazardous waste (HHW) collection participation increases by 20 percent above the 2005 baseline.

### **Goal L.3 Restore land to productive use by managing risk from contaminated sites.**

Objective L3a) Reduce the number of sites in the Superfund Program at a rate of 10 sites per year.

Objective L3b) Attain a net decline in the number of sites in the Petroleum Tank Release Program of 150 sites per year.

Objective L3c) Complete 100 percent of the construction and 100 percent of the land use plans for all 112 landfills in the Closed Landfill Program by 2012.

Objective L3d) Facilitate the redevelopment of contaminated properties through issuance of 200 assurance letters per year, consistent with standards established to protect human health and the environment.

## ***Vision: Minnesota Has Clean, Sustainable Surface and Ground Water***

### **Goal W.1 Assess the condition of Minnesota's ground water systems and provide information on the effectiveness of Best Management Practices to assist the Agency's efforts to prevent and reduce degradation of ground water and support ground water conservation.**

Objective W1a) Assess the ambient condition of Minnesota's ground water, focusing on vulnerable aquifers in nonagricultural areas.

Objective W1b) By December 31, 2012, and every five years thereafter, report on the condition of Minnesota's ground water.

Objective W1c) By December 31, 2010, identify Best Management Practices employed by programs to prevent or reduce ground water degradation, highlight those for which more data is needed to evaluate effectiveness, and develop a plan for addressing the data gaps.

### **Goal W.2 Assess the chemical, physical and biological integrity of Minnesota's lakes, streams and wetlands to identify if designated uses are being met, and provide information on the condition of waters.**

Objective W2a) By December 31, 2017, sample and assess Minnesota's 81 major watersheds to determine if they meet designated aquatic life, recreation and consumption beneficial uses, and to identify pollutant load trends.

Objective W2b) By January 1, 2017, gather water quality data and assess 100 percent of the lakes 500 acres and larger; at least 25 percent of the lakes between 100 and 499 acres; and continue to expand the Citizen Lake and Citizen Stream Monitoring Programs by five percent per year.

Objective W2c) Beginning in 2010, evaluate the overall state-wide quality of Minnesota's wetlands using probabilistic surveys every three years to determine if wetland programs are meeting the goal of no net loss of wetland quality and assist the Department of Natural Resources and the Minnesota Board of Water and Soil Resources in their evaluation of wetland quantity.

Objective W2d) By April 1, 2010, and every two years thereafter, identify impaired waters, report that information to the U.S. Environmental Protection Agency according to their requirements, and provide information about impaired and unimpaired waters to Minnesotans.

### **Goal W.3 Protect and improve the chemical, physical and biological integrity of Minnesota's lakes, streams and wetlands.**

Objective W3a) By May 1, 2011 and every three years thereafter, review Minnesota's water quality standards to incorporate standards that reflect current science and information.

Objective W3b) Wastewater National Pollutant Discharge Elimination System (NPDES) facilities do not contribute to the impairment or degradation of state waters.

Objective W3c) By January 1, 2014, strengthen local programs to reduce the percentage of subsurface soil treatment systems (SSTS) characterized as failing or imminent threats to public health and safety from 39 percent to less than five percent.

Objective W3d ) NPDES Stormwater sources do not contribute to the impairment or degradation of state waters.



Objective W3e) Ensure that manure does not contribute to the impairment or degradation of state waters.

Objective W3f) To provide a framework to guide water quality protection and impaired waters restoration efforts, develop watershed management and implementation plans for the 81 major watersheds by 2018.

Objective W3g) Restore impaired waters to meet designated uses.

## ***Vision: Excellence in Operations***

### **Goal E.1 Provide a safe and healthy workplace for all employees, volunteers and visitors.**

Objective E1a) Provide a safe workplace; free from work-related accidents and injuries by addressing safety issues and continuously improving agency practices.

Objective E1b) Staff has access to required training, including refresher training, including all new employees within probation period or before performing those duties where training is a prerequisite.

Objective E1c) Promote participation in employee wellness activities by sponsoring appropriate workplace and non-workplace activities.

### **Goal E.2 Manage agency operations to support the agency's environmental work and core operations in effective and efficient manner.**

Objective E2a) Maintain a human resources system that supports the agency's management of its employees in performing work of the agency.

Objective E2b) Using appropriate benchmarks, improve the linkage of the agency's strategic plan, budget, workplans and progress evaluation systems toward achieving environmental goals.

Objective E2c) Using appropriate benchmarks improve the system of managing agency's resources consistent with our priorities.

Objective E2d) Ensure the agency maintains consistent and current administrative policies and practices.

Objective E2e) Manage agency fiscal resources such that agency budgets are reflective of its priorities and financial information is available in real time.

Objective E2f) Develop measures for agency-wide compliance and enforcement efforts so that they remain relevant and current in context of the overall strategic plan.

Objective E2g) Increase employee engagement levels by three percent for each biennial survey/action planning cycle across the agency.

### **Goal E3 Achieve excellence through application of appropriate tools and best practices.**

Objective E3a) Routinely review agency performance and division dashboard measures and adjust strategic goals and priorities based on the data and best practices as directed by senior managers.

Objective E3b) Refresh the continuous improvement deployment plan routinely to establish appropriate measures and strategies for implementing agency-wide continuous improvement processes.

Objective E3c) Develop and implement a communications strategy that advances the agency goals.

Objective E3d) Develop and implement an education and outreach strategy that advances the agency goals.

Objective E3e) Measure pollution prevention results within targeted agency programs.

**Goal E4 Provide a reliable information management system that supports the agency and its partners in effective and efficient environmental work.**

Objective E4a) Provide timely access to environmental data so that 100 percent of our environmental data that is located in databases is available publicly.

Objective E4b) Provide an environmental context for 75 percent of our data that is publicly accessible.

Objective E4c) Provide IT services that enable staff to deliver environmental services more efficiently and effectively such that 90 percent of the IT services are provided within agreed upon timeframes.

Objective E4d) Develop the capability for paperless operation for 75 percent of the agency's major services.

Objective E4e) Design a records management system that incorporates 60 percent of paper records into an electronic document management system.

**Goal E.5 Maintain the agency's capacity to recognize and address emerging issues that fall within the agency's authority.**

Objective E5a) Continually collect and analyze data regarding the state of Minnesota's environment to identify trends for known stressors, identify new stressors, and assess the need for new or improved actions to protect Minnesota's environment and public health.

## **Website Information for MPCA Strategic Plan Supporting Documents**

[Minnesota's Recycling Industries: Economic Activity Summary](http://www.pca.state.mn.us/oea/market/economic.cfm) — [www.pca.state.mn.us/oea/market/economic.cfm](http://www.pca.state.mn.us/oea/market/economic.cfm)

[Pollution Prevention Evaluation Report](http://www.pca.state.mn.us/publications/reports/lrp-p2s-2sy08.pdf) — [www.pca.state.mn.us/publications/reports/lrp-p2s-2sy08.pdf](http://www.pca.state.mn.us/publications/reports/lrp-p2s-2sy08.pdf)

[2002 Minnesota Report Card on Environmental Literacy](http://www.seek.state.mn.us/publications/reportcard2002.pdf) — [www.seek.state.mn.us/publications/reportcard2002.pdf](http://www.seek.state.mn.us/publications/reportcard2002.pdf)

[Next Generation Act](http://www.nextstep.state.mn.us/res_detail.cfm?id=4034) — [www.nextstep.state.mn.us/res\\_detail.cfm?id=4034](http://www.nextstep.state.mn.us/res_detail.cfm?id=4034)

[Interagency Pollution Prevention Advisory Team Annual Report](http://www.nextstep.state.mn.us/res_detail.cfm?id=1120) — [www.nextstep.state.mn.us/res\\_detail.cfm?id=1120](http://www.nextstep.state.mn.us/res_detail.cfm?id=1120)

[Climate/Energy Citizen Partnership Grant Request for Proposals](http://www.nextstep.state.mn.us/res_detail.cfm?id=4041) — [www.nextstep.state.mn.us/res\\_detail.cfm?id=4041](http://www.nextstep.state.mn.us/res_detail.cfm?id=4041)

[Signers of the U.S. Mayors' Climate Protection Agreement](http://usmayors.org/climateprotection/list.asp) — <http://usmayors.org/climateprotection/list.asp>



# **MINNESOTA'S**

Environment 2005

*How are we doing?*

# Minnesota's Environment 2005

## *How are we doing?*

**C**lear lakes for swimming and fishing, clean air to breathe and safe water to drink — all are part of a quality of life that Minnesotans value.

Minnesota has a long history of environmental leadership and state residents overwhelmingly support clean air and water. Since the 1970s, the state has tackled many of the most pressing environmental problems — untreated sewage, belching smokestacks and careless dumping of hazardous wastes — while continuing to have a healthy economy.

Although Minnesota's abundant natural resources can support many people and activities, the state's rising population, energy consumption and land use patterns are putting pressure on the environment.

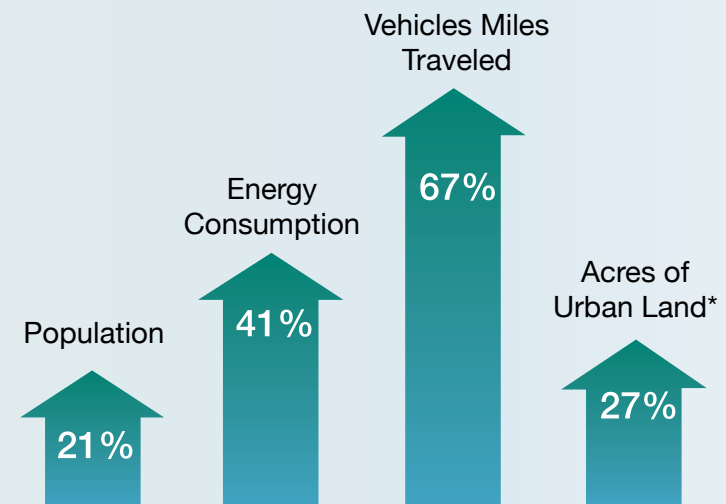
Minnesota's population has swelled to 5 million and is projected to grow 11 percent from 2000 to 2010 according to the state demographer. Projections suggest that while many counties in western Minnesota will lose population over the next few years, counties in the suburban Twin Cities, near Rochester, and in parts of north-central Minnesota will grow faster than the state average.

As more and more people choose to live in cities and surrounding suburbs, land that was once farmland and wetlands becomes shopping centers, schools and roads. The paved areas that result increase the amount and speed of stormwater runoff and the pollutants it carries with it into lakes and streams. More people need new and expanded sewage treatment and transportation systems.

Communities in north-central Minnesota and on the North Shore are also facing growing pains as demand for lakeshore property has skyrocketed in the past decade. The development of resorts, hotels, golf courses and cabins, and conversion of cabins to year-round use have led to significant shifts in land use. Lakeshore development too often removes natural cover near shorelines. More roofs and more pavement in nearby towns results in less land to filter pollutants.

Increasing population and greater urbanization also affect Minnesota's air. The burning of fossil fuels for electricity and pollution from transportation represent Minnesota's principal sources of air pollution. With more people driving more vehicles longer distances, congestion on Minnesota's highways has worsened. As population grows, so does demand for electricity, creating pressure to build new power plants. Polluted air affects people's health. It adds to worldwide mercury exposure and climate change.

### **Trends Affecting Minnesota's Environment: Percent Change Since 1985**



*\* urban acres measured from 1982*

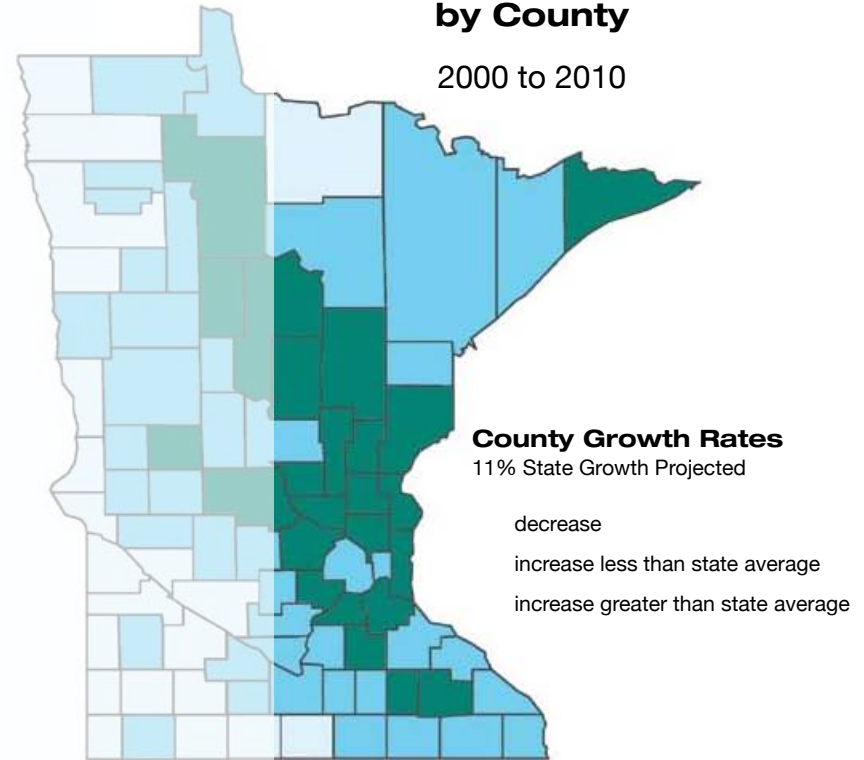
Agriculture, an important sector of the state's economy and the state's largest land use, also affects the health of Minnesota's environment. Erosion of soil by water and wind and runoff from improperly managed manure contribute to water quality problems in lakes and streams. Runoff from farm fields carries nutrients such as phosphorus into lakes and streams, which can harm water quality by causing algae growth and depleting available oxygen.

It's hard to know exactly what Minnesota's environment will look like in 2010 and beyond. But there's no question the quality of the state's water, land and air will be influenced by how Minnesota's residents respond to the environmental challenges created by an increasing population, changing land uses and growing consumption of resources.



## Projected Population Growth Rates by County

2000 to 2010



*Minnesota's population is projected to grow 11 percent by 2010. The greatest growth is predicted to be concentrated in the Twin Cities suburbs and along a corridor stretching from Rochester to the Brainerd Lakes Area.*



# Water

Water — lakes, streams, ground water and wetlands — is Minnesota's treasure. The state boasts 81 watersheds with 92,000 miles of streams and more than 12,000 lakes. Nearly 75 percent of Minnesotans use the state's vast ground water resources for drinking water. Nine million acres of wetlands provide habitat for aquatic animals, birds and plants.

Minnesotans need to be vigilant about protecting their abundant water resources. The following summary describes the status and trends for the state's lakes and streams, wetlands and drinking water.

## Lakes and Streams

**STATUS:**   
**Poor Fair Good**

**TREND:** The quality of many streams and some lakes has improved, but the quality of others has declined.

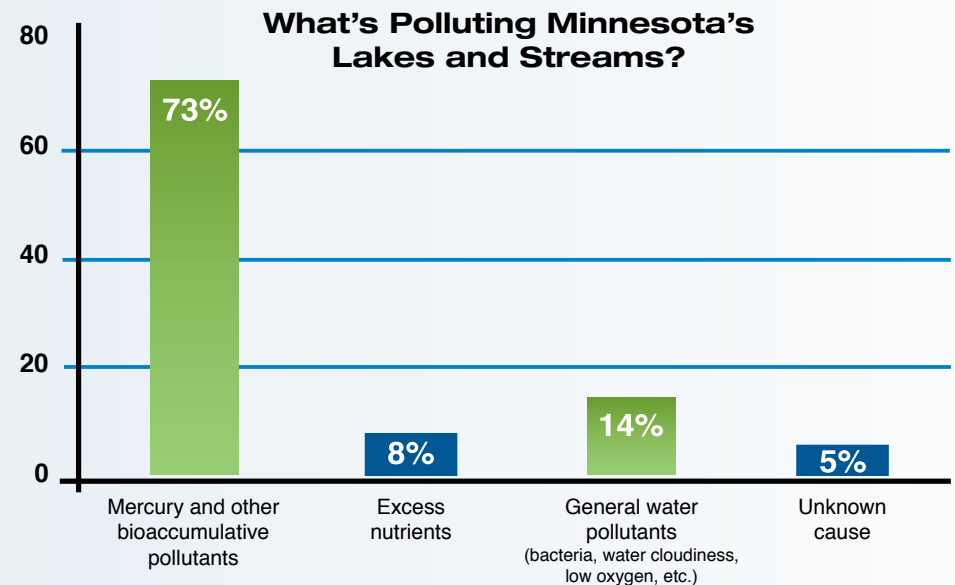
Minnesota's lake and stream quality ranges from very good in some parts of the state to very poor in others. Although Minnesota has assessed only a small portion of waters, many are unhealthy for aquatic life or unsafe for swimming and other water recreation. Many lakes and streams also have advisories limiting fish consumption because of unsafe mercury levels.

Minnesota uses water quality standards to assess the health of lakes and streams. The standards are designed to protect waters for specific uses:

- Does the water support healthy aquatic life?
- Is it safe for swimming and other water recreation?
- Are the fish safe to eat?

Lakes and streams not meeting the standards are considered "impaired" and must be cleaned up.

The overall picture of the health of Minnesota's lakes and streams is limited by a lack of monitoring. Currently, only 8 percent of streams and 14 percent of lakes have been assessed for impairment. Based on this limited monitoring, 916 lakes and 199 streams located across Minnesota are impaired.

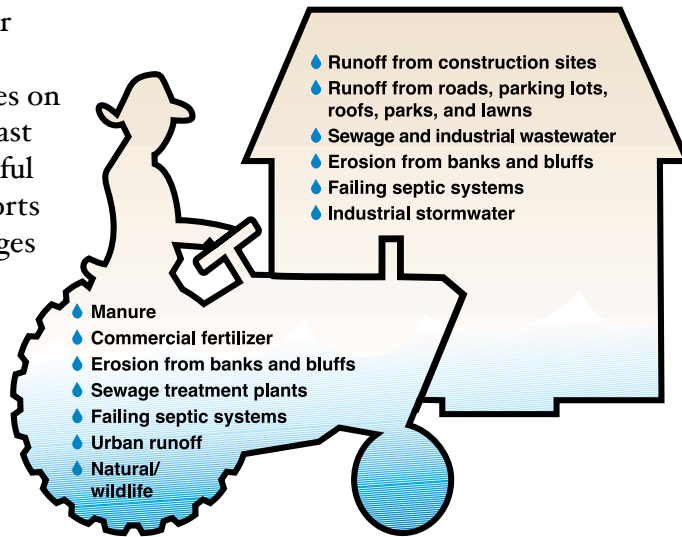


*Most of the state's impaired waters are the result of mercury, mainly from airborne sources outside of Minnesota. Other pollutants are the result of human activities on the land and make waters unsuitable for recreation and unhealthy for fish. (See Mercury discussion on page 11.)*



Many of the pollutants causing impairments — nutrients, low oxygen levels, bacteria, water cloudiness — come from human activities on the land. Over the past few decades, successful state and federal efforts have limited discharges from wastewater and sewage pipes — called “point sources.” The Mississippi and St. Louis rivers are dramatically improved, with renewed walleye fisheries, as a result of controls on point sources.

## Water Pollution Sources in Urban and Agricultural Areas (excluding mercury)

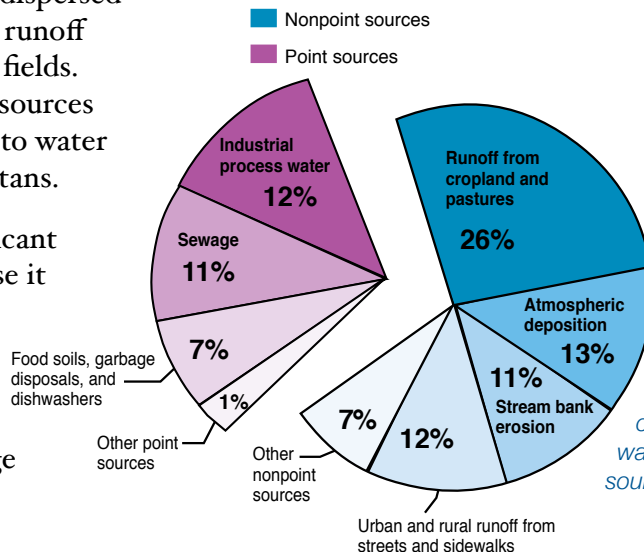


*Runoff and sewage and industrial wastewater are estimated to be the largest contributors to water pollution in cities. Manure, commercial fertilizer and bank and bluff erosion are the top three potential contributors in rural areas.*

Today, however, about 80 percent of water pollution comes from dispersed “nonpoint” sources — runoff from lawns, roads and fields. Controlling nonpoint sources requires commitment to water quality by all Minnesotans.

Phosphorus is a significant water pollutant because it helps algae grow in water, turning lakes and streams green. Although controls on discharges from sewage

## Sources of Phosphorus (average conditions)

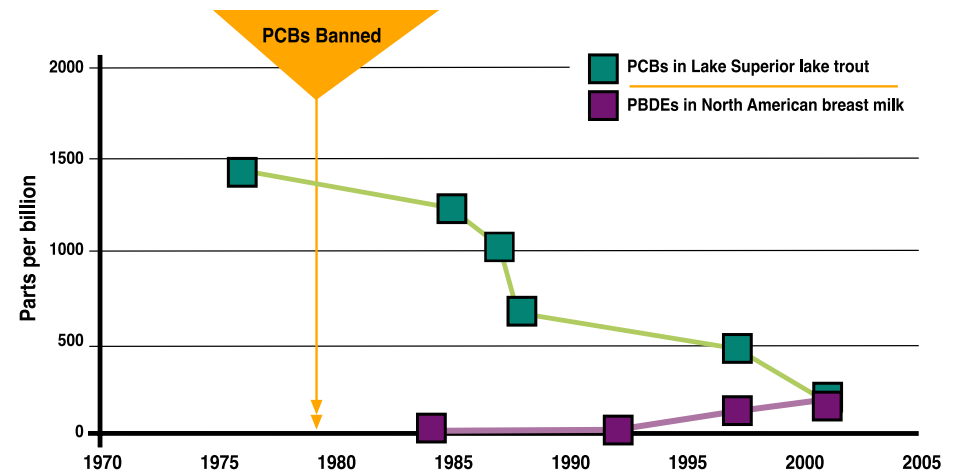


*During normal and rainy weather conditions, nonpoint sources contribute the most phosphorus to water bodies. During dry years, point sources are larger contributors.*

treatment plants have reduced this nutrient, runoff of phosphorus from fertilizers and other nonpoint sources continues to pollute waters.

Other pollutants are of special concern because they are toxic, remain in the environment for a very long time and increase in concentration as they move up the food chain. These pollutants, called persistent bioaccumulative toxics (PBTs), are used in electronics, carpeting and many other consumer items. When disposed of, PBTs are released and move easily in the environment and are often deposited in lakes and streams, where they accumulate in fish and can harm people and animals that eat fish.

## A Tale of Two PBTs



*Production of polychlorinated biphenyls (PCBs), coolants/lubricants used in electrical equipment, was banned in 1979. Levels declined steadily but slowly because of the persistent and bioaccumulative nature of the chemicals. Today, PCB concentrations in fish are down 90 percent. In contrast, manufacture of the most toxic types of polybrominated diphenyl ethers (PBDEs), widely used as flame retardants, has only recently ended. Some forms continue to be produced, and levels continue to rise.*

## Things to watch/concerns

- While most of Minnesota's lakes and streams may be in better shape than other states' waters, it's important for Minnesotans to act now to protect good quality waters and clean up the others so they don't get worse.
- Nationally, there is little information on most new kinds of water pollutants. Pesticides, pharmaceuticals, metals and household cleaners are among products that may end up in water and have harmful effects even at very small concentrations. While Minnesota is beginning to investigate and monitor for some of these chemicals, knowledge about their environmental effects is very limited.
- Invasive species including zebra mussels, Eurasian watermilfoil, purple loosestrife and carp threaten to radically alter native aquatic plant and animal populations.

## Physical habitat changes: Not your typical water pollution

Physical changes to lakes and streams can be just as detrimental as chemical pollution. Loss or changes in habitat through drainage, stream straightening and alteration of banks and shorelands can severely affect aquatic organisms' ability to live, feed and reproduce. Even when all chemical pollutant

sources are eliminated and water quality is good, healthy aquatic communities will not be present without necessary habitat. Improvements to habitat can have significant effects. Over the past 30 years, habitat improvements have more than doubled brown trout populations in southeastern Minnesota streams.

## Minnesota's Wetlands

**Wetlands continue to be lost; however, there were net gains in wetlands from 2001 to 2003 due to conservation programs.**

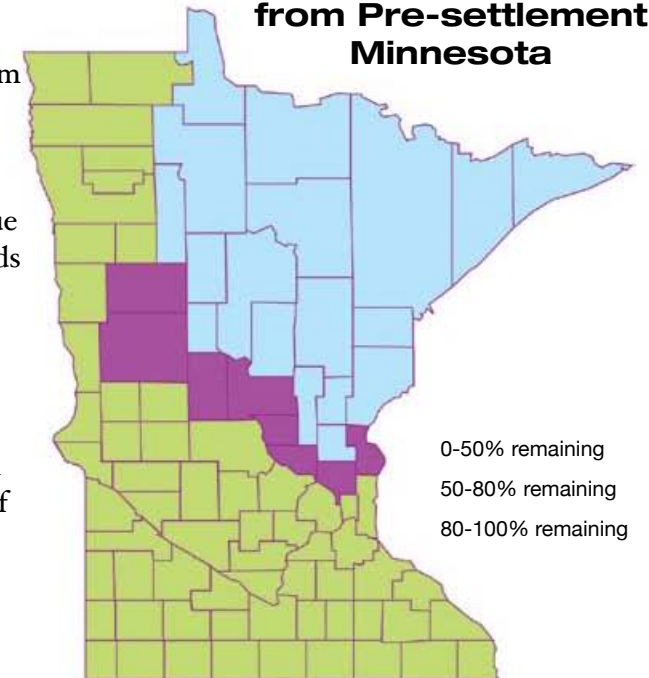
Statewide, about 50 percent of Minnesota's original wetlands have been lost, and nearly all of the original wetlands are gone in parts of southern and northwestern Minnesota. Initial efforts to assess the quality of the remaining wetlands suggest many are degraded.

Wetlands — marshes, swamps, ponds and bogs — provide habitat for aquatic animals and plants, including ducks, geese and other waterfowl. Wetlands play an important role in reducing flooding by holding water and slowing storm runoff in wet years and giving back water in times of drought.

Because of these unique characteristics, wetlands serve as a critical part of Minnesota's overall water system.

While Minnesota is still rich in wetlands in comparison to much of the U.S., the state has lost about half of its 18 million pre-settlement

### Wetlands Remaining from Pre-settlement Minnesota



*Courtesy of Board of Water and Soil Resources*

wetland acres to agricultural, urban and other development. Some areas of the state — southern, southwestern and northwestern Minnesota — have lost significantly more than half of their historic wetlands.

State and federal laws are designed to reduce wetland loss. Wetlands destroyed by filling or draining, in most cases, must be replaced by wetland restoration elsewhere. The state's wetlands continue to be lost because a number of development, agricultural and drainage activities are exempt from the laws. However, Minnesota has also experienced significant wetland gains because of state and federal conservation programs to offset losses and restore wetlands.

### *Things to watch/concerns*

- In replacing wetlands, different varieties of wetlands are often used, such as open water ponds. While open water ponds have aesthetic and other benefits, they don't support the healthy plant communities or provide the abundant wildlife habitat of the originals.
- As with lakes, invasive species in wetlands, such as hybrid cattails, reed canary grass, purple loosestrife, carp and Chinese mystery snails threaten the ecology and integrity of vast numbers of Minnesota's wetlands.

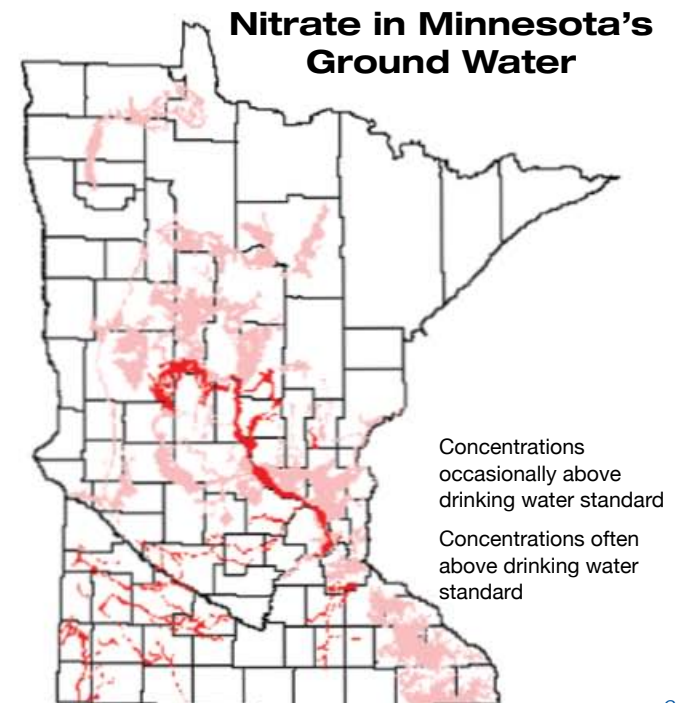
## Drinking Water

### **Steady. Drinking water continues to meet health standards.**

Nearly all of Minnesota's public drinking water supplies meet health standards after treatment. Sampling of private drinking water wells found nitrate as the only widespread human-caused contaminant in drinking water.

Minnesota's drinking water is of very high quality. No matter the source — lakes, rivers or ground water — Minnesotans can have a high degree of confidence in drinking water from public water supplies.

Minnesota's 8,300 public water supplies — those serving communities, businesses, schools, restaurants and highway rest stops — are all routinely tested for nitrate and bacteria, and many are also tested for pesticides, industrial chemicals and



metals. Nitrate can cause health problems in infants, and bacteria can cause intestinal illness.

Since 1998, only a handful of instances of nitrate and bacteria contamination exceeding health standards have been found in public water supplies, and the problems were corrected quickly. Contamination of community water supplies by pesticides and industrial contaminants is rarely found; the last time a city water supply violated a health standard was 1999.

Public water suppliers are required to send out a report card on the quality of the public water supply. The report cards provide detailed information about city water supplies.

Minnesotans also use individual wells as a drinking water source. Today, nitrate is the most widespread human-caused chemical in ground water. A recent statewide study of Minnesota's ground water found approximately 3 percent of the wells tested exceeded the drinking water standard for nitrate. In areas where ground water is susceptible to contamination, however, a much higher percentage of wells exceed the nitrate drinking water standard.

### *Things to watch/concerns*

- Pesticides, chemicals used to kill insects and weeds, may become a concern. Although use has declined recently, Minnesota currently uses 28 million pounds of pesticides annually. Pesticides have been found in ground water, but generally not at levels considered to be unsafe.
- Arsenic, a naturally occurring element, is found in about 15 percent of individual wells, primarily in west-central and northwestern Minnesota, at levels above the drinking water standard. Arsenic is part of the earth's crust and works its way into ground water from underground rock and soil.

# Air

Clean air means healthier people. Breathing polluted air can cause itchy throats and burning eyes, make asthma, bronchitis and heart conditions worse, and lead to more cases of cancer. Cleaner air also means cleaner water. Mercury and other PBTs fall out of the air and settle in Minnesota's lakes and streams. Once there, mercury can accumulate in fish. Consumption advisories for mercury in most of the state's lakes limit the type and amount of fish Minnesota anglers can safely eat.

Pollutants in Minnesota's air also reduce visibility, creating a haze that can affect scenic views in places like the Boundary Waters Canoe Area as well as in the state's urban areas. Air pollutants also contribute to global climate change.

This report looks at status and trends in air quality in four areas: air pollutants regulated by standards, cancer-causing air pollutants, mercury and climate-change pollutants.

## Key Air Pollutants

**STATUS:**   
**Poor Fair Good**

**TREND:** Pollutant levels are steady or decreasing.

Minnesota meets federal standards for all key air pollutants; however, recent scientific evidence indicates concentrations of fine particles in Minnesota's air are unhealthy for some people. Several times a year ozone and fine particle levels are unhealthy for sensitive individuals and trigger air alerts.

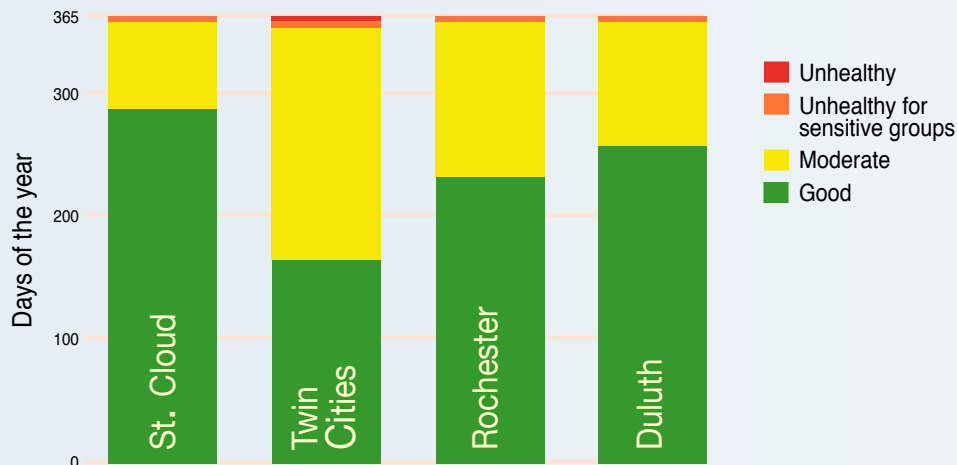


The 1970 Clean Air Act established standards to protect public health for six key air pollutants — sulfur dioxide, nitrogen oxides, particles, ozone, carbon monoxide and lead. Controls on factory emissions, improved pollution equipment on cars and trucks and the removal of lead from gasoline led to lower levels of many of these pollutants in Minnesota's air. Minnesota's air currently meets standards for all pollutants.

Despite meeting standards, the state still has several days each year that are unhealthy for sensitive groups such as children, the elderly, athletes and those with heart or lung diseases. Even moderate air quality days are a concern because studies show some people may have adverse health effects on those days.

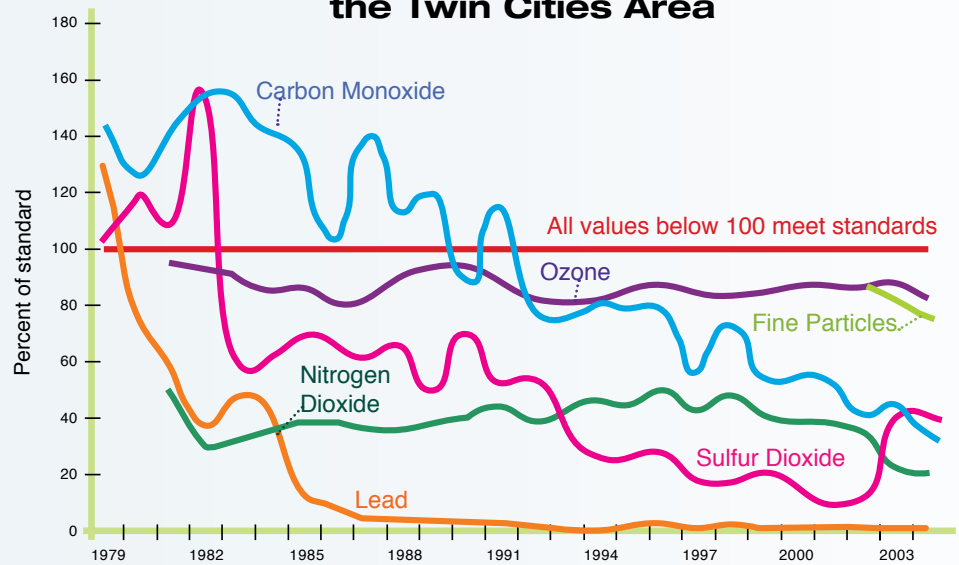
In Minnesota, unhealthy days are primarily caused by fine particles and ozone. Because ozone and fine particles can be carried by the wind for hundreds of miles, unhealthy air in Minnesota can be a mixture of pollution formed in the state and air blown in from elsewhere. Air quality is generally worse in areas with higher population.

### 2004 Air Quality in Minnesota Cities



*In 2004, Minnesota cities had up to seven days that were unhealthy for sensitive groups such as children, the elderly, athletes and those with heart and lung disease. Some people also have adverse health effects on moderate days.*

### Trends in Key Air Pollutants in the Twin Cities Area



*Minnesota has successfully reduced many of the air pollutants regulated by standards to protect public health since 1970. All pollutants are currently below standards.*

Fine particles are inhaled deep into the lungs. Recent health studies have linked long-term exposure to fine particle pollution to reduced lung function. Even short exposures to high particle levels can cause asthma attacks and acute bronchitis and are linked to heart attack deaths in people with heart disease. Fine particles suspended in the air also create haze which impairs visibility in areas throughout Minnesota.

Ozone, the main component of smog, is irritating to the eyes, nose, throat and lungs, and can worsen the symptoms of asthma. Children and adults who exercise outdoors and people with asthma are most at risk from unhealthy levels of ozone in the air.

Ozone is formed on hot sunny days when nitrogen oxides and volatile organic compounds react. Air pollution from cars, trucks, power plants and solvents contribute to the formation of ozone. Trees and plants also release volatile organic compounds into the air.

## Things to watch/concerns

- The federal government is currently evaluating health information amid growing concerns that the current fine particle standard is not protective of public health. The fine particle standard will likely be made more stringent.
- Minnesota's air is currently at about 80 percent of the federal ozone standard. Falling out of compliance with the ozone standard would be harmful to human health and would impose significant costs to Minnesota's transportation system.

### Sources of Ozone from Human Activities in Minnesota

*Nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOCs) are the main building blocks of ozone. Many everyday activities are sources of these chemicals in Minnesota's air.*



Wood burning stoves



Cars and trucks



Non-road vehicles



Power plants

Agricultural sources



Forest fires

### Sources of Fine Particles

Fine particles can be emitted directly or formed in the air from gases.

# Cancer-Causing Air Pollutants

## Pollutant levels are steady or decreasing.

Concentrations of all but one of the toxic air pollutants measured in Minnesota are below cancer health benchmarks at most locations. Formaldehyde consistently exceeds benchmarks in many areas of the state.

Toxic air pollutants are a group of chemicals that can cause or are suspected of causing cancer and other serious health problems. A statewide survey of over 70 of these chemicals was completed in 2001 and Minnesota currently monitors these pollutants in Twin Cities and Duluth neighborhoods. Levels found in Minnesota's air are compared to health benchmarks, when available, to determine if air toxics pose an unacceptable risk of cancer.

*Diesel buses, trucks and construction equipment release harmful exhaust to the air. Based on many studies linking lung cancer to diesel particles, several health agencies have concluded that this exhaust probably causes cancer in humans. The particles in vehicle exhaust are also linked to heart disease.*



Over the past several years, only two chemicals measured posed such a risk at multiple sites: benzene and formaldehyde. Minnesota has made good progress in reducing benzene in the air, and benzene is now below benchmarks at most locations. This is largely due to reductions in emissions from automobiles, gas station fueling operations and industrial facilities, and to lowered benzene levels in gasoline.

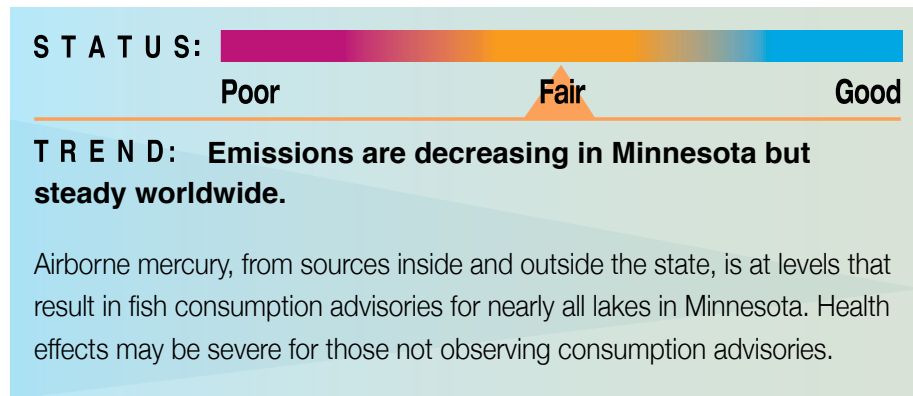
Formaldehyde levels are above benchmarks and have changed little since 1995. Formaldehyde can be directly released from wood burning and from fuel-burning vehicles, as well as industrial processes. It is also formed when other chemicals break down in the environment.

## Things to watch/concerns

- People are exposed to many chemicals at any given time, and very little is known about the effects of exposure to multiple pollutants.
- New scientific studies are showing a link between adverse health effects and proximity to major roads and vehicle exhaust. More studies are needed to better understand the risk to people living near busy streets.



# Mercury

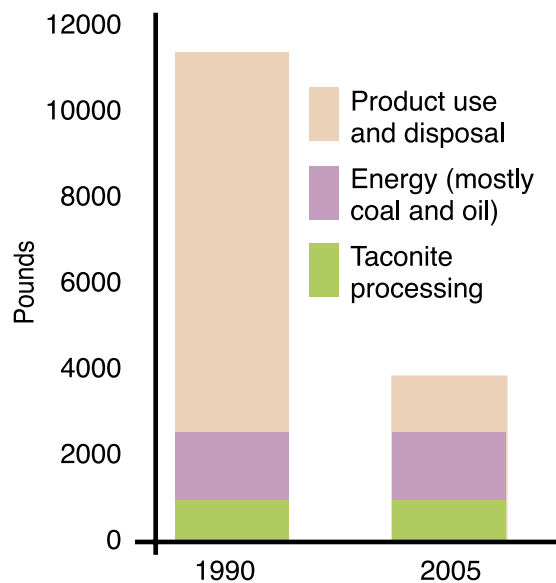


Mercury is a toxic pollutant that accumulates in fish. The health of people and wildlife that eat contaminated fish is the primary concern about mercury in Minnesota. Mercury can damage the nervous system. Unborn babies and children are most vulnerable.

Nearly all mercury in Minnesota comes from the atmosphere. Mercury can be transported over long distances, and about 90 percent of the mercury that falls on lakes, rivers and wetlands in Minnesota comes from sources outside the state.

*Mercury emissions in Minnesota declined about 72 percent between 1990 and 2005 mostly due to removal of mercury in products and control of incinerators.*

**Mercury Emissions in Minnesota 1990 and 2005**



About the same percentage of Minnesota's mercury emissions leave the state and are deposited elsewhere.

Coal combustion, taconite processing, and disposal of consumer products are the main sources of mercury emissions in the state. Minnesota, along with the federal government, has successfully removed mercury from many products including paint and batteries. Statewide mercury emissions declined about 72 percent from 1990 to 2005.

## Things to watch/concerns

- Although mercury emissions declined in Minnesota, the United States and Europe between 1990 and 2000, emissions in developing countries increased over the same period. As a result, global emissions have remained relatively constant in recent years.
- If energy consumption in Minnesota continues to rise, additional power will be needed to meet the state's demand for electricity. Electric utilities serving Minnesota customers project that the Upper Midwest will need to add about 6000 megawatts of electric power in the next 15 years. If new coal-fired power plants are built to meet the demand, mercury emissions in Minnesota may rise.



# Climate Change

## CO2 emissions are increasing.

Scientific evidence indicates the earth is experiencing warmer temperatures, due in part to increased emissions from the burning of fossil fuels. In Minnesota observed changes in climate include higher temperatures and more frequent heavy rainfalls and flooding.

Around the world, carbon dioxide and other greenhouse gases are increasing in the atmosphere, resulting in increased warming of the earth. Recent warming is linked to the burning of oil, coal and gas for energy in vehicles, businesses and homes. Many scientists are concerned about the effects a shifting climate will have on the world's ecosystems.

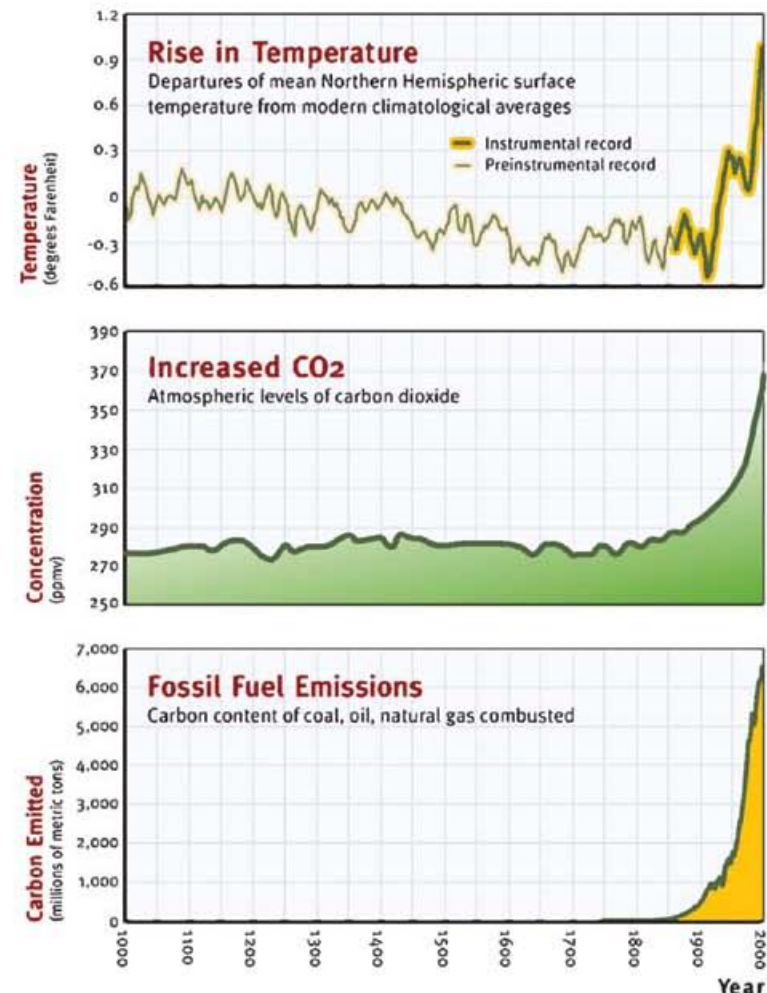
Although climate is extremely variable in Minnesota, over the past 100 years scientists have observed increases in annual average and subsurface temperatures, higher dew points, and a greater frequency of heavy rainfalls.

In Minnesota, emissions of carbon dioxide, the main heat-trapping gas, have increased 37 percent since 1985 despite increases in the energy efficiency of Minnesota's economy. The greatest increases are found in the energy and transportation sectors.

## Things to watch/concerns

- It's difficult to know for sure how a warming climate will affect ecosystems in Minnesota. Some possible effects include increased damage from floods and violent storms, shifts in the location of forests and grasslands, loss of species that cannot adapt quickly to new climates, and more poor air quality days during hotter summer months.

## Climate Change Trends



Recent warming is linked to the burning of fossil fuels and increased atmospheric levels of carbon dioxide.

Matt Kania, courtesy of Minnesota Conservation Volunteer

# Waste

In the 1970s, Minnesota began to address environmental contamination caused by waste disposal. Today, hazardous wastes produced by businesses are strictly regulated, and programs are in place to address environmental contamination of the past. Due to pollution prevention efforts by businesses, the volume of hazardous wastes produced has remained level, even while economic growth increased.

And, Minnesotans have more access to environmentally correct ways of disposing of household hazardous wastes — paint, lawn and garden chemicals and cleaners — than in other states. Participation rates in household hazardous waste collection programs and volumes of waste collected remain consistent with population growth.

Solid waste — the non-hazardous portion of materials Minnesotans throw away — is also an important focus for Minnesota.

## Solid Waste

**STATUS:**   
Poor Fair Good

**TREND:** Recycling rates are steady. Solid waste generation is increasing but has slowed in recent years.

Minnesota ranks among the most successful states for recycling. Yet, Minnesota's gains in recycling are outpaced by the amount of waste generated. Each year Minnesotans increase the overall amount of garbage they produce, resulting in greater energy use, air and water pollution and wasted natural resources.

Minnesota recycles nearly 40 percent of the solid waste it produces, a recycling rate among the best in the nation. In 2003 that recycling rate translated into 2.35 million tons of materials, saving enough energy to power 321,000 homes for one year and reducing net greenhouse gas emissions equivalent to taking more than 1 million cars off the road. Recycling 2.35 million tons also reduced overall air pollution by 1.98 million tons, water pollution by 6,700 tons and natural resource consumption for making steel by 585,000 tons.

While Minnesota's recycling rate is high, Minnesotans still throw away many materials that could be recycled. The state's recycling rate has remained relatively flat in recent years due to the overall growth in waste generation. Although in 2003 the amount of wastes generated experienced only a 1 percent increase, the smallest increase since 1991, this reduction is likely tied most closely to the slowing economy. As the economy improves, the rate of waste generation will likely begin to increase again.

Minnesota's disposal methods for solid waste have changed, too. Solid waste going to landfills — the least-preferred disposal option — has increased 158 percent since 1991, while wastes burned for energy and municipal waste composting operations have declined.

### Things to watch/concerns

- The current rate of waste growth and the plateau in the recycling rate may result in the need for new landfills or disposal infrastructure in the future. Efforts are underway to slow the waste increase through increasing waste reduction education, encouraging recycling options for businesses and developing systems for collection, processing and use of wastes that can be composted.

### How Much Waste Do We Produce?

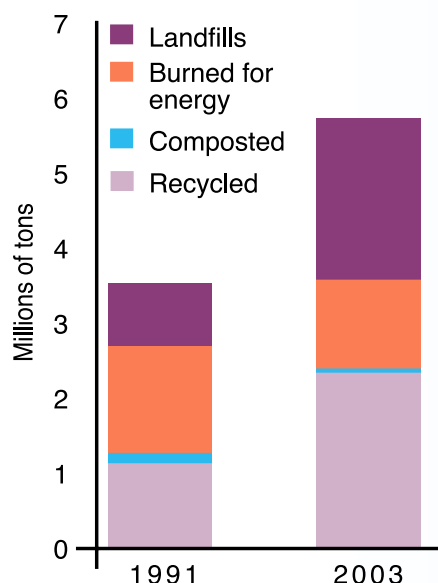
1991-2003



*Each Minnesotan produced 1.16 tons in 2003, up from 0.88 tons in 1991.*

- Waste burned in backyard fires is one of the largest sources of dioxin, a known human carcinogen. Dioxin in smoke is deposited on plants and crops, which are in turn eaten by animals. People can be exposed to dioxin when they consume meat and dairy products. A 2005 study of rural residents in Minnesota showed that 46 percent of those surveyed used burn barrels to dispose of household garbage.

## Where Does Minnesota's Waste Go?



Minnesota Pollution Control Agency

December 2005

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## Recycling contaminated land: a record of success

Throughout the 1980s and 1990s, Minnesota placed a priority on removing risks to humans and the environment from land contaminated by chemicals. Contaminated lands that posed the greatest risks were addressed first, and today they pose a much reduced risk. Once cleaned up, the land is recycled

for future uses. From 1994 to 2004, the acres of land recycled voluntarily by land owners increased from 438 acres to more than 55,000 acres, an area more than three times the size of Lake Minnetonka.

Because of these past successes, Minnesota is now able to focus greater attention on new environmental issues.



# **Environmental Conditions in Minnesota**

To put the elements of the 2009 – 2012 EnPPA in context, it is useful to take a brief look at the past four decades of progress and the current state of our waters, our air and our land. A summary of Minnesota's current environmental conditions follows:

## **Water**

Minnesota waters today are decidedly cleaner than they were in the 1960s and 1970s. Industrial and municipal discharges have been addressed. Most combined storm and sanitary sewers have been separated, significantly reducing overflows into the Mississippi. Fish, wildlife and boaters have returned to waters once heavily polluted by human and industrial waste.

Despite decades of progress in cleaning up water pollution, hundreds of Minnesota's lakes, rivers and streams are still not healthy enough for people to safely use and enjoy. These impaired waters do not meet water quality standards and pose risks to people and aquatic life. They contain too much sediment, bacteria, mercury, phosphorus and/or other contaminants. Biotic integrity also is impaired by physical alterations and invasive species.

MPCA staff identified 297 additional impairments in the 2008 assessment process for sections 303d and 305b of the Clean Water Act. There are now 349 rivers and streams impaired for one or more pollutants, and 1028 lakes and wetlands impaired for one or more pollutants, resulting in a total of 2,575 individual impairments in Minnesota waters to date. Due to the vast abundance of waters in the state and limited staff and funding to assess them, only a small portion, approximately 14 percent of the state's river miles and 18 percent of its lakes, has been formally assessed for impairments.

Once all Minnesota waters have been assessed, more than 10,000 impairments will likely have been found, located in every watershed in the state, given the 40 percent impairment rate noted so far for waters assessed here and nationally. The MPCA is on track to intensively monitor all of the state's major watersheds in the next ten years and through the 2008 sampling season 11% of Minnesota watersheds either have been sampled or sampling is underway. Correcting the water quality problems is made more challenging by the diffuse nature of the impairment sources, such as polluted stormwater, agricultural runoff, and atmospheric deposition of contaminants. Furthermore, distant water quality problems, such as hypoxia in the Gulf of Mexico, may be caused in part by nonpoint source pollutants coming from Minnesota and other Midwestern states. These numbers represent huge environmental, economic and quality of life concerns, and underscore the need for stable, effective funding of impaired waters assessment and cleanup by state, local and private partners.

## **Land**

During the 1980s and 90s, Minnesota took decisive and effective steps to clean up industrial and municipal waste dumps and leak sites that contaminated land and ground water. A series of laws and programs were enacted in Minnesota and nationally to appropriate funds, compel cleanup of the most serious sites, and to create incentives and funding sources to encourage voluntary cleanups.

The state Superfund, enacted in 1983, handles contaminated sites that are large and complicated and that may take several years to fully address. Remediation Division has done or overseen full investigation and final cleanup or control of 160 out of 237 listed industrial waste sites, and 21 of 46 Minnesota sites on the federal Superfund list. The remainder of the listed sites is in the cleanup process. Most sites need ongoing monitoring and maintenance for many years or decades.

The MPCA's award-winning Voluntary Investigation and Cleanup (VIC) program has overseen over 3,000 contaminated projects since its inception in 1988. A total of 3,841 liability assurances or other determination through the VIC program have been issued upon completion of investigation and, if necessary, remedial activities. This has contributed to those properties becoming candidates for sale, refinancing, or redevelopment. More than 566,000 acres of land have been returned to productive use. About 200 new projects are screened and processed each year in this program, which streamlines the investigation and encourages responsible parties to quickly address problem sites without the fear of protracted litigation that slowed earlier cleanup efforts.

Since 1990, the Resource Conservation and Recovery Act (RCRA) remediation program has completed the investigation and remediation of 262 hazardous waste release sites. The sites consist of hazardous waste generators, permitted RCRA facilities, and former facilities that operated under interim status.

For petroleum leaks, the story is similar. The Petrofund and Petroleum Remediation Program, created in 1987, has investigated and closed more than 15,000 of the 16,700 petroleum leak sites on its roster. About 350 new sites are expected to enter this program each year for the foreseeable future. The Petroleum Brownfields Program, a voluntary program similar to VIC has helped streamline assessment and cleanup actions at more than 2,500 sites, leading to the restoration of more than 1,500 acres in each of the past five years. The voluntary approaches result in liability assurance letters from the MPCA, as well as development plan approvals aiding redevelopment.

The Closed Landfill Program (CLP) was created by the legislature in 1994 as an alternative to Superfund. The CLP is responsible for cleanup and long-term care at up to 112 qualified closed state-permitted municipal waste landfills. Cleanup actions have included relocation of wastes, enhancement of site covers to current standards and installation of ground water pump/treat and active gas collection systems. Other response actions have included sampling and monitoring, operation of active remediation systems, general site care, reimbursement of certain past costs and land & property management. The CLP now operates 20 active gas collection systems which have destroyed more than 100 million pounds of methane in the past 4 years alone. A pilot Landfill Gas to Energy project was initiated using Stirling engines in 2007 at the WDE Landfill, a former NPL Superfund site. The CLP is currently undergoing a redesign effort to better address implementation of program requirements including development of Land Use Plans (LUPs) for landfills. LUPs are recognized as institutional controls to help the CLP, land owners and local governmental units responsibly manage qualified [landfill] facilities.

## **Ground Water**

Ground water is the source of drinking water for more than 70 percent of Minnesotans and is a major asset to agriculture and industry. Many threats to Minnesota's abundant ground water have been reduced in recent years by strong cleanup programs and preventive waste management practices, including waste reduction and recycling. However, continued residential and commercial growth along the St. Cloud- Twin Cities- Rochester corridor has begun to strain supplies of clean, available ground water in some areas. In addition, increasing withdrawals for irrigation and biofuels production have caused localized ground water shortages and will require careful monitoring in the future.

In recent years, the MPCA has re-established its ambient well monitoring network and is currently seeking additional funding to allow for construction of new wells in vulnerable aquifers to add to the network. The MPCA coordinates water monitoring and data sharing through an interagency agreement with the Minnesota Departments of Agriculture and Health. The three agencies track trends in ambient ground water quality for nitrates, volatile organic compounds (VOCs) chlorides, pesticides and other parameters, focusing on vulnerable aquifers, recharge zones and areas where land use is changing.

A 2007 MPCA report describing the statewide condition of Minnesota's ground water made the following conclusions:

- Ground water quality is generally good and complies with drinking water standards; however, human-caused impacts to ground water quality are apparent in many areas of the state.
- In urban areas, especially in the Twin Cities metropolitan area, Rochester and St. Cloud, elevated concentrations of chloride and nitrate and detectable concentrations of VOCs are common.
- In rural and agricultural areas, nitrate concentrations are frequently elevated or exceed standards; and pesticides and pesticide degradates are commonly detected, though at concentrations that are nearly always less than applicable drinking water standards.
- Areas of impacted ground water correlate well with land uses that are known to cause the observed quality impacts. The prevalence of elevated nitrate concentrations in ground water in regions dominated by agricultural land uses and in unsewered residential areas is particularly noteworthy.

A major challenge now facing ground water managers is the large number of newly recognized environmental contaminants from consumer products, waste disposal, agricultural and urban runoff, residential and industrial wastewater, and long-range atmospheric transport. These "emerging contaminants" are not currently incorporated into routine monitoring programs. Special studies are underway in Minnesota to determine the magnitude and extent of a number of these compounds in the environment, with particular focus on perfluorinated chemicals (PFCs) and endocrine-disrupting compounds (EDCs).

## **Air**

By many measures, Minnesota has good air quality. Even in the Twin Cities Metropolitan area which includes over three million people, the state fully attains all the current national ambient air quality standards. This is due in part to favorable geography and weather patterns, but credit must also be given to pollution control efforts by government and industry.

However, significant challenges loom. Since 2007, both the ozone and fine particle (PM<sub>2.5</sub>) standards were lowered. Currently, ozone is at 95 percent of the standard and PM<sub>2.5</sub> is at 85 percent of the standard. Fine particles from mobile and combustion sources add to regional haze and are of concern as research shows serious heart and lung effects on poor air quality days. In addition, the lead standard is expected to be lowered later this year. Certain areas of Minnesota near lead sources may not attain the new standards.

While most air toxics have been decreasing in concentration, a few such as formaldehyde are near or above health benchmarks. In 2007, daily concentrations of ozone or fine particles were high enough to result in air quality alerts for sensitive groups on nine days in 2007 in the Twin Cities area. Moderate air quality days (178) were equivalent to good air quality days (178) in 2007.

Attainment of national standards is important for both human health and economic health, as non-attainment designation means development restrictions. The combined effect of lower standards, regional air masses drifting into Minnesota from other states and increasing temperatures may squeeze the air quality closer to violating the standard, and compel more air quality alerts. A broad-based coalition of stakeholders from government, environmental groups and industry--Clean Air Minnesota--is working on voluntary measures to reduce pollutants and prevent non-attainment. Federal clean fuel requirements and other government and industry measures will help, but the outcome is uncertain.

In addition, emissions of carbon dioxide continue to increase in Minnesota, primarily from the burning of fossil fuels. The increased levels of carbon dioxide and other global warming gases are linked to climate change. In Minnesota, observed changes include higher temperatures, shorter winter lake ice cover, higher summer dew points, northward species migration, and more frequent heavy rainfalls and floods.