

SCW 2004

## Minnesota Tornado History and Statistics

Prepared by National Weather Service - Twin Cities, 1983. Updated by the State Climatology Office, 2004

Tornadoes are among the most devastating and awesome local storms that occur in the world. The United States has the dubious distinction of having the greatest frequency and the most severe tornadoes. They have the power to lift railroad cars and sail them many yards through the air. The power of their winds can make deadly missiles of loose objects, including broken glass. Even pieces of straw have been found imbedded in trees and boards after a tornado.

During the winter months (December through February) tornado activity is concentrated in the southeast U.S. and along the gulf coast. As spring (March/May) progresses tornado occurrence moves north and west across the central Mississippi and Ohio River Valleys. By summer (June/August) the potential threat of tornadoes has spread across the continental United States and Southern Canada. During autumn (September/November) tornadic activity gradually retreats to the south and southeast sections of the country.

This seasonal drift is principally caused by the increase of warm, gulf moisture into the central part of the country during spring and summer, decreasing during the fall and winter. The mixing which occurs when the moist gulf air clashes with contrasting colder, drier air from the north and northwest contributes to the triggering of tornadoes.

Minnesota lies along the north edge of the region of maximum tornado occurrence in the United States. *Tornado Alley*, as that part of the central U.S. has come to be known, reaches across parts of Texas, Oklahoma, Kansas, Missouri, East Nebraska, and West Iowa.

In Minnesota, tornadoes have occurred in every month from March through November. The earliest verified tornado in Minnesota occurred on March 18, 1968, north of Truman, and the latest in any year on November 16, 1931, east of Maple Plain. Historically and statistically, June is the month of greatest frequency with July not far behind. May has the third greatest frequency, followed closely by August. Nearly 3/4 of all tornadoes in Minnesota have occurred during the three months of May (16%), June (33%), and July (27%).

The most probable danger period in Minnesota, therefore, is late spring and early summer, between 2PM and 9PM. However, tornadoes can and do occur at any time of the day or night.

Despite a higher number of tornadoes reported in recent years, the number of fatalities and injuries due to tornadoes has been decreasing. This is thanks in part to better National Weather Service tools in detecting tornadoes, namely the NEXRAD doppler radar network installed in the mid 1990's. Also, the ability of alerting the public has improved as well with more National Weather Service radio transmitters and a close relationship with media outlets. An energetic spotter network has also been the key to alerting the public in Minnesota. There have only been 5 deaths due to tornadoes in Minnesota in the last 12 years (1992-2004) and there haven't been multiple deaths due to a single tornado since 1978. In fact, the increasing number of tornadoes reported may be a direct result of improved communications networks, public awareness, warning systems and training.

Most of the deadly and damaging tornadoes occur in groups of *outbreaks* that often last from 6 to 12 hours. The worst such outbreak in Minnesota occurred on June 28, 1979, when 18 tornadoes slashed across the state, from northwest to southeast, in a six and one half hour period. Two additional tornadoes occurred in eastern North Dakota with this system. Many such outbreaks have occurred, including the April 30, 1967 cluster in south central and southeast Minnesota.

Some notable tornadoes from Minnesota history include:

The tornado which struck Rochester 100 years ago, on August 21, 1883, (at 8:36PM) killing 31 and injuring many others. This was a large factor in the subsequent development of the Mayo Clinic.

On April 14, 1886 (4PM) the deadliest tornado in Minnesota history razed parts of St. Cloud and Sauk Rapids, leaving 72 dead and 213 injured. 11 members of a wedding party were killed including the bride and groom.

August 21, was again a tornado day, in 1918 (9:20PM), this time at Tyler, killing 38 people.

Less than a year later, June 22, 1919, (4:45PM) 59 lives were lost when the second deadliest killer tornado in Minnesota history roared through Fergus Falls.

More than 220 people were injured and nine killed in the Champlin area on June 18, 1939 (2PM).

On August 17, 1946, about an hour apart, tornadoes slashed through the cities of Mankato and North Mankato (5:40PM) leaving 11 dead and 60 injured, and Wells (6:50PM) where some 200 persons were injured.

Part of a larger outbreak on May 10, 1953, three tornadoes hit southeast Minnesota killing seven and injuring 19.

The Fargo, ND/Moorhead, MN tornado of June 20, 1957 (6:40PM) left 10 dead and more than 100 injured in its wake.

The most damaging series of tornadoes in Minnesota slashed across west and north sections of the Twin Cities Metro area (between 6PM and 9PM) on May 6, 1965. 14 persons were killed and 685 injured with damage in excess of 50 million dollars.

On this day eight tornadoes struck south central MN including three that were rated F4. 11 people were killed and 81 were injured. A four block wide swath was cut in the town of Waseca.

Tracy was in the path of a destructive tornado on June 13, 1968, (7:02PM) which killed 9 and injured 125 people.

The maxi-tornado which struck the Outing area on August 6, 1969, (4:02PM) left 12 dead and 70 injured.

One more recent killer tornado, in Minnesota, with one death and 83 injuries, tore across the Twin Cities from Edina to Roseville on June 14, 1981.

The greatest March tornado outbreak in Minnesota history was March 29, 1998. Two people died in a family of 13 tornadoes that struck St. Peter and Comfrey especially hard.

The most recent killer tornado (through 2004) in Minnesota with one death was in Granite Falls on July 25, 2000.

#### Some Minnesota Tornado Statistics

<u>1950 - 2004</u>	<u>Totals</u>	<u>Annual Averages</u>
Tornadoes	1371	23.9
Tornado Deaths	92	1.70
Tornado Injuries	1822	33.7

#### Tornado Totals and Averages by Month (1950 - 2004)

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
Total	18	70	221	453	364	153	64	27	1	1371
Average	0.3	1.3	4.1	8.4	6.7	2.8	1.2	0.5	0.01	25
Percent	>1	5	16	33	27	11	5	2	.04	100

#### Greatest Number of Tornadoes in Minnesota (1950-2004)

One Year	74 in 2001
One Month	38 in June 2001
One Day	18 on June 28, 1979 also on June 11, 2001 and June 13, 2001

#### Some Memorable Minnesota Tornadoes

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Deaths</u>	<u>Injuries</u>
Ft. Snelling (First tornado reported in Minnesota)	4/19/1820	11 PM (est)	0	0
Rochester	8/21/1883	6:36 PM	37	200
St.Cloud/Sauk Rapids (Most deaths from a single tornado in Minnesota)	4/14/1888	4:00 PM	72	213
Lake Gervias (Ramsey County) Widely visible throughout St. Paul	7/13/1890	5:30 PM	6	30

Minneapolis/St. Paul (Could have been straight-line winds or microburst.)	8/21/1904 7:30 PM	14	unknown
Tyler	8/21/1918 9:20 PM	36	225
Fergus Falls	8/22/1919 4:45 PM	57	200
Champlin	6/18/1939 2:00 PM	9	222
Mankato/North Mankato	8/17/1946 5:40 PM	11	100
Wells	8/17/1946 8:50 PM	0	30
South East Minnesota (Family of tornadoes)	5/10/1953 4-5 PM	7	19
Fargo/Moorhead	6/20/1957 8:40 PM	10	103
West-North Twin Cities (Family of tornadoes.)	5/6/1965 6-9 PM	14	683
South Central Minnesota (Family of tornadoes.)	4/30/1967 6-8 PM	11	81
Tracy	6/13/1968 7:02 PM	9	125
Outing	8/6/1969 4:02 PM	12	70
Gary (Last multiple deaths due to single tornado.)	7/5/1978 1:45 AM	4	38
Chandler (Last F5 tornado in Minnesota.)	6/16/1992 4:00 PM	1	35
Comfrey	3/29/1998 4:30 PM	1	16
Granite Falls (Last tornado to cause a fatality in Minnesota)	7/25/2000 4:57 PM	1	15

#### Links to tornado-related sites

- Minnesota Tornadoes by County 1950-2002
- Minnesota Tornadoes 2004 from the National Weather Service
- Minnesota Tornadoes 2003 from the National Weather Service
- Minnesota Tornadoes 2002 from the National Weather Service
- Minnesota Tornadoes 2001 from the National Weather Service
- Minnesota Tornadoes 2000 from the National Weather Service
- Minnesota Tornadoes 1999 from the National Weather Service
- Minnesota Tornado Statistics (1950-1995) from the Tornado Project
- Worst Minnesota Minnesota Tornadoes (1879-1995) from the Tornado Project
- The Tornado Project
- Storm Prediction Center
- National Severe Storms Laboratory
- Tornado photographs from the Minnesota Historical Society



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#### Comments/Questions

URL: <http://climate.umn.edu/doc/historical/tornadic.htm>  
 Last modified: October 21, 2004

HPRCC 2004

[State Map](#)  
[HPRCC Product Page](#)

**NOTE:**

To print data frame (right side), click on right frame before printing.

**1971 - 2000**

- [Daily Temp. & Precip.](#)
- [Daily Tabular data \(~23 KB\)](#)
- [Monthly Tabular data \(~1 KB\)](#)
- [NCDC 71-00 Normals \(~3 KB\)](#)

**1961 - 1990**

- [Daily Temp. & Precip.](#)
- [Daily Tabular data \(~23 KB\)](#)
- [Monthly Tabular data \(~1 KB\)](#)
- [NCDC 61-90 Normals \(~3 KB\)](#)

**Period of Record**

- [Station Metadata](#)
- [Station Metadata Graphics](#)

**General Climate Summary Tables**

- [Temperature](#)
- [Precipitation](#)
- [Heating Degree Days](#)
- [Cooling Degree Days](#)
- [Growing Degree Days](#)

**Temperature**

- [Daily Extremes and Averages](#)
- [Spring 'Freeze' Probabilities](#)
- [Fall 'Freeze' Probabilities](#)
- ['Freeze Free' Probabilities](#)
- [Monthly Temperature Listings](#)
  - [Average](#)
  - [Average Maximum](#)
  - [Average Minimum](#)

**Precipitation**

- [Monthly Average](#)
- [Daily Extreme and Average](#)
- [Daily Average](#)
- [Precipitation Probability by Duration](#)
- [Precipitation Probability by Quantity](#)
- [Monthly Precipitation Listings](#)
  - [Monthly Totals](#)

**Snowfall**

- [Daily Extreme and Average](#)

**BUFFALO, MN (211107)****Period of Record Monthly Climate Summary**

Period of Record : 8/ 1/1948 to 3/31/2004

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	21.0	27.7	39.4	56.4	70.2	78.7	83.3	81.0	71.4	59.0	39.8	25.9	54.5
Average Min. Temperature (F)	1.7	7.8	19.9	33.9	46.4	56.0	61.0	58.7	49.0	37.7	23.8	9.3	33.8
Average Total Precipitation (in.)	0.83	0.72	1.53	2.53	3.55	4.25	3.95	4.00	3.04	2.28	1.63	0.89	29.22
Average Total SnowFall (in.)	9.6	6.7	8.9	2.4	0.1	0.0	0.0	0.0	0.0	0.3	6.3	8.6	43.0
Average Snow Depth (in.)	8	9	5	0	0	0	0	0	0	0	1	4	2

**Percent of possible observations for period of record:**

Max. Temp.: 76.7% Min. Temp.: 76.6% Precipitation: 82.6% Snowfall: 74.8% Snow Depth: 75.3%

Check [Station Metadata](#) or [Metadata graphics](#) for more detail about data completeness.*High Plains Regional Climate Center, [contact us](#).*



U.S. Environmental Protection Agency

## 8-Hour Ground-level Ozone Designations

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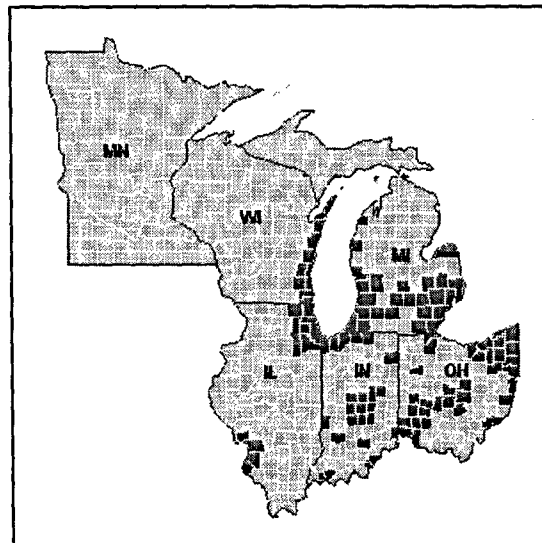
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### Region 5: State Designations

Boundary Designations for 8-hour Ozone Standard - EPA Region 5



8-Hour Ozone Designations  
April 15, 2004

- Unclassifiable/Attainment
- Nonattainment
- Nonattainment (part county)
- Unclassifiable

You will need Adobe Acrobat Reader, available as a free download, to view some of the files on this page. See [EPA's PDF page](#) to learn more about PDF, and for a link to the free Acrobat Reader.

This table identifies all counties EPA has designated as nonattainment. In some cases EPA designated partial counties. These are identified by a (P). Also, some counties are participating in an early action compact. These are identified as EAC. If a county is not listed below, EPA has designated it as unclassifiable/attainment.

State	Nonattainment Area Name	Counties	Classification	Maximum Attainment Date (from June 15, 2004)

Illinois	Chicago-Gary-Lake Co, IL-IN <u>Map</u> (PDF 1 p., 75.9 KB)	Cook DuPage Grundey (P) Kane Kendall (P) Lake McHenry Will	Moderate	June 2010
	St. Louis, MO-IL <u>Map</u> (PDF 1 p., 76.6 KB)	Jersey Madison Monroe St. Clair	Moderate	June 2010
Indiana (1)	Chicago-Gary-Lake Co IL-IN <u>Map</u> (PDF 1 p., 75.9 KB)	Lake Porter	Moderate	June 2010
	South Bend/Elkhart IN <u>Map</u> (PDF 1 p., 34.4 KB)	Elkhart St. Joseph	Basic	June 2009
	Louisville, KY-IN <u>Map</u> (PDF 1 p., 72.4 KB)	Clark Floyd	Basic	June 2009
	Indianapolis, IN <u>Map</u> (PDF 1 p., 51.7 KB)	Marion Boone Hendricks Morgan Johnson Shelby Hancock Madison Hamilton	Basic	June 2009
	Evansville IN-KY <u>Map</u> (PDF 1 p., 56.4 KB)	Vanderburgh Warrick	Basic	June 2009
	Muncie IN <u>Map</u> (PDF 1 p., 19.2 KB)	Delaware	Basic	June 2009
	Cincinnati-Hamilton OH-KY-IN <u>Map</u> (PDF 1 p., 62.4 KB)	Dearborn (P)	Basic	June 2009
	Greene Co IN <u>Map</u> (PDF 1 p., 26.7 KB)	Greene	Basic	June 2009
	Jackson Co IN <u>Map</u> (PDF 1 p., 30.5 KB)	Jackson	Basic	June 2009
	LaPorte IN† <u>Map</u> (PDF 1 p., 35.4 KB)	LaPorte	Marginal†	June 2007
	Fort Wayne IN <u>Map</u> (PDF 1 p., 29.4 KB)	Allen	Basic	June 2009
	Terre Haute IN <u>Map</u> (PDF 1 p., 30.5 KB)	Vigo	Basic	June 2009
Michigan (1)	Detroit-Ann Arbor, MI† <u>Map</u> (PDF 1 p., 83.5 KB)	Livingston Macomb Monroe Oakland St. Clair Washtenaw Wayne Lenawee	Marginal†	June 2007
	Flint, MI <u>Map</u> (PDF 1 p., 34.1 KB)	Genesee Lapeer	Basic	June 2009
	Grand Rapids MI <u>Map</u> (PDF 1 p., 29.8 KB)	Ottawa Kent	Basic	June 2009
	Muskegon Co, MI† <u>Map</u> (PDF 1 p., 25.7 KB)	Muskegon	Marginal†	June 2007
	Allegan Co, MI <u>Map</u> (PDF 1 p., 24 KB)	Allegan	Basic	June 2009

	Huron Co MI <a href="#">Map</a> (PDF 1 p., 27.6 KB)	Huron	Basic	June 2009
	Kalamazoo-Battle Creek - MI <a href="#">Map</a> (PDF 1 p., 47.3 KB)	Calhoun Kalamazoo Van Buren	Basic	June 2009
	Lansing-East Lansing - MI <a href="#">Map</a> (PDF 1 p., 41 KB)	Clinton Eaton Ingham	Basic	June 2009
	Benton Harbor - MI <a href="#">Map</a> (PDF 1 p., 31.6 KB)	Berrien	Basic	June 2009
	Benzie Co - MI <a href="#">Map</a> (PDF 1 p., 21.2 KB)	Benzie	Basic	June 2009
	Cass Co - MI† <a href="#">Map</a> (PDF 1 p., 22.5 KB)	Cass	Marginal†	June 2007
	Mason Co - MI <a href="#">Map</a> (PDF 1 p., 23.2 KB)	Mason	Basic	June 2009
Minnesota	entire state attainment			
Ohio	Canton-Massillon, OH <a href="#">Map</a> (PDF 1 p., 33.6 KB)	Stark	Basic	June 2009
	Cincinnati-Hamilton, OH-KY-IN <a href="#">Map</a> (PDF 1 p., 62.4 KB)	Butler Clermont Hamilton Warren Clinton	Basic	June 2009
	Cleveland-Akron-Lorain, OH <a href="#">Map</a> (PDF 1 p., 76.4 KB)	Ashtabula Cuyahoga Geauga Lake Lorain Medina Portage Summit	Moderate	June 2010
	Columbus, OH <a href="#">Map</a> (PDF 1 p., 60 KB)	Delaware Franklin Licking Fairfield Madison Knox	Basic	June 2009
	Dayton-Springfield, OH <a href="#">Map</a> (PDF 1 p., 30.8 KB)	Clark Greene Miami Montgomery	Basic	June 2009
	Steubenville-Weirton, OH-WV <a href="#">Map</a> (PDF 1 p., 55.7 KB)	Jefferson	Basic	June 2009
	Toledo, OH <a href="#">Map</a> (PDF 1 p., 39.1 KB)	Lucas Wood	Basic	June 2009
	Youngstown-Warren-Sharon, PA-OH <a href="#">Map</a> (PDF 1 p., 79.5 KB)	Mahoning Trumbull Columbiana	Basic	June 2009
	Wheeling, WV-OH <a href="#">Map</a> (PDF 1 p., 51.3 KB)	Belmont	Basic	June 2009
	Lima, OH <a href="#">Map</a> (PDF 1 p., 21.2 KB)	Allen	Basic	June 2009
	Parkersburg-Marietta, WV-OH <a href="#">Map</a> (PDF 1 p., 61.4 KB)	Washington	Basic	June 2009
	Door Co, WI <a href="#">Map</a> (PDF 1 p., 55.7 KB)	Door	Basic	June 2009
Wisconsin				

Kewaunee Co, WI <a href="#">Map</a> (PDF 1 p., 32.9 KB)	Kewaunee	Basic	June 2009
Manitowoc Co, WI <a href="#">Map</a> (PDF 1 p., 28.1 KB)	Manitowoc	Basic	June 2009
Milwaukee-Racine, WI <a href="#">Map</a> (PDF 1 p., 47.8 KB)	Milwaukee Ozaukee Racine Washington Waukesha Kenosha	Moderate	June 2010
Sheboygan, WI <a href="#">Map</a> (PDF 1 p., 23.6 KB)	Sheboygan	Moderate	June 2010

1. Includes Tribal lands

† This area has received a bump down in classification. See the [reclassifications page](#) for information.

Region 5 Recommendations and EPA Responses

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Last updated on Wednesday, July 27th, 2005

URL: <http://www.epa.gov/ozonedesignations/regions/region5desig.htm>



## STATE IMPLEMENTATION PLANS

- I. Overview – What is a SIP?
- II. Site or Area-Specific Plans and Requirements in Minnesota's SIP
- III. State Rules and Programs in Minnesota's SIP
- IV. Emerging Issues – Ozone, Regional Haze and PM<sub>2.5</sub>
- V. Staff Contacts

### I. What Is A SIP?

The federal Clean Air Act (CAA) places most of the responsibility on the states to prevent air pollution and control air pollution at its source. In order for a state to implement an air quality program, the state must adopt a plan and obtain approval of the plan from the Environmental Protection Agency (EPA). The federal review and approval process provides some consistency between programs in different state and ensures that a state program complies with the requirements of the CAA and EPA rules. The vehicle for demonstrating compliance with the CAA and EPA rules is the State Implementation Plan, or "SIP". A SIP adopted by the state and approved by the EPA is legally binding under both state and federal law and may be enforced at either level.

The contents of a SIP can be considered in two broad categories, (1) site or area-specific plans and documents; and (2) state rules and programs. Both are federally enforceable once accepted by EPA as part of the SIP.

Before the 1990 amendments to the CAA, the entire national strategy to improve air quality consisted of the effort to attain National Ambient Air Quality Standards (NAAQS). There are primary and secondary NAAQS established for the following pollutants: carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), particulate matter less than 10 microns and less than 2.5 microns in diameter (PM<sub>10</sub> and PM<sub>2.5</sub>), ozone, nitrogen oxides (NO<sub>x</sub>) and lead. Generally, primary standards define the air quality required to prevent adverse impact on human health, and secondary standards define the air quality required to prevent adverse impact on other elements of the environment such as vegetation.

SIPs focus on attainment and maintenance of the NAAQS. SIPs include state air quality rules, control strategies to attain and maintain the NAAQS, compliance schedules to attain the NAAQS, the new source review program, a program to prevent state emergency episodes, and visibility protection. There are other state programs that require a plan and approval by the EPA, however, they are not termed "SIPs". For example, the CAA amendments of 1990 required state submittal of an operating permit program, and gives states the option of submitting an air toxics program. The SIP only regulates the criteria pollutants listed above.

The primary function of the SIP is to protect ambient air standards (i.e. the NAAQS) for criteria air pollutants. Any site-specific plan or rule that the state or EPA believes is necessary to attain and maintain the NAAQS should be included in the SIP. A state may request, on its own, to include a plan or rule in the SIP or EPA may require a state to include certain rules and plans in its SIP. If a state fails to include an EPA mandated item in its SIP, the state may be subject to a Federal Implementation Plan (FIP). The legal requirements for SIP submittals are found in the CAA, section 110, parts A and D.

### **SIP Revision Process:**

Revisions to the SIP may be required by amendments to the CAA, by EPA, or by state initiated changes to the state air program. When a state submits a SIP to attain the NAAQS in a nonattainment area, the SIP submittal includes:

1. A formal letter of submittal from the Commissioner;
2. Copy of documents (administrative orders or permits) that contain emission limits and compliance requirements that have been issued to the culpable sources in the nonattainment area (or a rule that affects culpable sources);
3. Letters from the Attorney General's Office stating that the MPCA has legal authority to implement the SIP revision and that the MPCA complied with state procedural requirements in adopting the SIP;
4. Copy of the public notice published in a newspaper with general circulation in the nonattainment area. (It is important to note that EVERY change to the SIP, no matter how small, is required to be public noticed for 30 days);
5. If a public hearing is held, certification from the Commissioner that a public hearing was held after the 30-day comment period;
6. Any public comment and the MPCA's response; and
7. Air dispersion modeling of the nonattainment area.

To redesignate an area to attainment, the state must have an approved SIP for that area. The state must also show current modeled attainment, two years of monitoring without a violation, maintenance plans for maintaining the NAAQS for at least 10 years, and, in some cases, contingency plans outlining procedures the state will implement in the event that the area violates the NAAQS.

When the MPCA submits a state rule into the SIP, the requirements are the same except that the rule rather than a document containing limits and compliance requirements is submitted and no dispersion modeling is required unless the rule affects emission levels from culpable sources in a nonattainment area. Also, if the rules submitted are thought to be a "relaxation" of the SIP, the MPCA must justify this "relaxation."

### **What Is In Minnesota's SIP?**

SIPs that were submitted by states to the EPA and acted upon by the EPA are listed in 40 CFR part 52. Minnesota's SIP is identified in 40 CFR part 52.1220. Since the SIP has changed considerably since the 1990 CAA Amendments, some of the items listed in 40 CFR section 52.1220 are obsolete and recent additions to the SIP may not be reflected. The MPCA's SIP Coordinator can supply the current status of the SIP. The original SIP submittal of January 28, 1972 was about 1.5 inches thick, but the many revisions made to the SIP over the years almost fill a filing cabinet. The bulk of Minnesota's SIP includes state air quality rules and nonattainment area plans to achieve the NAAQS in designated areas. This document contains tables showing which air quality rules, documents and plans are included in the SIP.

## **II. Federally Enforceable Site or Area-Specific Plans and Requirements**

### **How Were Nonattainment Areas Designated In Minnesota?**

Currently, there are no nonattainment areas in Minnesota. A number of areas were once designated nonattainment but have been redesignated based on modeled and monitored compliance with the NAAQS. The last area to be redesignated was the St. Paul particulate matter nonattainment area. This redesignation became effective on September 24, 2002. The former nonattainment areas are now known as maintenance areas. In its redesignation requests, the MPCA included the required 10-year maintenance plan for the area, which generally consists of enforcement of any administrative orders, plans or rules affecting the emission facilities in the area. The MPCA is required to submit for EPA approval an updated 10-year plan eight years after approval of the redesignation to attainment status.

The nonattainment areas in Minnesota were assigned first by determining which air quality control monitors showed a violation of a particular criteria pollutant standard. Then an area surrounding the monitor was delineated, including all potentially significant contributors to that violation. The nonattainment classifications were determined from SO<sub>2</sub> monitoring performed between 1975 to 1977 and PM<sub>10</sub> monitoring in 1987. The lead nonattainment area was determined in 1991. Carbon monoxide areas were classified in 1978. Other areas of the state are classified as attainment or unclassifiable.

### **How Were The Sources That Contributed To The Nonattainment Area Identified?**

Generally, the potentially significant contributors to each nonattainment area were identified by determining which sources (point and area sources) emit a significant amount of the pollutant of concern. These sources are termed culpable sources. This data is obtained from an emissions inventory of each potential source in the area. Occasionally, other methods such as receptor modeling are used to determine potentially significant contributors. The distance and direction of the potential source from the monitor with the violation is also considered.

### **What Happens To Site-Specific Plans When An Area Is Redesignated To Attainment?**

Even though several of Minnesota's nonattainment areas have been reclassified to attainment, the sources in those areas must comply with the limits established in the area's nonattainment plan. The limits never expire, even though the area receives attainment status. When a nonattainment area is reclassified to attainment, the area is known as a maintenance area.

The potentially significant contributors to Minnesota's maintenance areas are listed in alphabetical order below:

<u>Source</u>	<u>Pollutant</u>	<u>Location</u>
Aggregate Industries Inc. <i>(Formerly J.L. Shiely Company (CAMAS))</i>	PM <sub>10</sub>	St. Paul
Associated Milk Producers	SO <sub>2</sub>	Rochester
Cenex Harvest States <i>(Formerly Harvest States Cooperatives)</i>	PM <sub>10</sub>	St. Paul
Commercial Asphalt, Inc.	PM <sub>10</sub>	St. Paul
Continental Nitrogen and Resources Co.	SO <sub>2</sub>	Rosemount
Federal Hoffman, Inc.	SO <sub>2</sub>	Anoka
Flint Hills Resources <i>(Formerly Koch Refining Company)</i>	SO <sub>2</sub>	Rosemount
Franklin Heating Station	SO <sub>2</sub>	Rochester
GAF Corporation	SO <sub>2</sub>	Minneapolis
Gopher Resource Corporation	Lead	Eagan
Great Western Dock and Terminal <i>(Formerly Great Lakes Coal and Dock Company)</i>	PM <sub>10</sub>	St. Paul
IBM Corporation	SO <sub>2</sub>	Rochester
LaFarge Corporation	PM <sub>10</sub>	Childs Road, St. Paul
LaFarge Corporation	PM <sub>10</sub>	Red Rock Road, St. Paul
Marathon Ashland Petroleum LLC	SO <sub>2</sub>	St. Paul Park Facility
Metropolitan Council Wastewater Treatment Plant	PM <sub>10</sub>	St. Paul
NRG - Minneapolis Energy Center; Main, Baker Boiler, and Soo Line Plants	SO <sub>2</sub>	Minneapolis
North Star Steel Company	PM <sub>10</sub>	St. Paul
Olmsted County Campus Power	SO <sub>2</sub>	Rochester
Rochester Public Utilities Silver Lake Plant	PM <sub>10</sub> , SO <sub>2</sub>	Rochester
Cascade Creek Plant	SO <sub>2</sub>	Rochester
St. Mary's Hospital	SO <sub>2</sub>	Rochester
St. Paul Terminals	PM <sub>10</sub>	Red Rock Road, St. Paul
United Defense, L.P.	SO <sub>2</sub>	Fridley
Xcel Energy <i>(Formerly Northern States Power Company)</i>	SO <sub>2</sub>	Inver Hills Plant
Xcel Energy <i>(Formerly Northern States Power Company)</i>	SO <sub>2</sub>	Riverside Plant

### **How Are Site Specific Plans Made Federally Enforceable?**

EPA required Minnesota to submit in its SIP revisions non-expiring limits and controls on each culpable source. The MPCA originally responded by issuing Administrative Orders to each of the culpable sources. (MPCA tried to use permits to establish these federally enforceable limits, but EPA did not except these as federally-enforceable limits because the permits expired. However, this issue has now been addressed as described below). The Administrative Orders were similar to the MPCA's pre-Title V program air quality permits except that they regulated only one pollutant and they did not expire.

Since the MPCA has received EPA approval of its Air Emissions Permit Rule as a federally-enforceable state operating permit program, the MPCA has been revoking the Administrative Orders in favor of federally-enforceable limits in its permits. The "SIP limits" appear as Title I conditions in the permits, which do not expire. EPA has approved this process for State-only permits provided that the State permit is issued as a non-expiring permit. When the Title V or qualifying State permit is issued, the MPCA submits the permit to the EPA as a SIP revision and asks that the permit replace the Order as the enforceable SIP document. Once EPA has approved the permit into the SIP, the Order is considered revoked.

### **How Can A Source With An Administrative Order Or Permit That Contains Title I Conditions Modify Its Facility?**

Compared to the permit amendment process, it tends to be a more complex lengthy process to modify an administrative order or a SIP Title I condition in a permit issued to a source contributing to a nonattainment or maintenance area. Once approved and promulgated by the EPA, the SIP (in which limits are a part) becomes federal rule. This means that every change made to an administrative order or SIP Title I condition in a permit must be public noticed, then submitted to and approved by EPA as a SIP revision. This process can take up to a year, sometimes more, to complete, even for changes that would not be major amendments as defined under permitting rules.

The MPCA's policy of replacing administrative orders with federally enforceable air emission permits helps to alleviate problems with the extended time frame. The permit can sometimes be written with more built-in operational flexibility than the original order at least to the extent that changes to the facility that do not require a permit amendment are unlikely to require a SIP amendment. If the permit needs to be amended, the MPCA can usually give construction authorization through the permit so that the SIP amendment process and construction at the facility can occur in parallel. No additional public notice is necessary provided that the permit amendment process included a public notice that made reference to pending changes in the SIP. More detail is provided in the next section.

### **How Are Sip Title I Conditions In A Permit Modified If The Company Requests A Modification?**

The MPCA and EPA have agreed to the following procedure for modifying site-specific SIP requirements in air quality permits:

1. When the MPCA wants to modify a SIP requirement contained in the permit, MPCA will draft a permit amendment. This proposed permit amendment will automatically be considered a major amendment (requiring it to go through public participation and EPA review, see items 3 and 4 below) because it is modifying a Title I SIP condition. At this time, EPA's Title I staff will be informed of the request, including the revised language and any supporting materials.
2. The proposed permit amendment will include the new SIP conditions, with a condition in the proposed permit amendment stating that these new SIP conditions will only become effective upon EPA approval as a SIP revision. The proposed permit amendment will continue to require compliance with the SIP requirements of the existing permit until the SIP is revised. (In other words, the company follows the "old" SIP requirements until EPA approves the "new" requirements into the SIP.) When the new requirements are approved, they become effective and the old requirements disappear.
3. The proposed permit amendment will be public noticed as a permit revision and as a Title I SIP revision.
4. After the public participation process, the proposed permit amendment will be sent to EPA for its 45-day permitting review. (Applies to Title V permits only).
5. If EPA has no permitting objection to the proposed permit amendment, the MPCA will issue the permit amendment. Therefore, EPA's permitting staff have not objected to the new SIP requirements, but also recognize and agree that they are not "applicable requirements" (under the permit) until the new requirements are approved into the SIP.
6. The permit amendment is sent to EPA as a SIP revision.
7. Because Title I staff have been involved with this permit amendment from the beginning, action on the SIP submission should happen relatively quickly.

## What Is The Status Of The Site-Specific Plans In Minnesota?

The following tables show the areas with site-specific plans, the sources or facilities that are affected by each plan, and the federal effective date of the plans. Once the plans are approved by EPA, they are federally-enforceable and part of the SIP.

### Site-Specific Plans In Place To Attain and Maintain the NAAQS

<b><u>PM<sub>10</sub> Nonattainment Area Plans AND Redesignation Requests</u></b>		
<b>County/City</b>	<b>Facilities Affected</b>	<b>Federal Effective Date of the Plan</b>
Ramsey/St. Paul	→Commercial Asphalt, Inc	March 17, 1994 (Federal Register publication: 2/15/94)
	→Great Western Dock and Terminal ( <i>Great Lakes Coal and Dock</i> )	
	→Cenex Harvest States	
	→Aggregate Industries Inc ( <i>J.L. Shiely Company/CAMAS</i> )	•Redesignated to attainment September 24, 2002 (Federal Register publication: 7/26/02)
	→LaFarge Corporation, Child's Road	
	→Metropolitan Council	
	→North Star Steel	
Supplementary submittal for Red Rock Road in St. Paul	→LaFarge Corporation, Red Rock Road	October 12, 1999 (Federal Register publication: 8/13/99)
	→St. Paul Terminals	
		•Redesignated to attainment September 24, 2002 (Federal Register publication: 7/26/02)
Olmsted/Rochester	→Rochester Public Utilities - Silver Lake Plant	March 17, 1994 (Federal Register publication: 2/15/94)
		•Redesignated to attainment July 31, 1995 (Federal Register publication: 5/31/95)

**Lead Nonattainment Area Plans  
AND Redesignation Requests**

<b>County/City</b>	<b>Facilities Affected</b>	<b>Federal Effective Date of the Plan</b>
Dakota/Eagan	→Gopher Resources	December 19, 1994 (Federal Register publication: 10/18/94)  •Redesignated to attainment in the same Federal Register publication as above

**SO2 Nonattainment Area Plans**

<b>County/City</b>	<b>Facilities Affected</b>	<b>Federal Effective Date of the Plan</b>
Twin Cities 7- County Area (excluding the Pine Bend and St. Paul Park Areas)	→Federal Hoffman, Inc. – Anoka →GAF Corporation – Minneapolis →NRG/Minneapolis Energy Center - Main, Baker, and Soo Line Plants →Xcel Energy (NSP) - Riverside Plant →United Defense, L.P. – Fridley	May 16, 1994 (Federal Register publication: 4/14/94)  •Redesignated to attainment July 31, 1995 (Federal Register publication: 5/31/95)
Pine Bend Area	→Flint Hills Resources ( <i>Koch Refining Company</i> ) and Sulfuric Acid Unit →Xcel Energy (NSP) - Inver Hills Facility →Continental Nitrogen and Resources Company	Oct 11, 1994 (Federal Register publication: 9/9/94)  •Redesignated to attainment July 31, 1995 (Federal Register publication: 5/31/95)



St. Paul Park Area	→Marathon Ashland Petroleum, LLP	March 20, 1995 (Federal Register publication: 1/18/95)
		•Redesignated to attainment July 14, 1997 (Federal Register publication: 5/13/97)
Olmsted/Rochester	→Associated Milk Producers →Franklin Heating Station →IBM Corporation →Olmsted County Campus Power →Rochester Public Utilities - Silver Lake Plant and Cascade Peaking Plant →St. Mary's Hospital	May 8, 2001 (Federal Register publication: 3/9/01)
		•Redesignated to attainment May 8, 2001 (Federal Register publication: 3/9/01)

<b><u>CO Requests to Redesignate Areas to Attainment</u></b>		
<b>County/City</b>	<b>Sources Affected</b>	<b>Federal Effective Date of the Plan</b>
St. Cloud	mobile sources	Aug 27, 1993 (Federal Register publication: 6/28/93)
Duluth	mobile sources	June 13, 1994 (Federal Register publication: 5/14/94)
Anoka, Hennepin, Ramsey, and portions of Carver, Dakota, Scott, Washington, and Wright Counties	mobile sources	November 29, 1999 (Federal Register publication: 10/29/99)

**CO Nonattainment Area Plans/Programs**

The following plans/programs are effective in the these counties: Anoka, Hennepin, Ramsey, and portions of Carver, Dakota, Scott, Washington, and Wright Counties

<b>Plan/Program</b>	<b>Federal Effective Date of the Plan</b>
1990 Base Year Inventory	October 19, 1994 (Federal Register publication: 9/19/94)
Oxygenated Fuels Program	November 3, 1994 (Federal Register publication: 10/4/94)
Vehicle Inspection and Maintenance Program	November 29, 1999 (Federal Register publication: 10/29/99) November 14, 1994 (Federal Register publication: 10/13/94)
Commitment to Contingency Measures	March 22, 1996 (Federal Register publication: 2/21/96)
1993 Periodic Inventory	December 22, 1997 (Federal Register publication: 10/23/97)

## **Nonattainment Areas in Minnesota**

Once the Ramsey County particulate matter (PM<sub>10</sub>) nonattainment area was redesignated, on September 24, 2002, Minnesota was in attainment for all applicable pollutants throughout the state. Since then and as of the date of this document there have been no nonattainment areas in Minnesota.

## **Maintenance Areas in Minnesota**

### **Carbon Monoxide:**

- The area within the official city limits of the City of St. Cloud contained within Benton, Sherburne, and Stearns Counties
- City of Duluth
- Anoka, Hennepin, Ramsey, and portions of Carver, Dakota, Scott, Washington, and Wright Counties

### **Sulfur Dioxide:**

- Seven County Twin Cities Metropolitan Area  
(Counties included: Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, Washington)
- City of Rochester

### **Particulate Matter (PM<sub>10</sub>):**

- A portion of the City of Rochester:

The area bounded on the south by U.S. Highway 14; on the west by U.S. Highway 52; on the north by 14th Street N.W. between U.S. Highway 52 and U.S. Route 63 (Broadway Avenue), U.S. Route 63 north to Northern Heights Drive, N.E. and Northern Heights Drive N.E. extended east to the 1990 City of Rochester limits; and on the east by the 1990 City of Rochester limits.

- A portion of the City of St. Paul:

The area bounded by the Mississippi River from Lafayette to Route 494, Route 494 east to Route 61, Route 61 north to I-94, I-94 west to Lafayette, and Lafayette south to the Mississippi River.

### **Lead:**

- A portion of the city of Eagan:

Lone Oak Road (County Road 26) to the north, County Road 63 to the east, Westcott Road to the south, and Lexington Avenue (County Road 43) to the west.

## **What Are The Restrictions On A Stationary Source Located Or That Intends To Locate In An Attainment Area?**

In areas that attain the NAAQS, rules have been designed to prevent growth and development from causing significant deterioration of the air quality. A source that wishes to locate in an attainment area that wants to obtain a permit for a major stationary source of a pollutant with a NAAQS must follow the prevention of significant deterioration (PSD) program. Some sources are defined as major if they have the potential to emit 100 tons per year or more of any pollutant subject to regulation under the CAA. A list of these sources is published at 40 CFR 52.21 (b)(1)(i)(a). Any other source is defined as major if the source has a potential to emit more than 250 tons per year of any pollutant subject to regulations under the CAA. A modification is considered major if net emissions increases exceed the significance thresholds listed in 40 CFR 52.21 (b)(23). These provisions also apply to pollutants other than those with NAAQS.

## **What Are The Restrictions On A Stationary Source Located Or That Intends To Locate In A Nonattainment Area?**

Minnesota's "Offset" rule, or New Source Review (NSR) Program for Nonattainment Areas, became federally enforceable on May 31, 1994. The rule is found at Minn. R. 7007.4000 – 7007.4030 and basically incorporates by reference 40 CFR 51, Appendix S with some exceptions. An important outcome of EPA approval of the Offset rule is that it lifts the construction ban for major sources and major SO<sub>2</sub> modifications in SO<sub>2</sub> nonattainment areas. Listed below are some common questions asked about the Offset rule:

### **To Whom Does The Offset Rule Apply?**

The Offset rule applies to new major sources or major modifications in nonattainment areas (for the pollutant that the area is designated nonattainment), or new major sources or major modifications that would contribute to a violation of the NAAQS in a nonattainment area. For clarity, if a facility located in a SO<sub>2</sub> nonattainment area wanted to do a major modification for PM<sub>10</sub>, the facility would NOT be subject to the Offset rule.

### **How do I know When To Apply The Offset Rule?**

New sources wanting to locate in a nonattainment area must go through nonattainment NSR if they have the potential to emit 100 tons per year (tpy) or more of the criteria pollutant for which the area is designated nonattainment. If a facility already located in a nonattainment area wants to do a modification, that facility must go through the nonattainment NSR process if the change would result in a net emissions increase in the following amounts:

CO	100 tpy	SO <sub>2</sub>	40 tpy	NOx	40 tpy
PM <sub>10</sub>	25 tpy	Lead	0.6 tpy	Ozone	40 tpy of VOCs

**Note:** These are the same thresholds as the PSD program modifications.

**What Conditions Must Be Met By A Source Before A NSR Permit Can Be Granted To A Source Located In A Nonattainment Area?**

- 1) The source is required to meet an emission limitation which specifies the lowest achievable emission rate (LAER) for that particular source.
- 2) The source must certify that all other facilities it owns or operates in Minnesota are in compliance with all applicable requirements.
- 3) The source must obtain emission reductions, or "offsets", from existing sources in the same area of the proposed source or source modification. In addition, offsets are based on actual emissions and can only be intrapollutant (e.g. SO<sub>2</sub> for SO<sub>2</sub>, not PM<sub>10</sub> for SO<sub>2</sub>).

For example, if Company X wants to locate a new major source in a SO<sub>2</sub> nonattainment area, it must obtain SO<sub>2</sub> emission offsets from another facility in the area. The facility that it obtains the emission offsets from can be owned by Company X or owned by another company.

If Company X wants to do a SO<sub>2</sub> major modification at Facility Z, it has three options to obtain SO<sub>2</sub> offsets: the offsets can come right from Facility Z (internal netting), from another facility in the area owned by Company X, or from a facility in the area owned by any other company.

- 4) Emission offsetting must provide a positive net air quality benefit in the nonattainment area. This means the emission offset must be greater than a one-to-one ratio. Dispersion modeling may also be needed to determine whether the new source or modification will attain the ambient air quality standards.

**What Is Offset Banking And Does Minnesota Have A Banking Provision?**

Offset banking is saving up emission reductions at a facility to provide offsets for a source seeking a permit in the future. At this time, Minnesota does NOT have a banking provision in its offset rule.

### III. State Rules and Programs

#### **What State Rules Are Included In Minnesota's SIP?**

The following tables are a complete listing of Minnesota Rules that are included in the SIP. Note that only the portions of the Air Emissions Permit Rule (Minn. Rules pts. 7007.0050-1850) that were effective on October 18, 1993, are included in the SIP. The Registration Permit portions, except Option C, are also included in the SIP.

#### **Minnesota Air Quality Rules in the State Implementation Plan**

<b>CHAPTER AND TITLE</b>	<b>SUBJECT</b>
<b>Chapter 7005 – Definitions</b>	
7005.0100	Definitions
7005.0110	Abbreviations
<b>Chapter 7007 - Air Emission Permits</b>	
7007.0050-1850 (Those effective October 18, 1993)	Air Emission Permits (Registration Permit Rule included <i>except for 7011.1125 - Option C</i> )
7007.0800, subp 6, item C(5)	Evidentiary Rule
7007.4000-4030	Emission Offsets
<b>Chapter 7009 - Ambient Air Quality Standards</b>	
7009.0010-0020, 0050-0080	Ambient Air Quality Standards
7009.1000-1110	Air Pollution Episodes
7009.9000	General Conformity

**Chapter 7011 - Standards of Performance for Stationary Sources**

7011.0010-0020	Applicability
7011.0060-0080	Control Equipment Rule
7011.0100-0115 (Note: 7011.0120- Opacity Standard Adjustment- is NOT in the SIP)	Opacity
7011.0150	Fugitive Particulate
7011.0500-0550	Indirect Heating Equipment
7011.0600-0620	Direct Heating Equipment
7011.0700-0735	Industrial Process Equipment
7011.0800-0805, 0815-0825	Portland Cement Plants
7011.0900-0905, 0915-0920	Asphalt Concrete Plants
7011.1000-1015, except 7011.1005, subp. 2	Grain Elevators
7011.1100-1125, 1135-1140	Coal Handling Facilities
7011.1201-7011.1207 for all rules for existing sources	Incinerators
7011.1300-1325	Sewage Sludge Incinerators
7011.1400-1430	Petroleum Refineries
7011.1500-1515	Liquid Petroleum and VOC Storage Vessels
7011.1600-1605, 1615-1630	Sulfuric Acid Plants
7011.1700-1705, 1715-1725	Nitric Acid Plants
7011.2100-2105	Inorganic Fibrous Materials
7011.2300	Stationary Internal Combustion Engine

<b>Chapter 7017 – Monitoring and Testing Requirements</b>	
7017.0100	Establishing Violations (Evidentiary Rule)
7017.1000	CEMS
7017.2001-2060	Performance Tests
<b>Chapter 7019 - Notification, Reporting, Record keeping, and Emissions Inventory</b>	
7019.1000	Notifications
7019.2000	Reports
7019.3000-3010	Emission Inventory
<b>Chapter 7023 - Mobile and Indirect Sources</b>	
7023.0100-0120	Motor Vehicles
<b>Minnesota Statutes Chapter 17 and 88</b>	
Sections 17.135, 88.01-.03, 88.16, and 88.171	Opening Burning
(These are DNR statutes EPA insisted we keep.)	

**Other Programs and Rules Included or Requested to be Included in the SIP**

<b>Program or Rule</b>	<b>Federal Effective Date</b>
Small Business Assistance Program	May 16, 1994 (Federal Register publication date: 3/16/94)



## **IV. Emerging Issues**

EPA is in the process of implementing new standards for a number of pollutants, as summarized below. All three pollutants result from intrastate transport of either the pollutant or its precursors. Control strategies for all three will also be regional. Minnesota will be part of the strategy for regional haze and may be part of a regional strategy for ozone or PM<sub>2.5</sub> even if we attain the standards.

### **Ozone:**

EPA established a new 8-hour standard for ozone in 1997. Ground level ozone is caused by the interaction of NO<sub>x</sub> and VOCs from both stationary and mobile sources. Ozone levels are generally highest downwind of large urban areas and are somewhat seasonal. The Twin Cities area has experienced a number of exceedences of the 1-hour standard and risks being classified as non-attainment if these are repeated in subsequent years. A voluntary effort, led by Clean Air Minnesota, is underway to investigate means of reducing ozone levels in the area before nonattainment becomes an issue. Both MPCA and EPA are actively supportive of this effort.

### **PM<sub>2.5</sub>:**

This new standard applies to particulate matter with an aerodynamic diameter of 2.5 microns or less. EPA proposed this standard based on current understanding of the health effects of airborne particles. The very small particles that comprise ambient PM<sub>2.5</sub> are largely formed from combustion sources. Much of PM<sub>2.5</sub> is formed by transformation of gaseous sulfur dioxide and nitrogen oxides to particles in the air. Sulfur dioxide and nitrogen oxides result from the combustion of fossil fuels in point sources such as power plants and mobile sources such as cars. The gaseous precursors and the very small particles can travel long distances. A good share of the particles here result from sources hundreds of miles away. PM<sub>10</sub> includes PM<sub>2.5</sub> and the larger particles between PM<sub>2.5</sub> and PM<sub>10</sub>. This PM<sub>2.5</sub> – PM<sub>10</sub> fraction tends to come from mechanical processes such as crushing or grinding rather than combustion. EPA is currently reviewing the PM<sub>2.5</sub> standard in light of new evidence of the health effects of PM<sub>2.5</sub> and even smaller particles. Monitoring in the Twin Cities area has shown levels close to the standard and voluntary efforts, similar to the ozone initiative, have been discussed.

### **Regional Haze:**

The goal of the regional haze program is to reduce the impacts of air pollution on visibility, particularly in Class I designated areas such as the Boundary Waters Canoe Area and Voyageurs Park. Small particles in the PM<sub>2.5</sub> size range have a diameter close to the wavelength of visible light (around one micron) and therefore will tend to scatter light. Therefore PM<sub>2.5</sub> is closely associated with regional haze issues. States are required to develop plans to address regional haze in Class I areas within the state and submit SIP revisions in 2006 to 2008. The MPCA is currently participating in the Central States Regional Air Resource Agencies (CenRAP) process to develop a regional haze SIP. The CenRAP states include Minnesota, Iowa, Nebraska, Missouri, Kansas, Arkansas, Oklahoma, Louisiana, and Texas. The MPCA has started to identify sources in Minnesota that would be subject to Best Available Retrofit Technology (BART), which is the control strategy built into the regional haze program.

## **V. Who Do I Contact If I Have Questions About The SIP?**

General questions on SIPs, rules and permits:	Stuart Arkley (651)296-7774
Questions specific to PM <sub>2.5</sub> :	Gordon Andersson (651)296-7667
Questions specific to mobile sources:	Susanne Spitzer (651)296-7723