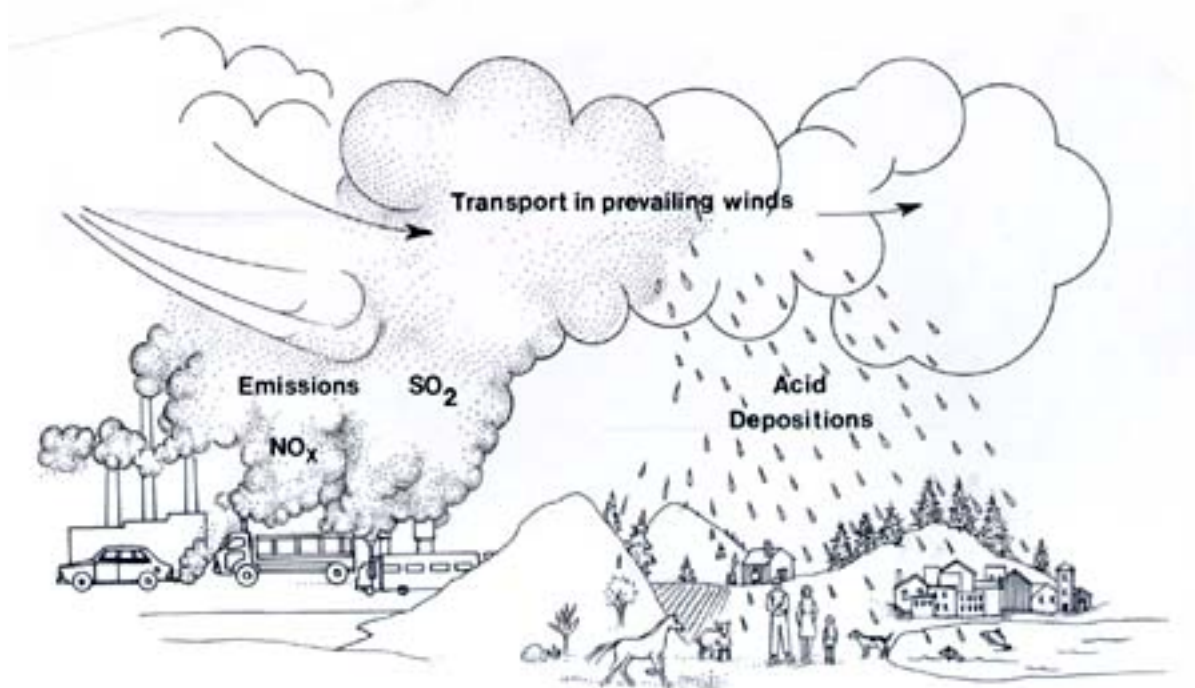


# 2005 Wisconsin *Sulfur Dioxide and Nitrogen Oxides Emissions Report*

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*February 2007*

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## **Acknowledgments**

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## **History**

In 1986, Wisconsin enacted one of the first and strongest acid rain control laws in the nation. This law, found under sections 285.41 through 285.49, Wis. Stats., states the sulfur dioxide and nitrogen oxides emission rates and goals for Wisconsin. The 2005 Sulfur Dioxide and Nitrogen Oxides Report is the twenty-first annual report of its kind since 1980 required under s. 285.11(12), Wis. Stats., (air pollution control). This report compiles sulfur dioxide and nitrogen oxides emissions from Wisconsin's five major utilities, as well as large, small, and area sources, as defined below, and compares these emission rates to the limits and goals specified in s. 285.41 – 285.49, Wis. Stats.

## **Effects of Sulfur Dioxide and Nitrogen Oxides**

Sulfur dioxide and nitrogen oxides can cause many problems when released into the atmosphere. Children and the elderly are especially susceptible to the health effects of these pollutants which include lung tissue irritation, airway constriction, and decreased immune system efficiency. In addition to harmful health impacts, these pollutants can also cause negative environmental impacts. Both have been shown to contribute to acid rain and nitrogen oxides contribute to the production of ground level ozone.

## **Acid Rain**

In recent history, the acid rain phenomenon has brought destruction to thousands of lakes, streams, forests, and monuments in the United States, Canada, and parts of Europe. Sulfur dioxide and nitrogen oxide emissions are the main causes of acid rain. Coal-fired power plants along with pulp and paper mills are the main producers of sulfur dioxide emissions, while coal-fired power plants, factories, vehicles, and home furnaces are the most significant sources of nitrogen oxide emissions in Wisconsin. While in the air, these chemicals react with oxygen and moisture to form sulfuric, nitric and nitrous acid. These acids then return to land as precipitation in the form of rain, snow, or fog. Pollutant-free rain has a pH value of 5.0 to 6.0, on a scale where 14 is the least acidic, 0 the most acidic, and 7 neutral. The Wisconsin Department of Natural Resources considers rain to be acidic if it has a pH less than 5.0. In the early 1980s, pH values ranged from 4.4 in southeastern Wisconsin to 4.8 in northwestern Wisconsin. The acid rain control law helped to improve that range by 2005 to 4.78 in the southeast and 5.29 in the northwest. A pH goal of 4.7 or greater is established in the state law.

## **Controlling Acid Rain**

Controlling acid rain is directly related to managing the combustion of fossil fuels. The byproducts of fuel combustion contain large amounts of nitrogen oxides which are emitted into the atmosphere and produce acid rain. The same is true for fuels that contain sulfur (such as coal and fuel oils) which emit sulfur dioxide when combusted. According to the 2005 Wisconsin Energy Statistics published by the Department of Administration's

Wisconsin Energy Bureau, 82 percent of the energy resources that Wisconsin consumed in 2005 were fossil fuel resources. Coal comprised 30.0 percent of the energy resources consumed in 2005, while petroleum and natural gas comprised 29.2 percent and 22.7 percent, respectively.

It is obvious that one way to control acid rain is to reduce the amount of sulfur dioxide and nitrogen oxides emitted into the atmosphere. This can best be accomplished by decreasing the use of fossil fuels used in utilities and increasing the use of alternative energy resources such as solar, wind, hydroelectric, and nuclear. During 2005 nuclear energy consumption accounted for only 5.5 percent of the total energy resources consumed in Wisconsin and renewable energy resources accounted for a mere 4.5 percent.

Another way to control acid rain is through energy conservation. Reductions in fossil fuel combustion are directly correlated to reductions in energy demand. Energy conservation is voluntary; therefore, this method of reducing sulfur dioxide and nitrogen oxide emissions could be effective only if participation is high. Combustion related alternatives that can be implemented at major utilities include switching to low-sulfur coal and/or low-sulfur petroleum products. Emission reductions at other sources can be accomplished by using more fuel-efficient vehicles or electric hybrid vehicles, and replacing old home furnaces with newer, more efficient furnaces. Major utilities in Wisconsin have now switched to low-sulfur coal in order to comply with acid rain laws. In the future, cars powered by fuel cells, electricity, or alternative fuels may also contribute to controlling acid rain.

## **Wisconsin's Acid Rain Law**

The state's acid rain control law was enacted in April of 1986. In addition to striving for a precipitation pH level above 4.7 throughout the state, standards for nitrogen oxides and sulfur dioxide emissions were created for each type of source. The primary goal is to reduce sulfur dioxide emissions to 50 percent of 1980 levels. A definition of each source and the emission limits and goals that affect those source types is as follows:

### ***Major Utility***

Under the acid rain law, a major utility is defined as any electric utility or electrical cooperative with \$2.5 million or more in annual gross operating revenues that has sulfur dioxide emissions of 5000 tons or more in any year after 1979 from all stationary sources in Wisconsin.

Wisconsin has five major utilities:

- Alliant Energy (formerly Wisconsin Power & Light)
- Dairyland Power Cooperative
- Madison Gas and Electric Company
- Wisconsin Electric Power Company (WE Energies)
- Wisconsin Public Service Corporation

Three goals, two for sulfur dioxide and one for nitrogen oxides emissions, are established for major utilities under the acid rain control law. Effective January 1, 1993, each major utility must limit their annual average sulfur dioxide emissions to 1.20 pounds of sulfur dioxide per million British thermal units (mmBtu) of heat input generated from fossil fuel-fired boilers located in Wisconsin. Also effective January 1, 1993, the total annual sulfur dioxide emissions from all major utilities are not to exceed 250,000 tons in any year. After 1991, the goal for nitrogen oxide emissions from all major utilities is not to exceed 135,000 total tons per year.

### ***Large Source***

A large source is defined in the acid rain law as any stationary source in Wisconsin, other than a fossil fuel-fired boiler under ownership or control of a major utility that has a five-year sulfur dioxide emissions average of 1,000 tons or more per year for the most recent five-year period. The large source had to be operational before May 2, 1986, and boilers subject to the new source performance standards (NSPS) for sulfur dioxide emissions established under s. 285.27(1), Wis. Stats. are excluded. Wisconsin's acid rain law does not specifically define large sources of nitrogen oxides. For this report, a large nitrogen oxides emission source is defined as any source other than a fossil fuel-fired boiler under the ownership or control of a major utility that emitted 1,000 tons or more of nitrogen oxides in the current year.

The acid rain law established the goal that all large sources in Wisconsin not exceed 75,000 tons of sulfur dioxide emissions per year. For state-owned large sources, the law also set a goal of not exceeding an average of 1.50 pounds of sulfur dioxide per mmBtu heat input per year for each source.

### ***Small Source***

Small sources consist of all of the stationary sulfur dioxide or nitrogen oxides emission sources listed in the Wisconsin Air Emissions Inventory maintained by the Department of Natural Resources that are neither large sources nor major utilities. In terms of emissions, small sources emit on average for the most recent five-year period less than 1000 tons of sulfur dioxide emissions per year and less than 1000 tons of nitrogen oxides emissions for the current year.

### ***Area Source***

Sources that are too small or too difficult to be surveyed individually, such as home furnaces and automobiles, are classified as area sources. They are called area sources because their emissions are totaled and reported collectively for geographic areas such as cities, counties, or states. The Department of Natural Resources does not routinely determine area source emissions. Area source sulfur dioxide and nitrogen oxides emissions from 1980 were estimated in the Wisconsin Acid Deposition Emission Inventory, which was produced as part of the Wisconsin Cooperative Acid Deposition Research Program. That estimate has been used to approximate 1980 to 2005 area source emissions for this report.

## **Federal Acid Rain Program**

In 1990 Title IV of the Clean Air Act was set into law with primary goals of reducing sulfur dioxide emissions to 10 million tons below 1980 levels and nitrogen oxides emissions to 2 million tons below 1980 levels.

### ***Sulfur Dioxide Reductions***

The law provided a two-phase tightening of restrictions placed on fossil fuel-fired boilers to achieve the desired goal for sulfur dioxide emissions. With a total of 445 units affected, Phase I began in 1995 with an initial 263 units at 110 mostly coal-burning electric utility plants located in 21 eastern and midwestern states. An additional 182 units joined Phase I as substitution or compensating units, which creates 445 total units affected by Phase I. Phase II began January 1, 2000 and capped the combined sulfur dioxide emissions generated at 8.95 million tons per year for Phase I affected units and other electric utility units serving generators over 25 MW. The Federal Acid Rain Program grants sulfur dioxide emission “allowances” to facilities based on a facility’s average heat input (in mmBtu) for 1985 through 1987. Facilities affected by Phase I are allocated allowances equivalent to 2.50 pounds of sulfur dioxide per mmBtu. The number of sulfur dioxide allowances allocated is based on an emission rate of 1.20 pounds per mmBtu during Phase II. Each affected source must have enough allowances to cover its sulfur dioxide emissions in a given year.

Wisconsin has 13 utility units affected by Phase I and approximately 70 utility units affected by Phase II. The 5 major utilities in Wisconsin are required by the Wisconsin acid rain control law to limit sulfur dioxide emissions to 1.20 pounds per mmBtu and 1.50 pounds per mmBtu for state owned facilities since 1993. For Phase I, Wisconsin utilities have met the required 2.50 pounds per mmBtu limit. In 2005 Wisconsin major utilities met Phase II emission limits as well.

### ***Nitrogen Oxides Reductions***

In 1997, the beginning of Phase I, the nitrogen oxides reduction program established nitrogen oxides limitations for dry bottom wall-fired boilers and tangentially fired boilers. The annual limitations set are 0.50 pounds of nitrogen oxides per mmBtu for dry bottom wall-fired boilers, and 0.45 pounds of nitrogen oxides per mmBtu for tangentially fired boilers. Beginning in 2000, the Phase II program enacted new nitrogen oxides emission limitations for dry bottom wall-fired and tangentially fired boilers and it also established limits for other types of boilers.

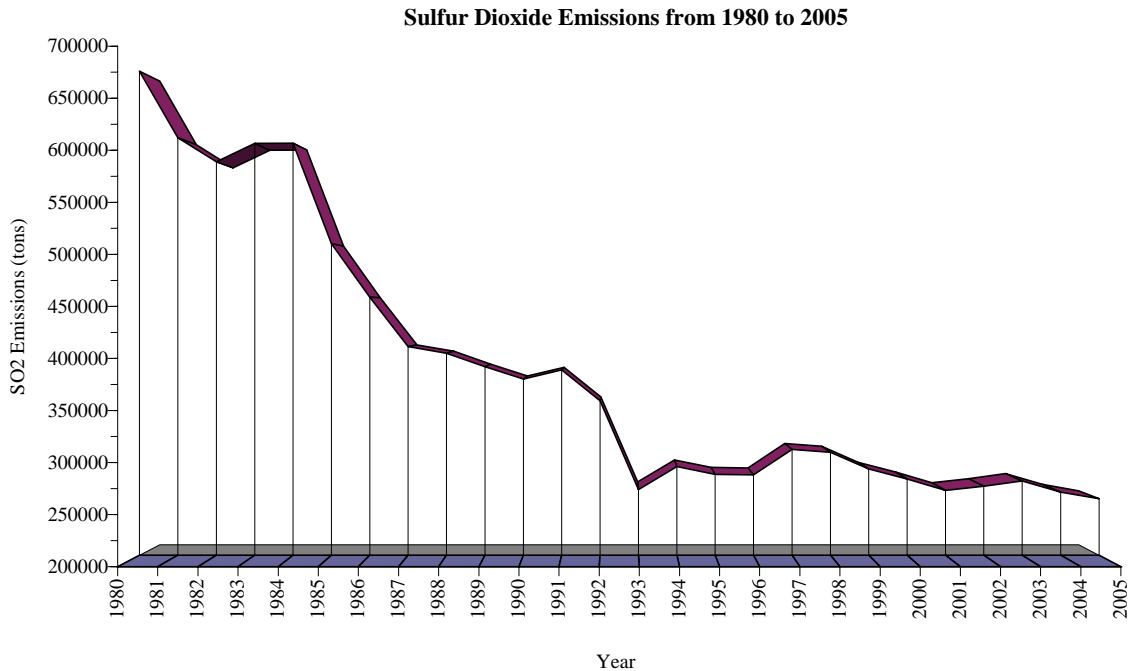
For more information on the federal acid rain program, see the EPA’s Acid Rain Program Home Page: <http://www.epa.gov/acidrain>



## Data Summary

### **Sulfur Dioxide Emissions**

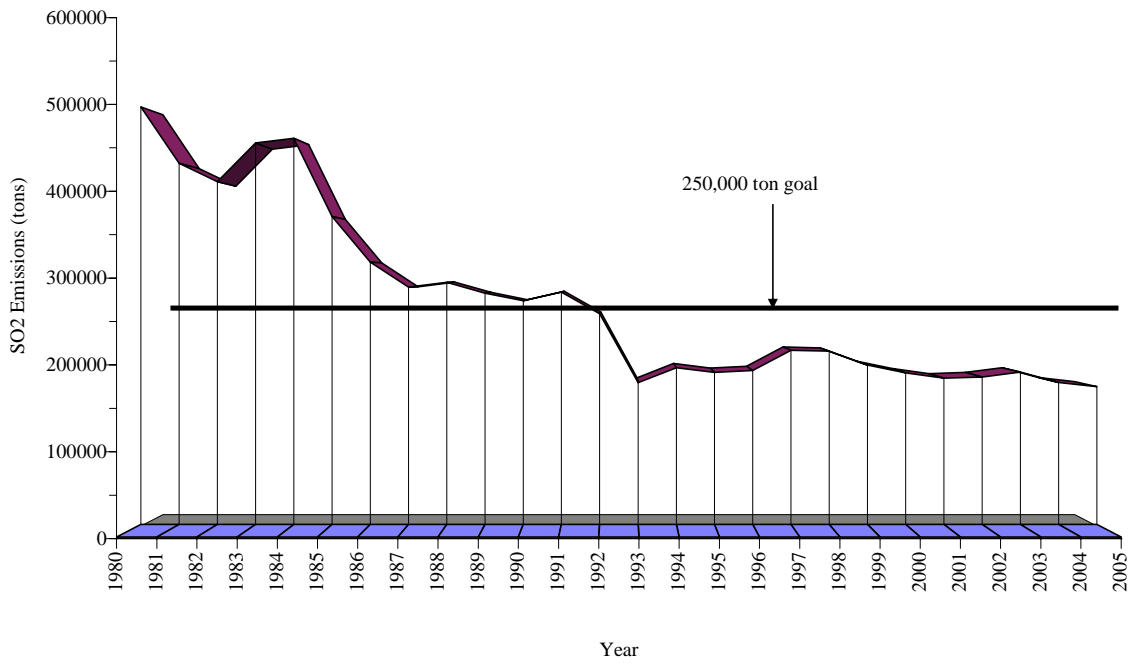
Wisconsin stationary sources emitted 256,712 tons of sulfur dioxide in 2005. These emissions are down 63 percent from the 1980 level of 686,399 tons. Figure 1 represents Wisconsin's sulfur dioxide emissions for the time period of 1980 to 2005.



**Figure 1. Time history of Wisconsin's sulfur dioxide emissions per year.**

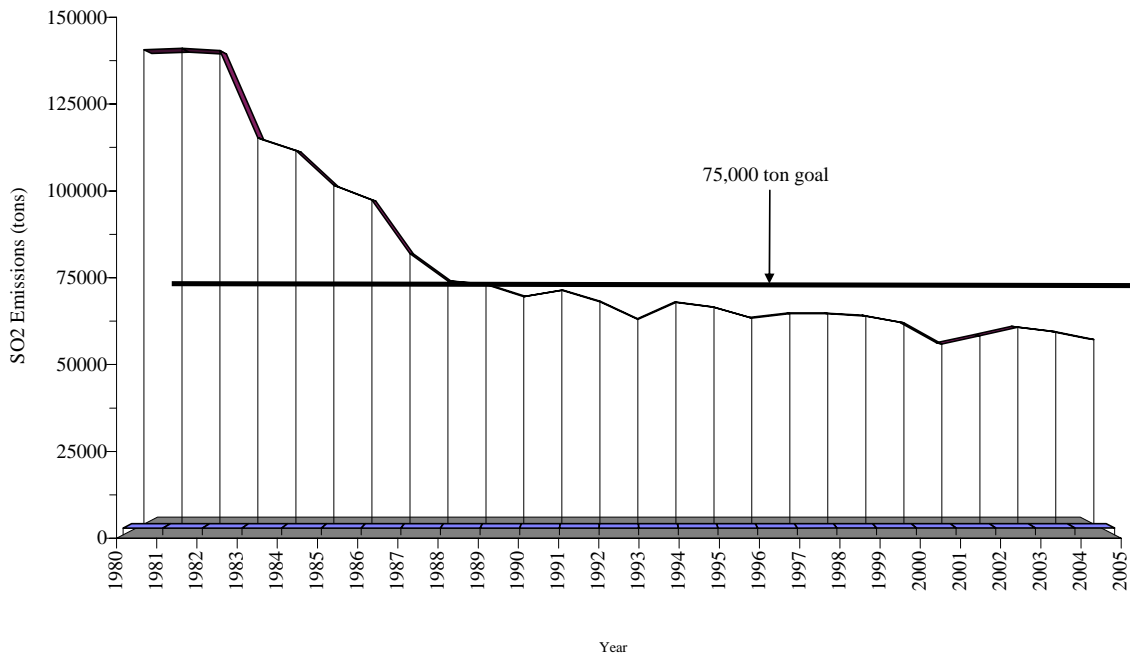
Major utilities alone reduced sulfur dioxide emissions from 506,954 tons in 1980 to 168,633 tons in 2005, a reduction of 67 percent below 1980 levels. Large sources reduced emissions from 144,439 tons in 1980 to 56,178 tons in 2005, a 61 percent reduction, and paper mills alone (a subset of large sources) reduced emissions from 127,339 tons in 1980 to 50,256 tons in 2005, also a 61 percent reduction. The total major utility emissions for 2005 are 81,367 tons below the annual goal of 250,000 tons established in Wisconsin's acid rain control law. Large source emissions in 2005 are 18,822 tons below the annual goal of 75,000 tons. Figures 2 and 3 represent sulfur dioxide emissions from Wisconsin's major utilities and large sources in reference to their emission goals.

**Sulfur Dioxide Emissions from Major Utilities from 1980 to 2005**



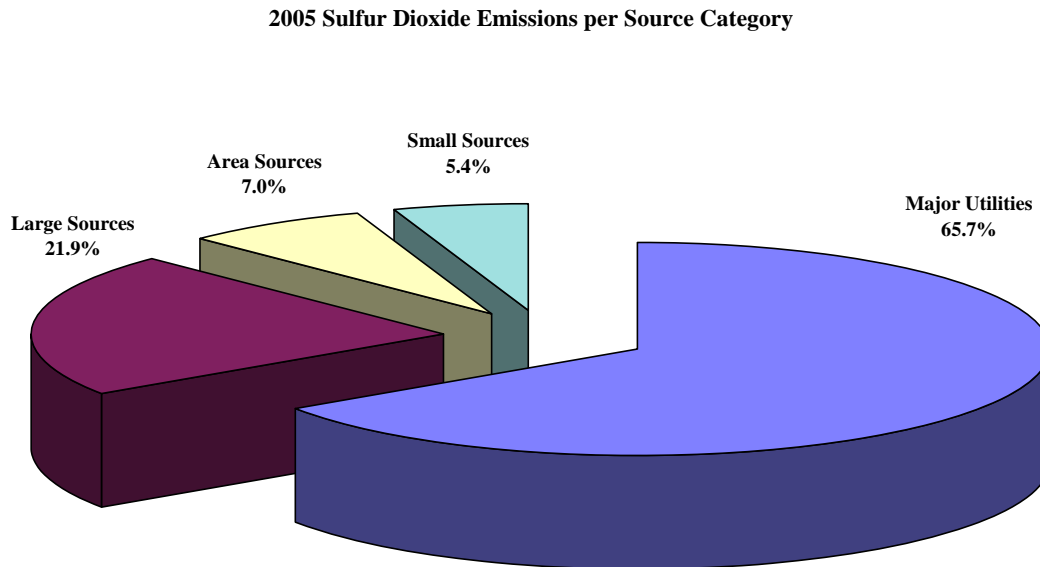
**Figure 2. Time history for major utilities' sulfur dioxide emissions in Wisconsin.**

**Sulfur Dioxide Emissions from Large Sources from 1980 to 2005**



**Figure 3. Time history for large sources' sulfur dioxide emissions in Wisconsin.**

Major utilities account for 65.7 percent of total stationary source sulfur dioxide emissions in 2005. Large sources account for 21.9 percent, 20 percent from paper mills alone. Collectively, 87.6 percent of the sulfur dioxide emissions originated from major utilities and large sources. The remaining 12.4 percent originated from area and small sources. Figure 4 represents the contribution of each source towards Wisconsin's total stationary source sulfur dioxide emissions.



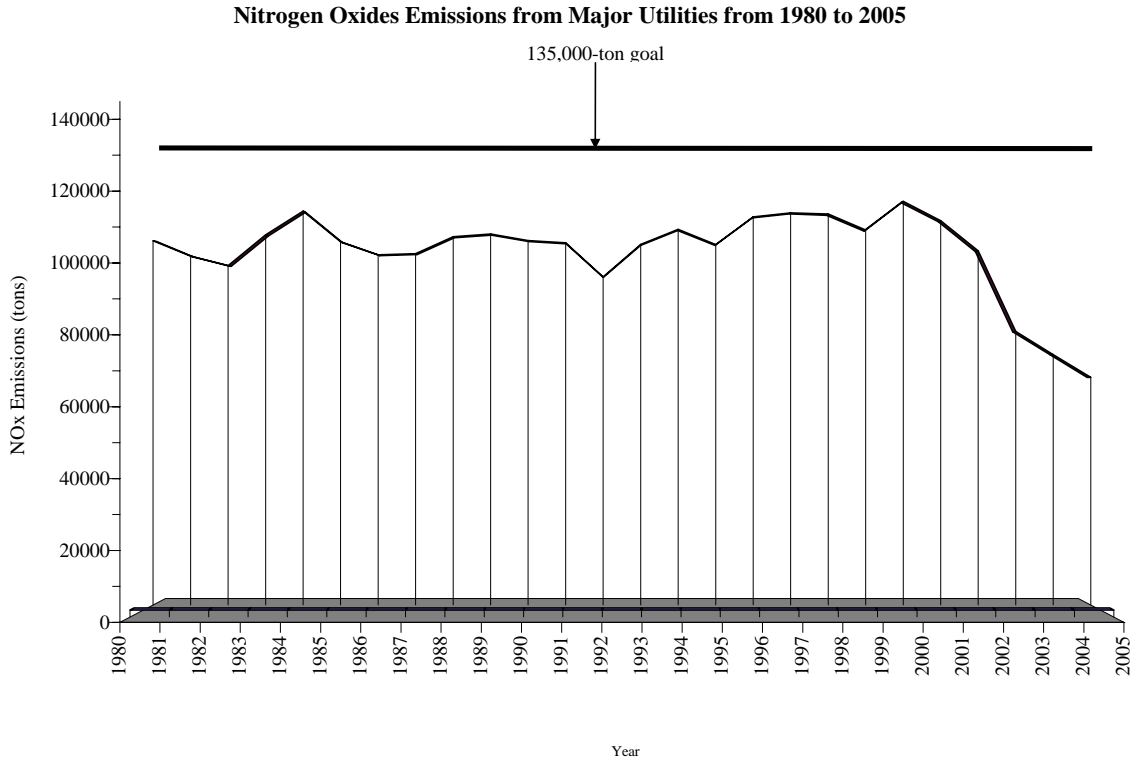
**Figure 4. Breakdown of Wisconsin's 2005 sulfur dioxide emissions by source category.**

In 2005, all of the five major utilities of Wisconsin have sulfur dioxide emission rates below the 1.20 pounds of sulfur dioxide per mmBtu of energy input established in the Federal and State acid rain programs. Wisconsin's one large, state-owned source, the University of Wisconsin-Madison Charter Street heating plant, also has a sulfur dioxide emission rate below the standard of 1.50 pounds of sulfur dioxide per mmBtu of energy input required in Wisconsin's acid rain control law for state owned facilities.

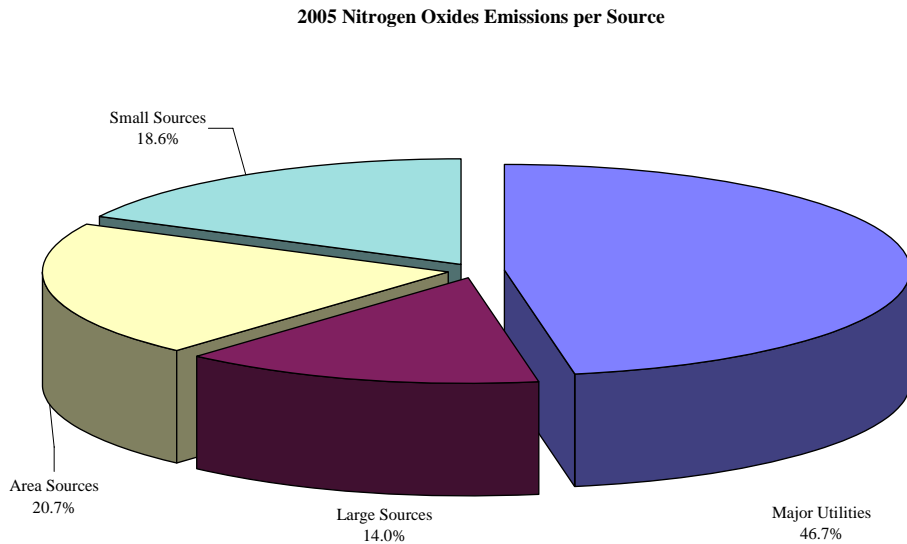
### ***Nitrogen Oxides Emissions***

Stationary sources emitted a total of 145,233 tons of nitrogen oxides in 2005. The 2005 nitrogen oxides emissions are 20 percent below the 1980 nitrogen oxides emission levels. Between 1980 and 2005, major utilities decreased nitrogen oxides emissions by 31 percent (from 108,606 to 67,839 tons). Nitrogen oxides emissions from the major utilities have remained below the 135,000-ton goal set in Wisconsin's acid rain control law. Figure 5 represents the emissions from the major utilities from 1980 to 2005. Large sources emitted 20,387 tons of nitrogen oxides in 2005, a 21 percent reduction from 1980 levels.

Major utilities account for 46.7 percent of the total stationary source nitrogen oxides emissions. Collectively, major utilities and large sources account for 60.7 percent of nitrogen oxides emissions. The remaining 39.3 percent originated from area and small sources. Figure 6 below represents the contribution of each source towards Wisconsin's total stationary source nitrogen oxides emissions.



**Figure 5. Time history for major utilities' nitrogen oxides emissions in Wisconsin.**



**Figure 6. Breakdown of Wisconsin's 2005 nitrogen oxides emissions by source category.**

## **Quality Assurance of Data**

The data presented in this report for stationary point sources was derived primarily from two sources: the 2005 Air Emissions Inventory File and the 2005 sulfur dioxide emission summaries that Wisconsin's major utilities submit for the acid rain control law. The area source estimate was derived from the Wisconsin Acid Deposition Emission Inventory.

Sources submitting information to the emission inventory certify the information submitted is accurate. In addition, the DNR regional staff reviewed the data for accuracy. Federal and state acid rain laws often require continuous emission monitoring of sulfur dioxide and nitrogen oxides for large sources, so the measurement and reporting of these emissions should be accurate.

The corporate averages were determined from the 2005 sulfur dioxide emission summaries submitted by the major utilities. Please note that some power plant boilers are owned by more than one major utility. Jointly owned facilities have emissions credited to the appropriate utility on the basis of the energy generated for that utility. Only utility-operated boiler units were considered in determining the annual average emission rates.

## **Tables and Appendices**

The following tables and appendices were created from major utility emissions data sheets submitted by the utilities and data obtained from the 2005 Air Emissions Inventory File. The tables and appendices provide historical information about Wisconsin's sulfur dioxide and nitrogen oxides emissions since 1980.

Several of the boilers operated by major utilities are co-owned. Total emissions from these boilers are listed under the majority owner for all tables and appendices except for Appendix C. In Appendix C, the emissions are broken down to show the portion of emissions that each major utility contributed to for co-owned boilers.

**Table 1: Wisconsin Stationary Source Sulfur Dioxide Emissions Arranged by Category from 1980 to 2005**

Values listed in tons of sulfur dioxide emitted

Year	Major Utilities			Large Sources				Area Sources	Small Sources	Total Emissions
	Pre-NSPS	NSPS	Total	Minor Utilities	Paper Mills	Other Facilities	Total			
1980	483,280	23,674	506,954	6,668	127,339	10,432	144,439	18,000	17,006	686,399
1981	409,320	29,527	438,847	7,360	122,363	15,124	144,847	18,000	17,868	619,562
1982	386,410	30,264	416,674	6,746	119,301	18,150	144,197	18,000	16,448	595,319
1983	425,814	37,859	463,673	4,526	99,729	13,370	117,625	18,000	14,475	613,773
1984	435,515	33,726	469,241	4,966	97,540	11,277	113,783	18,000	12,892	613,916
1985	334,732	39,668	374,400	5,525	87,464	10,147	103,136	18,000	17,526	513,062
1986	269,682	49,519	319,201	4,726	85,396	8,542	98,664	18,000	23,313	459,178
1987	230,882	58,209	289,091	2,490	70,658	9,204	82,352	18,000	20,234	409,677
1988	242,831	51,950	294,781	3,111	62,059	8,837	74,007	18,000	16,135	402,923
1989	222,739	59,027	281,766	2,879	61,955	8,129	72,963	18,000	16,706	389,435
1990	210,078	62,514	272,592	1,866	60,500	6,868	69,234	18,000	17,214	377,040
1991	220,487	62,798	283,285	3,284	57,521	10,370	71,175	18,000	13,712	386,172
1992	196,694	60,249	256,943	1,985	57,140	8,552	67,677	18,000	12,470	355,090
1993	116,814	56,776	173,590	2,280	53,923	6,125	62,328	18,000	11,954	265,872
1994	120,989	70,728	191,717	2,565	60,386	4,547	67,498	18,000	11,833	289,048
1995	116,236	69,654	185,890	2,267	59,525	4,245	66,037	18,000	11,270	281,197
1996	122,395	65,723	188,118	1,771	56,967	3,974	62,712	18,000	11,804	280,634
1997	142,484	70,180	212,665	1,877	58,033	4,140	64,050	18,000	11,468	306,183
1998	143,446	68,076	211,522	3,980	55,853	4,216	64,049	18,000	9,830	303,401
1999	122,938	71,870	194,808	2,770	56,717	3,866	63,353	18,000	10,368	286,528
2000	120,754	64,473	185,227	3,282	54,258	3,720	61,260	18,000	12,002	276,489
2001	112,839	65,969	178,808	3,052	47,988	3,828	54,868	18,000	13,472	265,148
2002	113,771	66,715	180,487	3,750	50,629	3,006	57,385	18,000	9,200	269,343
2003	116,593	69,653	186,246	3,304	53,797	2,870	59,971	18,000	10,430	274,647
2004	104,357	69,522	173,879	3,142	52,865	2,539	58,546	18,000	12,883	263,308
2005	100,843	67,790	168,633	3,068	50,256	2,854	56,178	18,000	13,901	256,712
<b>% Change from 1980 Levels</b>		<b>-67%</b>					<b>-61%</b>		<b>-18%</b>	<b>-63%</b>

**Table 2A: Wisconsin 2005 Major Utility Sulfur Dioxide Emissions Arranged By Facility**

Facility Name	Location	SO <sub>2</sub> Emissions (tons)	Percent of Total SO <sub>2</sub> Emissions
<b>Pre-NSPS</b>			
Alliant (WP&L), Blackhawk	Beloit	0	
Alliant (WP&L), Columbia 1	Pardeeville	13,640	
Alliant (WP&L), Edgewater 3&4	Sheboygan	9,122	
Alliant (WP&L), Nelson Dewey	Cassville	14,999	
Alliant (WP&L), Rock River	Beloit	7	
Alliant (WP&L), Sheepskin	Edgerton	0	
Dairyland Power Alma 1-5	Alma	8,847	
Dairyland Power, Genoa	Genoa	13,072	
Madison Gas & Electric, Blount	Madison	5,971	
Madison Gas & Electric, Fitchburg	Fitchburg	0	
Madison Gas & Electric, Nine Springs	Madison	0	
Madison Gas & Electric, Sycamore	Madison	0	
Madison Gas & Electric, WCCF	Madison	0	
WEPCO, Germantown	Germantown	0	
WEPCO, Oak Creek	Oak Creek	11,594	
WEPCO, Point Beach	Two Rivers	0	
WEPCO, Port Washington	Port Washington	0	
WEPCO, Valley	Milwaukee	7,427	
WPSC, Eagle River	Eagle River	0	
WPSC, Pulliam Plant	Green Bay	12,176	
WPSC, Weston 1&2	Weston	3,988	
	<b>Subtotal</b>	<b>100,843</b>	<b>39.3%</b>
<b>NSPS</b>			
Alliant (WP&L), Columbia 2	Pardeeville	12,370	
Alliant (WP&L), Edgewater 5	Sheboygan	7,378	
Dairyland Power, J.P. Madgett	Alma	7,764	
WEPCO, Pleasant Prairie	Kenosha	30,738	
WPSC, Peshtigo	Peshtigo	0	
WPSC, Weston 3	Weston	9,540	
	<b>Subtotal</b>	<b>67,790</b>	<b>26.4%</b>
	<b>Total</b>	<b>168,633</b>	<b>65.7%</b>
<b>Total for All Stationary Sources</b>		<b>256,712</b>	

**Table 2B: Wisconsin 2005 Large Source Sulfur Dioxide Emissions Arranged by Facility**

Facility Name	Location	SO <sub>2</sub> Emissions (tons)	Percent of Total SO <sub>2</sub> Emissions	
<b>Minor Utilities</b>				
Manitowoc Public Utilities	Manitowoc	3,068	1.2%	
	<b>Subtotal</b>	<b>3,068</b>		
<b>Pulp and Paper Mills</b>				
Combined Locks Energy Center, LLC <sup>1</sup>	Combined Locks	1093	19.6%	
Domtar A. W. Corporation-Nekoosa Mill <sup>2</sup>	Nekoosa	3728		
Domtar A. W. Corporation-Port Edward Mill <sup>3</sup>	Port Edwards	2967		
Stora Enso N. America-Biron Mill	Biron	5,158		
Stora Enso N. America-Kimberly Mill <sup>4</sup>	Kimberly	1,835		
Stora Enso N. America-Niagara Mill	Niagara	1,327		
Stora Enso N. America-Wis Rapids Pulp Mill	Wisc. Rapids	1,239		
Fort James Operating Company	Green Bay	12,220		
International Paper	Kaukauna	9,090		
Proctor & Gamble Paper Products Company	Green Bay	1,650		
Packaging Corporation of America <sup>5</sup>	Tomahawk	6,131		
Wausau-Mosinee Paper Corp.	Mosinee	1,367		
Wausau-Mosinee Paper Co.-Rhineland	Rhineland	2,451		
	<b>Subtotal</b>	<b>50,256</b>		
<b>Other Large Sources</b>				
Murphy Oil USA, Inc.	Superior	882		1.1%
University of Wisconsin - Charter St.	Madison	1,973		
	<b>Subtotal</b>	<b>2,854</b>		
	<b>Total</b>	<b>56,178</b>	<b>21.9%</b>	
<b>Total for All Stationary Sources</b>		<b>256,712</b>		

1. Previously Appleton Papers
2. Previously Nekoosa Papers, Inc.
3. Previously Nekoosa Papers, Inc.
4. Previously Inter Lake Papers
5. Previously Tenneco Packaging, Inc.



**Table 3: Wisconsin Stationary Source Nitrogen Oxides Emissions Arranged by Category from 1980-2005**

Values listed in tons of nitrogen oxides emitted

Year	Major Utilities			Large Sources	Area Sources	Small Sources	Total Emissions
	Pre-NSPS	NSPS	Total				
1980	94,354	14,252	108,606	24,715	30,000	23,462	186,783
1981	85,038	18,955	103,993	-	30,000	-	-
1982	83,041	18,110	101,151	-	30,000	-	-
1983	87,661	22,651	110,312	-	30,000	-	-
1984	93,530	23,921	117,451	-	30,000	-	-
1985	80,996	27,305	108,301	20,236	30,000	21,786	180,323
1986	73,815	30,588	104,403	18,286	30,000	22,466	175,155
1987	70,696	34,049	104,745	18,579	30,000	21,480	174,804
1988	77,175	32,640	109,815	18,763	30,000	22,788	181,366
1989	74,852	35,706	110,558	18,984	30,000	22,857	182,399
1990	70,978	37,653	108,631	19,029	30,000	23,300	180,960
1991	69,629	38,345	107,974	17,822	30,000	23,079	178,875
1992	64,943	32,873	97,816	31,731	30,000	21,595	181,142
1993	72,641	34,848	107,489	20,202	30,000	21,299	178,990
1994	75,524	36,450	111,974	22,507	30,000	21,182	185,663
1995	71,279	36,178	107,457	22,531	30,000	22,811	182,799
1996	78,723	36,995	115,718	18,627	30,000	27,671	192,016
1997	77,805	39,113	116,918	22,744	30,000	28,131	197,793
1998	77,948	38,590	116,538	24,764	30,000	22,493	193,795
1999	71,768	39,990	111,758	22,457	30,000	22,350	186,565
2000	77,666	42,652	120,319	21,348	30,000	23,023	194,690
2001	76,406	38,148	114,554	20,714	30,000	24,603	189,871
2002	70,437	35,144	105,581	21,110	30,000	20,126	176,817
2003	45,962	35,541	81,503	20,199	30,000	24,484	156,186
2004	44,714	29,884	74,598	19,577	30,000	25,132	149,307
2005	41,729	26,110	67,839	20,387	30,000	27,007	145,233
<b>% Change from 1980 Levels</b>			<b>-31%</b>	<b>-21%</b>		<b>7%</b>	<b>-20%</b>

- Emissions were not totaled for this source category in that year.

**Table 4A: Wisconsin 2005 Major Utility Nitrogen Oxides Emissions Arranged by Facility**

Facility Name	Location	NO <sub>x</sub> Emissions (tons)	Percent of Total NO <sub>x</sub> Emissions
<b>Pre-NSPS</b>			
Alliant (WP&L), Blackhawk	Beloit	18	28.7%
Alliant (WP&L), Columbia 1	Pardeeville	3,022	
Alliant (WP&L), Edgewater 3&4	Sheboygan	3,781	
Alliant (WP&L), Nelson Dewey	Cassville	3,060	
Alliant (WP&L), Rock River	Beloit	373	
Alliant (WP&L), Sheepskin	Edgerton	4	
Dairyland Power, Alma 1-5	Alma	3,837	
Dairyland Power, Genoa	Genoa	3,716	
Madison Gas & Electric, Blount	Madison	1,187	
Madison Gas & Electric, Fitchburg	Fitchburg	15	
Madison Gas & Electric, Nine Springs	Madison	0	
Madison Gas & Electric, Sycamore	Madison	16	
WEPCO, Germantown	Germantown	274	
WEPCO, Oak Creek	Oak Creek	4,650	
WEPCO, Point Beach	Two Rivers	1	
WEPCO, Port Washington	Port Washington	45	
WEPCO, Valley	Milwaukee	3,896	
WEPCO, Watertown	Watertown	835	
WPSC, Eagle River	Eagle River	9	
WPSC, Pulliam Plant	Green Bay	9,234	
WPSC, Weston 1&2	Weston	3,754	
	<b>Subtotal</b>	<b>41,727</b>	
<b>NSPS</b>			
Alliant (WP&L), Columbia 2	Pardeeville	2,829	18.0%
Alliant (WP&L), Edgewater 5	Sheboygan	2,282	
Dairyland Power, J.P. Madgett	Alma	4,468	
WEPCO, Paris	Paris	518	
WEPCO, Pleasant Prairie	Kenosha	11,317	
WPSC	Peshtigo	311	
WPSC, Weston 3	Weston	4,385	
	<b>Subtotal</b>	<b>26,110</b>	
	<b>Total</b>	<b>67,837</b>	<b>46.7%</b>
<b>Total for All Stationary Sources</b>		<b>145,231</b>	

**Table 4B: Wisconsin 2005 Large Source Nitrogen Oxides Emissions Arranged by Facility**

Facility Name	Location	NO <sub>x</sub> Emissions (tons)	Percent of Total NO <sub>x</sub> Emissions
Cardinal FG	Menomonie	1,493	14.0%
Cardinal FG	Portage	1,423	
Domtar A.W. Corporation-Nekoosa Mill <sup>1</sup>	Nekoosa	1,289	
Fort James Operating Co.	Green Bay	3,910	
Packaging Corporation of America <sup>2</sup>	Tomahawk	1,557	
Stora Enso North America-Biron Mill	Biron	2,133	
Stora Enso NA-WI Rapids Pulp Mill	Wisconsin Rapids	2,147	
Thilmany <sup>4</sup>	Kaukauna	2,019	
Wausau-Mosinee Paper Co.-Rhineland	Rhineland	1,618	
Xcel Energy Bay Front Generating Station <sup>3</sup>	Ashland	1,527	
Graetz MFG INC	Pound	1,271	
	<b>Total</b>	<b>20,387</b>	
<b>Total for All Stationary Sources</b>		<b>145,231</b>	

1. Previously Nekoosa Papers, Inc.

2. Previously Tenneco Packaging, Inc.

3. Previously Northern States Power Co.

4. Previously International Paper

**Table 5: 2005 Corporate Average Annual Sulfur Dioxide Emission Rates**

<b>Major Utilities</b>	<b>Average SO<sub>2</sub> Rates (LB/MMBTU)</b>
Alliant Energy Co. (WP&L)	0.87
Dairyland Power Cooperative	0.99
Madison Gas & Electric	0.94
Wisconsin Electric Power Co.	0.59
Wisconsin Public Service Co.	0.67
<b>Large Sources, State-Owned</b>	
University of Wisconsin-Madison - Charter St.	0.93

**Appendix A: Historical Listing of Sulfur Dioxide Emissions Arranged by Facility for 2001-2005**

Facility Name	Location	SO <sub>2</sub> Emissions (tons)					Five Year Average (2001-2005)
		2001	2002	Year 2003	2004	2005	
<b>Pre-NSPS Major Utilities</b>							
Alliant (WP&L), Blackhawk	Beloit	0	0	0	0	0	0
Alliant (WP&L), Columbia 1	Pardeeville	13,769	14,013	15,666	14,845	13,640	14,387
Alliant (WP&L), Edgewater 3&4	Sheboygan	8,656	7,790	8,511	7,721	9,122	8,360
Alliant (WP&L), Nelson Dewey	Cassville	11,323	15,709	14,554	17,194	14,999	14,756
Alliant (WP&L), Rock River	Beloit	12	9	11	8	7	9
Alliant (WP&L), Sheepskin	Edgerton	0	0	0	0	0	0
Dairyland Power Alma 1-5	Alma	4,350	7,284	9,386	7,675	8,847	7,508
Dairyland Power Genoa	Genoa	12,118	15,046	16,844	10,944	13,072	13,605
Madison Gas & Electric, Blount St.	Madison	6,795	7,181	6,494	7,945	5,971	6,877
MG&E, Fitchburg	Fitchburg	0	0	0	0	0	0
MG&E, Nine Springs	Madison	0	0	0	0	0	0
MG&E, Sycamore	Madison	0	0	0	0	0	0
MG&E, WCCF	Madison	0	0	0	0	0	0
WEPCO Germantown	Germantown	5	0	3	0	0	2
WEPCO Oak Creek	Oak Creek	17,882	10,569	13,294	13,570	11,594	13,382
WEPCO Point Beach	Two Rivers	0	0	0	0	0	0
WEPCO Port Washington	Port Wash.	12,778	9,820	9,062	7,059	0	7,744
WEPCO Valley	Milwaukee	15,060	16,218	11,537	6,542	7,427	11,357
WPSC Eagle River	Eagle River	0	0	1	0	0	0
WPSC Pulliam Plant	Green Bay	6,475	6,901	7,081	6,854	12,176	7,897
WPSC Weston 1&2	Weston	3,615	3,231	4,149	4,000	3,988	3,797
<b>Subtotal - Pre-NSPS Major Utilities</b>		<b>112,838</b>	<b>113,771</b>	<b>113,771</b>	<b>104,357</b>	<b>100,843</b>	<b>109,680</b>
<b>NSPS Major Utilities</b>							
Alliant (WP&L), Columbia 2	Pardeeville	14,535	13,489	14,554	14,606	12,370	13,911
Alliant (WP&L), Edgewater 5	Sheboygan	9,235	9,203	10,039	10,342	7,378	9,239
Dairyland Power J.P. Madgett	Alma	4,980	7,489	5,777	4,687	7,764	6,139
WEPCO Pleasant Prairie	Kenosha	28,411	27,972	30,334	30,979	30,738	29,687
WPSC	Peshigo	2	1	1	0	0	1
WPSC Weston 3	Weston	8,806	8,562	8,948	8,908	9,540	8,953
<b>Subtotal - NSPS Major Utilities</b>		<b>65,969</b>	<b>66,716</b>	<b>66,715</b>	<b>69,522</b>	<b>67,790</b>	<b>67,930</b>
<b>Total - Major Utilities</b>		<b>178,807</b>	<b>180,487</b>	<b>180,486</b>	<b>173,879</b>	<b>168,633</b>	<b>177,610</b>

... (con'd) Appendix A : Historical Listing of Sulfur Dioxide Emissions Arranged by Facility for 2001-2005

Facility Name	Location	SO2 Emissions (tons)					Five Year Average (2001-2005)
		Year					
		2001	2002	2003	2004	2005	
<b>Minor Utilities</b>							
Manitowoc Public Utilities	Manitowoc	3,052	3,750	3,304	3,142	3,068	2,021
<b>Subtotal - Minor Utilities</b>		<b>3,052</b>	<b>3,750</b>	<b>3,304</b>	<b>3,142</b>	<b>3,068</b>	<b>2,021</b>
<b>Paper Mills</b>							
Combined Locks Energy Center, LLC <sup>1</sup>	Combined Locks	1,081	825	1,130	1,195	1,093	1,065
Domtar A. W. Corporation-Nekoosa Mill <sup>2</sup>	Nekoosa	3,196	4,351	4,238	4,496	3,728	4,002
Domtar A. W. Corporation-Port Edwards Mill <sup>3</sup>	Port Edwards	4,008	2,816	2,392	2,385	2,967	2,914
Stora Enso N. America-Biron Mill	Biron	5,353	5,781	5,519	5,837	5,158	5,530
Stora Enso N. America-Kimberly Mill <sup>4</sup>	Kimberly	1,748	1,866	2,020	2,002	1,835	1,894
Stora Enso N. America-Niagara Mill	Niagara	1,822	2,040	1,964	1,509	1,327	1,732
Stora Enso N. Am.-WI Rapids Pulp Mill	Wisc. Rapids	1,245	1,248	1,520	1,342	1,239	1,319
Fort James Operating Company	Green Bay	12,380	13,470	14,124	12,725	12,220	12,984
International Paper	Kaukauna	8,266	8,253	8,740	9,182	9,090	8,706
Proctor & Gamble Paper Products Company	Green Bay	1,868	2,011	1,733	1,425	1,650	1,737
Packaging Corporation of America <sup>5</sup>	Tomahawk	6,922	7,381	6,596	6,976	6,131	6,801
Wausau-Mosinee Paper Corp.	Mosinee	1,198	1,422	1,567	1,290	1,367	1,369
Wausau-Mosinee Paper Co.-Rhineland	Rhineland	2,410	2,295	2,254	2,502	2,451	2,382
<b>Subtotal - Paper Mills</b>		<b>51,497</b>	<b>53,759</b>	<b>53,797</b>	<b>52,865</b>	<b>50,256</b>	<b>52,435</b>
<b>Other Large Sources</b>							
Murphy Oil USA, Inc.	Superior	2,140	1,659	1,021	890	882	1,318
University of Wisconsin - Charter	Madison	1,688	1,347	1,849	1,648	1,973	1,701
<b>Subtotal - Other Large Source Facilities</b>		<b>3,828</b>	<b>3,006</b>	<b>2,870</b>	<b>2,539</b>	<b>2,854</b>	<b>3,019</b>
<b>Total - Large Sources</b>		<b>58,377</b>	<b>60,515</b>	<b>59,971</b>	<b>58,546</b>	<b>56,178</b>	<b>58,717</b>

1. Previously Appleton Papers
2. Previously Nekoosa Papers, Inc.
3. Previously Nekoosa Papers, Inc.
4. Previously Inter Lake Papers
5. Previously Tenneco Packaging, Inc.

**Appendix B: Historical Listing of Nitrogen Oxides Emissions Arranged by Facility for 2001-2005**

Facility Name	Location	NO <sub>x</sub> Emissions (tons)				
		YEAR				
		2001	2002	2003	2004	2005
<b>Pre-NSPS Major Utilities</b>						
Alliant (WP&L), Blackhawk	Beloit	38	59	50	18	18
Alliant (WP&L), Columbia 1	Pardeeville	7,808	4,062	2,996	3,028	3,022
Alliant (WP&L), Edgewater 3&4	Sheboygan	9,994	5,727	5,421	5,321	3,781
Alliant (WP&L), Nelson Dewey	Cassville	4,787	5,167	4,281	4,583	3,060
Alliant (WP&L), Rock River	Beloit	415	560	741	462	373
Alliant (WP&L), Sheepskin	Edgerton	4	11	4	2	4
Dairyland Power, Alma	Alma	7,619	7,249	3,747	4,418	3,837
Dairyland Power, Genoa	Genoa	4,127	4,402	4,429	3,383	3,716
Madison Gas & Electric, Blount	Madison	1,379	1,401	1,460	1,636	1,187
Madison Gas & Electric, Fitchburg	Fitchburg	35	30	28	22	15
Madison Gas & Electric, Nine Springs	Madison	1	1	1	1	0
Madison Gas & Electric, Sycamore	Madison	13	15	17	13	16
WEPCO, Germantown	Germantown	174	133	108	85	274
WEPCO, Oak Creek	Oak Creek	17,967	16,583	5,016	5,472	4,650
WEPCO, Point Beach	Two Rivers	5	4	2	3	1
WEPCO, Port Washington	Port Washington	3,226	2,554	2,292	1,247	45
WEPCO, Valley	Milwaukee	7,410	7,668	3,093	3,246	3,896
WEPCO, Watertown	Watertown	141	128	93	67	835
WPSC, Eagle River	Eagle River	4	12	13	2	9
WPSC, Pulliam Plant	Green Bay	7,850	8,226	8,424	8,033	9,234
WPSC, Weston 1&2	Weston	3,412	6,444	3,746	3,671	3,754
<b>Subtotal - Pre-NSPS Major Utilities</b>		<b>76,409</b>	<b>70,436</b>	<b>45,962</b>	<b>44,714</b>	<b>41,729</b>
<b>NSPS Major Utilities</b>						
Alliant (WP&L), Columbia 2	Pardeeville	8,115	6,904	7,198	7,301	2,829
Alliant (WP&L), Edgewater 5	Sheboygan	3,097	3,122	3,145	2,852	2,282
Dairyland Power, J.P. Madgett	Alma	5,081	4,304	4,484	3,750	4,468
WEPCO, Paris	Union Grove	230	252	185	87	518
WEPCO, Pleasant Prairie	Pleasant Prairie	18,430	17,311	16,950	12,161	11,317
WPSC	Peshtigo	150	135	168	73	311
WPSC, Weston 3	Weston	3,045	3,116	3,411	3,659	4,385
<b>Subtotal - NSPS Major Utilities</b>		<b>38,148</b>	<b>35,144</b>	<b>35,541</b>	<b>29,884</b>	<b>26,110</b>
<b>Total - Major Utilities</b>		<b>114,557</b>	<b>105,580</b>	<b>81,503</b>	<b>74,598</b>	<b>67,839</b>
<b>Large Sources</b>						
Cardinal FG	Menomonie	1,546	1,577	1,284	1,455	1,493
Cardinal FG	Portage	1,457	1,420	1,421	1,471	1,423
Domtar A.W. Corporation-Nekoosa Mill <sup>1</sup>	Nekoosa	1,307	1,448	1,386	1,351	1,289
Stora Enso North America-Biron Mill	Biron	2,122	2,202	2,142	2,265	2,133
Stora Enso NA-WI Rapids Pulp Mill	Wisconsin Rapids	1,894	1,851	1,875	2,141	2,147
Fort James Operating Co.	Green Bay	138	4,400	4,012	4,076	3,910
Thilmany LLC	Kaukauna	2,110	2,132	2,146	2,165	2,019
Xcel Energy Bay Front Generating Station <sup>3</sup>	Ashland	1,392	1,038	1,346	1,389	1,527
Packaging Corporation of America <sup>2</sup>	Tomahawk	1,834	1,849	1,591	1,632	1,557
Graetz MFG INC	Pound	2	2	1	1,138	1,271
Wausau-Mosinee Paper Co.-Rhineland	Rhineland	1,518	1,519	1,586	1,631	1,618
<b>Total - Large Sources</b>		<b>15,318</b>	<b>19,436</b>	<b>18,789</b>	<b>19,577</b>	<b>20,387</b>

1. Previously Nekoosa Papers, Inc.
2. Previously Tenneco Packaging, Inc.
3. Previously Northern States Power Co.

**Appendix C: 2005 Sulfur Dioxide Emissions Rates for Major Utilities  
and One Large, State-Owned Source**

**Dairyland Power Cooperative**

Unit Name	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
Alma 1	1,105,202	943
Alma 2	1,147,230	978
Alma 3	1,194,952	1,019
Alma 4	3,017,665	2,457
Alma 5	4,237,473	3,450
J.P. Madgett	27,419,657	7,764
Genoa 3	22,117,481	13,072
Dairyland Totals	60,239,660	29,683
<b>lbs SO<sub>2</sub>/MMBtu</b>		<b>0.99</b>

**Madison Gas & Electric Company**

Unit Name	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
Columbia 1	9,144,707	3,005
Columbia 2	8,159,703	2,739
Blount 1-6 and 11	262,219	2
Blount 7	969,325	1,078
Blount 8	2,487,945	2,453
Blount 9	2,365,342	2,438
WCCF 1	817,349	0
WCCF 2	846,333	0
MG & E Totals	25,052,923	11,715
<b>lbs SO<sub>2</sub>/MMBtu</b>		<b>0.94</b>

**Alliant Energy Company (WP&L)**

Unit Name	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
Blackhawk 3	78,410	0
Blackhawk 4	53,755	0
Columbia 1	19,301,797	6,340
Columbia 2	17,048,983	5,732
Edgewater 3	5,153,791	1,724
Edgewater 4	13,923,748	4,730
Edgewater 5	16,197,563	5,682
Nelson Dewey 1	8,111,439	7,387
Nelson Dewey 2	8,358,153	7,612
Rock River 1	970,273	3
Rock River 2	1,177,618	4
WP & L Totals	90,375,530	39,213
<b>lbs SO<sub>2</sub>/MMBtu</b>		<b>0.87</b>

**Wisconsin Electric Power Company**

Unit Name	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
Edgewater 5	5,536,083	1,696
Milwaukee County	1,389,924	485
Oak Creek 5	13,928,783	2,806
Oak Creek 6	12,323,138	2,448
Oak Creek 7	16,338,424	3,306
Oak Creek 8	15,137,453	3,035
Pleasant Prairie 1	42,481,661	14,239
Pleasant Prairie 2	49,138,152	16,499
Port Washington 1	0	0
Port Washington 2	0	0
Port Washington 3	0	0
Port Washington 4	0	0
Port Washington 5	0	0
Valley 1	11,057,749	3,908
Valley 2	9,953,791	3,520
WEPCO Totals	177,285,159	51,940
<b>lbs SO<sub>2</sub>/MMBtu</b>		<b>0.59</b>

**Wisconsin Public Service Corporation**

Unit Name	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
Pulliam 8	11,464,499	4,308
Pulliam 7	6,828,582	2,593
Pulliam 5 & 6	9,031,915	3,748
Pulliam 3 & 4	3,884,884	1,527
Weston 3	31,935,958	9,540
Weston 2	8,531,456	2,460
Weston 1	5,299,704	1,528
Columbia 2	11,618,344	3,899
Columbia 1	13,073,803	4,295
Edgewater 4	7,712,764	2,668
WPSC Totals	109,381,909	36,566
<b>lbs SO<sub>2</sub>/MMBtu</b>		<b>0.67</b>

**University of Wisconsin-Madison (Charter Street)**

Unit Name***	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
B21	786,260	401
B22	760,985	388
B23	749,689	382
B24	1,629,251	802
B25	312,400	0
UW-Charter Street Totals	4,238,585	1,973
<b>lbs SO<sub>2</sub>/MMBtu</b>		<b>0.93</b>

***Legend***

\* Includes an additional 22% SO<sub>2</sub> removal per Permit 90-POY-037

\*\* Includes an additional 13% SO<sub>2</sub> removal per Permit 90-POY-037

\*\*\* These unit names are specified in the Air Emissions Inventory File

NOTE: This appendix does not include emissions from WEPCO Germantown & Point Beach, and WPSC Eale River & Peshi