

Appendix A: Mercury Emissions From Electricity Generation

Introduction

In accordance with Minnesota statute §116.925, this appendix reports mercury emissions associated with electricity production and consumption in Minnesota. In addition to electricity, mercury emissions are associated with a variety of other activities in Minnesota which are summarized below. The MPCA has historically considered mercury separately from other air pollutants because it is the subject of a special MPCA initiative with legislatively mandated reports in 2001 and 2005. The MPCA is in the process of preparing a more comprehensive report to the legislature on mercury emissions in Minnesota, to be delivered in October 2005.

Background

Mercury contamination of fish is a well-documented problem in Minnesota. The Minnesota Department of Health advises people to restrict their consumption of sport fish due to mercury in virtually every lake tested. Nearly all — probably about 99 percent — of the mercury in Minnesota lakes and rivers comes from the atmosphere. About 30 percent of mercury in the atmosphere is the result of the natural cycling of mercury. But 70 percent of the mercury is a result of human activities that have increased the release of mercury from the geological materials in which it had been locked up. These activities include the mining of mercury ores, the use of this mercury in products and manufacturing, and the incidental release of trace concentrations of mercury naturally present in coal, crude oil, and metal ores, such as taconite.

Because mercury vapor can be transported long distances by the atmosphere, most of Minnesota's emissions are deposited in other states and countries, and Minnesota receives some of their emissions. In rural Minnesota, about 10 percent of mercury deposition is the result of emissions within the state.

Sources and Emissions

Mercury emitted to the atmosphere due to human activities is divided by the MPCA into three categories: (1) emissions incidental to energy production, (2) emissions due to purposeful use, and (3) emissions due to material processing. Emissions from each of these categories are estimated in Table 1.

The data show that total mercury emissions in Minnesota declined significantly from 1990 to 2000, by about 68 percent. In 1990, emissions are estimated to have been 11,272 pounds. By 2000, mostly due to discontinued use of mercury in products and mandated controls on incineration of solid waste, emissions were just 3,638 pounds. This trend in reduced emissions is most likely a national or even international trend. Sediment core studies from lakes in Minnesota and elsewhere show slight declines in atmospheric deposition relative to a peak in the 1970s and 1980s. There is some evidence that concentrations of mercury in fish have also declined, but not to the point of significantly

reducing concerns about fish consumption. However, it is encouraging that efforts to reduce the use and release of mercury appear to have resulted in measurable environmental improvement.

Table 1. Estimated mercury emissions, from all sources, in Minnesota (pounds per year).

Mercury Emission Inventory for Minnesota (pounds per year)				1990	1990	1990	1995	1995	1995	2000	2000	2000
Date of Estimate: March 2004												
	confidence level			(best)	Min.	Max.	(best)	Min.	Max.	(best)	Min.	Max.
Incidental to Energy Production												
Coal combustion (total)	high			1,518.6	1,366.7	1,670.4	1,612.1	1,450.9	1,773.3	1,648.7	1,483.8	1,813.6
electric utility coal	high			1,418.3	1,276.5	1,560.2	1,512.8	1,361.5	1,664.1	1,544.8	1,390.3	1,699.2
commercial/industrial coal	medium			60.8	45.6	76.0	68.5	51.3	85.6	73.4	55.0	91.7
public utility / university & college heating	medium			39.0	29.3	48.8	30.5	22.8	38.1	30.2	22.6	37.7
residential coal	medium			0.4	0.3	0.5	0.4	0.3	0.5	0.4	0.3	0.5
Petroleum Product Refining and Consumption	low			136.0	68.0	204.0	156.0	78.0	234.0	175.0	87.5	262.5
Wood combustion	high			12.5	11.3	13.8	10.5	9.4	11.5	10.0	9.0	11.0
Natural gas combustion	low			0.2	0.1	0.5	0.3	0.1	0.6	0.3	0.1	0.6
Subtotal incidental with energy production				1,667.4	1,446.1	1,888.7	1,778.9	1,538.5	2,019.4	1,834.0	1,580.5	2,087.6
		% of total state emissions		15%			42%			50%		
Largely Resulting from the Purposeful Use of Mercury												
Latex paint volatilization	medium			2850.0	2137.5	3562.5	2.8	2.1	3.5	0.0	0.0	0.0
Municipal solid waste combustion	high			1806.4	1625.8	1987.0	633.9	570.5	697.2	168.6	151.7	185.4
On-site household waste incineration	low			402.0	201.0	603.0	93.0	46.5	139.5	60.0	30.0	90.0
Medical waste incineration	high			516.0	464.4	567.6	36.0	32.4	39.6	6.1	5.5	6.7
Sewage sludge incineration	med.			247.0	185.3	308.8	160.0	120.0	200.0	112.0	84.0	140.0
Fluorescent lamp breakage	low			272.3	136.2	408.5	59.4	29.7	89.1	32.2	16.1	48.3
Class IV incinerators	low			55.2	27.6	82.8	28.0	14.0	42.0	0.0	0.0	0.0
Crematories	low			30.8	15.4	46.2	49.5	24.8	74.3	68.2	34.1	102.3
General laboratory use	low			44.0	22.0	66.0	44.0	22.0	66.0	22.0	11.0	33.0
Dental preparations	low			103.0	51.5	154.5	99.0	49.5	148.5	95.0	47.5	142.5
Hazardous waste incineration	medium			5.0	3.8	6.3	5.0	3.8	6.3	5.0	3.8	6.3
Landfill volatilization	low			5.9	2.9	8.8	2.2	1.1	3.3	2.4	1.2	3.6
Recycling mercury from products within MN	medium			3.5	2.6	4.4	35.0	26.3	43.8	50.0	37.5	62.5
Minimills that recycle cars and appliances	medium			186.0	139.5	232.5	186.0	139.5	232.5	176.0	132.0	220.0
Volatilization from dissipative use	low			0.8	0.4	1.2	0.8	0.4	1.2	0.8	0.4	1.2
Golf course fungicide volatilization	low			1487.0	743.5	2230.5	1.0	0.5	1.5	1.0	0.5	1.5
Volatilization from spills and land dumping	low			54.7	27.3	82.0	48.0	24.0	72.0	48.0	24.0	72.0
Volatilization during solid waste collection & processing	low			805.5	402.7	1208.2	251.5	125.8	377.3	195.9	98.0	293.9
Volatilization: land application of compost	low			2.2	1.1	3.3	1.3	0.7	2.0	0.3	0.1	0.4
Volatilization: land application of sludge	low			3.6	1.8	5.4	1.8	0.9	2.7	1.4	0.7	2.1
Subtotal associated with purposeful use of mercury				8,880.8	6,192.2	11,569.3	1,738.2	1,234.3	2,242.2	1,044.8	678.0	1,411.6
		% of total state emissions		79%			41%			29%		
Emissions Incidental to Material Processing												
Taconite processing	high			710.5	639.5	781.6	742.3	668.1	816.5	745.4	670.8	819.9
Pulp and paper manufacturing	low			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soil roasting	low			13.3	6.7	26.6	13.3	6.7	26.6	13.3	6.7	26.6
Subtotal emissions incidental to material processing				723.8	646.1	808.2	755.6	674.7	843.1	758.7	677.5	846.5
		% of total state emissions		6%			18%			21%		
GRAND TOTAL =				11,272.0	8,284.5	14,266.2	4,272.7	3,447.5	5,104.8	3,637.5	2,936.0	4,345.7
Percent Reduction since 1990							62%			68%		

A more detailed version of this inventory, including explanations of each subcategory listed in the table below, is available on the MPCA's web site at <http://www.pca.state.mn.us/air/mercury.html#reports>.

Mercury Emissions from Electricity Generation

Minnesota statutes section 116.925 requires producers and retailers of electricity to report the amount of mercury emitted through the generation of electricity. This law also requires the MPCA to summarize this information in this biennial report to the legislature. Emissions from 2002 and 2003 are summarized in Tables 2 and 3.

The statute permits combustion facilities emitting less than three pounds of mercury in a year the option of not being included in this report. Therefore, some facilities that emit less than three pounds because of excellent pollution control or the use of low-mercury fuels, such as natural gas, are not listed in Tables 2 or 3. For similar reasons, generation facilities that do not emit any mercury, such as nuclear, wind, and hydro, are not included in the tables. Some facilities in this biennial report emit more than three pounds one year and less than three pounds in the other. For the latter case, some facilities chose to report emissions even though reporting is not required for emissions of less than three pounds per year.

Minnesota law exempts certain electric generation facilities from reporting mercury emissions: 1) those that operate less than 240 hours per year, 2) combustion units less than 150 British thermal units (Btu) per hour and 3) generation units with a maximum output of less than or equal to 15 megawatts.

Submissions from about 50 generation units in Minnesota are summarized in Table 2. The major fuel for most units was coal, although some facilities depend on municipal solid waste for fuel. Some units are fueled by oil or natural gas.

The law also requires Minnesota retailers and wholesalers of electricity produced outside the state to report mercury emissions associated with production; the information is summarized in Table 3.

Included in Table 3 are about 50 Minnesota distribution cooperatives, which distribute electricity to consumers but do not generate any electricity. All retailers of electricity are required to report mercury emissions associated with the generation of the electricity they distribute. In the case of Minnesota's distribution cooperatives, most of their electricity was generated in North Dakota, South Dakota, and Wisconsin. The information is provided to the distribution cooperatives by their suppliers, Great River Energy, Dairyland Power, Minnkota Power, and East River Electric Power Cooperative. The calculated mercury emissions per megawatt-hour from each supplier (milligrams per megawatt-hour, mg/MWh) may vary because of varying amounts of electricity purchased from the grid and from the variable use of hydroelectric power by each distribution cooperative.

For 2002, facilities in Minnesota reported the emission of 1,562 pounds of mercury in the production of 34,839,053 megawatt hours (MWh) of electricity, an average release rate of 20 milligrams per megawatt hour (mg/MWh). For 2003, reported emissions increased to 1,885 pounds in the production of 37,367,580 MWh, an average emission rate of 23 milligrams per MWh. In 2003, a number of facilities reported a higher ratio of mercury emissions to MWh than in 2002. While many in-state facilities (mostly smaller producers) reported decreased ratios, an increase in ratios at several larger facilities led to an overall increase in mercury emissions per unit of electrical production.

Reports of electricity consumed in Minnesota, but produced outside of Minnesota, in 2002 totaled 16,986,351 MWh associated with mercury-emitting facilities. These facilities emitted 1,120 pounds of mercury, for an average emission rate of 30 milligrams per MWh. Reports for 2003 were similar, totaling 17,195,799 MWh and 1,272 pounds of mercury emitted. The average emission rate for 2003 was 34 milligrams per MWh. The use of lignite coal as a fuel at power-generating facilities outside the state appears to be largely responsible for the higher ratio of mercury emissions to MWh for out-of-state producers (30 to 34 mg/MWh) compared to Minnesota producers (20 to 23 mg/MWh). Lignite coal contains more mercury per Btu than other types of coal.

Summing Tables 2 and 3 yields estimates of mercury emissions associated with electricity production and consumption in Minnesota. In 2002, 2,682 pounds of mercury were reported as emitted in the production of 51,825,404 megawatt hours, an average emission rate of 23 milligrams per megawatt hour of electricity. In 2003, 3,157 pounds of mercury were reported as emitted in the production of 54,563,379 megawatt hours, an average emission rate of 26 milligrams per megawatt hour. A significant proportion of mercury emissions associated with Minnesota's electrical consumption occurred outside state borders; 42% in 2002 and 40% in 2003.

Information

For more information about Minnesota's mercury emissions inventory and other information related to mercury, visit this website:

<http://www.pca.state.mn.us/air/mercury.html>

For questions about mercury emissions associated with the production of electricity, contact Michael Smith at 651 282-5849 or Michael.Smith@pca.state.mn.us.

For general question about mercury in Minnesota, contact Ned Brooks at 651 296-7242 or Ned.Brooks@pca.state.mn.us.

Table 2. Reported 2002 and 2003 emissions of mercury from non-exempt electrical production facilities in Minnesota.

Company	Generating Facility	Major Fuel Type(s)	2002 Electricity Produced (MWh)	2002 Mercury Emissions (lb)	2002 Mercury Emissions per Megawatt-hour (mg/MWh)	2003 Electricity Produced (MWh)	2003 Mercury Emissions (lb)	2003 Mercury Emissions per Megawatt-hour (mg/MWh)
Covanta Hennepin Energy Resource Co	Unit 1	MSW ^a	124,156	6.65	24	111,670	3.66	15
Covanta Hennepin Energy Resource Co	Unit 2	MSW ^a	124,156	8.46	31	exempt ^g	exempt ^g	exempt ^g
Great River Energy	Cambridge Station ^{c,d}	oil	384	0.00	0	359	0.00	0
Great River Energy	Elk River Station ^c	oil, gas, MSW ^a	205,474	2.31	5	207,889	2.34	5
Great River Energy	Lakefield Station ^{c,d}	oil, gas	193,724	0.00	0	202,281	0.00	0
Great River Energy	Maple Lake Station ^{c,d}	oil	419	0.00	0	347	0.00	0
Great River Energy	Pleasant Valley Station ^{c,d}	oil, gas	120,752	0.00	0	120,752	0.00	0
Great River Energy	Rock Lake Station ^{c,d}	oil	398	0.00	0	331	0.00	0
Great River Energy	St. Bonifacius Station ^{c,d}	oil	1,706	0.00	0	3,740	0.00	0
Interstate Power and Light Company, Sherburn, MN	Fox Lake Power Station #3 ^f	oil, gas	exempt ^g	exempt ^g	exempt ^g	141,060	4.30	14
Minnesota Power(Taconite Harbor Energy Center)	Taconite Harbor Energy Center Unit 1	coal, oil	223,731	14.00	28	535,319	31.00	26
Minnesota Power(Taconite Harbor Energy Center)	Taconite Harbor Energy Center Unit 2	coal, oil	343,202	19.00	25	506,935	26.00	23
Minnesota Power (Taconite Harbor Energy Center)	Taconite Harbor Energy Center Unit 3	coal, oil	298,234	13.00	20	537,861	21.00	18
Minnesota Power	Boswell Unit 1	coal	exempt ^g	exempt ^g	exempt ^g	490,555	3.30	3
Minnesota Power	Boswell Unit 2	coal, oil	443,459	3.10	3	exempt ^g	exempt ^g	exempt ^g
Minnesota Power	Boswell unit 3	coal, oil	2,585,540	107.00	19	2,471,119	93.00	17
Minnesota Power	Boswell Unit 4 ^e	coal, oil	3,850,131	184.00	22	4,506,304	195.00	20
Minnesota Power	Laskin Unit 1 & 2	coal, oil	622,581	19.00	14	713,451	20.00	13
Northshore Mining Company	Silver Bay Power Plant PB 1 ^c	coal, oil, gas	263,153	1.46	3	283,164	0.90	1
Northshore Mining Company	Silver Bay Power Plant PB 2 ^c	coal, gas	471,706	2.35	2	443,853	1.90	2

Company	Generating Facility	Major Fuel Type(s)	2002 Electricity Produced (MWh)	2002 Mercury Emissions (lb)	2002 Mercury Emissions per Megawatt-hour (mg/MWh)	2003 Electricity Produced (MWh)	2003 Mercury Emissions (lb)	2003 Mercury Emissions per Megawatt-hour (mg/MWh)
NSP dba Xcel Energy	AS King 1	coal, gas, petroleum coke	3,312,425	68.80	9	3,431,730	72.60	10
NSP dba Xcel Energy	Black Dog 3	coal, gas	503,445	18.20	16	589,942	28.10	22
NSP dba Xcel Energy	Black Dog 4	coal, gas	905,635	29.30	15	867,218	39.30	21
NSP dba Xcel Energy	Black Dog 5 ^{c,d}	gas	272,977	0.60	1	245,536	0.00	0
NSP dba Xcel Energy	Blue Lake 1-4 ^c	oil	2,846	0.10	16	13,443	0.09	3
NSP dba Xcel Energy	Granite City ^c	oil, gas	1,426	0.01	3	3,761	0.00	0
NSP dba Xcel Energy	High Bridge 5	coal, gas	491,580	21.00	19	640,297	30.00	21
NSP dba Xcel Energy	High Bridge 6	coal, gas	822,676	33.80	19	858,194	36.40	19
NSP dba Xcel Energy	Inver Hills ^c	oil, gas	73,100	0.30	2	112,023	0.21	1
NSP dba Xcel Energy	Key City 4-7 ^{c,d}	gas	4,340	0.02	3	3,158	0.00	0
NSP dba Xcel Energy	Minnesota Valley 4 ^c	coal, oil, gas	185	0.02	56	379	0.01	10
NSP dba Xcel Energy	Red Wing 1 Waste-to-Energy	gas, RDF ^b	58,684	4.70	36	37,601	7.10	86
NSP dba Xcel Energy	Red Wing 2 Waste-to-Energy	gas, RDF ^b	58,560	3.50	27	35,472	12.50	160
NSP dba Xcel Energy	Riverside 6/7	coal, oil, gas	933,879	50.20	24	857,531	40.90	22
NSP dba Xcel Energy	Riverside 8	coal, oil, coke	1,505,106	47.80	14	1,550,432	67.70	20
NSP dba Xcel Energy	Sherburne 1	coal, oil	4,895,847	262.00	24	4,894,323	326.40	30
NSP dba Xcel Energy	Sherburne 2	coal, oil	4,633,354	245.30	24	4,374,304	287.90	30
NSP dba Xcel Energy	Sherburne 3 (combined for 2002, Xcel owned portion for 2003)	coal, oil	5,815,447	370.60	29	3,747,019	289.70	35
NSP dba Xcel Energy	Wilmarth 1 Waste-to-Energy ^c	RDF ^b , gas	65,043	1.50	10	60,478	2.70	20
NSP dba Xcel Energy	Wilmarth 2 Waste-to-Energy ^c	RDF ^b , gas	66,111	0.60	4	62,996	4.30	31

Company	Generating Facility	Major Fuel Type(s)	2002 Electricity Produced (MWh)	2002 Mercury Emissions (lb)	2002 Mercury Emissions per Megawatt-hour (mg/MWh)	2003 Electricity Produced (MWh)	2003 Mercury Emissions (lb)	2003 Mercury Emissions per Megawatt-hour (mg/MWh)
NSP dba Xcel Energy	West Faribault 1-2 ^{c,d}	gas	384	0.00	2	239	0.00	0
Otter Tail Power	Hoot Lake #2 & 3	coal, oil	416,376	16.24	18	560,343	17.63	14
Rochester Public Utilities	Silver Lake 4	coal, gas	exempt ^g	exempt ^g	exempt ^g	227,316	5.16	10
Southern Minnesota Municipal Power Agency	Austin NE Power Plant	coal, gas	126,721	7.42	27	146,891	8.56	26
Southern Minnesota Municipal Power Agency	Sherburne 3 (combined with Xcel for 2002, SMMPA owned portion for 2003)	coal, oil	see Xcel Sherburne 3	see Xcel Sherburne 3	see Xcel Sherburne 3	2,711,751	201.59	34
Southern Minnesota Municipal Power Agency	Minnesota River Station Combustion Turbine ^{c,d}	oil, gas	exempt ^g	exempt ^g	exempt ^g	17,622	0.00	0
Willmar Municipal Utilities	Boiler 3	coal, natural gas	exempt ^g	exempt ^g	exempt ^g	40,591	3.70	41
		Summary of Reports	34,839,053	1,562	median = 15	37,367,580	1,885	median = 14
			Total Reported 2002 Electricity Produced (MWh)	Total Reported 2002 Mercury Emissions (lb)	Median Reported 2002 Mercury Emissions per Megawatt-hour (mg/MWh)	Total Reported 2003 Electricity Produced (MWh)	Total Reported 2003 Mercury Emissions (lb)	Median Reported 2003 Mercury Emissions per Megawatt-hour (mg/MWh)

Notes

aMSW is Municipal Solid Waste.

^bRDF is Refuse-Derived Fuel, which is sorted and processed municipal solid waste.

^cFacility has agreed to include for reporting mercury emissions of less than 3 pounds.

^dMercury emissions round to less than 0.00 pounds mercury for one or both years.

^e148 pounds of mercury in 2002 and 39 pounds mercury in 2003 associated with electricity sold out of state.

^f5.15% of total energy production for all facilities is sold to Minnesota customers.

^gExempt from reporting. (Facilities emitting under 3 pounds of mercury or less than 240 hours of operation per year.)

Table 3. Reported 2002 and 2003 emissions of mercury from electrical production facilities outside of Minnesota for which the electricity was likely consumed in Minnesota.

Company	Electrical Supplier, if not generated by the Reporting Company	Generating Facility	Major Fuel Type(s)	2002 Electricity Consumed in Minnesota (MWh)	2002 Mercury Emissions (lb)	2002 Mercury Emissions per Megawatt- hour (mg/MWh)	2003 Electricity Consumed in Minnesota (MWh)	2003 Mercury Emissions (lb)	2003 Mercury Emissions per Megawatt- hour (mg/MWh)
Minnesota Power	Minnkota Power Cooperative	Milton R. Young #2, Center, ND	lignite coal	2,320,085	182.00	36	2,285,734	294.00	58
Otter Tail Power, Fergus Falls, MN		Coyote Plant, Beulah, ND	lignite coal, oil	545,741	54.68	45	497,277	46.53	42
Otter Tail Power, Fergus Falls, MN		Big Stone Plant, Big Stone Lake, SD	sub coal, oil	799,996	63.51	36	1,016,800	51.58	23
Marshall Municipal Utilities	Heartland Power		lignite coal	403,841	NA	NA	449,109	NA	NA
Marshall Municipal Utilities	Omaha Public Power District		lignite coal	562,641	NA	NA	31,739	NA	NA
Northern Municipal Power Agency, Thief River Falls	Minnkota Power Cooperative	Milton R. Young #1, Center, ND	lignite coal	183,487	17.60	44	137,573	16.80	55
Northern Municipal Power Agency, Thief River Falls	Minnkota Power Cooperative	Milton R. Young #2, Center, ND	lignite coal	96,473	8.30	39	81,584	9.30	52
Northern Municipal Power Agency, Thief River Falls	Minnkota Power Cooperative	Coyote Station, Beulah, ND	lignite coal	89,852	11.50	58	69,586	6.60	43
People's Cooperative Services	Dairyland Power Cooperative	Alma 1-5	Bit/Sub Coal	28,805	1.00	16	35,811	1.09	14
People's Cooperative Services	Dairyland Power Cooperative	JP Madgett	Sub bituminous coal	88,633	3.06	16	92,981	4.49	22
People's Cooperative Services	Dairyland Power Cooperative	Genoa	Bit/Sub Coal	92,522	2.74	13	91,273	2.97	15
People's Cooperative Services	Dairyland Power Cooperative, Great River Energy/G3	Great River Energy/G3	Bit/Sub Coal	NA	NA	NA	1,569	0.05	14

Company	Electrical Supplier, if not generated by the Reporting Company	Generating Facility	Major Fuel Type(s)	2002 Electricity Consumed in Minnesota (MWh)	2002 Mercury Emissions (lb)	2002 Mercury Emissions per Megawatt- hour (mg/MWh)	2003 Electricity Consumed in Minnesota (MWh)	2003 Mercury Emissions (lb)	2003 Mercury Emissions per Megawatt- hour (mg/MWh)
Tri-County Electric Cooperative	Dairyland Power Cooperative	Alma 1-5	Sub Coal	36,775	1.28	16	48,126	1.47	14
Tri-County Electric Cooperative	Dairyland Power Cooperative	JP Madgett	Bit/Sub coal	113,158	3.90	16	124,958	6.03	22
Tri-County Electric Cooperative	Dairyland Power Cooperative	Genoa	Bit/Sub Coal	118,123	3.49	13	122,662	3.99	15
Tri-County Electric Cooperative	Dairyland Power Cooperative	Great River Energy/G3	Bit/Sub Coal	NA	NA	NA	2,109	0.07	15
Freeborn-Mower Cooperative Services	Dairyland Power Cooperative	Alma 1-5	Bit/Sub Coal	21,641	0.75	16	26,468	0.81	14
Freeborn-Mower Cooperative Services	Dairyland Power Cooperative	JP Madgett	Sub bituminous coal	66,591	2.30	16	68,724	3.32	22
Freeborn-Mower Cooperative Services	Dairyland Power Cooperative	Genoa 3	Bit/Sub Coal	69,513	2.06	13	67,461	2.19	15
Freeborn-Mower Cooperative Services	Dairyland Power Cooperative	Great River Energy/G3	Bit/Sub Coal	NA	NA	NA	1,160	0.04	16
Agralite Electric Cooperative	Great River Energy		lignite coal	145,492	7.08	22	160,142	7.97	23
Arrowhead Electric Cooperative	Great River Energy		lignite coal	60,780	4.06	30	63,892	4.26	30
Benco Electric Cooperative	Great River Energy		lignite coal	249,888	16.94	31	250,637	16.93	31
Brown County Rural Electrical Ass'n	Great River Energy		lignite coal	119,374	6.17	23	119,035	6.05	23
Connexus Energy	Great River Energy		lignite coal	1,923,134	130.34	31	2,007,965	135.65	31
Cooperative Light and Power	Great River Energy		lignite coal	83,912	5.69	31	87,057	5.88	31
Crow Wing Power	Great River Energy		lignite coal	459,941	31.17	31	482,127	32.57	31
Dakota Electric Ass'n	Great River Energy		lignite coal	1,643,329	111.38	31	1,690,760	114.22	31

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East Central Electric Ass'n	Great River Energy		lignite coal	795,180	53.89	31	827,512	55.90	31
Federated Rural Electric	Great River Energy		lignite coal	146,109	6.88	21	155,559	7.46	22
Goodhue County Cooperative Electric Ass'n	Great River Energy		lignite coal	82,326	5.58	31	83,056	5.61	31
Head of the Lakes Electric Cooperative	Great River Energy		lignite coal	6,952	0.47	31	Combined with East Central Energy	Combined with East Central Energy	Combined with East Central Energy
Itasca-Mantrap Co-op. Electrical Ass'n	Great River Energy		lignite coal	161,215	10.93	31	167,322	11.30	31
Kandiyohi Power Cooperative	Great River Energy		lignite coal	142,626	7.53	24	143,598	7.57	24
Lake Country Power	Great River Energy		lignite coal	626,767	42.48	31	648,434	43.80	31
Lake Region Electric Cooperative	Great River Energy		lignite coal	341,690	18.14	24	350,479	18.58	24
McLeod Cooperative Power Ass'n	Great River Energy		lignite coal	157,722	9.96	29	153,479	9.68	29
Meeker Cooperative Light & Power Ass'n	Great River Energy		lignite coal	145,657	8.30	26	148,879	8.56	26
Mille Lacs Electric Cooperative	Great River Energy		lignite coal	173,630	11.77	31	181,384	12.25	31
Minnesota Valley Electric Cooperative	Great River Energy		lignite coal	471,629	31.97	31	503,435	34.01	31
Nobles Electric Cooperative	Great River Energy		lignite coal	113,740	4.18	17	113,432	4.21	17
North Itasca Electric Cooperative, Inc.	Great River Energy		lignite coal	45,028	2.57	26	47,738	2.73	26
Redwood Electric Cooperative	Great River Energy		lignite coal	57,004	2.07	16	55,982	2.09	17
Runestone Electric Ass'n	Great River Energy		lignite coal	186,438	9.51	23	195,347	10.05	23
South Central Electric Ass'n	Great River Energy		lignite coal	139,001	6.79	22	136,846	6.58	22

Company	Electrical Supplier, if not generated by the Reporting Company	Generating Facility	Major Fuel Type(s)	2002 Electricity Consumed in Minnesota (MWh)	2002 Mercury Emissions (lb)	2002 Mercury Emissions per Megawatt- hour (mg/MWh)	2003 Electricity Consumed in Minnesota (MWh)	2003 Mercury Emissions (lb)	2003 Mercury Emissions per Megawatt- hour (mg/MWh)
Stearns Electric Ass'n	Great River Energy		lignite coal	353,095	20.71	27	364,937	21.55	27
Steele-Waseca Cooperative Electric	Great River Energy		lignite coal	188,979	12.80	31	202,132	13.65	31
Todd-Wadena Electric Cooperative	Great River Energy		lignite coal	149,034	8.08	25	155,004	8.43	25
Wright-Hennepin Cooperative Electric Ass'n	Great River Energy		lignite coal	647,785	43.90	31	675,066	45.60	31
Clearwater-Polk Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #1, Center, ND	lignite coal	27,186	2.60	43	26,348	3.20	55
Clearwater-Polk Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #2, Center, ND	lignite coal	14,294	1.20	38	15,625	1.80	52
Clearwater-Polk Electric Cooperative	Minnkota Power Cooperative	Coyote Station, Beulah, ND	lignite coal	13,313	1.70	58	13,327	1.30	44
North Star Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #1, Center, ND	lignite coal	43,704	4.20	44	162,990	19.80	55
North Star Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #2, Center, ND	lignite coal	22,979	2.00	39	96,657	11.00	52
North Star Electric Cooperative	Minnkota Power Cooperative	Coyote Station, Beulah, ND	lignite coal	21,402	2.70	57	82,443	7.80	43
PKM Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #1, Center, ND	lignite coal	35,327	3.40	44	32,927	4.00	55
PKM Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #2, Center, ND	lignite coal	18,574	1.60	39	19,526	2.20	51
PKM Electric Cooperative	Minnkota Power Cooperative	Coyote Station, Beulah, ND	lignite coal	17,299	2.20	58	16,655	1.60	44
Red Lake Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #1, Center, ND	lignite coal	45,813	4.40	44	42,307	5.20	56
Red Lake Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #2, Center, ND	lignite coal	24,087	2.10	40	25,089	2.80	51

Appendix A

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Company	Electrical Supplier, if not generated by the Reporting Company	Generating Facility	Major Fuel Type(s)	2002 Electricity Consumed in Minnesota (MWh)	2002 Mercury Emissions (lb)	2002 Mercury Emissions per Megawatt- hour (mg/MWh)	2003 Electricity Consumed in Minnesota (MWh)	2003 Mercury Emissions (lb)	2003 Mercury Emissions per Megawatt- hour (mg/MWh)
Red Lake Electric Cooperative	Minnkota Power Cooperative	Coyote Station, Beulah, ND	lignite coal	22,434	2.90	59	21,399	2.00	42
Red River Valley Cooperative Power Ass'n	Minnkota Power Cooperative	Milton R. Young #1, Center, ND	lignite coal	47,037	4.50	43	43,005	5.20	55
Red River Valley Cooperative Power Ass'n	Minnkota Power Cooperative	Milton R. Young #2, Center, ND	lignite coal	24,731	2.10	39	25,050	2.90	53
Red River Valley Cooperative Power Ass'n	Minnkota Power Cooperative	Coyote Station, Beulah, ND	lignite coal	23,033	3.00	59	21,753	2.10	44
Roseau Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #1, Center, ND	lignite coal	63,723	6.10	43	58,216	7.10	55
Roseau Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #2, Center, ND	lignite coal	33,504	2.90	39	34,523	3.90	51
Roseau Electric Cooperative	Minnkota Power Cooperative	Coyote Station, Beulah, ND	lignite coal	31,205	4.00	58	29,446	2.80	43
Wild Rice Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #1, Center, ND	lignite coal	85,960	8.20	43	81,067	9.90	55
Wild Rice Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #2, Center, ND	lignite coal	45,196	3.90	39	48,074	5.50	52
Wild Rice Electric Cooperative	Minnkota Power Cooperative	Coyote Station, Beulah, ND	lignite coal	42,094	5.40	58	41,005	3.90	43
Beltrami Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #1, Center, ND	lignite coal	178,061	17.10	44	156,122	19.00	55
Beltrami Electric Cooperative	Minnkota Power Cooperative	Milton R. Young #2, Center, ND	lignite coal	93,620	8.10	39	92,584	10.50	51
Beltrami Electric Cooperative	Minnkota Power Cooperative	Coyote Station, Beulah, ND	lignite coal	87,195	11.20	58	78,969	7.50	43
Sioux Valley-Southwestern Electric Coop	L & O Electric (Purchases from Basin Elec.)		coal	62,382	3.49	25.38	93,066	5.21	25.40

Company	Electrical Supplier, if not generated by the Reporting Company	Generating Facility	Major Fuel Type(s)	2002 Electricity Consumed in Minnesota (MWh)	2002 Mercury Emissions (lb)	2002 Mercury Emissions per Megawatt- hour (mg/MWh)	2003 Electricity Consumed in Minnesota (MWh)	2003 Mercury Emissions (lb)	2003 Mercury Emissions per Megawatt- hour (mg/MWh)
Lyon-Lincoln Electric Cooperative	East River Electric Power Cooperative		lignite coal	53,459	2.57	22	53,928	2.59	22
Minnesota Valley Coop. Light & Power Ass'n	Basin Electric		lignite coal	99,642	5.58	25	101,453	5.60	25
Traverse Electric Cooperative	Basin Electric		lignite coal	27,236	1.31	22	25,440	1.22	22
Wright-Hennepin Cooperative Electric Ass'n	Basin Electric		lignite coal	8,760	0.59	31	8,795	0.42	22
Renville Sibley Cooperative Ass'n	East River Electric Power Cooperative		lignite coal	99,375	4.76	22	101,724	4.88	22
Minnesota Valley Electric Cooperative	Utilities Plus		lignite, sub coal	43,800	1.57	16	43,669	1.61	17
Stearns Electric Association	Utilities Plus		sub coal, lignite	22,032	0.79	16	26,280	0.80	14
Wright-Hennepin Cooperative Electric Ass'n	Utilities Plus		lignite, sub coal	52,560	1.88	16	52,398	2.03	18
Summary of Reports				16,986,351	1,120	median = 31	17,195,799	1,272	median = 31
				Total Reported 2002 Electricity Produced (MWh)	Total Reported 2002 Mercury Emissions (lb)	Median Reported 2002 Mercury Emissions per Megawatt-hour (mg/MWh)	Total Reported 2003 Electricity Produced (MWh)	Total Reported 2003 Mercury Emissions (lb)	Median Reported 2003 Mercury Emissions per Megawatt-hour (mg/MWh)

Notes

NA indicates data was either not available or not submitted to MPCA