Mercury Alert: Cleaning up Coal Plants for Healthier Lives

March, 2011

EDF
ENVIRONMENTAL DEFENSE FUND™
Finding the ways that work

Summary

Coal-fired power plants are the primary source of toxic mercury air emissions in the U.S. Mercury pollution contaminates our land and waters, causing serious human health impacts.

In this report, Environmental Defense Fund identifies the top 25 emitters of mercury from the electric sector. These 25 plants alone contribute nearly a third of all mercury emissions from the electric sector while only providing 8% of our nation's electricity. In short, a large amount of toxic mercury air pollution in America is caused by a small number of power plants that have not installed readily available pollution controls that others are already using.

There are widely available, cost-effective, and tested technology solutions to reduce mercury pollution from power plants by more than 90%. Many states are leading the way in adopting policies to control mercury emissions, helping to drive investment in technology solutions.

But we need to do more to clean up mercury pollution from plants that remain largely uncontrolled. The EPA Utility Air Toxics Rule will establish a much-needed national policy to reduce mercury emissions from the electric sector and to protect the health of every American.

Coal-fired Power Plants Are the Primary Sources of U.S. Mercury Air Emissions

Humans, especially infants and young children, are vulnerable to mercury pollution

- Mercury in the air settles into surface waters or onto land where it is washed into water. Deposited in lakes and ponds, this mercury is converted by certain microorganisms to a highly toxic form of the chemical known as methylmercury.
- Methylmercury accumulates in fish and shellfish, as well as birds and mammals that feed on fish. Humans are exposed to mercury when they eat contaminated fish and shellfish. Fish and shellfish are the main sources of human methylmercury exposure.
- Mercury exposure at high levels can harm the brain, heart, kidneys, lungs, and immune system of people of all ages. Unborn babies and young children are particularly vulnerable to high levels of methylmercury in their bloodstreams.
- High levels of methylmercury can harm the developing nervous systems of fetuses and young children, resulting in later difficulties thinking and learning.
- An estimated average of 410,000 infants are born annually in the U.S. to mothers with blood mercury concentrations in excess of EPA's Reference Dose.[1]

A small amount of mercury can contaminate a disproportionately large area

- According to the Minnesota Pollution Control Agency, precipitation and deposition of just 12.5 $\mu g/m^2/yr$ (approximately the amount in a clinical thermometer per 20 acre per year) can contaminate water bodies rendering fish in them unfit for human consumption on a regular basis.[2]

Coal plants emit the majority of mercury air emissions in the U.S.

- Coal-fired power plants emit mercury by burning coal containing mercury.
- In 2008, collectively, power plants were responsible for 72 percent of mercury air emissions in the U.S.[3]

In addition to mercury, coal plants also emit a number of other toxic air pollutants, including metals and acid gases, that are known or suspected to cause cancer, birth defects, and other serious health issues in humans.

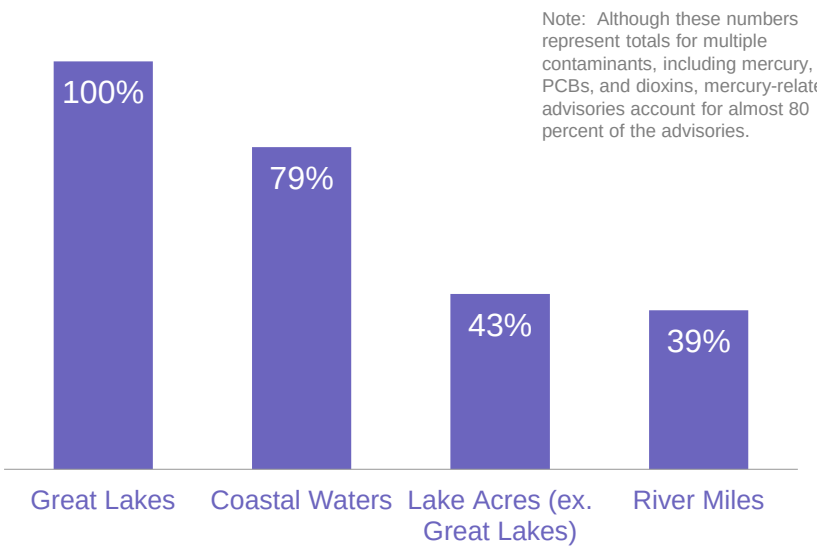
- Over 400,000 U.S. newborns are affected by mercury pollution each year.
- One small drop of mercury per year is enough to render fish in a 20-acre lake unfit for human consumption.
- Coal-fired power plants are responsible for almost three-quarters (35 tons) of all mercury air emissions in the U.S.

[1] Kathryn R. Mahaffey, NHANES 1999-2002 Update on Mercury & Northeast Regional Mercury Conference, U.S. EPA, April 2006
[2] Minnesota Pollution Control Agency, Michigan Department of Natural Resources, Wisconsin Department of Natural Resources, (grant from U.S. Environmental Protection Agency), "Mercury in the Environment: The Waste Connection," 1995
[3] M. J. Bradley & Associates. (2010). Benchmarking Air Emissions of the 100 Largest Electric Power Producers in the United States

Percentage of River-Miles and Lake-Acres under Mercury Contamination Advisories

Mercury deposition in lakes and ponds has resulted in fish consumption advisories and/or bans throughout the U.S. These advisories are primarily based on information about contaminant levels in fish collected by state and local advisory bodies.

Percentage of U.S. waterbodies for which advisories are currently in effect (2008)



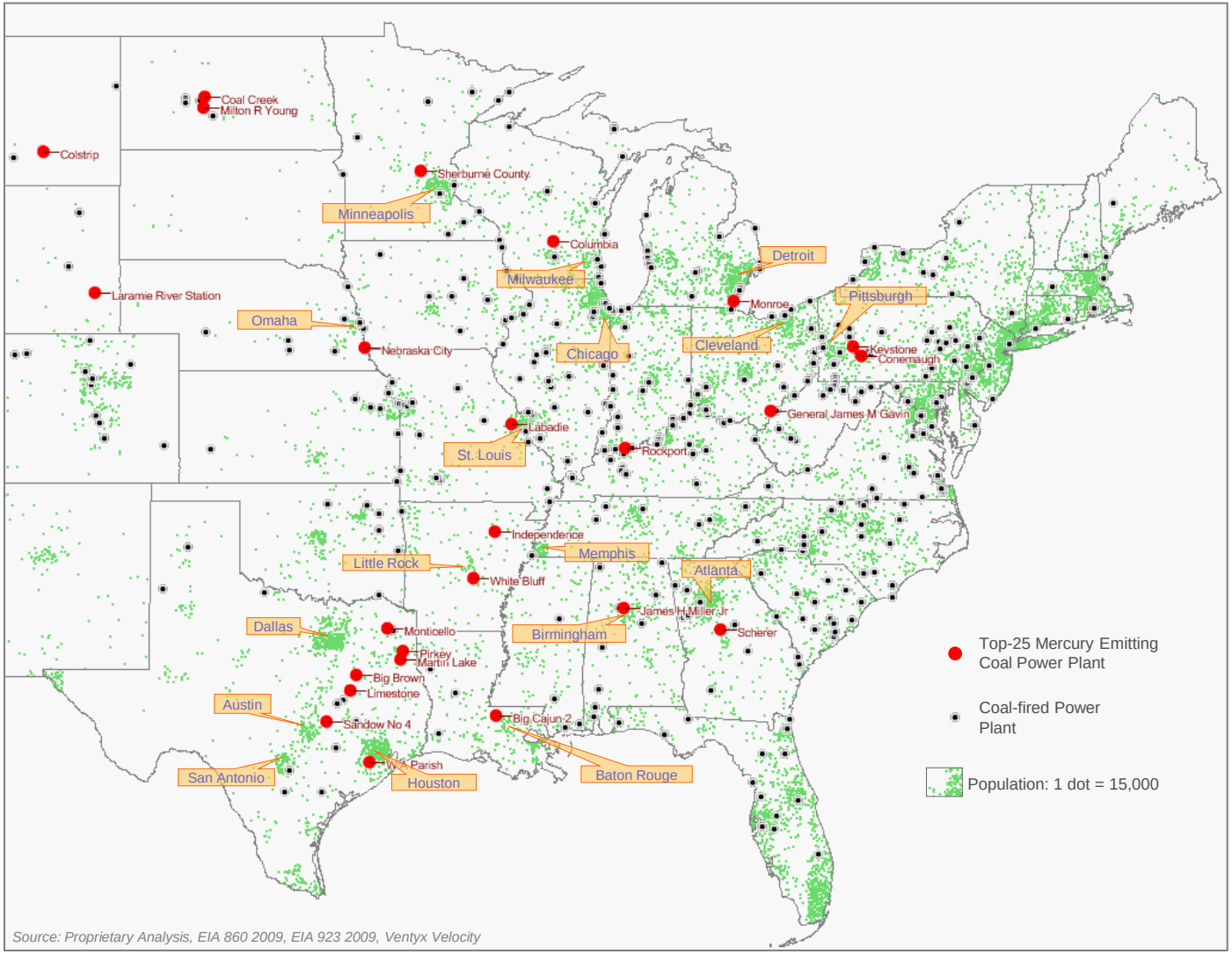
In 2008 –

- Nearly half of all U.S. river-miles and lake-acres were under water contamination advisories.
- Eighty percent of all water contamination advisories were issued because of mercury contamination.
- Some 17 million lake-acres and 1.3 million river-miles were under mercury-related contamination advisories.

Source: EPA, National Listing of Fish Advisories, 2008
http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/upload/2009_09_22_fish_advisories_nlfaslides.pdf

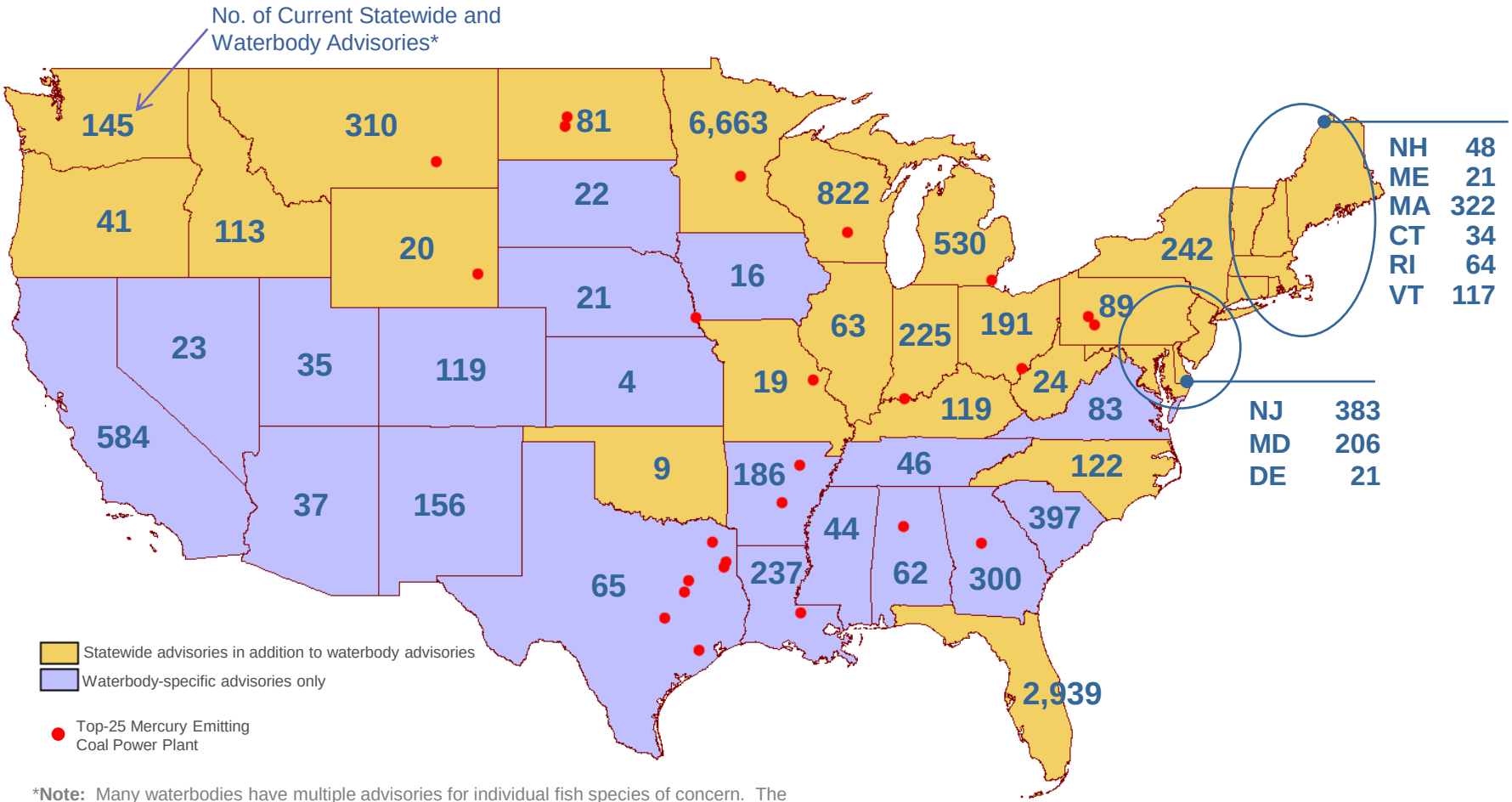
Top 25 Mercury Emitting U.S. Coal Plants in 2009 and nearby Population Centers

Twenty out of the top 25 mercury emitting coal plants are located within 50-100 miles of some of the largest metropolitan areas of the country including Chicago, Dallas, Houston, Atlanta, Minneapolis, Detroit, Pittsburgh, Cleveland, St. Louis, and Austin.



Mercury Fish Consumption Advisories by State

Includes state-issued fish advisories based on mercury contamination as of March 2011. Because monitoring and advisories are determined at the state level, only consumption advisories for a percentage of affected waterbodies are issued; therefore, this map reflects an under-representation of the number of actual waterbodies where the fish have concentrations of mercury that should be considered a concern to human health



*__Note:__ Many waterbodies have multiple advisories for individual fish species of concern. The totals above may include multiple advisories per lake or river if issued by the individual state.

Many states also issue blanket statewide advisories in addition to specific warnings for individual waterbodies and/or species of fish.

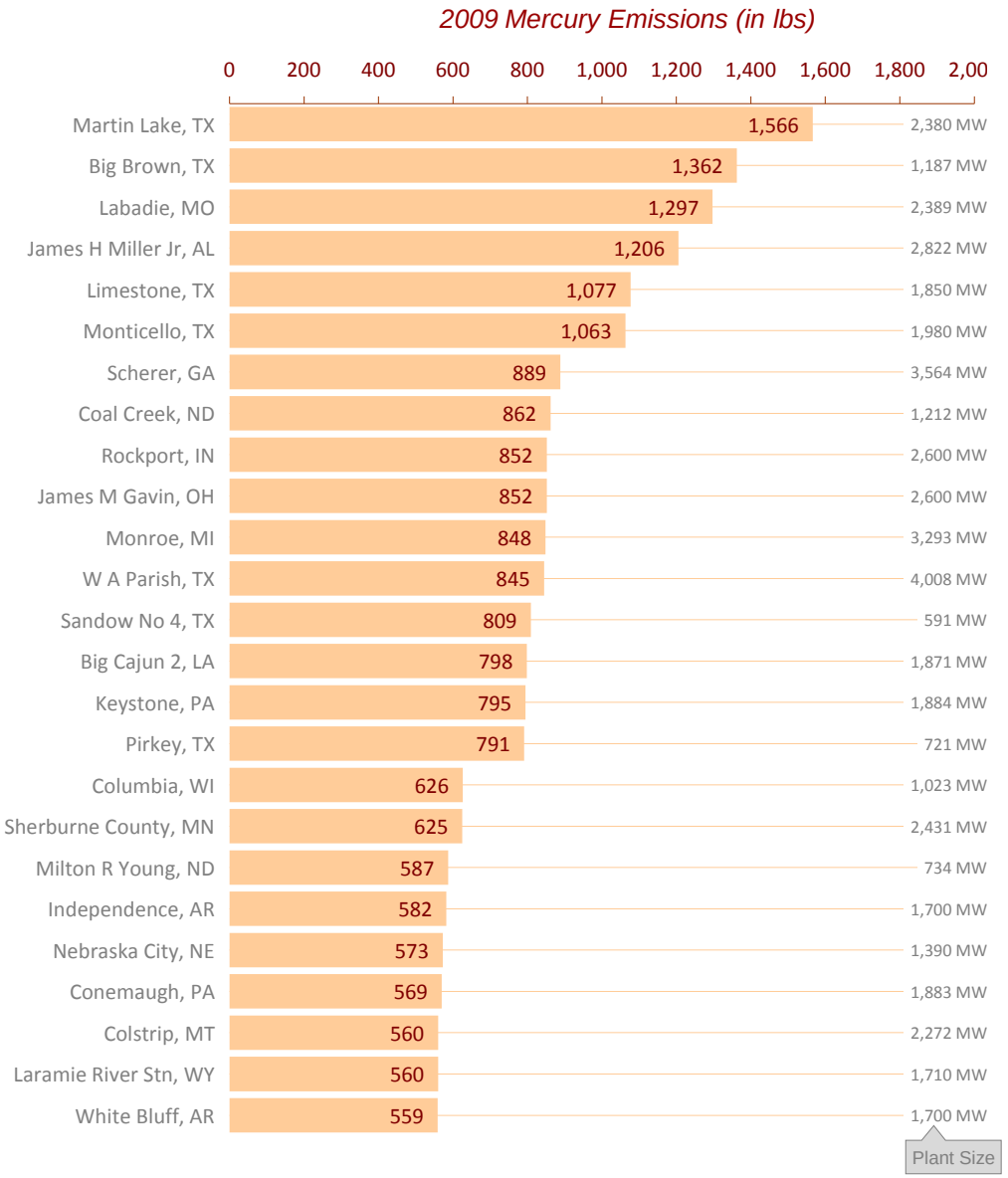
Source: Proprietary Analysis, EIA 860 2009, EIA 923 2009, EPA National Listing of Fish Advisories, 2008

http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/upload/2009_09_22_fish_advisories_nlfaslides.pdf

EPA National Listing of Fish Advisories Database accessed March 6, 2011

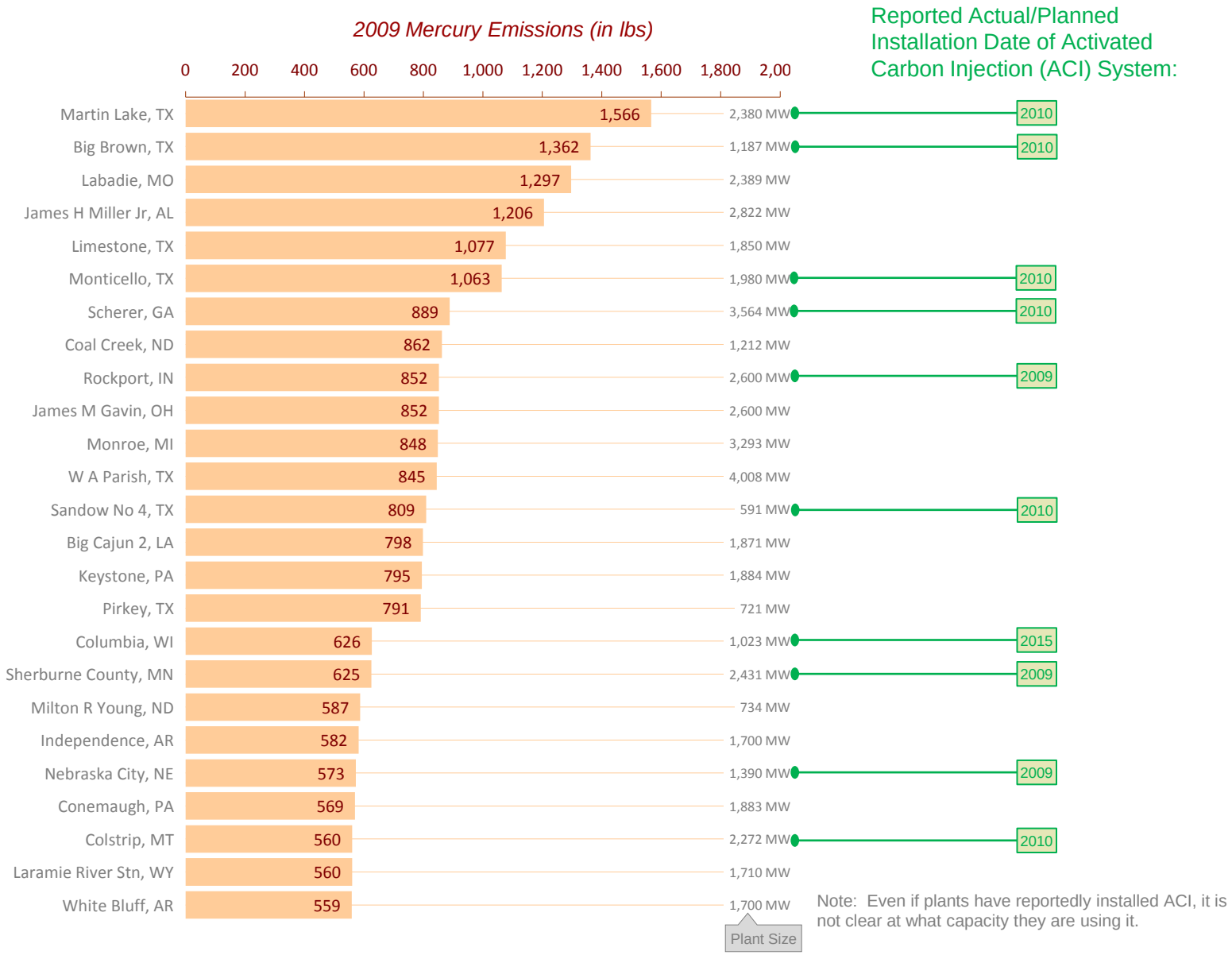
http://134.67.99.49/scripts/esrimap.dll?name=Listing&Cmd=Map.

Top 25 Mercury Emitting U.S. Coal Plants in 2009



The top 25 plants accounted for 11 tons of mercury emissions, out of a total of approximately 35 tons emitted by the entire U.S. electric sector.

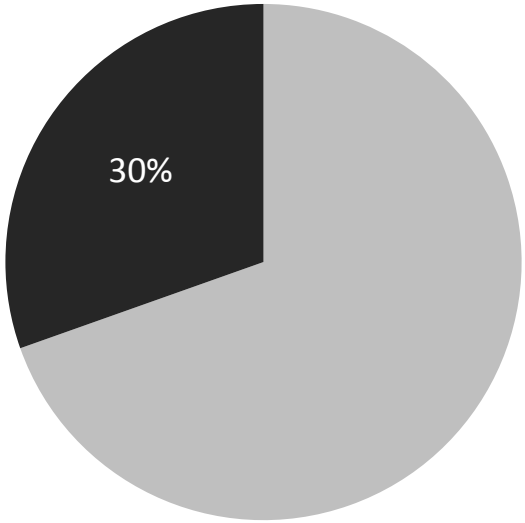
Reported Installations of Mercury Control Technology Since 2009



Note: Even if plants have reportedly installed ACI, it is not clear at what capacity they are using it.

Share of the Top 25 Mercury-Emitting U.S. Coal Plants in 2009

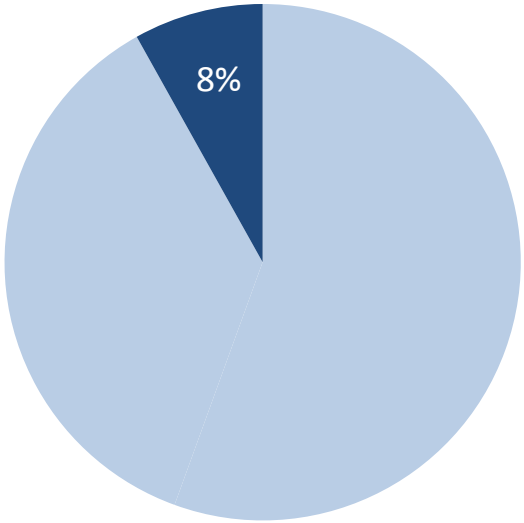
The top 25 mercury-emitting plants are responsible for almost *one-third* of all U.S. electric sector mercury air emissions…



Mercury Emissions

11 tons out of a U.S. Total of 35 tons in 2009

…while generating only 8 percent of total U.S. electricity needs.



Electricity

320 TWh out of a U.S. Total of 3,949 TWh in 2009

Technology and Policy Tools to Drive Mercury Emission Reductions

The following section demonstrates how tested and cost-effective technology solutions to reduce mercury emissions are now widely available for all types of coal plants.

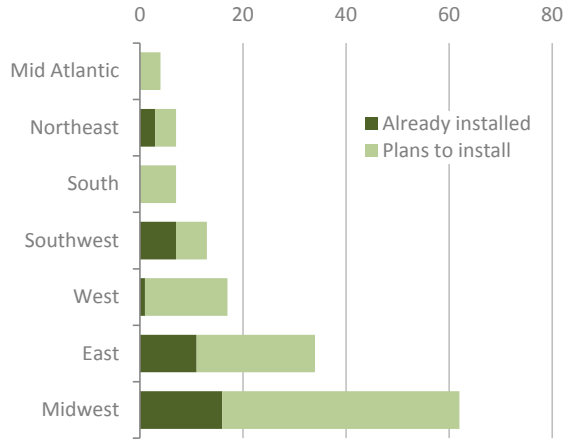
Some states have adopted policies to reduce mercury emissions, but national standards are needed to protect the health of all Americans.

Modern Mercury Controls are Being Broadly Deployed

Activated Carbon Injection (ACI) is the primary technology being used to reduce mercury emissions from new and existing coal plants. Data from power plants shows that the tested boilers achieved, on average, **reductions in mercury emissions of about 90 percent.**

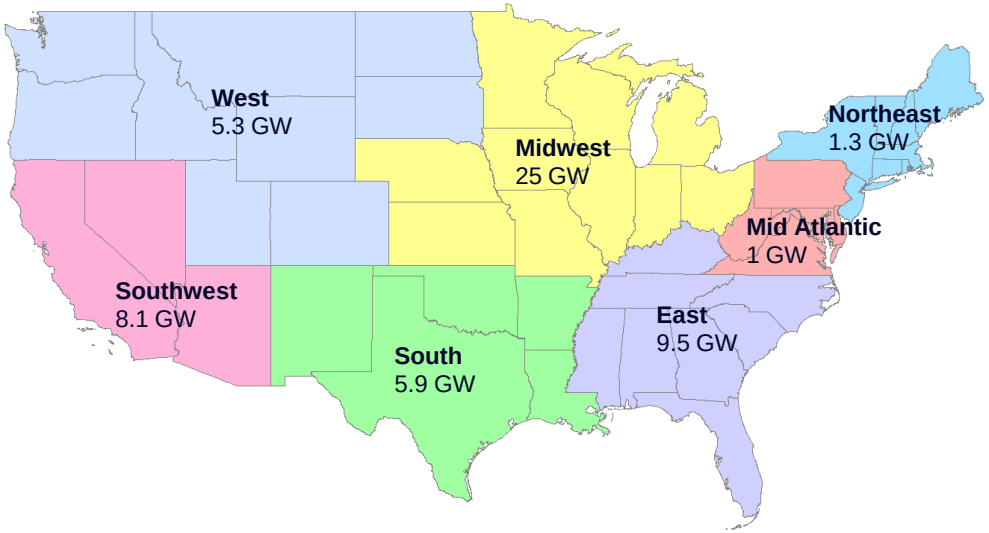
No. of coal-fired units already using or planning to use ACI technology by region

(based on ICAC data 2010)



Coal-fired capacity already using or planning to use ACI technology by region

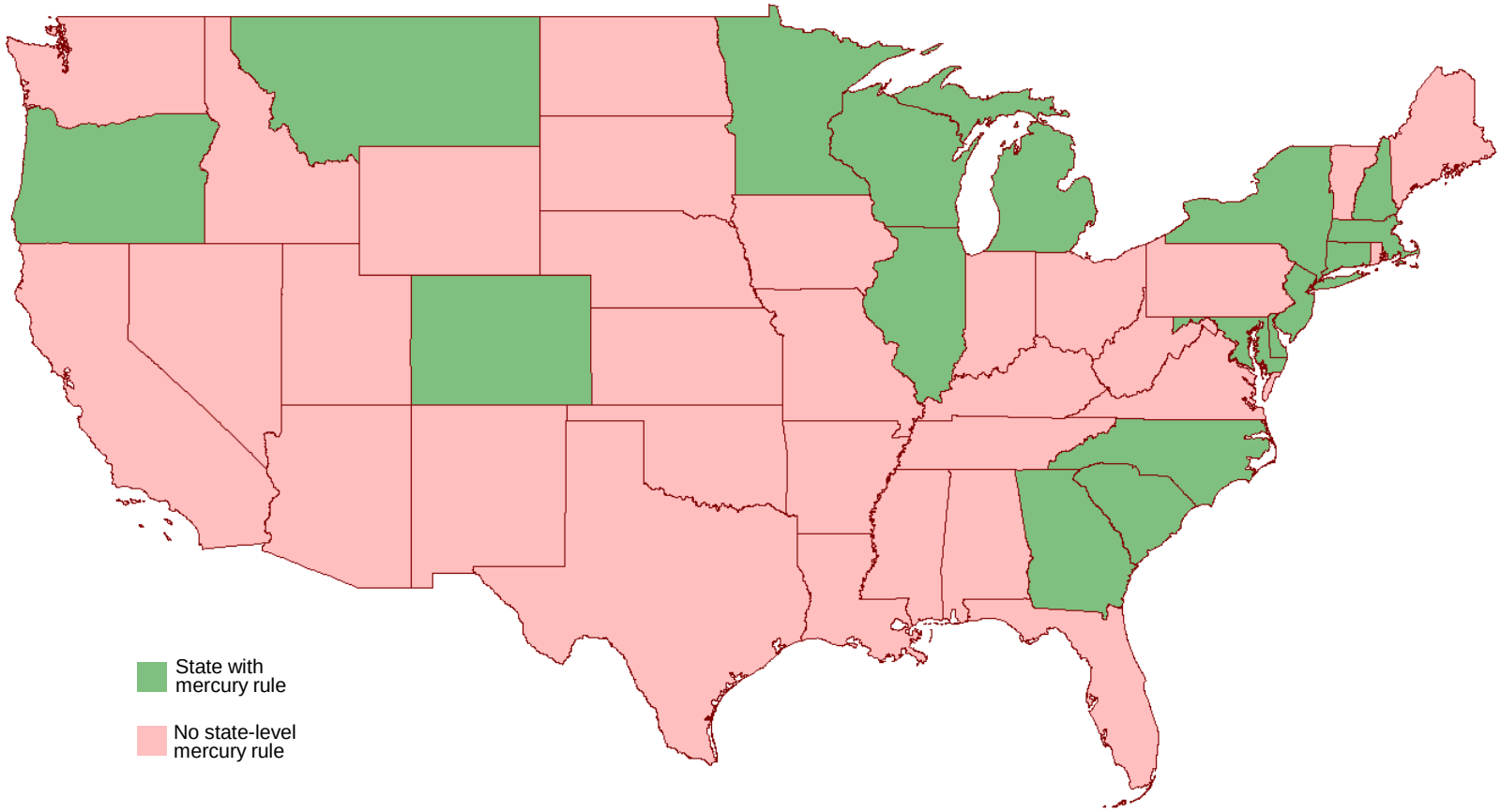
(based on ICAC data 2010)



- Mercury control technology is highly efficient and available for all coal types.
- The 2008 cost to capture a pound of mercury was 1/6 the 1999 price.
- As of June 2010, nearly 40 coal plant units had installed ACI and more than100 additional units had ordered the technology. These plants total more than 55,000 megawatts (MW) of generating capacity.

State Regulations: Seventeen States Have Established Mercury Emission Limits on Coal Plants

Since 1999, mercury air emissions from U.S. coal-fired power plants have decreased by almost 27 percent: from over 48 tons in 1999 to 35 tons in 2009. This overall reduction in mercury air emissions has been driven by several policies, including those established by states.



Some states are making progress to reduce mercury emissions from the electric sector, but we need a strong national Utility Air Toxics rule to protect the health of all Americans.

Data Sources, References, and Analysis Notes

- EIA FORM 923 POWER PLANT DATABASE (2009): EIA Form 923 provided almost all of the generation data analyzed in this analysis. EIA Form 923 provides data on the electric generation and heat input by fuel type for utility and non-utility power plants. The heat input and generation data were used to calculate weighted heat rates and mercury emission rates of the plants included in the report. This form is available at http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html
- EIA FORM 860 ANNUAL ELECTRIC GENERATOR REPORT (2009): EIA Form 860 is a generating unit level data source that includes information about generators at electric power plants, including information about generator ownership. EIA Form 860 was used as the primary source of power plant capacity and ownership for this report. The form is available at http://www.eia.doe.gov/cneaf/electricity/page/eia860.html
- EPA ACID RAIN PROGRAM DATABASE: EPA's Acid Rain Emissions Reporting Program accounts for all of the SO_2 and NO_x emissions included in this analysis. These emissions were compiled using EPA's on-line emissions database available at http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=emissions.wizard
- EPA TOXIC RELEASE INVENTORY (TRI 2009): Power plants and other facilities are required to submit reports on the use and release of certain toxic chemicals to the TRI. The 2009 mercury emissions used in this report are based on TRI reports submitted by facility managers and which are available at http://www.epa.gov/tri/tridata/tri09/nationalanalysis/index.htm
- Plant ownership data are primarily based on EIA-860 database from the year 2009. Ownership is further checked against self-reported data from the holding company's 10-K form filed with the SEC.
- Pollution control equipment information is collated from multiple sources including EIA Form 860, EPA's National Electric Energy Data System (NEEDS v 4.10), EPA's Acid Rain Program Database, as well as trade industry press articles.
- U.S. Government Accountability Office Report to the Chairman, Subcommittee on Clean Air and Nuclear Safety, Committee on Environment and Public Works, U.S. Senate, "Mercury Control Technologies at Coal-Fired Power Plants Have Achieved Substantial Emissions Reductions," 2009.
- National Energy Technology Laboratory press release, "Mercury-Control Program Achieves Success," June 23, 2008. http://energy.ihs.com/News/utilities/2008/netl-mercury-control-program-062308.htm
- Institute of Clean Air Companies, "Updated Commercial Hg Control Technology Bookings," (June 2010). Online at: http://www.icac.com/files/members/Commercial_Hg_Bookings_060410.pdf

Appendices

Top 25 Mercury Emitting U.S. Coal Plants in 2009

								Emissions				Emission Rates (lbs/MWh)					
Plant Name	State	County	Owner(s)	Coal Rank	Capacity (MW)	In Service	Controls	Mercury (lbs)	CO2 (m tons)	NOx (tons)	SO2 (tons)	Mercury	CO2	NOx	SO2	Cap. Factor*	Heat Rate* (Btu/KWh)
Martin Lake	TX	Rusk	Energy Future Holdings	Lignite	2,380	1977, 1978, 1979	ESP + Scrubber	1,566	19.3	15,703	71,842	9.19E-05	2,266.6	1.84	8.42	82%	11,003
Big Brown	TX	Freestone	Energy Future Holdings	Sub-bituminous	1,187	1971, 1972	ESP + Fabric Filter	1,362	8.8	5,777	55,547	1.77E-04	2,269.2	1.50	14.40	74%	11,022
Labadie	MO	Franklin	Ameren	Sub-bituminous	2,389	1970, 1971, 1972, 1973	ESP	1,297	18.3	9,200	61,683	7.53E-05	2,126.4	1.07	7.16	82%	10,321
James H Miller Jr	AL	Jefferson	Southern (96%), PowerSouth Coop (4%)	Sub-bituminous	2,822	1978, 1985, 1989, 1991	ESP + SCR + Wet Scrubber	1,206	22.1	7,929	62,241	5.81E-05	2,125.7	0.76	5.98	84%	10,332
Limestone	TX	Limestone	NRG	Lignite	1,850	1985, 1986	ESP + Wet Scrubber	1,077	12.8	12,019	20,849	9.03E-05	2,139.5	2.01	3.49	74%	10,391
Monticello	TX	Titus	Energy Future Holdings	Sub-bituminous	1,980	1974, 1975, 1978	Units 1,2: ESP + Fabric Filter; Unit 3: ESP + Wet Scrubber	1,063	17.6	11,938	58,265	7.01E-05	2,322.0	1.57	7.68	88%	11,271
Scherer	GA	Monroe	Southern (29%), Oglethorpe (30%), MEAG (15%), NextEra (19%), JEA (6%), Dalton Utilities (1%)	Sub-bituminous	3,564	1982, 1984, 1987, 1989	Units 1,2: ESP + Fabric Filter; Units 3,4: ESP + Fabric Filter + SCR + Wet Scrubber	889	24.3	17,172	69,523	3.87E-05	2,112.7	1.49	6.05	74%	10,254
Coal Creek	ND	McLean	Great River Energy	Lignite	1,212	1979, 1981	ESP + Wet Scrubber	862	10.3	10,647	28,638	9.44E-05	2,256.6	2.33	6.27	86%	10,952
Rockport	IN	Spencer	AEP	Sub-bituminous	2,600	1984, 1989	ESP	852	18.8	19,762	54,796	4.55E-05	2,007.1	2.11	5.85	82%	9,743
James M Gavin	OH	Gallia	AEP	Bituminous	2,600	1974, 1975	ESP + SCR + Wet Scrubber	852	19.2	6,906	26,265	4.45E-05	2,002.6	0.72	2.74	84%	9,721
Monroe	MI	Monroe	DTE Energy	Sub-bituminous	3,293	1972, 1973, 1974	Unit 1: ESP + SCR; Unit 2: ESP; Units 3,4: ESP + SCR + Wet Scrubber	848	19.2	20,374	85,898	4.44E-05	2,009.3	2.13	8.98	66%	9,754
W A Parish	TX	Fort Bend	NRG	Sub-bituminous	4,008	1977, 1978, 1980, 1982	2 units: ESP + Wet Scrubber; 1 unit: ESP + SCR + Wet Scrubber	845	19.9	5,060	42,502	4.69E-05	2,102.1	0.53	4.48	54%	10,433
Sandow No 4	TX	Milam	Energy Future Holdings	Lignite	591	1981	ESP + SCR + Wet Scrubber	809	5.0	4,912	25,594	1.89E-04	2,345.1	2.29	11.91	83%	11,385
Big Cajun 2	LA	Pointe Coupee	NRG (86%), Entergy (14%)	Sub-bituminous	1,871	1981, 1982, 1983	ESP	798	12.9	11,434	35,893	6.63E-05	2,144.0	1.90	5.95	74%	10,408
Keystone	PA	Armstrong	PSEG (23%), Exelon (21%), Constellation (21%), GenOn (17%), PPL (12%), Delmarva, Duquesne, Keystone (2% each)	Bituminous	1,884	1967, 1968	ESP + SCR + Wet Scrubber	795	10.4	3,718	113,137	7.56E-05	1,974.7	0.71	21.46	64%	9,590
Pirkey	TX	Harrison	AEP (86%), Northeast Texas Coop (12%), OK MPA (2%)	Lignite	721	1985	ESP + Wet Scrubber	791	3.9	3,328	4,363	2.30E-04	2,271.7	1.92	2.52	55%	11,052
Columbia	WI	Columbia	Alliant (46%), Integrys (32%), Madison Gas & Electric (22%)	Sub-bituminous	1,023	1975, 1978	Unit 1: ESP; Unit 2: ESP	626	7.1	4,766	24,228	9.68E-05	2,193.2	1.47	7.48	72%	10,648
Sherburne County	MN	Sherburne	Xcel (85%), Southern MN MPA (15%)	Sub-bituminous	2,431	1976, 1977, 1987	Units 1,2: ESP + Wet Scrubber; Unit 3: Fabric Filter + Dry Scrubber	625	16.4	13,874	24,016	4.08E-05	2,146.4	1.81	3.13	72%	10,418
Milton R Young	ND	Oliver	Minnkota Power Coop (68%), ALLETE (32%)	Lignite	734	1970, 1977	ESP + Wet Scrubber	587	5.7	14,046	25,724	1.17E-04	2,258.2	5.60	10.25	78%	10,969
Independence	AR	Independence	Entergy (48%), AR Electric Coop (35%), Other Public Cities (17%)	Sub-bituminous	1,700	1983, 1985	ESP	582	12.1	14,338	27,425	5.12E-05	2,122.1	2.52	4.82	76%	10,301
Nebraska City	NE	Otoe	Omaha Public District	Sub-bituminous	1,390	1979, 2009	Unit 1: ESP; Unit 2: Fabric Filter + SCR + Wet Scrubber	573	7.5	15,137	19,074	7.74E-05	2,036.8	4.08	5.15	61%	9,890
Conemaugh	PA	Indiana	PSEG (23%), Exelon (21%), Constellation (11%), GenOn (16%), PPL (16%), Others (13%)	Bituminous	1,883	1970, 1971	ESP + Wet Scrubber	569	11.9	18,980	7,222	4.69E-05	1,964.0	3.12	1.19	74%	9,534
Colstrip	MT	Rosebud	Puget Energy (33%), PPL (26%), Portland General (14%), MidAmerican (7%), Avista (10%), NorthWestern Energy (10%)	Sub-bituminous	2,272	1975, 1976, 1984, 1986	Wet Scrubber	560	14.7	17,516	15,919	4.26E-05	2,230.6	2.66	2.42	66%	10,827
Laramie River Stn	WY	Albany	Basin Electric Power Coop (42%), Tri-State (24%), Missouri Basin MPA (17%), Other Public Agencies (17%)	Sub-bituminous	1,710	1980, 1981, 1982	ESP + Wet Scrubber	560	12.3	16,527	9,294	4.80E-05	2,107.8	2.83	1.59	78%	10,232
White Bluff	AR	Jefferson	Entergy (57%), AR Electric Coop (35%), Other Public Cities (8%)	Sub-bituminous	1,700	1980, 1981	ESP	559	11.4	14,523	33,832	5.18E-05	2,102.8	2.69	6.26	73%	10,209

Capacity Factors (Utilization Rates) and Heat Rates are averages (weighted for Coal) for the entire plant. Individual units may have different rates.

State Regulations: Seventeen States Have Established Mercury Emission Limits on Coal Plants

State	Year Enacted	Policy/Rule
New Hampshire	2002	Requires 75% reduction in annual mercury emissions from coal plants compared to 1996/97 emissions.
Connecticut	2003	Requires coal-fired power plants to achieve either an emissions standard of 0.6 lb/tBtu or a 90% efficiency in technology installed to control mercury emissions.
New Jersey	2004	Requires a 90% reduction of mercury emissions from coal-fired power plants by the end of 2007. Plants have the option of meeting the standards in 2012 if they also make major reductions in their emissions of sulfur dioxide, nitrogen oxides, and fine particulates.
Delaware	2006	Requires power plants to capture at least 80% of mercury beginning in 2009 and 90% beginning in 2013.
Maryland	2006	Requires power plants to capture at least 80% of mercury beginning in 2010 and 90% beginning in 2013.
Illinois	2006	Requires power plants to reduce mercury emission by 90% starting in July of 2009.
North Carolina	2006	Requires power plants submit by January 1, 2013 detailed plans and timetables for achieving maximum technically and economically possible mercury reductions at each unit. Units that are not controlled by 2017 must be shut down.
Montana	2006	Requires mercury emitting EGUs to achieve an emission rate lower than 0.9 lbs/TBtu by January 1, 2010. EGUs unable to meet this limit after installing an approved control strategy may apply for an alternative limit by July 1, 2011.
Minnesota	2006	Requires MN's largest coal-fired power plants to cut mercury emissions by 90% by 2015.
Massachusetts	2007	Requires requires power plants to capture at least 85% of mercury (or achieve a rate of 0.0075 lbs/GWh) by 2008 and 95% of mercury (or achieve a rate of 0.0025 lbs/GWh) by 2012.
New York	2007	Phase I (2010): Power plants must reduce mercury emissions by 50%. Phase II (2015): Implementation of unit-based limits for each facility to reduce mercury emissions by 90% using Maximum Available Control Technologies
Colorado	2007	Requires new or reconstructed units to achieve a minimum mercury capture rate of 90% and implement BACT.
Georgia	2007	*Multipollutant Control for EGUs (steam)* requires four specific power plants to carry out feasibility studies for mercury controls by 2018. *Mercury emissions from new EGUs* requires the use of BACT to control mercury emissions.
Wisconsin	2008	Requires large (>150 MW) coal-fired power plants to either – a) achieve a 90 percent reduction in mercury emissions from coal by the year 2015; or b) reduce multiple pollutants, including nitrogen oxides (NOx) and sulfur dioxide (SO2), and achieve 90 percent reduction in mercury emissions six years later Requires small (> 25 MW and < 150 MW) coal-fired power plants reduce their mercury emissions to BACT level.
South Carolina	2008	Requires power plants to install mercury emission monitoring equipment by June 2009.
Michigan	2009	Requires EGUs to reduce mercury emissions by 90%, or achieve 75% mercury emission reductions along with nitrogen oxides (NOx) and sulfur dioxide (SO2) reductions.
Oregon	2010	Caps mercury emissions from new EGUs and requires installation of mercury controls at existing ones. Total statewide mercury emissions limited to 60 lbs/year after 2018. New coal plants cannot emit more than 25 lbs per year