Mercury Alert: Cleaning up Coal Plants for Healthier Lives

March, 2011
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 μg/m²/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.
- Continuous deposition of mercury in trace amounts, as little as only one tablespoon by the end of an 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.

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)

- 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.

Note: Although these numbers represent totals for multiple contaminants, including mercury, PCBs, and dioxins, mercury-related advisories account for almost 80 percent of the advisories.

Source: EPA, National Listing of Fish Advisories, 2008
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.

Source: Proprietary Analysis, EIA 860 2009, EIA 923 2009, Ventyx Velocity
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.

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

![Bar chart showing 2009 Mercury Emissions (in lbs) for various plants with their installation dates and plant sizes.]

**Reported Actual/Planned Installation Date of Activated Carbon Injection (ACI) System:**

- Martin Lake, TX: 2010, 1,566 lbs, 2,380 MW
- Big Brown, TX: 2010, 1,362 lbs, 1,187 MW
- Labadie, MO: 2010, 1,297 lbs, 2,389 MW
- James H Miller Jr, AL: 2010, 1,206 lbs, 2,822 MW
- Limestone, TX: 2010, 1,077 lbs, 1,850 MW
- Monticello, TX: 2010, 1,063 lbs, 1,980 MW
- Scherer, GA: 2010, 889 lbs, 3,564 MW
- Coal Creek, ND: 2009, 862 lbs, 1,212 MW
- Rockport, IN: 2010, 852 lbs, 2,600 MW
- James M Gavin, OH: 2009, 852 lbs, 2,600 MW
- Monroe, MI: 2010, 848 lbs, 3,293 MW
- W A Parish, TX: 2010, 845 lbs, 4,008 MW
- Sandow No 4, TX: 2010, 809 lbs, 591 MW
- Big Cajun 2, LA: 2010, 798 lbs, 1,871 MW
- Keystone, PA: 2010, 795 lbs, 1,884 MW
- Pirkey, TX: 2010, 791 lbs, 721 MW
- Columbia, WI: 2015, 626 lbs, 1,023 MW
- Sherburne County, MN: 2009, 625 lbs, 2,431 MW
- Milton R Young, ND: 2009, 587 lbs, 734 MW
- Independence, AR: 2009, 582 lbs, 1,700 MW
- Nebraska City, NE: 2009, 573 lbs, 1,390 MW
- Conemaugh, PA: 2010, 569 lbs, 1,883 MW
- Colstrip, MT: 2010, 560 lbs, 2,272 MW
- Laramie River Stn, WY: 2010, 560 lbs, 1,710 MW
- White Bluff, AR: 2010, 559 lbs, 1,700 MW

Note: Even if plants have reportedly installed ACI, it is not clear at what capacity they are using it.
The top 25 mercury-emitting plants are responsible for almost *one-third* of all U.S. electric sector mercury air emissions…

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

**Mercury Emissions**

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

**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.

- 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 than 100 additional units had ordered the technology. These plants total more than 55,000 megawatts (MW) of generating capacity.
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.

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

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 SO2 and NOx 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.


• 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
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<th>Plant Name</th>
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<th>Coal Rank</th>
<th>Capacity (MW)</th>
<th>In Service</th>
<th>Controls</th>
<th>Emissions Rates (lbs/MWh)</th>
<th>Emissions Emission Rates (lbs/MWh)</th>
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<tr>
<td>Martin Lake</td>
<td>TX</td>
<td>Rusk</td>
<td>Energy Future Holdings</td>
<td>Lignite</td>
<td>2,380</td>
<td>1977, 1978</td>
<td>ESP + Scrubber</td>
<td>1.566</td>
<td>19.3 15,703 71.842</td>
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<td>Big Brown</td>
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<td>Energy Future Holdings</td>
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<td>1,187</td>
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<td>NRG</td>
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<td>Titus</td>
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<td>1974, 1975, 1978</td>
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<td>Scherer</td>
<td>GA</td>
<td>Monroe</td>
<td>Southern (29%), Ogletorpe (30%), MEAG (15%), NextEra (19%), JE (6%), Dalton Utilities (1%)</td>
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<td>3,564</td>
<td>1983, 1984, 1987, 1989</td>
<td>Units 1,2: ESP + Fabric Filter; Units 3,4: ESP + Fabric Filter + SCR + Wet Scrubber</td>
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<td>Coal Creek</td>
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<td>McLean</td>
<td>Great River Energy</td>
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<td>Spencer</td>
<td>AEP</td>
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<td>ESP</td>
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<td>Big Cajun 2</td>
<td>LA</td>
<td>Pointe Coupee</td>
<td>NRG (86%), Entergy (14%)</td>
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<td>1981, 1982, 1983</td>
<td>ESP</td>
<td>798</td>
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<td>Keystone</td>
<td>PA</td>
<td>Armstrong</td>
<td>PSEG (23%), Exelon (21%), Constellation (21%), GenOn (17%), PPL (12%), Delmarva, Bituminous (20%), Duquesne, Keystone (2% each)</td>
<td>Bituminous</td>
<td>1,884</td>
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<td>10.4 3,718 113.137</td>
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<td>Pirkey</td>
<td>TX</td>
<td>Harrison</td>
<td>AEP (86%), Northeast Texas Coop (12%), OK MPA (2%)</td>
<td>Lignite</td>
<td>721</td>
<td>1985</td>
<td>ESP + Wet Scrubber</td>
<td>791</td>
<td>3.9 3,328 4,363</td>
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<td>Columbia</td>
<td>WI</td>
<td>Columbia</td>
<td>Alliant (46%), Integris (32%), Madison Gas &amp; Electric (22%)</td>
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<td>1,023</td>
<td>1975, 1978</td>
<td>Unit 1: ESP; Unit 2: ESP</td>
<td>626</td>
<td>7.1 4,766 24,228</td>
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<td>Sherburne County</td>
<td>MN</td>
<td>Sherburne</td>
<td>Xcel (85%), Southern MN MPA (15%)</td>
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<td>2,431</td>
<td>1976, 1977, 1987</td>
<td>Units 1,2: ESP + Wet Scrubber; Unit 3: Fabric Filter + Dry Scrubber</td>
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<td>Milton R Young</td>
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<td>Oliver</td>
<td>Minnnesota Power Coop (68%), ALLETE Power Coop (32%)</td>
<td>Lignite</td>
<td>734</td>
<td>1970, 1977</td>
<td>ESP + Wet Scrubber</td>
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<td>Independence</td>
<td>AR</td>
<td>Independence</td>
<td>Entergy (48%), AR Electric Coop (35%), Other Public Cities (17%)</td>
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<td>1,700</td>
<td>1983, 1985</td>
<td>ESP</td>
<td>582</td>
<td>12.1 14,338 27,425</td>
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<td>Nebraska City</td>
<td>NE</td>
<td>Otoe</td>
<td>Omaha Public District</td>
<td>Sub-bituminous</td>
<td>1,390</td>
<td>1979, 2009</td>
<td>Unit 1: ESP; Unit 2: Fabric Filter + SCR + Wet Scrubber</td>
<td>573</td>
<td>7.5 15,137 19,074</td>
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<td>Conemaugh</td>
<td>PA</td>
<td>Indiana</td>
<td>PSEG (23%), Exelon (21%), Constellation (11%), GenOn (16%), PPL (16%), Others (13%)</td>
<td>Bituminous</td>
<td>1,883</td>
<td>1970, 1971</td>
<td>ESP + Wet Scrubber</td>
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<td>11.9 18,980 7,222</td>
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<td>Colstrip</td>
<td>MT</td>
<td>Rosebud</td>
<td>Puget Energy (33%), PPL (26%), Portland General (14%), MidAmerican (7%), Arista (10%), NorthWestern Energy (10%)</td>
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<td>2,272</td>
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<td>Wet Scrubber</td>
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<td>14.7 17,516 15,919</td>
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<td>Laramie River Stn</td>
<td>WY</td>
<td>Albany</td>
<td>Basin Electric Power Coop (42%), Tri-State (24%), Missouri Basin MPA (17%), Other Public Agencies (17%)</td>
<td>Sub-bituminous</td>
<td>1,710</td>
<td>1980, 1981, 1982</td>
<td>ESP + Wet Scrubber</td>
<td>560</td>
<td>12.3 16,527 9,294</td>
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<td>White Bluff</td>
<td>AR</td>
<td>Jefferson</td>
<td>Entergy (57%), AR Electric Coop (35%), Other Public Cities (8%)</td>
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<td>1,700</td>
<td>1980, 1981</td>
<td>ESP</td>
<td>559</td>
<td>11.4 14,523 33,832</td>
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</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>State</th>
<th>Year Enacted</th>
<th>Policy/Rules</th>
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<tbody>
<tr>
<td>New Hampshire</td>
<td>2002</td>
<td>Requires 75% reduction in annual mercury emissions from coal plants compared to 1996/97 emissions.</td>
</tr>
<tr>
<td>Connecticut</td>
<td>2003</td>
<td>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.</td>
</tr>
<tr>
<td>New Jersey</td>
<td>2004</td>
<td>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.</td>
</tr>
<tr>
<td>Delaware</td>
<td>2006</td>
<td>Requires power plants to capture at least 80% of mercury beginning in 2009 and 90% beginning in 2013.</td>
</tr>
<tr>
<td>Maryland</td>
<td>2006</td>
<td>Requires power plants to capture at least 80% of mercury beginning in 2010 and 90% beginning in 2013.</td>
</tr>
<tr>
<td>Illinois</td>
<td>2006</td>
<td>Requires power plants to reduce mercury emission by 90% starting in July of 2009.</td>
</tr>
<tr>
<td>North Carolina</td>
<td>2006</td>
<td>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.</td>
</tr>
<tr>
<td>Montana</td>
<td>2006</td>
<td>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.</td>
</tr>
<tr>
<td>Minnesota</td>
<td>2006</td>
<td>Requires MN’s largest coal-fired power plants to cut mercury emissions by 90% by 2015.</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>2007</td>
<td>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.</td>
</tr>
<tr>
<td>Colorado</td>
<td>2007</td>
<td>Requires new or reconstructed units to achieve a minimum mercury capture rate of 90% and implement BACT.</td>
</tr>
<tr>
<td>Georgia</td>
<td>2007</td>
<td>Multipollutant Control for EGUs (steam) requires four specific power plants to carry out feasibility studies for mercury controls by 2018.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mercury emissions from new EGUs requires the use of BACT to control mercury emissions.</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>2008</td>
<td>Requires large (&gt;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 (&gt; 25 MW and &lt; 150 MW) coal-fired power plants reduce their mercury emissions to BACT level.</td>
</tr>
<tr>
<td>South Carolina</td>
<td>2008</td>
<td>Requires power plants to install mercury emission monitoring equipment by June 2009.</td>
</tr>
<tr>
<td>Michigan</td>
<td>2009</td>
<td>Requires EGUs to reduce mercury emissions by 90%, or achieve 75% mercury emission reductions along with nitrogen oxides (NOx) and sulfur dioxide (SO2) reductions.</td>
</tr>
<tr>
<td>Oregon</td>
<td>2010</td>
<td>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.</td>
</tr>
</tbody>
</table>