Controlling Mercury from Power Plants:
Current State of Technology

A FACTSHEET OF THE NATIONAL WILDLIFE FEDERATION'S CLEAN THE RAIN CAMPAIGN

Effective and affordable technology is available today to capture nearly all the mercury released into the air by coal-burning power plants.

Solving the Mercury Problem Today

Coal-fired power plants remain the largest source of mercury pollution in the United States today, accounting for 41 percent of the nation's industrial mercury emissions. At these levels, mercury contamination will remain a serious concern for local communities unless steps are taken to modernize the nation's 430 coal plants.

The technology to control mercury has advanced significantly over the past five years. Today, nearly every power plant in the U.S. can choose from a number of options for controlling its mercury emissions. Whether it's installing technology originally designed to capture a different pollutant, installing mercury-specific technology, or optimizing already-installed technology, solutions are available at costs significantly lower than estimates presented by the Department of Energy just five years ago, in some cases up to 90% lower (see box on page 3).

Up to 90% Mercury Reduction Feasible for All Coals

In 2002, 870 million tons of coal was sold to U.S. electric utilities: 47.4% bituminous, 45% subbituminous and 7.5% lignite. Full-scale testing on power plants throughout the country demonstrate that controlling mercury is possible for plants burning different types of coals.

Based on stack tests conducted by the U.S. EPA and others, coal plants can capture up to 90 percent (or more) of the mercury in their flue gas using control equipment designed to capture sulfur dioxide, nitrogen oxides, and fine particulate pollution.

- 90 + % mercury removal with wet scrubber (SO2 control) and selective catalytic reduction (NOx control) (burning bituminous coal)
- 86% mercury removal with fabric filter (particulate control) and low NOx burner (burning subbituminous coal)
- 84% mercury removal with low NOx burner, wet scrubber, and fabric filter (burning bituminous-subbituminous coal blend)
- 80 + % mercury removal with wet scrubber (SO2 control) and using an additive for NOx control (burning bituminous coal)
- 80% mercury removal with limestone injection and fabric filter (burning lignite coal)

Mercury Technologies Do the Job

For over a decade, activated carbon injection has been used to capture mercury from commercial waste

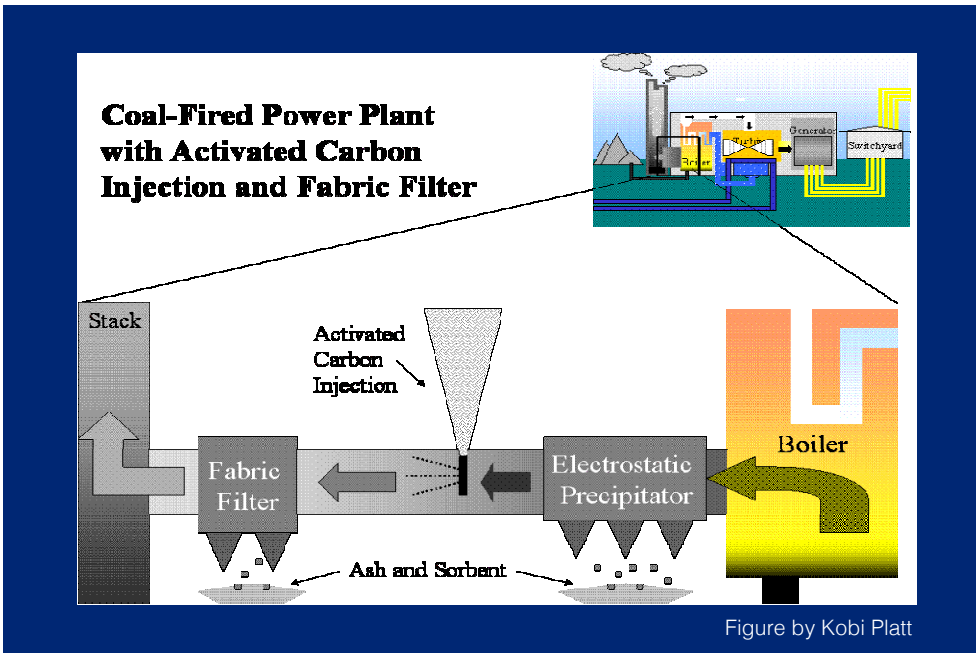


Figure by Kobi Platt

incinerators. Today, it is the technology of choice for many power companies who are looking to achieve significant mercury reductions.

Low capital investments, coupled with low operating costs and quick installation, have contributed to strong interest in this technology.

Since 1999, manufacturers of activated carbon injection have completed full-scale tests on power plants throughout the country burning a variety of coals, in partnership with Department of Energy, Environmental Protection Agency, and universities. DOE and the private sector already have invested over $75 million in these tests. With each passing year, the performance of the technology has improved while the costs have decreased.

Activated carbon injection (ACI) works by releasing carbon particles into the flue gas to absorb elemental and oxidized mercury. The carbon particles are then trapped by a particulate control device (an electrostatic precipitator, ESP, or a fabric filter) for disposal. Full-scale tests have found that ACI currently works best in conjunction with a fabric filter. For plants with no existing fabric filter, an alternative to ACI with an add-on filter is using carbon that has been chemically altered in a way that allows it to more effectively capture mercury, so that even with only an ESP, high capture rates can be achieved.

Recent full-scale tests demonstrate the versatility and high performance of ACI, at a cost of less than $0.001/kwh:

- 90 + % mercury removal at a plant burning subbituminous coal with different carbon sorbents, a spray dryer absorber (NOx control) and a fabric filter
- 90 + % mercury removal at a plant burning bituminous coal with 2 ESP's
- 90 + % mercury removal at a plant burning subbituminous coal with brominated activated carbon and an ESP
- 95 + % mercury removal at a plant burning lignite coal with brominated activated carbon, spray dryer absorber, and a fabric filter (>80% removal with untreated carbon)

Passing the Test: Power Plants Implement Full-scale Mercury Control Tests Nationwide

Mercury control tests have been conducted throughout the United States on many different power plants burning a variety of coal types. Sound results from these tests have eliminated any remaining technological uncertainties associated with capturing mercury from power plants. For detailed descriptions of the pollution control technologies listed below that have been installed and tested, see NWF's report, *Getting the Job Done.*

PLANT NAME	COAL TYPE & CONTROLS*
Independence (AR)	Bit (TOX)
Gaston (AL)	LS-Bit (FF)
Gaston (AL)	LS-Bit (H-ESP)
Arapahoe (CO)	Subbit (FF)
Yates 1 (GA)	Bit (ESP/FGD)
Yates 2 (GA)	Bit (ESP)
Council Bluffs 2 (IA)	PRB (H-ESP)
Louisa (IA)	PRB (H-ESP)
Abbott (IL)	HS-Bit (C-ESP)
Crawford (IL)	Subbit (ESP)
Will County (IL)	Subbit (H-ESP)
Holcomb (KS)	PRB (SDA/FF)
Brayton Point (MA)	LS-Bit (C-ESP)
Salem Harbor (MA)	LS-SA Bit (C-ESP)

PLANT NAME	COAL TYPE & CONTROLS
DTE Monroe (MI)	PRB/Bit (ESP)
Endicott (MI)	Bit (C-ESP/FGD)
Presque Isle (MI)	PRB (H-ESP/TOX)
St. Clair (MI)	Subbit (C-ESP)
Laskin (MN)	Lignite (W-P-Scrbr)
Meramac (MO)	PRB (C-ESP)
Corette (MT)	PRB
Lee 1 (NC)	Bit (ESP)
Lee 3 (NC)	Bit
Cliffside Station (NC)	Bit (H-ESP)
Buck Station (NC)	Bit (H-ESP)
Antelope Valley (ND)	Lignite (SDA/FF)
Coal Creek (ND)	Lignite (C-ESP)

PLANT NAME	COAL TYPE & CONTROLS
Leland Olds (ND)	Lignite (C-ESP)
Milton R. Young (ND)	Lignite (ESP/FGD)
Stanton 1 (ND)	Subbit (C-ESP)
Stanton 10 (ND)	Lignite (SDA/FF)
Conesville (OH)	HS-Bit (ESP/FGD)
Gavin (OH)	Bit (TOX)
Lausche (OH)	PRB (H-ESP)
Miami Fort 6 (OH)	Bit (C-ESP)
Portland (PA)	Bit
Monticello (TX)	Lignite (ESP/FGD)
Pleasant Prairie (WI)	PRB (C-ESP)
Laramie River (WY)	Subbit (SDA/FF)
Dave Johnston (WY)	Subbit

*Lists controls currently installed. Abbrev. for coal type: LS- or HS-Bit (low or high sulfur bituminous); Subbit (subbituminous); PRB (Powder River Basin); LS-SA Bit (low sulfur-South American bituminous). Abbrev. for controls: TOX (TOXICON), FF (fabric filter); H- or C-ESP (hot- or cold-side electrostatic precipitator); SDA (spray dryer absorber); W-P-Scrbr (wet particulate scrubber); FGD (flue gas desulfurization).

- 85 + % mercury removal at a plant burning bituminous coal with a fabric filter

Commercially Available: Companies Buying Mercury Control Equipment Today

There is significant commercial activity underway in the air pollution control industry to meet the needs of power companies to comply with new mercury standards. In particular, the combination of more stringent state rules, state consent decrees, permit requirements—and now, state activity surrounding implementation of EPA's rule—have significantly increased commercial activity over the past two years.

According to the Institute of Clean Air Companies (ICAC):

- Over 12 different coal-fired power companies from around the country have signed contracts with equipment manufacturers to install mercury control equipment.
- Over 80 bids have been completed by one manufacturer alone for installing activated carbon injection.
- At least 7 different manufacturers of mercury-specific pollution control equipment are in business today in the U.S.

Modernizing the Industry: A Boost for Local Economies

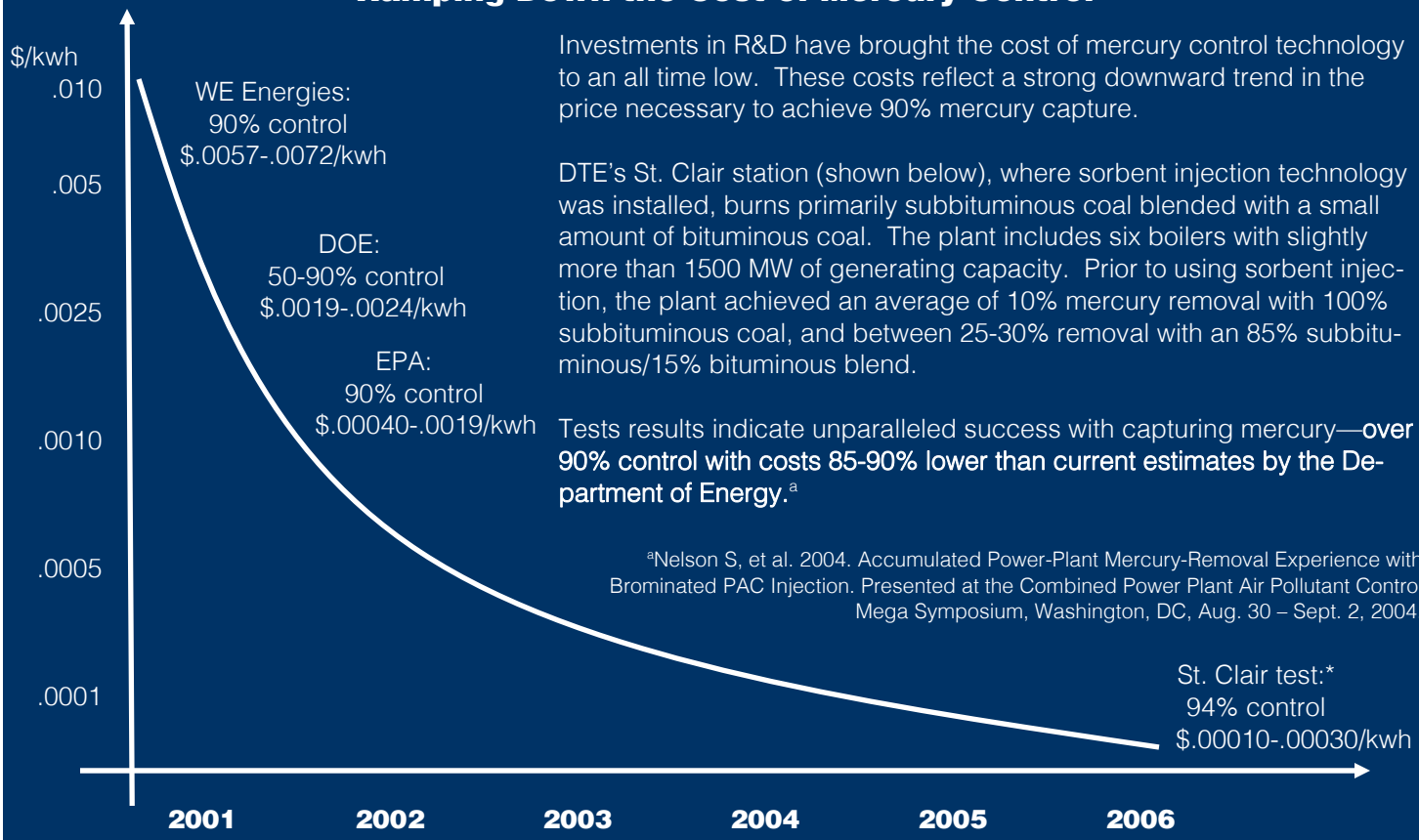
Today, manufacturers of pollution control equipment employ over 130,000 people nationwide. The industry estimates that this number will likely double in the next decade as power companies face a wave of new pollution control requirements at the state and federal level.

Several construction projects currently underway, or projected to commence, illustrate the potential for job creation and economic growth associated with modernizing the nation's power industry. Below are a few examples:

- 1,000 construction jobs generating $250 million in wages at Xcel Energy's Comanche plant (Colorado)
- 1,000 construction jobs generating $300 million in wages at MidAmerican Energy's Council Bluffs plant (Iowa)
- 940 construction jobs generating $32 million in wages at PNM's San Juan plant (New Mexico), and an additional $14.7million in local and state taxes between 2005 and 2014.

The Institute of Clean Air Companies recently estimated that installing pollution control equipment at six of Maryland's coal burning power plants will require 3,000 person-years of labor, generating $150 million in wages.

Ramping Down the Cost of Mercury Control



Investments in R&D have brought the cost of mercury control technology to an all time low. These costs reflect a strong downward trend in the price necessary to achieve 90% mercury capture.

DTE's St. Clair station (shown below), where sorbent injection technology was installed, burns primarily subbituminous coal blended with a small amount of bituminous coal. The plant includes six boilers with slightly more than 1500 MW of generating capacity. Prior to using sorbent injection, the plant achieved an average of 10% mercury removal with 100% subbituminous coal, and between 25-30% removal with an 85% subbituminous/15% bituminous blend.

Tests results indicate unparalleled success with capturing mercury—**over 90% control with costs 85-90% lower than current estimates by the Department of Energy.**[a]

[a]Nelson S, et al. 2004. Accumulated Power-Plant Mercury-Removal Experience with Brominated PAC Injection. Presented at the Combined Power Plant Air Pollutant Control Mega Symposium, Washington, DC, Aug. 30 – Sept. 2, 2004.

States Take the Lead

Before the federal government finalized its mercury rule in March 2005, several states already had implemented rules requiring power plants to reduce their mercury emissions by up to 90% within a decade.

Since March 2005, a number of additional states have signaled their intent to develop plans to reduce mercury from power plants more aggressively than EPA requires. In most cases, states are looking to impose reduction requirements on the order of 80-90% control before 2015. This is over a decade sooner than EPA's rule would require. In addition, with states rejecting EPA's national mercury trading program, mercury reductions will occur within their state borders, thereby guaranteeing immediate benefit to people and wildlife.

Below is a snapshot of current state action on mercury reductions from power plants. For a more detailed review of state activities, please see NWF's factsheet.

States with final rules or legislation:

- New Jersey
- Connecticut
- Massachusetts
- Wisconsin

States with consent decrees or permit requirements currently being implemented for new or modified sources:

- Montana
- Colorado
- Iowa
- New Mexico

States where administration has announced plans to regulate more stringently than EPA's rule:

- Pennsylvania
- Maryland
- Minnesota
- Georgia

Photo: Donny Browning. FWS

Real Impact: Reducing Mercury Benefits Fish and Wildlife

Scientific studies have repeatedly shown that there is a clear local benefit to controlling mercury pollution. When mercury emissions are reduced, levels of contamination in downwind water bodies decrease – in a matter of years, not decades as scientists once predicted. Following are several examples where the local benefits of reduced mercury pollution have been documented:

A recent 10-year study in the Florida Everglades found that there was a nearly 1:1 relationship between the mercury going into the air and the mercury levels in largemouth bass downwind. Incinerator emissions in southern Florida — the largest source of mercury emissions in the area through the early 1990s — declined by approximately 99 percent over a 10 year period due to pollution prevention programs and other controls placed on the industry. In response to this decrease, mercury levels in fish and wildlife declined by about 60 percent.

Long-term monitoring data from Massachusetts recently revealed that significant decreases in fish tissue concentrations (as much as 60% in some lakes) resulted within 3-4 years of the adoption of stringent mercury emission reduction requirements on nearby pollution sources.

A study in northern Wisconsin found that a 10% decline in mercury air deposition from 1995-1999 was accompanied by a 5% decline in mercury levels in yellow perch during that same period. The researchers attributed the decline in mercury deposition to regional mercury reduction measures.

In New Hampshire, scientists documented a decline in mercury levels in fish and loons when mercury emissions were reduced from upwind sources.

A recent EPA study found that 70% of the mercury contained in rain collected at an Ohio River Valley monitoring site came from nearby coal-burning plants.

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