HEALTH FACTS

Summary of Recent Mercury Emission Limits for Power Plants in the United States and China

2011 was a banner year for mercury clean up commitments from power plants. Both China and the United States adopted landmark standards to curb mercury emissions among other pollutants as well from power plants, addressing the largest global source of mercury air pollution. Globally, coal-fired power plants are the largest source of mercury emissions, with China and the United States contributing a significant portion. In China, power plant emissions standards are expected to deliver mercury reductions in 2015, mainly through controls for other air pollutants, but nevertheless significant. In the U.S., significant mercury reductions are expected from coal-fired power plants beginning in 2016.

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CHINA

- On July 18, 2011, China adopted the air pollutant emission standards for coal-fired power plants, which will be effective starting January 1, 2012.[1] In addition to mercury, the new standards regulate emissions of particulate matter, sulfur dioxide, and nitrogen oxides.
- About 73 percent of China's electricity comes from thermal power plants that consume 1.6 billion tons of coal annually.[2] By the end of 2010, the country's total electricity generation capacity reached 962 million kilowatts (kW), the second highest in the world.
- The total mercury emission from power plants in China was estimated to be 123.3 tonnes in 2007. Today, coal power plants alone contribute almost 20 percent of mercury emissions in China. Fortunately, increasing use of scrubbers has led to decreasing mercury emissions over time.[3]
- The estimated *cost of compliance* with the new standards could be about 260 billion yuan ($40.7 billion) in new investments for power companies by 2015.[4] (Note that mercury limits appear to be a minor portion of total cost).
- The *emission limits* for mercury and mercury compounds were set at 0.03 milligrams per cubic meter (mg/m^3) for both new and existing coal-fired power plants beginning on January 1, 2015. *Monitoring and enforcement* of the standards are left to local environmental departments. It is suggested that air monitoring be done in sensitive areas such as residences, schools, and hospitals, or according to zones defined by the Environmental Impact Assessment. Stack testing is also suggested.

UNITED STATES

- On December 21, 2011, the U.S. Environmental Protection Agency (EPA) issued final mercury and other emission standards for power plants.[5] Table 1 summarizes these standards. All power plants with 25 megawatts or more of capacity will have to meet the new standards within *four* years.[6]
- The EPA estimates that roughly 600 power plants with 1,100 coal-fired units and 300 oil-fired units will be affected by the rule. In addition to mercury, this rule regulates emissions of particulate matter, sulfur dioxide, nitrogen oxides, acid gases including hydrogen chloride and hydrogen fluoride, and other heavy metals including arsenic, cadmium, chromium, lead, and nickel.
- Power plants are responsible for 50 percent of mercury emissions in the United States, for which coal-fired units contribute 99 percent of emissions. Roughly 40 percent of coal-fired plants currently lack advanced pollution control equipment.
- Expected *mercury emissions reductions* in 2016 will be 20.0 tons from the power sector (*a 70 percent reduction relative to the status quo*).[7]
- The estimated annualized cost of compliance for the power plants to control all the pollutants is $9.6 billion.[8] The mercury controls account for roughly one-fifth of the total cost, or $2 billion.

Table 1: Mercury Emission Standards for Coal and Oil-fired Power Plants in the United States				
		Subcategory	**Mercury Emission Limit (lb/GWh)**	**Expected Technology**
Coal- and oil-fired Units	**Existing**	Regular coal	0.013	**Fabric Filters, Activated Carbon Injection (ACI), and Upgrades to Existing Controls**
		Designed for low-rank coal[a]	0.12 or 0.040	
		IGCC (gasified coal)	0.030	
		Solid-oil derived & Continental liquid oil	0.0020	
		Non-continental liquid oil	0.0040	
	New	Regular coal	0.00020	
		Designed for low-rank coal	0.040	
		IGCC (gasified coal)	0.0030	
		Solid-oil derived	0.0020	
		Continental liquid oil	0.00010	
		Non-continental liquid oil	0.00040	

lb/GWh = pounds pollutant per gigawatt-electric output

[a] Most of these units burn lignite coal.

Source: EPA MATS Final rule, pages 347-351, http://www.epa.gov/mats/pdfs/20111216MATSfinal.pdf. Accessed March 20, 2012.

Continuous compliance with mercury limits can be demonstrated through Continuous Emissions Monitors (CEMS) or sorbent trap monitoring systems. Costs of mercury monitoring are expected to be roughly $23,000 for sorbent traps—with annual operational costs of $128,000—or $271,000 for Hg CEMS—with annual operational costs of $110,000.

EXPECTED MERCURY CONTROLS

The types of pollution controls expected on coal power plants (measured in gigawatts (GW) of capacity) in 2015 with the proposed rule, versus without it (Base Case), are summarized in table 2. Activated carbon injection (ACI) is expected to triple to an installed capacity of 148 GW of coal capacity, comprising almost half of all coal generating capacity in 2015 (310 GW total).

Table 2: US Power Plant Control Technologies Expected With and Without the Mercury Rule (MATS)		
Control Technology	**Base Case Capacity (GW, 2015)**	**Total Capacity with MATS (GW, 2015)**
Wet FGD(Flue gas desulfurization)	180	174
Dry FGD	29	51
FGD Upgrade	-	63
DSI (Dry sorbent injection)	9	52
SCR (Selective catalytic reduction)	146	146
ACI (Activated carbon injection)	49[a]	148
FF (Fabric filter)	90	191
ESP (Electro-static Precipitator) Upgrade	0	34

Source: RIA 3-16 and personal communications with various U.S. Environmental Protection Agency staff, January 2012.

[a] This is a 2012 estimate based on the U.S. Environmental Protection Agency's National Electric Energy Data System (NEEDS) database, v4.10_MATS, available at: http://www.epa.gov/airmarkets/progsregs/epa-ipm/toxics.html. Accessed March 20, 2012. The final MATS documentation did not include a base case estimate of expected ACI use towards state rules in 2015.

COMPARISON OF US AND CHINESE STANDARDS

The Chinese mercury standard for coal-fired power plant emissions is twice as high as the weak end of the range of the U.S. standards for coal plants, which are measured in units of power output to encourage energy efficiency. Converting the U.S. standards to mg/m^3 requires the heating value of the coal to be factored in; thus, the following are examples of how two different power plants may compare to the **Chinese standard (0.03 mg/m^3)**:

1) **U.S. standard**, as it applies to a Bituminous coal plant: **0.0017 mg/m^3** (0.013 lb/GWh)

2) **U.S. standard**, as it applies to a Lignite coal plant: **0.0153 mg/m^3** (up to 0.12 lb/GWh)

The biggest reason for the difference is that lignite—or "low rank"—coal plants in the United States have a much less stringent standard. Note that the Chinese standard is similar to an old German standard for mercury emissions from waste combustion. A recent report by the China Council for International Cooperation on Environment and Development (CCICED) recommended that China tighten its mercury standard to 0.005 mg/m^3 by 2015, and 0.003 mg/m^3 by 2020. If this recommendation was followed, according to the CCICED, China mercury emissions would be reduced from 2007 levels by an additional 10 percent by 2015, and an additional 30 percent by 2020, even with a 10 percent annual growth of coal consumption within this sector.[9]

Health Impacts of Mercury Pollution

Exposure to mercury, even in small amounts, is a great danger to humans and wildlife. When mercury enters the body it acts as a neurotoxin, which means it harms our brain and nervous system. Mercury exposure is especially dangerous to pregnant women and young children, but all adults are at risk for serious medical problems. Most mercury pollution is produced by coal-fired power plants and other industrial processes. The most common way we are exposed to mercury is by eating contaminated fish.

1 Ministry of Environmental Protection of the People's Republic of China, *Emission Standard of Air Pollutants for Thermal Power Plants*, GB 13223-2011; http://www.zhb.gov.cn/gkml/hbb/qt/201109/t20110921_217526.htm accessed March 20, 2012 (Translated into English by NRDC, Beijing).

2 Li Jing, China Daily, Emission rules on power plants get tougher, http://www.chinadaily.com.cn/bizchina/2011-09/22/content_13764129.htm accessed March 20, 2012.

3 The China Council for International Cooperation on Environment and Development, Executive Report, Special Policy Summary of Mercury Management in China, November 2011.

4 $1 = 6.382 yuan; http://uk.reuters.com/article/2011/09/22/us-china-emission-power-idUKTRE78L0U120110922.

5 For information on the U.S. Environmental Protection Agency's (EPS) mercury regulation for power plants, "Mercury Air Toxics Standards" or "MATS", see: http://www.epa.gov/mats/ accessed March 20, 2012.

6 This is a slight adjustment from the three-year Clean Air Act requirement from earlier drafts of the regulation. It includes acknowledgement that state permitting authorities can also grant an additional year as needed for technology installation. The EPA expects this option to be broadly available.

7 This number would be higher if state mercury reduction efforts were not considered. Instead, the EPA rightly acknowledges mercury control programs in various states and the progress made to date under those programs.

8 EPA, Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards, December 2011. http://www.epa.gov/ttn/ecas/regdata/RIAs/matsriafinal.pdf Accessed March 20, 2012.

9 The China Council for International Cooperation on Environment and Development, Executive Report, Special Policy Summary of Mercury Management in China, November 2011, p. 45.