MERCURY REGULATION IN THE UNITED STATES
HEALTH EFFECTS AND EXPOSURE PATHWAYS OF MERCURY EMISSIONS

The Regulatory Assistance Project
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The effective regulation and control of mercury emissions continues to be a top priority of health professionals and others to protect human health and the environment worldwide. In particular, coal-fired power plant emissions, both in the US and in other countries such as China, have been identified as a significant source of atmospheric mercury. These emissions impact not only the health and environment of the countries where they are produced but also are transported many thousands of miles, adversely affecting the people and ecosystems of other countries and regions.

The fate and transport of mercury emissions are generally well understood. In general, mercury emissions are deposited into soils and waters and undergo a chemical change to methylmercury. This transformed element then makes its way into the food-chain where it bio-accumulates in fish, which are then ingested by humans.

The public health impacts of this exposure are also generally well understood. Methymercury is a potent neurotoxin and its presence in humans can cause substantial adverse neurological and other impacts. In particular, fetal exposure to mercury can cause life-long learning disabilities and a wide range of serious, permanent effects.[1]

Among reputable scientists and health experts there is consensus that the reduction of mercury emissions is very important to improving public health and the environment generally.

I. Magnitude of the Problem

Atmospheric mercury occurs naturally in the environment, emitted from volcanoes and other sources and through evaporation from natural sources. And, of course, mercury emissions are also produced by human (anthropogenic) activities.

[1] "Mercury Emissions from Coal-Fired Power Plants: The Case for Regulatory Action", NESCAUM, October 2003, available at http://www.google.com/url?sa=t&source=web&ct=res&cd=1&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Frpt031104mercury.pdf%2F&ei=nvuRSeH6CJW6tweT8ZXSCw&usg=AFQjCNHt6Fi8L4-vytQVJ4v3ruRiYmgdUA&sig2=L7BW2olSdv4dCz2e5-Xi7A; "Toxicological Effects of Methylmercury", National Research Council, 2000, available at http://www.nap.edu/openbook.php?isbn=0309071402.

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As of 2008, the global anthropogenic emissions of mercury were estimated at approximately 2,427 tons per year. The following is a breakdown of these emissions by continent, tons, and shares:

Continent	Tons	Percentages
Asia	1,311	54%
Africa	388	16%
Europe	340	14%
North America	170[2]	7%
South America	97	4%

For the US, the electric power sector's mercury emissions, at approximately 48 tons, constitute about one-third of the nation's total man-made mercury emissions.

II. History of Mercury Emissions Control in the US

Despite widespread agreement on the health effects of mercury emissions and the need to control and reduce them, it has nevertheless proven difficult in the US to develop and implement an effective program at the national level to achieve the goal of reducing mercury air emissions from coal-fired power plants.

As early as 1970, the federal Clean Air Act (CAA) required EPA to set emissions standards for hazardous air pollutants at levels that would provide ample margins of safety to protect public health (CAA Section 112). But, importantly, mercury emissions from power plants were exempted from this requirement.

Other mercury emissions, however, were not. The sources that were regulated under this authority included the processing of mercury ore, the use of mercury chlor-alkali cells to produce chlorine gas, and incinerators and dry wastewater treatment plants. But, beyond these few areas of control no significant other mercury emission regulations were developed. This was also the case for many other categories of hazardous emissions.

In 1990, the Clean Air Act was amended. Congress was dissatisfied with the slow pace with which EPA had regulated hazardous air pollutants. Only eight pollutants had been regulated by EPA in the previous twenty years, and many of these regulations were heavily litigated before they were able to become effective. Congress significantly revised Section 112 of the CAA to create a very specific two-step process to regulate hazardous emissions, along with prescribed timelines for when the new standards were to become effective. This amendment also established a list of 166 Hazardous Air Pollutants (HAPs), now expanded to include 187, of which one was mercury. EPA was required to regulate the list of pollutants established by Congress within ten years.

Under this new approach, EPA promulgated Maximum Achievable Control Technology (MACT) standards, which reflected the average level of emission control achieved by the best performing 12% from among the existing sources in a particular category. MACT is defined as "the

[2] The United States is responsible for 161 tons, Canada for nine.

maximum degree of reduction" that EPA determines is achievable at a particular time, taking into account such factors as cost, energy requirements, and health and environmental impacts.

After MACT standards had been implemented, EPA was then required to determine if there was any remaining residual risk—risk above a determined level. If so, then EPA was authorized to establish further controls for that sector.

Pursuant to the amended Section 112 mandates, EPA established mercury emission limits for several sources, including municipal waste combustors in 1995, medical waste incinerators in 1997, and hazardous waste incinerators in 1999.

Despite these meaningful achievements, EPA still lagged far behind in its responsibility to establish MACT standards for many sources, including mercury emissions from the power sector. Standards for this sector were to be proposed by 1995 and the sources were to be subject to the standards by 2000 if EPA found, as it did in late 2000, that it was appropriate and necessary to regulate mercury emissions from the power sector.

Also, in 1998, EPA required utilities to collect information on the mercury content in coal and required some larger utilities to measure their mercury emissions. These data informed EPA's later regulatory actions.

In 2003, in a step that would have effectively substituted a federal law for the EPA regulation of mercury emissions, President Bush proposed the Clear Skies legislation. This proposed law would have required emissions reductions of NO_X, SO_2 and mercury through the use of cap-and-trade mechanisms. However, Congress failed to pass this legislation. Many legislators felt that the reduction levels proposed were too weak and that the cap-and-trade provision for mercury could have the unwanted effect of creating "toxic hot spots"—areas near power plants with very high levels of mercury in the environment.

In 2004, EPA proposed a regulation that offered two alternative approaches to regulating mercury emissions from the power sector:

1. The Agency would establish an emissions standard using the Congressionally prescribed approach to regulate hazardous air pollutants; or
2. It would reverse its previous finding that it was necessary and appropriate to regulate mercury emissions from power plants, thereby proceeding under a different section of the CAA, one that had been traditionally used only to set performance standards for new sources, and develop a cap-and-trade program.

In 2005, EPA chose the second option and promulgated a regulation, referred to as the Clean Air Mercury Rule (CAMR). This was the first significant federal law to actually regulate mercury emissions from the power sector, and it made the US the first nation to do so.

CAMR established a market-based cap-and-trade program for power sector mercury emissions with two phases of reductions over a 13-year period. It required the power sector to reduce

emissions to 38 tons per year by 2010 and to 15 tons per year by 2018. These reductions would have constituted 70% reductions below then current levels. Mercury emissions were to be apportioned among 47 states, two Native American tribes, and the District of Columbia.

However, in 2008, following the filing of a legal challenge to CAMR by 15 states and other groups, a federal appeals court ruled the regulation to be invalid and remanded it to EPA for further action. Thus, it is not now in effect and, once again, the US is without a mercury emissions reduction law. The federal court identified several legal deficiencies with the rule, including that EPA had the legal obligation to regulate mercury as a HAP once it made its finding that it was necessary and appropriate to regulate it. EPA then appealed the adverse ruling to the US Supreme Court. Many states have since developed their own regulations to reduce mercury, as explained below.

III. Costs of Control

In recent years, various US federal agencies have developed estimated costs of mercury controls. These costs have ranged from a high of about $10 billion nationally to a low of $1.7 billion. The lower estimate, by EPA, was for a reduction of 65% in power sector emissions and was projected to be achieved through a combination of technology and policy: carbon injection with spray cooling and fabric filters and a cap-and-trade mechanism. Peer-reviewed studies have found that the health benefits of reducing mercury emissions far exceed the costs.[3]

The 2000 EPA Notice of Regulatory Finding also determined that the use of a multi-pollutant strategy would reduce costs significantly. That is, through the installation and use of controls for other pollutants, such as SO_X and NO_X, that mercury would also be reduced, thus further reducing the unit costs of mercury control.

IV. Technologies and Mechanisms of Control

The 2000 EPA Notice of Regulatory Finding determined the use of oxidizing agents or sorbents injected into the gas stream would be effective in reducing mercury emissions. More recently, the Northeast States for Coordinated Air Use Management (NESCAUM), a coalition of eight northeast states that work together on air pollution issues of mutual concern, determined that power plant mercury emissions could be reduced 90%—i.e., from 48 tons/year to 7 tons/yr—with existing technology, including activated carbon injection.[4]

[3] "Economic Valuation of Human Health Benefits of Controlling Mercury Emissions from US Coal-fired Power Plants," NESCAUM, February 2005, available at http://www.nescaum.org/documents/rpt050315mercuryhealth.pdf/.
[4] "Mercury Emissions from Coal-Fired Power Plants: The Case for Regulatory Action," NESCAUM, October 2003, available at http://www.google.com/url?sa=t&source=web&ct=res&cd=1&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Frpt031104mercury.pdf%2F&ei=FPuRSbTEIOCbtwf6lezcCw&usg=AFQjCNHt6Fi8L4-vytQVJ4v3ruRiYmgdUA&sig2=l0wsNQL5307EhsS8Y7smsA.

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V. State and Local Control Efforts

CAA Section 112(l) allows for state and local programs to control toxic emissions like mercury. In the absence of federal action to regulate mercury, a number of US states and cities have now adopted laws to regulate such emissions from the power sector and other sources. These laws are currently the primary means by which power sector mercury emissions are regulated in the US.

There are several notable state efforts. Pennsylvania, which is one of the largest coal- producing and coal-using states in the US and which has 36 coal-fired power plants, adopted a regulation in 2007 requiring, by 2015, a 90% reduction in mercury emissions from 1999 levels, with no trading between companies or between states (note that EPA's CAMR called for only an 86% reduction by 2026).[5] Connecticut adopted a law requiring that, by June 2008, power plants (a) will emit no more than 0.6 pounds of mercury per million Btu of output or (b) will have reduced their output of mercury by 90% reduction, whichever is more readily achievable. Maine enacted a law that, beginning in 2007, limits emissions from any one source to 35 pounds per year; in 2010, that limit will drop to 25 pounds per year. Massachusetts law requires that, by 2008, sources reduce their mercury output by 85% or not exceed 0.0075 pounds per gigawatt-hour; in 2012, the requirements become more stringent, 95% or 0.0025 pounds/GWh, respectively (the law does allow, however, for averaging among units of the same facility). New Hampshire requires an 80% reduction though the use of scrubbers by 2013.[6] And, lastly, the National Association of Clean Air Agencies (NACAA) has developed a model regulation that can be used by state and local air agencies to regulate mercury emissions.[7]

VI. Conclusion

It has been difficult, at the federal level, to establish a meaningful regulatory program to reduce mercury emissions from the power sector. But, after almost 40 years of study and efforts, the US seems poised finally to take action. It is expected that President Obama and EPA Administrator Jackson (who is from a state that has regulated mercury) will move quickly to propose a new federal regulatory program for significant reductions of mercury emissions from the power sector. On February 4, 2009, President Obama announced that the government would drop the appeal, filed by the Bush Administration, of the federal court's ruling against CAMR. Instead, the president said that he was directing the EPA to develop a new mercury emissions reduction program. The actions of the several states may serve as models for the new federal rule, as they can as well for those of other nations.

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[5] A federal court has recently ruled that Pennsylvania does not have the authority to regulate mercury emissions because EPA is regulating them. The State is expected to appeal this ruling.

[6] A comprehensive listing of state programs is provided at "State Mercury Programs for Utilities," *National Association of Clean Air Agencies*, December 4, 2008, available at http://www.4cleanair.org/documents/StateTable.pdf.

[7] "Regulating Mercury from Power Plants: A Model Rule for States and Localities," *State and Territorial Air Pollution Program Administrators* and *Association of Local Air Pollution Control* Officials, November 2005, available at http://www.4cleanair.org/FinalMercuryModelRule-111405.pdf,

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