Mercury Regulatory Policy and Electric Utilities

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Introduction

On December 15, 2003, Environmental Protection Agency (EPA) Administrator Leavitt signed the "Utility Mercury Reductions" proposal—the first-ever proposed rule to regulate mercury emissions from new and existing coal-based power plants and nickel emissions from new and existing oil-based power plants. The Utility Mercury Reductions proposal contains two alternative control plans—a market-based cap-and-trade approach and a Maximum Achievable Control Technology (MACT) standard. This paper will give a brief history, synopsis, and critique of this regulatory proposal, and how it compares to other proposed policies aimed at controlling mercury emissions from the electric utility industry.

Regulation of Power Plant Mercury Emissions

The Clean Air Act Amendments (CAAA) of 1990 authorize EPA to regulate mercury emissions and other air toxics from electric utilities, if necessary, to protect against specific threats to public health caused by these emissions. On December 14, 2000, EPA issued a "regulatory determination" under the Clean Air Act (CAA) that regulation of mercury is "appropriate and necessary" for coal- and oil-based power plants, and that certain other hazardous air pollutants (HAPs) pose a "potential concern for carcinogenic effects…[and] public health."[1] EPA listed coal-based power plants for regulation under §112(c) of the Clean Air Act—the list of source categories for which EPA must develop emissions standards based on the Maximum Achievable Control Technology (MACT). Under the MACT program, emissions restrictions based on the levels achieved in practice by the best performing 12 percent of plants must be applied to all existing plants.

The EPA regulatory determination noted, "there are uncertainties regarding the extent of the risks due to electric utility mercury emissions."[2] Previously, in its Mercury Research Strategy, in which EPA describes its strategic approach for its mercury research program through 2005, the agency stated that "[t]he amount of mercury deposited in the United States that can be directly attributed to domestic combustion sources remains uncertain."[3] Notwithstanding these conclusions, EPA began to craft a proposed standard for mercury that would require MACT. Under the terms of a consent decree, EPA proceeded on a track to issue a proposed rule by December 2003, a final rule by December 2004, and to require compliance by December 2007.

The December 2000 regulatory determination limited the EPA Administrator's policy options, specifically with respect to implementing a flexible and cost-effective program. Electric utilities are explicitly treated differently under the CAA than other major sources of HAPs. Under §112(n)(1)(A) of the CAA, EPA is not required to regulate electric utility plants using the MACT program. As EPA stated, "if EPA determines that regulation of mercury emissions from electric utilities is necessary and appropriate, EPA would have the full set of regulatory tools available under §112 to address those emissions, including §112(f), as well as any alternative control strategies the Agency has identified in its Report to Congress."[4]

Mercury Emissions From Power Plants

Trace amounts of mercury are naturally present in coal. As a trace metal that is emitted during coal combustion, mercury is transformed into three major chemical species: elemental, ionic (or oxidized), and particulate. The chemical species of mercury formed during the combustion process and post-combustion conditions vary significantly from one plant to another. Of the total mercury formed, the amount of elemental mercury varies from 10-90 percent. Elemental mercury usually travels great distances from its source, and can remain in the atmosphere for months to years. Ionic mercury is water soluble, and as such, falls or washes out of the air. Deposition of ionic mercury is typically in the local vicinity (50–100 km) of its source.

In order to assess mercury emissions from coal-based power plants, in 1998 EPA issued an Information Collection Request (ICR)[5] that required owner/operators to report for calendar year 1999 the quantity of fuel consumed and the mercury content of that fuel. In addition, 84 plants were selected to measure flue gas mercury emissions and its chemical form. Based on analysis of the ICR data, EPA concluded that U.S. electric utilities release about 48 tons of mercury every year, which is roughly one-third of the total anthropogenic emissions of mercury in the United States, less than 10 percent of total North American emissions, and about one percent of total global mercury emissions.

Mercury Controls

A power plant which burns fossil fuels for the generation of electricity is typically equipped with a high-efficiency baghouse—fabric filter (FF)—or electrostatic precipitator (ESP) for particulate removal; staged-combustion burner configurations for low-nitrogen oxides (NO_x) emissions; and post-combustion flue gas treatment devices for NO_x and sulfur dioxide (SO_2) control—selective catalytic reduction (SCR) and selective noncatalytic reduction (SNCR) technologies for NO_x control, and high-efficiency flue gas desulfurization (FGD) scrubbers for SO_2 control. Not all power plants utilize all these control devices. For example, about 65 percent of plants use only an ESP, 10 percent use only a FF, and 25 percent use a combination of an ESP and wet FGD to control particulates; about 25 percent of plants use scrubbers and the rest either use low-sulfur coal or fuel-switch to control SO_2.[6]

Mercury control options are highly dependent on the existing power plant's design, operating characteristics, and fuel used—in the case of coal, the type of coal used is also important. Thus, potential mercury emissions are unique to each unit. For some plants, mercury emission reductions of 70–90 percent may be impossible to achieve. In addition, there is still considerable uncertainty in the measurement of mercury emissions, since mercury CEMs will most likely not be commercially available, accurate, or reliable within the next few years.

The characteristics of the coal-based plant that most affect emissions of mercury and the type of control technology used are the mercury content and other chemical aspects of the coal (particularly the chloride content); the boiler operating conditions; the design and operation of any particulate collection devices; the design and operation of any flue gas treatment systems; and the use of advanced NO_x removal technology, such as SCR and SNCR.

In addition to removing specific pollutants, such as fine particulates, SO_2, and NO_x, currently installed air pollution controls may also remove mercury. Measurements at a variety of U.S. power plants performed under EPA's mercury ICR indicate that existing emission control devices for particulates (fly ash) and SO_2 capture, on average, approximately 40 percent of the mercury present in the flue gas from burning coal, as well as a large amount of non-mercury HAPs. Mercury removal rates, however, varied from 0 to more than 90 percent among the power plants that were tested.[7]

EPA, DOE, and others are in agreement that the implementation of further controls for reducing SO_2 and NO_x as required in the proposed Interstate Air Quality Rule (IAQR), will result in significant additional reductions in mercury emissions. Focusing on these "co-benefits" of reduced mercury emissions also would allow adequate time for the development and commercialization of mercury control technologies that are currently in progress.

MACT Alternative Control Plan

One alternative control plan in the Utility Mercury Reductions proposal to set national emission standards for hazardous air pollutants (NESHAP) pursuant to §112 of the CAA. The proposed §112 MACT rule would require coal- and oil-based power plants to meet HAP emissions standards reflecting the application of the MACT determined pursuant to the procedures set forth in CAA §112(d).

In October 2002, the final report of the Utility MACT Working Group was submitted to the Clean Air Act Advisory Committee. This report included recommendations of the "Industry Stakeholder Group," which comprised owners and operators of electric utility steam generating units from both the public and private sectors, fuel suppliers, labor unions, and others. The Group summarized major issues and posed options to be considered by EPA in developing a MACT rule.

Among the major issues raised, a couple remain with respect to the MACT alternative control plan: first, the presumptive three-year compliance period contained in §112(d) is too short. Based on real-world considerations, and particularly for those facilities that would be required to make major capital expenditures (e.g., installing a scrubber), it will take many years to bring all coal-fired electric utility steam generating units into compliance with a MACT standard. Second, the extremely restrictive emission limits for new sources do not appear to be justified based on the rationale for the emission limits for existing units.

Although the MACT alternative allows for some flexibility for power plants to achieve those reductions—subcategorization by coal type, accounting for variability in emissions and plant operations in the MACT floors, a 12-month rolling average to measure compliance, allowing facility-wide averaging, the format of the standard for existing units—analyses by the U.S. Energy Information Administration (EIA)[8] and others indicate that a command-and-control reduction program would be significantly more expensive than a cap-and-trade system that would achieve the same levels of mercury emission reductions.

Cap-and-Trade Alternative Control Plan

Emissions trading is a system of establishing a cap on emissions and allowing sources the flexibility to choose the emissions reduction plan that works best for their situation, including increasing efficiency, using lower-emitting fuels, installing pollution control equipment, and trading. Trading allows a source that can over-control its emissions to sell extra reductions to another source for which controls would be very expensive or technologically difficult (e.g., small units). Without trading, small units may have to shut down, even though their total emissions are low. Emissions trading gained prominence with the implementation of the Title IV (Acid Rain Control) trading program for SO_2 in the 1990 CAAA.

The other alternative control plan in the Utility Mercury Reductions proposal is a market-based cap-and-trade approach. The proposal would amend CAA §111 rules and would establish a mechanism by which mercury emissions from new and existing coal-based power plants would be capped at specified, nation-wide levels. EPA states that the primary goal of this approach is to reduce power plant mercury emissions 70 percent from current levels by 2018, and sets a 15 ton cap on these emissions in 2018. A near-term cap is also set in 2010 at a level that reflects mercury "co-benefits"—defined as the maximum reduction in mercury emissions that could be achieved through the installation of FGD and SCR units that will be necessary to meet the 2010 caps for SO_2 and NO_x in the proposed IAQR.

Some critics view emissions trading as "buying the right to pollute," expressing concern about local "hot spots" where emissions could increase as a result of emissions trading. Many groups accept this logic for mercury and oppose mercury trading due to perceived "localized effects on public health." Based on many years of real-world experience, studies of the SO_2 allowance trading program conducted by EPA,[9] the Environmental Law Institute,[10] and Resources for the Future[11] demonstrate that trading did not significantly change where emission reductions actually occurred. The clear success of the acid rain SO_2 trading program provides evidence to allay fears about localized effects.

There are two major reasons which suggest that localized effects will not occur with a mercury emissions trading program. One, the trading of allowances is most likely to involve large coal-based power plants controlling their emissions more than required and selling allowances to smaller plants. This viable assumption is based on the basic economics of capital investment in the utility industry. Under a trading system where emission-removal effectiveness is unrelated to plant size, it makes more economic sense for the utility to allocate pollution-prevention capital to its larger facilities than to smaller plants (since more allowances will be earned). Thus, any economies of scale of pollution control investment will favor investment at the larger plants. Two, the species of mercury that are deposited locally—oxidized and particulate mercury—are controlled by the same equipment that controls fine particles, SO_2 and NO_x. As noted earlier, these species of mercury are more likely to be deposited locally than gaseous elemental mercury, which is transported long distances from the source. As utilities install controls to comply with the new fine particle and ozone control regulations of the IAQR, a "co-benefit" in mercury control will accrue as particulate controls, scrubbers, and SCR units are installed on an increasing percentage of coal-based power plants. Therefore, the economics of a trading system are likely to favor controls of mercury that are likely to be deposited locally, thereby reducing any local hot spots.

Legislative Multi-Emissions Approach.

Many in government, industry, and academia believe that the current regulatory approach—with its uncoordinated and inconsistent air quality regulations—is duplicative, costly, and complex, and presents significant challenges and uncertainties. Coal-based electric generators are currently subject to more than 20 major environmental regulations aimed at reducing power plant air emissions. For these reasons, many policymakers and regulators have concluded that there is a better way to achieve air quality goals, while protecting the environment and public health. A "multi-emissions" strategy, if properly designed, could streamline the current regulatory process, provide greater certainty to electric companies, accomplish the nation's air quality goals at a fraction of the cost, and maintain a reliable supply of electricity.

The National Energy Policy report released in May 2001[12] noted that uncertainty about future environmental controls is of particular concern for companies that operate existing coal-based power plants, and that future coal electricity generation will need to meet new challenges to reduce mercury emissions. To address these concerns, the report recommended that EPA work with Congress to propose legislation that would establish a flexible, market-based program to reduce and cap emissions of SO_2, NO_x, and mercury from electric

power generators. The report concluded that such a program would provide significant public health benefits even as electricity supplies are increased.

As a result of the report's recommendations, numerous proposals have surfaced to reduce utility mercury emissions. These range from applying "co-benefits," to 90 percent-plus removal. In February 2003, the "Clear Skies Act of 2003" was introduced, which requires sulfur dioxide (SO_2), nitrogen oxides (NO_x), and mercury emissions from power plants to be reduced by about 70 percent over the next decade using a market-based cap-and-trade approach.

A legislative strategy for improving air quality—with clear, congressionally-mandated emissions cuts—would provide far greater certainty and produce air quality improvements almost immediately. The Utility Mercury Reductions proposal's cap-and-trade alternative approximates the requirements of the Clear Skies Act, but ultimately leaves the design of the program up to individual states. This could be potentially confusing to implement and prove more costly to electricity customers than a national cap-and-trade program, which would reduce emissions just as fast. The MACT alternative would be far more expensive—yet no more effective—than a cap-and-trade approach. EPA Administrator Mike Leavitt, in announcing the Utility Mercury Reductions proposal, said it best himself: "Enacting Clear Skies is by far the best route to better air quality in the most cost-effective manner."

Conclusion

Federal efforts to limit electric utility mercury emissions continues to proceed on two tracks. In the Utility Mercury Reductions proposal, EPA has recognized that scientifically justified and verifiable mercury reductions can be achieved while at the same time providing the electric utility industry some flexibility to achieve those reductions. Further, EPA acknowledges that this flexibility can be achieved by subcategorization based on coal type, and by taking into account plant operational variability over time in setting the emission limits. However, allowing for market-based mechanisms such as trading will help achieve overall reductions and further increase the cost-effectiveness of any program.

The scientific data underlying these policy options to reduce utility mercury emissions is still evolving. EPA recognized this in its explanation of the agency's proposal to revise the regulatory finding that it made on December 20, 2000. The electric utility industry continues to test the effectiveness of various pollution control systems in reducing mercury emissions, and is funding additional health effects, fate-and-transport, and other related research. Accordingly, electric utilities are committed to working with DOE and EPA to address concerns with respect to the efficacy of emerging, mercury-specific control technologies, which are relatively new and untested on a commercial scale.

The electric power industry is subject to a broad array of federal, state, and local statutes and regulations, and is one of the nation's most regulated industries. Electric companies have exceeded many statutory and regulatory emission reduction targets, despite a growing national demand for electricity and increased electricity production. The electric utility industry understands the importance of continuing to work with EPA as the regulatory process proceeds to the next step of promulgating a final rule.

As federal efforts continue, the industry will work to ensure that critical data on the effectiveness of various pollution control systems, as well as health effects and other important related research, are available to assist EPA in developing a mercury emissions reduction program that is protective of public health, scientifically sound, flexible, and cost-effective.

References

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