Regulating Mercury from Power Plants:
A Model Rule for States and Localities

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About STAPPA and ALAPCO

The State and Territorial Air Pollution Program Administrators (STAPPA) and the Association of Local Air Pollution Control Officials (ALAPCO) are the two national associations of air quality officials in the states, territories and major metropolitan areas throughout the country. The members of STAPPA and ALAPCO have primary responsibility for implementing our nation's air pollution control laws and regulations. The associations serve to encourage the exchange of information and experience among air pollution control officials; enhance communication and cooperation among federal, state and local regulatory agencies; and facilitate air pollution control activities that will result in clean, healthful air across the country. STAPPA and ALAPCO share joint headquarters in Washington, DC.

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Acknowledgements

On behalf of the State and Territorial Air Pollution Program Administrators (STAPPA) and the Association of Local Air Pollution Control Officials (ALAPCO), we are pleased to provide *Regulating Mercury from Power Plants: A Model Rule for States and Localities*. Our associations developed this document in response to concern that the U.S. Environmental Protection Agency's *Clean Air Mercury Rule* issued in March 2005 was inconsistent with the requirements of the Clean Air Act and would not result in adequate reductions in emissions of mercury from coal-fired power plants to protect public health. This document describes two options for state and local governments that wish to develop utility mercury rules that are more protective of public health and the environment than EPA's regulation and contains model rule language for both.

STAPPA and ALAPCO express gratitude to Richard Ayres, Ayres Law Group, and Julie Wakefield for their assistance in drafting this document. We also thank John Paul (Dayton, OH) and Bill O'Sullivan (New Jersey), the associations' mercury leads, under whose guidance this document was prepared. We also appreciate the efforts of the STAPPA and ALAPCO model rule workgroup, particularly Sunila Agrawal (New Jersey), Andy Bodnarik (New Hampshire), Brock Nicholson (North Carolina), Charles Homer (Montana), Jon Heinrich (Wisconsin), Marlin Gottschalk (Georgia), Praveen Amar (Northeast States for Coordinated Air Use Management) and Sharon Weber (Massachusetts). We are grateful for the comments and input provided by other state and local air pollution control agency representatives, who helped shape the options presented in this document. Finally, we thank Bill Becker, Executive Director of STAPPA and ALAPCO, and Mary Sullivan Douglas, Senior Staff Associate of STAPPA and ALAPCO, who oversaw the project.

Once again, we believe that *Regulating Mercury from Power Plants: A Model Rule for States and Localities* will serve as a useful and important resource for states and localities as they develop approaches to regulate emissions of mercury from power plants and thank all of those who contributed to its development.

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STAPPA President

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Table of Contents

Executive Summary

Regulating Mercury from Power Plants: A Model Rule for States and Localities (Model Rule) for coal-fired electric generating units (EGUs) is intended to provide state and local governments the tools needed to obtain reductions in mercury emissions required to meet the requirements of the Clean Air Act (CAA). The Model Rule would protect public health using technologies that are available and rapidly entering the commercial market.

Mercury emissions from coal-fired electric power generating facilities pose a serious threat to public health and the environment that requires a swift and effective response. EGUs account for approximately 48 tons per year, or 43 percent, of mercury emissions in the United States. To protect public health and environment, it is necessary and appropriate to require EGUs to make major reductions in mercury emissions.

Since mercury is a hazardous air pollutant (HAP) under the CAA, the Model Rule treats mercury emissions from EGUs in the same manner as other HAP emissions. That is, like Section 112(d)[1] of the CAA, the Model Rule requires expeditious application of state-of-the-art emission control technology to each EGU.

The U.S. Environmental Protection Agency (EPA) has taken a different and less effective approach to regulating mercury emissions from coal-fired EGUs. EPA has removed EGUs from its list of HAP source categories that must be regulated under Section 112 of the CAA.[2] Rather than require the use of Maximum Achievable Control Technology (MACT) for mercury, EPA adopted the *Clean Air Mercury Rule* (CAMR). The CAMR establishes a nationwide mercury emissions cap set at a level that does not require until 2018 (13 years from now) any more mercury reductions beyond those that would result from actions taken to control other pollutants.[3] EPA's rule also provides for interstate mercury emission trading among EGUs, and allows banking of mercury "allowances." As a result, EPA predicts that the mercury emission cap will not be achieved until well beyond 2020. The EPA approach was severely criticized by EPA's own Inspector General, and by the U.S. Government Accountability Office.[4]

STAPPA and ALAPCO criticized the CAMR for providing insufficient protection for public health and the environment. The CAMR mercury emission cap does not require application of available mercury emission control technology for EGUs and the rule delays emission reductions for up to two decades. Further, interstate trading and banking could result in continuation of existing mercury "hot spots" of exposure near EGUs that choose to comply using allowances rather than reduce emissions. EPA's

use of Section 111(d) of the CAA[5] as legal authority for CAMR invites protracted legal battles that could further delay protection of public health and the environment.

State and local air pollution control officials supported national regulation of mercury emissions from EGUs as HAPs, using Section 112 of the CAA. Indeed, local and state officials, members of STAPPA and ALAPCO, were deeply involved in discussions with industry and others in an effort to develop recommendations to EPA on a Section 112 HAP rule when EPA abruptly changed course, removed EGUs from the list of sources of HAP and abandoned its clear MACT authority under Section 112 of the CAA. Instead, EPA adopted a cap-and-trade program, claiming legal authority under Section 111(d) of the CAA – an interpretation of Section 111(d) never before advanced in its 35-year history. Instead of using its unquestionable authority under Section 112 to achieve rapid reductions in mercury pollution, the agency gave EGUs an unduly extended period for compliance with a rule that fails to provide adequate protection for public health and the environment.

To provide better health protection, state and local agencies may wish to adopt their own programs to control emissions of mercury, nickel, and other HAPs from EGUs, which they are free to do.[6] This Model Rule is limited to mercury emissions from coal-fired EGUs because mercury emissions from these units represent the most serious danger to public health and the environment. STAPPA and ALAPCO's Model Rule is intended to provide guidance to state and local agencies that wish to adopt a more health-protective rule.

Under the Model Rule, all new and modified large EGUs would be required to install state-of-the-art mercury emission controls when built. All existing EGUs would be required to install such technology on an expeditious timetable. To give owners and operators of EGUs flexibility to craft their own compliance plan, the Model Rule includes two options. Option I requires each owner or operator of EGUs in the state to achieve an average 80-percent capture of inlet mercury, or meet an alternative output-based emission standard, across its in-state units by the end of 2008. By the end of 2012, EGUs would be expected to achieve 90-95 percent capture of inlet mercury, or meet an alternative output-based mercury emission standard. Emissions averaging is not allowed in Phase 2, although an owner or operator may demonstrate compliance on a plantwide basis.

Option II allows an owner or operator to bifurcate the compliance process, in order to accommodate systems that coordinate installation of mercury control equipment with control technology for sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM). In Phase 1, EGUs that constitute one-half of an owner or operator's generating capacity in the state may postpone compliance with mercury control requirements until the end of 2012, if the owner or operator makes enforceable commitments to achieve emissions reductions specified in the Model Rule for SO_2, NO_x, PM and mercury. The other half must achieve 90-95 percent capture of inlet mercury, or an alternative mercury output-based emission standard, by the end of 2008.

In the chapters that follow, we present the information a state agency will need in order to adopt its own mercury emission control requirements for EGUs. Chapters 1 and 2 summarize the current state of knowledge on the health effects and routes of exposure to mercury emitted from industrial sources, including EGUs. Chapter 3 recounts the history of federal efforts to curtail mercury emissions from EGUs. Chapter 4 relates the state-of-the-art in mercury emission control technology. Chapter 5 details the efforts of the states to date to control mercury emissions from EGUs. Chapter 6 provides a preamble and the text of the Model Rule in regulatory language to make it easier for states that wish to adopt the STAPPA and ALAPCO approach.

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[1] 42 U.S.C. 7412(d).
[2] 70 Fed. Reg. 15994 (March 29, 2005).
[3] 70 Fed. Reg. 28618 (May 18, 2005).
[4] "Additional Analyses of Mercury Emissions Needed Before EPA Finalizes Rules for Coal-Fired Electric Utilities," Report No. 2005-P-00003, EPA Office of the Inspector General (February 3, 2005); "Observations on EPA's Cost-Benefit Analysis of its Mercury Control Options," Report to Congressional Requesters, GAAO-05-252, U.S. Government Accountability Office (February, 2005).
[5] 42 U.S.C. 7411(d).
[6] *See* 40 CFR 60.4101, 70 Fed. Reg. 28657 (May 18, 2005).

Chapter 1: Health and Environmental Effects of Mercury

Exposure to mercury in all its forms can cause health effects in humans and animals. At high doses, exposure in the womb to the known poison can cause such severe effects as mental retardation, cerebral palsy, deafness, and blindness.

While high-dose poisonings are rare in the United States, chronic low-dose exposure to methylmercury is widespread. EPA found in 2000 that "mercury is both a public health concern and a concern for the environment." Nationwide, most human exposures occur through eating fish and shellfish. In the United States, humans are most commonly exposed outside the workplace to methylmercury and at low doses, which can also be toxic in less obvious ways. In recent years, evidence has emerged implicating increasingly lower doses of methylmercury in adverse human health effects. The most well-documented health effects are neurotoxic. Exposures have been linked to subtle neurodevelopmental effects in children, who are more vulnerable than adults because their nervous systems are immature and their exposure is higher relative to body weight.

Children who are exposed to methylmercury before birth as a result of their mothers' fish consumption may perform poorly on tests designed to measure verbal learning, vocabulary, attention, and motor functioning. They may also suffer IQ deficits. The risk of these effects to the general population from methylmercury is low. However, the Centers for Disease Control and Prevention (CDC) reports that some 6 percent of women of childbearing age are exposed to levels of methylmercury that may put their babies at risk for these effects. Moreover, studies reveal that the harmful health effects tied to methylmercury exposure, such as cognitive impairment, are likely irreversible.

Extensive data reveal that methylmercury, when ingested in sufficient quantities, affects the development of the brain as well as the intact nervous system in humans and animals, particularly in developing fetuses. The developing child can be placed at risk when the mother is exposed before and after pregnancy because methylmercury can persist in the body for several months and is found in breast milk. The severity of effects depends on the timing and concentration of exposure, with certain windows during fetal development being most critical. In adults, sensory and motor impairment have also been documented. Other forms of mercury can also impair several organ systems.

Methylmercury exposure may also produce cardiovascular effects in adults and children. The strongest association for a link to myocardial infarction, or heart attacks, has been shown in studies of adult men. This is alarming, given that heart disease

remains the leading killer of Americans. Methylmercury has also been linked to an increased risk of blood pressure problems and heart-rate irregularities in exposed children and adults. Researchers suggest that methylmercury may interfere with the protective cardiovascular effects of fish oils but a specific mechanism of action is unknown. Methylmercury also appears to have the potential to affect the immune system. Although evidence in humans is largely lacking, animal studies suggest that methylmercury exposure can weaken the immune system function.

Current data indicate that significant numbers of pregnant women and women of childbearing age are exposed through their diets to doses of methylmercury that pose risks to the fetus. Three large studies have examined the adverse neurological effects of methylmercury exposure. Two of these studies, in the Faroe Islands and New Zealand, found that *in utero* exposures produced later neurobehavioral deficits in development, attention, fine motor function, language, visual-spatial abilities, and memory. A third study in the Seychelles Islands found no association. But the results in New Zealand and the Faroe Islands are consistent with a broad body of research on the neurotoxic effects of methylmercury. More recent studies in exposed Amazonian villagers and Cree Indians in Northern Quebec also demonstrated reduced function on neuropsychological tests. Thus the weight of evidence indicates an adverse health association.

A general agreement has emerged in the scientific community supporting the potential for moderate levels of methylmercury exposure to result in adverse health effects. The National Research Council (NRC), an arm of the National Academy of Sciences, recommended in 2000 that the findings from the Faroe Islands study be used by the EPA to set its risk-based guideline for low-dose chronic exposure. In addition, NRC found that the magnitude of exposure reported in such studies was sufficient to be linked with increases in poor classroom performance, perhaps even requiring remedial or special education classes.

EPA, among other national and international health organizations, and consistent with the recommendations of the NRC, has set a daily consumption standard of 0.1 micrograms of methylmercury per kilogram body weight per day. However, there is no evidence of a safe level given that heath effects have been demonstrated at exposures below the reference dose. In the United States, mercury contamination is so pervasive in the environment that at least 45 state health departments have issued fish consumption advisories. Experts agree that the only real remedy is to make the fish safer to eat.

The U.S. Food and Drug Administration (FDA) has also recommended that expectant and nursing mothers and young children avoid swordfish, tilefish, shark and king mackeral, and limit consumption of fish that are lower in mercury, such as shrimp, salmon, and canned tuna, to two average-sized meals or to 12 ounces a week at most. FDA also recommends consulting local fish advisories before consuming fresh-water fish. The risks posed by elevated levels of mercury in fish pose an additional public health problem because fish contain beneficial nutrients that are not easily obtained

elsewhere. Interestingly, researchers suggest that the statistical correlation between methylmercury and heart disease may be attributed to the compound's interference with the beneficial fatty acids found in varying levels in assorted fish. Yet mercury's contribution to heart disease may be related to other undiscovered toxic mechanisms as well.

In the 1999-2000 and 2001-2002 National Health and Nutrition Examination Survey (NHANES), the CDC sampled body burdens and found that almost 6 percent of women tested above the EPA threshold. Mercury ingested by a woman is then concentrated for her unborn baby. Several recent studies have compared mercury concentrations in umbilical cord blood and maternal blood and have shown that cord blood on average has 70 percent higher mercury concentrations. Based on these studies, about 410,000 babies born each year – 10 percent of the national total – have been exposed *in utero* to mercury levels that exceed EPA's reference dose. The exposures are not uniform across the population, since fresh-water fish are consumed disproportionately in the families of sports anglers, certain ethnic groups, and subsistence fishers.

Studies of the environmental effects of mercury have focused almost exclusively on wildlife impacts. Although the studies do not generally signal the decline of entire species, they do illustrate the adverse impact on wildlife of mercury contamination in different regions of the United States. For example, loon chick production in Wisconsin has shown a decline on lakes where the methylmercury content of chick blood was elevated. There is also evidence of reduced survivorship in otters in areas where mercury deposition levels are high. Meanwhile, an increasing amount of evidence indicates methylmercury affects behavioral patterns in fish populations.

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Chapter 2: Routes of Exposure, Emissions, and Deposition

Anthropogenic emissions of mercury to the air in the United States totaled 115 tons in 1999. Coal-fired electricity generating plants are the largest contributor to this amount, accounting for 43 percent, or 48 tons, of known U.S. anthropogenic air emissions, according to EPA's best available estimates. None of the coal-fired power plants in the United States is currently operating with permanently-installed mercury-specific emissions control equipment. These plants collectively remain the largest uncontrolled source of mercury pollution nationally.

Considerable reductions in mercury emissions were achieved during the 1990s by effective national regulation and control of mercury emissions from medical waste incinerators and municipal waste combustors. Likewise, effective regulation of coal-fired power plants for this hazardous air pollutant will reduce mercury emissions and deposition to surface waters. But the current contribution of EGUs remains high and will increase as new coal-fired EGUs are built.

In some areas of the country, mercury emissions from coal-fired power plants may account for as much as 80 percent of the mercury deposited, according to recent studies by the Electric Power Research Institute (EPRI). According to EPRI, the portion of mercury deposition from coal-fired plants ranges from 10 to 80 percent depending on the region. EPA's own modeling shows that in many areas of the country where there are coal-fired power plants, those plants account for more than half of mercury deposition.

After mercury is deposited from the atmosphere, it becomes bioavailable through reactions occurring in the aquatic ecosystem. Mercury can be converted by bacteria in the sediments to methylmercury, a form that is toxic to humans and wildlife. Smaller organisms pick up the methylmercury and fish become contaminated as they feed on other organisms. As larger fish eat smaller ones, methylmercury concentrations increase in the bigger fish, a process known as bioaccumulation. Consequently, larger predator fish usually have higher concentrations of methylmercury from eating contaminated prey. Those at the top of the food chain, such as humans, birds and other wildlife that eat fish, are exposed to the highest levels of methylmercury in this way.

Modeling deposition patterns for mercury is similar to modeling deposition of other pollutants, but it is complicated by the fact that power plants emit mercury in three forms, each of which has a different fate in the atmosphere. Gaseous elemental mercury may move long distances with air masses and resides in the atmosphere usually until it oxidizes, which can take up to a year. The reactive and particulate-bound forms of mercury – oxidized mercury and mercury adsorbed to particles – stay in the

atmosphere for a few days and are usually deposited within 50 to 100 miles of a source by wet or dry deposition.

The type of air pollution control devices in place and the type of coal burned can also affect the quantity and species of mercury emitted. For example, installing a selective catalytic reduction (SCR) system to control emissions of NO_x at a unit that does not have an SO_2 scrubber or Activated Carbon Injection (ACI) can increase emissions of the reactive oxidized species of mercury.

Other major anthropogenic sources of mercury emissions were regulated by EPA through MACT standards EPA adopted under its Section 112 HAP-control authority in the 1990s. Mercury emissions from medical waste incinerators and municipal waste combustors have decreased by more than 90 percent since 1990. This dramatic reduction is attributed to the installation of mercury emissions control equipment on new and existing incinerators as well as closures of small, inefficient units and declining use of mercury in products and industrial production.

The declining use of mercury in consumer products, such as paint, paper, and batteries, has also contributed to lessened emissions from municipal waste combustors. Both the use and disposal of mercury in these products are coming under increasing state and local regulation. More than 19 states have passed legislation concerning the use, sale or labeling of mercury-containing products.

Field studies show a direct relationship between mercury deposition and mercury levels in fish. The findings indicate that reducing domestic emissions of reactive mercury compounds can lower mercury concentrations in fish in the United States, regardless of distribution of contributions from natural and foreign sources. Changes in atmospheric mercury deposition can rapidly affect concentrations in fish, according to a 2002 study by Wisconsin researchers. The research team found a 10-percent decrease in deposition corresponded with a 5-percent decrease in mercury levels in fish tissue. The findings are similar to those of a South Florida study, published in 2001, that tracked the link between reductions in mercury deposition and corresponding decreases in mercury levels in water and fish tissue over a multi-year period. In another ongoing study being conducted by an international team of scientists in a lake area of northern Ontario, mercury isotopes that were added to the lake have been found in fish living in the lake within a few months. On the basis of these studies, researchers suggest that the amount of mercury added to an ecosystem from new sources, rather than that already trapped in sediment, is the main determinant of how much mercury is introduced into the food chain. These and other developing studies demonstrate the efficacy of reducing current emissions of mercury in reducing concentrations of mercury in fish and other animals.

Substantial reduction in U.S. power sector mercury emissions will not be sufficient by itself to solve the entire mercury contamination problem. Other large sources need to be controlled and several have been. But since coal-fired power plant emissions are the largest remaining source of mercury emissions, regulating this

industry is the most effective way to mitigate the existing threat to human health and the environment presented by mercury emissions. Regulation and concomitant reduction of mercury emissions will reduce the mercury contamination of fish in this country and reduce the resulting adverse health impacts. Also, it will allow the U.S. to take more of a leadership role internationally than it has to date.

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Chapter 3: History of Federal Regulation of Mercury Under the Clean Air Act

Since 1970, the Clean Air Act has provided for federal regulation of emissions of HAPs. In 1970 Congress mandated EPA to adopt HAP standards that would "protect public health with an ample margin of safety." Health-based standards for HAPs proved hard to adopt, and by 1990 EPA had managed to establish standards for only seven categories of HAP-emitting sources.

In response to this failure, Congress drastically revised the HAPs program in 1990. The new program sought to avoid cumbersome health-related investigations. Instead, it mandated that EPA establish technology-based emission limitations for sources of HAPs. Congress listed more than 180 HAPs,[1] including mercury, and ordered EPA to write "Maximum Achievable Control Technology" (MACT)[2] standards for industrial sources of these pollutants on a prescribed statutory timetable.[3]

One source category of industrial HAPs received special treatment in the 1990 CAA Amendments – "electric utility steam generating units." Rather than imposing MACT standards immediately, EPA was directed to perform a study of HAP emissions from EGUs, and to report to Congress, not later than November 15, 1994, on the hazards to public health resulting from EGU emissions.[4] EPA was to regulate HAP emissions from EGUs under Section 112 of the CAA if, based on the results of the EPA study, the Administrator determined that regulation was "appropriate and necessary."[5]

EPA's response to Congressional direction on EGU HAPs was less than prompt. In July 1995, EPA made available for peer and public review a "draft" of the Report to Congress on HAPs from EGUs.[6] But the Final Report was not transmitted to Congress until February 1998.[7] The Final Report deferred making a determination whether "regulations to control HAP emissions from EGUs are appropriate and necessary."[8] But the Report concluded that mercury was the HAP of greatest concern, and that "available information, on balance, indicates that utility mercury emissions are of sufficient potential concern for public health to merit further research and monitoring."[9]

Two years later, after a large information-collection effort concerning the magnitude and nature of mercury emissions from power plants, EPA issued a regulatory finding that "regulation of HAP emissions from coal- and oil-fired electric utility steam generating units under section 112 of the CAA is appropriate and necessary," and added these units to the list of source categories of HAPs under Section 112(c) of the CAA subject to MACT standards.[10]

EPA based its finding on the Report to Congress and information subsequently obtained, which provided the following reasons for regulation of mercury emissions from EGUs:

- Mercury is "highly toxic, persistent, and bioaccumulates in the food chain."[11]
- Dietary methylmercury is a neurotoxin that is absorbed in the blood and distributed to all the tissues, including the brain.[12]
- The developing fetus is considered most sensitive to the effects of methylmercury, with studies suggesting that low exposures *in utero* "have resulted in delays and deficits in learning abilities."[13]
- About 7 percent of women of childbearing age are exposed to methylmercury at levels exceeding the Reference Dose, and about 1 percent has exposures 3-4 times that level.[14]
- Exposure to methylmercury "can have serious effects on wildlife as well as humans."[15]
- EGUs are the largest source of mercury emissions in the U.S.[16]
- As a result, emissions from EGUs "are a threat to public health and the environment."[17]
- It is possible to control mercury emissions from EGUs.

Regulation of HAP emissions from EGUs is thus "appropriate," EPA concluded, because:

> "electric utility steam generating units are the largest domestic source of mercury emissions, and mercury in the environment presents significant hazards to public health and the environment."[18]

Regulation is "necessary" because:

> "implementation of other requirements under the CAA will not adequately address the serious public health and environmental hazards arising from such emissions identified in the Report to Congress and confirmed by the National Academy of Sciences study, and which section 112 is intended to address."[19]

STAPPA and ALAPCO representatives were involved in a formal, one-and-a-half year stakeholder process that EPA sponsored under the Federal Advisory Committee Act (FACA) to advise the agency on the utility MACT. The workgroup consisted of federal, state and local officials and representatives of industry and environmental organizations, who met 14 times over an 18-month period and thoroughly analyzed the issues related to the regulation of hazardous air pollution from utilities.

In the FACA process, state and local agency representatives reiterated the need for a mercury control program from EGUs that incorporates the following principles:

- The most stringent control of mercury emissions technically achievable;
- No trading of toxics;

- Minimal subcategorization among coals or types of EGUs;
- A multi-pollutant approach;
- Enhanced ability for States to implement the standards; and
- Early compliance encouraged through the use of incentives.

These principles were articulated in letters to EPA, in meetings with EPA, in discussions within the Utility MACT Workgroup, in testimony before Congress, in testimony before the agency and in resolutions adopted by STAPPA and ALAPCO.

In April 2004, EPA abruptly terminated the FACA group and reversed its regulatory course, ignoring the advice of the FACA stakeholder committee. In two *Federal Register* announcements that showed evidence of excessive reliance on industry input, EPA proposed: (1) to revise its 2000 regulatory finding to remove coal- and oil-fired electric EGUs from the list of HAP emitters under Section 112(c) of the CAA, and, (2) to adopt a cap-and-trade program, described as a "standard of performance" under Section 111(d) of the CAA, instead of adopting MACT standards under Section 112 of the CAA.[20] Questioning the health-effects studies relied upon in EPA's earlier regulatory finding,[21] EPA advanced an entirely new interpretation of the "appropriate and necessary" language in the CAA.[22] Even if regulation were "appropriate," under the proposed new interpretation, it would not be "necessary" unless EPA determined that "the other authorities of the CAA, *once implemented,* would not adequately address those HAP emissions from "Utility Units" that warrant regulation."[23] Where previously the agency had said it would consider HAP reductions from other regulations that were already in place when it decided whether a MACT standard was "necessary," under this wholly novel interpretation the agency could not regulate a HAP from an EGU unless it could show that there was no program that *could be adopted* under the Clean Air Act to curtail the toxic emissions.

The legal theory advanced in support of EPA's proposed cap-and-trade program was particularly problematical. No category of sources ever classified as HAP emitters has ever before been subsequently delisted and regulated under the agency's Section 111(d) authority. Moreover, in nearly 35 years of interpreting Section 111, EPA has never advanced the theory that the statutory term "standard of performance" could be interpreted to include a cap-and-trade program. Indeed, two statutory definitions[24] make clear that "standard of performance" refers to a standard to require specific facilities to install emission control technology to achieve a specified level of emission control.

The agency admitted that its cap-and-trade "standard of performance" "may not eliminate the risk of unacceptable adverse health effects of Hg emissions."[25] EPA stated its intention to adopt a "near term cap" in 2010 that could be met without installation of any mercury-specific controls, to be attained simply from emission reductions that will incidentally occur from projected installation of control equipment for other pollutants under other CAA programs. Analysis suggests, the agency said then, that these incidental reductions will reduce annual emissions from EGUs to approximately 34 tons. Beginning in 2018, EPA proposed to impose a national cap on

total Utility Unit emissions of mercury of 15 tons.[26] Since emitters would be allowed to "bank" mercury emission credits, total national emissions would exceed 15 tons per year for some time beyond 2018.[27] Moreover, there was no assurance that the 15-ton cap would ever be reached because the agency proposed a "safety valve" that would require EPA to borrow from the next year's mercury allowances to increase current year mercury emissions if the price of allowances ever reached $2,187.50.[28]

EPA rationalized such a lax proposal on the grounds that "Currently, there are no commercially available control technologies specifically designed for reducing Hg emissions."[29] This rationale is vulnerable on two grounds. First, a mercury-specific control technology, ACI, is operating on dozens of large municipal waste combustors and medical waste combustors across the country. ACI is today being offered by vendors for use on EGUs (see Chapter 4, below). Second, under the Clean Air Act, EPA has been directed to use its regulatory powers to stimulate commercialization of technologies to protect public health. This mandate has been endorsed repeatedly by reviewing courts over the past 30 years.[30]

In a supplemental notice of proposed rulemaking, the agency took a more optimistic view of ACI, stating that "deployment could occur on a large scale after 2010" and that "large scale operation of the technology is feasible by 2013 and 2015."[31] No change was proposed, however, in the compliance dates of 2010/2018 that EPA had proposed earlier.

EPA received over 500,000 comments – the largest number ever received by the agency on a proposed regulation – overwhelmingly critical of the agency's proposal. STAPPA and ALAPCO's comments noted that EPA had completely disregarded the stakeholder group's deliberations. For example, neither EPA nor the industry participants ever suggested using Section 111 as legal authority for mercury control regulations. Further, the FACA workgroup had acknowledged that Section 112 did not allow for a mercury emission-trading program among utilities. Notwithstanding the recommendations of the FACA workgroup, EPA had failed to analyze more stringent control options to reduce mercury emissions. Indeed, the comments noted that EPA's proposal was more lenient than positions agreed to by electric power industry representatives on the FACA committee.

In December 2004, citing the large number of comments and new information relevant to the "two primary regulatory approaches" it had proposed, as well as to the agency's benefits calculation methodology, EPA reopened the comment period. Noting that "we have become aware of new information on the ability of sorbent injection technologies [ACI] to remove Hg emissions," the agency asked whether it would be "appropriate for an economic forecast to assume an improvement in costs over time?"[32]

About four months later, EPA issued a final rule declaring "in error" its 2000 finding that regulation of utility mercury emissions was "appropriate and necessary" under CAA Section 112,[33] and removing coal- and oil-fired EGUs from the Section

112(c) source category list for regulation. In the final regulation, EPA stated its new interpretation of the statutory phrase "appropriate and necessary" even more baldly:

> [W]e interpret the term "necessary" in section 112(n)(1)(A) to mean that it is necessary to regulate Utility Units under section 112 *only if there are no other authorities available under the CAA* that would, if implemented, effectively address the remaining HAP emissions from Utility Units.[34]

Contrary to the original proposal, in this final rule the agency maintained that once the Clean Air Interstate Rule (CAIR) rule, and its mercury cap-and-trade rule (CAMR) were implemented, there would be no "unacceptable hazards to public health" from mercury emitted by coal-fired EGUs.[35] The agency admitted that this was a probability statement rather than a regulatory assurance.[36]

In May 2005, EPA promulgated a model emission cap-and-trade program, and state-by-state mercury emission budgets.[37] The budgets are applicable whether or not a state chooses to adopt the EPA cap-and-trade program.[38] The Phase I national cap is set at 38 tons, while the Phase II cap is 15 tons. Because of banking and trading, EPA projects that even by 2020, emissions will still be 24.3 tons, reduced only 50 percent from a 1999 baseline.[39] States are not required to use the EPA cap-and-trade program or any other cap-and-trade program, but each state must submit a "State Plan" to achieve the statewide mercury emissions budget provided in the EPA rule. States that do not participate in the cap-and-trade system must demonstrate that their program will require as much as the CAMR.[40] But they are free to address the problem of mercury emissions from EGUs through alternative approaches, such as the facility-specific emission limitations without trading suggested in this Model Rule.

At the same time, EPA promulgated a final rule establishing NSPS standards for mercury emissions from new and modified EGUs.[41] This rule, a complement to the cap-and-trade system, established separate output-based standards, applicable to any new or reconstructed unit for which construction commenced after January 30, 2004.[42]

Fourteen states filed a Petition for Reconsideration with EPA, asking that the agency stay the effectiveness of the agency's final rule removing coal- and oil fired units from the Section 112(c) list of sources of toxic emissions and convene a proceeding for reconsideration of the CAMR.[43] A similar petition was filed by a coalition of environmental organizations and Native American jurisdictions.[44] On June 24, 2005, the EPA Assistant Administrator for Air and Radiation refused to stay the CAMR.[45] On October 28, 2005, EPA reopened comment for an additional 45 days on certain specific points, among them the legal basis for the CAMR, the public health effects of mercury pollution, and the work the agency used to assess mercury levels in fish tissue.

An attempt to nullify the EPA rule by Congressional action failed on September 13, 2005, when the Senate rejected a resolution under the Congressional Review Act. By a narrow 51-47 vote, the Senate defeated S.J. Res. 20, sponsored by a number of Senators, which would have overturned EPA's decision to use Section 111 of the CAA

as authority for a cap-and-trade program for mercury. Instead, it would have required MACT standards be adopted under Section 112(d) of the CAA.

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[1] CAA Section 112 (b), 74 USC 7412 (b).
[2] CAA Section 112 (d), 74 USC 7412 (d).
[3] CAA Section 112 (e), 74 USC 7412 (e).
[4] CAA Section 112 (n)(1)(A), 74 USC 7412 (n)(1)(A). Congress also directed the Administrator to conduct a study of mercury emissions from EGUs, municipal waste combustors, and other sources to determine emissions, health and environmental effects, and the availability and cost of control technologies. CAA Section 112(n)(1)(B), 42 USC 7412(n)(1)(B), cited in Chapters 2 & 3. Congress also mandated a study by the National Institute of Environmental Health Sciences by November 15, 1993, to determine a threshold of mercury exposure below which "human health effects are not expected to occur." CAA Section 112 (n)(1)(C), 42 USC 7411 (n)(1)(C).
[5] CAA Section 112 (n)(1)(A), 42 USC 7412 (n)(1)(A).
[6] 60 Fed. Reg. 35393 (July 7, 1995).
[7] EPA, "Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units: Final Report to Congress" (February, 1998).
[8] *Id*. at ES-1.
[9] *Id*. at ES-18.
[10] 65 Fed. Reg. 79825 (Dec. 20, 2000).
[11] *Id*. at 79829.
[12] *Id*.
[13] *Id*.
[14] *Id*. at 79830. Subsequently EPA has concluded that the number exposed in excess of the Reference Dose is 5.8 percent, rather than 7 percent as stated in the Report to Congress.
[15] *Id.*
[16] *Id*. at 79827.
[17] *Id*.
[18] *Id*. at 79830.
[19] *Id*.
[20] 69 Fed. Reg. 4652 and 4661 (Jan. 30, 2004); 69 Fed. Reg. 12398 (March 16, 2004).
[21] 69 Fed. Reg. at 4658 (Jan. 30, 2004).
[22] CAA Section 112 (n)(1)(A), 42 USC 7412 (n)(1)(A).
[23] 69 Fed. Reg. at 4684 (Jan. 30, 2004) (emphasis added).
[24] CAA Section 111(a)(1), 42 USC 7411(a)(1) and Section 302(l), 42 USC 7602(l).
[25] 69 Fed.Reg. at 4686/3 (Jan. 30, 2004).
[26] *Id.* at 4698.
[27] 69 Fed Reg. 12411 (March 16, 2004). "Because of the banking of excess emission reductions in the first phase of the Hg program, emissions in the second phase will be initially higher than the caps that are required under CAMR." 70 Fed. Reg. 16018 (March 29, 2005).
[28] *Id*. at 12414.
[29] 69 Fed. Reg. at 4691 (Jan. 30, 2004). The agency brushed aside the evidence that ACI technology had achieved 90-percent reduction in mercury emissions from incinerators on a commercial basis, citing "important technical differences between Utility Units and municipal waste combustors…." *Id*. at 4674.
[30] See, for example, *International Harvester Co. v. Ruckelshaus,* 478 F.2d 615, 629 (D.C. Cir. 1973); *Natural Resources Defense Council v. Thomas,* 805 F.2d 410, 429 (D.C. Cir. 1986); *Portland Cement Ass'n v.Ruckelshaus,* 486 F.2d 375, 391 (D.C. Cir. 1973); *Natural Resources Defense Council v. EPA,* 655 F.2d 318, 328 (D.C. Cir. 1981) (EPA "expected to

press for the development and application of improved technology rather than be limited by that which exists today"); *Wisconsin Electric Power Co. v. Reilly,* 893 F.2d 901, 909-10 (7th Cir.1990); *Husqvarna v. EPA,* 254 F.3d 195 (D.C. Cir. 2001) ("Congress intended the agency to project future advances in pollution control capability.")

[31] 69 Fed. Reg at 12403/2 (March 16, 2004).

[32] 69 Fed. Reg. 69870 (December 1, 2004).

[33] 70 Fed. Reg. 15994, 16005 (March 29, 2005).

[34] *Id*. at 16001/2 (emphasis added).

[35] *Id*. at 16024/3 "Risks Remaining After Implementation of CAIR, and Even More So After CAMR, Are Acceptable."

[36] *See Id*. at 16024 *ff.*

[37] New 40 CFR 60.4140, 70 Fed. Reg. 28665. The model emission trading program dropped the safety valve mechanism of the original proposal. *Id*. at 28630/2.

[38] *Id*. at 28624/2.

[39] *Id.* at 28619/3.

[40] *Id*. at 28632/1.

[41] 70 Fed. Reg. 28606 (May 18, 2005).

[42] New 40 CFR 60.45a, 70 Fed. Reg. 28653.

[43] Petition for Reconsideration filed by California, Connecticut, Delaware, Illinois, Maine, Massachusetts, New Hampshire, New Jersey, New Mexico, New York, Pennsylvania, Rhode Island, Vermont, and Wisconsin (May 31, 2005).

[44] Petition for Reconsideration of Revision of December 2000, Regulatory Finding, filed by Natural Resources Defense Council, Clean Air Task Force, Ohio Environmental Council, United States Public Interest Research Group, Natural Resource Council of Maine, Aroostook Band of Micmacs, Houlton Band of Maliseet Indians, the Penobscot Indian Nation, the Passamaquoddy Tribe of Maine (Indian Township and Pleasant Point).

[45] Letter to Peter C. Harvey, Attorney General of New Jersey, and Jon P. Devine, Jr., Natural Resources Defense Council from Jeffrey Holmstead, Assistant Administrator for Air and Radiation, U.S. EPA (June 24, 2005).

Chapter 4: Status of Mercury Pollution Control Technology

Technology to reduce emissions from coal-burning power plants by more than 90 percent on many plants is now commercially available, cost-effective and rapidly advancing.

Controlling mercury emissions from coal-fired power plants does not require the development of new technology. The leading technology for removing mercury from EGU exhaust gases is essentially identical to that which has successfully been deployed nationwide for years to curtail mercury emissions on large municipal waste combustors. In recognition of the current state of technology, states in the Northeast and other parts of the country have already adopted standards that are much more stringent than proposed in the EPA's mercury rule and that should achieve reduction targets on an earlier timetable.

Generally, there are two ways to reduce mercury emissions: technologies to target mercury specifically; and technologies developed to reduce other pollutants, such as PM or SO_2, that produce mercury emission reductions as a "co-benefit." Several "multi-pollutant" technologies that target mercury and other pollutants are also commercially available or are in the late stages of development and testing.

Field tests of the most highly developed mercury control technology, known as sorbent injection, have achieved mercury capture of up to 95 percent at coal-fired power plants. Sorbent injection (typically Activated Carbon Injection) and other advanced technologies have not yet been permanently installed at power plants because no law requires it. But 95-percent capture rates have now been demonstrated in short-term tests for all ranks of coal, bituminous, subbituminous and lignite. Chemically enhanced sorbents make high rates of removal of all species of mercury achievable even with low-rank coals.

The cost of mercury control technologies will decrease substantially over time as a market evolves and as use becomes widespread, most stakeholders predict. Moreover, recent tests of chemically enhanced sorbents reveal that EPA's cost projections overestimate the actual costs to power plants.

Claims by some stakeholders that technologies are unavailable to reduce emissions from coal-burning power plants are contradicted by the success of ACI in large municipal combustors, by successful field tests and sales of ACI for electric generating plants, and by recent National Energy Technology Laboratory (NETL) and EPRI tests on myriad existing enhancements to ACI technology with respect to all coal types. Further, existing control devices designed to control pollutants other than mercury can significantly reduce mercury emissions.

Mercury-Specific Control Technologies

ACI remains the leading option among control technologies specific for mercury. ACI is a mature mercury emission control technology, currently deployed on scores of municipal waste combustors across the country with mercury removal rates of more than 90 percent. Some plants, in fact, have achieved removal rates of more than 98 percent. The technology entails injecting a powdered sorbent that binds to mercury in the flue gas and then collecting the particles with a particulate control device, such as those already installed on all large EGUs. Activated carbon – carbon that has been treated to alter its surface properties – is the most commonly used sorbent.

Large-scale field tests of ACI on coal-fired electric generating units have demonstrated removal rates of 90 percent and higher. Although no ACI unit has been installed commercially on an EGU yet, 90-percent and higher mercury capture with ACI is feasible. The technology involves very little capital equipment: a silo to hold the sorbent, and hose, nozzles and pumps to inject it into the flue gas ducts. Tests on such ACI systems continue to show improvement. The removal rates may be further improved when the technology is used along with such additional controls as a fabric filter, or “bag house,” used for PM control. Some vendors are currently offering ACI to electric generating plant customers and two sales have so far been reported.

The efficiency of ACI in removing mercury from lower ranks of coal, such as subbituminous and lignite, has clearly caught up with ACI's success rate in removing mercury from bituminous coal. In a leading approach, the injection of halogenated sorbents into the gas stream of units burning lower ranks of coal can enable ACI to attain results comparable to those with bituminous coals. Carbon sorbents impregnated with bromine or iodine compounds enhance capture of mercury on subbituminous western coals, which contain lower chlorine levels and are therefore more challenging to clean. Research findings clearly indicate lignite and subbituminous coals behave similarly to each other in terms of mercury speciation and control. For this reason, halogenated sorbents offer much promise for improving mercury capture in these lower ranks of coal. Moreover, the technology can be readily adopted on existing coal-fired boilers.

The capital costs of installing ACI are two orders of magnitude less than the capital costs of equipment used to control oxides of sulfur or NO_x. Recent data from field testing sponsored by NETL indicate that the average cost of controlling mercury will range from 0.2 to 0.8 mills/KWh. Based on this estimate, mercury control would add 15 to 60 cents per month to a typical 750 KWh residential electric bill. Taking into account capital and operating costs of ACI, one state agency has estimated the cost of mercury control for its ratepayers at less than $10 per year. These new findings illustrate the rapid pace of technological development in mercury control. Only a year ago, EPA estimates ranged from 1.12 and 3.10 mills/KWh,. Technologies are in development that may further reduce the cost of ACI, which is driven by the cost of the sorbent material. Processes that require less sorbent or more economical sorbents are

being tested. At a Wisconsin state hearing, one participant may have summed it up best when he pointed out that, having paid $20 for his annual fishing license, he would be happy to pay a similar amount if necessary to be able to eat the fish he caught.

NETL and EPRI are currently testing the long-term efficacy of ACI. Recent testing of other improvements to conventional ACI technology has also yielded promising results, and such enhancements will further reduce cost of controls, EPA forecasts. For example, a process developed by EPRI, COHPAC-TOXECON, was recently tested by Southern Company at a plant burning eastern low-sulfur bituminous coal. The process entails injecting activated carbon downstream of an existing electrostatic precipitator but upstream of a fabric filter. This keeps the majority of the fly-ash from being contaminated because most of the ash is removed before the activated carbon is introduced into the system. This innovation may be important for plants that sell their fly ash for use in construction materials. In the long-term test, 90 percent of the mercury was removed at reasonable cost.

Multi-Pollutant Technologies

Tests of multi-pollutant technologies that specifically target mercury are yielding better and better rates of reduction. Test results for KFX's K-Fuel™ Technology on subbituminous coals demonstrated mercury reductions of up to about 70 percent. Powerspan-ECO™ test results were up to 90 percent. Although fewer tests have been completed on lignite-burning plants, the technology for controlling emissions from lignite is mature enough to justify near-term deployment.

KFX has begun operating a commercial plant in Wyoming for its K-Fuel™ Technology, which is essentially a processed coal derived from western subbituminous coals. Lower in ash and higher in British Thermal Unit (BTU) value, it yields lower pollutant emissions than the parent coals. The two-step process relies on physical separation and thermal processing to produce a fuel that has higher BTU value and is cleaner than the original coal. It entails elevated temperature and pressure, greatly reducing the moisture content of the coal. The mercury is volatilized and then captured in a carbon-bed reactor. The process also removes sulfur and up to 30 percent of SO_2 and NO_x emissions. Besides operating its own plants, the company is making the technology available for licensing to other facilities.

Powerspan-ECO™, with an 80- to-90-percent mercury removal range, is being tested at a commercial facility in Ohio. It is a post-combustion multi-pollutant control technology, consisting of a high-energy oxidation reactor followed by an ammonia-based scrubber and a wet electrostatic precipitator, which captures the products of oxidation (about 90 percent of NO_x and 98 percent of the SO_2). The process produces fertilizer byproducts (ammonium nitrate and sulfate) as do several other multi-pollutant technologies that are in development, including the Enviroscrub/Pahlmanite™ process and the Airborne Process.

Such multi-pollutant technologies are cost-effective in other ways. For example, many of the multi-pollutant technologies produce a marketable by-product from the flue gas air pollutants.

"Co-Benefits" From Technologies Designed to Reduce Emissions of Other Pollutants

So-called "co-benefit" techniques are capable of achieving some mercury reductions at many coal-powered plants. Systems that have been installed to reduce emissions of SO_2, NO_x, and PM sometimes can be operated to make some reductions in mercury emissions. Some NO_x control devices can enhance the ability of SO_2 controls to reduce mercury emissions. At plants that have already installed technologies to remove SO_2 and NO_x pollution, optimizing these control systems to reduce mercury represents an extremely low-cost means to make a partial reduction in mercury emissions. The potential for capturing mercury varies greatly at individual plants depending on the control systems, the plant and the type of coal burned.

Recent research indicates that at certain EGUs with particular control technology configurations burning certain bituminous coals, optimizing controls for PM, NO_x and SO_2 emissions for mercury removal may capture more than 90 percent of mercury in the coal. Such remarkable capture efficiencies have been obtained using SCR for NO_x control and wet flue gas desulfurization (FGD) for SO_2 control on a handful of plants burning bituminous coal, including the Mecklenburg Cogeneration Facility in Virginia and the Logan Generating Plant in New Jersey.

High "co-benefit" mercury capture has been demonstrated at EGUs equipped with scrubbers to control SO_2 and fabric filters for PM control, but only a handful of EGUs in the United States (about 14 percent) have fabric filters. Since ACI, especially halogenated carbon sorbents, can accomplish approximately the same capture of mercury at a cost two orders of magnitude smaller, it seems unlikely that many additional scrubbers or fabric filters will be installed to achieve mercury "co-benefits."

Whether optimized SCR and scrubbers used in tandem can remove mercury from subbituminous and lignite coals remains to be seen. Scrubbers only effectively capture mercury in its oxidized form as mercury chloride or another mercury halogen. They are incapable of capturing the insoluble elemental mercury. Better reduction rates may be attainable for lower rank coals when additional halogenated sorbents are injected into the flue gas in units fitted with an SCR and a wet FGD. The additional halogen (often bromine or iodine) may increase existing concentrations of oxidized mercury in the flue gas to levels sufficient for realizing reductions. So far, however, the co-benefits achieved have been much lower on other plant configurations and coal types other than bituminous. Other chemical additives that minimize re-emissions of mercury from wet FGD systems currently in use at European coal-fired power plants, as well as other enhancements, are also being tested in the United States.

According to EPA, more than one-third of the mercury from coal burned by electric generating plants is currently captured in existing systems installed to control other pollutants. Many more plants are currently installing NO_x and SO_2 controls to meet regulatory requirements for those pollutants. Though far from achieving desirable or reasonably attainable mercury emission reductions, co-benefit techniques offer the opportunity to obtain significantly more than the 21-percent reduction in the total industry emissions targeted by EPA's CAMR.

Mercury Regulation Will Spur Rapid Technological Improvement

The pace of mercury control technology development is indeed moving rapidly. All trends indicate that several multi-pollutant and mercury-specific technologies are entering the commercial market. The ongoing mercury debate, despite its unique nuances, is similar to earlier regulatory debates regarding emissions controls from this and other industry sectors.

An analysis of decades of regulatory experience reveals that regulations requiring emissions reductions will accelerate the pace of technology development and demonstration and decrease compliance costs. The Northeast States for Coordinated Air Use Management (NESCAUM) recently studied cases of control technology development for NO_x and SO_2 from power plants and of the control of automobile emissions through the use of technologies and fuels. NESCAUM concluded that technological innovation follows, rather than precedes, regulatory requirements. In each case early cost estimates dramatically overstated actual compliance costs. The report cautions against enacting weak regulations that provide a lower level of environmental protection than is affordable.

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Chapter 5: Existing State Programs to Control Mercury Emissions from EGUs

Even before EPA's CAMR was adopted, the Conference of New England Governors and Eastern Canadian Premiers called for a 75-percent reduction in mercury emissions from all sources by 2010 and adopted an ultimate goal of the "virtual elimination" of anthropogenic mercury emissions.

At least six states have already adopted legislation or regulatory programs to reduce mercury emissions – Connecticut, Massachusetts, Minnesota, New Jersey, North Carolina, and Wisconsin. Others, including Indiana, Michigan, Montana, New Hampshire and Pennsylvania, are considering regulations or statutes to control mercury emissions from coal-fired EGUs. The adopted state programs are all substantially more protective of public health than the EPA CAMR. The following table provides basic information on these programs:

State	**Program**
Connecticut	90% control or 0.6 lb per trillion Btu (whichever is less stringent) by 2008 (statute).
Massachusetts	85% capture or 0.0075lb/GWh by 1/1/2008; 95% capture or 0.0025 lbs/GWh by 10/1/2012 (regulation).
Minnesota	Achieved a 70% reduction in emissions of mercury from 1990 levels by 2005 (statutory requirement – applies to all emissions, including utilities). 93% reduction goal is proposed. The schedule and methods of achieving the goal are to be developed.
New Hampshire	Cap of 50 lbs/year after federal compliance dates; cap of 24 lbs/year four years later. (Initial Department recommendation to legislature. Proposal for amended legislation due for legislative session that commences January 2006.)
New Jersey	90% reduction in emissions or 3 mg/MWh by 12/15/2007 (regulation); 5-year extension to 12/15/2012 available if multi-pollutant control is being installed on all units for NO_x, SO_2, Total Suspended Particulates and mercury.
North Carolina	64% reduction in Hg by 2013; recommendations for additional reductions due in 2005 (statute).
Wisconsin	40% reduction by 2010; 75% reduction by 2015 (regulation). Goal of 80% reduction by 2018 (regulation).

As is apparent from the table, the states have a far more optimistic view of the availability of mercury pollution control technology and techniques than does EPA. Based on their staffs' expertise in mercury emission control technology, they have adopted emission limitations that will require the use of mercury control technology by as early as 2007.

The states with the most stringent requirements, Massachusetts and New Jersey, both offer owners and operators of EGUs a choice of meeting a percentage reduction requirement or an emission limitation expressed in terms of mercury emissions per unit of energy output (lb/GWh or mg/MWh). Output-based standards have the benefit of encouraging efficiency. The STAPPA and ALAPCO Model Rule presented in the following chapter includes both types of standards.

New Jersey requires meeting mercury emission limitations by December 15, 2007, but offers an extension of the mercury compliance deadline for up to half of generating capacity to owners and operators of coal-fired EGUs who agree to meet multi-pollutant standards by December 15, 2012. Covered units must meet emission limitations for SO_2, NO_x, and PM, as well as the state's mercury standards.

Chapter 6: The STAPPA and ALAPCO Model Rule

A. Preamble to Model Rule

I. Architecture of the Model Rule.

The Model Rule provides standards applicable to coal-fired EGUs in two phases. Though based on the accumulated knowledge of state and local air pollution control officials regarding the state of the art in mercury emission reduction technology, these standards do not specify or require any particular technology or method. The objective is to identify achievable emission reductions that will protect public health, and to stimulate the rapid commercialization of additional mercury control technologies and methods to achieve those reductions. In the last few years, mercury control technologies for coal-fired EGUs have advanced rapidly. Studies have shown that continuous advances in control technology will be assured only if manufacturers know there will be a market in the near term sufficient to justify significant investments.

STAPPA and ALAPCO have developed two different approaches in this Model Rule. Each of these Options leaves owners or operators free to choose their own control strategies. Whatever the control strategy chosen, however, the emission standard must be met. Under each Option, new and modified sources will be required to capture 90-95 percent of inlet mercury, or meet a specified mercury output-based emission standard. The state will need to consider, within five years, whether to tighten these emission standards for new and modified sources based on available mercury emissions control equipment and techniques. The two Options take somewhat different approaches to existing sources, however. For existing sources, each Option has two Phases.

Option I is designed to achieve substantial public health benefits in the near term, while providing owners and operators flexibility with regard to which emission reduction technology and measures, on which units, will be installed. Phase 1 requires each owner or operator to capture an average of at least 80 percent of inlet mercury from its existing EGUs in the state, or meet a specified alternative average output-based emission standard, by the end of 2008. Four years later, Phase 2 requires each covered electric generating plant to meet a state-specified requirement to capture 90-95 percent of inlet mercury or meet a specified alternative output-based emissions standard.

Option II achieves similar ends, but offers a different alternative to owners and operators who wish to coordinate their mercury control efforts with the installation of control technologies for SO_2, NO_x and/or PM. Under Option II, an owner or operator

may choose to postpone compliance for four years with the Phase 1 mercury standard at EGUs constituting not more than 50 percent of its generating capacity in the state if the owner or operator makes binding enforceable commitments to meet specified emissions standards for SO_2, NO_x, PM, and mercury by the end of 2012. The remainder of an owner or operator's EGUs must capture a minimum of 90-95 percent of inlet mercury, or meet a specified output-based emission standard, by the end of 2008.

Emission limitations for new EGUs and for existing EGUs in Phase 2 of both Options of the Model Rule are stated as a range (i.e., either a 90-95 percent capture of inlet mercury, or an output-based mercury emissions standard between 0.0060 and 0.0025 lb/GWh). These ranges recognize today's uncertainty about the ultimate capability of technologies to remove mercury. STAPPA and ALAPCO are persuaded that, using currently demonstrated technologies, existing EGUs are capable of capturing at least 90 percent of inlet mercury on the timetables provided in the Model Rule. Many STAPPA and ALAPCO members are convinced that greater reductions – of at least 95 percent – can be achieved on the specified timetables. Indeed, Massachusetts regulations already require 95-percent capture of inlet mercury by 2012. Past experience with other pollution control technologies and methodologies suggests that pollution reduction efficiencies will turn out to be greater, and costs lower, than today's most optimistic predictions.

II. How Would a State Adopt the Model Rule?

The federal CAMR requires that a state adopt and submit a State Plan showing how it will reduce statewide mercury emissions sufficiently to achieve the EPA-imposed mercury emissions budget. 70 Fed. Reg. 28624 (May 18, 2005). The EPA rule offers a model cap-and-trade program as one way to implement the required emission reductions. The cap-and-trade program is optional, not required. Thus as long as a State Plan provides for achieving mercury emission reductions sufficient to meet the federal emissions budget for the state and meets the other minimum requirements of CAMR, EPA is bound by its own rule to approve the State Plan.

III. Choosing an Option.

The Model Rule assumes that each regulated entity would make an initial choice to comply with one of the Options that will apply thereafter to all units it owns or operates within the state. The state will review the compliance plan submitted by the source owner or operator to assure that it is adequate and enforceable, and that the plan includes the baseline or other information that will be needed to determine compliance. If the state concludes that the compliance plan is adequate and enforceable, and that it provides the necessary information, the state will incorporate the relevant provisions into its State Plan.

IV. Emissions Trading.

STAPPA and ALAPCO have been supporters of using a cap-and-trade system to control the emissions responsible for acid rain and other programs to address broad regional, national or international environmental problems. However, state and local air pollution control officials do not recommend trading programs where exposures to hazardous air pollutants can be heavily influenced by nearby emission sources. If trading were allowed in such situations, existing high pollution "hot spots" could be allowed to continue or worsen, and new hot spots could be created, by EGUs' decisions to comply using credits rather than reducing emissions. EPA has argued, based on computer modeling, that its mercury cap-and-trade program will not produce mercury hot spots. While the accuracy of these computer-based predictions of utility industry behavior can be debated, the key point is that citizens are not probabilities. State and local pollution control officials cannot endorse a system that promises only a probability of health protection to their citizens.

Thus the Model Rule requires, under either Option, that the ultimate Phase 2 limitation be met at each plant site. STAPPA and ALAPCO oppose allowing EGUs to comply with mercury standards through a broad trading program that allows interstate trading and banking of emission allowances. If allowance trading is acceptable, some owners or operators will choose to comply using emission allowances rather than reducing mercury emissions; similarly, if allowances may be banked, state and local air pollution control agencies cannot prevent them from being used later. In our view, it is not appropriate to place public health policy decisions in the hands of private entities. Consistent with this policy, the Model Rule includes no emissions trading regime.

In order to allow for more demanding requirements in the near term, Option I temporarily provides for contemporaneous emissions averaging among units owned or operated within the state by each entity. From 2008 to 2012, compliance with Option I can be achieved by emissions averaging among units within the state owned or operated by the same entity. If a unit is owned or operated by more than one entity, the state or local agency will make a binding allocation to each owner or operator of an appropriate portion of the generation from the unit for purposes of demonstrating compliance. Emission reductions in a current year may not be banked – that is, they may not be used to average against mercury emissions in a future year. In Phase 2, intrastate emissions averaging is not permitted. Contemporaneous emissions averaging at a site where there is more than one emission unit is acceptable under both Options as a Phase 2 compliance strategy because it will provide the same protection against hot spots as if each unit at a site individually complied with the Phase 2 emission limitation.

The Model Rule also provides for dealing with mercury emission allowances allocated under the CAMR rule. Under CAMR, EPA will allocate an amount of emission allowances to each state equal to the state's EPA-established mercury emission budget. In turn, states that adopt a cap-and-trade system are expected to reallocate all or part of their cache of mercury allowances to owners and operators of EGUs within

their borders. Under CAMR, individual owners and operators would be allowed to trade allowances freely within or even outside the state.

Even though CAMR allowances may not be used for compliance with the Model Rule, the purposes of the Model Rule would be defeated if the state were to distribute the EPA CAMR allowances and allow in-state owners and operators to transfer or sell those allowances to be used by EGUs outside the state. If interstate sales were allowed, the allowances could license emissions upwind that would be blown back into a state that had adopted the Model Rule. For this Model Rule to be effective, therefore, states that adopt the Model Rule must retain the CAMR emissions allocated by EPA rather than selling or reallocating them to owners and operators of EGUs in the state.

V. Applicability.

The Model Rule applies to coal-fired EGUs. STAPPA and ALAPCO recognize that oil-fired EGUs are also a source of significant hazardous air pollutant emissions, particularly nickel. Because of the differences in emissions and control technologies between coal- and oil-fired EGUs, however, this Model Rule is limited to mercury emissions from coal-fired units with a capacity exceeding 25 MWe.

VI. One Standard for All Coals.

The Model Rule does not provide different emission standards for different ranks of coals. While it was earlier believed that mercury emission control technologies were not capable of achieving high levels of removal in units burning lower ranks of coal, the most recent research gives confidence that commercially available technologies will be capable of achieving the same high levels of mercury removal in time to achieve the standards of each Phase of the Model Rule program.

VII. Variances and Exceptions.

Variances or special exceptions are sometimes used as a means to provide regulatory flexibility to deal with differences in fuels or technological issues among emission sources. The Model Rule provides for flexibility in two ways:

- Compliance is determined on an annual rolling average basis, not over short-term periods. By using a rolling annual average, the Model Rule assures that short-term variations in fuels and in the performance of pollution control technology will not cause noncompliance.

- Each Option incorporates an explicit method in Phase 1 to provide compliance flexibility. In Option I, owners and operators are permitted to comply with the Phase 1 standard through intrastate averaging of emissions from their units. In Option II, an owner or operator that commits to meeting multi-pollutant standards at the end of 2012 may choose to postpone

compliance with the mercury emission standard for four years at no more than half the entity's electric generating capacity.

Because the Model Rule incorporates these flexibility mechanisms, STAPPA and ALAPCO believe that compliance can be achieved across the industry in the time periods provided. Should an EGU fail to meet the applicable mercury emissions standards under the Model Rule, despite having implemented the emission reduction measures and technologies included in the State Plan, existing state regulations provide a number of potential responses. Some states provide in the permit for an explicit limitation on liability for sources required to achieve a stringent emission standard. Some require a noncompliant source to agree to a consent agreement, in some cases imposing monetary penalties. Others provide for "alternative emission limitations" if a source can demonstrate that it has failed to meet the emission standard despite best efforts. States that currently do not have such flexibility mechanisms may want to consider adopting them in the process of adopting the Model Rule.

VIII. Monitoring and Record Keeping Requirements.

The Model Rule follows the federal CAMR with respect to monitoring and reporting requirements.

B. STAPPA and ALAPCO Model Mercury Emissions Control Rule For Coal-Fired Electric Generating Units

I. Policy Objective**.** The purposes of this regulation are:

a. To protect the public health and welfare of the State of _____ by requiring substantial reductions in emissions of mercury from coal-fired electric generating units;
b. To require, in two stages, installation of pollution control equipment and/or other measures to achieve specified reductions in mercury emissions from coal-fired electric generating units no later than the end of 2008 and 2012; and
c. To provide flexibility in implementation in order to reduce the economic cost of meeting the requirements of this regulation.

II. Definitions. When used in this chapter, the terms below shall have the following meanings:

Boiler means an enclosed fossil- or other fuel-fired combustion device used to produce heat and to transfer heat to recirculating water, steam or other medium.

Bottoming-cycle cogeneration unit means a cogeneration unit in which the energy input to the unit is first used to produce useful thermal energy and at least some of the reject heat from the useful thermal energy application or process is then used for electricity production.

Coal means any solid fuel classified as anthracite, bituminous, subbituminous or lignite by the American Society of Testing and Materials (ASTM) Standard Specification for Classification of Coals by Rank D388-77, 90, 91, 95, or 98a (incorporated by reference, see 40 CFR part 60, §60.17).

Coal-derived fuel means any fuel (whether in a solid, liquid or gaseous state) produced by the mechanical, thermal or chemical processing of coal.

Coal-fired means combusting any amount of coal or coal-derived fuel, alone or in combination with any amount of any other fuel, during any year.

Cogeneration Unit means a stationary, coal-fired boiler or stationary, coal-fired combustion turbine:

(1) Having equipment used to produce electricity and useful thermal energy for industrial, commercial, heating or cooling purposes through the sequential use of energy; and

(2) Producing during the 12-month period starting on the date the unit first produces electricity and during any calendar year after which the unit first produces electricity:

(a) For a topping-cycle cogeneration unit:

(i) Useful thermal energy not less than 5 percent of total energy output; and

(ii) Useful power that, when added to one-half of useful thermal energy produced, is not less than 42.5 percent of total energy input, if useful thermal energy produced is 15 percent or more of total energy output, or not less than 45 percent of total energy input, if useful thermal energy produced is less than 15 percent of total energy output; and

(b) For a bottoming-cycle cogeneration unit, useful power not less than 45 percent of total energy input.

Combustion turbine means:

(1) An enclosed device comprising a compressor, a combustor, and a turbine and in which the flue gas resulting from the combustion of fuel in the combustor passes through the turbine, rotating the turbine; and

(2) If the enclosed device under paragraph (1) of this definition is combined cycle, any associated heat recovery steam generator and steam turbine.

Electric Generating Unit or *Unit* means:

(1)(i) Except as provided in paragraph (ii), a stationary coal-fired boiler (boiler) or stationary, coal-fired combustion turbine (combustion turbine) in the state serving at any time a generator with a nameplate capacity of more than 25 megawatts electric (MWe), producing electricity for sale; or

(ii) A stationary boiler or stationary combustion turbine that, under paragraph (1)(i) of this definition, is not an electric generating unit, which begins to combust coal or coal-derived fuel and to serve a generator with a nameplate capacity of more than 25 MWe producing electricity for sale.

(2) “Electric generating unit” does not include a boiler or combustion turbine that qualified as a cogeneration unit during the 12-month period subsequent to the date it first produced electricity and continues to qualify as a cogeneration unit, and which has not served, at any time, a generator with nameplate capacity of more than 25 MWe supplying in any calendar year more than one-third of the unit’s potential electric output capacity, or 219,000 megawatt hours (MWh), whichever is greater, to any utility power distribution system for sale. If an otherwise qualifying boiler or combustion turbine

ceases to qualify as a cogeneration unit, it shall become subject to paragraph (1) of this definition starting on the day it no longer qualifies as a cogeneration unit.

(3) “Electric Generating Unit” does not include a “solid waste incineration unit” as defined in Clean Air Act section 129(g)(1) combusting “municipal waste” as defined in Clean Air Act section 129(g)(5) so long as it is subject to Subpart Eb of 40 CFR Part 60; Subpart AAAA of 40 CFR Part 60; an EPA-approved state plan for implementing Subpart Cb of 40 CFR Part 60; Subpart FFF of 40 CFR 62; an EPA-approved state plan for implementing Subpart BBBB of 40 CFR Part 60; or Subpart JJJ of 40 CFR Part 62.

Electric Generating Plant means an Electric Generating Unit or Units that are located on one or more contiguous or adjacent properties, and under common control of the same person (or persons under common control) which supply electricity to the electricity grid through a common electrical connection.

Existing Unit or Existing EGU means any Electric Generating Unit other than a new Electric Generating Unit.

Inlet Mercury means the average concentration of mercury in flue gas at the inlet of the emission control device immediately downstream of the boiler of an Electric Generating Unit, as determined by methods prescribed by the state.

Nameplate Capacity means, starting from the initial installation of a generator, the maximum electrical generating output (in MW) that an Electric Generating Unit is capable of producing on a steady-state basis during continuous operation as specified by the manufacturer.

New or Modified Unit or New or Modified Electric Generating Unit means any Electric Generating Unit, construction or modification of which is commenced after the date of publication of proposed regulations prescribing a standard for control of mercury that will be applicable to the Electric Generating Unit.

NO_x means oxides of nitrogen (nitrogen oxide and nitrogen dioxide).

Operator means any person that operates, controls or supervises an electric generating unit or a source that includes an electric generating unit and includes, but is not limited to, any holding company, utility system or plant manager of such an electric generating unit or source.

Output-Based Emission Standard means a maximum allowable rate of emissions of mercury or other pollutant per unit of electrical output from an EGU.

Owner means any person that has an ownership interest, legal or equitable, (or who is a holder of a leasehold interest) in a unit; or is an owner or operator of a unit, or any purchaser of power from a unit or owner or operator under a life-of-the-unit, firm

power contractual arrangement, provided that, unless expressly provided in leasehold agreement, the term “owner” shall not include a passive lessor.

PM means particulate matter.

SO_2 means sulfur dioxide.

III. Applicability**.** The requirements of this chapter apply to owners and operators of Electric Generating Units located within the State of _____.

IV. Requirements. The owner or operator of an Electric Generating Unit subject to this chapter shall, not later than _____, apply to the [Department] for a mercury emissions permit.

A. Such application shall include:

1. A statement indicating that electric generating units in the state under the control of the owner or operator will comply with the emission limitations and other requirements of §V.A and §V.B or §V.C of this chapter;
2. A detailed compliance plan for each applicable emission limitation for each unit under the control of the owner or operator, including monitoring and reporting;
3. A description of the fuel assumptions on which the plan is based; and
4. A description, for units where a catalytic reduction device will be installed to reduce emissions of NO_x, of the measures that will be taken to avoid any increase in emission of oxidized forms of mercury.

B. The [Department] shall promptly review the mercury permit application and shall, if the application meets the terms of this chapter, issue a permit. Such permit shall include:

1. [Option I] Provisions applicable to each unit as follows:

   a. Enforceable requirements to comply with the emission limitations and other conditions of §V.A and §V.B.1 and §V.B.3 for the period commencing December 31, 2008 and ending December 30, 2012;
   b. Enforceable requirements to comply with the emission limitations and other requirements of §V.A and §V.B.2 and §V.B.3 for the period commencing December 31, 2012; and
   c. Enforceable requirements to comply with the monitoring, recordkeeping and reporting obligations of §§VII and VIII.

2. [Option II] Provisions applicable to each unit as follows:

a. Enforceable requirements to comply with the emission limitations and other obligations of §§V.A, V.C.1 and V.C.4 for the period commencing December 31, 2008 and ending December 30, 2012;
b. Enforceable requirements to comply with the emissions limitations and other obligations of §§V.A, V.C.2 and V.C.4 commencing December 31, 2012; and
c. Enforceable requirements to comply with the monitoring, recordkeeping and reporting obligations of §§VII and VIII.

V. Emission Standards.

A. Emission Standards for New Units.

1. Any new or modified unit subject to this chapter shall comply at commencement of operation with one of the following two standards on a rolling 12-month basis:

   a. A mercury output-based emission standard of 0.0060 – 0.0025 lb/GWh; or
   b. A minimum 90-95 percent capture of inlet mercury.

2. The Department shall review the emission standards of §V.A.1 within five years after adoption of this regulation, and subsequently at intervals of no more than five years, to determine whether greater reductions in mercury emissions are available, and shall revise the emission standard for new and modified units accordingly not more than one year after completion of its review.

B. Emission Standards for Existing Sources: Option I.

An electric generating unit subject to this chapter shall meet the following emission limitation requirements, unless the owner or operator chooses to comply with §V.C:

1. Phase 1 –

   a. Beginning December 31, 2008, the owner or operator of an existing unit subject to this chapter shall comply with one of the following standards on a rolling 12-month basis:

      i. A mercury output-based emission standard of 0.010 lb/GWh; or
      ii. A minimum 80-percent capture of inlet mercury.

   b. An owner or operator may demonstrate compliance with §V.B.1.a by averaging emissions from all existing units it owns or operates within the state.

2. Phase 2 –

a. Beginning December 31, 2012, the owner or operator of an existing unit subject to this chapter shall comply with one of the following standards on a rolling 12-month basis:

i. A mercury output-based emission standard of 0.0060 – 0.0025 lb/GWh; or
ii. A minimum 90-95 percent capture of inlet mercury.

b. An owner or operator may demonstrate compliance with §V.B.2.a by averaging emissions from all existing units owned or operated at a single electric generating plant.

c. In the event that a unit is owned or operated by more than one entity, the [Department], shall, for purposes of demonstrating compliance with Phase 1 or Phase 2 standards through averaging emissions, allocate to each owner or operator an appropriate portion of the generation from the unit to each owner or operator with such interest on the basis of information available to the [Department]. The [Department's] allocation of interests for this purpose shall be final.

3. An owner or operator that installs a selective catalytic reduction system or other device on an electric generating unit subject to this chapter to control emissions of NO_x shall take whatever steps are necessary to prevent any increase in emissions of oxidized forms of mercury.

C. Emission Standards for Existing Units: Option II. An electric generating unit subject to this chapter shall meet the following emission limitation requirements, unless the owner or operator chooses to comply with §V.B:

1. Phase 1 –

a. Beginning December 31, 2008, each company that owns or operates an existing electric generating unit shall comply with one of the following standards on a rolling 12-month basis:

i. A mercury output-based emission standard of 0.0060 – 0.0025 lb/GWh; or
ii. A minimum 90-95 percent capture of inlet mercury.

b. An owner or operator may postpone compliance with §V.C.1.a for a group of its units that comprise not more than 50 percent of the owner or operator's electric generation capacity in the state. Such

a postponement may be granted by the [Department] upon approval of:

i. Enforceable commitments for each postponed unit to comply with the multi-pollutant control requirements of §V.C.2.a and §V.C.2.b no later than December 31, 2012; and
ii. Enforceable commitments for each postponed unit to prevent increases in oxidized mercury emissions from the date this regulation is proposed through December 30, 2012.

2. Phase 2 –

a. Beginning December 31, 2012, each unit subject to this chapter for which compliance with Phase 1 has been postponed pursuant to §V.C.1.b shall comply with each of the following multi-pollutant emission limitations:

i. Sulfur Oxides:

A. A sulfur dioxide output-based emission standard of 1.5 lb/MWh; or
B. A minimum 95 percent capture of fuel sulfur.

ii. Nitrogen Oxides: A nitrogen oxides output-based emission standard of 1.0 – 0.7 lb/MWh.

iii. Mercury:

A. A mercury output-based emission standard of 0.0060 – 0.0025 lb/GWh; or
B. A minimum 90-95 percent capture of inlet mercury;
C. Compliance to be determined on a rolling 12 month basis.

b. Beginning December 31, 2012, each unit subject to this chapter for which compliance has been postponed pursuant to §V.C.1.b shall comply with a particulate matter emission standard of 0.030 – 0.015 lb/mmBtu. Compliance will be determined based on testing once per year.

3. In the event that a unit is owned or operated by more than one entity, the [Department], shall, for purposes of demonstrating compliance with §§V.A, V.B, or V.C by averaging emissions at any electric generating plant, allocate to each owner or operator an appropriate portion of the generation from the unit to each owner or operator with such interest on

the basis of information available to the [Department]. The [Department's] allocation of interests for this purpose shall be final.

4. An owner or operator who installs a catalytic reduction or other device to control emissions of NO_x on a unit subject to this chapter shall take whatever steps are necessary to prevent any increase in emissions of oxidized forms of mercury.

VI. Compliance Determination.

A. Compliance with the 12-month rolling average emission standards of this chapter shall be determined in accordance with the method set forth at 40 CFR Part 60, Subpart Da, § 60.50(h).

B. Compliance with the multi-pollutant requirements of this chapter shall be determined in accordance with the procedure set forth in the [Department's] regulations at _____.

VII. Monitoring.

A. The owner or operator of an EGU subject to this chapter demonstrating compliance with a mercury emission limitation shall measure, record and report the mercury in the exhaust gases by meeting the requirements of 40 CFR Part 60, §60.49a(p), 60.4170-60.4176, and 40 CFR Part 75, Subpart I.

B. The owner or operator of an EGU subject to this chapter demonstrating compliance with an emission limitation for SO_2 or NO_x pursuant to §V.C.2.a shall make such demonstration using data collected to meet the requirements of 40 CFR Part 75, in addition to any other required information (such as SO_2 inlet concentration and MWh generated). The owner or operator of an EGU subject to this chapter demonstrating compliance with an emission limitation for particulate matter pursuant to §V.C.2.b shall make such a demonstration using 40 CFR Part 60 Method 5.

VIII. Recordkeeping and Reporting.

A. The owner or operator of an electric generating unit subject to this chapter shall comply with the record keeping and reporting requirements incorporated in 40 CFR Part 75 and 40 CFR Part 63, §63.10(b) – (f).

B. The owner or operator of an electric generating unit subject to this chapter shall maintain for a period consistent with its Operating Permit, and file with the [Department], records of all compliance calculations and supporting information.

IX. Treatment of EPA Mercury Allowances.

In the event that the U.S. Environmental Protection Agency allocates mercury allowances to the state of _____, such allowances shall be treated as follows:

A. No such allowances shall be allocated to any owner or operator of EGUs or other sources of mercury emissions into the atmosphere or discharges into the water of the state.

B. The state shall hold all allowances allocated by EPA to the state. At the end of each calendar year, the state shall instruct the U.S. Environmental Protection Agency to retire permanently all such allowances.