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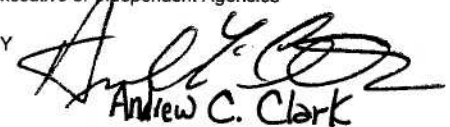
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NOTICE OF FINAL RULEMAKING

DEPARTMENT OF ENVIRONMENTAL PROTECTION  
ENVIRONMENTAL QUALITY BOARD

Mercury Emission Reduction Requirements for Electric Generating Units



**Notice of Final Rulemaking**  
**Department of Environmental Protection**  
**Environmental Quality Board**  
**(25 Pa. Code, Chapter 123)**  
**(Standards for Contaminants)**

**Order**

The Environmental Quality Board (Board) amends Chapter 123 (relating to standards for contaminants) to read as set forth in Annex A. The purpose of this final rulemaking is to establish "state-specific" requirements to reduce mercury emissions from coal-fired electric generating units (EGUs) with a nameplate rated capacity of 25 megawatts that produce electricity for sale. The final-form regulation establishes mercury emission standards, annual emission limitations as part of a statewide annual non-tradable mercury allowance program and monitoring, recordkeeping and reporting requirements to reduce mercury emissions from coal-fired electric generating units or cogeneration units. This final-form regulation will be submitted to the U. S. Environmental Protection Agency (EPA) as an element of the State Plan required under Section 111(d) of the Clean Air Act.

This order was adopted by the Board at its meeting of October 17, 2006.

**A. Effective Date**

These amendments will be effective upon publication in the *Pennsylvania Bulletin* as final-form rulemaking.

**B. Contact Persons**

For further information, contact Krishnan Ramamurthy, Chief, Division of Compliance and Enforcement, Bureau of Air Quality, 12th Floor, Rachel Carson State Office Building, P. O. Box 8468, Harrisburg, PA 17105-8468, (717) 783-9476; or Robert "Bo" Reiley, Assistant Counsel, Bureau of Regulatory Counsel, 9th Floor, Rachel Carson State Office Building, P. O. Box 8464, Harrisburg, PA 17105-8464, (717) 787-7060.

**C. Statutory Authority**

This action is being taken under the authority of section 5(a)(1) of the Air Pollution Control Act (APCA) (35 P. S. § 4005(a)(1)), which grants to the Board the authority to adopt regulations for the prevention, control, reduction, and abatement of air pollution.

## **D. Background and Summary**

### **1. Legal and Regulatory History Related to the Control of Mercury Emissions**

Mercury is a highly toxic pollutant--one specifically targeted by Congress when, in 1990, it amended section 112 of the Clean Air Act (CAA) (42 U.S.C.A. § 7412). The environmental impacts of mercury are significant, widespread and adverse.

Under the 1990 Amendments to the CAA Congress altered the principle focus of the hazardous air pollutants (HAPs) program under Section 112, 42 U.S.C. §7412, from a health-based to a technology-based regulatory program. As part of this new regulatory focus, under Section 112(b), Congress listed 189 HAPs. Those chemicals chosen to be regulated as HAPs under the CAA by Congress are especially harmful to public health and the environment. These chemicals are known to cause cancer, birth defects, lung disease, nervous system disorders, liver damage, and other health problems. Many of these chemicals are also known to bioaccumulate in living organisms and become more concentrated at higher levels in the food chain.

Congress chose to regulate and reduce HAP emissions through a technology-based standard rather than a health-based standard, because the former is more effective in reducing emissions. The control of HAPs through health-based standards by EPA under the pre-1990 CAA Amendments resulted in serial litigation with industry and regulatory paralysis at the agency. Moreover, EPA had a difficult time conducting the necessary risk analysis and ambient air quality analysis to list pollutants and establish emission standards. As a result, Congress concluded that a technology-based approach was appropriate because routine and episodic releases of HAPs posed a significant threat to public health; the risk of adverse health effects related to these emissions were significant; and HAPs may cause significant environmental damage. *See S. COMM. REP. NO. 101-228 at 132 (Report on S. 1630, Clear Air Amendments of 1989.)*

Under Section 112(c), EPA was required to establish a list of all categories and subcategories of major and area sources of air pollution for those pollutants listed under subsection (b). For each listed category of sources, EPA is required, under Section 112(d), to promulgate standards requiring the installation of maximum achievable control technology (MACT), in light of economic, energy, and environmental considerations.

EPA is required to base the standard on the best technology currently available for the source category in question. These standards must be at least as stringent as the level achieved in practice by the best-controlled source in the source category for new sources, or for the best performing group of sources for existing source MACT standards. For existing source MACT standards, EPA defines the "MACT floor" (the minimum stringency level for existing source MACT) in terms of the central tendency (arithmetic mean or median) of the best 12 percent of sources in the source category (where there are 30 or more sources in the category) or the best performing 5 sources (where there are fewer than 30 sources in the category).

As part of this MACT process, EPA has already finalized mercury emission limits for municipal waste combustors and medical waste incinerators, which resulted in a 90 percent

reduction in mercury emissions within 5 years. However, Congress set forth additional regulatory steps before mercury emissions from electric generating units (EGUs) could be controlled.

Under Section 112(n)(1)(A) of the CAA, 42 U.S.C. §7412(n)(1)(A), Congress directed EPA to perform a study of the hazards to public health reasonably anticipated to occur as a result of emissions of HAPs by EGUs. Under this same subparagraph, EPA is further directed to regulate these units, if the agency finds such regulation is appropriate and necessary after considering the results of the study.

In addition to this section of the CAA, Section 112(n)(1)(B), 42 U.S.C. §7412(n)(1)(B), further directs EPA to conduct a study of mercury emissions from EGUs, municipal waste combustion units, and other sources to consider the rate and mass of such emissions, the health and environmental effects of such emissions, control technologies, and the costs of such technologies.

In December of 1997, EPA fulfilled the statutory directive of Section 112(n)(1)(B) when it issued its "Mercury Study Report to Congress," EPA-452/R-97-003. This 1,800 page, eight-volume report discusses the national inventory of anthropogenic mercury emissions in the U.S., the fate and transport of mercury in the environment, an assessment of exposure to mercury in the U.S., health effects of mercury and mercury compounds, an ecological assessment for anthropogenic mercury emissions in the U.S., characterization of human health and wildlife risks from mercury in the U.S., and an evaluation of mercury control technologies and costs.

On February 28, 1998, EPA fulfilled its statutory obligation, under Section 112(n)(1)(A) of the CAA, when it released its "Study of Hazardous Air Pollutant Emissions from Electric Steam Generating Units – Final Report to Congress." This Utility Air Toxics Study issued in February 1998 evaluated EGUs that burn coal, oil, or gas to generate electricity and are greater than 25 megawatts in size. This study includes the description of the utility industry; an analysis of air toxics emissions data from fossil-fuel (coal, oil and gas) fired utilities; an assessment of risks to public health from exposure to toxics emissions through inhalation; assessment of potential risks to the public health from exposure to four specific air toxics (radio nuclides, mercury, arsenic and dioxins) through other indirect means of exposure (e.g., food ingestion, dermal absorption); a general assessment of the fate and transport of mercury through environmental media; and a discussion of alternative control strategies.

On December 20, 2000, EPA concluded, based upon the findings of its 1998 report and on information subsequently obtained, that in accordance with Section 112(n)(1)(A) of the CAA, the regulation of mercury emissions from electric utilities was "appropriate and necessary." 65 Fed. Reg. 79825. As a result of these findings, the agency added these units to the list of source categories to be regulated under Section 112(c). EPA was then required to establish emission standards for this source category under Section 112(d) of the CAA.

On March 29, 2005, EPA published a final rule entitled "Revision of December 2000 Regulatory Finding on the Emissions of Hazardous Air Pollutants From Electric Utility Steam Generating Units and the Removal of Coal- and Oil-Fired Electric Utility Steam Generating

Units From the Section 112(c) List.” 70 Fed. Reg. 15993. The agency now believes that it is neither appropriate nor necessary to regulate mercury from these units under Section 112 of the CAA.

As a result of this conclusion, EPA removed coal- and oil-fired EGUs from the Section 112(c) list. This final action means that EPA does not have to promulgate MACT standards for the control of mercury emissions from utility units. This action also cleared the way for EPA to regulate these emissions under a Section 111 cap-and-trade approach.

On March 15, 2005, EPA finalized the Clean Air Mercury Rule (CAMR.) The final rulemaking published on May 18, 2005, established standards of performance for mercury for new and existing coal-fired EGUs, as defined in Section 111 of the CAA. 70 Fed. Reg. 28606. New EGUs are subject to different standards of performance based on five subcategories - subbituminous, bituminous, lignite, waste coal, or integrated gasification combined cycle. The CAMR establishes a “cap-and-trade” program by which mercury emissions from new and existing coal-fired EGUs are capped at specified, nation-wide levels. The Phase 1 cap of 38 tons per year (tpy) becomes effective in 2010, and the Phase 2 cap of 15 tpy becomes effective in 2018. Facility owners and operators must demonstrate compliance with the standard by holding one “allowance” for each ounce of mercury emitted in any given year. Allowances will be readily transferable among all regulated facilities under the Section 111 trading scheme.

In response to EPA’s March 29, 2005, revision and CAMR, petitions for review challenging these final agency actions were filed with the U.S. Court of Appeals for the D.C. Circuit. In addition to Pennsylvania, State challengers include California, Connecticut, Delaware, Illinois, Maine, Massachusetts, New Hampshire, New Mexico, New Jersey, New York, Rhode Island, Vermont, and Wisconsin.

On May 31, 2005, Pennsylvania together with the States of California, Connecticut, Delaware, Illinois, Maine, Massachusetts, New Hampshire, New Jersey, New Mexico, New York, Minnesota, Rhode Island, Vermont, and Wisconsin filed a petition for reconsideration under Section 307(d)(7)(B) of the CAA, 42 U.S.C. §7607(d)(7)(B), related to EPA’s March 29, 2005, final action revising its December 2000 regulatory finding. Issues related to this petition included, but were not limited to, whether EPA’s action is contrary to the CAA and supported by the record, and whether the procedural requirements under the Administrative Procedures Act and CAA were followed.

On July 18, 2005, Pennsylvania together with these same States filed a petition for reconsideration under Section 307(d)(7)(B) of the CAA related to CAMR. Issues related to this petition included, but were not limited to, the setting of new source performance standards (“NSPS”) standards based on subcategories of coal, the cost-benefit analysis, air quality modeling, and provisions concerning the 2010 cap on mercury emissions.

On October 28, 2005, EPA granted reconsideration on both petitions and reopened the public comment period related to certain issues under both final actions. *See* 70 Fed. Reg. 62200, and 70 Fed. Reg. 62213.

On December 19, 2005, Pennsylvania and the other States filed comments on these reconsideration actions. Issues related to these reconsideration notices included, but were not

limited to, EPA's legal interpretations, EPA's methodology and conclusions concerning reasonably anticipated hazards to public health resulting from EGU mercury emissions, modeling of mercury deposition, costs, NSPS standards, and statistical analysis used for the NSPS standards.

On June 9, 2006, after considering the petitions for reconsideration and the comments received, EPA decided not to further revise the CAMR other than to explain in more detail what the agency meant by the effectiveness element in the term "necessary." 70 Fed. Reg. 33388. The only two substantive changes EPA made to CAMR in response to comments involve revisions to the State mercury allocations, and to the NSPS. The agency also finalized the regulatory text that clarifies the applicability of CAMR to municipal waste combustors and certain industrial boilers. Finally, the agency denied the requests for reconsideration with respect to all other issues raised in the petitions for reconsideration submitted for both rules.

Section 111(c) and (d) of the CAA requires each state to develop and submit to the U.S. EPA Administrator a procedure for implementing and enforcing the new source performance standards for new sources and emission guidelines for existing sources. Specifically, EPA authorizes States, under the CAMR, to adopt the mercury cap-and-trade program whether by incorporating by reference the CAMR cap-and-trade rule that will be codified in 40 CFR Part 60, Subparts Da and HHHH, or by codifying the provisions of the CAMR cap-and-trade rule, in order to participate in the EPA-administered mercury cap-and-trade program. The final CAMR establishes Pennsylvania's 2010-2017 mercury emissions budget as 1.77 tons and the 2018 budget as 0.702 tons.

Each State participating in the EPA-administered cap-and-trade programs must develop a method for allocating an amount of allowances authorizing the emissions tonnage of the State's CAMR budget. Each State has the flexibility to allocate its allowances however they choose, so long as certain timing requirements are met. States may elect to participate in the EPA-managed cap-and-trade program for coal-fired EGUs. However, state participation in this program is voluntary. For States that elect not to participate in the EPA-administered mercury cap-and-trade program, a methodology must be established by the States to meet the CAMR mercury emission budgets by reducing mercury emissions.

By November 17, 2006, States must submit a plan to EPA to implement the requirements of the CAMR or a more protective program. If a State fails to submit a State plan, as required in the final rule, EPA will prescribe a Federal plan for that State, under Section 111(d)(2)(A) of the CAA. EPA would propose the model rule under CAMR as that Federal plan. However, EPA has indicated in the preamble to the final rule that States are free to develop a more stringent mercury control program than the one set forth in the final rule.

The Department held three public hearings on the proposed State Plan for designated EGU facilities. See 36 Pa.B. 4269 (August 5, 2006.) On September 6, 2006, public hearings were held at two DEP Regional Offices in Norristown and Pittsburgh, and at the Rachel Carson State Office Building in Harrisburg. This final-form regulation will be submitted to EPA as the State Plan to fulfill Pennsylvania's requirements under CAMR for existing EGUs.

## **2. Anthropogenic Sources of Mercury Emissions**

Since the beginning of the industrial age, human activities have increased the amount of mercury releases to the environment. Today in the United States, the combustion of coal at coal-fired power plants represents the largest source category of mercury emissions at approximately 43 percent. The second largest category after coal-fired power plants is electric arc furnaces at 10 percent.

Pennsylvania has 36 coal-fired power plants with 78 EGUs that represent approximately 20,000 megawatts of capacity. These units accounted for approximately 78 percent of the more than 5 tons of mercury emitted into the air from all contamination sources in this Commonwealth, ranking this Commonwealth second only to Texas in terms of total mercury emissions and third behind Texas and Ohio, respectively, for EGU-specific mercury emissions in 2003. The Commonwealth's next largest source of mercury emissions is the stone/clay/glass category, which accounts for almost 9 percent of the total.

The primary reason that coal-fired power plants represent such a large percentage of mercury emissions in the United States and Pennsylvania is because this source category is unregulated for this type of emissions. While both the national and Pennsylvania figures show that coal-fired power plants emit a disproportionate amount of mercury, mercury emissions from coal-fired power plants in Pennsylvania are disproportionate to the national figure. Therefore, the Board believes that it is important to ensure that uncontrolled mercury emissions from the EGU source category are regulated as intended by Congress under the CAA.

## **3. The Mercury Cycle in the Environment**

Mercury cycles throughout the environment are a consequence of both natural and human activities. The annual global cycling of mercury in the earth's atmosphere amounts to about 5,000 tons. It is estimated that 4,000 tons are the consequence of anthropogenic activities. The U.S. is responsible for 3 percent of the global anthropogenic emissions. Mercury in the air eventually settles into water or onto land where it can be washed into water. Once deposited, certain microorganisms can change it into methylmercury, a highly toxic form that builds up in fish, shellfish and animals that eat fish. Methylmercury builds up more in some types of fish and shellfish than others. The levels of methylmercury in fish and shellfish depend on what they eat, how long they live and how high they are in the food chain. Fish and shellfish are the main sources of methylmercury exposure to humans. Because the developing fetus may be the most sensitive to the effects from methylmercury, women of childbearing age are regarded as the population of greatest interest.

## **4. Mercury Deposition in Pennsylvania's Environment**

The mercury in the flue gas of EGUs can be characterized as being in two forms: ionic (oxidized) or elemental. The ability of an air pollution control system to capture the mercury is dependent, in part, on the species of the mercury in the flue gas. When the coal is burned in an electric utility boiler, the resulting high combustion temperatures vaporize the mercury in the coal to form gaseous elemental mercury ( $\text{Hg}^0$ ). Subsequent cooling of the combustion gases and



interaction of the gaseous  $\text{Hg}^0$  with other combustion products results in a portion of the Hg being converted to gaseous ionic or oxidized forms of mercury ( $\text{Hg}^{+2}$ ) and particle bound mercury ( $\text{Hg}_p$ ). The lifetime of elemental mercury ( $\text{Hg}^0$ ) in the atmosphere is estimated to be up to a year, while ionic forms have a lifetime of only a few days because of particulate settling and solubility.  $\text{Hg}^0$  can be transported over transcontinental distances, whereas  $\text{Hg}^{+2}$  gaseous and  $\text{Hg}_p$  forms are deposited near their source. Coal-fired power plants that burn bituminous coal emit oxidized forms of mercury. In Pennsylvania, 85 percent of the coal burned by coal-fired power plants is bituminous, with the remainder waste coal. In Pennsylvania, on a statewide average, the exhaust gas split of the three forms of mercury is as follows: 5.93 percent  $\text{Hg}_p$ , 59.99 percent  $\text{Hg}^{+2}$ , and 34.08 percent  $\text{Hg}^0$ . The percentage of  $\text{Hg}^{+2}$  emitted in Pennsylvania is higher than the national average. Consequently, Pennsylvania coal-fired power plants are more likely to cause local deposition.

On April 27, 2005, preliminary results from the EPA-funded "Steubenville Mercury Deposition Source Apportionment Study" were released. This study found that nearly 70 percent of the mercury in rain collected at an Ohio River Valley monitoring site originated from nearby coal-burning industrial plants. This study entitled "Sources of Mercury Wet Deposition in Eastern Ohio, USA" is scheduled to appear in the peer-reviewed journal of *Environmental Science and Technology* shortly. Also, according to the Goddard Earth Observing System-Chem modeling and Community Multi-scale Air Quality (CMAQ) modeling results for 2001 the mercury deposition attributable to U.S. EGUs in the eastern portion of the country is generally 1 - 5  $\mu\text{g m}^{-2}$  range. However, in the eastern U.S. there is a large area in the Ohio River Valley with EGU attributable mercury depositions in the 5 - 10  $\mu\text{g m}^{-2}$  range and a much smaller area in the 10 - 15  $\mu\text{g m}^{-2}$  range. U.S. EGUs attributable mercury depositions over 20  $\mu\text{g m}^{-2}$  are found in parts of the Commonwealth of Pennsylvania. It is in Pennsylvania where the maximum percentage of utility attributable deposition of 71 percent compared to total deposition from all sources occurs. See "Mercury Deposition Modeling with the Community Multi-scale Air Quality (CMAQ) Model for the Clean Air Mercury Rule (CAMR)," Thomas N. Braverman, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Mail Code C439-01, Research Triangle Park, NC 27711, Poster Session, 8th International Conference on Mercury as a Global Pollutant, June 2006. These and other studies confirm the Board's conclusion that the mercury speciation trends for Pennsylvania tend to favor the likelihood of higher local mercury deposition than that for the national average.

## 5. Mercury in Pennsylvania's Environment

Accumulation of mercury in aquatic ecosystems has resulted in 45 states, including this Commonwealth, issuing fish consumption advisories. The Commonwealth has fish consumption advisories for mercury in approximately 80 waterways across this Commonwealth, which includes the Delaware, Ohio, Potomac and Susquehanna River Basins and the Lake Erie Basin. Mercury fish advisories account for 60 percent of the fish consumption advisories throughout the Commonwealth.

The Department has reviewed the mercury tissue concentration of fish in Pennsylvania water bodies from 1999 to 2004. The highest fish concentration of mercury was 1.564 ppm in walleye found at Lake Wallenpaupack. The lowest fish concentration of mercury was 0.036 ppm found

in brown trout in the Delaware River near State Route 191. Of the approximately 187 sampling sites, 100 sites found fish tissue concentrations of 0.32 ppm or more which has an EPA risk-based consumption limit of no more than 2 meals per month.

The Department has mapped the location of the active, and in some cases, inactive power plants located in Pennsylvania together with the mercury concentration found in fish. For example, the Department has identified four sampling sites with fish tissue concentrations in the 0.30 to 0.89 ppm range within a 50-mile radius of the Shawville power plant in Clearfield County. This data suggests a correlation between higher mercury fish concentrations and power plants within a 50-mile radius from the sampling sites. Also this data lends strong support to the Department's concern that coal-fired power plants that burn bituminous coal emit ionic forms of mercury, which are deposited near their source. As a result, the Board has concluded that mercury contamination is ubiquitous across the Commonwealth and should be reduced.

## **6. Health Effects of Mercury**

Mercury is a dangerous reproductive and neurological toxicant. It can affect the brain, spinal cord, kidneys and liver. High exposure levels to mercury can affect the ability to feel, see and taste and has the potential to limit mobility. A study by the National Academy of Sciences (NAS) concluded that human exposure to methylmercury from eating contaminated fish and seafood is associated with adverse neurological and developmental health effects. Women of childbearing age and pregnant women are of special concern in terms of methylmercury exposure. Methylmercury exposure prior to pregnancy can actually place the developing fetus at risk because methylmercury persists in body tissue and is only slowly excreted from the body. Furthermore, according to the NAS, chronic low-dose prenatal methylmercury exposure has been associated with poor performance on neurobehavioral tests in children, including those tests that measure attention, visual spatial ability, verbal memory, language ability, fine motor skills and intelligence. Adults can be affected by high mercury exposures as well, with effects on the nervous system and impaired vision and hearing.

In EPA's Mercury Study Report to Congress (1997) EPA estimated that 7 percent of women of childbearing age would have blood mercury concentrations greater than those equivalent to the RfD. The estimate of 7 percent of women of childbearing age above the RfD was based on patterns of fish and shellfish consumption and methylmercury concentrations present in fish and shellfish. Blood mercury analyses in the 1999-2000 National Health and Nutrition Examination Survey for 16-to-49 year old women showed that approximately 8 percent of women in the survey had blood mercury concentrations greater than 5.8 ug/L (which is a blood mercury level equivalent to the current RfD). Based on this prevalence for the overall U.S. population of women of reproductive age and the number of U.S. births each year, it is estimated that more than 300,000 newborns each year may have increased risk of learning disabilities associated with in utero exposure to methylmercury.

To determine levels of total blood Hg in childbearing-aged women and in children aged 1--5 years in the United States, Centers for Disease Control's National Health and Nutrition Examination Survey ("NHANES") began measuring blood Hg levels in these populations in 1999. The "NHANES is a continuous survey of the health and nutritional status of the civilian,

noninstitutionalized U.S. population; data are released and reported in 2-year cycles.” NHANES results for 1999--2002 confirmed that blood mercury levels in young children and women of childbearing age usually are below levels of concern. However, approximately 6 percent of childbearing-aged women had levels at or above a reference dose.

One area in which the toxicokinetic data have been consistent is the finding that methylmercury is actively transferred to the fetus across the placenta via neutral amino acid carriers during gestation. Although maternal and cord blood mercury concentration is highly correlated, core-blood mercury is consistently higher than the corresponding maternal concentration with an average ratio of about 1.7. Consequently for biomonitoring of adult women's blood methylmercury commonly used as a surrogate for potential fetal exposure, the corresponding fetal level will be, on average, 70 percent higher than maternal blood and up to three-times higher at the 95th percentile. The maternal body burden of methylmercury tends to decrease during gestation, consistent with hemodilution and a transfer of a portion of the maternal body burden to the fetus.

Recent separate studies by Stern, et. al. (2006), Trasande et. al (2005), and Mahaffey, et al. (2004), suggest that even the EPA established RfD is too high. According to Trasande, there is no evidence to date validating the existence of a threshold blood mercury concentration below which adverse effects on cognition are not seen. See Leonardo Trasande, et al., “Public Health and Economic Consequences of Methylmercury Toxicity to the Developing Brain,” 113 *Environmental Health Perspectives*, No. 5 (May 2005). Stern in his 2006 presentation at the 8th International Conference on Mercury as a Global Pollutant titled, “An Estimate of the Population Variability in the Relationship Between Cord Blood Mercury and Maternal Methylmercury Intake” found that the EPA RfD should be reduced by 33 percent. See also Stern, et al., “An Assessment of the Cord Blood Maternal Blood Methylmercury Ratio: Implications for Risk Assessment,” *Environmental Health Perspective* 111:1465–1470 (2003.) In January 2004 an EPA researcher estimated that at least 7.8 percent (and possibly as many as 15.7 percent) women of child bearing age had blood mercury levels high enough that approximately 630,000 newborns may be at risk from the adverse effects of mercury. Kathryn R. Mahaffey, PhD., *Methylmercury: Epidemiology Update* (Jan. 26, 2004).

Additionally Congress has declared that the HAPs listed under Section 112(b) of the CAA pose a significant threat to public health; the risk of adverse health effects related to these emissions were significant; and HAPs may cause significant environmental damage.

Because of these, and other studies, the Board has determined that methylmercury is a public health concern for the developing fetus, women of childbearing age, young children, and adults. Moreover, the Board has determined that a reduction in the amount of mercury and methylmercury in the environment would improve local ecosystems and public health, especially the health of developing fetuses, young children, and women of childbearing age.

## **7. Cost Benefit Studies Related to Mercury Emissions**

The Northeast States for Coordinated Air Use Management (“NESCAUM”) sponsored a report analyzing the cost savings and public health benefits of controlling mercury emissions from

power plants. NESCAUM, *Economic Valuation of Human Health Benefits of Controlling Mercury Emissions from U.S. Coal-fired Power Plants*, (Feb. 2005) (“Harvard Study”). The Harvard Study reveals that EPA miscalculated the “nature of the risk involved” by underestimating the public health benefits of reducing mercury. Specifically, the Harvard Study indicates that the public benefit of reducing power plant mercury emissions to 15 tons per year ranges from \$119 million annually (if only persistent IQ deficits from fetal exposures to methylmercury are counted) to as much as \$5.2 billion annually (if IQ deficits, cardiovascular effects, and premature mortality are all counted).

The May 2005 edition of *Environmental Health Perspectives* indicates that EPA underestimated the health benefits to be gained from reducing mercury. In one study, scientists from the Mount Sinai School of Medicine examined national blood mercury prevalence data from the Centers for Disease Control and Prevention and found that between 316,588 and 637,233 children each year have cord blood mercury levels greater than 5.8 micrograms per liter - the level associated with loss of IQ. See Leonardo Trasande, *et al.*, “Public Health and Economic Consequences of Methylmercury Toxicity to the Developing Brain,” 113 *Environmental Health Perspectives*, No. 5 (May 2005). They estimated that the resulting loss of intelligence and diminished economic activity amounted to \$8.7 billion annually, with \$1.3 billion each year being directly attributable to mercury emissions from power plants. The scientists further caution that these costs will recur each year with each new birth cohort as long as mercury emissions are not controlled.

Trasande and his colleagues have further concluded that their calculations on economic cost may, in fact, be an underestimate. See “Mental retardation and prenatal methylmercury toxicity.” *AM J Ind Med.* 2006 Mar; 49(3):153-8. Downward shifts in IQ resulting from prenatal exposure to methylmercury of anthropogenic origin are associated with 1,566 excess cases of mental retardation annually (range: 376-14,293). This represents 3.2 percent of mental retardation cases in the US (range: 0.8 percent-29.2 percent). The mental retardation costs associated with decreases in IQ in these children amount to \$2.0 billion/year (range: \$0.5-17.9 billion). Mercury from American power plants accounts for 231 of the excess mental retardation cases/year (range: 28-2,109), or 0.5 percent (range: 0.06 percent-4.3 percent) of all mental retardation. These cases cost \$289 million (range: \$35 million-2.6 billion). Therefore, Trasande concludes that toxic injury to the fetal brain caused by mercury from coal-fired power plants exacts a significant human and economic toll on American children. These conclusions have been peer-reviewed.

It should also be noted, as previously discussed, under the 1990 Amendments to the CAA Congress ended the debate related to the development of risk analyses for HAPs. Congress concluded that a technology-based approach was appropriate because routine and episodic releases of HAPs posed a significant threat to public health; the risk of adverse health effects related to these emissions were significant; and HAPs may cause significant environmental damage. As a result, HAP emissions must be regulated to the maximum extent possible. Therefore the Board concludes that the benefits of regulating mercury emissions from coal-fired power plants in the Commonwealth outweigh the costs associated with that regulation.

## **8. Federal Analysis Related to CAMR**

On February 3, 2005, the EPA Office of Inspector General (“OIG”) published an Evaluation Report: “Additional Analyses of Mercury Emissions Needed before EPA Finalizes Rules for Coal-Fired Electric Utilities.” EPA’s OIG found that EPA’s cap-and-trade proposal failed to adequately address the potential for hotspots of mercury pollution. The OIG also found evidence that, instead of basing its proposed MACT standard on an unbiased determination under Section 112(d) of what mercury emission rates the top performing units were achieving, EPA staff followed orders from EPA senior management and simply set the MACT standard at a rate that would result in national emissions of 34 tons annually. Finally, the OIG found that EPA’s rule development process did not comply with certain Agency and Executive Order requirements, including not fully analyzing the costs/benefits of regulatory alternatives and not fully assessing the rule’s impact on children’s health. The OIG recommended that EPA conduct additional analyses of mercury emissions data, strengthen its cap-and-trade proposal, assess the costs/benefits of regulatory alternatives to its proposal, and fully explore potential impacts to children’s health.

In February 2005, the United States Government Accountability Office (“GAO”) issued a report to Congressional requesters entitled “Clean Air Act: Observations on EPA’s Cost-Benefit Analysis of Its Mercury Control Options.” The GAO concluded that EPA’s economic analysis of its proposed mercury control options had four major shortcomings: it failed to document some of its analysis; it failed to follow Office of Management and Budget guidance; it did not estimate the value of health benefits that would result from decreased mercury emissions; and it failed to analyze some of the key uncertainties underlying its cost/benefit estimates. The GAO concluded that, as a result of these shortcomings, EPA’s cost/benefit estimates are not comparable and are of limited use for assessing the economic trade-offs of the different options for controlling mercury.

On April 15, 2005, the Congressional Research Service developed a report entitled, “Mercury Emissions from Electric Power Plants: An Analysis of EPA’s Cap-and-Trade Regulations.” Among other things, this report found that CAMR would allow utilities to delay full compliance with the 70 percent reduction until well beyond 2018, as they use up banked allowances rather than install further controls. The agency’s analysis projects actual emissions to be 24.3 tons as late as 2020 (less than a 50 percent reduction compared to baseline 1999 emissions). It appears that full compliance with the 70 percent reduction might be delayed until 2030.

In a May 15, 2006 report entitled, “Monitoring Needed to Assess Impact of EPA’s Clear Air Mercury Rule on Potential Hotspots, the OIG found several uncertainties associated with key variables in the analysis could affect the accuracy of the Agency’s conclusion that CAMR will not result in “utility-attributable” hotspots. They noted gaps in available data and science for mercury emissions estimates, limitations with the model used for predicting mercury deposition, uncertainty over how mercury reacts in the atmosphere, and uncertainty over how mercury changes to a more toxic form in water bodies.

The Board finds that there were serious procedural and analytical flaws related to the promulgation of EPA’s CAMR.

**9. Legal Analysis Related to the Control of Hazardous Air Pollutants under the federal Clean Air Act and the Pennsylvania Air Pollution Control Act**

The Department has determined that EPA does not have the legal authority to develop a regulatory scheme for a HAP, like mercury, under Section 111 of the CAA. The Congressional intent related to the regulation of mercury is clear and unambiguous – it must be regulated under Section 112 of the CAA. Mercury is explicitly identified as a hazardous air pollutant under Section 112(b). For sources other than coal-fired units, EPA must list source categories under Section 112(c) and then set emission standards for those categories under Section 112(d). While the statutory scheme for regulating mercury from coal-fired units is under Section 112(n), the Congressional intent is the same – mercury emissions from these units must be regulated under the Section 112 MACT approach.

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EPA's proposed "cap-and-trade" program is an unreasonable interpretation of its statutory authority under Section 111 and Section 112. The fact that Congress chose to list specific HAPs under Section 112 indicated that Congress believed that these pollutants required more stringent measures than those permitted under Section 111. Moreover, regulation under Section 112 has been historically and consistently interpreted as requiring HAPs to be controlled through installation and operation of maximum achievable control technology. A cap-and-trade approach under this Section was never contemplated as a control technology. As a result, EPA is now acting contrary to this Congressional intent by attempting to regulate mercury HAP sources under a less stringent standard than the framers of the CAA desired.

The Pennsylvania Air Pollution Control Act ("APCA") also contains specific provisions applicable to the regulation of HAPs regulated under Section 112 of the CAA. Section 6.6 (a) of the APCA provides that "the regulations establishing performance or emission standards promulgated under section 112 of the [CAA] are incorporated by reference into the Department's permitting program." 35 P.S. § 4006.6(a). Section 6.6(a) further provides that the "Environmental Quality Board may not establish a more stringent performance or emission standard for hazardous air pollutant emissions from existing sources, except as provided in subsection (d) [regarding health risk-based emission standards]." This "no more stringent than" provision applies to performance standards (maximum achievable control technology) or requirements adopted pursuant to Section 112 of the CAA.

As previously noted, on March 29, 2005, EPA revised its December 2000 “appropriate and necessary” regulatory finding for the regulation of mercury emissions from coal- and oil-fired EGUs as HAPs and de-listed EGUs, which were included on a list of source categories under Section 112(c) of the CAA. 70 Fed. Reg. 15994. Section 6.6(a) of the APCA provides that the Board may establish emission standards for source categories which are not included on the list of source categories established under Section 112(c) of the CAA. Because of EPA’s March 29, 2005, “delisting” action, the limitations in Section 6.6 (a) are not applicable to performance standards and other measures that would be adopted to implement the Section 111 standards for new and existing sources.

The Board had determined that it has the legal authority to promulgate a regulation under the APCA to control mercury emissions from coal-fired EGUs within this Commonwealth.

#### **10. Petition for Rulemaking Process**

On August 9, 2004, Citizens for Pennsylvania's Future, PennEnvironment, Pennsylvania Federation of Sportsmen's Clubs, Pennsylvania NOW, Pennsylvania State Building and Construction Trades Council, Pennsylvania Trout, Planned Parenthood Pennsylvania Advocates, Sierra Club Pennsylvania Chapter, Women's Law Project and WomenVote PA (petitioners) filed a petition for rulemaking, under Chapter 23 (relating to Environmental Quality Board Policy for processing petitions--statement of policy), requesting that the Board adopt regulations to reduce mercury emissions from electric utilities located in this Commonwealth. Since the original filing of the petition, an additional 39 organizations declared their intent to be copetitioners. The petitioners seek to protect human health and the environment through the regulation of mercury emissions from coal-fired power plants in this Commonwealth. They requested that the Department exercise its statutory authority under the APCA and develop a regulatory program to reduce the mercury emissions from electric utilities for consideration by the Board. The petitioners submitted suggested regulatory language adapted from a January 5, 2004, New Jersey Department of Environmental Protection (NJDEP) proposal to reduce mercury emissions from coal-fired boilers.

On May 18, 2005, the Department finalized its response to the petitioners' petition for rulemaking and set forth its rationale as to why neither the NJDEP regulation nor the EPA's CAMR was in the best interest of this Commonwealth. The New Jersey regulatory language has one emission standard for both new and existing sources. The Department believes there should be separate emission standards for new and existing coal-fired boilers. Moreover, New Jersey has a limited number of coal-fired utility units, which are not representative of the significantly varied boiler types in this Commonwealth.

The Department also does not believe that the EPA's Section 111 approach to mercury control for the electric generating sector is best for this Commonwealth. The Department strongly opposes a cap-and-trade approach under the CAMR for the regulation of mercury emissions from the utility sector for a number of reasons. First, the Department believes that the EPA does not have the legal authority to regulate an HAP like mercury under the less stringent provisions of section 111 of the CAA, as opposed to the more stringent provisions under section 112 of the CAA. Second, the Department believes this approach will significantly delay the control of

mercury emissions from the utility sector and will create "hot spots" of mercury exposure that could be very detrimental to humans and wildlife. Third, the Department believes that the CAMR, since it is not a fuel-neutral regulation, requires greater reductions from coal-fired units that burn bituminous coal from states like this Commonwealth. Consequently, the Department recommended that a comprehensive approach to mercury control should be considered and recommended the development of a fuel-neutral regulatory approach to mercury emissions control.

On August 16, 2005, the Board accepted the Department's recommendation to move forward with a Pennsylvania-specific mercury rule with an expanded public involvement process. The list of stakeholders to be included in the public involvement process was expanded to include the Pennsylvania Chamber of Business and Industry, Pennsylvania Chemical Industry Council, Associated Petroleum Industries of Pennsylvania, Pennsylvania Manufacturers Association, Industrial Energy Users of Pennsylvania, Electric Power Generation Association, Pennsylvania Coal Association, United Mine Workers of America, Air Quality Technical Advisory Committee, Citizens Advisory Council, the petitioners and other representatives of the potentially regulated community.

The Department established a Mercury Rule Workgroup (Workgroup) as part of the expanded public involvement process for a Pennsylvania-specific mercury rule. The intent of the Workgroup was not to reach consensus related to the regulation of mercury emissions in Pennsylvania, but to develop information to assist the Department in the development of a mercury rule and enhance the public participation related to the drafting of this rule. The first Workgroup meeting was held on October 14, 2005. During the first meeting, presentations included Workgroup objectives, an overview of mercury, its fate and transport and other state regulations. The second meeting of the Workgroup was held on October 28, 2005. The second meeting focused on the health impacts of mercury. The third meeting of the Workgroup was held on November 18, 2005. Speakers at this meeting discussed the health impacts of mercury and methods of controlling mercury emissions from coal-fired power plants. The last Workgroup meeting was held on November 30, 2005. This last meeting focused on additional health impacts regarding mercury, and Workgroup members and others discussed their organizations' proposals for the control of mercury.

On February 22, 2006, the Department presented concepts of its proposal at a joint meeting of the Citizens Advisory Council/Air Quality Technical Advisory Committee/Mercury Workgroup. Additionally, on March 30, 2006 the Air Quality Technical Advisory Committee (AQTAC) recommended that the Board consider the proposed rulemaking at its May 17, 2006, meeting.

On May 17, 2006, the Board heard a Department presentation concerning the proposed Mercury Rule. During discussions on the proposal, EQB members from the Citizen's Advisory Council requested that the Department prepare a "Decision Document." Following discussion, the Board approved the proposed rulemaking for public comment. The Board also requested a Decision Document to complement other documentation prepared for the final mercury rulemaking. The Board noted that this document should set forth the Department's justification, rationale, and supporting information for the final rule. This decision document is available for public inspection at the Department's web site at <http://www.depweb.state.pa.us>. This document



includes a compilation and summary of the data, models, studies, and evidence considered and used to support the decision-making; the legal and regulatory history and rationale for the rule; and an evaluation of arguments and information presented by those opposed to the rulemaking and an explanation of the decision trail and intent of the final-form regulation.

On June 24, 2006, the proposal was published in the *Pennsylvania Bulletin* for a 60-day comment period. See 36 Pa.B. 3185.

On September 27, 2006, the Department requested that the AQTAC take action on this final-form rulemaking. AQTAC approved this final-rulemaking for consideration by the Board at its October 17, 2006 meeting.

#### **11. Public Health and Environmental Improvements Related to a Pennsylvania-Specific Mercury Emissions Reduction Rule**

The Department has reviewed several studies and reports of fish consumption by the general population and by sport anglers to answer the question of how these anglers and their families might be at risk of consuming mercury contaminants at levels greater than health-based limits in the fish they caught. Because statewide data is limited, the Department reviewed national surveys to evaluate fish consumption. These studies are extraordinarily useful to summarize data on human behaviors and characteristics, which affect exposure to environmental contaminants, like mercury. For example, EPA's "Exposure Factors Handbook" was consulted to obtain data on standard factors needed to calculate human exposure to mercury from fish intake. For all fish the recommended values are 6.0 grams per day (g/d) for freshwater/ estuarine fish, 14.1 g/d for marine fish, and 20.1 g/d for all fish. The recommended mean and 95th percentile values for recreational freshwater anglers are 8 g/d and 25 g/d, respectively.

The Pennsylvania Fish and Boat Commission has determined that approximately 800,000 anglers fish in Pennsylvania waters in 2005. Studies of sport fish consumption by angler cohorts in Michigan provide a thorough evaluation of consumers of sport fish. The studies of Michigan anglers provide data for total amounts of fish and self-caught fish consumed by various sub-groups of the cohort. See e.g., West, "1991-1992. Michigan sport anglers fish consumption study." University of Michigan School of Natural Resources for the Michigan Department of Natural Resources, Technical Report No. 6, 1993. This group also consumes much more fish than the general population, with mean and 95th percentile rates as high as 61.3 and 123.9 g/d (99 and 199 meals/year), respectively. Particularly relevant for describing at-risk populations are the information regarding females (ages not specified), with mean and 95th percentile of total fish consumption reported to be 42.3 and 85.7 g/d (68 and 138 meals/year), respectively.

Hudson River Sloop Clearwater, Inc. conducted a survey of adherence to fish consumption health advisories among Hudson River anglers. See "Hudson River Angler Survey," Hudson River Sloop Clearwater, Inc. (1993). Approximately 94 percent of Hispanic Americans were likely to eat their catch, while 77 percent of African Americans and 47 percent of Caucasian Americans intended to eat their catch. Of those who eat their catch, 87 percent were likely to share their meal with others (including women of childbearing age, and children under the age of fifteen).

In 2000, a study was published on behalf of the Pennsylvania Fish and Boat Commission to determine levels of stocked trout consumption among anglers as well as their awareness and attitudes towards consumption advisories. See "Levels of Trout Consumption and Attitudes Toward Consumption Advisories Among Pennsylvania Trout Anglers," Responsive Management, 2000, Conducted for the Pennsylvania Fish and Boat Commission. Seventy-eight percent of those who were aware of trout consumption advisories stated that they followed them but only 48 percent said that the advisory impacted their consumption decisions regarding stocked trout.

The Department's review of fish consumption literature provides strong support that Pennsylvania sport anglers may consume amounts of sport-caught fish that could allow them and their families to exceed health-based limits for mercury contaminants in their fish. The literature regarding anglers' consumption of their catch strongly suggests that a subset of these anglers have meal frequencies that put them well above the recommended rates for even fairly low levels of contamination. Furthermore, a review of the relevant studies suggests that there is a strong environmental justice component related to this public health issue. Consumption rates were higher among minorities, people with low income, and people residing in smaller communities. As a result, the Department can say with a high level of confidence that it is possible for anglers and their families to consume enough sport fish to put themselves and their families at risk from mercury contamination from their fish.

A multi-agency State of Florida study launched in 1994 compared mercury levels in the Everglades before and after pollution controls were installed at municipal and medical waste incinerators in South Florida. See "Everglades Consolidated Report," The South Florida Water Management District and the Florida Department of Environmental Protection. Since the 1980s, mercury emissions from waste incinerators close to the Everglades have dropped nearly 99 percent. Over the last ten years, scientists documented a 70 percent decline in mercury in bird feathers and a 60 percent decrease in fish tissue. While this study focused on waste incinerators, and not bituminous coal-fired power plants, it is important to note that both of source categories emit comparable amounts of ionic mercury, which deposits locally. As a result, the conclusions in multi-agency Florida study are applicable to Pennsylvania.

The mercury concentration in fish was investigated in a region of Massachusetts predicted to have regionally high atmospheric deposition of mercury during 1999 to 2004. See "Massachusetts Fish Tissue Mercury Studies: Long Term Monitoring Results 1999-2004," by the Massachusetts Department of Environmental Protection, 2006. In eight of the nine water bodies located in northeastern Massachusetts significant decreases in mercury in yellow perch were observed with a range of 26.0 percent to 61.9 percent. The mean decrease over all lakes was 32.4 percent. Five of the remaining eight lakes around the rest of the state also had statistically significant, but not as large, decreases in yellow perch mercury levels ranging from 20.1 percent to 28.0 percent with an overall mean decrease of 15.4 percent.

Large mouth bass mercury concentrations followed a similar pattern with 11 of 17 lakes throughout the state decreasing in tissue mercury concentrations. Eleven of the lakes sampled were in northeastern and mercury levels in large mouth bass from 7 of those decreased

significantly, ranging from 16.0 percent to 55.2 percent with a mean decrease of 24.8 percent. Four of the remaining six lakes located around the rest of the state also had statistically significant but smaller decreases in large mouth bass mercury concentrations. The range of these decreases was 15.9 percent to 36.4 percent with a mean decrease of 19.0 percent. These reductions were achieved primarily through the imposition of stringent mercury emissions controls on municipal solid waste incinerators and medical waste incinerators, as well as reductions from other regional sources. In both studies, the emission reductions, which are predominantly in the form of ionic mercury from local incinerators, resulted in significant reductions in mercury levels in fish. As with the Florida study, while this study focused on waste incinerators, and not bituminous coal-fired power plants, it is important to note that both of source categories emit comparable amounts of ionic mercury, which deposits locally. As a result, the conclusions in multi-agency Florida study are applicable to Pennsylvania.

Other studies confirm the results of the Florida and Massachusetts studies where the response of mercury deposition rates to emission reductions close to anthropogenic sources is expected to be much more rapid than that at remote locations, largely because near-field mercury deposition is probably dominated by local  $Hg^{+2}$  emissions. These studies find good historical evidence from lake-sediment records for rapid and large (30 percent – 50 percent) declines in mercury deposition from urban areas in the United States and Europe. Moreover, these declines occurred over the last one to three decades and correspond with known reductions in local and regional mercury emissions for the same areas. See Munthe, J.; *et al*, "Input-output of Hg in forested catchments in Europe and North America." *RMZ-Materials and Geoenvironment* 51:1243-1246, (2004). See also Engstrom, D.R., and Swain, E.B. 1997. "Recent declines in atmospheric mercury deposition in the upper Midwest." *Environ. Sci. Technol.* 31: 60—967. See Kamman, N.C., and Engstrom, D.R. 2002. "Historical and present fluxes of mercury to Vermont and New Hampshire lakes inferred from 210Pb dated sediment cores." *Atmos. Environ.* 36: 599-1609.

The literature review conducted by the Department confirms that mercury reduction approaches translate into a significant drop in mercury concentrations found in fish and other fauna. These illustrate the point that despite the fact that there are global mercury transportation issues, local emission reduction efforts are very significant to the local air quality, human exposure, and environmental impacts. Continued improvements to the ecosystem are expected in the long-term as these reductions work their way through the food chain. Consequently, the Board has found reductions in mercury emissions do translate into real, measurable improvements in public health and the environment in Pennsylvania.

## **12. Improvements Related to the Pennsylvania Tourism Industry**

As previously noted, the Pennsylvania Fish and Boat Commission has determined that approximately 800,000 anglers fish in Pennsylvania waters in 2005. Fish licensing sales in Pennsylvania amounted to \$18.5 million in 2005. According to the Erie Regional and Growth Partnership, Pennsylvania residents age 16 years and older spent \$400 million on fishing in Pennsylvania in 2001. The average angler spent \$458 in 2001 on fishing. These direct expenditures created \$1.2 billion in Pennsylvania economic output. Also as noted previously, the Commonwealth has fish consumption advisories for mercury in approximately 80 waterways

across this Commonwealth, 60 percent of which are related to mercury fish consumption advisories.

Resources for the Future conducted a study on mercury contamination of the Chesapeake Bay entitled "The Benefits and Costs of Fish Consumption Advisories for Mercury," October 2002. Applying an estimate of the percentage of consumer surplus lost due to an advisory from the literature to consumer surplus estimates for a fishing day in the Chesapeake Bay, they estimate an annual consumer surplus loss over all Maryland saltwater fishing days of \$8.83 million (in \$2000). For the commercial striped bass fishery, they estimate a very simple model of supply and demand that predicts equilibrium price and quantity with reasonable accuracy. Using parameter estimates from this model, they estimate annual consumer and producer surplus losses of \$215,800 and \$304,500, respectively, under commercial consumption advice, for a total annual surplus loss of \$520,300.

Furthermore, based on their mortality estimate, the Resources for the Future report estimates annual health benefits from an advisory to be approximately \$14 million. They conclude the value of further information for this mercury mortality relationship is quite high, as it suggests that significant health benefits may accrue at lower mercury levels than has been suggested by the research focusing on neurological development effects from fetal exposure, the health endpoint that has been the focus of policy discussion to date.

As a result, the Commonwealth has a significant economic interest in fresh water fishing as an economic driver. Therefore, the Board finds that any improvement, or prevention of loss, to Pennsylvania's fish activities through implementation of Pennsylvania's mercury rule could have a positive impact to this important industry.

### **13. Mercury Reduction Technologies**

Coal-fired power plants that burn subbituminous coal emit elemental mercury, which is very difficult to capture with conventional air pollution control devices like wet flue gas desulfurization (WFGD) for sulfur dioxide (SO<sub>2</sub>) control and selective catalytic reduction (SCR) for nitrogen oxides (NO<sub>x</sub>) control. Moreover, coal-fired power plants that burn sub-bituminous coal emit Hg<sup>0</sup>, which can be transported over transcontinental distances. Coal-fired power plants that burn bituminous coal emit oxidized forms of mercury, which are easier to capture using WFGD and SCR. Coal-fired power plants that burn bituminous coal emit oxidized forms of mercury, which are deposited near their source. For example, EGUs that burn 100 percent subbituminous coal and control emissions with a WFGD and SCR can expect to capture approximately 16 percent of mercury emissions. In contrast, EGUs that burn 100 percent bituminous coal and control emissions with a WFGD and SCR can expect to capture approximately 90 percent of mercury emissions. In Pennsylvania, 85 percent of coal the burned by coal-fired power plants is bituminous, with the remainder waste coal.

This final-form rulemaking is designed, in part, to take advantage of the co-benefit reductions that will occur under the Clean Air Interstate Rule (CAIR), designed to reduce SO<sub>2</sub> and NO<sub>x</sub> emissions from EGUs. 70 Fed. Reg. 72268, (November 22, 2005).

Owners and operators of facilities in Pennsylvania provided mercury emissions data and mercury coal content data to the Department in December of 2005 in response to our information request. Using this data the mercury removal efficiencies from the facilities that provided mercury emissions data were determined. Our analysis of this data shows that EGUs controlled with cold side-ESP and FGD reduce mercury by 80 percent and EGUs controlled with cold side-electrostatic precipitator (ESP), FGD, and SCR reduce mercury by over 90 percent. While these control devices were not specifically designed to remove mercury, it is possible to modify their operation to increase mercury collection without degrading other emission control or operational aspects. Testing has shown that increasing the rate of slurry recirculation in scrubbers will increase mercury removal. New additives, injected into the scrubber slurry, may also increase mercury removal.

Powdered activated carbon injection (ACI) controls mercury emissions by adsorption onto its surface. Carbon is injected into flue gas and controlled downstream by a particulate collector along with adsorbed mercury. Properties of the activated carbon are selected to maximize mercury control. It is much more effective adsorbing ionized mercury than elemental mercury vapor. Activated carbon treated with a halide, usually bromine, can also be used. It generally provides additional mercury control over other activated carbon for the same injection rate into the flue gas. The Compact Hybrid Particulate Collector (COHPAC) system requires installation of a final fabric filter in addition to existing control equipment. Tested mercury removal rates for various activated carbon injection rates from the EPA paper, "Control of Mercury Emissions from Coal Fired Electric Utility Boilers: An Update", issued February 18, 2005 shows removal rates of 90 percent for ACI with cold side-ESP, ACI-COHPAC, and brominated ACI with cold side-ESP.

The Institute of Clean Air Companies (ICAC) found that air pollution control vendors are reporting booking new contracts for mercury control equipment for more than a dozen power plant boilers. The contracts for commercial systems are attributed to federal and state regulations, including new source permit requirements and consent decrees, which specify high levels of mercury capture.

A Congressional Research Service Report, April 15, 2005, found that EPA's own Office of Research and Development (ORD), in a white paper posted on the EPA website March 2, 2004, appears to conclude that technology is more available and more effective than is maintained in the agency's CAMR rulemaking. ORD found that fabric filters, a relatively simple technology that is currently installed on more than 12 percent of power plants, achieve a 90 percent reduction in mercury emissions at bituminous coal plants and a 72 percent reduction at subbituminous plants. The addition of a scrubber increased the emission reduction to 98 percent at bituminous plants, according to ORD. The white paper further stated that, by 2010, activated carbon injection with a fabric filter "has the potential to achieve 90 percent Hg reduction" on any rank of coal, and could be installed within 1-2 years of signing a contract to do so. Since the white paper was written, there have been reports that a European firm, Donau Carbon, has begun offering commercial guarantees for mercury removal from coal-fired power plants using ACI technology.

Accordingly, the Board finds that mercury reduction technologies are commercially available and cost effective to the owners and operators of EGUs to assist them in reducing mercury emissions from EGUs.

#### **14. Issues Related to Cost and Electricity Availability**

The Department conducted an analysis to determine the cost of the Pennsylvania rule above and beyond CAIR. CAIR involves the installation air pollution control equipment for SO<sub>2</sub> and NO<sub>x</sub>. Under EPA's CAIR analysis Pennsylvania's average retail electric prices without CAIR would be: in 2010 - \$0.0593 kWh in 2010; and in 2015 - \$0.0695 kWh. Under this same analysis Pennsylvania's average retail electric prices with CAIR would be: in 2010 - \$0.061 kWh; and in 2015 - \$0.072 kWh. Consequently, the average retail electric price in Pennsylvania would rise approximately 3 percent because of CAMR compliance costs.

For each unit the capital cost, annualized capital costs, and operating costs were determined. This was offset against how much it would cost to purchase an equivalent amount of emissions allowances based on EPA's projections of mercury allowance costs from 2010 through 2030. These projections come from a U. S. Department of Energy (DOE) document titled "Annual Energy Outlook 2006 With Projections to 2030"). The costs of control were based on cost estimates for installing and operating activated carbon injection systems. The capital costs were determined by estimating the cost ranging from \$2/kW - \$4/kW of plant electrical generating capacity. This capital cost was then annualized over 20 years assuming a 10 percent interest rate. The operating costs were calculated for Phase 1 based on a brominated- activated carbon injection ("B-ACI") injection rate of 6 lbs. per million actual cubic feet of exhaust gas. For Phase 2 an injection rate of 4.84 or 9.68 lbs. per million actual cubic feet of exhaust gas was used depending on how much was needed to meet the emission limit. The injection rate was multiplied by the average of the three highest years of heat input between 1998 and 2002 and then multiplied by \$ 0.0175 lb of sorbent/Million Btu. This calculation was performed for each effected emission unit.

For Phase 2, the Department estimated that 18 units at 7 facilities might opt for mercury specific control beyond the CAIR control installations. Some EGU owners and operators may choose to install compact hybrid powdered activated carbon (COHPAC) filter systems to comply with the Pennsylvania mercury rule. Electric Power Research Institute has patented "TOXECON" process which employs COHPAC in the control configuration. TOXECON/COHPAC has been demonstrated to achieve around 90% reduction of mercury emissions. The capital costs for were determined by estimating the cost ranging from \$56.53/kW - \$125/kW of plant electrical generating capacity.

For each applicable EGU in the State, the Department determined the amount of mercury, if any, that would need to be controlled beyond CAIR control levels for Phase 1 and Phase 2. For Phase 1, the Department estimated that 16 units at 7 facilities might opt for mercury-specific control beyond the CAIR control installations. The total capital costs needed for B-ACI were estimated to be approximately \$4.9 to \$9.8 million. The annual operating costs were estimated to be approximately \$14.7 million. The total annualized costs for Phase 1 were estimated to be approximately \$15.4 to \$15.8 million.

The difference between the lower-bound and upper-bound costs estimates for Phase 2 reflects the difference between carbon injection and the installation of COHPAC filter systems. The total capital costs are estimated to range from \$141.6 to \$313.3 million. The total annualized cost (capital and operating) of mercury-specific control technology that EGU owners and operators might opt to install beyond CAIR to comply with the Pennsylvania Mercury Rule would range from \$16.7 to \$53 million per year. The estimated total cost of purchasing mercury allowances (using \$2,619 per ounce, according to a U.S. Department of Energy estimate) would be approximately \$28.3 million per year if EGU owners and operators did not implement additional measures beyond CAIR to comply with CAMR.

As previously noted, the Pennsylvania final-form regulation is designed, in part, to take advantage of the co-benefit reductions that will occur under CAIR, designed to reduce SO<sub>2</sub> and NO<sub>x</sub> emissions from EGUs. The Phase 1 and Phase 2 timeframes under the Pennsylvania regulation coincide with the timeframes under CAIR. It is anticipated that the majority of EGUs in the Commonwealth will opt to comply with both phases of the rule using existing WFGD and SCR technology, which will be necessary in order to comply with CAIR. While some EGUs may opt to install mercury specific control technology, the Department believes that there are a number of currently available control technologies that coal-fired power plants can use to reduce their emissions of mercury to the atmosphere, which will result in a minor cost increase on a cents per kW-hr. basis.

As previously described for Phase 1, the total annualized cost (capital and operating) of mercury-specific control technology that EGU owners and operators may opt to install beyond CAIR to comply with the Pennsylvania-specific mercury rule would be \$15.4 million per year. The total cost of purchasing mercury allowances if EGUs did not do anything beyond CAIR in order to comply with CAMR would be \$15.7 million per year. As a result, the total cost of complying with the Pennsylvania-specific mercury regulation for Phase 1 would be no more than the cost of complying with CAMR.

As previously described for Phase 2, the total annualized cost (capital and operating) of mercury-specific control technology that EGU owners and operators might opt to install beyond CAIR to comply with the Pennsylvania Mercury Regulation would range from \$16.7 to \$53 million per year. The resulting cost per kilowatt-hour would be no greater than \$0.0038/kWh for the EGU owners and operators utilizing the TOXECON/COHPAC control technology to comply with the Phase 2 limits. The cost of \$0.0038/kwh represents the upper bound cost estimate for the owners and operators of EGUs to comply with the Phase 2 limits.

The cost differential between allowance costs and technology costs were \$25.1 million on the high end and an incremental cost reduction of \$11.6 million on the low end. The total kilowatt-hours calculated for the 18 units that will not be installing CAIR controls to meet the Phase 2 requirements are 13,748,393,901. The resulting cost per kilowatt-hour ranges from \$0.0018/kwh for the use of the TOXECON/COHPAC control technology to \$0.00084/kwh for using B-ACI to comply with the Phase 2 limits.

Because of these analyses, the Board concludes that the costs related to the control of mercury emissions from coal-fired EGUs is reasonable and that any increased cost in electricity is insignificant on a dollar per kilowatt hour basis.

#### **15. Impacts on Pennsylvania Coal**

When coal burn, mercury vapor can be released to the atmosphere. Therefore any regulatory approach aimed at reducing these emissions is of concern to the coal mining industry. This is especially the case in Pennsylvania, which is the fourth largest coal producing state in the nation with approximately 66 million short tons mined annually. Wyoming is first with 396,000,000 short tons. West Virginia is second with 148,000,000 short tons. Kentucky is third with 114,000,000 short tons. Texas is fifth with 45,000,000 short tons.

According to the Department's Pennsylvania Coal Report for 2004, 6,825 miners are employed in Pennsylvania with about 55 percent of the miners employed in Greene and Washington counties. In addition, these two counties account for over 66 percent of the coal mined in Pennsylvania. Moreover, the Department has determined that the median mercury content of the coals mined in these two counties is approximately 8.8 lb of mercury per Trillion Btu (lb. Hg/Tbtu). The median content of mercury from all coals mined in Pennsylvania is 18.1 lb. Hg/Tbtu.

Data acquired by the Department shows that coal washing is a viable pretreatment option. For example, the data from our analysis shows an average "as received" mercury content of 26.73 lb. Hg/Tbtu. The average "as washed" mercury content is 12.93 lb. Hg/Tbtu. This translates into an average removal of 49.5 percent. As a result of this study and comments received during the proposed rulemaking a pretreatment credit has been added to this final-form rulemaking.

The EPA CAMR finalized New Source Performance Standards Mercury limits for new units are: bituminous coal at  $20 \times 10^6$  lb/MWh; subbituminous coal (wet units) at  $66 \times 10^6$  lb/MWh; subbituminous coal (dry units) at  $97 \times 10^6$  lb/MWh; lignite coal at  $175 \times 10^6$  lb/MWh; coal refuse at  $16 \times 10^6$  lb/MWh; and IGCC at  $20 \times 10^6$  lb/MWh. This clearly shows that the most stringent standards have been reserved for bituminous and coal refuse units. All units in Pennsylvania burn either bituminous or coal refuse. As a result, all new EGUs in Pennsylvania would be subject to the most stringent mercury emission standards in the nation.

On the other hand, the Pennsylvania mercury regulation is fuel-neutral. All new and existing units regardless of fuel-type are subject to the same mercury emission standards. New pulverized coal-fired (PCF) units must meet an emission standard of 0.011 pounds of mercury per gigawatt hour (lb. Hg/GWh) or a minimum 90 percent of total mercury removal. New circulating fluidized bed units (CFB) burning 100 percent coal refuse must meet a mercury emission standard of 0.0096 lb.Hg/GWh or a minimum 95 percent control of total mercury as measured from the mercury content in the coal, as fired. New CFBs burning 100 percent coal must meet an emission of 0.011 lb. Hg/GWh or a minimum 90 percent of total mercury removal. New integrated gasification combined cycle (IGCC) must meet a mercury emission standard of 0.0048 lb. Hg/GWh or a minimum 95 percent of total mercury removal.



Existing PCF units must meet an emission of 0.024 lb. Hg/GWh or a minimum 80 percent of total mercury removal in Phase 1, and an emission of 0.012 lb. Hg/GWh or a minimum 90 percent of total mercury removal in Phase 2. Existing CFB units burning 100 percent coal refuse must meet a mercury emission standard of 0.0096 lb.Hg/GWh or a minimum 95 percent control of total mercury as measured from the mercury content in the coal in Phases 1 and 2.

In addition to these fuel neutral emission standards, the Department anticipates the vast majority of the mercury reductions in Pennsylvania will be achieved through the installation of CAIR controls for NO<sub>x</sub> and SO<sub>x</sub>. Therefore, there does not exist the same incentive to utilize fuel switching to lower mercury content coal as there is under CAMR. Based on emissions data submitted to the Department's data request, fuel switching is not necessary to comply with the emission standards.

One of the more significant changes to the final-form rulemaking involves the demonstration of compliance under subsection (o) for those EGUs subject to §123.207 (relating to annual emission limitations for coal-fired EGUs). In addition to compliance on a unit-by-unit and facility-wide basis, owners and operators of affected EGUS may now demonstrate compliance through system-wide demonstration. For example, so long as the actual emissions of mercury from the EGUs at the facility and other EGUs at other facilities covered in the system-wide demonstration are less than the allowable emissions of mercury from all EGUs covered by the demonstration on an annual basis compliance has been demonstrated. This additional compliance option will make it even less likely that owners and operators will opt to switch fuels as a compliance option.

As a result of the Department's analysis and changes made between proposed and final-form rulemaking, the Board does not anticipate adverse impact on the local coal industry because of the Pennsylvania-specific mercury rule.

## **16. Reductions Beyond CAMR**

The Department reviewed the list of IPM runs that EPA conducted in support of CAMR. Base case model runs for Pennsylvania in 2010 and 2020 include the national Title IV SO<sub>2</sub> cap-and-trade program and the NO<sub>x</sub> SIP Call regional ozone season cap-and-trade program without CAIR or CAMR. These show mercury emissions from coal-fired power plants in Pennsylvania in 2010 and 2020 as 5.862 tons (11,724 lbs.) and 5.625 tons, (11,250 lbs.) respectively. A second round of model runs were conducted for 2010, which included CAIR and CAMR control strategies and for 2020, which included CAIR and CAMR control strategies. These show mercury emissions from coal-fired power plants in Pennsylvania in 2010 and 2020 as 1.491 tons (2,982 lbs.) and 1.153 tons, (2,306 lbs.) respectively. While these model runs show that Pennsylvania coal-fired power plants will emit 16 percent less mercury or 0.279 ton (558 lbs) than the established cap in 2010 of 1.77 tons of mercury (3,540 lbs), these same model runs show that Pennsylvania coal-fired power plants will emit 39 percent more mercury 0.451 ton (902 lbs.) than the established cap of 0.702 ton (1,404 lbs) in 2020. As a result, the owners and operators of these EGUs would be required to purchase allowances to come into compliance with CAMR. The purchase of additional allowances needed to comply with CAMR is particularly troublesome given Pennsylvania's experience under Title IV of the CAA. In Pennsylvania the total current SO<sub>2</sub>

acid rain allowances equal 540,000. Pennsylvania EGUs emit about 1,000,000 tons per year of SO<sub>2</sub>. Therefore, Pennsylvania currently "imports" about 460,000 SO<sub>2</sub> allowances per year from reductions in other states. The trading of mercury allowances under CAMR may mimic the Acid Rain Program.

In comparison, the Pennsylvania regulation would require an 80 percent reduction of mercury present in the coal fired in EGUs on a 12-month rolling average by 2010, and 90 percent reduction of mercury present in the coal fired in EGUs on a 12-month rolling average by 2015. After Phase 1 of the program, it is anticipated that the Pennsylvania rule would achieve a 29 percent greater reduction than required under CAMR or a 16 percent greater reduction than EPA projects from its IPM model runs. This would amount to 1.2567 tons (2,513.4 lbs.) of mercury emissions as opposed to 1.77 tons (3,558 lbs.) mercury emissions under the required CAMR cap or 1.491 tons (2,983 lbs.) as projected under EPA's IPM model runs. After Phase 2, it is anticipated that the Pennsylvania regulation would achieve a 39 percent greater reduction than what would be achieved by CAMR under Phase 2. This would mean that Pennsylvania would achieve its cap of 0.702 ton (1,404 lbs.) by 2015 rather than exceeding it by 0.451 ton (902 lbs.)

However, it should be noted that EPA concedes that due to the banking and trading provisions of CAMR, projected reductions may not be achieved until 2026 or later. Moreover, as the previous analysis shows, EPA's IPM models expect Pennsylvania coal-fired power plants will emit 64 percent more mercury 0.451 ton (902 lbs.) than the established cap of 0.702 ton (1,404 lbs) in 2020. As a result, under a Pennsylvania-specific rule no mercury allowances would be imported which would result in greater mercury emissions and greater local mercury deposition.

Due to this analysis the Board finds that a Pennsylvania-specific mercury rule would result in faster and steeper cuts in mercury emissions than under CAMR.

#### **17. Benefits to Pennsylvanians**

Prior to CAIR and CAMR, in the base year of 2001, EPA estimates fish-tissue methylmercury concentrations at the 90th percentile, 99th percentile, and maximum levels attributable to coal-fired power plants are 0.11, 0.27, and 0.85 milligrams per kilogram (mg/kg) respectively. EPA estimates that after CAIR and CAMR implementation these concentrations at the 90th percentile, 99th percentile, and maximum levels attributable to coal-fired power plants would be reduced by 0.06, 0.19, and 0.44 mg/kg, respectively.

However, the Department estimates that after implementation of the Pennsylvania-specific mercury regulation in Phase 2, these concentrations at the 90<sup>th</sup> percentile, 99<sup>th</sup> percentile, and maximum levels attributable to coal-fired power plants would be reduced to 0.0985, 0.31, and 0.72 mg/kg, respectively. This means that these concentrations at the 90<sup>th</sup> percentile, 99<sup>th</sup> percentile, and maximum levels would be reduced by an additional 0.0385, 0.12, 0.28 mg/kg, respectively. As a result, the Pennsylvania-specific mercury regulation would amount to an additional 36 percent reduction in fish-tissue methylmercury concentrations.

EPA estimates that when CAMR is fully implemented it will reduce mercury emissions from coal-fired power plants to 15 tons per year by 2018. If this goal is reached, NESCAUM

estimates that the predicted annual benefit associated with IQ increases in the annual birth cohort ranges are \$119 million to \$288 million. This benefit is from reduced fetal methylmercury exposure. If cardiovascular effects are only experienced by male populations that consume non-fatty freshwater fish, then the monetized annual benefits are \$86 million. If these cardiovascular effects are experienced by the whole U.S. population, then the monetized annual benefits are predicted to be \$4.9 billion.

If as EPA predicts in Phase 2, EGUs in Pennsylvania emit 1.153 tons (2,306 lbs.) then the annual benefit associated with IQ increases in the annual birth cohort ranges are \$2.66 million to \$6.45 million. This benefit is from reduced fetal methylmercury exposure. If cardiovascular effects are only experienced by the male population that consumes non-fatty freshwater fish, then the monetized annual benefits are \$1.15 million. If these cardiovascular effects are experienced by all Pennsylvanians, then the monetized annual benefits are predicted to be \$128.6 million.

However, under a Pennsylvania-specific mercury rule, EGUs in Pennsylvania will emit no more than 0.702 ton (1,404 lbs.) by 2015. As a result, annual benefit associated with IQ increases in the annual birth cohort ranges are \$4.165 million to \$10.08 million. This benefit is from reduced fetal methylmercury exposure. This means that the Pennsylvania rule will provide an additional benefit of \$1.49 million to \$3.63 million per year over CAMR. If cardiovascular effects are only experienced by the male population that consumes non-fatty freshwater fish, then the monetized annual benefits are \$1.8 million. This means that the Pennsylvania rule will provide an additional benefit of \$0.65 million per year over CAMR. If these positive cardiovascular effects are experienced by all Pennsylvanians, then the monetized annual benefits are predicted to be \$200.9 million. This means that the fully implemented Pennsylvania final-form regulation will provide an additional benefit of \$72.3 million per year over CAMR. Moreover, Pennsylvanians will see these results being achieved by 2015.

In comparison, the total cost of complying with Phase 1 of the Pennsylvania-specific rule would be no more than the cost of complying with CAMR. For Phase 2 at the low end of the cost estimate, the annualized cost of mercury specific technology may not be any more than the costs of purchasing the allowances. However, at the high end of the cost estimate, the additional cost above purchasing allowance would be around \$24.7 million. Nevertheless, the benefits of a Pennsylvania rule outweigh the costs. Therefore, the Board finds that this difference will result in significant environmental improvement with reduced fish-tissue methylmercury concentrations and increased monetized benefits for all Pennsylvanians as well as future Pennsylvanians.

## **18. Conclusion**

A large body of scientific evidence, some of which was developed as a result of EPA's obligations under the federal CAA, has clearly demonstrated that mercury is a persistent, toxic, bioaccumulative pollutant, which can have adverse effects on human health and the environment. The Department has determined that effective mercury control technology does exist to significantly reduce mercury emissions from EGUs. Furthermore, mercury control technology is presently being implemented at a number of air pollution emitting sources, and recent testing of mercury control technologies on coal-fired utilities has been shown to be effective in reducing

mercury emissions. The Department has determined that the provisions in EPA's final mercury rule for the utility sector that was promulgated under Section 111 of the CAA are not adequate to ensure that the citizens of Pennsylvania and the environment will be adequately protected from the harmful effects of mercury emissions.

CAMR does not require any specific reductions in mercury emissions from any specific EGU facility. Due to the CAMR cap-and-trade provisions, the owners and operators of a facility that emits mercury beyond its CAMR allowance level can purchase allowances from credits generated at a facility that emits below its CAMR allowance level anywhere in the U.S. A large portion of the mercury emission reductions that will occur will be as a result of co-benefit reductions occurring where a CAIR compliance plan for a facility to reduce both its NO<sub>x</sub> and SO<sub>x</sub> emissions involves the installation of SCR and wet FGD control technologies. The NO<sub>x</sub> emission control equipment of SCR oxidizes elemental mercury of the mercury emissions, which makes the removal of mercury emissions even more efficient by the wet FGD controls. However, where a facility only reduces its NO<sub>x</sub> emissions with a SCR control to meet the CAIR requirements, but does not also utilize a wet FGD for SO<sub>x</sub> control, this will result in much higher quantities of the ionic form of mercury to be emitted and deposited nearby, and this will result in a much greater negative mercury impact on the nearby environment.

Additionally, under the federal CAMR mercury emissions trading, it is even possible that mercury emissions in Pennsylvania could actually increase because there would not be any regulatory ability to restrict such actual emission increases due to the importation of out-of-state allowances. Another important problem with EPA's national mercury emissions trading provisions under CAMR is that it allows significantly less control of mercury in one area compared to another; and it allows emissions to be further increased through the use of banked allowances from previous years. Allowing mercury emission reductions to be used in different control periods further delays the real mercury emission reductions that are seen by the environment. The federal GAO evaluation of CAMR states that the mercury emission levels that are required by 2018, during the second Phase of the required CAMR reductions, will not actually occur until 2030, or later. This will result in a larger burden of mercury into the ecosystem resulting over time and a significant lengthening of the time exposure to these emissions.

The Department's state-specific mercury regulation assures a specific maximum level of actual mercury emissions from Pennsylvania utilities, and assures that these levels are achieved in a much shorter time than CAMR. The Phase 2 mercury emissions caps will be achieved in Pennsylvania by 2015, not 2018 which translate into 2030 because of emissions trading under CAMR. Furthermore, in Pennsylvania each and every owner or operator of an electric generating facility will make significant reductions in their mercury emissions at each and every one of their facilities. This is not the case under CAMR.

Data generated by EPA has shown that Pennsylvania has the highest wet deposition of mercury in the nation with a direct correlation to the location and quantity of mercury emissions from coal-fired electric generating facilities. Research has also shown that higher percentages of more recently deposited ionic mercury are more quickly methylated in the ecosystem. The methylation of mercury eventually leads to a concentration of methylmercury in the tissue of fish

and other wildlife. These higher concentrations of mercury in the wildlife are not only directly affecting the wildlife in such ways as reduced reproductivity, but also affecting humans when they eat this wildlife.

Recent studies in the Florida Everglades and in the state of Massachusetts indicate that mercury concentrations found in fish and wading birds in the Everglades have dropped significantly. These illustrate the point that despite the fact that there are global mercury transportation issues, local emission reduction efforts are very significant to the local air quality and environmental impacts, and reductions in mercury emissions do translate into real, measurable improvements in the environment. Continued improvements to the ecosystem are expected in the long-term as these reductions work their way through the food chain and Pennsylvanians will receive the greatest portion of these benefits.

After consideration of mercury control technology, the Department has determined that a state-specific mercury reduction rule is necessary to protect the public health and environment. Moreover, the required control levels of 80 percent in Phase 1 and 90 percent in Phase 2 are achievable and will allow the Pennsylvania emission limits under CAMR to be achieved as well.

#### **E. Summary of Final-Form Rulemaking**

The final-form rulemaking amends Chapter 123 by adding Section 123.201 (relating to purpose) to provide that §§ 123.202--123.215 establish mercury emission standards, annual emission limitations as part of a Statewide mercury allowance program with annual nontradable mercury allowances and other requirements for the purpose of reducing mercury emissions from coal-fired EGUs or cogeneration units.

Section 123.202 (relating to definitions) defines terms used in §§ 123.203--215. The new definitions include: "Act," "Administrator," "Btu--British thermal unit," "Bottoming-cycle cogeneration unit," "CFB--circulating fluidized bed unit," "Clean Air Act," "CO<sub>2</sub>," "CS-ESP--cold side electrostatic precipitator," "coal," "coal refuse," "cogeneration unit," "commence operation," "control period," "EGU--electric generating unit," "existing EGU," "FF--fabric filter," "facility," "GWh--gigawatt-hour," "heat input," "IGCC--integrated gasification combined cycle unit," "MMBtu," "MW--megawatt," "MWe--megawatt electric," "MWh--megawatt-hour," "nameplate capacity," "new EGU," "O<sub>2</sub>," "operator," "owner," "Phase 1," "Phase 2," "PCF--pulverized coal-fired unit," "rolling 12-month basis," "SCR--selective catalytic reduction," "SO<sub>2</sub>," "space velocity," "standby unit," "system," "system-wide compliance demonstration," "topping-cycle cogeneration unit," "WFGD--wet flue gas desulfurization unit" and "watt-hour." The definition "Bituminous coal" has been deleted. While the definition "EGU--electric generating unit" remains it has been amended to reflect a change made by EPA during its reconsideration process. Minor changes between proposed and final-form rulemaking were made to the terms "CFB--Circulating fluidized bed unit," "Existing EGU," and "New EGU." New terms "Act," "Administrator," "Bottoming-cycle cogeneration unit," "Clean Air Act," "coal," "commence operation," "control period," "heat input," "owner," "operator," "system," "system-wide compliance demonstration," and "topping-cycle cogeneration unit" were added between proposed and final-form rulemaking.

Additionally, a new subsection to Section 123.202 was added between proposed and final-form rulemaking to provide that the definitions under the Standards of Performance for New Stationary Sources and Emission guidelines for Existing Sources Promulgated in 40 CFR Part 60 Subparts Da and HHHH are adopted in their entirety and incorporated by reference. The provisions will be used in the interpretation of applicable requirements in §§123.202 – 123.215.

Section 123.203 (relating to applicability) provides that the requirements of §§ 123.201, 123.202, 123.204--123.215 and this section apply to owners and operators of an EGU in this Commonwealth and except as otherwise noted, supercedes those requirements adopted in their entirety and incorporated by reference under 25 Pa. Code § 122.3 (relating to adoption of standards.).

Section 123.204 (relating to exceptions) provides that the owner or operator of an EGU that enters into an enforceable agreement with the Department for the shutdown and replacement of the unit with IGCC technology shall be exempted from compliance with the Phase 1 requirements of § 123.205. This section was modified between proposed and final-form rulemaking so that owners or operators that shutdown and replacement a unit with IGCC technology are not exempt from compliance with the Phase 1 emission limitation requirements under §123.207.

Section 123.205 (relating to emission standards for coal-fired EGUs) establishes emission standards for coal-fired EGUs. New PCF EGUs and IGCC EGUs are required to meet either a certain mercury emission standard or minimum mercury control percentage upon construction and new CFB EGUs are required to meet a certain mercury emission standard upon construction. In addition, existing PCF EGUs and IGCC EGUs are required to meet either an increasingly stringent mercury emission standard or minimum mercury control percentage from Phase 1 (effective from January 1, 2010, to December 31, 2014) to Phase 2 (effective beginning January 1, 2015). Existing CFB EGUs are required to meet a certain mercury emission standard or minimum mercury control percentage, which does not change from Phase 1 to Phase 2.

This section was modified between proposed and final-form rulemaking to provide that CFB EGUs must meet either a certain mercury emission standard or minimum control efficiency of mercury emissions. The owners and operators of CFB EGUs must comply with either of the following: (1) a mercury emission standard of 0.0096 pounds of mercury per gwh or (b) a minimum 95% control of total mercury as measured from the mercury content in the coal refuse, either as fired or as approved in writing by the department. Changes were also made to ensure that owners and operators of new EGUs comply with the standards promulgated under 40 CFR Part 60, Subparts Da and HHHH. Modifications were further rendered to allow owners and operators to receive mercury reduction credit for the pretreatment of fuel. Additionally, modifications were made to delete the terms “bituminous” and “rolling 12-month basis” under specific subsections.

Section 123.206 (relating to compliance requirements for the emission standards for coal-fired EGUs) establishes compliance requirements for the emission standards for coal-fired EGUs. Compliance can be demonstrated on a unit-by-unit basis or by facility-wide emissions averaging. The Department may approve in a plan approval or operating permit an alternative mercury

emission standard or schedule, or both, if the owner or operator of an EGU subject to the emission standards of § 123.205 demonstrates in writing to the Department's satisfaction that the mercury reduction requirements are economically or technologically infeasible. Lastly, the Department has established certain calculation requirements to ensure that a facility does not exceed the applicable emission standard or control percentage requirement.

The Board has made some significant modifications to this section. The compliance presumptions for those owners and operators of an existing EGU combusting 100 percent bituminous coal controlled by certain air pollution control device configurations has been deleted because of constitutionality concerns raised by commentators. The Board has also added language that the Department's approval of an alternate emission standard or a compliance schedule will not relieve the owner or operator of the EGU from complying with the other requirements of §§ 123.207-123-215. Additional language has been added to provide that the Department's approval of an alternative of an alternative emission standard or compliance schedule shall be based on the information provided in the application submitted by the owner or operator of the EGU. Another addition includes certain provisions related to facility wide averaging. Subsection (f) provides allows the an EGU owner or operator to demonstrate compliance with the requirements of § 123.205 (relating to emission standards for coal-fired eGUs) by means of facility-wide Averaging that demonstrates that the actual mercury emissions from EGUs covered under the Emissions averaging Demonstration are less than the allowable mercury emissions from all EGUs covered by the Demonstration on a 12-month rolling basis. Section 123.207 (relating to annual emission limitations for coal-fired EGUs) establishes an annual emission limitation for coal-fired EGUs. In addition to the mercury emission standard requirements of § 123.205, the owner or operator of a new or existing affected EGU subject to § 123.203 shall comply with the annual emission limitations established through a Statewide mercury nontradable allowance program under this section. The total ounces of mercury emissions available for emission limitation set-asides as annual nontradable mercury allowances in the Statewide mercury allowance program are 56,928 ounces (3,558 pounds) of mercury emissions for Phase 1, effective from January 1, 2010, through December 31, 2014, and 22,464 ounces (1,404 pounds) of mercury emissions for Phase 2, effective beginning January 1, 2015, and each subsequent year. Of this overall total, 5 percent of the Phase 1 annual allowances will be set aside for new units and 3 percent of the Phase 2 annual allowances will be set aside for new units for the calendar year beginning January 1, 2015, and subsequent years. However, annual allowances will not be set aside for the owner or operator of an existing affected EGU, which is already shut down, scheduled for shutdown or is on standby as of the effective date of each set-aside phase.

The maximum number of annual nontradable mercury allowances set aside for the owner or operator of each existing affected CFB or PCF will be determined by multiplying the affected unit's baseline heat input fraction of the State's total baseline annual heat input for all EGUs. The Department will publish in the *Pennsylvania Bulletin* the maximum number of annual allowances set aside for the owner or operator of each existing affected CFB and PCF. If the actual emissions of mercury reported to the Department are less than the maximum number of annual allowances set aside in the allowance program for the owner or operator of an EGU, the Department will place the unused portion of annual allowances in the annual emission limit supplement pool established under § 123.208.

A number of modifications have been to Section 123.207 between proposed and final-form rulemaking. First, Subsection (a) additionally provides that the Department will issue to the owner or operator of an affected EGU a plan approval or operating permit that contains the applicable requirements of this section and §123.202-206 and 123.210-215 before the later of January 1, 2010 or the date on which the affected EGU commences operation. Second, because of changes made by EPA during the reconsideration process, Pennsylvania was allotted 2 lbs. less than under the original CAMR. As a result, this change is reflected in the final-form rulemaking. Third, the Board has established a more detailed process for the allocation of allowances for new EGUs under subsection (c). For instance, after a new EGU has commenced operation and completed three control periods, the EGU will become an existing EGU. The new EGU will continue to receive non-tradable allowances from the new unit set-aside until the new EGU is eligible for non-tradable allowances allocated from the existing EGU set-aside. Fourth, the Board has promulgated additional procedures for the allocation of allowances for permanently shutdown units under subsection (k). For example, annual nontradable mercury allowances will not be set aside for the owner or operator of an existing affected EGU that is already shut down, scheduled for shutdown, unless the owner or operator of the EGU obtains a plan approval for the construction of a new EGU.

One of the more significant changes to this section involves the demonstration of compliance under subsection (o) for those EGUs subject to §123.207. In addition to compliance on a unit-by-unit and facility-wide basis, owners and operators of affected EGUS may now demonstrate compliance through a system-wide compliance demonstration. For example, so long as the actual emissions of mercury from the EGUs at the facility and other EGUs at other facilities covered in the system-wide demonstration are less than the allowable emissions of mercury from all EGUs covered by the demonstration on an annual basis compliance has been demonstrated. However, an owner or operator may not include an EGU in more than one system-wide averaging demonstration submitted for the purposes of complying with the requirements of §§ 123.202-123-215. Additionally, the Board has made a number of minor changes to subsections of this section in order to ensure consistency with the more significant changes that were made.

Section 123.208 (relating to annual emission limitation supplemental pool) establishes annual emission limitation supplement pool. Annual allowances that have either been created as part of the new EGU set-aside or are unused annual allowances as part of the annual emission limitation for coal-fired EGUs will be set aside in the supplement pool for future use. No changes were made to this section between proposed and final-form rulemaking.

Section 123.209 (relating to petition process) establishes a petition process for the owner or operator of an EGU to request additional annual allowances from the annual emission limit supplement pool. Each calendar year beginning January 1, 2010, the Department may at its discretion, allocate allowances from the supplemental pool to the owners or operators of new or existing affected EGUs that successfully petition the Department in accordance with the requirements of this section. If the petition for supplemental annual nontradable mercury allowances is approved by the Department, the supplemental annual nontradable mercury allowances set aside for the owner or operator of the new or existing affected EGU will be added



to the maximum number of annual nontradable mercury allowances set aside for the owner or operator of the EGU under § 123.207 only for the calendar year of the request.

The major change to Section 123.209 that occurred between proposed and final-form rulemaking is the deletion of the order of preference for the allocation of supplemental allowances generally, and the order of preference for the allocation of supplemental allowances as it specifically relates to those owners and operators that burn 100 percent bituminous coal and employ certain air pollution control technologies. The Board has added a provision that the Department's approval of supplemental annual nontradable mercury allowance allocations shall be based on the information provide in the petition submitted by the owner or operator of the EGU.

Further modifications for owners and operators of affected EGUs were made under a new subsection (h). For instance, the owner or operator of an EGU for which construction of a new stack or flue, installation of add-on Hg emission controls, a flue gas desulfurization system, a selective catalytic reduction system, or a compact hybrid particulate collector system is completed after the applicable deadline under subsections (f) and (g) of this section, shall comply with the monitoring system certification and other requirements of subsection (e) of this section.

Under subsection (k), no owner or operator of an EGU shall use any alternative monitoring system, alternative reference method, or any other alternative to any requirement of 40 CFR Part 75 unless such alternative is approved, in writing, by the Administrator accordance with 40 CFR Part 75 Subpart E (relating to alternative monitoring systems).

Under subsection (n), the owner or operator of an EGU that is using a continuous emission monitoring system or a sorbent trap system to continuously monitor Hg emissions pursuant to §123.210(c)(1) and 40 CFR §75.81(a), may elect to comply with the methodology specified in §123.210(c)(2), and 40 CFR §75.81(b)-(f).

Section 123.210 (relating to general monitoring and reporting requirements) creates general monitoring and reporting requirements for the owner or operator of a new or existing EGU subject to §§ 123.201--215. The owner or operator of a new EGU shall demonstrate compliance with §§ 123.205 and 207 by installing and operating a continuous emissions monitoring system to measure, record and report the concentration of mercury in the exhaust gases from each stack. The owner or operator of a new or existing affected EGU shall comply with the monitoring, recordkeeping and reporting requirements in this section and in §§ 123.211--123.215, § 139.101 (relating to general requirements) and the applicable provisions of the *Continuous Source Monitoring Manual* (DEP 274-0300-001), and 40 CFR Part 75, Subpart I (relating to Hg Mass Emission Provisions). Additionally, for purposes of complying with the requirements of this section, the definitions in § 123.202 (relating to definitions) and 40 CFR § 72.2 (relating to definitions) are applicable requirements. However, the owner or operator of an existing affected EGU that emits 464 ounces (29 pounds) or less of mercury per year shall either demonstrate compliance with the requirements of §§ 123.205 and 207 and 40 CFR Part 75, Subpart I or implement the excepted sorbent trap monitoring methodology for an EGU meeting the requirements in subsections (b) through (e) of 40 CFR § 75.81 (relating to monitoring of Hg mass emissions and heat input at the unit level)

The Board has made a number of modifications to §123.210 between proposed and final-form rulemaking. For example, the owner or operator of a new or existing affected EGU shall comply with the monitoring, recordkeeping and reporting requirements in this section and in §§ 123.211-123.215, § 139.101 (relating to general requirements) and the applicable provisions of the Continuous Source Monitoring Manual (DEP 274-0300-001), and 40 CFR Part 75, Subpart I (relating to Hg Mass Emission Provisions). Also, the provisions under 40 CFR §§ 60.4110 through 60.4114 are adopted in their entirety and incorporated by reference in this subsection in response to EPA comments concerning these mercury designated representative provisions. Additionally, for purposes of complying with the requirements of this section, the definitions in § 123.202 (relating to definitions) and 40 CFR § 72.2 (relating to definitions) shall apply. Also the owner or operator of an existing affected EGU that emits 464 ounces (29 pounds) or less of mercury per year shall either demonstrate compliance with the requirements of §§ 123.205 and 207 and 40 CFR Part 75, Subpart I or implement the excepted sorbent trap monitoring methodology for an EGU meeting the requirements in subsections (b) through (e) of 40 CFR § 75.81 (relating to monitoring of Hg mass emissions and heat input at the unit level). Additional minor changes were also made to §123.210 to ensure consistency with the more significant changes that were made.

A new subsection (h) was also added in the final-form regulation to provide that the owner or operator of an EGU for which construction of a new stack or flue, installation of add-on mercury emission controls, a flue gas desulfurization system, a selective catalytic reduction system, or a compact hybrid particulate collector system is completed after the applicable deadline must comply with the monitoring system certification and other requirements of §123.210.

Additionally, subsection (k) now provides that no owner or operator of an EGU shall use any alternative monitoring system, alternative reference method, or any other alternative to any requirement of 40 CFR Part 75 unless the alternative system, method or requirement is approved, in writing, by the Administrator in accordance with 40 CFR Part 75, Subpart E (relating to alternative monitoring systems).

Subsection (n)(3) now provides that the owner or operator of an EGU that is using a continuous emission monitoring system or a sorbent trap system to continuously monitor mercury emissions pursuant to §123.210(c)(1) and 40 CFR 75.81(a), may elect to comply with the methodology specified in §123.210(c)(2) and 40 CFR 75.81(b)-(f).

Section 123.211 (relating to initial certification and recertification procedures for emissions monitoring) creates initial certification and recertification procedures for emissions monitoring. By the applicable deadline in § 123.210, the owner or operator of an affected EGU shall comply with certain initial certification and recertification procedures for a continuous monitoring system or continuous emission monitoring system and an excepted monitoring system (sorbent trap monitoring system) as required under 40 CFR 75.15 (relating to special provisions for measuring Hg mass emissions using the excepted sorbent trap monitoring methodology) and Chapter 139, Subchapter C (relating to requirements for source monitoring for stationary sources). Only minor changes were made to this section between proposed and final rulemaking were to reflect that the requirements under §123.210 also apply in certain circumstances.

Section 123.212 (relating to out-of-control periods for emissions monitors) creates out-of-control periods for emissions monitors if an emissions monitoring system fails to meet the quality-assurance and quality-control requirements or data validation requirements. One change to this section has been made between proposed and final-form rulemaking. If a mass emissions monitoring system fails to meet a quality-assurance or quality-control requirement, mass emissions data shall be substituted using the missing data procedures in 40 CFR Part 75, Subpart I.

Section 123.213 (relating to monitoring of gross electrical output) creates monitoring requirements regarding gross electrical output of an affected EGU. One minor change to this section has been made between proposed and final-form rulemaking. The owner or operator of an EGU complying with the requirements of only § 123.206(d) and not § 123.206(e) must monitor gross electrical output of the associated generators and report in watt-hours per hour.

Section 123.214 (relating to coal sampling and analysis for input mercury levels) creates sampling and coal analysis for input mercury levels of affected EGUs. The Department may revise the frequency of the sampling of the coal combusted in the EGU for the mercury content based on historical data provided by the owner or operator of the EGU. One change to this section has been made between proposed and final-form rulemaking. The Department now has the authority to approve, in writing, an alternate coal sampling and analysis program submitted by the owner or operator of an EGU to demonstrate compliance with §§ 123.201- 123.215.

Section 123.215 (relating to recordkeeping and reporting) creates recordkeeping and reporting requirements. Among other things, the owner or operator of an affected EGU must comply with all recordkeeping and reporting requirements in this section and the applicable recordkeeping and reporting requirements in 40 CFR Part 75 and Chapter 139, Subchapter C. No changes were made to this section.

#### **F. Comments and Responses**

The Board received nearly 11,000 comments on the proposed rulemaking. The Board determined that over 99 percent of the commentators are in favor of the proposed rulemaking. The commentators were extraordinarily diverse ranging from the public, sportsmen, industry, trade associations, and EPA. Additionally comments were received from the Pennsylvania Senate Environmental Resources and Energy Committee and the Independent Regulatory Review Commission (IRRC). The complete set of comments and responses is in the Comment and Response Document for the final rule. A summary of the comments and responses follows.

While other commentators echoed many of the comments of the Senate Environmental Resources and Energy Committee, the committee recommended that the Advanced Notice of Final Rulemaking process be used to solicit comment and input on its revisions. The Board disagrees. Since the close of the public comment period, the Department has held additional meetings with the Mercury Rule Workgroup, the Citizens Advisory Council and the AQTAC on the draft final-form regulation. Notices of these meetings were published in the *Pennsylvania*

*Bulletin* and the meetings were open to the public to comment on the revisions. As a result, the Board believes that sufficient comment has been received on the revisions.

IRRC also had many of the same comments posed by other commentators, but believes that a “health-based” analysis is necessary as provided under Section 6.6 of the APCA. The Board disagrees. The statutory requirements set forth in Section 6.6 of the APCA do not apply to this rulemaking because EPA revised the “appropriate and necessary” finding in order to establish a cap-and-trade scheme under Section 111 of the CAA for the trading of mercury allowances. As part of its decision-making process, the Department has completed an analysis of the health impacts of the rulemaking. A detailed summary of the health benefits resulting from the implementation of this final rulemaking is provided in Section G (relating to Benefits, Costs and Compliance) of this order.

An overwhelming number of commentators strongly support the proposed rulemaking on mercury reductions from coal-fired power plants in Pennsylvania. The Board appreciates this strong support for the rulemaking.

One commentator notes Pennsylvania lakes, rivers, and streams are contaminated with mercury pollution. The Board agrees. There is a statewide fish consumption advisory in effect in this Commonwealth. The 2006 advisory covers water bodies in the following river basins: the Delaware River Basin, Susquehanna River Basin, Lake Erie Basin, Ohio River Basin and the Potomac River Basin. Over 60 percent of those advisories are for mercury.

Another commentator says mercury pollution builds up in areas close to the source, creating dangerous “hot spots” of high mercury concentrations. The Board agrees. The preliminary results of the “*Sources of Mercury Wet Deposition in Eastern Ohio, USA*,” study (hereinafter the “Steubenville Study”) conducted by Dr. Gerald J. Keeler, *et al*, found that local and regional wet deposition of mercury from coal-fired powered plants is much higher than anticipated. This study was published on the American Chemical Society’s web page on September 8, 2006 and will subsequently be published in *Environmental Science and Technology*.

Approximately 70 percent of the wet mercury deposition has been attributed to coal-fired units. Moreover, in May 2006, EPA’s Acting Inspector General, Bill Roderick, stated that the agency’s analysis of the methylation of mercury “...did not fully account for the highly variable ways that mercury bioaccumulates in fish. *See also* “Monitoring Needed to Assess Impact of EPA’s Clean Air Mercury Rule on Potential Hotspots, Report No. 2006-P-00025.”

A commentator finds that Pennsylvania is number two in the nation for mercury pollution to air from coal-fired power plants and that the most recent Toxic Release Inventory from the Environmental Protection Agency ranks Pennsylvania as second worst in the nation for mercury pollution to the air, behind only Texas. The Board agrees with this comment. According to the 2004 Toxic Release Inventory, mercury emissions from coal-fired EGUs in Pennsylvania accounted for approximately 79 percent of the mercury emitted to the atmosphere.

One commentator says the federal CAMR does too little too late. CAMR proponents claim that Pennsylvania will see an 86 percent drop in mercury pollution as a result of the federal rule. But

the Congressional Research Service has detailed that CAMR won't deliver the reductions it promises, due to mercury pollution trading, where dirty plants are allowed to buy credits from cleaner, more modern ones. The Board agrees. The claims that implementation of the CAMR in Pennsylvania would result in an 86 percent reduction in mercury emissions in PA by 2018 overestimates the actual reduction under the cap and trade program. According to the independent Congressional Research Service, EPA projected mercury emission reductions may not be met until 2030. The final-form "state-specific" regulation establishes emission standards requiring at least an 80 percent mercury emissions reduction by January 1, 2010, and at least a 90 percent reduction by January 1, 2015 from existing EGUs or ion the alternative a numerical emission standard.

One commentator contends that mercury pollution controls are available and affordable, and Pennsylvania coal-fired power plants are very profitable. The Board agrees. The Board has determined that a control technology combination of cold side-ESP and FGD would result in at least 80 percent control efficiency of mercury emissions from coal-fired power plants in Pennsylvania. Moreover, a control technology combination of cold side-ESP, FGD, and SCR would result in at least 90 percent control efficiency of mercury emissions from coal-fired power plants in Pennsylvania. Because of this determination, the Board has selected the 80 and 90 percent control efficiencies as requirements for the Pennsylvania-specific mercury regulation. In addition, the Board has selected the Phase 1 and Phase 2 compliance dates of 2010 and 2015, because they coincide with the deadlines under CAIR. As this analysis relates to mercury-specific control technology, the Board believes there is sufficient evidence to show that for those owners and operators that choose to this type of technology is cost-effective and commercially available.

Another commentator notes, the federal mercury rule is bad for Pennsylvania's economy. Mercury contamination is threatening the Commonwealth's sporting, angling, and recreation industry, a significant source of revenue and jobs throughout the state. Because of the trading system set up in CAMR, Pennsylvania plants are more likely to pay for pollution credits than to clean up and modernize old plants. Most importantly, there are significant costs associated with the devastating health impacts; rates of learning disabilities and associated health effects of mercury in children are increasing

The Board agrees. The Pennsylvania Fish and Boat Commission has determined that approximately 800,000 anglers fished in Pennsylvania waters in 2005. Fish licensing sales in Pennsylvania amounted to \$18.5 million in 2005. According to the Erie Regional and Growth Partnership, Pennsylvania residents age 16 years and older spent \$400 million on fishing in Pennsylvania in 2001. The average angler spent \$458 in 2001 on fishing. These direct expenditures created \$1.2 billion in Pennsylvania economic output. As a result, the Commonwealth has a significant economic interest in fresh water fishing as an economic driver. The purchase and sale of mercury allowances will not be allowed under the Pennsylvania-specific rulemaking. The Board shares this concern regarding the adverse health impacts of exposure to mercury emissions. According to Dr. Leonardo Trasande, Assistant Director for The Mount Sinai Center for Children's Health and the Environment, it is found that each year between 316,588 and 637,233 children "...have cord blood mercury levels > 5.8 µg/L, a level associated with loss of IQ. The resulting loss of intelligence causes diminished economic

productivity that persists over the entire lifetime of these children. This lost productivity is the major cost of methyl mercury toxicity, and it amounts to \$8.7 billion annually (range, \$2.2–43.8 billion; all costs are in 2000 US dollars). Of this total, \$1.3 billion (range, \$0.1–6.5 billion) each year is attributable to mercury emissions from American power plants.

One commentator said that each unit should make mercury reductions. The Board agrees. In February 2005, the EPA Office of Inspector General issued a report to EPA stating, "...EPA did not fully analyze the potential for hot spots (i.e., areas of elevated pollutant concentrations) to occur under its proposed cap-and-trade option. The potential for hot spot formation under the proposed cap-and-trade rule has generated a great deal of concern and debate among various stakeholders. In the Decision Document, the Department has a summary of the hot spot analysis it conducted and determined that a reduction in the local contribution of mercury emissions from Pennsylvania coal-fired utilities through a Pennsylvania-specific mercury rule would result in direct benefits to the citizens of the Commonwealth. Pennsylvania will receive the majority of any reduction that is required to come from a Pennsylvania coal-fired utility. The federal CAMR not only ignores the issue of potential local mercury hotspots, but also does not guarantee that any reductions in mercury emissions will occur at Pennsylvania coal-fired utilities. As a result, a Pennsylvania-specific mercury rule would improve local ecosystems and concomitantly improve public health by reducing mercury deposition.

One commentator supports the fastest and furthest reduction of mercury emissions to protect our citizens from even low levels of exposure. The Board agrees that the federal CAMR will not adequately protect public health and the environment within our borders. The final-form regulation does not establish a cap-and-trade program and will ensure that greater reductions in mercury emissions are achieved prior to the 2018 compliance deadline established under Phase 2 of CAMR. The final-form regulation will achieve a 90 percent reduction in total mercury removal from coal-fired power EGUs by January 1, 2015. Alternatively, the owners and operators of pulverized coal-fired unit may comply with an output-based standard of 0.012 pounds of mercury per gigawatt-hour (lb/GWh), starting January 1, 2015 (Phase 2) and each year thereafter. The owners and operators of circulating fluidized bed EGUs will have the option of complying with an emission standard of 0.0096 lb/GWh or a minimum 95 percent control of total mercury, as measured from the mercury content in the coal as fired.

A commentator states that no evidence was presented by any party showing the proposed rule will provide any additional environmental or health benefit to Pennsylvania beyond the EPA CAMR and that no credible evidence of mercury "hot spots" was presented by any party. The commentator states that evidence was presented that there were no local mercury "hot spots." The Board strongly disagrees. The Department's analysis has determined that a reduction in the local contribution of mercury emissions from Pennsylvania coal-fired utilities through a Pennsylvania-specific mercury rule would result in direct benefits to the citizens of the Commonwealth. For instance, it is well known that some forms of atmospheric mercury are rapidly deposited by both wet and dry processes, and emissions of these forms of mercury, especially near ground level, are responsible for a large portion of the observed mercury deposition in a surrounding area. These more reactive forms of mercury, which are emitted by EGUs burning bituminous coal, are usually deposited from the atmosphere before they can travel long distances. Therefore, the Department can say with confidence that elemental mercury is

more inert and can be transported globally, and that oxidized mercury compounds are more reactive and travel much shorter distances before depositing. As a result, Pennsylvania will receive the majority of any reduction that is required to come from a Pennsylvania coal-fired utility. The federal CAMR not only ignores the issue of potential local mercury hotspots, but also does not guarantee that any reductions in mercury emissions will occur at Pennsylvania coal-fired utilities.

One commentator says that mercury pollution credit trading cannot be allowed. The Board agrees. The Board believes EPA is without the legal authority to regulate hazardous air pollutants such as mercury under Section 111 of the CAA. The Board also believes that EPA is not legally authorized under Sections 111 or 112 of the CAA to implement a cap-and-trade program. The Congressional intent related to the regulation of mercury is clear and unambiguous – it must be regulated under Section 112 of the CAA. Mercury is explicitly identified as a hazardous air pollutant under Section 112(b). For sources other than coal-fired units, EPA must list source categories under Section 112(c) and the set emission standards for those categories under Section 112(d). While the statutory scheme for regulating mercury from coal-fired units is under Section 112(n), the Congressional intent is the same – mercury emissions from these units must be regulated under the Section 112 MACT approach. See *Chevron, U.S.A., Inc. v. Natural Resources Defense Council, Inc.*, 467 U.S. 837 (1984) (where if the intent of Congress is clear, that is the end of the matter; for the court, as well as the agency, must give effect to the unambiguously expressed intent of Congress.) EPA's proposed "cap-and-trade" program is an unreasonable interpretation of its statutory authority under Section 111 and Section 112. The fact that Congress chose to list specific HAPs under Section 112 indicated that Congress believed that these pollutants required more stringent measures than those permitted under Section 111. Moreover, regulation under Section 112 has been historically and consistently interpreted as requiring HAPs to be controlled through installation and operation of maximum achievable control technology. A cap-and-trade approach under this Section was never contemplated as a control technology.

A commentator requests that Pennsylvania revise the definition of EGU in the State's rule to reflect EPA's revised definition in its notice entitled, "Revision of December 2000 Clean Air Act Section 112(n) finding Regarding Electric Utility Steam Generating Units: and Standards of Performance for New and Existing Electric Utility Steam Generating Units: Reconsideration" (71 FR 33388, June 9, 2006). The Board agrees. This change has been made.

One commentator requests that a number of terms that are now included in CAMR by virtue of its reconsideration process now be included in the final-form rulemaking. In addition new definitions may be added once EPA finalizes its federal implementation plan on CAMR. The Board agrees. In order to address the fact that EPA will be revising definitions, possibly even after the Board's regulation is final, "incorporation by reference" regulatory language has been added. This new provision reads as follows: "The definitions under the Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources promulgated in 40 CFR Part 60 subpart Da and HHHH are adopted in their entirety." The Board's final regulation will contain the necessary EPA definitions and will also provide for any additional definitions, or changes in definitions, that are required for implementation of the Board's regulation.

The commentator is concerned by Pennsylvania's proposed § 123.204 that exempts EGUs replaced with IGCC technology from the emission limitations under §123.207 may not assure that the State Plan will meet the cap on annual mercury emissions for the State as set forth at 40 CFR 60.24(h). As a result, Pennsylvania's proposed rule may not be approvable under the provisions of 40 CFR §60.24(h) if Pennsylvania submits it with § 123.204 as proposed. The Board agrees. Owners and operators of EGUs that are replaced with IGCC technology will only be exempt from the emission standards under §123.206.

The commentator requests that Pennsylvania include a provision in § 123.205 notifying all owners and operators of new sources that they must also comply with the mercury control requirements in EPA's New Source Performance Standards as specified in Subpart Da and as adopted by reference by Pennsylvania. The Board agrees. The final-form rulemaking will reflect this change.

Commentators propose that owners and operators be given credit for coal cleaning. The Board agrees. The proposed mercury rule has been amended in Section 123.205(a)(4) to read that the mercury removal efficiency due to pretreatment of coal or waste coal may be credited towards the minimum percent control efficiency of total mercury.

A commentator recommends that the Board eliminate the annual emission limitations for coal-fired EGUs and recommends a restricted market based trading program. The Board disagrees with this recommendation since it does not believe there is sufficient legal authority under existing federal and State law to allow for the trading of a statutorily recognized HAP and potent neurotoxin like mercury.

A commentator asserts that the proposal's prohibition of allowance trading and banking would cause the premature shutdown of smaller, older coal-fired plants in Pennsylvania, leading to loss of jobs and reliable electric power. The Board disagrees. Section 123.206 provides that the Department may approve of an alternative mercury emission standard or schedule, or both, if the owner or operator of an EGU subject to the emission standards of § 123.205 demonstrates in writing to the Department's satisfaction that the mercury reduction requirements are economically or technologically infeasible. The provision was added at the request of AQTAC to address the concerns about smaller, older plants. While the Department's approval of an alternate standard or a compliance schedule will not relieve the owner or operator of an EGU from complying with the other requirements of §§ 123.207- 123.215, owners and operators of these smaller, older plants may also petition the Department for supplemental allowances under § 123.209. The Board is also adding a provision to § 123.207 of the final rule to allow the owner or operator of an EGU to demonstrate compliance with the annual emission limit by using system-wide averaging. This compliance option will be in addition to the options included in the proposal for compliance on a unit-by-unit basis or by facility-wide emissions averaging. As a result, there are a number of provisions in the regulation to ensure that smaller, older plants are safeguarded. Because Pennsylvania is not electing to participate in CAMR, the EPA has not provided the Department with the option of banking allowances from year to year.



A commentator states that the federal CAMR allows emission trading, which provides a strong incentive for generators to reduce emissions more than and sooner than required. The Pennsylvania rule does not. The Board disagrees. EPA admits that compliance with the CAMR caps will not be achieved by 2026 or as late as 2030. To provide further incentive in Pennsylvania, the Board has revised § 123.207 of the final rulemaking to add a provision to allow the owner or operator of an EGU to demonstrate compliance with the annual emission limit by using system-wide averaging. This compliance option will provide incentive for units within a system to over-control and will be in addition to the options included in the proposed rulemaking for compliance on a unit-by-unit basis or by facility-wide emissions averaging.

A commentator states that the federal CAMR does not disadvantage Pennsylvania coal, which contains more mercury than coal from other states. The Pennsylvania rule disadvantages Pennsylvania coal. The Board disagrees. CAMR discriminates against bituminous coal through the allowance allocation program as well as the New Source Performance Standard emission limits. The final-form rulemaking treats all coal types evenly. Owners and operators may now take credit for the pretreatment of coal as a means of compliance. These same owners and operators may also take advantage of a system wide compliance demonstration. Since owners and operators may use CAIR-type technologies to reduce mercury emissions, they are less likely to switch coals because bituminous coal allows for a higher capture rate. Additionally, Pennsylvania has an abundance of low-mercury-content coal found in the southwestern part of the State.

Another commentator states that under the proposed rule, the Commonwealth will be in violation of its CAMR State Budget beginning in 2018. The Board disagrees. The Board reviewed the list of IPM runs that EPA conducted in support of CAMR. These model runs show that Pennsylvania coal-fired power plants will emit 64 percent more mercury 0.451 ton (902 lbs.) than the established cap of 0.702 ton (1,404 lbs) in 2020. In contrast, after Phase 2, it is anticipated that the Pennsylvania rule would achieve a 39 percent greater reductions than CAMR under Phase 2. This means that Pennsylvania would achieve its 2018 cap of 0.702 ton (1,404 lbs.) by 2015.

Commentators assert that the annual emission limit in § 123.207, which is based on the CAMR allocations, is an extremely stringent and unnecessary requirement. The imposition of this on a unit or even facility basis will force many Pennsylvania high-mercury coals out of the market for the generation of electricity. Some smaller generating units cannot employ the maximum control technologies that would be necessary to achieve the levels specified in this section and remain competitive in the wholesale power market. The Board disagrees. The annual emission limitation provisions are designed to ensure that the mercury emission cap established for EGUs in Pennsylvania is not exceeded. The Board has revised § 123.207 of the final rulemaking to include the option of system-wide emissions averaging. This provision allows the owners or operators of two or more affected EGUs under common ownership or operator control within this Commonwealth to demonstrate compliance by ensuring that the aggregate of actual mass emissions from all units, under the averaging demonstration, is less than the aggregate of allowable mass emissions from all such units. Therefore, smaller units that belong to systems that include larger units that over-control will be able to average their annual emissions as part of the system-wide averaging provision. This averaging will help the smaller units meet their

annual emission limitations. The Board has also decided to give credit to EGUs that pretreat their coal to reduce its mercury content. This will help EGUs meet both the unit-specific emission standards and the annual limit. Also these owners and operators may petition the department for alternative emission standards or compliance schedules under §123.206 and supplemental allowances under §123.209.

Some commentators believe that the unused nontradable allowances in the new source set aside provision of § 123.207(c)(2) should not be retained in the supplemental pool. Those unused nontradable allowances should be returned to the affected units. The Board disagrees. The final-form regulation does not include banking and trading provisions. The Department has made the determination that the state-of-the-art mercury control technology is such that each unit can, if the appropriate measures are taken, meet its emissions cap. The Department will retain the unused allowances for each unit and allocate them to units that have not met their cap and have applied for additional allowances from the annual emission limit supplement pool. The Department's petition process will ensure that those units that have demonstrated the most effort in reducing their mercury emissions will be eligible to receive allowances. The Board has also revised § 123.207(o) of the final rulemaking to include the option of system-wide emissions compliance demonstration. This provision allows the owners or operators of two or more affected EGUs under common ownership or operator control within this Commonwealth to demonstrate compliance by ensuring that the aggregate of actual mass emissions from all units, under the averaging demonstration, is less than the aggregate of allowable mass emissions from all such units. This compliance option will be in addition to the options included in the proposed rulemaking for compliance on a unit-by-unit basis or by facility-wide emissions averaging.

Commentators contend that an owner of a standby unit cannot rely on the potential for allowances to be made available to assure they are in compliance with this proposed regulation. An owner must be certain a standby unit can come back into service and be in compliance, or there will be no choice but to prematurely retire that unit. A cap-and-trade program would provide that opportunity. The Board disagrees. Pennsylvania currently has no units that qualify as standby units. If the owner or operator of a unit changes its designation to standby in the future, its allowances will be transferred to the annual emission limit supplement pool established under § 123.208. If the owner or operator subsequently applies to restart a designated standby unit, it would then need to meet the applicable emission limit requirements of § 123.205.

One commentator believes that the Department's compliance bank may not cover all potential requests for allowances. The Board disagrees. The annual emission limit supplement pool established under § 123.208 is not a "compliance bank" nor is it intended to be a permanent "crutch" for owners and operators of units to rely upon to meet their annual emissions cap. The owner or operator of each affected unit should design its compliance program to comply with the applicable requirements in the final-form regulation. In the event then that the unit happens to exceed its limit, the Department can make nontradable supplemental allowances available to that unit if the owners or operators successfully petition the Department in accordance with the requirements of § 123.209. The Department's analysis shows that the Pennsylvania rule would achieve approximately a 29 percent greater reduction than CAMR during Phase 1. This would amount to 1.2567 tons (2,513.4 lbs.) of mercury emissions as opposed to 1.77 tons (3,540 lbs.)

mercury emissions under the CAMR cap. During Phase 2, it is anticipated that the Pennsylvania rule would achieve approximately a 39 percent greater reductions than CAMR under Phase 2. Therefore, Pennsylvania would achieve its cap of 0.702 ton (1,404 lbs.) by 2015 rather than exceeding it by 0.451 ton (902 lbs.). As a result, there should be sufficient allowances in the supplemental pool.

One commentator believes that proposed §§ 123.206 and 209 are unconstitutional under the commerce clause of the U.S. Constitution because they effect a preference for Pennsylvania coal under the guise of bituminous coal. The Board disagrees that these sections are unconstitutional. However, after consideration of comments received on the proposed mercury rule, the Board has removed the provisions for presumptive compliance with the emission standards and preferential allowance allocations for bituminous coal. While the original intent of the bituminous coal preference was to reflect known control capabilities while burning bituminous coal, the intended simplification of implementation of the mercury regulations was outweighed by the possible legal challenges that jeopardized the reliance of our industry on these provisions. Therefore, the final-form regulation will not contain these provisions.

One commentator states that Pennsylvania must modify proposed § 123.210(b) by adding a statement that source owners and operators must also comply with the requirements of 40 CFR Part 75, entitled "Continuous Emission Monitoring," with regard to mercury mass emissions. The Board agrees and the requirements for 40 CFR Part 75 Subpart I compliance, for mass emission monitoring systems, have been added to the final-form rulemaking.

A commentator asks that Pennsylvania state in its regulation that the Part 75 requirements will take precedence if a case should arise where there is a conflict between the requirements of Part 75 and Pennsylvania's State requirements. The Board agrees. This change has been made to §123.210.

A commentator asks that Pennsylvania clarify in the proposed regulation that the Department will not approve alternative requirements unless they are consistent with the Part 75 requirements. The Board agrees. This change has been made to §123.210.

Another commentator believes that the Board should adopt the sampling provisions laid out in CAMR and not the daily 'as fired' sampling protocol. The Board disagrees. CAMR does not provide methodology for determining or demonstrating compliance with percent-reduction limits or coal sampling and analysis. The Board believes daily coal sampling in conjunction with outlet mercury emission monitoring will accomplish the goal of ensuring compliance with percent-reduction limits for subject EGUs without imposing unreasonable costs. Daily sampling is specified in order to establish a relationship between the coal that is sampled and that which is burned, and to conform with provisions of 40 CFR Part 60 for pretreatment for sulfur removal, as well as the discussions and clarifications in the preamble to Subpart Da and determinations under Subpart Da, recorded on the EPA's Applicability Determination Index.

One commentator believes that if Pennsylvania sources purchase allowances from out-of-state sources that have over-controlled their emissions, in virtually all instances the selling sources would be located to the west and southwest of Pennsylvania. This would benefit Pennsylvania's

environment since those power plants did over-control and are up-wind of Pennsylvania. The Board disagrees. Coal-fired power plants that burn bituminous coal emit oxidized forms of mercury, which are deposited near their source. Sources to the west and south west primarily burn bituminous coal and would see local deposition improve. In Pennsylvania, 85 percent of the coal burned by coal-fired power plants is bituminous, with the remainder waste coal. As a result, Pennsylvania would not see reductions in actual emissions of mercury within the environs of the Commonwealth and may even see increased emissions, if power plants in Pennsylvania were allowed to purchase allowances from out-of-state sources rather than installing controls.

One commentator believes that MACT would have been a superior way to reduce mercury emissions. By allowing trading not all geographic areas benefit from pollution reductions. The Board agrees with this comment. The Board believes that EPA does not have the legal authority to regulate a hazardous air pollutant, like mercury, under the less stringent provisions of Section 111 of the CAA, as opposed to the more stringent MACT provisions under Section 112 of the CAA. Since EPA promulgated its Section 111 approach for the control of mercury emission from power plants, petitions for review challenging this final agency action were filed with the U.S. Court of Appeals for the D.C. Circuit. In addition to Pennsylvania, state challengers include California, Connecticut, Delaware, Illinois, Maine, Massachusetts, New Hampshire, New Mexico, New Jersey, New York, Rhode Island, Vermont, and Wisconsin.

Some commentators state that Dr. Terry Sullivan of Brookhaven National Lab found no evidence of hot spots created by emissions trading. The Board disagrees. Impacts related to mercury deposition were studied at the Bruce Mansfield coal-fired power plant in Shippingport, Pennsylvania and reported in Sullivan, T.M., *et al.*, "Assessing the Mercury Health Risks Associated with Coal-Fired Power Plants: Impacts of Local Depositions," Brookhaven National Laboratory, Upton, NY. The Bruce Mansfield plant is characterized by high total mercury emissions. From the deposition modeling, the average increase in deposition as compared to a background deposition rate of  $20 \mu\text{g}/\text{m}^2/\text{yr}$  over a  $2500 \text{ km}^2$  area around the plant was 15 percent at Bruce Mansfield. Over an area that is  $50 - 100 \text{ km}^2$ , immediately adjacent to the plant, deposition doubled at the Bruce Mansfield plant. The report concluded that if the plant emissions double the local deposition, the fish concentration would be similarly doubled. As a result, the U.S. mean fish mercury content is 0.21 ppm and near the Bruce Mansfield plant the mean fish mercury content is 0.41 ppm.

One commentator states that the Board's proposed rule lacks a market-driven cap-and-trade program, a proven tool to reduce air pollution, to promote early reductions of mercury emissions in a cost-effective way. The Board disagrees. Pennsylvania has been a strong proponent of traditional cap-and-trade programs related to criteria pollutants. However, because mercury is a designated hazardous air pollutant under Section 112 of the Clean Air Act and a potent neurotoxin, trading of such a substance is illegal under the Clean Air Act and bad environmental and public health policy. Because of the trading provisions under CAMR, owners and operators of EGUs in Pennsylvania do not have to make reductions of actual mercury emissions in Pennsylvania. They can purchase allowances to offset the amount of mercury they emit over their cap to ensure compliance, which means that reductions in Pennsylvania may only be realized on paper. Moreover, mercury emissions in Pennsylvania may be much higher than EPA projects.

Some commentators say there is no certainty a pool of allowances will be created under this proposed rule to be available to owners of electric generating units (EGUs) without the economic incentives included in the CAMR cap-and-trade program. The Board disagrees. After Phase 1 of the program, the Board anticipates that the Pennsylvania rule will achieve approximately 29 percent greater reductions than CAMR. After Phase 2, the Board anticipates that the Pennsylvania rule will achieve approximately 39 percent greater reductions than CAMR. As a result, the Board anticipates that there will be a supplemental pool available for use for eligible owners or operators of EGUs. Furthermore, the Board has added a system-wide emissions averaging approach to address the commentator's concerns regarding incentives for early reductions. Under this approach owners or operators of two or more affected EGUs under common ownership or operator control within this Commonwealth may achieve compliance with the annual mercury emission limitation by ensuring that the aggregate of actual mass emissions from all units, under the averaging demonstration, is less than the aggregate of allowable mass emissions from all such units.

Some commentators believe that the Board has viewed the public comment period as a public opinion poll, rather than a genuine opportunity to solicit and consider substantive comments. The commentators feel that the vast majority of the comments received were form emails or letters drafted by advocacy organizations to "run up the numbers". The Board disagrees. It is undisputed that there is a substantial public interest in the state-specific rulemaking to reduce emissions from coal fired power plants. The unprecedented number of commentators for this rulemaking shows that the public is extraordinarily concerned about mercury emissions from coal-fired power plants and is exercising their constitutional right to comment on an issue that directly affects them. Many of these comments were substantive in nature, which resulted in the Board making revisions to the final-form rulemaking.

Some commentators believe that if trading is not added to the proposed rule and controls cannot be built because of time, labor or financial constraints. The Board disagrees. Section 123.206(c) provides that the Department may approve of an alternative mercury emission standard or schedule, or both, if the owner or operator of an EGU subject to the emission standards of § 123.205 demonstrates in writing to the Department's satisfaction that the mercury reduction requirements are economically or technologically infeasible. While the Department's approval of an alternate standard or a compliance schedule will not relieve the owner or operator of an EGU from complying with the other requirements of §§ 123.207- 215, owners and operators of these plants may also petition the Department for supplemental allowances under § 123.209. As a result, there are a number of provisions in the regulation to ensure that plants are safeguarded. In addition, an alternate schedule would not require these units to operate at a reduced level of output.

One commentator states that a recent study shows the proposed mercury rule would increase Pennsylvania's cost for compliance by \$1.7 billion, doubling the investments EGUs would have to make in advanced pollution control equipment over the CAIR/CAMR rule. Commentator further states that the Board has done no detailed study of the cost impacts of this proposed rule on electric generators or electric customers. The Board disagrees. The Department has done a

thorough cost analysis and has found that the increase in cost to Pennsylvania electric utility customers would be very small, and that the increased cost would be \$0.0012 to 0.0038 Kwh.

Some commentators are extremely concerned about the impact the Board's proposed rule will have on the economy. Imposition of burdensome, unnecessary mercury regulations can have a devastating, rippling effect throughout the energy production, mining and manufacturing sectors. The Board shares this concerns as well, but does not believe the final-form rule will have this effect. There will be compliance costs related to the construction and operation of air pollution control devices to control mercury, NO<sub>x</sub> and SO<sub>x</sub>. The total cost of complying with the state-specific mercury rule in Phase 1 is estimated to be between \$15.4 and \$15.8 million per year. Purchasing mercury allowances (at \$953 per ounce, according to the U.S. Department of Energy) would cost approximately \$15.7 million per year.

The Phase 2 cost range is based on the control technologies needed to meet the annual limit. The high end cost estimate is based upon using TOXECON/COHPAC at an annual cost of \$53.4 million. The low end is based upon utilizing B-ACI at an annual cost of \$16.7 million. The capital costs for each of these technologies were annualized based upon 20 years and an interest rate of 10 percent. The Phase 2 mercury allowance cost was estimated to be \$28.3 million annually based upon the assumption of allowances costing \$41,900/lb. This allowance cost is based on an average from DOE projected costs for 2015 and 2030.

The cost differential between allowance costs and technology costs were \$25.1 million on the high end and a savings of \$11.6 million on the low end. The total kilowatt-hours calculated for the 18 units that will not be installing CAIR controls to meet the Phase 2 requirements are 13,748,393,901. The resulting cost per kilowatt-hour ranges from \$0.0018/kwh for the use of the TOXECON/COHPAC control technology to a savings of \$0.00084/kwh for using B-ACI to comply with the Phase 2 limits.

Commentator contends that there is a lack of evidence that the proposed rule will provide an environmental benefit to Pennsylvania beyond the EPA Clean Air Mercury Rule. The Board disagrees. The Board's analysis shows that a Pennsylvania specific mercury reduction rule will reduce mercury emissions in the Commonwealth. A reduction in mercury emissions will lead to improved environmental quality. This improvement in the environment will lead to reduced environmental and public health impacts. These reduced impacts will improve the health of ecosystems and improve public health.

Commentators state that in 1996, then Governor Tom Ridge promulgated Executive Order 1 of 1996. This order dictates that state rules should be no more stringent than federal requirements unless there is a compelling state reason to do so. Commentators believe that to date, the Department has demonstrated no compelling reason to implement a state specific mercury rule. Since executive orders stand until formally withdrawn and such an action has not occurred with Executive Order 1 of 1996, the Department's mercury rule should not be promulgated.

The Board disagrees. The Department believes that it has demonstrated that a state-specific rule is necessary because of compelling reasons. A large body of scientific evidence, some of which was developed as a result of EPA's obligations under the federal Clean Air Act, has

clearly demonstrated that mercury is a persistent, toxic, bio-accumulative pollutant that can have adverse effects on human health and the environment. The Department has determined that effective mercury control technology does exist to significantly reduce mercury emissions from EGUs. Furthermore, mercury control technology is presently being implemented at a number of air pollution emitting sources, and recent testing of mercury control technologies on coal-fired utilities has been shown to be effective in reducing mercury emissions. The Department has joined a number of other parties in a lawsuit challenging EPA's national cap-and-trade approach as both inappropriate for regulating a potent neurotoxin like mercury and also contrary to the statutory provisions of the Clean Air Act. The Department has determined that the provisions in EPA's final mercury rule for the utility sector that was promulgated under Section 111 of the CAA are not adequate to ensure that the citizens of Pennsylvania and the environment will be adequately protected from the harmful effects of mercury emissions.

### **G. Benefits, Costs and Compliance**

#### *Benefits*

Overall, the citizens of this Commonwealth will benefit from these regulatory amendments because they will result in improved air quality by reducing mercury emissions. In addition, it is anticipated that local mercury deposition will be reduced since coal-fired power plants that burn bituminous coal emit oxidized forms of mercury, which are deposited near their source. Moreover, the Board believes that there are a number of reliable cost/benefit studies which indicate cost savings and public health benefits from controlling mercury emissions from EGUs.

The Commonwealth is concerned that the CAMR's cap- and- trade approach will result in hot spots to which this Commonwealth is particularly susceptible given that all 36 coal-fired utilities in this Commonwealth burn bituminous coal as their primary fuel source. Bituminous coals generally have high mercury, chlorine and sulfur contents and low calcium content, resulting in a high percentage of organic mercury. This type of mercury has a residence time of a few days and is deposited near the source of the release. Therefore, it is not a suitable candidate for emission trading against emission reductions in other regions because it results in hot spots.

Impacts regarding mercury deposition were studied at the Bruce Mansfield coal-fired power plant in Shippingport, PA. Sullivan, T.M., *et al.*, *Assessing the Mercury Health Risks Associated with Coal-Fired Power Plants: Impacts of Local Depositions*, Brookhaven National Laboratory, Upton, NY. This plant is characterized by high total mercury emissions. From the deposition modeling, the average increase in deposition as compared to a background deposition rate of 20 ug/m<sup>2</sup>/yr over a 2,500 km<sup>2</sup> around the plant was 15 percent at Bruce Mansfield. Over an area that is 50--100 km<sup>2</sup>, immediately adjacent to the plant, deposition doubled at the Bruce Mansfield plant. The report concluded that if the plant emissions double local deposition, the fish concentration would be similarly doubled. As a result, the United States mean fish mercury content is 0.21 ppm and near the Bruce Mansfield plant the mean fish mercury content is 0.41 ppm.

The 2003 results of the EPA Office of Water study *Draft Mercury REMSAD Deposition Modeling Results* reinforce the Commonwealth's concern. This Regulatory Modeling System for Aerosols and Deposition modeling shows that, at mercury hot spots, local emission sources within a state can be the dominant source of deposition. At hot spots, local sources within a state commonly account for 50 percent to 80 percent of the mercury deposition. In-state sources contribute more than 50 percent of the pollution to sites in the top eight worst hot spot states, which are Michigan, Maryland, Florida, Illinois, South Carolina, North Carolina, Pennsylvania and Texas, respectively.

In addition to these studies, "Sources of Mercury Wet Deposition in Eastern Ohio, USA," which is the EPA-funded Steubenville Mercury Deposition Source Apportionment Study will be published in *Environmental Science and Technology* shortly. This study found that approximately 70 percent of the mercury in rain collected at an Ohio River Valley monitoring site originated from nearby coal-burning industrial plants. It is anticipated that this peer-reviewed study will be published in the scientific literature within the next couple of months.

The Northeast States for Coordinated Air Use Management (NESCAUM) sponsored a report analyzing the cost savings and public health benefits of controlling mercury emissions from power plants. NESCAUM, *Economic Valuation of Human Health Benefits of Controlling Mercury Emissions from U.S. Coal-fired Power Plants*, (Feb. 2005) (Harvard Study). The Harvard Study was prepared by the Harvard Center for Risk Analysis, funded by the EPA, co-authored by an EPA scientist and peer-reviewed by two other EPA scientists. The Harvard Study reveals that the EPA miscalculated the "nature of the risk involved" by underestimating the public health benefits of reducing mercury. Specifically, the Harvard Study indicates that the public benefit of reducing power plant mercury emissions to 15 tpy ranges from \$119 million annually (if only persistent IQ deficits from fetal exposures to methylmercury are counted) to as much as \$5.2 billion annually (if IQ deficits, cardiovascular effects and premature mortality are all counted).

The May 2005 edition of *Environmental Health Perspectives* indicates that the EPA underestimated the health benefits to be gained from reducing mercury. In one study, scientists from the Mount Sinai School of Medicine examined National blood mercury prevalence data from the CDC and found that between 316,588 and 637,233 children each year have cord blood mercury levels greater than 5.8 micrograms per liter--the level associated with loss of IQ. See Leonardo Trasande, et al., *Public Health and Economic Consequences of Methylmercury Toxicity to the Developing Brain*, 113 *Environmental Health Perspectives* (May 2005). They estimated that the resulting loss of intelligence and diminished economic activity amounted to \$8.7 billion annually, with \$1.3 billion each year being directly attributable to mercury emissions from power plants. The scientists further caution that these costs will recur each year with each new birth cohort as long as mercury emissions are not controlled.

Trasande and his colleagues have further concluded that their calculations on economic cost may, in fact, be an underestimate. See "Mental retardation and prenatal methylmercury toxicity." *AM J Ind Med.* 2006 Mar; 49(3):153-8. Downward shifts in IQ resulting from prenatal exposure to methylmercury of anthropogenic origin are associated with 1,566 excess cases of mental retardation annually (range: 376-14,293). This represents 3.2 percent of mental retardation cases



in the US (range: 0.8 percent-29.2 percent). The mental retardation costs associated with decreases in IQ in these children amount to \$2.0 billion/year (range: \$0.5-17.9 billion). Mercury from American power plants accounts for 231 of the excess mental retardation cases/year (range: 28-2,109), or 0.5 percent (range: 0.06 percent-4.3 percent) of all mental retardation. These cases cost \$289 million (range: \$35 million-2.6 billion). Therefore, Trasande concludes that toxic injury to the fetal brain caused by mercury from coal-fired power plants exacts a significant human and economic toll on American children. These conclusions have been peer-reviewed.

On April 28, 2005, an unpublished report that was funded and completed by the EPA's Office of Wetlands, Oceans and Watersheds became available to the public. See Douglas Rae & Laura Graham, *Benefits of Reducing Mercury in Saltwater Ecosystems*. This study found that a 30—100 percent reduction of mercury emissions would translate into a \$600 million to \$2 billion cost savings. The cost savings were largely attributable to reduced health risks, including cardiovascular risks.

As a result of these and other studies, the Board believes that there are substantial benefits regarding the proposed rulemaking. Moreover, the proposed rulemaking is designed to maximize the co-benefit of mercury emission reduction achieved through the installation of pollution controls, which are required for compliance with the CAIR program. Owners and operators of EGUs are not disadvantaged under this time frame, and there should not be any reliability concerns for delivery of power over the electric grid.

Under a Pennsylvania-specific mercury rule, EGUs in Pennsylvania will emit no more than 0.702 ton (1,404 lbs.) by 2015. As a result, annual benefit associated with IQ increases in the annual birth cohort ranges are \$4.165 million to \$10.08 million. This benefit is from reduced fetal methylmercury exposure. This means that the Pennsylvania rule will provide an additional benefit of \$1.49 million to \$3.63 million per year over CAMR. If cardiovascular effects are only experienced by the male population that consumes non-fatty freshwater fish, then the monetized annual benefits are \$1.8 million. This means that the Pennsylvania rule will provide an additional benefit of \$0.65 million per year over CAMR. If these positive cardiovascular effects are experienced by all Pennsylvanians, then the monetized annual benefits are predicted to be \$200.9 million. This means that the Pennsylvania rule will provide an additional benefit of \$72.3 million per year over CAMR. Moreover, Pennsylvanians will see these results being achieved by 2015.

In comparison, the total cost of complying with Phase 1 of the Pennsylvania-specific rule would be no more than the cost of complying with CAMR. For Phase 2 at the low end of the cost estimate, the annualized cost of mercury specific technology may not be any more than the costs of purchasing the allowances. However, at the high end of the cost estimate, the additional cost above purchasing allowance would be around \$24.7 million. Consequently, the benefits of a Pennsylvania rule outweigh the costs.

The Department's analysis assumes the continued use of the existing coal feedstocks. Because we anticipate the majority of the mercury reductions in this Commonwealth to be achieved through the installation of CAIR controls for NO<sub>x</sub> and SO<sub>x</sub>, there will not exist the same incentive to utilize fuel switching to lower mercury content coal as there is under the CAMR. A

control strategy combining fuel switching and the purchase of mercury allowances is a viable option that many companies are expected to use to meet the CAMR requirements. The Board's rulemaking disallows the purchase and trading of allowances. Based on the data submitted in response to the Department's data request, fuel switching is not necessary to comply with its final rulemaking emission standards. Therefore, fuel switching is not necessary to comply with the final rulemaking and the continued use of the existing coal feedstocks should not be affected. However, owners and operators of affected EGUs are free to employ any compliance strategy necessary to comply with this rulemaking.

### *Compliance Costs*

The Department performed a cost analysis as part of the development process of the Pennsylvania Mercury Rule. The analysis was also conducted to determine the cost of the rulemaking emission limits above and beyond CAIR. CAIR involves the installation air pollution control equipment for sulfur dioxide and nitrogen oxides control. For each applicable EGU in the state, the Department determined the amount of mercury, if any, that would need to be controlled beyond CAIR control levels for Phase 1 and Phase 2.

For each unit the capital cost, annualized capital costs, and operating costs were determined. This was offset against how much it would cost to purchase an equivalent amount of emissions allowances based on EPA's projections of mercury allowance costs from 2010 through 2030. These projections come from a U. S. Department of Energy (DOE) document titled "Annual Energy Outlook 2006 With Projections to 2030"). The costs of control were based on cost estimates for installing and operating activated carbon injection systems. The capital costs were determined by estimating the cost ranging from \$2/kW - \$4/kW of plant electrical generating capacity. This capital cost was then annualized over 20 years assuming a 10 percent interest rate. The operating costs were calculated for Phase 1 based on a brominated- activated carbon injection ("B-ACI") injection rate of 6 lbs. per million actual cubic feet of exhaust gas. For Phase 2 an injection rate of 4.84 or 9.68 lbs. per million actual cubic feet of exhaust gas was used depending on how much was needed to meet the emission limit. The injection rate was multiplied by the average of the three highest years of heat input between 1998 and 2002 and then multiplied by \$ 0.0175 lb of sorbent/Million Btu. This calculation was performed for each effected emission unit.

For Phase 1, the Department estimated that 16 units at 7 facilities might opt for mercury-specific control beyond the CAIR control installations. The total capital costs needed for B-ACI were estimated to be approximately \$4.9 to \$9.8 million. The annual operating costs were estimated to be approximately \$14.7 million. The total annualized costs for Phase 1 were estimated to be approximately \$15.4 to \$15.8 million. The cost of \$0.0012/kWh represents the upper bound cost estimate for the EGUs to comply with the Phase 1 limits.

The mercury allowance costs were approximately \$15.7 million using DOE's projections of mercury allowance costs from 2010 through 2015 at \$953 per ounce. As a result, the total cost of complying with Phase 1 of the Pennsylvania-specific mercury regulation would be no more than the cost of complying with CAMR.

For Phase 2, the Department estimated that 18 units at 7 facilities might opt for mercury specific control beyond the CAIR control installations. Some EGU owners and operators may choose to install compact hybrid powdered activated carbon (COHPAC) filter systems to comply with the Pennsylvania mercury rule. Electric Power Research Institute has patented "TOXECON" process which employs COHPAC in the control configuration. TOXECON/COHPAC has been demonstrated to achieve around 90% reduction of mercury emissions. The capital costs for were determined by estimating the cost ranging from \$56.53/KW - \$125/KW of plant electrical generating capacity.

The difference between the lower-bound and upper-bound costs estimates reflects the difference between carbon injection and the installation of TOXECON/COHPAC filter systems. The total capital costs are estimated to range from \$141.6 to \$313.3 million. The total annualized cost (capital and operating) of mercury-specific control technology that EGU owners and operators might opt to install beyond CAIR to comply with the Pennsylvania Mercury Rule would range from \$16.7 to \$53 million per year. The resulting cost per kilowatt-hour would be no greater than \$0.0038/kWh for the EGUs utilizing the TOXECON/COHPAC control technology to comply with the phase 2 limits. The cost of \$0.0038/kwh represents the upper bound cost estimate for the EGUs to comply with the Phase 2 limits.

The estimated total cost of purchasing mercury allowances (using \$2,619 per ounce, according to a U.S. Department of Energy estimate) would be approximately \$28.3 million per year if EGU owners and operators did not implement additional measures beyond CAIR to comply with CAMR. At the low end of the cost estimate, the annualized cost of mercury specific technology may not be any more than the costs of purchasing the allowances. However, at the high end of the cost estimate, the additional cost above purchasing allowance would be around \$24.7 million. This would represent about \$0.0018/kWh.

Based on the Department's analysis, there is no compelling evidence to suggest that electricity rates will significantly be impacted because of the final-form rulemaking.

#### *Compliance Assistance*

The Department plans to educate and assist the public and regulated community with understanding any newly revised requirements and how to comply with them. This will be accomplished through the Department's ongoing Regional Compliance Assistance Program.

#### *Paperwork Requirements*

This final rulemaking will not increase the paperwork that is already generated during the normal course of business.

### **H. Pollution Prevention**

The Pollution Prevention Act of 1990 (42 U.S.C.A. §§ 13101--13109) established a National policy that promotes pollution prevention as the preferred means for achieving state

environmental protection goals. The Department encourages pollution prevention, which is the reduction or elimination of pollution at its source, through the substitution of environmentally friendly materials, more efficient use of raw materials and the incorporation of energy efficiency strategies. Pollution prevention practices can provide greater environmental protection with greater efficiency because they can result in significant cost savings to facilities that permanently achieve or move beyond compliance. This final rulemaking will reduce mercury emissions from EGUs. Coal-fired power plants that burn sub-bituminous coal emit Hg<sup>0</sup>, which can be transported over transcontinental distances. Coal-fired power plants that burn bituminous coal emit oxidized forms of mercury, which are deposited near their source. In this Commonwealth, 85 percent of the coal burned by coal-fired power plants is bituminous, with the remainder as waste coal. Reducing mercury emissions will reduce mercury deposition and will therefore reduce mercury related water pollution.

**I. Sunset Review**

This final-form rulemaking will be reviewed in accordance with the sunset review schedule published by the Department to determine if the regulations effectively fulfill the goals for which they were intended.

**J. Regulatory Review**

Under section 5(a) of the Regulatory Review Act (71 P. S. § 745.5(a)), on June 16, 2006, the Department submitted a copy of this final rulemaking and a copy of a Regulatory Analysis Form to the Independent Regulatory Review Commission (IRRC) and to the Chairpersons of the House and Senate Environmental Resources and Energy Committees for review and comment.

Under section 5(c) of the Regulatory Review Act, IRRC, and the Committees were provided copies of the comments received during the public comment period, as well as other documents when requested. In preparing the final-form rulemaking, the Department considered the comments received by IRRC, the Committees, and the public.

Under section 5.1(d) of the regulatory review Act (71 P.S. §745.a(d)), on xxxx,xx, 2006, this final-form rulemaking was deemed approved by the House and Senate Committees. Under section 5.1(e) of the regulatory review act, IRRC met on xxxx,xx, 2006 and approved the final-form rulemaking.

**K. Findings of the Board**

The Board finds that:

- (1) Public notice of proposed rulemaking was given under sections 201 and 202 of the act of July 31, 1968 (P.L. 769, No. 240) (45 P.S. §§1201 and 1202) and regulations promulgated thereunder at *1 Pennsylvania Code* §§7.1 and 7.2.

- (2) A public comment period was provided as required by law, and all comments were considered.
- (3) These regulations do not enlarge the purpose of the proposal published at 36 Pa. Bull. 3185 (June 24, 2006).
- (4) These regulations are necessary and appropriate for administration and enforcement of the authorizing acts identified in Section C of this order.

**L. Order of the Board**

The Board, acting under the authorizing statutes, orders that:

- (a) The regulations of the Department of Environmental Protection, *25 Pennsylvania Code*, Chapters 123, are amended by amending sections 123.201 – 215 to read as set forth in Annex A.
- (b) The Chairperson of the Board shall submit this order and Annex A to the Office of General Counsel and the Office of Attorney General for review and approval as to legality and form, as required by law.
- (c) The Chairperson of the Board shall submit this order and Annex A to the Independent Regulatory Review Commission and the Senate and House Environmental Resources and Energy Committees as required by the Regulatory Review Act.
- (d) The Chairperson of the Board shall certify this order and Annex A and deposit them with the Legislative Reference Bureau, as required by law.
- (e) This order shall take effect immediately upon publication in the *Pennsylvania Bulletin*.

BY:

KATHLEEN A. MCGINTY  
Chairperson  
Environmental Quality Board

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