Power Plant Emissions in Maryland: An Overview of the Problem and Efforts to Implement a Multi-pollutant Approach to Reduce Emissions

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November 22, 2005

The Honorable Thomas V. Mike Miller, Jr., President of the Senate
The Honorable Michael E. Busch, Speaker of the House of Delegates
Members, Maryland General Assembly

Ladies and Gentlemen:

Pollutants from power plants (such as nitrogen oxides, sulfur dioxide, carbon dioxide, and mercury) contribute to a whole host of environmental problems including smog, acid rain, global warming, and water pollution. In an effort to address concerns regarding air emissions from several coal-fired power plants in the State, Senate Bill 744 and House Bill 1169 were introduced during the 2005 session; however, neither bill was successful.

In anticipation of this issue resurfacing in the coming session, during the 2005 interim, the Natural Resources, Environment, and Transportation Workgroup of the Office of Policy Analysis prepared a report regarding multi-pollutant strategies to reduce emissions from power plants. Enclosed please find a copy of the report for your review.

Governor Robert L. Ehrlich, Jr. recently announced that the Maryland Department of the Environment will be proposing regulations addressing the emission of pollutants from certain coal-fired power plants in the State. I trust that this report will prove useful to you during the General Assembly's consideration of those proposed regulations and any legislation that may be introduced during the 2006 session.

For further information on this report, please contact Lesley Cook of the Office of Policy Analysis at 410-946-5510.

Sincerely,

Karl S. Aro
Executive Director

cc: Mr. Warren G. Deschenaux

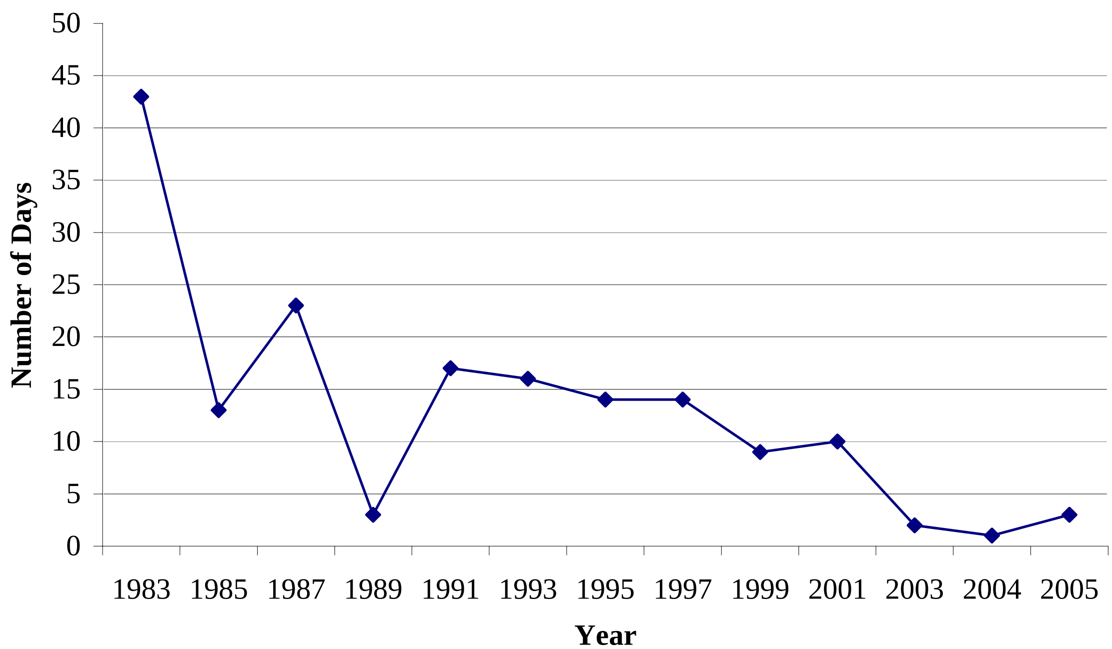
Enclosure

Contents

Chapter 1: Introduction

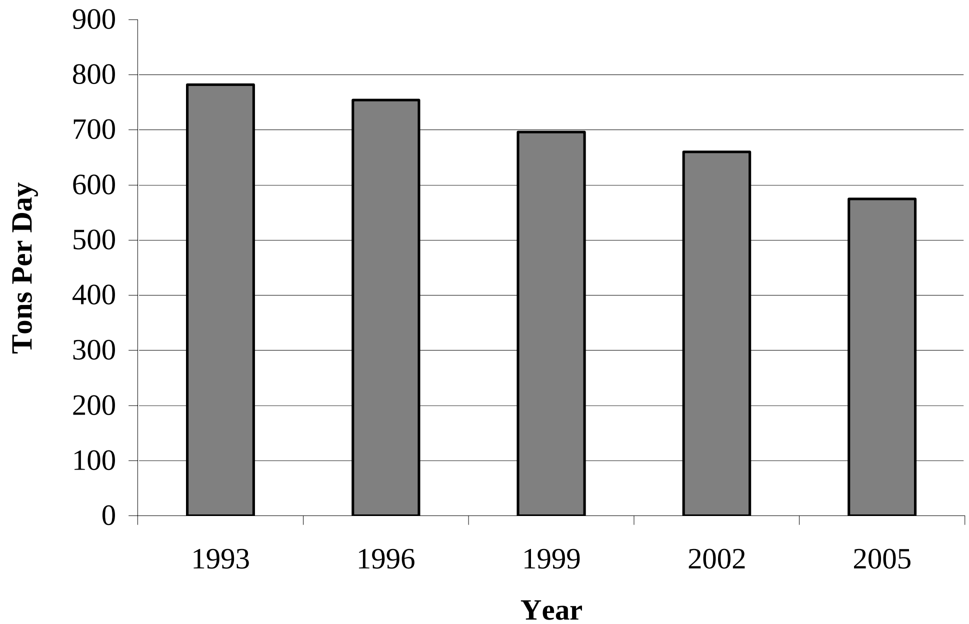
While Maryland has made progress in meeting clean air goals, air pollution continues to threaten public health and the health of the Chesapeake Bay. In recent years, Maryland has experienced some reductions in air pollution, as evidenced by fewer days exceeding ground-level ozone (smog) standards and less nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the Baltimore region (**Exhibits 1-1** and **1-2**). According to the Maryland Department of the Environment (MDE), air emissions in Maryland have been cut by about 40 percent since 1990. However, while air emissions have decreased, approximately one-third of the Chesapeake Bay's total yearly nitrogen load still comes from air deposition, as shown in **Exhibit 1-3**. In addition, much of the State remains in nonattainment of federal air quality standards for ozone and particulate matter (PM).

Exhibit 1-1
Number of Days in Maryland Exceeding Ozone Standards



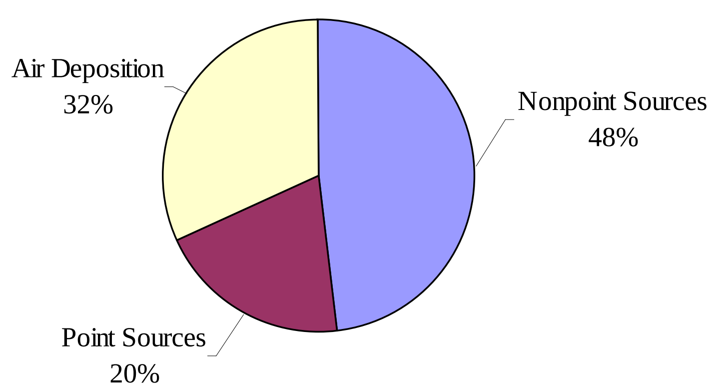
Source: Maryland Department of the Environment

Exhibit 1-2
NO_x and VOC Emissions in the Baltimore Region



Source: Maryland Department of the Environment

Exhibit 1-3
Nitrogen Deposition to the Chesapeake Bay



Source: Maryland Department of the Environment

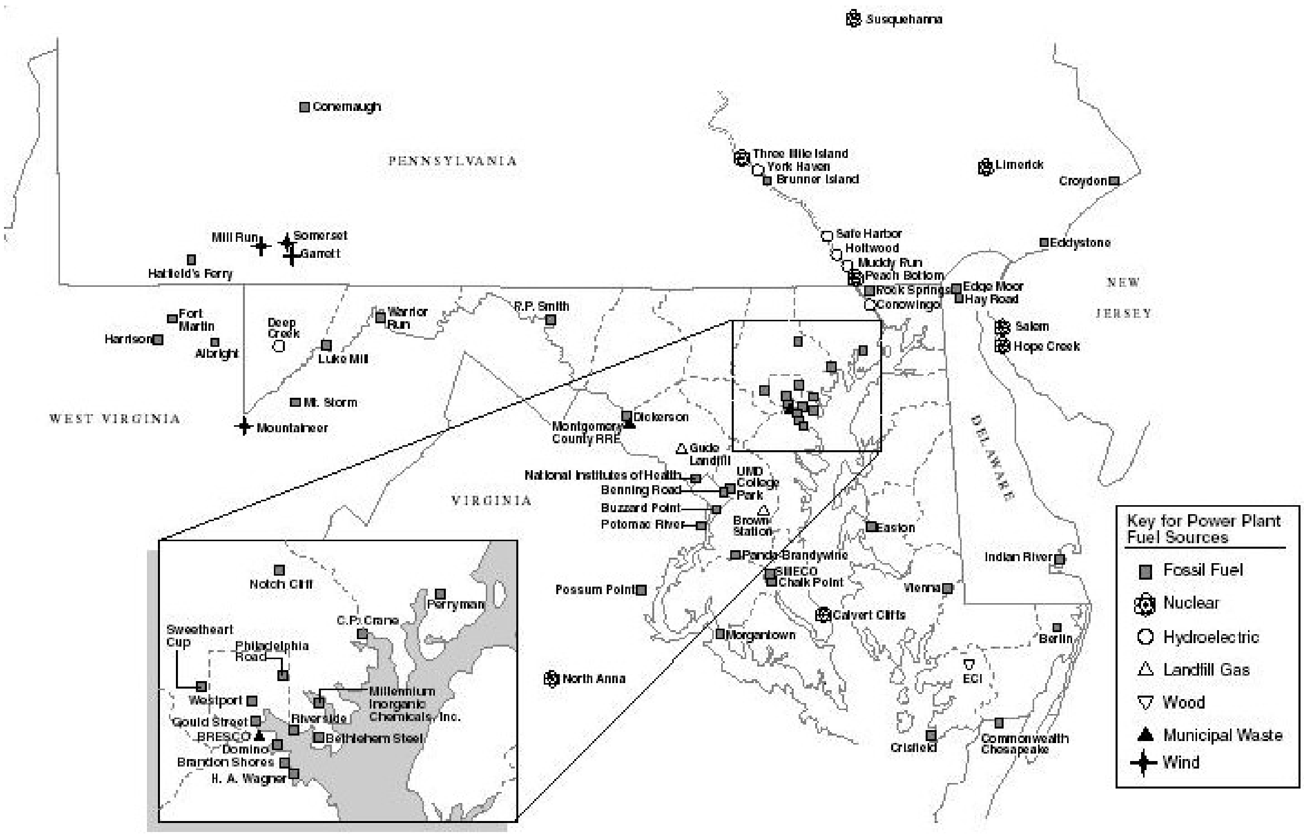
Air pollution is a complex scientific and public policy issue. This issue defies political boundaries, is the result of multifaceted scientific interactions, is subject to numerous federal and state regulations, and has diverse sources. As a result of this complexity, this paper addresses only one source of air pollution – pollution in Maryland generated by power plants. This paper provides the following information:

- an overview of Maryland's power plant infrastructure, emissions, associated environmental and health impacts, and the technology available to reduce air emissions (Chapter 1);
- the federal, State, and regional statutory and regulatory framework that governs air emissions from power plants (Chapter 2);
- a summary of Maryland's status in reaching air quality standards and efforts to reduce emissions from power plants (Chapter 3);
- actions other states have taken to reduce emissions from power plants, including case studies on three states that have implemented multi-pollutant strategies (Chapter 4); and
- issues that should be addressed in Maryland when considering multi-pollutant legislation (Chapter 5).

An Overview of Maryland's Power Plants and Associated Emissions

As of February 2004, there were 36 power plants operating in Maryland with a capacity rating of two or more megawatts (MW); the combined generating capacity of these plants is nearly 13,500 MW. Electricity generated in Maryland is sent to the transmission grid via the Pennsylvania-New Jersey-Maryland Interconnection (PJM). **Exhibit 1-4** is a map of all of the power plants in the PJM, including those located in Maryland.

Exhibit 1-4
Maryland Power Plants



Source: Power Plant Research Program, Department of Natural Resources

Approximately two-thirds of the electricity generated in Maryland comes from the burning of fossil fuels (coal, oil, and natural gas). The process of burning fossil fuels produces many different air pollutants including sulfur dioxide (SO_2), NO_x, carbon dioxide (CO_2), mercury, VOCs, and PM. Maryland has 17[1] fossil fuel-fired power plants, including six older, coal-fired plants that are not required under the federal Clean Air Act (CAA) to meet New Source Performance Standards (NSPS) due to their age. **Exhibit 1-5** illustrates the SO_2, NO_x, and CO_2 emissions from these 17 fossil fuel-fired power plants in Maryland in 2003.

Power plants are responsible for a significant portion of the State's overall SO_2 and NO_x pollution, as shown in **Exhibit 1-6**. In addition, according to 2003 data from MDE, electric generating units emit over 2,250 pounds of mercury per year – approximately 70 percent of total point source mercury emissions in the State. According to a 2004 report by the Environmental Integrity Project, Mirant's Morgantown plant ranked twenty-fifth on its list of the nation's top 50 polluting power plants for SO_2 in 2003, and Constellation Energy's Brandon Shores plant ranked thirty-first on its list of the nation's top 50 polluting power plants for mercury in 2001.

[1] These facilities include those power plants that have at least one fossil fuel-fired unit and that have a total nameplate capacity of at least 25 MW. Self-generators are not included.

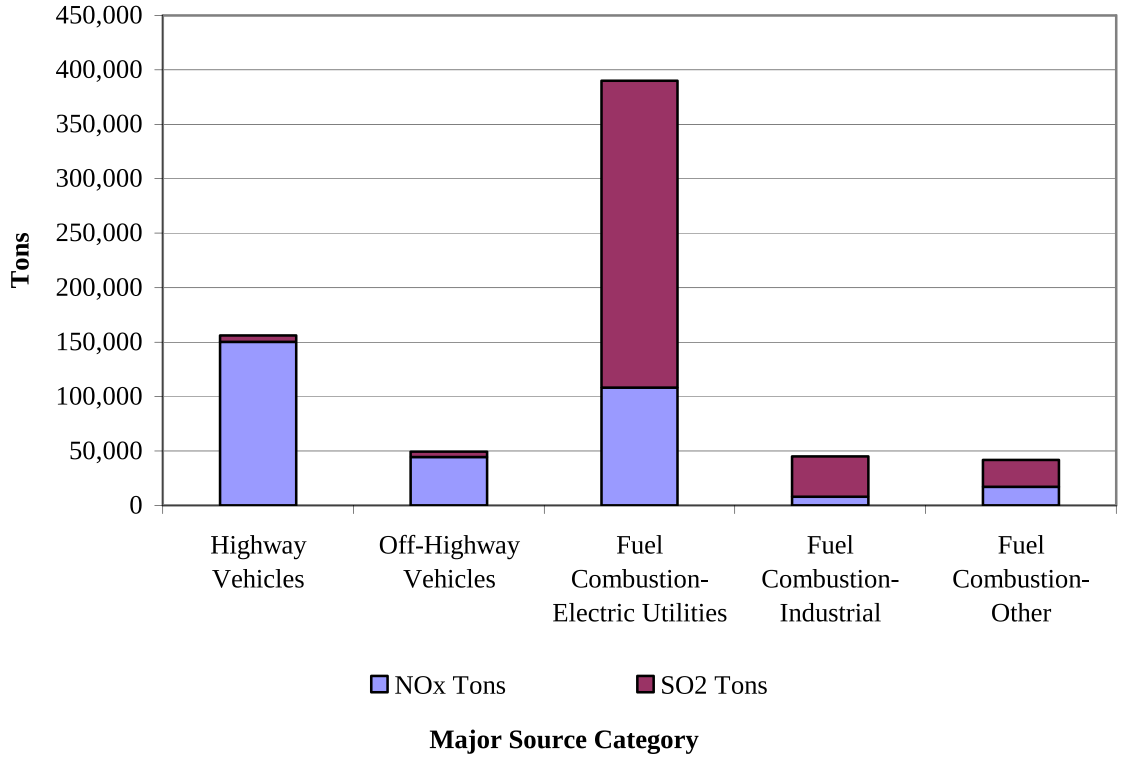
Exhibit 1-5
Maryland Power Plant Facility Generating Capacity, Fuel Type, and 2003 Emissions

Facility Name	Total Nameplate Capacity (Megawatts)	Primary Fuel	SO_2 Tons	NO_x Tons	CO_2 Tons
AES Warrior Run	229	Steam (Coal)	n/a	482.6	n/a
Brandon Shores	1370	Steam (Coal)	40,766.7	13,042.9	8,148,886.8
CP Crane*	416	Steam (Coal)	32,260.8	10,849.4	2,601,391.3
Chalk Point*	2647	Steam (Coal and Residual Fuel Oil)	52,278.8	13,448.5	6,249,666.9
Dickerson*	930	Steam (Coal) and Combustion Turbine (Distillate Fuel Oil)	30,174.7	5,181.9	2,761,808.9
Easton	61	Internal Combustion (Distillate Fuel Oil)	n/a	n/a	n/a
Herbert A. Wagner*	1059	Steam (Coal and Residual Fuel Oil)	23,153.9	6,297.0	3,612,517.4
Morgantown*	1548	Steam (Coal) and Combustion Turbine (Distillate Fuel Oil)	85,340.6	17,792.8	7,759,622.1
North Cliff	144	Combustion Turbine (Natural Gas)	n/a	n/a	n/a
Panda Brandywine	288	Combined Cycle Combustion Turbine and Combined Cycle Steam (Natural Gas)	7.0	82.5	106,497.1
Perryman	404	Combustion Turbine (Distillate Fuel Oil)	14.5	41.5	33,013.6
Philadelphia Road	83	Combustion Turbine (Distillate Fuel Oil)	n/a	n/a	n/a
R. Paul Smith Power Station*	110	Steam (Coal)	3,749.3	988.8	544,712.8
Riverside	244	Steam (Natural Gas) and Combustion Turbine (Distillate Fuel and Kerosene)	0.0	20.1	8,304.8
Rock Springs Generating Facility	680	Combustion Turbine (Natural Gas)	0.8	40.8	165,707.5
Southern Maryland Electric Cooperative (SMECO)	84	Combustion Turbine (Natural Gas)	n/a	n/a	n/a
Vienna	183	Steam (Residual Fuel Oil)	1,022.4	198.5	103,157.7
Total	**10,480**		**268,769.5**	**68,467.3**	**32,095,286.9**

Sources: U.S. Environmental Protection Agency Quick Reports
http://cfpub.epa.gov/gdm/index.cfm?fuseaction=emissions.quickreports.
Power Plant Research Program, Maryland Department of Natural Resources

Note: n/a = Not Available
*Indicates facilities that have at least one unit that is not subject to CAA's NSPS because the plants were built prior to 1971.

Exhibit 1-6
Maryland NO_x and SO_2 Emissions by Major Category (1999)



Source: U.S. Environmental Protection Agency.
http://www.epa.gov/air/data/emcatbar.html?st~MD~Maryland.

Air Pollution Transport: Other Areas Contribute to Our Problems

The role of air pollution that floats into the State from the west and the south has been an issue of increasing interest in Maryland. While all states are impacted by air pollution transport to some degree, Maryland's transport problem is recognized as significant. According to MDE, on any given day, over half of Maryland's ozone may originate in upwind states. On some days, the upwind contribution may be 70 percent or more. This influx of ozone is the result of the very unique meteorology of the Mid-Atlantic region coupled with the influence of a wide area of emissions (most of the east). According to MDE, new science now confirms that a large mass of ozone covers our region and floats in mass from one state to the next over large parts of the east.

Environmental and Human Health Impacts

Since air pollutants eventually return to the Earth's surface, they may affect a broad array of terrestrial and aquatic life. SO_2 emissions contribute to acid rain and the formation of harmful fine PM. NO_x emissions are a precursor to ground level ozone and contribute to acid rain, regional haze, and algae blooms in the Chesapeake Bay. CO_2, a greenhouse gas, has been linked to global warming. Mercury – which is a heavy metal – is easily taken up in living tissue and builds up over time, causing neurological and reproductive disorders in humans and wildlife. Mercury pollution has led to several fish consumption advisories in the State.

As shown in **Exhibit 1-7**, the U.S. Environmental Protection Agency (EPA) has identified numerous human health impacts associated with SO_2, NO_x, CO_2, and mercury emissions.

Exhibit 1-7
Health Risks Associated with SO_2, NO_x, CO_2, and Mercury

Pollutant	Related Health Risks
SO_2	Can cause respiratory illness, cause temporary breathing difficulty for people with asthma, and aggravate existing heart disease. When mixed with other chemicals in the air, it can cause increased respiratory disease, difficulty breathing, and premature death.
NO_x	Leads to smog, which damages lung tissue and reduces lung function. It mixes with other chemicals to form tiny particles that damage lung tissue, can cause or worsen respiratory diseases like emphysema and bronchitis, aggravate existing heart disease, and lead to premature death.
CO_2	Can accelerate the spread of infectious disease.
Mercury	Accumulates in the tissues of aquatic life; when ingested, it can cause increased risk of cancer, damage to the developing nervous system of fetuses causing disabilities in children, gastrointestinal illness, and even death in individuals with compromised immune systems. Mercury does not break down in the environment.

Source: U.S. Environmental Protection Agency

Technologies Available to Reduce Emissions

Billions of dollars are being invested by power plants around the country in air pollution technology. As generating technologies mature and pollution reduction goals become more aggressive, emission rates for fossil fuel fired plants are decreasing. The most common technologies used to reduce power plant emissions are described below.

NO_x

Power plants use two general types of technologies to reduce NO_x emissions: "combustion" and "post-combustion" controls. Combustion controls suppress the formation of NO_x during the combustion process; post-combustion controls reduce NO_x with add-on control systems after combustion.

Combustion Controls

- **Low-NO_x Burners (LNB)** use air staging to allow a majority of the fuel to burn at lower temperatures, thus reducing the formation of NO_x. Typical NO_x emission reductions of 40 to 85 percent have been achieved by LNB technology.

- **Overfire Air** involves redirecting a portion of the combustion air to lower the combustion temperature and reduce the concentration of air in the combustion zone, which reduce NO_x formation in the exhaust gas stream. Overfire air systems can reduce NO_x emissions by about 20 to 30 percent.

- **Burners Out of Service (BOOS)** modifies the mechanics of the fuel flow in the boiler (air staging) to reduce NO_x formation. BOOS systems can achieve NO_x reductions of about 10 to 20 percent.

Post-combustion Controls

- **Selective Catalytic Reduction (SCR**) reduces NO_x in an exhaust stream into nitrogen and water, using ammonia in the presence of a catalyst. Ammonia is injected into the exhaust stream prior to the catalyst. SCR can typically achieve NO_x emission reductions in the range of 70 to 90 percent. MDE advises that more than 50 percent of the coal fired capacity in key upwind states will be controlled with SCR in 2005. SCR is required on all new power plants, but older plants may be exempt. While SCR is typically more expensive than other NO_x control technologies, costs have dropped in recent years. According to the University of Maryland's Environmental Law Clinic, in 1995, SCR capital costs were reported in the range of $59 to $110 per kilowatt (kW), while more recent estimates are in the range of $28 to $41/kW.

- **Selective Non-Catalytic Reduction (SNCR)** is similar to SCR and uses ammonia injected into the exhaust stream to reduce NO_x emissions, achieving NO_x reductions of 25 to 40 percent.

SO_2

Technology called flue gas desulfurization (FGD) can remove up to 90 percent of SO_2. According to the University of Maryland's Environmental Law Clinic, costs for FGD have decreased significantly in recent years. Whereas costs in the 1980s were reported in the $150 to $200/kW range, by the late 1990s, FGD costs were reported in the range of $70 to $150/kW. The University of Maryland's Environmental Law Clinic also reports that advanced FGD technologies, which can reduce more than 90 percent of SO_2, have been reported in the range of $80 to $95/kW.

Mercury

Activated carbon injection (ACI) has been used by other industries for decades to clean pollutants from water, waste incineration, and food processes. ACI works by injecting powdered carbon into the flue gas to absorb elemental and oxidized mercury. The particles are then captured in a particulate control device. According to the National Wildlife Federation (NWF), power plants in states with mercury regulations are already signing contracts to purchase and install this technology, and recent tests demonstrate the effectiveness of the technology (with specific examples ranging from about 70 to 90 percent mercury control).

According to a 2004 estimate by NWF, achieving 90 percent mercury control with ACI in seven states was estimated to result in an increase in electricity costs for an average household of between $0.55 and $2.14 per month. Costs for commercial and industrial customers were estimated to increase by 1 to 3 percent. In a January 2005 article, NWF advised that ACI costs were anticipated to decline due to market demand and that, in 2004, the cost of ACI decreased by 400 percent.

The control devices used to reduce NO_x and SO_2 also reduce mercury emissions. For example, according to the University of Maryland's Environmental Law Clinic, power plants burning mid to high sulfur bituminous coal that install a FGD system to reduce SO_2 can achieve 60 to 80 percent removal rates of water-soluble oxidized mercury.

CO_2

There is no readily available CO_2 control technology; however, power plants can use other means to reduce CO_2 emissions, such as interstate trading, energy-efficiency improvements, demand-side management, the use of renewable energy, and carbon sequestration.

Appendix 1 summarizes the various pollution reduction technology in place at the 17 coal, oil, and natural gas-fired power plants in Maryland as of November 2005. Of the Maryland plants that have coal-fired units, only one (Warrior Run) has post-combustion controls for both NO_x and SO_2.

Chapter 2: Current Federal, State, and Regional Statutory and Regulatory Framework

Federal Level – The Clean Air Act

History

The federal Clean Air Act (CAA) can be traced back to the Air Quality Act of 1967, which was established in response to a number of deaths in the 1960s attributed to smog in London and New York. The first of its kind, the Air Quality Act set up a basic framework for regulating sources of air pollution in the U.S. Three subsequent sets of amendments to the Air Quality Act essentially created the modern version of the CAA as we know it today. The 1970 amendments directed the newly created U. S. Environmental Protection Agency (EPA) to create the National Ambient Air Quality Standards (NAAQS), which are standards that establish an acceptable level of a pollutant in the ambient air. They required the EPA to develop regulatory guidance for states in order to achieve the NAAQS, and they created the New Source Performance Standards (NSPS) program, which authorizes the EPA to set stringent technology-based requirements for new, modified, and reconstructed sources of air pollution.

Congress adopted another set of amendments in 1977, which extended the times for attaining compliance with the NAAQS for certain areas and created the New Source Review (NSR) program to require new emission control requirements for major stationary sources in nonattainment areas. The 1977 amendments also codified the Prevention of Significant Deterioration (PSD) program, which requires stationary sources to obtain a permit before they can build new stationary sources or modify existing major sources of air pollution in attainment areas.

Amendments passed in 1990 created new requirements for areas that do not meet certain NAAQS by ranking specific areas according to the severity of their nonattainment. Additionally, the 1990 amendments marked the creation of an acid rain program, required an operator permit program for major sources, created a new stratospheric ozone program, strengthened enforcement, and added new requirements to the NSR preconstruction permitting process.

National Ambient Air Quality Standards

The building blocks of the CAA are the NAAQS, the health and welfare-based standards that establish an acceptable level of a pollutant in the ambient air. Currently, there are NAAQS for six common pollutants, called “criteria pollutants.” The six criteria pollutants are sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide, ozone, nitrogen dioxide, and lead. **Exhibit 2-1** describes the criteria pollutants and the primary sources of those pollutants.

Exhibit 2-1
Six Criteria Pollutants

Pollutant	Description	Primary Sources
SO_2	A gas that is produced by burning certain fossil fuels, including coal and oil. Sulfur in the fuel is released during the combustion process.	Power plants and motor vehicles
Particulate Matter (PM)	Includes dust, soot, and other tiny particles that are released into the air. PM can cause eye, nose, and throat irritation.	Motor vehicles, factories, construction sites, tilled fields, unpaved roads, stone crushing, and burning of wood
Carbon Monoxide	A colorless, odorless, poisonous gas produced by incomplete burning of carbon-based fuels such as natural gas, oil, and coal.	Fuel-burning equipment
Ozone	Compound consisting of three oxygen atoms. A gas that is found at both ground level and in the stratosphere. Ground-level ozone is a product of reactions among volatile organic compounds and nitrogen oxides.	Motor vehicle exhaust, industrial emissions, gasoline vapors, and chemical solvents
Nitrogen Dioxide	A compound formed when nitric acid is oxidized in the atmosphere.	Motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels
Lead	A metal emitted by motor vehicles burning leaded fuel and from certain types of manufacturing processes.	Motor vehicles, incinerators, refineries, and lead smelters

Source: *Clean Air Act*, Roy S. Belden and the U.S. Environmental Protection Agency

NAAQS are divided into two categories – primary standards and secondary standards. Primary standards are set at a level designed to protect the public health, and secondary standards are intended to focus on impacts to the environment, including damage to plants and trees. Each standard is expressed in terms of a maximum acceptable concentration of the regulated pollutant in the ambient air. NAAQS are set for each Air Quality Control Region (AQCR). AQCRs are designated separate air quality regions, which are classified to be either in attainment with the NAAQS or in nonattainment with the NAAQS. The attainment and nonattainment designations trigger separate regulatory requirements.

New Source Performance Standards

The NSPS were enacted as part of the CAA amendments of 1970 to establish a minimum floor of emission limitations applicable to certain categories of industry sources. These nationwide, technology-based standards apply to new, modified, and reconstructed sources, regardless of whether the emissions source is in a NAAQS attainment area. The NSPS are triggered whenever a new source is constructed, or whenever an existing source (constructed after the NSPS trigger date) undergoes a "modification," which is any physical change of a stationary source that increases the amount of any air pollutant emitted. The standards are intended to reflect the degree of emission limitation achievable by using the best demonstrated technology (BDT). In enacting the NSPS program, Congress determined that it would be more cost-effective to impose the program on new, modified, or reconstructed sources, and not on existing sources. In Maryland, the NSPS took effect in 1971; the six coal-fired power plants built prior to this date are, therefore, not subject to NSPS.

New Source Review

The NSR program was added to the CAA in 1977 to ensure that major sources of pollution, both new and existing, would use modern pollution control technologies. There are two parts within the NSR program – PSD for attainment areas and NSR for nonattainment areas. PSD requires new major sources in attainment areas and existing major sources in attainment areas that undergo major modifications to install the best available control technology (BACT). Under NSR, the lowest achievable emissions rates (LAER) are required for new major sources in nonattainment areas and existing major sources in nonattainment areas that undergo major modifications.

The general intent of the PSD program is to ensure that air quality in attainment areas will not degrade. On the other hand, the NSR program for nonattainment areas is designed to ensure that any new industrial growth will comply with stringent emissions limits, with the ultimate goal of improving overall air quality to meet the NAAQS in that area. NSR requires installing the most protective pollution controls and obtaining emission offsets whenever a new major source is to be built or whenever a major modification to an existing major source occurs in a nonattainment area. Over the years, however, it has been discovered that the NSR program created a disincentive for older power plants to upgrade their pollution controls. At the time of the 1977 amendments, Congress envisioned that sources already planned or existing would either be upgraded or replaced over time and that, whenever changes were made later, existing facilities would be required under NSR to install cleaner technologies to minimize air pollution. However, many older power plants have successfully avoided NSR altogether by claiming that their modifications are "routine maintenance," which the EPA exempted from triggering NSR. Accordingly, a number of older plants have only minimal pollution controls.

Federal Level – Recent Activity

New Source Review

Of late, a flurry of legal challenges to numerous EPA rule changes has impeded consistent application and implementation of the NSR program under the CAA. Among these, the predominant issues involve the application of the routine maintenance rule, and the standard by which to measure power plant emissions under NSR.

In December 2003, the EPA proposed a rule altering the requirements for power plants to install pollution controls when making production upgrades by way of maintenance, repair, or replacement. Under the existing interpretation of NSR, power plants are prohibited from making such upgrades without implementing new pollution-control measures to offset any resulting increase in air pollution emissions. Under the EPA's proposed rule, a power plant would be excluded from NSR if the capital cost of the work performed on the facility's equipment did not exceed 20 percent of the replacement value for the entire unit. On December 24, 2004, the U.S. Court of Appeals for the District of Columbia issued a stay on the effective date for the rule pending resolution of the legal challenges raised by 13 states (including Maryland) and the District of Columbia. The case, *State of New York vs. U.S. EPA,* is scheduled for oral arguments in February 2006.

In October 2005, the EPA proposed a rule to harmonize the existing NSR regulations governing power plant emissions testing with the ruling of the U.S. Court of Appeals for the Fourth Circuit in *United States v. Duke Energy Corporation.* Prior to the proposed rule, the EPA measured emissions from power plants on an annual, or actual, basis under NSR. Under the proposed rule, the NSR standard would be based on the plant's hourly emissions. In *Duke*, the Department of Justice (DOJ) and environmental groups maintained that, under the CAA the EPA was authorized to base NSR exemptions on annual emission rates. In siding with the industry position however, the *Duke* court ruled that because the historical interpretation of the CAA by the EPA and Congress had been to test power plant emissions on an hourly basis, the CAA only allows NSR violations to be based on a power plant's hourly emission rates. The EPA's proposed rule is currently open for comment.

Clear Skies Legislation

The Clear Skies Act, first introduced by the Bush Administration in 2002, would substantially amend the CAA to establish new cap-and-trade programs requiring reductions of SO_2, nitrogen oxides (NO_x), and mercury emissions from electric generating facilities.[2]

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[2] The EPA defines a cap-and-trade program as a market-based policy tool for protecting human health and the environment. A cap-and-trade program first sets an aggressive cap, or maximum limit, on emissions. Sources covered by the program then receive authorizations to emit in the form of emissions allowances, with the total amount of allowances limited by the cap. Each source can design its own compliance strategy to meet the overall reduction requirement, including sale or purchase of allowances, installation of pollution controls, and

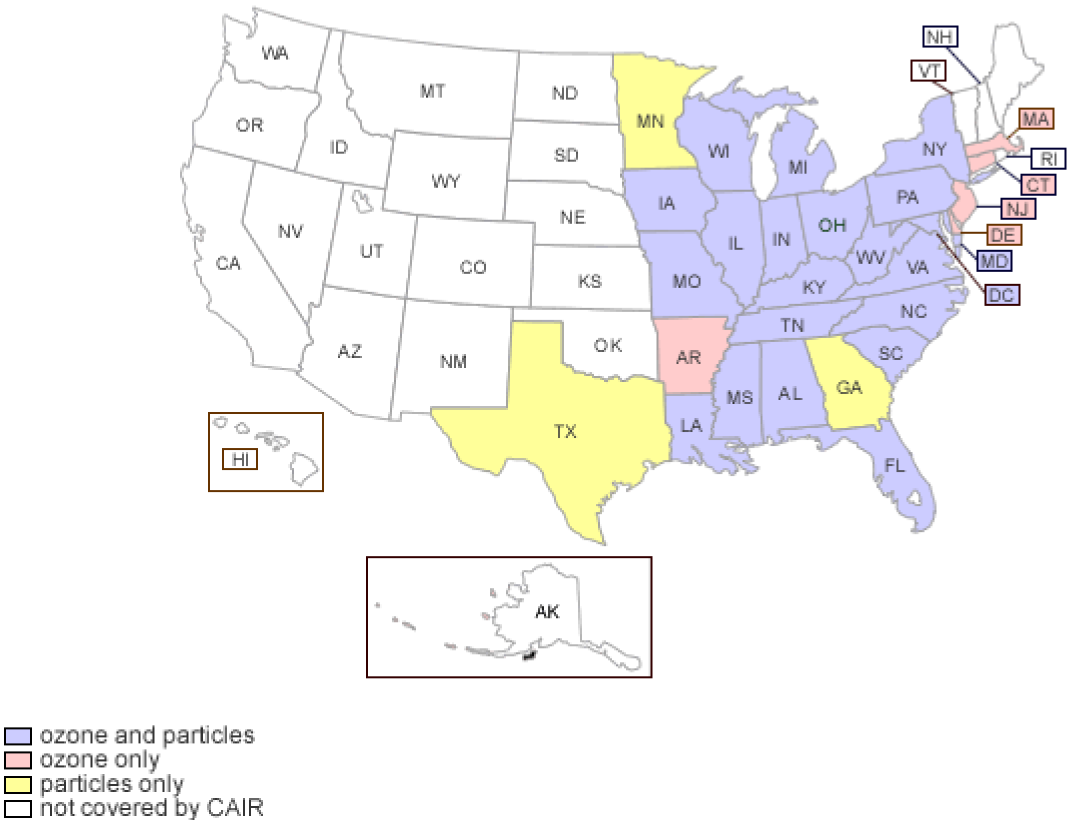
According to the Bush Administration, the Clear Skies Act would result in approximately $93 billion per year in health benefits by 2020. The EPA claims that improvements in visibility in national parks and wilderness areas would total $3 billion per year by 2020 and that nitrogen loads in the Chesapeake Bay and other waters along the East and Gulf Coasts would be reduced. Opponents of the Clear Skies Act, however, claim that it actually weakens the existing CAA by rolling back standards that would force power plants to clean up at a much faster rate. They argue that the overall result of the Clear Skies Act would be to weaken and delay health protections already required under current law. Due in part to this opposition, the Clear Skies Act has yet to be approved by Congress. In the meantime, the Bush Administration has moved forward with a number of regulations addressing key provisions of the proposed legislation.

Clean Air Interstate Rule

In March 2005, the EPA issued the Clean Air Interstate Rule (CAIR), which caps emissions of SO_2 and NO_x in the eastern United States. The rule assigns each state an emissions budget and requires states to achieve certain emissions reductions to meet those budgets by using one of two compliance options. The first option is to have the state meet its emissions budget by requiring power plants to participate in an EPA-administered interstate cap-and-trade system that caps emissions in two stages. The second option is to have the state meet its budget through measures of the state's choosing. CAIR sets emissions budgets for 28 eastern states and the District of Columbia. **Exhibit 2-2** shows a map of the states covered under the rule.

implementation of efficiency measures, among other options. Individual control requirements are not specified under a cap-and-trade program, but each source must surrender allowances equal to its actual emissions in order to comply.

Exhibit 2-2
Map of States Covered by CAIR



Source: http://www.epa.gov/cair/where.html

The EPA estimates that when fully implemented, CAIR will reduce SO_2 emissions in these states by over 70 percent and NO_x emissions by over 60 percent from 2003 levels. In 2015, CAIR will provide health and environmental benefits valued at more than 25 times the cost of compliance. According to the EPA, by 2015, CAIR will result in $85 to $100 billion in annual health benefits. Additionally, it is estimated to result in nearly $2 billion in annual visibility benefits in southeastern national parks and significant regional reductions in sulfur and nitrogen deposition.

Clean Air Mercury Rule

Also in March 2005, the EPA issued the Clean Air Mercury Rule (CAMR) to permanently cap and reduce mercury emissions from coal-fired power plants. This rule makes the United States the first country in the world to regulate mercury emissions from utilities. Specifically, CAMR establishes "standards of performance," which limit mercury emissions from new and existing coal-fired power plants and creates a market-based cap-and-trade program that will reduce nationwide utility emissions of mercury in two distinct phases. The first phase is a cap of 38 tons; in this phase, emissions will be reduced by taking advantage of "co-benefit" reductions. "Co-benefit" reductions are mercury reductions achieved by reducing SO_2 and NO_x emissions under CAIR. In the second phase, due in 2018, coal-fired power plants will be subject to a second cap, which will reduce emissions to 15 tons upon full implementation. The rule also requires new coal-fired power plants to meet stringent new source performance standards.

Responses to CAIR and CAMR

Both CAIR and CAMR are now subject to various legal challenges from states, environmental groups, and industry groups. North Carolina is the only state to have acted against CAIR, claiming that the rule does not adequately limit emissions in states upwind from North Carolina, thus leaving some of the state's counties unable to comply with federal air quality standards. North Carolina has filed a petition for review of the rule in federal court and has formally asked the EPA to reconsider the rule. Additionally, four environmental groups have filed suit against CAIR claiming that two seemingly innocuous passages from the preamble to the rule will actually limit the federal government's ability to further reduce power plant emissions in the future. At the same time, power plant and utility companies have filed a dozen separate suits against the EPA, claiming that CAIR goes too far in its efforts to reduce power plant emissions.

The EPA has come under stronger attack from states over its recent mercury rules. A coalition of 15 states – Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Vermont as well as California, Illinois, Michigan, Minnesota, New Mexico, and Wisconsin – has filed two lawsuits challenging the mercury rules. The first suit contests a new EPA rule that removes coal- and oil-fired power plants from a section of the CAA that requires plants to use "maximum achievable control technology" (MACT) when managing emissions. The EPA first placed coal- and oil-fired plants in this category during the waning days of the Clinton Administration, but the current EPA regime has determined that the earlier decision "lacked foundation," thus warranting reversal. The lawsuit seeks to nullify the new rule and return coal- and oil-fired plants to regulation under the MACT standards.

The same coalition of states has also sued to challenge the cap-and-trade provisions of CAMR. Before announcing CAMR, the EPA concluded that any individual power plant is responsible for only a small amount of local pollution, meaning that cap-and-trade provisions would not have a disproportionately adverse effect on regions close to power plants. The challenging states dispute this conclusion, declaring that mercury emissions do in fact cause local mercury contamination. According to the lawsuit, if power plants are permitted, through a cap-and-trade program, to purchase the right to emit more mercury than their allowance, areas with high mercury concentrations may develop near the plants. Accordingly, the states argue that mercury should be regulated through a regional approach, rather than just a national approach.

In response to the concerns raised in these petitions, the EPA announced in October 2005 that it will reopen the public comment period on portions of its mercury rules.

State Level

State Implementation Plans

In order to enforce the NAAQS in each AQCR, the CAA requires the development of State Implementation Plans (SIPs). A SIP is a collection of the EPA-approved control strategies and regulations which may include state statutes, rules, local ordinances, and other measures that are designed to prevent air quality deterioration for areas that are in attainment or to reduce criteria pollutants emitted in nonattainment areas. Essentially, a SIP explains how each state will do its job under the CAA. The EPA must approve each SIP, and if a SIP is not acceptable, the EPA can take over enforcing the CAA in that state.

Regional Level

Ozone Transport Commission

The 1990 amendments to the CAA established an Ozone Transport Commission (OTC) to assess the degree of interstate transport of ozone and its precursors in the northeastern and mid-Atlantic transport region. The commission was charged with assessing strategies for mitigating interstate pollution and with recommending any measures necessary to ensure that states attain and maintain the NAAQS for ozone in the Northeastern United States. OTC members include Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia.

NO_x SIP Call

As a result of the work of the OTC and another group called the Ozone Transport Assessment Group, the EPA issued the NO_x SIP Call rule. The NO_x SIP Call was designed to mitigate significant transport of NO_x. For those states opting to meet the obligations of the NO_x SIP Call through a cap-and-trade program, the EPA included a model NO_x Budget Trading Program rule. This trading program was developed to facilitate cost effective emissions reductions of NO_x from large stationary sources. The trading program includes provisions for applicability, allocations, monitoring, banking, penalties, trading protocols, and program administration.

CAIR Plus

The OTC is currently developing a model rule for all OTC states that would establish a regional trading program for SO_2 and NO_x, called CAIR Plus. CAIR Plus would go beyond CAIR for the electrical generating unit and large industrial boiler sectors. The OTC's current position calls for reductions of SO_2, NO_x, and mercury in three phases beginning in 2008 and ending in 2015. The current schedule calls for the OTC states to begin adopting the model regulations by late 2006. According to the Maryland Department of the Environment (MDE), the OTC plan is achievable and cost effective.

Regional Greenhouse Gas Initiative

In response to the United States' decision to not commit the U.S. to the Kyoto Protocol, a group of Northeastern and mid-Atlantic states formed the Regional Greenhouse Gas Initiative to reduce carbon dioxide (CO_2) emissions. Central to this initiative is the implementation of a proposed cap-and-trade program. The proposed program would cap CO_2 emissions at 150 million tons a year, and starting in 2015, the cap would be lowered. Emissions would be cut by another 10 percent in 2020. Before the caps can take effect, each participating state legislature must approve them. New York, New Jersey, Connecticut, Delaware, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont are all participating members of the initiative. Maryland, the District of Columbia, Pennsylvania, the Eastern Canadian Provinces, and New Brunswick are observers in the process. Currently, the draft plan is being circulated among industries, power companies, and environmental groups for feedback.

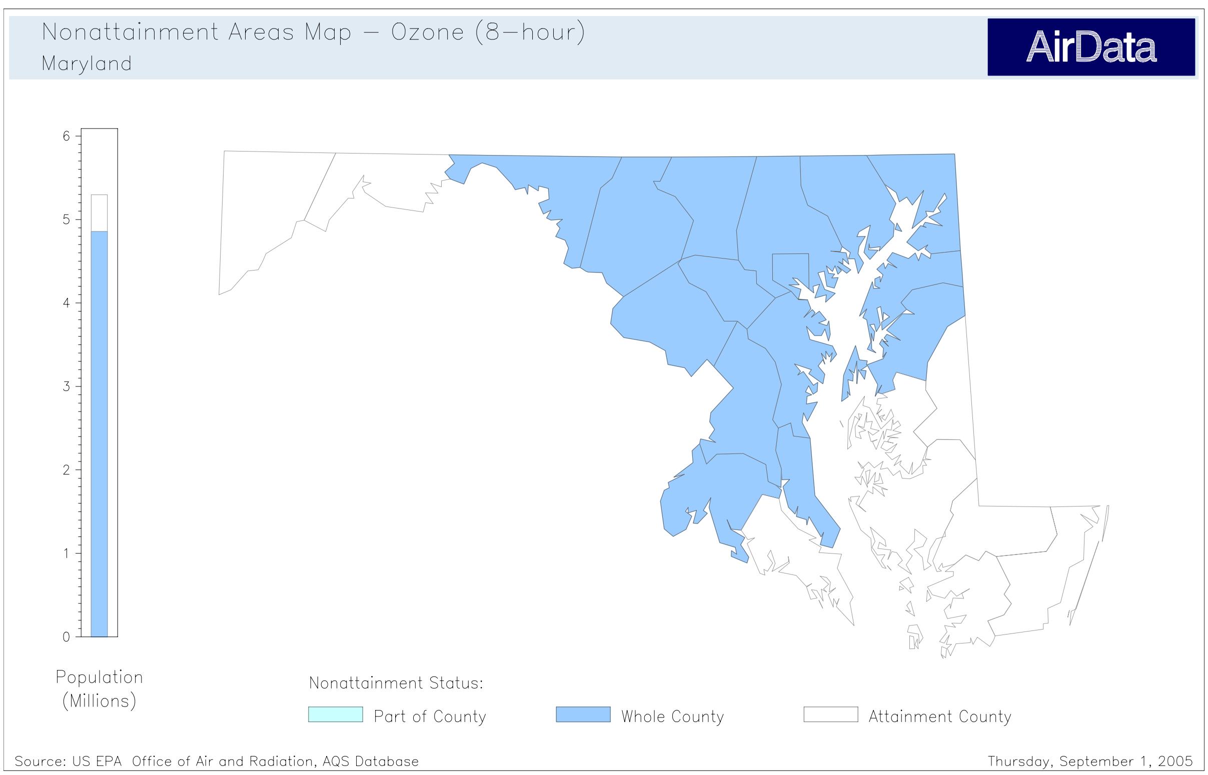
Chapter 3: Maryland's Current Status in Meeting Air Quality Standards and Efforts to Reduce Power Plant Emissions

Maryland's Attainment Status and Implications

Under the federal Clean Air Act (CAA), Maryland is in attainment for all criteria pollutants with the exception of ozone and particulate matter (PM). As mentioned previously, power plants are a major source of nitrogen oxides (NO_x), an ozone pre-cursor, and PM. A new eight-hour ozone standard was recently implemented, replacing the previous one-hour standard. While the one-hour standard was intended to protect people against ozone peaks, the new eight-hour standard is intended to protect against both ozone peaks and chronic levels of ozone exposure over the long-term. In June 2004, the U.S. Environmental Protection Agency (EPA) designated 14 counties and Baltimore City as being in nonattainment of the new eight-hour ozone standard, as shown in **Exhibit 3-1.** The Maryland Department of the Environment (MDE) must submit a State Implementation Plan (SIP) to the EPA by June 15, 2007, describing how the State will reach attainment; attainment must be reached by June 15, 2010.

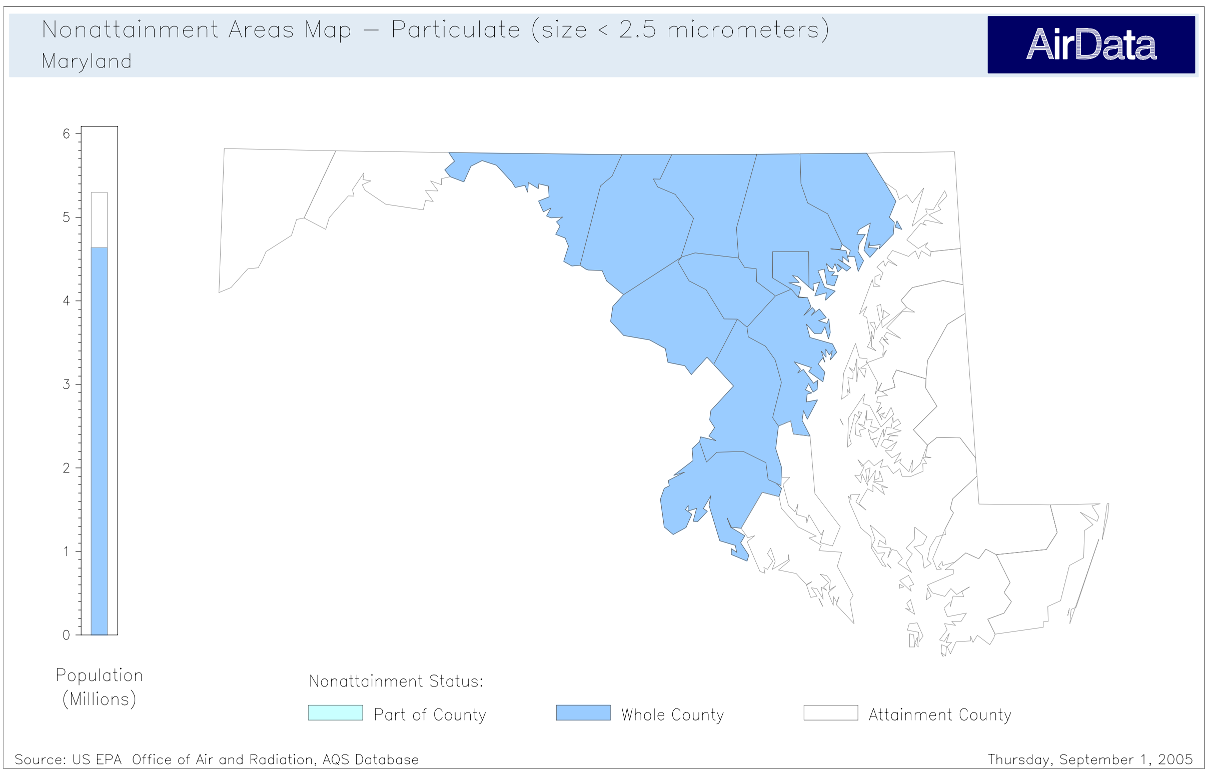
Exhibit 3-1

Attainment and Nonattainment Areas in Maryland for Ozone (Eight-hour)



In 1997, the EPA set new National Ambient Air Quality Standards (NAAQS) for PM that included standards for fine particulate matter ($PM_{2.5}$), which are particles smaller than 2.5 micrometers in diameter. However, a number of events delayed the implementation of the new standard, and it was not until September 2005 that the EPA issued a proposed rule describing how states must implement the standard in their SIPs. In 2005, the EPA identified 10 counties and Baltimore City as in nonattainment for $PM_{2.5}$, as shown in **Exhibit 3-2.** By April 5, 2008, MDE must submit a SIP to the EPA describing how the State will achieve attainment; attainment must be reached by April 5, 2010.

Exhibit 3-2
Attainment and Nonattainment Areas in Maryland for $PM_{2.5}$



These specific nonattainment designations affect how the CAA is applied to power plants in Maryland. For example, all *new* stationary sources constructed in nonattainment areas must employ the lowest achievable emissions rates (LAER) technology, which includes selective catalytic reduction (SCR). In addition, when existing major sources make major modifications to their facilities, they must also upgrade to the LAER technology in accordance with New Source Review (NSR). All *existing* major emissions sources in a nonattainment area must only employ Reasonably Available Control Technology (RACT). RACT constitutes a minimum level of pollution control technology, such as low NO_x burners. As described previously, there are a number of power plants in the State that have avoided the requirement to upgrade their pollution control technology by claiming that their modifications are routine maintenance as opposed to major modifications.

Maryland's Participation in Federal and Regional Programs

In an effort to address emissions from power plants in the State, Maryland currently participates in a number of federal and regional programs. Maryland's involvement in the EPA's Acid Rain program has resulted in significant reductions of sulfur dioxide (SO_2) since 1990. As mentioned in Chapter 2, Maryland also participates in the Ozone Transport Commission (OTC) in order to reduce the interstate transport of ozone in the northeastern and mid-Atlantic states. In 1994, Maryland signed a Memorandum of Understanding with the other OTC member states to reduce NO_x emissions from utilities and large industrial boilers. In 2003, the OTC NO_x Budget Trading program went into effect. This program involves an allowance trading system, similar to the EPA's Acid Rain program. Each allowance permits a source to emit one ton of NO_x during the control period (May through September); allowances may be bought, sold, or banked.

In addition to Maryland's participation in the Acid Rain program and the NO_x Budget Trading Program, as mentioned in Chapter 2, the OTC is currently developing a plan to adopt a model multi-pollutant rule, called the Clean Air Interstate Rule (CAIR) Plus. Because MDE believes that CAIR alone will not help the State meet attainment of the NAAQS for ozone (and, possibly, PM) by 2010, as of September 2005, MDE advises that it is currently in support of the CAIR Plus proposal, which calls for deeper and quicker reductions from power plants than those in CAIR.

Relevant Judicial Action – The Mirant Consent Decree

In the latest controversy concerning the air quality of the mid-Atlantic region, Maryland, Virginia, and the EPA teamed together to file several air quality claims against Mirant Corporation. In 2003, Mirant's Potomac River Generating Station – located in Alexandria, Virginia – violated its operating permit by exceeding its NO_x emissions limit by 1,120 tons. In September 2004, Mirant settled those claims and agreed to a consent decree whereby it would reduce its annual NO_x emissions by 64 percent from 2002 levels in the Washington, DC area by 2010. Although the suit was based on NAASQ violations at the Potomac River plant, the consent decree also applies to the three Maryland power plants owned by Mirant (Morgantown, Chalk Point, and Dickerson). Under the terms of the agreement, the EPA estimates that it will cost Mirant $133 million to cap its emissions from the four affected facilities. In addition, Mirant agreed to pay a $500,000 civil fine.

Mirant structured the ownership of the four plants affected by the consent decree so that the corporation actually leased the power plants from its subsidiaries. As a result, the consent decree presented certain legal issues for the lessors of the affected plants. According to Maryland's Office of the Attorney General, negotiations for an amended consent decree are underway. The amended consent decree is expected to be lodged with the court by the end of 2005. At this point, it is unclear what steps will be taken – and when – to reduce emissions from these power plants.

Legislative Proposals

In an effort to further address emissions from coal-fired plants in the State, legislation has been introduced in each of the past three legislative sessions of the Maryland General Assembly. Senate Bill 744 and House Bill 1169 of 2005, as introduced, would have established facility-specific limits on NO_x, SO_2, mercury, and carbon dioxide (CO_2) from specified power plants in the State. The majority of these emission limits would have taken effect in 2011 with additional limits on CO_2 effective in 2021. The bills allowed for emissions of CO_2 to be offset by reductions at other affected facilities, by reductions achieved in another state participating in the Regional Greenhouse Gas Initiative, or by reductions achieved in any other multi-state cap and-trade program. The House bill also allowed for CO_2 emissions to be offset by vegetative sequestration measures. Both bills provided that each affected facility would have been permitted to determine how best to achieve the collective emissions requirements.

Proponents of the legislation argued that these bills:

- would reduce as much as one-third of the nitrogen entering the Chesapeake Bay;
- would reduce mercury pollution, which can cause developmental problems in fetuses;
- would reduce ground level ozone, which contributes to a number of health problems, including bronchitis, heart disease, emphysema, and asthma; and
- could be implemented in an economically feasible manner.

On the other hand, opponents of the legislation argued that these bills:

- would not solve the problem of pollution transport;
- would disadvantage State power plants competing in the regional electricity market; and
- would interfere with various federal and regional initiatives to improve air quality.

Amendments to the Senate bill, adopted by the Senate Education, Health, and Environmental Affairs Committee, removed the facility-specific emissions limits. As amended by committee, the bill would have required MDE to adopt statewide emissions ceilings for all electric power generating facilities in the State; these ceilings were taken from the newly promulgated federal CAIR. The amendments provided that all affected facilities must achieve their emissions budget by 2011, and that all other facilities must achieve their emissions budget by 2015. The amendments also altered the reductions required of CO_2 and mercury.

House Bill 1169 was reported unfavorably by the House Economic Matters Committee. Senate Bill 744 passed the Senate Education, Health, and Environmental Affairs Committee with amendment but was eventually re-committed to the committee from the Senate floor. Given the attention surrounding this legislation during the 2005 session, and the ongoing concerns over air quality in the State, it is anticipated that multi-pollutant legislation will resurface during the 2006 session.

Chapter 4: Multi-pollutant Strategies in Other States

As the federal government and the Ozone Transport Commission (OTC) continue to debate various proposals to control power plant emissions of nitrogen oxides (NO_x), sulfur dioxide (SO_2), mercury, and, in some cases, carbon dioxide (CO_2), several states have taken the lead in developing multi-pollutant policies to reduce power plant emissions. Examples of these actions include:

- New York has proposed several pieces of legislation in recent years that would have addressed emissions of NO_x, SO_2, mercury, and CO_2;

- Virginia proposed legislation in 2004 and 2005 that would have addressed emissions of NO_x, SO_2, mercury, and particulates;

- Texas proposed legislation in 2005 that would have addressed emissions of NO_x, SO_2, and mercury;

- Florida proposed legislation in 2004 that would have regulated emissions of NO_x, SO_2, and particulates;

- In Illinois, multi-pollutant legislation adopted in 2001 required the state's Environmental Protection Agency to submit a report proposing multi-pollutant reduction targets and compliance timelines;

- Connecticut passed legislation in 1998 that addresses performance standards for electric generating facilities; however, the law limits the standards from taking effect until other specified states have adopted such standards;

- Nine states have initiated rulemaking or passed legislation to reduce mercury pollution from coal-burning power plants, including Connecticut, Iowa, Massachusetts (MA), Minnesota, New Jersey, Wisconsin, Illinois, New Hampshire (NH), and North Carolina (NC); and

- Ten states (in addition to Maryland), have considered regulatory or legislative action to reduce mercury pollution from coal-burning power plants including Delaware, Indiana, Michigan, Montana, New Mexico, New York, Ohio, Pennsylvania, Texas, and Virginia.

While there has been a lot of state-level activity in this area, only three states – Massachusetts, New Hampshire, and North Carolina – have adopted multi-pollutant strategies to date. A summary of these programs is presented in **Exhibit 4-1**. Case studies of these programs are provided below.

Exhibit 4-1
Summary of Multi-Pollutant Strategies Adopted in MA, NH, and NC

	Emission Limits (% Reductions)	Effective Dates	Number of Facilities Affected	Estimated Costs
MA	NO_x: 50% reduction by 2006; SO_2: 50-75% reduction by 2006; CO_2: 10% reduction by 2008; and mercury (Hg): 85% reduction by 2012	NO_x and SO_2 limits phase in from 2004-2006; CO_2 limits phase in from 2006-2008; Hg limits phase in from 2006-2012	Six	No overall estimate available; potential costs to achieve Hg reductions through activated carbon injection were estimated at $1,000 per pound
NH	NO_x: 90% reduction from 1990 levels by 2006; SO_2: 89% reduction from 1990 levels by 2006; CO_2: reduction to 1990 levels by 2006. Limits on Hg have been proposed but not enacted.	2006	Three	Cost to purchase SO_2, NO_x, and CO_2 allowances estimated to total $17.5 million per year; capital costs to meet proposed Hg caps range from $7 million to $76 million
NC	NO_x: 77% reduction by 2009; SO_2: 73% reduction by 2013; required study and report on Hg and CO_2	NO_x limits take effect in 2007 for some facilities and phase in from 2007-2009 for others; SO_2 limits phase in from 2009-2013	Fourteen	Original estimate totaled $2.3 billion; updated estimate totals over $2.6 billion

Notes: Emission limits are represented as percent reductions, although specific statutes/regulations may include actual caps on tons or pounds per unit of electricity produced.

Cost estimates for NH allowances do not factor in any effects of co-benefits, which could significantly reduce costs. It is unclear at this time whether the limits in NH will be met by purchasing allowances or installing controls; costs to install controls were not available.

Source: Department of Legislative Services

Massachusetts

Background

In September 1998, a group of 150 public health, environmental, consumer, and community organizations, calling themselves the Clean Air Now Coalition, presented a petition to the Massachusetts Department of Environmental Protection (DEP) calling for emission reductions from the largest and oldest power plants in Massachusetts. Subsequently, former Governor Celucci signed a pledge to reduce power plant emissions from the so-called "Filthy Five" and directed DEP to take actions to effectuate a multi-pollutant emissions control plan. Pursuant to the Governor's directive, DEP held a series of in-depth meetings with stakeholders to discuss how the goals of the petition could be addressed. Subsequently, DEP issued proposed regulations in 2000, and issued final regulations in the spring of 2001. On May 11, 2001, DEP adopted final regulations to control emissions of NO_x, SO_2, mercury, and CO_2.

Goals

The regulations apply to fossil fuel-fired power plants that emitted more than 500 tons of SO_2 and NO_x during any calendar year from 1997 to 1999, and were permitted prior to August 7, 1977. The purpose of the regulations is to control emissions of NO_x, SO_2, mercury, and CO_2 by establishing output-based emission rates for NO_x, SO_2, and CO_2, and requiring DEP to establish a cap on CO_2 and mercury emissions from affected facilities. Whereas the emission limits for NO_x and SO_2 were based on achieving the most efficient production of energy with the least amount of emissions, the mercury emission limits were based on actual reductions with the goal of eventually eliminating man-made mercury pollution. The six largest power plants in Massachusetts are affected by the regulations.

Emissions Limits

By October 1, 2004, the affected facilities were required to control NO_x emissions to no more than 1.5 pounds per megawatt-hour (lbs/MWh) over any 12-month period, and SO_2 emissions by no more than 6.0 lbs/MWh over any 12-month period. By October 1, 2006, these facilities must further limit NO_x emissions to no more than 3.0 lbs/MWh over any month period, and SO_2 emissions to no more than 3.0 lbs/MWh over any 12-month period, and 6.0 lbs over any month period.

Pursuant to the regulations, DEP was instructed to complete an evaluation, by December 1, 2002, of the technological and economical feasibility of controlling emissions of mercury from power plants. On December 10, 2002, DEP determined that removal of 90 percent or more of mercury in flue gas is both technological and economically feasible. In May 2004, DEP issued final regulations for mercury emissions calling for two phases of reductions. Under the first phase, by January 1, 2008, affected facilities must either (1) achieve an average total mercury removal efficiency of 85 percent; or (2) achieve an average total mercury emission rate of .0075 pounds per gigawatt-hour (lbs/GWh). Under the second phase, by October 1, 2012, affected facilities must either (1) achieve an average total mercury removal efficiency of at least

95 percent; or (2) a facility average total mercury emission rate of .0025 lbs/GWh. According to DEP, mercury emissions will be reduced simply by implementing an output-based standard that rewards generation efficiency. By 2008, DEP projects that mercury emissions will be reduced by over 155 pounds per year.

The emission standards for CO_2 represent the first of their kind in the country. As with the other pollutants, a two-phased approach was established. Beginning in 2006, each affected facility is required to report to DEP by January 30 of each year that CO_2 emissions in the previous year did not exceed historical actual emissions. DEP established this baseline emission rate as the average CO_2 emissions from the affected facilities from 1997 through 1999. In phase two of the CO_2 emission standards, the affected facilities are required to certify that the average CO_2 emission rate does not exceed 1,800 lbs/MWh. Unlike NO_x, SO_2, and mercury, a facility may demonstrate compliance by using offsite reductions or carbon sequestration, provided that the reductions are "real, surplus, verifiable, permanent, and enforceable."

Although the regulations allow for some trading, they do not permit trading with out-of-state facilities. Under the regulations, NO_x and SO_2 allowances may only be traded between facilities owned by the same person. Mercury allowances may only be traded among the units within the same facility. These trading rules strengthen the regulations' emission limits by requiring each owner of a power plant to do their respective share of limiting Massachusetts' air pollution. Furthermore, these rules compel each mercury emitting source to take the necessary steps to reduce mercury emissions, thereby avoiding mercury "hotspots" in exchange for an overall decrease in mercury emissions.

Although Massachusetts' multi-pollutant regulations apply to all affected facilities, DEP works with each facility to develop individual emission control plans (ECPs). These detailed plans are tailored to the specific units of the facility in order to achieve emission control limits under the multi-pollutant regulations, as well as for other pollutants, such as ammonia, covered by other regulations.

Update on Compliance

Following the issuance of the final regulations, the Salem Harbor power plant (Salem) – one of the dirtiest of the "Filthy Five" – engaged in protracted negotiations over the ECP for the plant pursuant to the regulations. On June 13, 2003, DEP and then-owner of the plant, Pacific Gas & Electric, finally reached a consensus on Salem's ECP, thus avoiding a seemingly inevitable extension for compliance. Less than a year later, Salem petitioned the Federal Energy Regulatory Commission (FERC) for an $85 million ratepayer-funded bailout for the costs associated with installing necessary air pollution controls. Attorney General Thomas Reilly immediately opposed the measure, calling it "unfair to consumers." In July 2004, FERC denied the plan. Since then, DEP has had no major issues with the power plant failing to comply with the regulations.

Impacts on Industry

Although Massachusetts did not undertake a facility-specific cost analysis study, DEP did study the economic feasibility of reducing mercury emissions under the regulations. Under the regulations, affected facilities are permitted to determine whether the SO_2 and NO_x approved controls will also achieve mercury reductions sufficient to preclude the need for additional mercury controls. According to a report by DEP, should a facility be unable to achieve the prescribed mercury emission standards, the technology most likely to be installed would be activated carbon injection (ACI). Activated carbon costs approximately $0.50 per pound, and DEP estimates that, on average, 2,000 pounds of carbon is required in order to reduce one pound of mercury. Therefore, DEP estimates that, if needed, ACI technology would cost an affected facility approximately $1,000 per pound of mercury emission reduction.

In January 2005, Dominion Energy, a leading producer of U.S. energy, purchased the bankrupt Salem power plant and the Brayton Point Station power plant (Brayton) – historically the largest air polluter in the New England region. Since taking ownership of the 1,599-megawatt (MW) Brayton power station, Dominion has committed to spending more than $230 million on air pollution controls, including two selective catalytic reduction (SCR) systems to reduce NO_x emissions, and scrubbers to reduce SO_2 emissions. According to Dominion, Brayton is currently on-track to be in compliance with the 2006 standards. While these costly pollution controls are the best way to achieve substantial emission reductions, other power plants have made reductions by switching the fuel used to generate power. The Somerset Station power plant, for instance, currently relies on natural gas for 15 percent of its energy production in order to curb CO_2 emissions.

New Hampshire

Background

New Hampshire has three fossil fuel-burning power plants old enough to have been exempted from the emissions standards required under amendments passed in 1977 to the federal Clean Air Act (CAA). All three plants are owned by Public Service of New Hampshire (PSNH), the state's largest of four electricity suppliers. In 1991, New Hampshire began its first programs restricting SO_2 and NO_x emissions from these older plants but, by the end of the 1990s, had not imposed any limits on emissions of mercury or CO_2. In January 2001, the state's Department of Environmental Services (DES) published *The New Hampshire Clean Power Strategy* (NHCPS), which recommended further restrictions on emissions of SO_2 and NO_x and new restrictions on CO_2 and mercury. Legislation based on the report was introduced in the New Hampshire legislature that year. The next year, an amended compromise version of the bill was passed, making New Hampshire the first state in the country to require its grandfathered power plants to reduce emissions of the four major pollutants. The Clean Power Act was signed by the Governor in 2002 and became effective on July 1 of that year.

Goals

The goals of the Clean Power Act are to enact "aggressive reductions" in emissions of SO_2, NO_x, CO_2, and mercury, pollutants that the New Hampshire legislature found are "primarily responsible for the human health and ecosystem impacts" documented in the NHCPS study. The legislature also declared that emissions reductions would benefit the state economically, through lowered health care costs and through increased tourism and more productive forestry and agricultural sectors.

Emissions Limits

As of December 31, 2006, annual emissions from the three grandfathered power plants in New Hampshire are capped at 7,289 tons of SO_2, 3,644 tons of NO_x, and 5,425,866 tons of CO_2. These caps represent an 89 percent reduction in annual SO_2 emissions since 1990, a 90 percent reduction in NO_x emissions since 1990, and a reduction of CO_2 emissions to 1990 levels. A lower CO_2 cap, to be set at a level recommended by DES, is to take effect January 1, 2011. The SO_2 and NO_x limits, which are the same as those recommended in the NHCPS study, were calculated by multiplying the total megawatt-hours (MWh) of electricity generated in 1999 by 3.0 lbs/MWh (for SO_2) and 1.5 lbs/MWh (for NO_x).

These limits will be implemented in the form of allowances that are to be allocated by DES to the three affected sources in amounts proportional to the electrical output of each source. Each source will be able to use SO_2, NO_x, and CO_2 allowances available under federal or regional banking and trading programs to account for emissions beyond the annual caps.

Because of concerns that the cap-and-trade provisions would enable PSNH to purchase its way out of making on-site emissions reductions, the legislature included in the Clean Power Act incentives for PSNH to comply with the emissions caps in ways that will most benefit New Hampshire. First, voluntary expenditures by PSNH for energy efficiency, new renewable energy projects, or conservation and load management can be converted into allowances. Also, if PSNH reduces its SO_2 emissions below a three-year moving average, it can receive credits for those reductions in the form of additional allowances for the following year. Finally, allowances purchased from sources in the OTC states are worth slightly more than allowances purchased from other states.

Noticeably absent from the Clean Power Act are specific caps on mercury. In the NHCPS report in 2001, DES recommended an annual mercury emissions cap of 82 pounds (derived by multiplying recent mercury emissions by 25 percent) to take effect in 2006 "or as soon as appropriate control technology is commercially available." The Clean Power Act required DES to recommend a cap by March 31, 2004, "with timely consideration by the legislature expected by July 1, 2005." The recommendation by DES has been introduced before the legislature (Senate Bill 128 of 2005), although the bill has been held over until the next legislative session, in early 2006. The bill features a two-phased implementation, with an annual cap of 50 pounds beginning July 1, 2009, and a reduction to 24 pounds annually beginning July 1, 2013. The bill explicitly excludes mercury from the cap-and-trade options available for SO_2, NO_x, and CO_2.

Impacts on Industry

In its NHCPS report in 2001, DES, operating on the assumption that SO_2 allowances would cost $150 per ton (they had hovered between $100 and $200 per ton from 1994 through 2000) and figuring for 18,832 allowances necessary to comply with their proposed caps, estimated that SO_2 compliance achieved exclusively by purchasing allowances would cost approximately $2.8 million per year. This would amount to approximately 0.06 cents per kilowatt-hour (kWh) of electricity, or 30 cents per month for an average household using 500 kWh monthly. Using similar calculations, DES estimated that the NO_x caps could be reached for about $1.4 million annually or about 15 cents per month for a 500 kWh/month household. Likewise, compliance with the CO_2 caps achieved only through purchasing allowances would cost about $13.3 million per year, or about $1.37 per month for a 500 kWh/month household.

However, DES considered these estimates to be at the extreme high end of possible costs because they do not factor in opportunities for "co-benefits." These co-benefits, according to DES, are common with new pollution control technologies, and DES estimated that statewide compliance costs for the Clean Power Act could be negligible for SO_2 (although this assumes technologies to control mercury, which was not capped in the Clean Power Act) and CO_2 emissions and $1.22 million annually for NO_x, which translates into $1.68 annually for a household that uses 500 kWh each month. For the proposed mercury caps, the Public Utilities Commission of New Hampshire has reported that DES and PSNH have estimated that the capital improvements necessary to reach the 2009 cap range from $7 million to $76 million, with additional operating and maintenance costs estimated at between $5 million and $10 million annually.

Update on Compliance

Because the caps do not take effect until the end of 2006, it is unclear whether they will be met. The law required PSNH to file a compliance plan with DES by July 1, 2003. PSNH did file such a plan, which was, in the words of one DES official, "somewhat vague," declaring only that the company planned to comply by either reducing emissions or purchasing allowances. Since the plan was filed, SO_2 allowance prices have skyrocketed, from the $100 to $200 per ton range to about $875 per ton today. So, while the original plan may have been to purchase SO_2 allowances, PSNH may end up determining that installing control equipment is a more cost-effective option. All of PSNH's plants already have NO_x control equipment in place and should be able to comply with the purchase of few, if any, NO_x allowances. And finally, for the first phase of CO_2 cap compliance, PSNH plans to comply by repowering one of its coal-fired units with wood, which it has done, at a cost of $70 million.

North Carolina

Background

A series of public hearings held in 2000 regarding rules for complying with the federal NO_x State Implementation Plan (SIP) Call rule led to the introduction of multi-pollutant legislation in North Carolina. The state Senate passed the initial version of the legislation in 2001, but it stalled in the House because of concerns over its effects on utility rates for industries. As a result, the Governor and the legislature met with utilities and other stakeholders to develop a compromise. The Clean Smokestacks Act (Chapter 4) was signed by the Governor in June 2002.

Goals

The goals of the Act are to significantly reduce air emissions from power plants that contribute to smog, soot, and acid rain in the state; help power plants pay for the costs of pollution control measures to achieve emissions reductions that are more stringent than federal requirements; and ensure that federal "pollution allowances" earned through compliance with the Act are not sold to power plants in upwind states whose emissions may drift back into North Carolina.

Emissions Limits

The Clean Smokestacks Act establishes the following schedule for reducing emissions of NO_x and SO_2 from coal-fired generating units:

NO_x: For affected facilities that emitted more than 75,000 tons of NO_x in 2000 from affected units, the facility may not emit more than 35,000 tons in any calendar year beginning January 1, 2007, and may not emit more than 31,000 tons in any calendar year beginning January 1, 2009. Affected facilities that emitted 75,000 tons or less of NO_x in 2000 from affected units may not emit more than 25,000 tons of NO_x in any calendar year beginning January 1, 2007.

SO_2: For affected facilities that emitted more than 225,000 tons of SO_2 in 2000 from affected units, the facility may not emit more than 150,000 tons in any calendar year beginning January 1, 2009, and may not emit more than 80,000 tons in any calendar year beginning January 1, 2013. Affected facilities that emitted 225,000 tons or less of SO_2 in 2000 from affected units may not emit more than 100,000 tons in any calendar year beginning January 1, 2009, and may not emit more than 50,000 tons in any calendar year beginning January 1, 2013.

In terms of percentage reductions, the Act requires coal-fired power plants to achieve a 77 percent reduction in NO_x emissions by 2009 and a 73 percent reduction in SO_2 emissions by 2013. This represents about a one-third reduction of the total NO_x emissions and a one-half reduction of the total SO_2 emissions from all sources in North Carolina. Although mercury was not specifically addressed, the state estimated that the controls needed to meet the NO_x and SO_2 limits would reduce mercury by as much as 60 to 90 percent. The Act includes study and reporting requirements relating to both mercury and CO_2 emissions.

Duke Power (a division of Duke Energy Corporation) and Progress Energy Carolinas, Inc. (Progress Energy), North Carolina's two largest utilities, must achieve emissions reductions through actual reductions at their 14 plants in the state; they may not buy or trade credits from utilities in other states. The utilities also cannot sell credits for their emissions cuts. According to the National Conference of State Legislatures (NCSL), the most critical provision in the law authorizes the Governor to enter into annual agreements with electric utilities to voluntarily transfer pollution allowances to the state; these allowances are held in trust for the citizens of the state and cannot be transferred without legislative approval.

Update on Compliance

According to a May 2003 report, Progress Energy and Duke Energy filed their initial compliance plans as required in June and July of 2002. The Department of Environment and Natural Resources (DENR) reviewed the plans and determined that they appeared adequate to achieve the emissions limits set forth in the Act. Annual compliance plans submitted by the companies provide updates on their progress.

According to the North Carolina Division of Air Quality (DAQ) and NCSL, and based on the 2005 annual report submitted by DENR and the North Carolina Utilities Commission, compliance is on target. For example, according to a 2004 report by NCSL, to meet the NO_x limits, Duke Energy plans to install SCR equipment on three of its generating units, and selective non-catalytic reduction (SNCR) with low NO_x burners on its remaining 24 units. To meet the SO_2 limits, Duke Energy plans to install scrubbers on its 12 largest units. Progress Energy also plans to upgrade a number of its facilities to meet the Act's requirements; its Asheville plant will be the first in the state (by the fall of 2005) to install scrubbers to comply with the SO_2 reduction requirements. DAQ has begun to permit the technologies and devices that will be used to meet the limits.

Both companies held meetings with environmental groups to discuss their strategies before filing their compliance plans. According to NCSL, environmental groups have expressed general satisfaction with the Act's early implementation schedule.

Impacts on Industry

The costs for installing pollution controls to meet the required reductions were originally estimated at $2.3 billion. The final legislation provided for a freeze on electric rates for five years, allowing utilities to generate sufficient revenue to cover these costs. Electric rates were anticipated to go down; freezing the rates enabled the utilities to collect more revenue than they otherwise would have received. (It should be noted that North Carolina's electric utility industry has not been restructured and still operates in a regulated environment.)

Duke Energy spent $800,000 in 2001, $3.6 million in 2002, $16 million in 2003, and $106.8 million in 2004 to comply with the Act; costs related to project studies and investigations, engineering, equipment specifications development, equipment layout, contracting related costs, logistics, and general grading and site preparation activities. Duke Energy originally estimated that it would spend approximately $1.5 billion (in future dollars) over 10 years to comply with the Act. In its 2005 compliance plan, the company reported that its expected costs are about 17.8 percent higher (almost $1.75 billion). The increased cost estimate results from additional project scope definition, refinement of project schedules, and higher costs for certain commodities (mainly steel) and labor.

Progress Energy spent $830,000 in 2002 for preliminary engineering and planning activities; $22.3 million in 2003, which reflected the beginning of construction at two plants; and $78.3 million in 2004, which reflected costs related to continuing construction at two plants and preliminary engineering for two additional plants. Progress Energy originally estimated total compliance costs at approximately $813 million (in future dollars) over 10 years; however, in its 2005 compliance plan, Progress Energy reported that the estimated total capital costs are currently projected at $895 million, a 10 percent increase from the original 2002 cost estimate. The cost increases are due to higher steel prices and changes to the original plan.

Chapter 5: Putting It All Together: Policy Issues for Consideration and Conclusions

Policy Issues for Consideration

This report raises a number of issues that merit special consideration within the context of making changes to Maryland's air pollution policies and programs.

Activities to Date

- Maryland's efforts to reduce air pollution have resulted in recent air quality improvements, and recent pollution reduction upgrades at power plants in Midwestern states may result in additional air pollution reductions in Maryland. Other actions, such as the Mirant Consent Decree, also may reduce emissions from Maryland's power plants in the future.

- In June 2005, Maryland began measuring its air quality under a new eight-hour standard for ozone. Although the eight-hour standard is more difficult to meet, according to the Maryland Department of the Environment (MDE), it provides a more accurate measurement of the State's air quality, and is more protective of the public health.

- Of the three states that have enacted multi-pollutant strategies to date, two (Massachusetts and New Hampshire) have administered their respective programs in a deregulated energy market similar to Maryland's. This shows that it is possible to implement a state-specific multi-pollutant strategy in a state with a restructured electric industry.

A Regional Approach Is Strategic

- Pollution Transport – Since some air pollution is transported to Maryland from Midwestern states, Maryland's ability to make improvements to its air quality is partially dependent upon the existence of state and federal policy frameworks that reflect the regional nature of air pollution.

- Maryland's Participation in the Ozone Transport Commission (OTC) – The U.S. Environmental Protection Agency (EPA) asserts that the Clean Air Interstate Rule (CAIR) will result in the largest reduction of air pollution in more than a decade. Nevertheless, by its own account, the EPA estimates that by 2015, despite the reductions mandated under CAIR, many regions of Maryland will remain in nonattainment under the eight-hour ozone standard. Because of this, Maryland and other OTC states believe a more aggressive effort is necessary to adequately address ozone and particulate matter (PM). However, while the OTC CAIR Plus initiative provides a stronger regional approach to reducing nitrogen oxides (NO_x), sulfur dioxide (SO_2,), and mercury pollution, member-states are not scheduled to adopt model regulations until late 2006.

- Regional Energy Market Implications – Maryland participates in a regional energy market (the PJM). If Maryland requires extensive pollution reduction upgrades to its power plants, and other PJM states do not, Maryland energy suppliers could be put at a significant, competitive disadvantage.

State Policy Framework

- Setting an Example – To ensure meaningful collaboration on a regional basis, Maryland's commitment to reducing air pollution should be readily apparent. It would be difficult for Maryland to argue for emissions reductions in other states when it lacks aggressive air pollution policies and programs.

- Federal Policy Could Hinder State Progress – It is possible that the cap-and-trade provisions within CAIR and the Clean Air Mercury Rule (CAMR) could encourage pollution "hotspots" in some states. Therefore, policy makers should carefully consider the potential risks associated with these cap-and-trade provisions.

- Chesapeake 2000 Agreement (C2K) – Maryland's ability to achieve the goals set forth in C2K is dependent upon making additional reductions in air pollution. While Maryland's recent commitment to reducing point source pollution from wastewater treatment plants is significant, the State must make additional progress in other areas to achieve the C2K goals.

A Fluid Policy Context

- New Federal Policies and Legal Challenges – In the past year alone, the EPA has promulgated and proposed several rules relating to power plant emissions. Several of these are now subject to legal challenges. Since changes to the federal policy framework are inevitable, Maryland may want to consider establishing a stronger State policy framework for regulating power plant emissions.

- Rising Energy Costs – The policy implications of recent increases in energy costs are variable and potentially wide ranging. This trend could prompt reductions in total energy use and/or consumer concerns about the impact of air pollution reduction efforts on energy bills. Clearly, however, energy will be a significant policy issue during Maryland's 2006 legislative session.

Conclusion

The evolution of air pollution regulation has clearly resulted in significant accomplishments in managing air pollution controls; as a result, the air quality in Maryland and nationwide has improved greatly in the last few decades. Charged with enforcing the Clean Air Act (CAA), the EPA continues to provide a regulatory framework for air pollution. Of late, however, the EPA has moved away from most states' views on how it should interpret the CAA with respect to power plants. With numerous rules governing the CAA being litigated in federal courts, and new CAA rules yet to be implemented, the extent to which Maryland's power plants will reduce emissions under federal regulatory safeguards is uncertain.

By most accounts, the state of Maryland's air quality requires additional action to reduce air pollution and reach attainment under the National Ambient Air Quality Standards (NAAQS). Given that power plants are a significant source of air pollution in the State, a multi-pollutant approach to reduce emissions from these facilities could help Maryland reach its air quality goals. In considering State-specific legislation, however, Maryland legislators will need to balance the impacts to the electric generating industry with the impacts to the environment and public health, such as respiratory illnesses and developmental problems caused by the ingestion of mercury-contaminated fish. While the costs of installing additional pollution controls on Maryland power plants could put them at a competitive disadvantage in the regional market for electricity, the costs of inaction – including rising health care costs and government spending to address the continued degradation of the environment – should not be overlooked.

Appendix 1

Maryland Power Plant Air Emissions Reduction Systems
November 2005

Plant	Owner	No. of Steam Units and Primary Fuel Type	No. of Combustion Turbines and Fuel Types	No. of Internal Combustion Units and Fuel Types	NO_x Pollution Reduction Systems*	SO_2 Pollution Reduction Systems*	PM Pollution Reduction Systems*	Hg Pollution Reduction Systems*	CO_2 Pollution Reduction Systems*
AES Warrior Run	AES Enterprise	1 Coal	--	--	SNCR	Fluidized Bed Combustion (FBC) technology with lime injection	Fabric Filter	Some co-control of Hg by Fabric Filters	--
Brandon Shores	Constellation	2 Coal	--	--	LNB with overfire air; SCR during ozone season (May-Oct)	--	ESPs	Some co-control of Hg by ESPs	--
C.P. Crane**	Constellation	2 Coal	1 Fuel Oil	--	Coal units: Overfire air during ozone season	--	Fabric Filters	Some co-control of Hg by Fabric Filters	--
Chalk Point**	Mirant Corporation	2 Coal 2 Fuel Oil	2 Fuel Oil 5 Natural Gas	--	Coal units: LNB with overfire air; one unit being retrofitted with SACR for ozone season 2006	--	ESPs	Some co-control of Hg by ESPs	--
Dickerson**	Mirant Corporation	3 Coal	2 Natural Gas/Fuel Oil	--	Coal units: LNB with overfire air	--	ESPs and Fabric Filters	Some co-control of Hg by ESPs and Fabric Filters	--
Easton	Easton Utilities	--	--	7 Fuel Oil 5 Natural Gas/Fuel Oil 4 Residual Fuel Oil	--	--	--	--	--
H.A. Wagner**	Constellation	2 Coal 2 Fuel Oil	1 Fuel Oil	--	Coal units: LNB or LNB with overfire air on all units; Unit 3 SCR during ozone season	--	ESPs	Some co-control of Hg by ESPs	--
Morgantown**	Mirant Corporation	2 Coal	6 Fuel Oil	--	Coal units: LNB with overfire air; planning installation of SACR for ozone season '09	--	ESPs	Some co-control of Hg by ESPs	--
Notch Cliff	Constellation	--	8 Natural Gas	--	--	Use of natural gas	Use of natural gas	--	--

Maryland Power Plant Air Emissions Reduction Systems
November 2005

Plant	Owner	No. of Steam Units and Primary Fuel Type	No. of Combustion Turbines and Fuel Types	No. of Internal Combustion Units and Fuel Types	NO_x Pollution Reduction Systems*	SO_2 Pollution Reduction Systems*	PM Pollution Reduction Systems*	Hg Pollution Reduction Systems*	CO_2 Pollution Reduction Systems*
Panda Brandywine	Panda Energy	--	2 Natural Gas/Fuel Oil	--	--	Use of natural gas and low sulfur fuel oil	Use of natural gas and low sulfur fuel oil	--	--
Perryman	Constellation	--	4 Natural Gas/Fuel Oil	--	One unit: water injection, DLN	Use of natural gas and low sulfur fuel oil	Use of natural gas and low sulfur fuel oil	--	--
Philadelphia Road	Constellation	--	4 Fuel Oil	--	--	--	--	--	--
R. Paul Smith**	Allegheny Energy Group	2 Coal	--	--	LNB	--	ESPs	Some co-control of Hg by ESPs	--
Riverside	Constellation	1 Natural Gas	2 Fuel Oil 1 Kerosene	--	--	Use of natural gas	Use of natural gas	--	--
Rock Springs	ODEC/ConEd	--	4 Natural Gas	--	Dry Low-NOx (DLN) Combustors	Use of natural gas	Use of natural gas	--	--
SMECO	SMECO	--	1 Natural Gas	--	--	Use of natural gas	Use of natural gas	--	--
Vienna	NRG Energy	1 Fuel Oil	1 Fuel Oil	--	LNB	--		--	--

*Represents controls in place at the steam generating units ("boilers") and not the combustions turbines, with the exception of Notch Cliff, Panda-Brandywine Perryman, Rock Springs and SMECO. For these three plants, the control technology information applies to combustion turbines.

** Indicates facilities that have at least one unit that is not subject to CAA's NSPS because the plants were built prior to 1971.

Note: Facilities listed in this chart are those power plants that have at least one fossil fuel-fired unit and that have a total nameplate capacity of at least 25 MW. Self-generators are not included.

Abbreviations

Controls		Pollutants	
SNCR	Selective non-catalytic reduction	NO_x	Nitrogen Oxides
LNB	Low-NOx burners	SO_2	Sulfur Dioxide
DLN	Dry low-NOx combustors	PM	Particulate Matter
ESPs	Electrostatic precipitators	Hg	Mercury
FBC	Fluidized bed combustor	CO_2	Carbon Dioxide
SCR	Selective catalytic reduction		
SACR	Selective auto-catalytic reduction		

Sources: Department of Natural Resources, Maryland Department of the Environment

Appendix 2

ACI	Activated Carbon Injection
AQCR	Air Quality Control Region
BACT	Best Available Control Technology
BDT	Best Demonstrated Technology
BOOS	Burners Out of Service
CO_2	Carbon Dioxide
C2K	Chesapeake 2000
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMR	Clean Air Mercury Rule
DAQ	North Carolina Division of Air Quality
DENR	North Carolina Department of Environment and Natural Resources
DEP	Massachusetts Department of Environmental Protection
DES	New Hampshire Department of Environment Services
DOJ	Department of Justice
ECP	Emission Control Plan
EPA	U.S. Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
FGD	Flue Gas Desulfurization
Hg	Mercury
KW	Kilowatt
KWh	Kilowatt-hour
LAER	Lowest Achievable Emissions Rates
lbs/GWh	Pounds per Gigawatt-hour
lbs/MWh	Pounds per Megawatt-hour
LNB	Low-NO_x Burners
MACT	Maximum Achievable Control Technology
MDE	Maryland Department of the Environment
MW	Megawatts
MWh	Megawatt-hour
NO_x	Nitrogen Oxides
NAAQS	National Ambient Air Quality Standards
NCSL	National Conference on State Legislatures
NHCPS	The New Hampshire Clean Power Strategy
NSPS	New Source Performance Standards
NSR	New Source Review
NWF	National Wildlife Federation
OTC	Ozone Transport Commission
PJM	Pennsylvania-New Jersey-Maryland Interconnection
PM	Particulate Matter
$PM_{2.5}$	Fine Particulate Matter
PSD	Prevention of Significant Deterioration
PSNH	Public Service of New Hampshire
RACT	Reasonably Available Control Technology
SO_2	Sulfar Dioxide
SCR	Selective Catalytic Reduction
SIP	State Implementation Plan
SNCR	Selective Non-Catalytic Reduction
VOC	Volatile Organic Compound