

THE MASSACHUSETTS APPROACH TO POWER PLANT CLEAN-UP

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Introduction

On April 23, 2001, the Commonwealth of Massachusetts announced the release of final regulations to direct the clean up of six old and high pollutant-emitting power plants. For the first time in the history of Commonwealth's air quality protection efforts, this regulation targets multiple pollutants and focuses on setting output based facility-wide emissions standards. This includes, for the first time nationally, carbon dioxide. These regulations are the beginning of a new approach to improving environmental quality in our state, and they establish a national model for four-pollutant power plant clean up.

This integrated, multi-pollutant approach to regulating power plants makes environmental, public health, and economic sense. The strategy will reduce the pollutants that cause acid rain and that cause the fish in Massachusetts lakes and ponds to be contaminated by mercury. The rule also focuses on energy efficiency and on slowly reducing the gases that cause global warming. This long-term pollution prevention strategy supports our energy deregulation efforts by leveling the playing field between older and new plants. Finally, the regulations require changes at power plants to be phased in over several years to avoid any economic disruption and provide regulatory certainty to our electricity generators.

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The Commonwealth's Air Quality Strategy

Massachusetts is concerned about the public health and environmental effects of acid deposition, nitrogen deposition, and mercury emissions. Over the years, we have been involved in a number of initiatives to study the effects of these pollutants on the environment and to reduce emissions of these pollutants. In fact, Massachusetts has one of the most comprehensive and stringent air pollution control programs in the country.

Throughout the 1990s, the state required nitrogen oxide (NO_x) emission reductions of more than 60% (since 1990) and has committed, along with other Northeastern states, to a 75% emission reduction by 2003. In addition, in June 1998, the New England Governors and Eastern Canadian Premiers signed an agreement to significantly reduce mercury emissions and the precursors of acid deposition in New England and in Eastern Canada.

In 1999, Massachusetts announced its coordinated air quality pollution prevention strategy. The goals of the strategy are to reduce smog, acid rain, global warming pollutants, mercury and other air toxics, and to improve public health and environmental quality. Our four-pollutant approach to reducing emissions from fossil fuel-fired generating facilities will further this strategy by: reducing ozone (smog) formation in the summer; reducing the impact of acid deposition year round on Massachusetts forests, wildlife, water, aquatic, and cultural resources; protecting the Commonwealth's water resources and reducing mercury deposition and the accumulation of mercury in the food chain; reducing emissions of global warming pollutants; and reducing the amount of particles in the air that are dangerous to breathe and affect visibility.

The Four Pollutants and Their Effects

Massachusetts is faced with significant pollution problems and health threats that are caused by air emissions of sulfur dioxide (SO₂), NO_x, mercury and carbon dioxide (CO₂). Though there are many effects from these pollutants, this paper focuses on three main ones: climate change, acid rain, and mercury contamination.

Climate Change

Climate change has a number of direct impacts on Massachusetts. For example, we are already seeing changes in the patterns of migratory birds and the timing of their migrations. In some areas, geese have become year-round residents owing to the milder winters. We are seeing increasing incidence of diseases like West Nile Virus, Eastern Equine Encephalitis, and Lyme disease – tropical diseases previously unknown in our area. The rate of climate fluctuations we are now just beginning to experience will be so severe that many animals and plants will be unable to respond fast enough to survive. The make-up of our forests will change as the range of certain species, like the sugar maple, shifts to the north. The biodiversity that makes our lives so rich and that allows our many ecosystems to thrive is suffering.

For a coastal state such as Massachusetts, the danger from sea level rise is both direct and severe. We are already seeing damage from coastal storms as sea levels rise and the resulting storm surges pose greater danger to our coastal communities. In Boston, sea level has already risen – by 11 inches last century – and a rise of another 22 inches is predicted by 2100. Already at this rate, an average of 65 acres of upland is being submerged each year by a combination of rising seas and subsiding land. Much of this loss occurs along the south-facing coast between Rhode Island and the outer shore of Cape Cod, including the islands of Nantucket and Martha's Vineyard.

Trying to respond to sea level rise is costly. Ocean front properties are very expensive and seawalls cost more than \$2 million per mile. The cumulative cost of sand replenishment to protect the coast of Massachusetts from a 20-inch sea level rise by 2100 is estimated at \$2.6 billion. For those who may argue that the cost of addressing climate change is too high – they need only take a look at the costs of dealing with the devastation that results from rising temperatures.

Climate change is a global problem. But that does not mean we must sit around and wait for global solutions. It means that each and every one of us – every citizen, town, city, state, province and country – must do their part and take action. The balance of nature is being tipped.

Acid Rain/Regional Haze

Acid rain continues to have significant effects in Massachusetts. The acidic precipitation causes acidification of lakes and streams and contributes to tree damage at high elevations. Acid deposition affects the ability of certain areas to maintain healthy species biodiversity. Acid deposition can be especially harmful in the Northeast in the springtime, when the acid-laden snow pack melts. This shocks the ecosystem with a large load of acidic water, which leaches toxic metals (such as mercury and aluminum) from the soil and introduces them into the ecosystem. In addition, the acidic water may directly harm small spring creatures during critical phases of their reproductive cycles. Acid deposition also damages man-made materials, including historical buildings and statues, and affects crops and other vegetation.

Recent evidence indicates a slower-than-expected recovery of these ecosystems in the Northeast, despite reductions achieved under the Federal and State Acid Rain Program. Massachusetts, along with other Northeast states, is petitioning to set secondary National Ambient Air Quality Standards for NO_x, SO₂, and fine particles to further reduce acid deposition.

The human health effects of SO₂ and NO_x are well documented. Fine particles of SO₂ combine with water vapor to form acidic aerosols harmful to the respiratory tract and aggravate symptoms associated with lung diseases such as asthma and chronic bronchitis. NO_x is also known to aggravate symptoms associated with asthma and bronchitis, and has been shown to lower resistance to respiratory infections and increase respiratory illnesses in children.

Finally, prior to falling to the earth, SO₂ and NO_x gases and their particulate matter forms, sulfates and nitrates, contribute to visibility degradation and impact public health. For a state where our rolling countryside and scenic vistas are an important part of our quality of life, regional haze is a continuing concern.

Mercury Contamination

Mercury is a toxic metal that exists naturally as a trace metal in the earth's crust. However, in other forms and amounts it is a dangerous pollutant. Mercury is a powerful, persistent pollutant that can damage the brain, impair the human

nervous system, reduce or limit kidney function, and cause tingling in the limbs. Exposure to methylmercury in utero can cause neonatal brain damage, and cause developmental effects in children.

Worst of all, small amounts of mercury can cause extensive contamination. One seventieth of a teaspoon can make the fish in a 20-acre lake unsafe for eating. A comparison of historical records and more recent measurements suggests that the total global atmospheric mercury burden has increased since the beginning of the industrial age by a factor of two to five. Concern about mercury contamination has led to a range of regulatory initiatives in the Northeast and in Canada aimed at reducing mercury emissions.

In the Northeast, we have some of the highest levels of mercury deposition in the country. In Massachusetts alone, more than 80 water bodies have health advisories warning against consumption of fish species due to mercury pollution. In fact, Massachusetts Department of Public Health has issued a statewide advisory that cautions pregnant women against eating any freshwater fish caught in Massachusetts, and it recommends eating saltwater fish only rarely.

The Problem with Older “Grandfathered” Power Plants

Despite the work that had already been done to clean up all of the power plants in the state, concern about the above issues led a coalition of Massachusetts public health, environmental, community, and consumer organizations to raise concerns about the disproportionate public health and environmental impacts of the larger, older power plants in Massachusetts. These are the plants that were built before the Clean Air Act Amendments of 1977. Congress expected that these plants would soon be retired and replaced with newer, cleaner, more efficient combustion and generation technologies. Instead, many older plants have been maintained for years beyond their anticipated useful life.

Specifically, although these plants have made some improvements, they still use more outdated generating and emission control technologies. In addition, they are not required to meet the same stringent regulations as more recently permitted power plants. As a result, their energy efficiencies are lower and their emission rates are higher than newer plants.

It follows that these older power plants represent a disproportionate part of our climate change, acid rain, regional haze and mercury contamination problems. The six oldest facilities provide 25% of the power generated in Massachusetts but are responsible for:

- approximately 48% of the SO₂ emissions in the state and 99% of the SO₂ emissions from power plants;
- 50% of the NO_x emissions and 80% of the NO_x emissions from power plants;
- 87% of the CO₂ emissions from power plants in Massachusetts; and
- 30% of all of the mercury emissions in the state.

The Massachusetts Four-Pollutant Solution

In 1998, in response to the concerns and initiatives described above, a coalition of public health, environmental, consumer, and community organizations, supported by Governor Cellucci, submitted a petition to the Department of Environmental Protection (DEP) seeking emission reductions from the largest and oldest power plants in Massachusetts. DEP proposed regulations to lower emissions of SO₂, CO₂ and NO_x from certain power plants, and to establish a framework that will also lead to reductions in emissions of mercury and particulate matter.

These comprehensive, multi-pollutant power plant regulations require the six highest-polluting power plants to reduce the pollution that causes acid rain, regional haze, mercury emissions and global climate change through a major upgrading of the pollution control technology or a major repowering at each plant. The rule also creates a significant incentive for companies to repower their plants to use a cleaner fuel or a more efficient technology. We are the first state to level the environmental playing field between old and new power plants by regulating them for these four pollutants.

Historically, air emission control requirements have been issued for individual pollutants in response to federal requirements and state policies to address health and environmental threats stemming from single pollutant emissions. However, fossil fuel powered electric generating facilities emit several pollutants that are associated with adverse health and environmental impacts. This rule establishes, in a single regulation, environmental performance standards that address four pollutants at once. This integrated approach enables facility owners

to make emission control decisions while considering several standards at once and to make more comprehensive assessments of pollution control strategies and find integrated approaches that can reduce costs.

Energy Deregulation and a Level Playing Field

The four-pollutant regulation supports the Commonwealth's new approach to regulating the electric power plant sector. In 1997, the Legislature passed a law restructuring the state's electric industry. This law, and similar laws and regulations passed in other Northeast states, set in motion several significant changes to the framework of the industry in the region. The goal was to implement restructuring without environmental or public health impacts.

The promise of lower electricity prices without adverse environmental impact through industry restructuring will be realized if all generators are subject to the same market rules, there are no unfair advantages to incumbent generators, and there are no barriers to entry in the generation market. A significant competitive inequity that exists among electricity generators in Massachusetts is that the largest, oldest fossil fuel fired plants are subject to emission standards that are much less stringent than the newer plants that are their direct competitors within Massachusetts. These higher emissions rates can lead to unacceptable public health impacts. Therefore, this rule seeks to protect public health and provide the greatest level of competitive parity feasible among in-state facilities.

Output-Based Standards

It may be hard to believe, but the historic way the electricity industry has been regulated is to allow emissions based on the past level of fuel input. That is to say, if you have a very old and inefficient plant that uses large quantities of coal, it would be permitted higher levels of emissions than a more efficient plant, in perpetuity. This embeds the economic advantage to the older, dirty plants, which tend to use the least expensive fuels. By moving to standards based on net output we have made a conscious effort to close this loophole, which allows a high polluting plant to remain untouched. We believe that this will encourage the plants to increase generating efficiency and minimize the facility's internal power use. This is the type of policy decision that we believe will set a level playing field and will encourage environmentally sound decision making overall.

What Do the Regulations Require?

The regulations require facilities to meet overall limits of 1.5 lbs./MWh for NO_x and 3.0 lbs./MWh for SO₂. These caps will require approximately a 50% reduction in NO_x emissions over current requirements and a 53% to 74% reduction in SO₂ over the emissions limitations in the current rules. These benefits will be obtained while the total electrical generating capacity of these six facilities will increase by almost 50% through the addition of several new units at these locations (to approximately 2200 MW). The Commonwealth's efforts to prevent pollution will encourage companies to reach emissions targets by investing in cleaner, more efficient energy generation in Massachusetts. The regulations require:

- Reductions of NO_x beginning as early as 2003 and being completed at all plants by 2008.
- Reductions in mercury by the maximum amount feasible with state of the art equipment.
- A cap on CO₂ emissions today and a 10% reduction in CO₂ emissions through efficiency changes or the purchase of offsets by 2006, for plants putting on control equipment, or by 2008, for plants being rebuilt.

Table 1 summarizes these requirements. Companies on a standard control equipment path will meet dates in the first column. If a facility chooses to repower, the second set of timelines will apply because of the more complex processes for engineering design, permitting and construction.

CO₂ Emissions and Clean-up Requirements

The six facilities covered under the regulation are responsible for 87% of the CO₂ emissions from in-state power plants. While the average annual CO₂ emission rate for a new power plant is 760 lbs. per megawatt hour, the average annual CO₂ emission rate from the six facilities is nearly 2,000 lbs. per megawatt hour. The rule will both cap total CO₂ emissions and create an emission standard of 1,800 pounds of carbon dioxide per megawatt-hour for these old plants. The standard represents a reduction of 10% below the current average CO₂ emissions rate (as measured by the average of 1997-99 output).

The new standards can be met either by increased efficiency at the plant or by the purchase of credits from other CO₂ reduction programs, provided that the DEP determines that such reductions are real, surplus, verifiable, permanent, and enforceable.

TABLE 1: SUMMARY OF COMPLIANCE PATHS AND DATES

Emission Standard (lbs./MWh)	Standard Pathway Compliance Dates	Repowering Pathway Compliance Dates
NO _x 1.5 lbs.	2004	2006
SO ₂ 6.0 lbs.	2004	2006
SO ₂ 3.0 lbs.	2006	2008
CO ₂ 1800 lbs.	2006	2008

Mercury Clean-up Requirements

Beginning immediately, the plant owners must begin stack testing for mercury and reporting these results to the DEP. By December 1, 2002, the DEP will complete an evaluation of technology options for mercury control, in accordance with the regional Mercury Action Plan. Within six months of completing this feasibility evaluation, the DEP will propose emissions standards for mercury, to be met by October 1, 2006.

Power Reliability and the Four-Pollutant Regulations

During the fall of 2000 and the winter of 2000-2001, power shortages started to arise in California and industry opponents to the four-pollutant rule started to sound the alarm of power shortages in Massachusetts. Luckily, the content and the timing of the energy restructuring bill had already solved this problem for the most part.

According to the New England Independent System Operator, the private consortium of utilities responsible for dispatching electricity in the region, Massachusetts will be a net exporter by the year 2005. There are 14 plants (ten new and four voluntarily repowering) under construction that will come on line by 2005. Six more plant proposals have begun the siting process – all are striving to be complete by 2005. None of these last six were factored into the ISO study. The energy supply picture was sufficient to permit these plants to be taken out of service for upgrades in an organized manner, allowing the Commissioner of Energy Resources to confirm that supply concerns did not provide a reason to delay the much-needed clean-up.

Emissions Trading for CO₂

To encourage and recognize the actions of companies that reduce their emissions of CO₂ and other greenhouse gases, the Commonwealth of Massachusetts will establish a Massachusetts Greenhouse Gas Reductions Registry. The Registry will provide a record of emissions reductions to facilitate their creation and ease of purchase by companies needing them. The location of CO₂ emission reductions is irrelevant in reducing global emissions of this pollutant, and DEP will offer the affected facilities the widest possible set of options for complying with this emission standard. The registry will:

- record emissions and reductions in a consistent format, supported by third-party verification;
- encourage and support the mandatory and voluntary reduction of greenhouse gas emissions by Massachusetts sources;
- recognize, publicize and promote registrants making reductions; and
- recruit broad participation from all economic sectors and regions of the state.

To encourage early reduction and allow flexibility at individual sources, each facility can generate Early Reduction Credits by operating below its historical average emission rate in advance of their compliance date. For SO₂, there are also emissions trading provisions. All facilities must meet the 6.0 lbs. SO₂/MWh emission standard; the credits will allow a facility more flexibility and time in making the final choice as to its ultimate compliance method.

Costs to Massachusetts Ratepayers

All projected plant costs, if evenly spread, would not exceed \$2.40 per month for the average residential electricity customer. However, since customers now have the freedom to choose alternative electricity suppliers, not all of this cost can be passed on to ratepayers. Compared with the maximum cost estimate discussed above, we expect the human health and environmental benefits to exceed costs by a ratio of about eight to one.

Recommendations for Other States

In addition to emissions from Massachusetts sources, every summer the Commonwealth suffers from about 500,000 tons of smog producing pollutants (such as NO_x) per year entering our state from Midwestern power plants on the prevailing winds. Air pollution does not respect political boundaries.

It is essential, therefore, that in addition to the regulations on the grandfathered power plants in-state, regional and national strategies continue to force clean up at the dirty Midwestern power plants. To reach this end, we have pursued a joint strategy of cleaning up our own plants and working with the U.S. EPA to require the dirtiest Midwestern plants to clean up. We have filed petitions and legal suits to expedite this action. For example, the 40 sources named in our lawsuit emitted, in 1990, roughly as much NO_x as all 225 power plants from Northern Virginia up to Maine. We have instituted controls on emissions, in our state and in the Northeast region, and it is time to extend those controls across the borders to the Midwest. We now challenge other states across the country to follow our lead. Such changes are also likely to reduce CO₂ emissions as plants are upgraded for efficiency or repowered.

Conclusion

The Massachusetts four pollutant approach targets the cause of three key long-term environmental and public health issues facing the Commonwealth – acid rain, climate change and mercury contamination. The rule was developed in way that supports our energy deregulation efforts by leveling the playing field between older and newer power plants. Furthermore, by removing the incentives that favored our older, less efficient and more polluting power plants we are able to provide reliable, sufficient energy in a manner that is protective of public health and the environment.