BEFORE THE
ENVIRONMENT AND PUBLIC WORKS COMMITTEE,
UNITED STATES SENATE

HEARING TO ASSESS THE ENVIRONMENTAL AND PUBLIC HEALTH IMPACTS OF POWER PLANT EMISSIONS

THE NEED FOR COMPREHENSIVE FEDERAL POWER PLANT AIR EMISSIONS CONTROL POLICY

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ON BEHALF OF

CLEAR THE AIR
CLEAN AIR TASK FORCE
NATIONAL ENVIRONMENTAL TRUST
U.S. PUBLIC INTEREST RESEARCH GROUP

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Summary of Testimony

Mr. Chairman, members of the Senate Environment and Public Works Committee, Good morning, my name is Conrad Schneider, Advocacy Director of the Clean Air Task Force. I appreciate the opportunity to speak to you today. Based in Boston, the Clean Air Task Force is a national non-profit, environmental advocacy organization whose mission includes reducing the adverse environmental impacts of fossil-fuel electric generating plants. Our staff and consultants include scientists, attorneys, economists, and engineers. Today I am testifying on behalf of Clear the Air: The National Campaign Against Dirty Power, a joint effort of the Task Force, the National Environmental Trust, and the United States Public Interest Research Group Education Fund; a campaign that involves over 120 organizations in 40 states.

The adverse public health and ecological impacts from the nation's older coal- and oil-fired fleet of power plants are so numerous and so significant that it is scarcely possible to do more than list them in five minutes of testimony. Electric power plants are by most measures the nation's largest industrial air polluter. Power plant emissions are the biggest contributor to the single largest environmental risk to public health: disease and premature death due to inhalation of fine particles. Power plant air emissions cut a broad swath of damage across human health, and the local, regional and global environment. Unhealthy levels of ozone smog that trigger millions of asthma attacks each summer; fine particles that shave years off peoples lives and damage lungs; the damage to forests, lakes, bays and crops due to acid rain; mercury contamination of fish and wildlife; shrouds of haze in our national parks; and contributions to greenhouse gasses; the damage from fuel extraction, and groundwater contamination from the lack of proper disposal of solid and liquid waste from power plant fuel combustion – these are just some of the major problems associated with the nation's fossil electric generating fleet. Attachment 1 illustrates the many different ways in which power plant pollution affects our lives and the natural world around us.

The best available scientific evidence demonstrates that very deep cuts are needed in all four major power plant pollutants: sulfur dioxide, nitrogen oxides, mercury and other air toxics, and carbon dioxide:

- Research from the nation's top acid rain scientists at Hubbard Brook Research Foundation indicates that nothing short of the 75 percent reductions in sulfur dioxide and nitrogen oxides called for in the Clean Power Act of 2001 (S. 556) will be sufficient to allow damaged ecosystems to begin to recover by mid-century.

- Analysis of power plant health impacts performed using methodology approved by U.S. EPA's Science Advisory Board found that fine particles from power plant sulfur dioxide and nitrogen oxide emissions shorten the lives of over 30,000 Americans each year, and that a 75 percent cut in these pollutants would avoid over 18,000 of these premature deaths. Lesser reductions will avoid fewer unnecessary deaths.

- Pristine vistas in our national parks and wilderness areas will be restored only with pollution reductions of this magnitude.

- Mercury from a variety of sources over the years has contaminated the food chain to the point that in over 40 states people are warned to limit or avoid consumption of fish for fear of neurotoxicological effects. Power sector reductions of mercury of up to 90 percent are feasible with current technology, and reductions of 90 percent or more appear commercially viable within the time horizon contemplated by the Clean Power Act of 2001. Technical means include coal cleaning, sulfur dioxide and nitrogen oxides scrubbing co-benefits, fabric filters, carbon sorbent injection, adoption of cleaner fuels, and a greater reliance on energy efficiency and clean renewable energy resources.

- The buildup of carbon dioxide and other heat-trapping gases in the atmosphere is primarily responsible for the unprecedented global warming seen over the last 50 years, according the National Research Council. As the Council recently concluded, the adverse health and environmental impacts of climate change are real. The largest source of carbon dioxide in the United States is the electric power industry, accounting for 40 percent of all U.S. emissions. Of that, more than 88 percent of power plant emissions come from older, less efficient coal-fired facilities. Any rational policy dealing with the U.S. contribution to climate change must include power sector carbon reductions. Capping power sector emissions of carbon dioxide at 1990 levels, in accord with the Rio Treaty, is technically feasible. This will require an expansion of the nation’s use of energy efficiency, clean renewable, and gas-fired energy sources, and potentially the use of advanced coal technologies.

For a host of reasons, the time is right for action finally to reduce the devastating effects of power plant pollution. We commend Senator Jeffords and the members of this Committee for advancing the issue and look forward to working with you as the process continues. There will be many points of agreement and disagreement among the affected parties around issues of implementation, costs, etc. However, public health and protection of the environment demand that emission reductions as prescribed by the Clean Power Act of 2001 must be achieved and achieved as quickly as possible. I would be happy to answer any questions.

Mr. Chairman, members of the Senate Environment and Public Works Committee, Good morning, My name is Conrad Schneider, Advocacy Director of the Clean Air Task Force. I appreciate the opportunity to speak to you today. Based in Boston, the Clean Air Task Force is a national non-profit, environmental advocacy organization whose mission includes reducing the adverse environmental impacts of fossil-fuel electric generating plants. Our staff and consultants include scientists, attorneys, economists, and engineers. Today I am testifying on behalf of Clear the Air: The National Campaign Against Dirty Power, a joint effort of the Task Force, the National Environmental Trust, and the United States Public Interest Research Group Education Fund; a campaign that involves over 120 organizations in 40 states.

Electric power plants are by most measures the nation's largest industrial air polluter. Power plant emissions are the biggest contributor to the single largest environmental risk to public health: death and disease due to inhalation of fine particles. Power plant air emissions cut a broad swath of damage across human health, and the local, regional and global environment. Unhealthy levels of ozone smog; fine particles that shave years off peoples lives and damage lungs; the damage to forests, lakes, bays and crops due to acid rain; mercury contamination of fish and wildlife; shrouds of haze blanketing our national parks; contributions to greenhouse gasses; and groundwater contamination from the lack of proper disposal of solid and liquid waste from power plant fuel combustion – these are just some of the major environmental problems associated with the nation's fossil electric generating fleet. Attachment 1 illustrates the many different ways in which power plant pollution affects our lives and the natural world around us.

Although to date the Clean Air Act has taken a pollutant-by-pollutant approach, the suite of pollutants from power plants: sulfur dioxide, nitrogen oxides, mercury and other air toxics, and carbon dioxide interact and operate synergistically to damage the environment. For example, global warming will likely increase the incidence and severity of summer smog episodes; acidification of water bodies mobilizes existing deposits of mercury meaning more mercury uptake into the food chain, etc. For these and other reasons (cost-effectiveness, planning certainty for industry, etc.) the problem of power plant pollution demands a comprehensive solution that includes all four major power plant pollutants.

Moreover, the best science available demonstrates that public health and ecosystem protection demand steep cuts in all four of these pollutants:

- Reductions in power plant emissions of sulfur dioxide and nitrogen oxides on the order of 75 percent beyond current law.
- Mercury emission reductions of 90 percent from current levels.
- Power plant carbon dioxide caps set at 1990 levels.

I will address the impacts from each of these pollutants in turn and discuss the science that supports these reduction targets:

Sulfur Dioxide

The problems associated with sulfur dioxide include: damage from acid rain, deadly fine particles, and the haze that obscures scenic vistas in national parks and our urban areas. Power plants emit about two-thirds of the sulfur dioxide emitted in the U.S. each year.

Sulfur Dioxide Reductions of 75 Percent or More are Necessary to Allow Ecosystem Recovery from Acid Rain by Mid-Century

It is increasingly well-documented that the problem of acid rain has not been solved and that the acid rain provisions of the 1990 Clean Air Act Amendments will not be sufficient to solve it. Over 150 years of deposition of sulfur has taken a serious toll on ecosystems. Although sulfur emissions have declined somewhat in recent years, they remain very high when compared to historic levels. See Attachment 2.

As a result of this legacy, lakes and streams and the aquatic life that live in them are experiencing the most widespread impact from high concentrations of acidity. The majority of sensitive waterbodies are those that are located atop soils with a limited ability to neutralize (or buffer) acidity. Sensitive areas in the US include the Adirondack Mountains, Mid-Appalachians, southern Blue Ridge[1] and high-elevation western lakes.[2] Water bodies are affected not just by the chronic acidification that occurs from cumulative deposition but also by episodic acidification that occurs when pulses of highly acidic waters rush into lakes and streams during periods of snowmelt (acids have collected in the snow over the winter) and heavy downpours.

In some places, chronic and episodic acidification together have completely eradicated fish species. For example, acid-sensitive fish have disappeared and/or populations have been reduced in Pennsylvania streams where they formerly occurred in large numbers. Acidification, together with high levels of aluminum leaching, is blamed for the reduction in fish diversity that many Pennsylvania streams have experienced over the past 25-34 years.[3]

Acid rain also saps calcium from the needles of trees, weakening the cell membranes and making the trees susceptible to damage from freezing in the winter and more vulnerable to diseases and/or insect outbreaks.[4] Acid rain also depletes soil nutrients — largely calcium and magnesium — needed for healthy forest growth. The U.S. Geological Survey has shown that calcium in forest soils has decreased at locations in the northeastern and southeastern U.S. forest soils, with acid rain being one of the major factors contributing to this depletion.[5]

Although most evidence shows that conifers tend to be more impacted than hardwood trees, acid rain is also hurting deciduous trees. Detection of patches of dead trees in northern hardwood forests of the Southern Appalachian National Forests has been attributed to the interactions of many stressors, including air quality.[6]

Some specific problems that are documented to be associated with acidic deposition are:

- Preliminary work suggests that episodic acid deposition has contributed to the decline of Atlantic salmon in Maine, with this periodic acidification having the greatest impact on smolts and fry.[7]

- Forty one percent of lakes in the Adirondack region of New York and 15 percent of lakes in New England are either chronically or periodically acidic. Nearly 25 percent of surveyed lakes in the Adirondacks do not support any fish, and many others have less aquatic life and reduced species diversity when compared to less acidic lakes.[8] Acid rain is the major cause of red spruce mortality in New York.[9]

- Reduction in fish diversity in northwest Pennsylvania is linked to aluminum leaching from acid rain. Comparison of fish data collected in the Allegheny Plateau and Ridge and Valley region 40 years ago to data collected in the mid-1990's found an overall decrease in species diversity, with the most dramatic declines occurring in five species of non-game, acid-sensitive fish. Streams that experienced a loss of species had greater increases in acidity and more episodic acidification than streams that either gained or had no change in species.[10] In the same area, acid rain has been associated with poor sugar maple and red oak regeneration as well as deterioration of tree health and excessive mortality in mature trees of both species.[11]

- The West Virginia Department of Natural Resources has identified hundreds of miles of streams that are chronically acidic and is currently liming 60 streams to offset the damage from acidic deposition.

- Episodic acidification is "ubiquitous" in Shenandoah National Park streams, and chronic acidification of surface water is also a serious concern. Values of pH as low as 5.0 (nearly as acidic as lemon juice) are common in these streams.[12] In spring, 2001, Paine Run River was placed on the American River's Most Endangered list because, without further cuts in air pollution, it will become too acidic to sustain populations of brook trout and other aquatic organisms. Thirty percent of trout streams in Virginia are either chronically (6 percent) or episodically (24 percent) acidic and therefore either marginal or unsuitable for acid-tolerant brook trout.[13] By the time acid-tolerant species are affected, there are many acid-sensitive species that are no longer productive.

- Great Smoky Mountains streams are very sensitive to acidic deposition. The sensitivity of these sites has emerged later than was observed in the Northeast, suggesting that it took longer to leach out agents that were able to buffer sensitive sites from acidity. Many high elevation streams are currently acidic.[14] Acidic deposition is also causing forest soils to experience chemical imbalances that are contributing to tree stress.[15,16]

- Many soils in the southeast are already nutrient-poor. Human intervention, and in particular the chronic loading of sulfate and nitrate from acidic deposition, has made already calcium-poor soils more calcium deficient. Analyses at forest sites in the southeastern US suggest that within 80 to 150 years, soil calcium reserves will not be adequate to supply the nutrients needed to support the growth of merchantable timber.[17]

- Because pollutants cross borders, there is documented damage in Canada as well. Atlantic salmon habitat in Nova Scotia rivers has been seriously reduced by increased acidity. A study of 49 rivers that historically supported salmon found populations to be extinct in 14 rivers and severely impacted in 20. Loss of salmon is correlated with increased acidity.[18] Sensitive watersheds, located primarily in central Ontario and Quebec, have not responded to reductions in sulfate deposition as well or as rapidly as those in less-sensitive regions. At the current sulfur deposition levels (20 kg wet sulfate/ha/yr.), roughly 95,000 lakes will continue to be damaged by acid deposition. Lakes continue to acidify despite reductions in sulfur deposition.[19] Modeling found that after full implementation of the acid rain program of the Clean Air Act Amendments of 1990 and Air Quality agreements that 76,000 lakes in SE Canada will remain damaged, that is have a pH below 6.[20]

- A continuing decline in soil nutrients, due to acidic deposition, is occurring in forest ecosystems in Ontario and Quebec. In Ontario, levels of acidic deposition are accelerating the loss of base cations and essential nutrients from soils that support sugar maple dominated hardwood forests. In Quebec, studies have shown the nutrient status of sugar maple seedlings declined as soil acidification levels and soil base saturation decreased. At current deposition levels, these effects will likely be sustained or increased. With sustained soil nutrient loss, not only will nutrient uptake by tree roots be reduced, but also forest ecosystem productivity will decline.[21]

Despite declines in power plant sulfur emissions due to acid rain provisions of the 1990 Clean Air Act amendments, the acidity of many waterbodies has not improved.[22] Scientists believe that cuts called for in the 1990 amendments to the Clean Air Act will not be adequate to protect surface water and forest soils of the northeastern US.[23]

What will it take to reverse the impacts of nitrogen saturation, ozone and acid rain? Recent work by scientists with the Hubbard Brook Research Foundation found that an additional 80 percent reduction in sulfur from levels achieved by Phase II of the acid rain program of the Clean Air Act Amendments of 1990 would be needed to allow biological recovery to begin mid century in the Northeastern US.[24] Model simulations in the Shenandoah project that greater than 70 percent reduction in sulfate deposition (from 1991 levels) would be needed to change stream chemistry such that the number of streams suitable for brook trout viability would increase. A 70 percent reduction would simply prevent further increase in Virginia stream acidification.[25] In the Great Smoky Mountains National Park, two separate ecosystem models have concluded that sulfate reductions of 70 percent are necessary to prevent acidification impacts from increasing. Deposition reductions above and beyond these amounts are necessary to improve currently degraded aquatic and terrestrial ecosystems.[26,27] To reverse and recover from acidic deposition impacts, Canadians in the Acidifying Emissions Task Group have recommended a 75 percent reduction in US sulfur emissions, post Phase II of the acid rain program of the Clean Air Act Amendments of 1990.[28] Thus, nothing short of the overall 75 percent reduction called for in the Clean Power Act of 2001 will finish the job of solving the acid rain problem. Tighter targeted cuts may be necessary for sources directly impacting sensitive areas. And, the longer we wait for the reductions to begin, the longer we will await recovery of these systems.

A 75 Percent Reductions in Power Plant Sulfur Dioxide Emissions will Avoid Over 18,000 Particulate-Related Premature Deaths Each Year

One of the air pollutants most carefully studied in the 1990's is particulate matter. Fine particles, such as those that result from power plants emissions, defeat the defensive mechanisms of the lung, and can become lodged deep in the lung where they can cause a variety of health problems. See Attachment 3. New evidence indicates that short-term exposures can not only cause respiratory (e.g., triggering asthma attacks), but also cardiac effects, including heart attacks.[29] In addition, long-term exposure to fine particles increases the chances of death, and has been estimated to shave years off the life expectancy of people living in our most polluted cities, relative to those living in cleaner ones.[30]

Fine particulate matter may be emitted directly from tailpipes and smokestacks (known as "primary" particulate matter), but the largest proportion of fine particles come from gas emissions (called "secondary" particulate matter). Sulfur dioxide emissions from coal plants contribute the most to secondary particle formation. Sulfur dioxide is chemically altered in the atmosphere after it is released from a smokestack to become a "sulfate" particle. Sulfates include sulfuric acid particles that, when breathed, reach deep into the human lung. Indeed, analysis of the relative toxicity of particles indicates that sulfate particles are among the most toxic.[31] In the East and Midwest U.S., sulfate makes up the largest proportion of the particles in our air—in many regions well over half of the fine particles. Moreover, power plants currently emit two thirds of the sulfur dioxide in the U.S. Therefore, to reduce particulate matter, major reductions in pollution emissions from fossil-fuel power plants are needed.

The hazards of particulate matter have become particularly clear in the past decade's research. Two of the largest landmark studies on particulate matter and death, the Harvard Six Cities Study, published in 1993, followed by the American Cancer Society Study in 1995, demonstrated greater risk of premature death from particulate matter in more polluted cities compared to cities with cleaner air. The Harvard Six Cities study monitored particulate matter and tracked mortality in Six U.S. cities and discovered a 25 percent higher risk between the cleanest city, Portage Wisconsin and the dirtiest, Steubenville Ohio. Fine particles, especially sulfates, were most strongly associated with excess mortality in polluted cities. The American Cancer Society study examined half a million people in over 150 metropolitan areas throughout the United States and found a 17 percent greater relative risk of mortality between the city with the least sulfate and particulate matter and the city with the highest levels of this particulate pollution. The results of these studies were challenged by industry resulting in an independent reanalysis by the Health Effects Institute (HEI)—funded by industry and EPA. HEI found the results to be robust and actually strengthened the associations found by the original investigators.[32]

Thus, the evidence is clear, and has been confirmed independently, fine particle air pollution, and especially those particles emitted primarily by fossil-fuel power plants, are adversely affecting the lives and health of Americans. The importance of these particulate matter-health effects relationships is made clear by the fact that virtually every American is directly impacted by this pollution. Indeed, a recent analyses by Abt Associates using the methodology approved by EPA's independent Science Advisory Board estimated that emissions from power plants alone are responsible for about 30,000 premature deaths per year -- more than from drunk driving or homicides. That same study determined that a 75 percent reduction in power plant sulfur dioxide and nitrogen oxide emissions would result in reduced fine particle levels and avoid over 18,000 premature deaths per year -- more lives than are saved by safety belts each year.[33] The greatest risk is faced by people living in the Midwest and Southeast where the greatest concentrations of coal-fired power plants are located. See Attachment 4.

In addition, recent work by researchers at the Harvard School of Public Health including that summarized in "Risk in Perspective",[34] the journal of the Harvard Center for Risk Analysis, found that the risk from power plant pollution is not evenly distributed geographically. The risk was found to be greatest in relatively close proximity to the power plants: people living within 30 miles of a plant were found to face a risk of mortality from the plant's emissions 2-3 times greater than people living beyond 30 miles do.[35] These "local" impacts suggest that a national "cap and trade" program that allows some plants to escape pollution controls through the purchase of emission credits will not reduce the specific risk posed by those emissions to the surrounding population. This work supports the need for the "birthday bill" provision of the Clean Power Act of 2001 that requires each facility to meet modern pollution standards by a date certain.

These scientific studies have found that the relationship between fine particles and premature mortality is linear -- meaning that every additional ton of pollution we remove from the air will carry an additional, incremental benefit in saving more lives. The chart in Attachment 5 compares the benefits of several power plant bills introduced in the last Congress. With technology available today that can cost-effectively reduce power plant sulfur dioxide emissions by up to 90-95 percent,[36] public health demands that Congress adopt emissions cuts no less stringent than those called for in the Clean Power Act of 2001.

A 75 Percent Reduction in Power Plant Sulfur Dioxide will be Necessary to Regain Pristine Vistas in our National Parks and Wilderness Areas

In the last several decades, visibility – how far you can see on an average day – has declined dramatically, especially in the Eastern half of the United States. In the East, annual mean visibility is commonly one quarter of natural conditions and as little as one-eighth in the summer. One of the greatest casualties of this upsurge in regional haze has been the national parks. An example of the magnitude of visibility decline due to high air pollution levels are shown in the Great Smoky Mountains National Park slide attached to this testimony. See Attachment 6.

There is no question that power plants are the major driver of this problem: visibility impairment has tracked closely in parallel with sulfate and electric power production for nearly half a century. Taken together, sulfur, carbon and nitrogen oxide emissions are responsible for about well over 80 percent of this visibility impairment. When these components are assessed for their contribution to the problem, electric power is accountable for about 2/3 of the emissions that lead to regional haze-related visibility impairment in the East, most of which is caused by sulfate.

Half-measures will not solve the problem of visibility impairment in our nation's parks. EPA has set a long-term goal of eliminating man-made haze by 2060. That goal will never be achieved without steeply cutting power plant emissions consistent with the reduction targets in the Clean Power Act of 2001. Indeed, the cuts in sulfur dioxide to date under the acid rain program have not led to perceptibly improved vistas. Research shows that visibility improves more rapidly with deeper cuts in sulfate. Thus, we will achieve pristine views in those areas shrouded in a sulfate haze only when the deepest cuts in sulfur dioxide emissions have been achieved.

There is concern about haze from other quarters as well. New research is showing that both haze and particulate matter are depressing optimal yields of crops.[37] Yield decreases in the northeastern United States are estimated to be occurring in the 5 – 10 percent range. In the southeast the decrease in optimal yields for summertime crops is likely higher — about 10 – 15 percent.

Nitrogen Oxides

The problems associated with nitrogen oxides include the massive health and ecosystem damage due to ozone smog and nitrogen deposition. Power plants are responsible for about one-quarter of the nitrogen oxides emitted in the U.S. each year.

A 75 percent Reduction is Necessary to Reduce Ozone Smog and Help Attain the New Ozone Standard

Ground level ozone is a colorless, odorless pollutant that causes respiratory damage ranging from temporary discomfort to long-term lung damage. According to a recent study[38], in the Eastern half of the United states, ground level ozone sends an estimated 159,000 people to emergency rooms each summer; triggers 6.2 million asthma attacks, and results in 69,000 hospital admissions. Many more millions of Americans experience other respiratory discomfort. The year 2000 saw one of the worst ozone summers in recent history, with more than 7,000 violations of the federal ozone health standard.

Although much of the controversy around ground level ozone in recent years has centered on ozone levels in the Northeast, and the impact of Midwest and Southern emissions on the Northeast, this misses an important part of the story. ***In fact, many Midwestern and Southeastern states suffer greater ozone exposures and per capita health impacts than many Northeast states.*** According to a recent study by the Ohio Environmental Council, in collaboration with the University of Michigan and Harvard University,[39] for example, people in Ohio River Valley communities such as Cincinnati and Marietta, Ohio are often exposed to dangerous levels of ground level ozone as much as 75 percent ***more*** than people in Boston and New York. Ohio River Valley ozone hospital admission rates also track this pattern – with admission rates higher in the Ohio Valley than in the East. Similarly, some of the nation's highest and most persistent ozone smog violations are outside of the cities, in places considered pristine – places like the Great Smokies (there were an astonishing 52 exceedance days of the 8 hour ozone standard in the Great Smoky Mountains National Park in 1999 where it is now unhealthy to breathe on about half of the days of summer), Door Country, Wisconsin, and the nation's seashore points.[40]

The reason is not hard to discern. There is a high correlation between elevated ground level ozone and proximity to power plants – especially in the Midwest and Southeast where roughly 60 percent of the nation's coal-fired generating capacity is located. In the Ohio Valley area studied, for example, emissions from coal- and oil-fired power plants contribute nearly ***fifty percent*** of elevated ozone levels in the Valley, enough by themselves to cause violations of the federal health standard.[41]

Crop Losses Due to Ozone Smog

Human health is not smog's only victim. There is strong scientific evidence showing that current levels of ground level ozone are reducing yields, particularly in sensitive species — soybean, cotton, and peanuts from NCLAN studies. Annual crop loss from ozone for soybeans alone in Illinois, Indiana and Ohio has been calculated to fall between $198,628,000 – 345,578,000. Ozone-induced growth and yield losses for the seven major commodity crops in the Southeast (sorghum, cotton, wheat barley, corn, peanuts and soybeans) are costing southeast farmers from $213-353 million annually.[42]

Year-Round Reductions of Nitrogen Oxides will be Necessary to Minimize the Effects of Nitrogen Deposition

Power plant nitrogen emissions deposited on land and water — sometimes at great distances from their original sources —is an important contributor to declining water quality.[43] Estuarine and coastal systems are especially vulnerable. Too much nitrogen serves as a fertilizer, causing excessive growth of seaweed. The result is visual impairment and loss of oxygen. With the loss of oxygen, many estuarine and marine species — including fish — cannot survive.[44]

The contribution of nitrogen from atmospheric deposition varies by watershed. In the Chesapeake Bay, atmospheric nitrogen accounts for 27 percent of nitrogen entering the system.[45] Of that amount, power plants account for about a third.

Nitrogen is also being deposited on ocean surfaces many, many miles away from land. Atmospheric nitrogen accounts for 46 to 57 percent of the total externally supplied (or new nitrogen) deposited in the North Atlantic Ocean Basin.[46]

Mercury

A 90 Percent Reduction in Mercury and other Power Plant Toxic Emissions is Necessary to Minimize the Risk to Children

Mercury is another power plant pollutant that poses a threat to human health and the environment**.** Exposure to mercury in the U.S. primarily comes from the consumption of freshwater, estuarine, marine fish and shellfish. Across the U.S., mercury contaminates freshwater and saltwater fish populations, poses health risks to the people and wildlife that consume these fish and threatens the multibillion-dollar recreational and commercial fishing industries. State health departments in over 40 states have issued advisories warning the public about consuming certain species of fish in certain water bodies, eleven states have advisories for every water body and 13 now issue consumption advice for certain marine species. Methylmercury (the form of mercury in fish) is a developmental toxin and poses the greatest hazard during prenatal development. EPA has estimated that 3 million children and 4 million women of childbearing age are exposed to Methylmercury at levels above what EPA considers safe.

Coal-fired power plants are the largest emitters of mercury in the nation - they account for 33 percent of air emissions and have been linked to contamination of the nation's fisheries.[47] (Forty-one states have mercury fish consumption advisories, 11 have statewide advisories.)[48]

People are exposed to mercury primarily through eating contaminated fish. Most at risk is the developing fetus because mercury interferes with the normal development of the nervous system.[49] The fetus is exposed to mercury when the mother eats fish. Infants appear normal during the first few months of life, but later display subtle effects such as poor performance on tests of attention, fine motor function, language, visual-spatial abilities (e.g., drawing), and memory. According to the National Academy of Sciences, these children will likely have to struggle to keep up in school and might require remedial classes or special education.[50]

A recent Centers for Disease Control survey of hair and blood samples found that 10 percent of the women of childbearing age that were tested were above the EPA's safe level for mercury exposure.[51] Nationally, this translates into 6 million women of childbearing age with elevated levels of mercury from eating contaminated fish, and approximately 390,000 newborns at risk of neurological effects from being exposed in utero to elevated levels of mercury.[52]

Mercury pollution has been linked to a number of industrial sources. EPA estimates, however, that about a third of the nation's airborne mercury emissions come from power plant smokestacks; this assessment ignores the likely additional mercury flows coming from power plant solid waste streams. EPA recently determined to regulate mercury from power plants, but industry has challenged that decision in court. Until these regulations go forward, power plants will remain the only large industrial source of mercury that is unregulated.

Power plants emit many other (HAPs) air pollutants. In EPA tests, 67 different HAPs were detected in the flue gas.[53] Of these, 55 are known to be neurotoxic or developmental toxins (i.e., affect development of a child's brain, nervous system or body). Examples include cadmium, manganese and selenium.[54] In addition, 24 are also known, probable or possible human carcinogens.[55] Examples include arsenic, chromium, and beryllium. Power plants rank first in release of toxics to the air - 842 million pounds of chemical releases to the air in 1999 (Toxics Release Inventory).[56] This accounts for 40 percent of the nation's total.

The Clean Power Act of 2001 requires a 90 percent reduction in mercury emissions from power plants by 2007. Can a 90 percent reduction be achieved in this timeframe? Yes. Numerous bench-scale and pilot-scale field studies of sorbent injection technologies developed specifically to capture mercury have demonstrated that removal efficiencies in excess of 90 percent are achievable[57,58.] Recent data collected by the EPA on the mercury capture efficiency of conventional pollution controls illustrates that for some coals and pollution control devices, more than 90 percent of the mercury is already being captured.[59] In particular, for some coals, a combination of nitrogen oxides and sulfur dioxide controls can result in mercury removals ranging from 50 to more than 90 percent.[60,61]

To optimize the mercury capture efficiency of existing technologies the Department of Energy has committed to full-scale demonstration projects that are underway right now. These demonstration projects will be completed between 2002 and 2005 – a consistent timetable for achieving significant mercury reductions by 2007. Previous demonstration projects of emerging technologies have achieved mercury reductions in excess of 80 percent.[62,63] In addition, the EPA states that controlling mercury emissions with multi-pollutant control technologies can be a cost-effective method for collectively controlling multiple pollutants. We believe that mercury legislation is needed as a technology-forcing mechanism and to provide the certainty that regulatory agencies, research groups, industry and equipment vendors need to carry their work through to full-scale commercialization within a reasonable period of time.

Carbon Dioxide

The Power Sector Must Reduce Its Share of Greenhouse Gas Emissions

Carbon dioxide (CO2) is a byproduct of burning fossil fuels such as coal and oil. In a balanced system, carbon dioxide helps regulate the Earth's climate. However, too much carbon dioxide causes excess heat to be trapped in the atmosphere, forcing global temperatures upward, the process known as global warming.

The largest source of carbon dioxide in the United States is the electric power industry, accounting for about 40 percent of all U.S. emissions. Of that, more than 88 percent of power plant emissions come from older, dirtier coal fired facilities. As a result of excessive burning of fossil fuels, carbon dioxide in the atmosphere has increased 30 percent since the start of the industrial revolution, and is expected to continue climbing unless emissions are steadily reduced. If current energy trends continue, our atmosphere will contain twice as much carbon dioxide by 2050 as it did before the industrial revolution.

The Intergovernmental Panel on Climate Change (IPCC) recently detailed the sensitivity, adaptive capacity, the vulnerability of natural and human systems and the potential consequences of climate change in its "Climate Change 2001: Impacts, Adaptation, and Vulnerability" report.[64] For example, the IPCC found that a 5-degree increase in global temperatures over the next century could result in the death or displacement of hundreds of millions of people.[65] The White House, as part of its review of U.S. climate change policy requested the National Research Council to conduct a review of the IPCC report.[66] Among other questions, the White House asked the NRC to assess the likely consequences for the U.S. of climate change. In responding, the NRC relied heavily on the U.S National Assessment of Climate Change Impacts.[67]

Health Effects Associated with Climate Change

The NRC found that climate change has the potential to influence the frequency and transmission of infectious disease, alter heat- and cold-related mortality and morbidity, and influence air and water quality. Changes in the agents that transport infectious diseases (e.g., mosquitoes, ticks, and rodents) were found likely to occur with any significant change in precipitation and temperature. The Assessment tied increases in adverse air quality to higher temperatures. Children, the elderly, and the poor were considered most vulnerable to these adverse health outcomes.[68]

Ecological Impacts Associated with Climate Change

The Assessment found that coastal regions are at greatest risk from sea level rise and to increases in the frequency and severity of storms. Significant climate change will cause disruption to many U.S. ecosystems, including wetlands, forests, grasslands, rivers, and lakes.[69]

Regarding effects on crops, the Assessment found that many crop distributions would change, thus requiring significant adaptations. Such changes were found likely to be more costly to small farmers than large corporate farms. Hotter, drier scenarios increase the potential for declines in both agriculture and forestry.[70]

Two articles in the most recent edition of the journal *Science* mark the first time scientists have computed the likelihood of a specific temperature increase rather than simply offering a range of possibilities. An Intergovernmental Panel on Climate Change committee released a report earlier this year saying a 5-degree increase would make it hot enough to cause severe weather that could kill or displace hundreds of millions of people. According to this latest research, there is a 90 percent chance that global warming will increase the Earth's temperature from 3 to 9 degrees Fahrenheit by the year 2100, and a 50-50 chance that a 5-degree increase will occur.[71]

Climate change cannot be reversed without significant cuts in U.S. emissions that contribute to the greenhouse effect. This was the conclusion that formed the basis for the Framework Convention on Climate Change and the 1992 Rio de Janeiro Treaty. The U.S. Senate unanimously ratified the Rio Treaty on October 7, 1992, shortly after its submission by President Bush. The Rio Treaty committed the US to achieving a "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system." Specifically, the Rio Treaty aimed at reducing carbon dioxide emissions to their 1990 levels by 2000. Obviously, the U.S. has not met the levels set out in the Accord. Instead, carbon dioxide emissions have risen by more than 15 percent since 1990 according to the Energy Information Administration. Any rational plan to curb global warming must include sharp reductions in power plant carbon dioxide emissions. Power system reductions consistent with the Rio targets are included in the Clean Power Act of 2001.

Reductions Appropriate In Federal Policy

In each of the above areas, the best scientific evidence calls for large reductions in emissions:

- In the case of sulfur, cuts of at least 75 percent are suggested by the imperatives of ecosystem recovery; huge health and environmental dividends in the form of fine particle reduction and reduced haze will result as well.
- In the case of nitrogen oxides, ozone smog health impacts are roughly linear, and 75 percent cuts in nitrogen oxides will dramatically reduce summer smog as well as year round nitrogen and acid rain impacts.
- Mercury is highly toxic in small amounts, and, as for other industries, maximum available control thresholds should be pursued.
- While reducing US power plant emissions alone will not solve the world climate change problem, an important start can be made in this sector. Reductions consistent with the nation's Rio treaty commitments – a return to 1990 levels – are an appropriate starting point.

Fortunately, the technology is at hand to dramatically reduce these power plant emissions and their resultant impacts throughout the nation, at reasonable costs. For example:

- Power sector reductions of sulfur dioxide of 75 percent beyond current law are readily achievable through a combination of flue gas desulfurization (scrubbing), use of cleaner fuels, and greater commitment to energy efficiency and renewable resources.
- Year round nitrogen reductions of 75 percent or more are achievable through selective catalytic and non-catalytic reduction technology, low NOx burners, overfire air, and use of cleaner fuels, and greater commitment to energy efficiency and renewable resources.
- Power sector reductions of mercury in the range of up to 90 percent are currently feasible with some coals, and reductions of 90 percent or more from all coals appear commercially viable within the time horizon contemplated by the Clean Power Act of 2001. Technical means include coal cleaning, sulfur dioxide and nitrogen oxides scrubbing co-benefits, fabric filters, carbon sorbent injection, and adoption of cleaner fuels.
- The buildup of carbon dioxide and other heat-trapping gases in the atmosphere is primarily responsible for the unprecedented global warming seen over the last 50 years, according the National Research Council. As the Council recently concluded, the adverse health and environmental impacts of climate change are real. The largest source of carbon dioxide in the United States is the electric power industry, accounting for 40 percent of all U.S. emissions. Of that, more than 88 percent of power plant emissions come from older, less efficient coal-fired facilities. Any rational policy dealing with the U.S. contribution to climate change must include power sector carbon reductions. Capping power sector emissions of carbon dioxide at 1990 levels, in accord with the Rio Treaty, is technically feasible. This will require an expansion of the nation's use of energy efficiency, clean renewable and gas-fired energy sources, and potentially the use of advanced coal technologies.

The Time For Action Is Here

The discussion we are having today is hardly new. It goes back at least to 1995, when EPA initiated its "Clean Air Power Initiative" designed to bring stakeholders together around a comprehensive set of pollution reductions. For a variety of reasons, that initiative never came to a consensus conclusion.

However, much has changed in the last five years to change the landscape:

- The science underlying reduction targets for acid rain, fine particles, haze and mercury has become more compelling.

- Many states have moved ahead of the federal Clean Air Act. Recently, for example, Massachusetts, Connecticut, and Texas have adopted regulations that will chop air pollution from grandfathered power plants by up to 75 percent. In Illinois, legislation has passed that will require promulgation of similar regulations by 2002. Such a measure has passed one house of the state legislatures in North Carolina and New York. While demonstrating leadership, however, the effectiveness of state action will be limited by transboundary impacts

- Public opinion is increasingly supportive of steep power plant emission cutbacks. Opinion leaders throughout the Midwest and Southeast have voiced a concern about current emission levels, as evidenced by many recent newspaper editorials.

- Many voices in industry are recognizing the value of a comprehensive multi-pollutant approach including carbon dioxide, rather than a balkanized approach – and the wisdom where possible of not throwing good money after bad.

ENDNOTES

[1] US EPA 1995. Acid Deposition Standard Feasibility Study Report to Congress. EPA 430-R-95-001a. http://www.epa.gov/acidrain/effects/execsum.html

[2] National Acid Precipitation Assessment Program (NAPAP). 1998. Biennial Report to Congress: an Integrated Assessment. http://www.nnic.noaa.gov/CENR/NAPAP/NAPAP_96.htm

[3] Heard, R.M., W.E. Sharpe, R.F. Carline and W.G. Kimmel. 1997. Episodic acidification and changes in fish diversity in Pennsylvania headwater streams, Transactions Am. Fisheries Soc. 126: 977-984.

[4] Dehayes, Donald H., P.G. Schaberg, G.J.. Hawley and G.R. Strimbeck. 1999. Acid Rain Impacts on Calcium Nutrition and Forest Health— Alteration of Membrane-Associated Calcium Leads to Membrane Destabilization and Foliar Injury in
Red Spruce. BioScience: 49(10).

[5] USGS. 1999. Soil-Calcium Depletion Linked to Acid Rain and Forest Growth in the Eastern United States. http://bqs.usgs.gov/acidrain/

[6] US Forest Service. 1997. Forest Service and Air Management. George Washington and Jefferson National Forests. http://svinet2.fs.fed.us:80/gwjnf/airpollution.html

[7] Haines, T.A., S.A. Norton, J.S. Kahl, C.W. Fay, and S.J. Pauwels. 1990. Intensive studies of stream fish populations in Maine. Ecological Research Series. U.S. Environmental Protection Agency. Washington, D.C. 354 pp.

[8] Baker, J.P., J. Van Sickle , C.J. Gagen, D.R. DeWalle, W.E.Sharpe, R.F. Carline, B.P. Baldigo, P.S. Murdoch, D.W. Bath, W.A. Kretser, H.A. Simonin, and , P.J.Wigington. 1996. Episodic Acidification of Small Streams in the Northeastern United States: Effects on Fish Populations. Ecological Applications 6(2): 422-437.

[9] Driscoll, C.T., Lawrence, GB, Bulger, AT, Butler, TJ, Cronan, CS, Eagar, C, Lambert KF, Likens, GE, Stoddard, JL and Weathers KC, 2001. Acidic deposition in the Northeastern United States: Sources, inputs, ecosystem effects and management strategies. Bioscience. 51(3).

[10] Heard, R.M., W.E. Sharpe, R.F. Carline and W.G. Kimmel. 1997. Episodic acidification and changes in fish diversity in Pennsylvania headwater streams. Transaction Am. Fisheries Soc. 126:977-984.

[11] Sharpe, William and Joy R. Drohan, eds. 1998, The Effects of Acidic Deposition on Pennsylvania's Forests. Proceedings of the 1998 PA Acidic Deposition Conference. Vol. 1. Environmental Resources Research Institute, University Park, PA.

[12] Bulger, A.J., B.J. Cosby, C.A. Dolloff, K.N. Eshleman, J.R. Webb, and J.N. Galloway. 2000. *Shenandoah National Park: Fish in Sensitive Habitats Final Report*. University of Virginia and Virginia Polytechnic Institute and State University. Report to the National Park Service, Coop Agreement CA-4000-2-1007.

[13] Bulger, A.J., B.J. Cosby, and J.R. Webb. 2000. Current, reconstructed past, and projected future status of brook trout (salvelinus fontinalis) streams in Virginia. Canadian Journal of Fish and Aquatic. Sci 57: 1515-1523.

[14] Cook, R.B., J.W. Elwood, R.R. Turner, M.A. Bogle, P.J. Mulholland, and A.V. Palumbo. 1994. Acid-base chemistry of high-elevation streams in the Great Smoky Mountains. Water, Air and Soil Pollution 72:331-356.

[15] DeFelice, T.P. 1997. Investigation of wet acidic deposition episodes capable of damaging Red Spruce in the Mt. Mitchell State Park. Atmospheric Research. 43: 325-344.

[16] McLaughlin, S, J. D. Joslin; W. Robarge, A. Stone, R. Wimer and S. Wullschleger. 1998. The impacts of acidic deposition and global change on high elevation southern Appalachian spruce-fir forests. *From* The productivity and sustainability of southern forests ecosystems in a changing environment. Springer-Verlag, New York: 255-277.

[17] Huntington, Thomas. 2000. The Potential for Calcium Depletion in Forest Ecosystems of Southeastern United States: Review and Analysis. 14(2) 623-638.

[18] Watt, W.D., C.D. Scott, P.J. Zamora and W.J. White. 2000. Acid Toxicity Levels in Nova Scotian Rivers have not Declined in Synchrony with the Decline in Sulfate Levels. Water Air and Soil Pollution. 118(3-4): 203-229.

[19] Environment Canada, 1997. Canadian Acid Rain Assessment, Volume 3. The Effects on Canada's Lakes, Rivers and Wetlands.

[20] Jeffries, D.S., D.C.L. Lam, I. Wong, and M.D. Moran, 2000. Assessment of Changes in the Lake pH in Southeastern Canada Arising from Present Levels and Expected Reductions in Acidic Deposition. Can. J. Fish Aquat. Sci. 57(Suppl2): 40-49.

[21] Duchesne, D. Houle and P.A. Arp. 2000. Critical Loads and Exceedances of Acid Deposition and Associated Forest Growth in the Northern Hardwood and Boreal Coniferous Forests in Québec, Canada. Water Air Soil Pollution

[22] Stoddard, J.L.; D.S. Jeffries; A. Lükewill; T.A. Clair; P.J. Dillon; C.T. Driscoll; M. Forsius; M. Johannessen; J.S. Kahl; J.H. Kellog; A. Kemp; J. Mannio; D.T. Montelth; P.S. Murdoch; S. Patrick; A. Rebsdorf; B.L. Skjelkvåle; M.P. Stainton; T. Traaen; H. van Dam; K.E. Webster; J. Wieting and A. Wilander. 1999. Regional Trends in Aquatic Recovery from Acidification in North America and Europe. Nature. 401: 575-579.

[23] "Acid Rain Revisited: Advances in Scientific Understanding Since the Passage of the 1970 and 1990 Clean Air Act Amendments, Hubbard Brook Research Foundation (2000); Driscoll, Charles T., et al., Acid Deposition in the Northeastern U.S.: Sources and Inputs, Ecosystems Effects, and Management Strategies. BioSience. Vol. 51, no. 3; Likens, G.E., C.T. Driscoll and D.C. Buso. 1996. Science. Long-Term Effects of Acid rain: Response and Recovery of a Forest Ecosystem. 272: 244-46.

[24] Driscoll, C.T, supra.

[25] Ibid.

[26] Cosby, B.J. and T.J. Sullivan. 1998. Final Report: Application of the MAGIC Model to Selected Catchments: Phase I, Southern Appalachian Mountain Initiative (SAMI).

[27] Munson, R.K. 1998. Application of the NuCM Model to Noland Divide, White Oak Run and Shaver Hollow for SAMI Phase I. Final Report.

[28] The Acidifying Emissions Task Group. 1997. Towards a National Acid Rain Strategy submitted to the National Air Issues Coordinating Committee.

[29] Gold, D. et al., "Ambient Pollution and Heart Rate Variability," Circulation, v. 101, 1267-1273, American Heart Association (March 21, 200); Peters, A. et al., "Increases in Heart Rate Variability During an Air Pollution Episode," 150 American Journal of Epidemiology, p. 1094-1098 (1999); Peters, A. et al., "Air Pollution and Incidence of Cardiac Arrhythmia," 11 Epidemiology, no. 1, p. 11-17 (2000); Schwartz, J., "Air Pollution and Hospital Admissions for Heart Disease in Eight U.S. Counties, 10 Epidemiology 17-22 (1999).

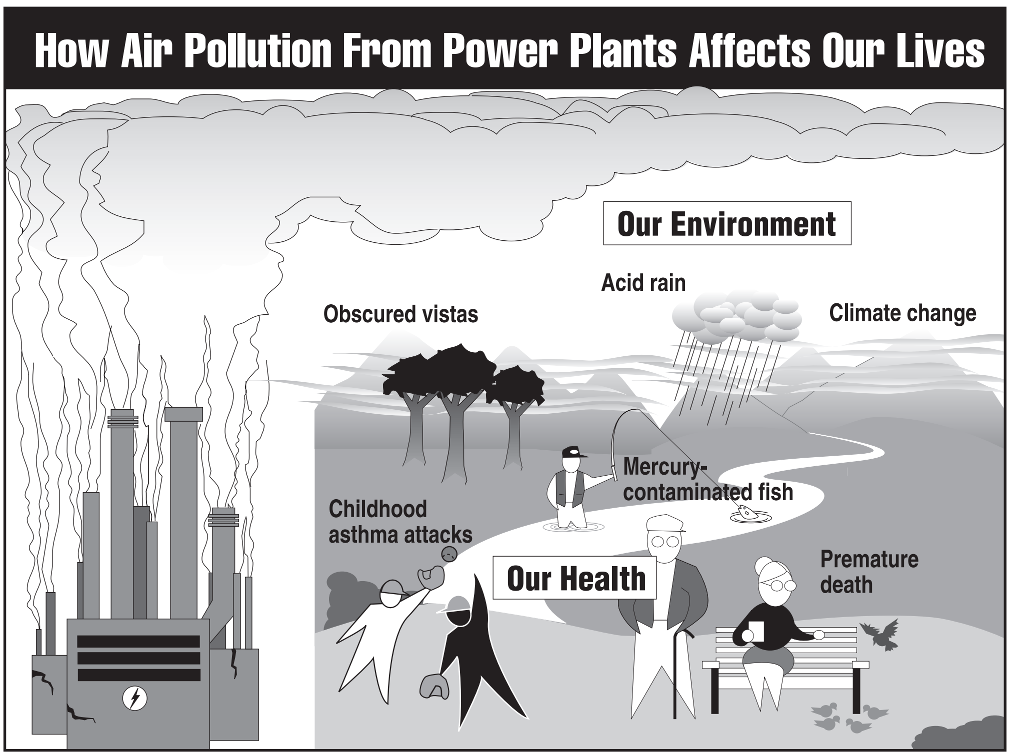
[30] Pope, C.A., "Epidemiology of Fine Particulate Air Pollution and Human Health: Biologic Mechanisms and Who's at Risk?" 108 Env. Health Persp. (Supp 4) 713-723 (August 2000).

[31] Thurston, George, "Determining the Pollution Sources Associated with PM Health Effects," Air And Waste Management Association (January 1998); Laden F, Neas LM, Dockery DW, Schwartz J. Association of fine particulate matter from different sources with daily mortality in six U.S. cities. Environ. Health Perspect. 108: 941-947(2000).

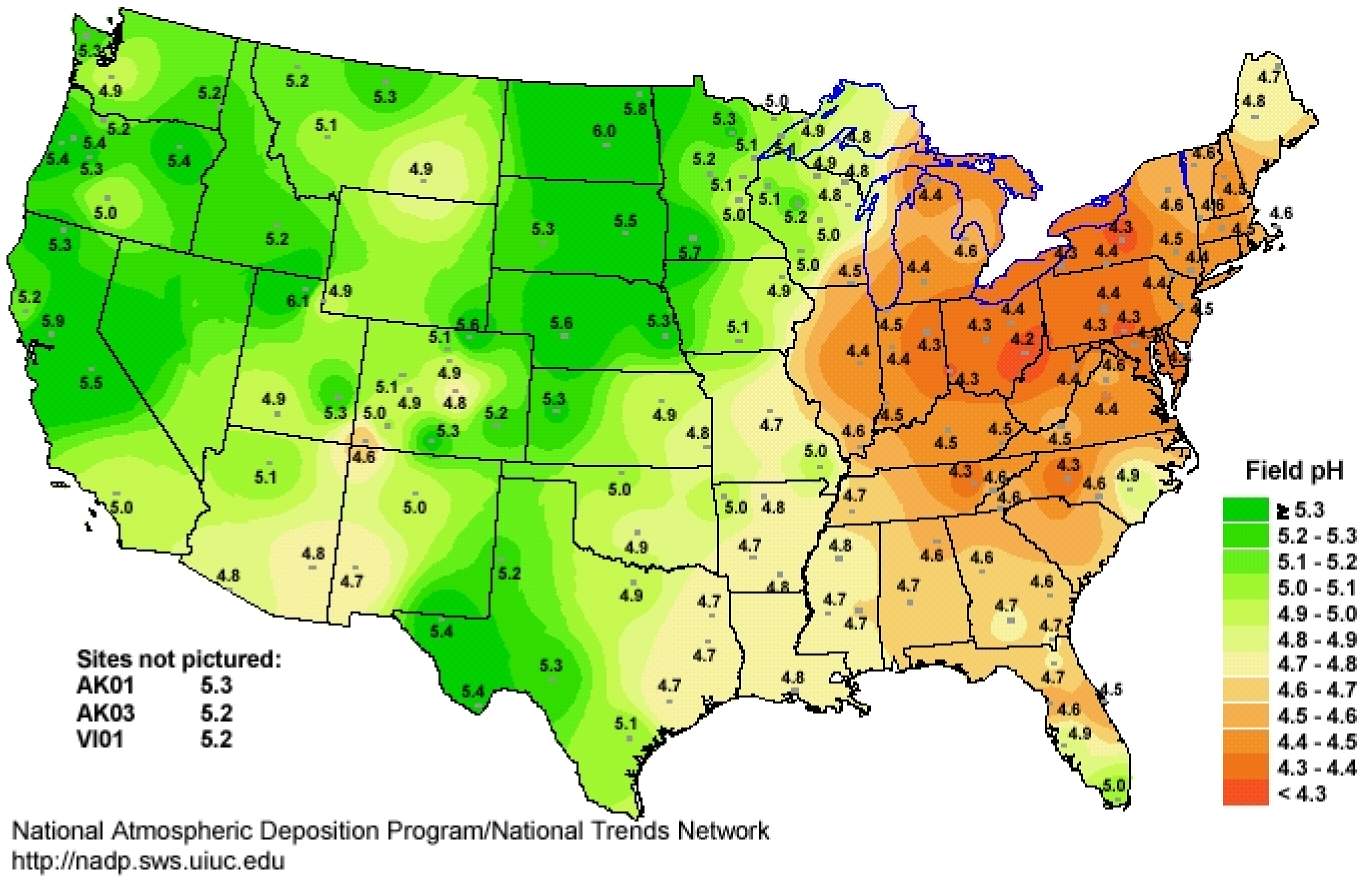
[32] Krewski, D., Burnett, R.T. Goldberg, M.S., Hoover, K., Siemiatycki, J., Jerrett, M., Abrahamowicz, A. and White, W.H., "Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Matter and Mortality," Health Effects Institute, Cambridge, MA (2000).

[33] "Death, Disease, and Dirty Power," Clean Air Task Force (2000); "The Particulate-Related Benefits of Reducing Power Plant Emissions," Abt Associates (2000).
[34] Levy, J. and Spengler, J., "Health Benefits of Emissions Reductions From Older Power Plants," Risk in Perspective/Harvard Center for Risk Analysis Vol. 9, Issue 2 (April 2001).
[35] Levy, J., Spengler, J., Hlinka, D. and Sullivan, D., "Estimated Public Health Impacts of Criteria Pollutant Air Emissions from the Salem Harbor and Brayton Point Power Plants." Available online at www.hsph.harvard.edu
[36] Srivastava, R.K. (2000) EPA ORD Control of SO2 Emissions: An Analysis of Technologies. EPA/600R-00/093.
[37] Chameides, W.L., H. Yu, M. Bergin, X. Zhou, L. Meqarns, G.Wang, C.S. Kiang, R.D. Saylor, C. Luo, Y. Huang, A. Steiner and F. Giorgi. 1999. Case Study of the Effects of Atmospheric Aerosols and Regional Haze on Agriculture: An Opportunity to Enhance Crop Yields in China through Emission Controls? PNAS. 96(24): 13626-13633.
[38] Abt Associates, "Out of Breath: Adverse Health Effects Associated with Ozone in the Eastern United States," Abt Associates (October 1999).
[39] "Ozone Alley," Ohio Environmental Council (2000).
[40] "No Escape: Can You Really Ever 'Get Away' from the Smog?" Clean Air Network and Clean Air Task Force (August 1999).
[41] "Ozone Alley" supra.
[42] Production and yield figures come from 1997 United States Department of Agriculture, National Agricultural Statistics Service. Ozone impact data comes from EPA 1996. Office of Air Quality Planning and Standards Staff Paper. Review of National Ambient Air Quality Standards for Ozone. EPA-452/R-96-007.
[43]US EPA 1999 Office of Water, Oceans and Coastal Protection Division, Air Pollution and Water Quality, Atmospheric Deposition Initiative http://www.epa.gov/owow/oceans/airdep/
[44] US EPA 1997. Deposition of Air Pollutants to the Great Waters. Second Report to Congress, Office of Air Quality Planning and Standards. http://www.epa.gov/oar/oaqps/gr8water/2ndrpt/execsumm.html
[45] Valigura, Richard, Winston Luke, Richard Artz and Bruce Hicks. 1996. Atmospheric Nutrient Input to Coastal Areas. Reducing the Uncertainties. National Oceanic and Atmospheric Administration Coastal Ocean Program.
[46] Paerl, Hans, 1999. Atmospheric Nitrogen in North Atlantic Ocean Basin. Ambio (Royal Swedish Academy of Sciences Journal) (June 1999). Summary online: http://www.seagrantnews.org/news/19990630_n.html
[47] U.S. EPA, 1997. Mercury Study Report to Congress: Volume I Executive Summary. December. EPA 452/R-97-003.
[48] http://www.epa.gov/ost/fish
[49] U.S. EPA, 1997b. Mercury Study Report to Congress, Volume VII: Characterization of Human and Wildlife Risks from Mercury Exposure in the United States. EPA-452/R-97-009.
[50] Toxicological Effects of Methylmercury, National Academy Press, Washington, DC, 2000. http://www.nap.edu
[51] U.S. Centers for Disease Control and Prevention. Blood and hair mercury levels in young children and women of childbearing age - United States, 1999. Morbidity and Mortality Weekly, March 2, 2001.
[52] Derived from 1990 census data. http://www.census.gov
[53] U.S. EPA, 1998. Study of hazardous air pollutant emissions from electric utility steam generating units – final report to Congress. February. 453/R-98-004a.
[54] National Environmental Trust (NET), et al. 2000. Polluting Our Future: Chemical Pollution in the U.S. that Affects Child Development and Learning. September. www.environet.org.
[55] U.S. EPA, 1998. Study of hazardous air pollutant emissions from electric utility steam generating units – final report to Congress. February. 453/R-98-004a.
[56] U.S. EPA, 2001. 1999 Toxics Release Inventory – Public Data Release. www.epa.gov/tri
[57] U.S EPA, Mercury Study Report to Congress, Volume VIII, EPA–452/R-97-010, December, 1997.
[58] Northeast States for Coordinated Air Use Management. Environmental regulation and technology innovation: controlling mercury emissions from coal-fired boilers. September 2000.

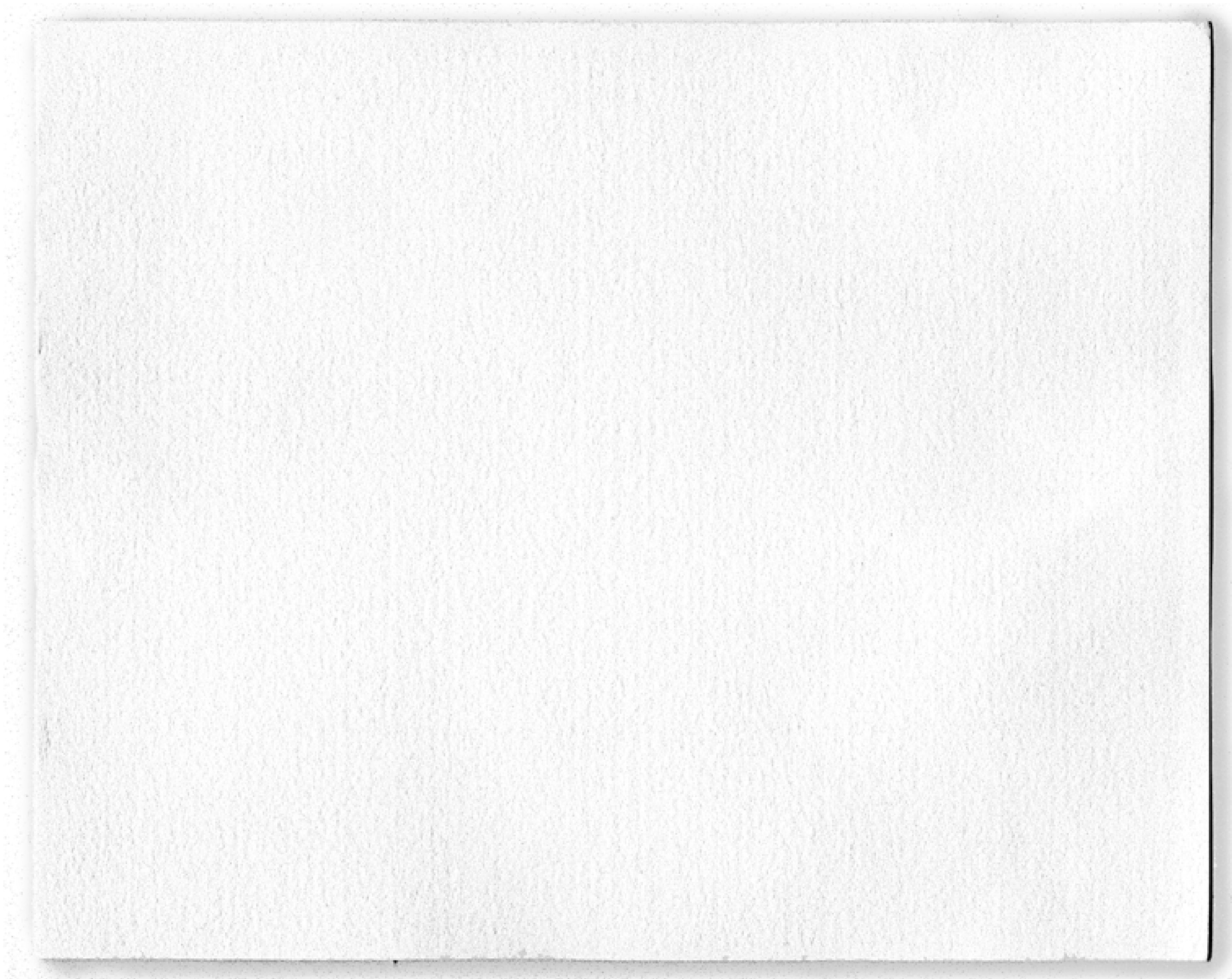
[59] Kilgroe, J. D. and R. K. Srivastava. EPA studies on the control of toxic air pollution emissions form electric utility boilers. Environmental Management, January 2001.
[60] Gutberlet et. al. (1992). Measurement of the trace element mercury in bituminous coal furnaces with flue gas cleaning plants. As cited in Sloss, L. 1995. Mercury emissions and effects – the role of coal. IEA Coal Research, United Kingdom.
[61] Kilgroe, J. D. and R. K. Srivastava. EPA studies on the control of toxic air pollution emissions form electric utility boilers. Environmental Management, January 2001.
[62] Pavlish, J.H. and M.D. Mann, An economic basis for developing mercury control strategies. Energy and Environmental Research Center, University of North Dakota. Presented at Power-GEN International, Orlando, Florida, December 9-11, 1998.
[63] Powerspan Press Release, August 23, 2000. Powerspan Corp.'s ECO Technology Demonstrates Unmatched Reductions in Mercury and Fine Particulate Matter.
[64] International Panel on Climate Change, "Climate Change 2001: Impacts, Adaptations, and Vulnerability -- Summary for Policymakers (February 2001);
[65] Ibid.
[66] "Climate Change Science: An Analysis of Some Key Questions," Committee on the Science of Climate Change, Division of Earth and Life Studies, National Research Council (National Academy Press 2001).
[67] U.S. National Assessment. U.S. Global Change Research Program, "Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change", 2001 Cambridge University Press.
[68] Ibid.
[69] Ibid.
[70] Ibid.
[71] Wigley, T.M.L, and Raper, S.C.B., "Interpretation of High Projections for Global-Mean Warming " Science (July 2001); Goldenberg, Stanley B., Christopher W. Landsea, Alberto M. Mestas-Nunez, and William M. Gray, "The Recent Increase in Atlantic Hurricane Activity: Causes and Implcations," Science (July 2000).


How Air Pollution From Power Plants Affects Our Lives
Our Environment
Acid rain
Obscured vistas
Climate change
Mercury-
contaminated fish
Childhood
asthma attacks
Our Health
Premature
death

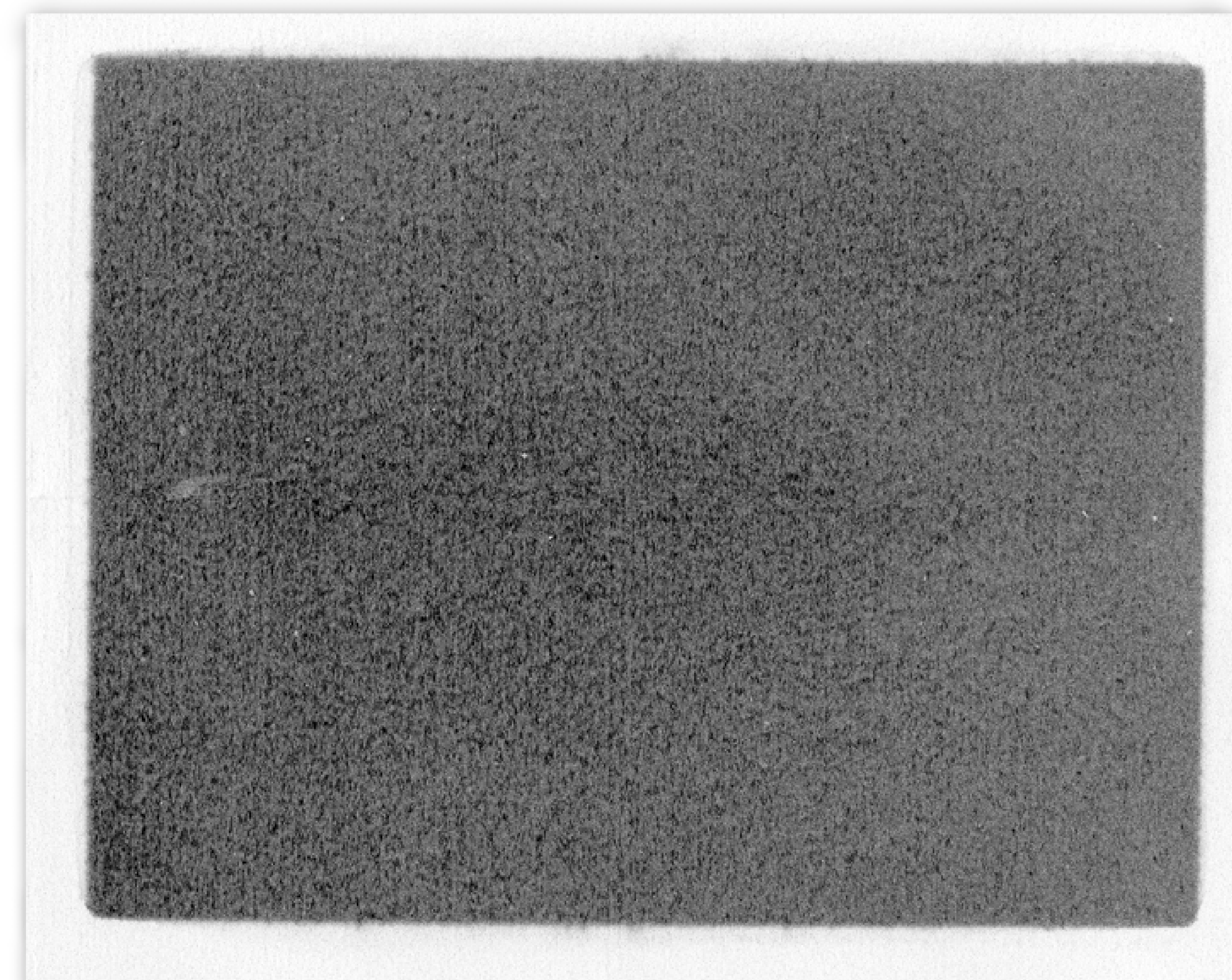
Acidity of deposition, in pH



Particulate Matter Monitor Filters



Clean



Exposed 24 hours

Portland, Maine
1/7/93
48 ug/m3

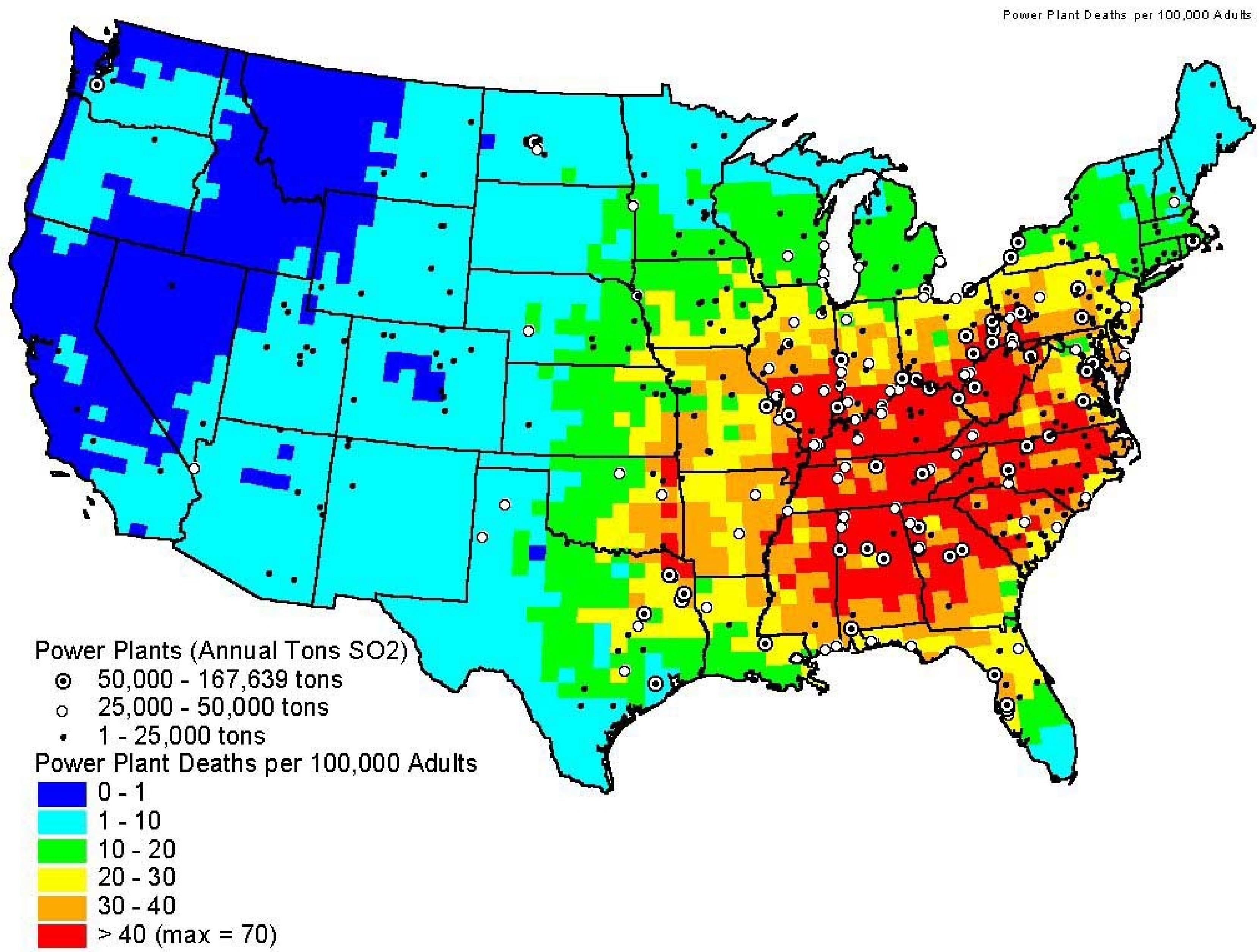
Source: Maine DEP

Comparative Benefits

Avoided Health Endpoints	S 172 (Moynihan)	HR 2569 (Pallone)	S 1369 (Jeffords)
SO_2 Cap (million TPY)	4.50	4.00	3.24
Percent Below 1990 CAAA	50	55	64
Mortality	10,600	13,000	18,700
Total (all) Health Benefit	$60 billion	$75 billion	$111 billion
Visibility Benefits	$1 billion	$1 billion	$3 billion
Total Benefits	*$61 billion ($1997)*	*$76 billion ($1997)*	*114 billion ($1999)*

Greater Emissions Reductions Yield Greater Benefits

Clean Air Task Force
77 Summer Street, Boston, MA 02110
Tel: (617) 292-0234
Fax: (617) 292-4933


Power Plant Deaths per 100,000 Adults
Power Plants (Annual Tons SO2)
50,000 - 167,639 tons
25,000 - 50,000 tons
1 - 25,000 tons
Power Plant Deaths per 100,000 Adults
0 - 1
1 - 10
10 - 20
20 - 30
30 - 40
> 40 (max = 70)

Great Smoky Mountains National Park

Examples of hazy and clear days. On the haziest days, sulfates account for over 80% of the visibility impairment (Photos: IMPROVE/NPS)