Chapter 6

Policy Options

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This chapter presents options for congressional action on acid deposition and other transported air pollutants. As background, it first describes existing Federal statutes relating to transported air pollutants, and summarizes the legislative proposals introduced during the 97th and 98th Congresses.

CURRENT LAW AND RECENT LEGISLATIVE PROPOSALS

The present Clean Air Act is designed to control ***airborne concentrations*** of pollutants that endanger public health and welfare. The act requires EPA to set National Ambient Air Quality Standards (NAAQS), and makes each State responsible for bringing its air pollutant concentrations down to or below the NAAQS. * Despite these limitations on allowable concentrations, large quantities of pollutants are still emitted and eventually deposited. Provisions were added to the act in 1977 to prohibit a State's emissions from contributing to violations of NAAQS ***in other States,*** or to any pollution problem ***in other countries.*** These provisions, however, appear to be ineffective for dealing with problems of the geographic scope of acid deposition.

The act further restricts ***future*** emissions by placing stringent emission limits on new sources of pollution, such as electric utilities and motor vehicles. These New Source Performance Standards (NSPS) are expected to achieve reductions in total emissions within 30 to 50 years. Continuing emissions from both old and new sources, however, will maintain or increase pollution levels during the next few decades unless additional controls are mandated.

To date, congressional action on acid deposition has been limited to funding research. The Acid Precipitation Act of 1980—Title VII of the Energy Security Act, Public Law 96-294—created an Interagency Task Force to conduct a comprehensive 10-year assessment of the causes and consequences of, and means and costs of controlling, transported acidic pollutants, The Task Force presented an Assessment Plan to Congress in June 1982. Under the plan, Congress would receive policy-related "integrated assessments' between 1987 and 1989.

Several bills were introduced during the 97th and 98th Congresses to accelerate the research program from 10 to 5 years; another bill would direct the Task Force to report to Congress on the progress of research, and provide recommendations for action, once every 2 years. Options for making the research plan more responsive to congressional (and potentially, regulatory) needs are presented later in this chapter under "Approach C: Modifying the Federal Acid Deposition Research Program.

Legislators have also introduced a variety of proposals to control acid deposition directly. Many would establish a 31-State control region, and mandate reductions of annual sulfur dioxide emissions in the region by 8 to 12 million tons below actual 1980 emission levels by the early 1990's. Individual States would be allocated reductions through formulas based primarily on utility sulfur dioxide emission rates. Variations on this approach include designating a smaller, 22-State control region, designating a 48-State control region, establishing a trust fund to pay some or all of the costs of emissions reductions, allocating reductions by considering ***both*** utility and industrial emissions, and allowing 2 tons of nitrogen oxides emissions to be substituted for each required ton of sulfur dioxide emissions reductions.

The bills vary in their treatment of new sources of emissions; some allow emissions from post-1980 sources to increase total emissions in the region, while others require further reductions to offset new emissions. Options for controlling the sources of

"National Ambient Air Quality Standards currently exist for six pollutants: sulfur dioxide, nitrogen dioxide, ozone, total suspended particulate, carbon monoxide, and lead.

transported air pollutants are discussed under ' 'Approach A: Mandating Emissions Reductions. "

Bills addressing other aspects of transported pollutants have also been introduced during the 97th and 98th Congresses. For example, several bills would tighten nitrogen oxide emission standards for utility and mobile sources, accelerate development of innovative pollution control technologies, and provide Federal funding to lime acid-altered bodies of water that have ceased to support some fish species. Alternatives for implementing the last of these proposals are presented under "Approach B: Liming Lakes and Streams. "

Bills have also been introduced to amend the interstate and international provisions of the Clean Air Act. Clarifying the scope of these provisions could aid States, EPA, and affected foreign countries in dealing with transboundary pollution problems other than acid deposition—in particular, mid-distance transport of air pollution currently regulated under the act. Options for amending these sections of the current law are presented under "Approach D: Modifying the Existing International and Interstate Sections of the Clean Air Act.

APPROACHES AND OPTIONS

This section presents congressional options for addressing acid deposition and other transported air pollutants, grouped according to four major approaches:

- Approach A: Mandating emissions reductions to further ***control the sources*** of transported pollutants;
- Approach B: Liming lakes and streams to mitig***ate some of the effects*** of acid deposition;
- Approach C: Modifying the Federal acid deposition research program to provide ***more timely*** guidance for congressional decisions; and
- Approach D: Modifying existing sections of the Clean Air Act to ***enable-EPA, States, and countries to more effectively address transported pollutants other than acid deposition.***

Congress could choose to adopt some or all of these approaches in considering clean-air legislation. A comprehensive strategy for addressing transported air pollutants might well include options from all four approaches. The four are described below, along with their respective options.

APPROACH A: Mandating Emissions Reductions

Discussion:

Additional legislated emissions reductions could range from modest, possibly interim, reductions to offset expected future emissions growth, to large-scale control programs. In choosing an appropriate program, Congress will need to weigh the risks of potential resource damage against those of inefficient control expenditures. These decisions are complicated by the scientific uncertainties, disagreement over values, and distributional issues discussed throughout this report.

Mandating further emissions reductions would require Congress to make a number of interrelated choices. These include decisions about which pollutant emissions to reduce, from what source regions, by how much, and over what time period. Congress would also need to choose specific policy mechanisms to implement the reductions, allocate their costs, and address undesired secondary consequences of emissions reductions.

OTA has outlined a series of eight control-policy decisions that must be made in order to design acid deposition control legislation. These are summarized below, to provide the framework for considering three representative emissions control options presented at the end of this section. Chapter 7 discusses the eight control-policy decisions in greater detail, and presents options available to Congress under each decision area.

- ***Which Pollutants Should Be Further Controlled?***

Three pollutants are potential candidates: sulfur dioxide, nitrogen oxides, and hydrocarbons. Sulfur dioxide and nitrogen oxides (and their transformation products) are major sources of acidity to the environment. In the ***Eastern*** United States, sulfur compounds annually contribute about twice as much acidity to precipitation as nitrogen compounds. Moreover, during most times of the year, plants use much of the deposited nitrogen as a nutrient, making sulfur compounds responsible for a still larger share of acidity reaching water bodies. For these reasons, any control program for the Eastern United States would have to include provisions for reducing sulfur dioxide emissions.

If desired, additional resource protection can be achieved by also mandating reductions of nitrogen oxides emissions. Nitrogen oxides emissions are expected to increase more rapidly over the next few decades than sulfur dioxide emissions. During springtime snow melt, both sulfur and nitrogen compounds accumulated in the snow over the winter can reach water bodies unimpeded. In the West, nitrogen compounds may contribute as much as or more acidity to precipitation than do sulfur compounds, and thus should be considered if a nationwide control program is enacted.

Hydrocarbons can affect the geographic distribution of acid deposition. The atmospheric chemistry involved, however, is not sufficiently understood to "fine-tune' a sulfur dioxide or combined sulfur dioxide and nitrogen oxides control program with hydrocarbon emissions control.

- ***How Widespread Should a Control Program Be?***

Four regions are potential candidates for emissions reductions, starting with the Northeastern United States and expanding southward and westward: 1) the approximately 2 l-State Northeastern region receiving the greatest levels of acid deposition; 2) a 31-State region (all States east of and bordering on the Mississippi River), incorporating a band of States around the region of greatest deposition; 3) a 37-State region, including all States east of the Rocky Mountains; and 4) the contiguous 48 States.

About 65 percent of the Nation's sulfur oxides and 45 percent of its nitrogen oxides are emitted in the 2 l-State region east of the Mississippi and north of and including Tennessee and North Carolina. About 85 percent of the Nation's sulfur oxides and 65 percent of nitrogen oxides are emitted in the 31-State region.

- ***What Level of Pollution Control Should Be Required?***

The congressional choice of how much pollution to eliminate must, of necessity, be based on incomplete information. Expected resource-protection benefits, control costs, and other potential risks and benefits are concerns that must be balanced to determine the socially desirable level of emissions reductions. The ***costs*** of various levels of control are relatively well-known, but only a few reference points are available for assessing the potential ***benefits*** of further emissions control.

An acid deposition control program could range in size from one that would prevent future increases in emissions—eliminating about 2 to 3 million tons of the 22 million tons of sulfur dioxide emitted annually in the Eastern 31-State region to offset expected growth through the year 2000—to one that would achieve large-scale reductions below current levels. Eliminating about 11 to 12.5 million tons of sulfur dioxide per year might be considered the upper end of this range; mandating even larger emissions reductions would require most ***existing*** utilities to adopt more stringent emissions controls than those governing emissions sources subject to NSPS.

Reducing sulfur dioxide emissions in the eastern United States by 8 to 10 million tons per year below current levels would probably protect all but the most sensitive aquatic resources in many areas receiving high levels of acid deposition, but not in those areas receiving the greatest amounts. Risks of damage to sensitive forests, materials, and crops would also be reduced. In addition, airborne fine-particle levels would be lower, improving visibility and reducing risks to human health. Such reductions— near the upper end of the feasible range— would cost about $3 to $6 billion per year, depending on the design of the control program. Costs would rise steeply if greater resource protection were desired; both control costs and the amount of resource protection would be less with lower emissions reductions.

About 2 to 5 million tons of sulfur dioxide emissions per year could probably be eliminated for about $1 billion per year or less. This would certainly be enough to prevent emissions from increasing through 2000 (i. e., offset expected industrial and utility growth), and could potentially decrease emissions 2 to 3 million tons below current levels by 2000. Risks of damage to sensitive aquatic resources, forests, agriculture, materials, and health would be reduced, but at present it is impossible to gauge by how much.

Congress could either specify the level of emissions reductions directly or state the policy goals to be met and instruct the Administrator of EPA to set the level of reductions.

• ***By What Time Should Reductions Be Required?***

A congressional decision to require further controls is likely to take at least 6 or 7—possibly 10 or more—years to implement. Extensive Federal, State, and source-level planning will be required even before the contract and construction stages begin. Smaller levels of emissions reductions, if achieved primarily through fuel switching, might be implemented somewhat more quickly.

Alternatively, Congress might decide to wait for guidance from the National Acid Precipitation Assessment Program, thereby delaying controls an additional 4 to 6 or more years. Additional risks of resource damage would result from such a delay, but current understanding does not allow their quantification.

Congress could also direct Federal and State officials to begin control planning now, but make the contract and construction phase ***conditional*** **on the** results of further research. Control programs could be modified or specific implementation plans changed as late as about 2 years before the compliance date, at which point major construction expenditures would have to begin.

• ***What Approach to Control Should Be Adopted?***

Existing environmental regulations focus on either: 1) pollution sources, i.e., directly regulating total emissions or emission rates from sources or regions; or 2) pollutant exposure, i.e., setting goals or standards to limit human or environmental exposure to pollutants.

The first approach, a source-oriented control program, could be implemented now, either by directly limiting emissions or emission rates or by requiring the use of control technologies.

Controlling acid deposition through the second approach would require a well-developed understanding of the transport, transformation, fate, and effects of pollutants. Such knowledge—accurate enough for a receptor-based regulatory program—does not yet exist for acid deposition. By the mid-1990's, however, models and similar tools might have accuracy sufficient for designing a receptor-based approach on a ***regional scale*** **(i.e.,** with emissions reductions allocated to State-size or larger areas).

. ***How Should Emissions Reductions Be Allocated?***

Congress could limit emissions directly by: 1) mandating a reduction formula that applies to all or a subset of ***individual sources*** within a control region; or 2) allocating emissions reductions to ***States,*** allowing the States to allocate source-level cutbacks within their borders. Alternatively, Congress could direct EPA to allocate emissions reductions to meet specified congressional goals.

Policy considerations pertinent to designing an allocation formula include: "Who is to gain the benefit of resource protection and who is to bear the burden of reductions?" and "How administratively and economically efficient is the plan?' Most legislative proposals to date have been based on: 1) ***emission rates (i. e.,*** sulfur dioxide emitted per quantity of fuel burned) in order to reduce emissions most cost effectively, and 2) ***utility emissions only,*** to reduce the administrative complexity of determining each State's share. While fairly accurate data are available on the 70 percent of Eastern sulfur dioxide emissions from utilities, emissions from other sectors are difficult to estimate accurately.

Chapter VII and appendix A review a number of allocation approaches, some based on ***total*** State emissions, some on a State's utility emissions alone. Each allocation formula varies in the resulting geographic pattern of emissions reductions, total costs for equivalent regionwide reductions, and administrative complexity.

- ***Who Pays the Costs of Emissions Reductions?***

Allocating reductions and allocating their costs are two distinct issues. Congress could: 1) require affected sources to pay the full costs of control, or 2) create a fee or tax to spread control costs over a larger group than those required to reduce emissions. While the former approach is consistent with the current Clean Air Act, the latter recognizes the difficulty of linking emissions from any given source to damage in areas far removed.

- ***What Can Be Done to Mitigate Employment and Economic Effects of a Control Policy?***

Cutting back sulfur dioxide emissions could significantly affect two industries: coal mining and electric utilities. If utilities and other emitters are allowed to switch to lower sulfur fuels= often a cost-effective means of reducing emissions—some production will shift from regions producing high-sulfur coal to those producing low-sulfur coal, with associated employment and economic effects. Employment shifts might be reduced by requiring emitters to install control technologies designed for use with high-sulfur coals, or by restricting coal purchases according to location of coal supply. Such a program might increase total control costs considerably, however. For reductions in the range of 8 to 10 million tons per year, costs might rise by 25 to 50 percent, depending on the specifics of the plan. Special compensation to workers or communities affected by the new law would also be possible.

Those utilities that choose (or are required) to use control technologies for meeting major emissions reduction requirements would need to raise additional capital to build such equipment. Congress could reduce financial pressures on utilities by establishing a tax to help pay for the costs of control, or by funding research and demonstration projects to develop potentially cheaper control technologies.

Options:

Congress could design a control program by selecting alternatives from each of the eight decision areas summarized above. Obviously, many combinations are possible; the three options presented below represent portions of the decisionmaking spectrum ranging from modest reductions to large-scale control programs. Each strikes a different balance between the risks of future resource damage and the risks of inefficient pollution control.

Option A-1: Mandate Small-Scale Emissions Reductions.

A small-scale program would logically focus on controlling sulfur dioxide emissions—the major manmade acidic pollutant in the Eastern United States—within the broad region receiving greatest levels of acid deposition. Eliminating about 2 to 5 million tons of sulfur dioxide emissions per year would be feasible within about 5 to 7 years from the date of passage. Reductions of this magnitude would probably hold acid deposition levels about constant, or result in modest declines, through the end of the century.

The control region might encompass either the Northeastern 21 States or the 31 Eastern States. All States could be required to eliminate an equal percentage of emissions (e. g., 10 to 20 percent), or be allocated reductions based on emission rates (e.g., an emission rate limitation of between 2.5 and 4.0 lb of sulfur dioxide per million Btu of fuel burned). Each State might be responsible for determining which sources to control and how much pollution to eliminate from each source. Alternatively, Congress could mandate emission rate limitations for all sources emitting in excess of a specified rate.

Other possibilities for modest emissions reductions include mandatory coal washing for certain types of coal, or requiring selected sources to use emissions control technology. The former might eliminate up to about 2 million tons of sulfur dioxide per year, while the latter approach could be designed to achieve cutbacks of any desired magnitude in the range of 2 to 5 million tons per year. Either of these last two approaches would minimize losses of high-sulfur coal production and related employment, but would increase the cost of control.

A small-scale program could be accomplished for under $1 billion per year (1982 dollars) for a cutback of 2 to 3 million tons per year of sulfur dioxide, and for about $1 to $1.5 billion per year for about a 5-million-ton reduction, Costs could range, however, as high as $2.5 billion per year for a 5-million-ton program requiring the use of emissions control technology. Congress could require the sources allocated emissions reductions, and their customers, to pay the cost of reductions directly, or spread the costs more widely by establishing a fee on electricity or pollutant emissions.

Option A-2: Mandate Large-Scale Emissions Reductions.

Many of the acid deposition control proposals introduced during the 97th and 98th Congresses would reduce sulfur dioxide emissions by 8 to 12 million tons annually. Several include reductions in nitrogen oxide emissions as part of the control program as well.

As discussed in chapter 5, large-scale sulfur dioxide emissions reductions (8 to 10 million tons annually below 1980 levels) would probably protect all but the most sensitive lakes and streams in many areas receiving high levels of acid deposition. Areas currently receiving ***the highest*** levels of acid deposition (e. g., Western Pennsylvania) would also benefit, but to a lesser extent—a larger proportion of their aquatic resources might still be at risk.

The control region for a program of this scale might include the 31 Eastern States, all States east of the Rocky Mountains, or the 48 contiguous States. If the desired control region extends to the West, nitrogen oxides emissions become increasingly important, as nitrogen oxides contribute relatively larger shares of precipitation acidity in the West than in the East.

A large-scale program would require about 8 to 12 years to implement. By choosing a longer compliance time (e. g., 12 years), Congress could allow greater opportunity for modifying control plans to incorporate future research results or newly developed control technologies. The program could be altered or implementation plans changed until about 2 to 4 years before the scheduled compliance date. Although Federal, State, and source-level personnel would have spent considerable time and effort planning the program, few contracts would have been let before that time, and major capital expenditures would not have occurred. The program could either have a single compliance date or be implemented in phases, beginning with a first phase similar to option A-1.

Emissions reductions can be allocated to States in many ways. Major alternatives are discussed in detail in chapter 7 and appendix A. Each formula has distributional implications—for both who reduces and who receives the benefits of the reductions. In addition, the formulas vary in administrative complexity. For example, many recent acid rain control proposals have been based on utility emissions in excess of a specified rate— 1.2 or 1.5 lb of sulfur dioxide per million Btu of fuel burned. This is perhaps the least expensive approach for reducing ***regional*** emissions, but it concentrates much of the required reduction in the Midwest. Such a program would cost from $2 to $5 billion per year, depending on the stringency and design. Offsetting future emissions growth, if required, might cost an additional $1 to $2 billion per year.

Because such an approach would be costly for electricity consumers in some States, Congress might want to create a trust fund to finance part of the program. A trust fund to pay for capital costs associated with emissions control technology would also assist an already capital-short utility industry. The trust fund could be based either on pollutant emissions or on a surrogate, such as electricity generated or fuel deliveries.

Paying part of the costs of pollution control technology through a trust fund (but not reimbursing fuel-switching costs) would also help to prevent losses in high-sulfur coal production and employment. However, encouraging the use of control technology through a trust fund, or mandating its use, would increase total control costs and reduce potential gains in Western coal production.

Option A-3: Mandate an "Environmental Quality" Standard.

Rather than mandating specific emissions reductions, Congress could direct the Administrator of EPA to develop a control plan to achieve congressionally specified environmental quality goals (including cost considerations, if desired). Though at present scientists cannot accurately predict the benefits of various levels and regional patterns of emissions reductions, such capability might be possible by 1995 or 2000. A control program could then be based in part on a better understanding of the relationship between emissions and deposition among State or multi-State regions. It is unlikely, however, that scientists will be able to relate emis-

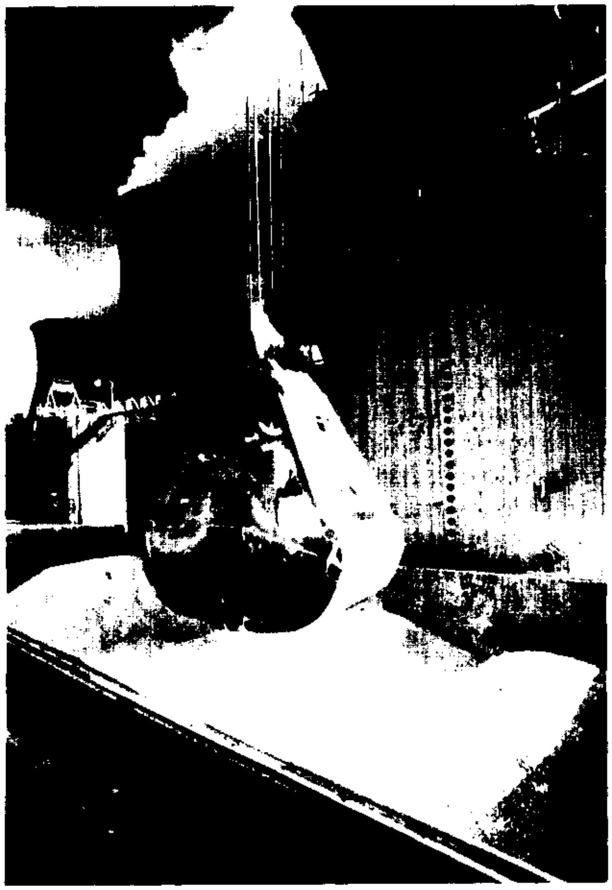


Photo credit: Ted Spiegel

The coal from this Ohio mine is about to be "washed' '-physically cleaned—to remove sulfur, ash, and other impurities. About one-third of the coal burned by Eastern and Midwestern utilities is washed, thereby preventing about 2 million tons of sulfur dioxide emissions each year. An additional 2 million tons could be eliminated by more extensive use of this technique

Photo credit Ted Spiegel

At the Bruce Mansfield powerplant in Pennsylvania, lime is destined for use in the plant's flue-gas "scrub ber." The lime is mixed with water and sprayed over the exhaust gas, removing over 90 percent of the sulfur dioxide that otherwise would have been emitted. The sulfur-laden lime slurry is discharged as a wet sludge that must be disposed with care to prevent water contamination. Newer technologies promise easier waste disposal or the possibility of reclaiming a usable product

sions from single sources to small receptor areas for the foreseeable future.

A concerted 10- to 15-year effort might produce a control program either less expensive or more effective than that outlined in option A-2. However, the longer time required to achieve compliance—it would be about 2005 to 2010 before the plan could be implemented—would also permit additional resource damage.

Congress might choose to precede such a program with mandated, small-scale emissions reductions, such as presented in option A-1. The reductions required under option A-1 are unlikely to exceed those eventually required under the environmental quality standard; at a minimum, they would prevent acid deposition levels from increasing before the remainder of the plan is implemented.

APPROACH B: Liming Lakes and Streams.

Discussion:

OTA estimates that about 3,000 lakes and 23,000 miles of streams in the **Eastern 31** States are extremely sensitive to acid deposition or are already acid-altered. Damage to or elimination of fisheries has been documented in several regions of eastern North America. Any congressional decision to reduce emissions that contribute to acid deposition would take at least a decade to implement, so it might be many years before lakes could be seen to improve. Moreover, while a significant portion of these lakes and streams would benefit from substantial emissions reductions, some might still not improve sufficiently to ensure support of self-sustaining fish populations.

Several forms of chemical treatment have been used for reducing acid-related damages to sensitive aquatic ecosystems. Most involve neutralizing acidic waters and sediments with large quantities of alkaline substances. One technique-temporarily restoring the buffering capacity of a lake or stream with lime-often improves water quality sufficiently to maintain reproducing fisheries. Treating terrestrial ecosystems has also been proposed; however, while alkaline materials are commonly added to acidic agricultural soils, little experimentation has occurred on forested ecosystems. Counteracting surface-water acidity cannot substitute for controlling transported pollutants at their source. Such measures can, however, provide short-term protection to some currently altered resources, by treating one of the ***symptoms*** of acid deposition.

Not all lakes and streams respond sufficiently to liming to maintain reproducing fisheries. In particular, lakes with short water-retention times (i. e., where water remains in the lake for less than a year), and streams with great variations in flow, are very difficult to lime effectively. Historically, such additional factors as demonstrated ability to support a significant, viable fishery, recreational potential and public access to waters, and degree of acidification have been used to guide the choice of liming targets. For those lakes where liming is effective, a single application of lime will restore buffering capacity for a period of 3 to 5 years; to prevent reacidification, lime must be reapplied every few years.

While liming has enhanced fish survival in a number of lakes and streams, its long-term implications for the food chain on which fish depend is uncertain. Scientists do not know how periodic **changes in water body chemistry through liming will affect aquatic ecosystems over the long term. Little research has been done on alternative measures or on minimizing adverse impacts of liming. Increased Federal and State efforts to develop and test aquatic treatment methods could help to increase availability of fishing recreation in highly sensitive areas over the next few decades.**

Liming has been effective in counteracting surface-water acidification in parts of Scandinavia, Canada, and in the United States in New York and Massachusetts. The most extensive U.S. program was begun by the New York State Department of Environmental Conservation in 1959. It initially targeted small, naturally acidic ponds in heavily used recreational areas, and expanded to treating selected acidified lakes with significant potential to support recreational fishing during the mid-1970's. The program is quite small-only about 60 lakes in total (covering about 1,000 acres) have been treated since its inception. Following liming, water quality has improved at a number of lakes and ponds, and self-propagating sport fishing populations have been reintroduced and maintained.

Costs for liming ponds and lakes under the New York State program have ranged from approximately $30 to $300 per acre for each application, depending on the size and accessibility of the water body. A recent study of liming requirements in the Adirondack Mountain region of New York State estimated that a 5-year program for liming several hundred acidified lakes in the region could be implemented for between $2 and $4 million per year, depending on the desired buffering level.[1] This does not include the costs of restocking fish or continuing monitoring of lake water chemistry and biology, which would increase the cost considerably.

Federal funds have been available since 1950 under the Dingell-Johnson Act to aid States in carrying out "projects having as their purpose the restoration, conservation, management, and enhancement of sport fish and the provision for public use and benefits from these resources. A IO-percent excise tax on the wholesale cost of fishing tackle

[1]Frederic C. Menz and Charles T. Driscoll, "An Estimate of the Costs of Liming To Neutralize Acidic Adirondack Surface Waters, Contribution #13 of the Upstate Freshwater Institute, June 1983.

Photo credit: New England Interstate Water Pollution Control Commission

Adding lime to a lake can temporarily restore its ability to neutralize incoming acids, thereby preventing harm to aquatic life. Lakes near roads can often be limed by boat (shown above); for others, large quantities of lime must be transported by aircraft. Not all lakes and streams can be effectively limed

provides revenues under the act. States are reimbursed for 75 percent of their expenditures on projects approved by the U.S. Fish and Wildlife Service (FWS). About 60 percent of total Dingell-Johnson funds are currently used by States for survey, management, and research activities.

Dingell-Johnson funds have been used in the past to support individual liming projects; they provided startup money to the New York State Department of Environmental Conservation's liming program from 1959 to 1965. FWS program staff suggest that States able to demonstrate the potential cost-effectiveness of liming to meet a specific acidification problem could presently receive Federal funds for liming and follow-up monitoring.

A proposal to expand the coverage of the Dingell-Johnson excise tax to include additional recreational fishing equipment is currently before the Congress (H.R. 2163); if passed, the proposal would approximately double receipts collected under the act. Expanding the fund has been advocated as a means of allowing States to keep up with the costs of sport fish management in an era of rising costs and declining State resources. Such a move might also encourage States to include mitigation efforts among their project proposals for Federal funding.

Lack of funding for liming projects, however, may not be the most important impediment to expanding mitigation activities. Improving our current ability to restore or protect acid-altered waters will require extensive monitoring of the chemical and biological changes that follow liming applications. Until considerably greater resources are allocated to studying the ways in which liming affects various types of water bodies, the results of each application will remain uncertain.

Federal research on aquatic treatment methods, as specified in the Acid Precipitation Act of 1980, began in 1982 under the direction of the FWS. To date, the Federal research effort has produced a technical report on liming, and an agenda of further research needs determined by participants in an international mitigation conference. Total Federal funding for these efforts in fiscal year 1983 amounted to $225,000.

The administration recently proposed about $5 million dollars for liming research for fiscal year 1985. Such funding increases would permit researchers to study the effects of liming on water bodies with differing geological, chemical, and biological characteristics throughout the Eastern United States, and to investigate the effectiveness of alternative mitigation measures.

Options:

Specific options available to Congress for Federal support of research and implementation of techniques to mitigate some of the effects of acid deposition are described below.

Option B-1: Expand Federal Research on Aquatic (and Other) Treatment Methods.

Although researchers at the FWS have begun to investigate the effects of a few mitigation techniques—primarily liming—on aquatic life in acidified lakes, levels of funding are low and permit only a few research projects to be undertaken each year. Additional funding—for example, at the $5 million per year level proposed by the administration— would allow the FWS program to expand its coverage to a variety of lakes and streams being treated under differing geological, geographic, and biological conditions. Such expansion would aid the FWS in developing guidelines on liming and other mitigation techniques for use by States, local communities, and private interests.

Further research on treatment methods for terrestrial ecosystems and watersheds could also be undertaken through either the Forest Service or FWS. Congress could provide additional funding specifically for mitigation research, or direct the Interagency Task Force (responsible for directing Federal acid deposition research under the Acid Precipitation Act of 1980) to allocate a greater portion of its existing budget to such activities.

Option B-2. Expand Federal-State Cooperative Efforts for Treating Acidified Surface Waters and Assessing Results.

While costs for liming acidified surface waters are relatively modest, assessing the effectiveness of these treatments can be much more expensive than liming itself, and requires substantial technical expertise. Federal funds to support liming and follow-up monitoring are potentially available under the existing Dingell-Johnson Act, although States currently carry out very little mitigation-related work with these funds.

Congress could instruct the FWS to provide guidelines to States on requirements for qualifying for Dingell-Johnson funds to treat acidified surface waters. Congress could also broaden the act's excise tax base to provide States with additional funds as an indirect means of encouraging State-level mitigation efforts. Alternatively, Congress could establish a new Federal-State cooperative program specifically to support surface-water treatment and subsequent monitoring activities.

Option B-3: Establish Demonstration Projects for Acidified Water Bodies on Federal Lands.

The Federal Government has extensive land holdings in areas of the Eastern United States that are considered sensitive to the effects of acid precipitation, including the White Mountain National Forest in New Hampshire, the Green Mountain National Forest in Vermont, and the Allegheny National Forest in northwestern Pennsylvania. Congress could direct the Forest Service and the FWS to establish cooperative demonstration programs to treat selected lakes and streams on Federal lands with significant recreational fishing potential or heritage fish populations, and subsequently monitor their chemical and biological responses. Funding could be provided through the existing interagency acid deposition research program to fund FWS monitoring activities, or be allocated to the Forest Service specifically for surface-water mitigation.

APPROACH C: Modifying the Federal Acid Deposition Research Program

Discussion:

Under the Acid Precipitation Act of 1980 (Title VII of the Energy Security Act of 1980—Public Law 96-294), Congress created an Interagency Task Force* to conduct a comprehensive 10-year national assessment program on acid deposition. The goals of the research program are:

- **to identify the causes and sources of acid precipitation,**
- **to evaluate the environmental, social, and economic effects of acid precipitation, and**
- **to determine the effectiveness of actions available** to control the emissions responsible for acid deposition, and mitigate harmful effects of acid deposition on receptor systems.

The act requires the Task Force to submit annual reports to the President and Congress, describing the progress of the research program and recommending actions that Congress and appropriate Federal agencies might take to alleviate acid deposition and its effects.

The Task Force presented a detailed research program—the National Acid Precipitation Assessment Program (NAPAP)—to Congress in June 1982. NAPAP outlines the general strategy for organizing the research effort, using 10 working groups organized by scientific discipline. These working groups are composed of program managers and experts from the Federal agencies participating in the research effort. Areas of responsibility for each of the 10 working groups are outlined in table 5.

The plan specifies an ambitious research program requiring extensive coordination among groups. If the research continues on schedule, the Task Force expects to develop by 1985 preliminary estimates of current and potential resource damage due to acid deposition. It plans to use this information, along with models developed by the task groups, to produce integrated, policy-related assessments in 1987 and 1989. The 1985 damage estimates are expected to be used primarily for redirecting or fine-tuning the further research efforts. Since the planned assessment activity calls for extensive methods development and data collection before

* The Interagency Task Force is composed of heads and representatives of various agencies and national laboratories and four members appointed by the President.

Table 5.—Organization of the National Acid Precipitation Assessment Program

Task Group** A: **Natural Sources
Coordinating agency—NOAA. Responsibility—assess the effect of natural emissions on acid deposition.

Task Group B: Man-Made Sources
Coordinating *agency—DOE.* Responsibilities-refine existing sulfur dioxide and nitrogen oxides emissions estimates, and develop improved models to estimate future sulfur and nitrogen emissions from major polluting sectors.

Task Group C: Atmospheric Recesses
Coordinating agency—/VOAA. Responsibilities—examine the link between emission of pollutants and acid deposition.

Task Group D: Deposition Monitoring
Coordinating agency—DO/, Responsibilities—develop a long-term national program to monitor the chemical composition of acid deposition (both wet and dry), and improve the reliability and accuracy of sampling techniques.

Work Group E: Aquatic Effects
Coordinating agency—EPA. Responsibilities—1) assess the resources at risk in the United States from acid deposition, 2) study the mechanisms by which biological damage can occur, 3) evaluate the risk of acidifying drinking water supplies through acid deposition, and 4) analyze strategies to mitigate the harmful effects of acid deposition.

Task Group F: Terrestrial Effects
Coordinating agency—DOA. Responsibilities—assess the nature and extent of the effects of acid deposition on crops, forests, and noncommercial terrestrial ecosystems.

Task Group G: Effects on Materials
Coordinating agency—DOI. Responsibilities—assess the effect of air pollution—in particular, acid deposition—on a range of economically important materials and historic monuments and structures.

Task Group H: Control Technologies
Coordinating agency—EPA. Although this group was referred to in the National Plan of June 1982, the latest draft operating plan does not contain a work statement for the control technology group, nor does it specify deliverable reports.

Task Group 1: Assessments and Policy Analysis
Coordinating agency—EPA. Responsibilities—integrate the research results of the other work groups, and carry out cost-benefit analyses to assist the Task Force in formulating guidance for policy makers.

Task Group J: International Activities
Coordinating agency–DOS. Responsibility–ensure that the National Program is coordinated with ongoing U. S.-Canadian and other international activities related to acid deposition.

SOURCE: Office of Technology Assessment, based on information from the National Acid Precipitation Assessment Program, June 1982; and the interagency Task Force on Acid Precipitation, January 1982.

policy analysis begins, NAPAP does not anticipate ‘ ‘useful guidance to policy makers’ until 1987 to 1989.

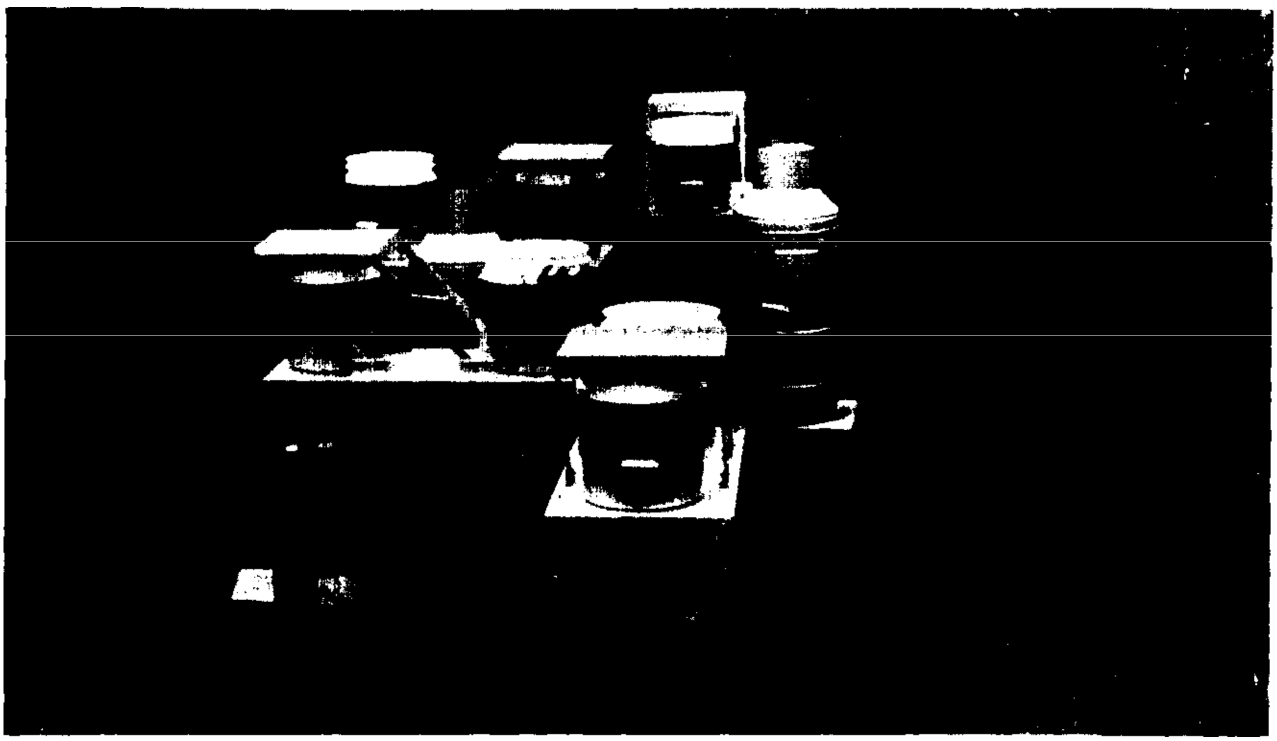
Many members of Congress and public interest groups have expressed concern about the length of time projected for NAPAP to produce a useful policy assessment. While such a research plan might produce more accurate analyses than those resulting from a shorter effort, many consider waiting until 1989 for this level of refinement unacceptable. Several bills introduced in the 97th and 98th Congresses proposed to accelerate the originally planned 10-year program to a 5-year effort.

Such a legislated acceleration could seriously compromise the scientific credibility of the results. Substantial time and effort would be needed to redesign the research schedule. (The present program required 2 years to plan.) Many currently planned research efforts are designed to build on results from work presently under way; these projects would have to be significantly redesigned so that they could begin more quickly. Moreover, many of the currently planned efforts simply could not be accelerated, even if additional funding were provided.

For many field experiments on lakes, forests, and soils, doubling the number of experiments in one year usually cannot substitute for 2 consecutive years of research. It is doubtful that a new generation of atmospheric transport models could be developed within a few years. Such modeling efforts involve years of trial and error—and require several more years of monitoring data to validate the results over a range of climatological conditions,

A strong, continuing research program is a necessary part of any strategy Congress might choose to address the problem of acid deposition. Several modifications, however, might make the current program more responsive to congressional information needs.

If a decision on an emissions control program is delayed for several years, Congress could estab-



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lish a new, separate assessment activity investigating a range of legislative options. Findings from ongoing Federal research could then be incorporated into policy guidance more quickly than is planned under the present timetable, without disturbing the longer term Federal plan.

If Congress acts to control acid deposition, the program could be redirected to support implementation and evaluation of the legislation. Concerns have been raised within the scientific community that if control legislation is enacted, important research efforts might not be adequately funded over the long term. At least 5 years would elapse between the time legislation is passed and emissions reductions are achieved. Continued research in a number of fields would be important for further evaluation of the control strategy throughout this period, and for designing and implementing the chosen control program into the 1990's.

Many within the scientific community are also concerned over the breadth of the research program, regardless of whether a control program is adopted. NAPAP's enabling legislation focuses on acid deposition. However, researchers have found this emphasis to be restrictive in two ways. Several resources—notably forests, crops, and materials-are exposed to multiple air pollutants; understanding the effect of any single pollutant requires research on all. Similarly, the potential benefits of emissions reductions are not limited to those associated with lowered levels of acid deposition.

For example, reductions of sulfur dioxide emissions will improve visibility and lower concentrations of airborne fine particles. It is difficult, however, to coordinate the various existing Federal air-pollution research programs addressing these problems with the NAPAP effort. The innovative research management framework established by the Acid Precipitation Act of 1980 could serve as the basis for a more encompassing Federal air-pollution research effort.

Options:

Specific options available to Congress for modifying the current acid deposition research program are described below.

Option C-1: Establish a "Two-Track" Research Program.

Concurrent with the existing research program, Congress could mandate a separate policy assessment—with separate funding—to be completed by a specified date. The current Plan could remain intact, although some modifications might be necessary to provide needed information to the policy assessment effort. Such a "two-track' program could provide Congress with timely policy guidance, without jeopardizing the longer term research currently under way.

Congress could require the assessment to evaluate a series of control alternatives within 2 or 3 years. Though the evaluation would have to be based on incomplete information (as might the currently planned integrated assessment), a common set of alternative scenarios would be available for policymakers to consider. This option would establish a research effort similar to this OTA assessment—a description of plausible outcomes from various policy alternatives-but with the benefit of a few more years of data and greater resources.

Such a research effort would use a consistent set of assumptions and models to evaluate:

- the costs of each control program,
- secondary effects of control (e. g., shifts in coal-mining related employment),
- expected deposition reductions (using several currently available atmospheric transport models),
- other air quality benefits (e. g., improvements in visibility and air concentrations for fine particulate), and
- resource benefits (e. g., percent of land area receiving deposition at or below levels thought to be safe for sensitive aquatic resources).

EPA (which currently coordinates the Assessments and Policy Analysis Task Group), might be designated to conduct the short-term evaluation, or another organization (e. g., the Council on Environmental Quality) might be chosen if two separate assessments are desired. One (or a consortium) of the national laboratories or the National Academy of Sciences are possible candidates from outside the Federal agencies.

Option **C-2:** *Redirect the Research Program If a Control Program Is Legislated.*

The Acid Precipitation Act of 1980 does not provide for modifying the research program if a control program were enacted. Continued research—with some redirection—would serve several purposes if control legislation were passed. Research results could be used in designing and implementing the details of the chosen control strategy through the 1990's. Because it might take about a decade to implement, the control program would require vigorous research support to reflect the most current, rather than 10-year-old, scientific information. In addition, the research program could provide data to evaluate the effectiveness of the legislation after passage.

The Interagency Task Force is already examining necessary changes to the research plan to be responsive to potential control legislation. Congress could direct the Task Force to modify the program to provide information appropriate for regulatory decisionmaking.

Option C-3: *Broaden the Research Program To Address Other Transported Air Pollutants.*

The Acid Precipitation Act of 1980 established an innovative, interagency research program to evaluate the effects of acid deposition and the effectiveness of means available to control it. The effects on many resources, however, are difficult to determine without active research on other pollutants. Similarly, the benefits of reducing pollutant emissions are not confined to those associated with reduced levels of acid deposition.

Congress could use the existing interagency structure and broaden its mandate to include research on other air pollutants. For example, research showing forest productivity declines in the United States and West Germany has led scientists to become concerned about the combined stress from acid deposition, ozone, and heavy-metal deposition. Broadening the research program could provide useful information to Congress for evaluating both current proposals to control acid deposition and, perhaps more importantly, future modifications to the Clean Air Act that might be desirable for addressing the more general problem of transported air pollutants.

APPROACH D: Modifying Existing International and Interstate Sections of the Clean Air Act

Discussion:

The 1977 Amendments to the Clean Air Act added provisions to regulate interstate and international air pollutant effects through the existing control mechanism of state implementation plans (SIPS). Section lo requires SIPS to prevent a State's emissions from causing violations of air quality standards in *other States.* * The section further prohibits EPA from approving a SIP or a SIP revision that causes violations of National Ambient Air Quality Standards (NAAQS) in another State. Currently, however, this section applies only to air concentrations of pollutants for which NAAQS exist and therefore does not directly address acid deposition.

EPA has not issued regulations interpreting section 110(a)(2)(E) since it was enacted in 1977; however, agency reviews of potential interstate pollution violations to date have been limited to the portion of the SIP undergoing revision. When proposed SIP revisions would relax an individual source's emissions limitations, EPA assesses only how the source's proposed emissions ***increase*** would affect interstate air quality. EPA also takes the position that there are no adequate modeling tools to assess the long-range effects of either individual or multiple sources.

Several States and other petitioners have filed suit in the U.S. Circuit Courts to challenge EPA's approval of SIP relaxations, claiming that the resulting pollution increases would violate this interstate pollution provision. Few of these legal suits, however, have been settled. While some uncertainty remains over how the courts will interpret interstate pollu-

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[2]Sec. 110 states that the SIP must contain: Adequate provisions (i) prohibiting any stationary source within the State from emitting any air pollution in amounts which will (a) prevent attainment or maintenance by any other State of any such national primary or secondary ambient air quality standard, or (b) interfere with measures required to be included in the applicable implementation plan for any other State under Part C to prevent significant deterioration of air quality or to protect visibility and, (ii) insuring compliance with requirements of sec. 126, relating to interstate pollution abatement. (sec. 1 1 o) .

tion control requirements, recent decisions suggest that the Federal courts are not prepared to interpret section 110 to require broader consideration of interstate pollution effects than occurs under current EPA practices.

Section 126 allows any State or political subdivision to petition the Administrator of EPA to remedy interstate pollution. The language of section 126 is relatively vague, and to date EPA has not issued interpretive regulations. The section relies on provisions of section 110 for determining the prohibited quantity of interstate pollution. A number of States seeking relief from long-range interstate pollution have filed section 126 petitions. EPA has consolidated the petitions of the States of New York, Pennsylvania, and Maine into a single proceeding. These States have requested far-reaching relief from alleged interstate pollution problems, including revision of EPA policies and broad-scale reductions in emissions throughout the Eastern United States.

EPA has not yet ruled on these petitions; despite the statutorily mandated deadline (60 days) for ruling on a State's petition, a number have been outstanding for years. States have the right to challenge an EPA determination on a section 126 petition in court, but no such challenge is possible until EPA acts on the petitions. In March 1984, six Northeastern States sued EPA to rule on the outstanding petitions but no court action has yet been taken.

Section 115 of the Clean Air Act provides an administrative mechanism for controlling pollution that crosses international boundaries. It is activated either by the Administrator of EPA or at the request of the Secretary of State. If the Administrator determines that the United States is causing or contributing to "air pollution which may reasonably be anticipated to endanger public health or welfare in a foreign country, EPA must require revisions to SIPS in the States in which the emissions originate. Section 115 allows control of ***any*** air pollutant—unlike the interstate pollution provisions, which can be used only to control air concentrations of pollutants for which NAAQS have been issued. Thus, the section may be interpreted to permit direct control of acid deposition caused by transboundary pollution. *

Acid deposition resulting from long-range pollution transport has become a major issue between the United States and Canada. At present, no agreement between the two nations directly addresses transboundary air pollution; however, the two countries have begun negotiations to reach a bilateral accord under a Memorandum of Intent signed Aug. 5, 1980.

Options:

Specific options to clarify Clean Air Act provisions controlling long-range pollution transport (sections lo, 126, and 115) are described below.

Option D-1: Amend the Interstate Pollution Provisions of the Clean Air Act.

Section 110 of the Clean Air Act is the major existing interstate pollution provision. It was designed to address local-scale interstate pollution problems. The section applies to air concentrations of pollutants for which NAAQS exist (e. g., airborne particulate); it does not directly address acid deposition. * *

Currently, EPA reviews only the effects of SIP ***revisions*** on interstate pollution levels. States are also concerned, however, with the ***cumulative*** emissions from sources outside their border leading to potential air quality degradation within their State. Several States have protested to both EPA and the courts about EPA's interpretation of this and other aspects of the section.

● On Jan. 13, 1981, then EPA Administrator Douglas M. Costle announced a finding of endangerment with respect to acid deposition in Canada, and moved to activate this international provision. To date, however, EPA has sent no formal notification requiring revision of any State implementation plan.

* ● Amendments to sec. 11 O(a)(2)(E). if combined with, for example, a new deposition standard, or ncw NAAQS for sulfates and nitrates, could in theory be used to control acid deposition. However, such mechanisms would offer, at best, an indirect and uncertain means of doing so, They would leave to administrative discretion a wide range of political issues, including the size of the control region, the required amount of emission reductions, and the distribution of reductions among States or other regions. They would also require a lengthy standard-setting and allocation process, and could engender substantial legal and procedural battles among EPA, the States, and the Federal court system.

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Clarification of EPA's responsibilities for restricting interstate pollution requires congressional guidance on several aspects of section 110. These include: 1) whether the section restricts interstate pollution from ***individual sources only,*** or from the cumulative emissions of sources throughout the State, 2) how much interstate pollution is permissible, 3) what constitutes proof of causation of interstate pollution effects, 4) whether EPA is required to review the ***entire*** SIP for compliance with section 11 O(a)(2)(E) when States revise a portion of their SIPS, and 5) whether EPA is required to review SIPS approved before the section went into effect.

Closely related to clarification of section 1 IO(a) (2)(E), Congress could require EPA to develop guidelines for ***reviewing*** interstate pollution petitions (currently contained in section 126 of the Clean Air Act). Section 126 could also be modified to require EPA to resolve petitions within a specified amount of time. For example, Congress could retain the 60-day requirement for holding hearings on a section 126 petition, but allow EPA additional time from the close of the hearing to reach a determination. By further specifying ***de facto*** denial of the petition if the agency fails to make a determination within, for example, 6 months to a year, Congress could make it possible for States to receive ***judicial*** review of section 126 petitions in the absence of administrative review by EPA.

Such changes could be effective in ending the current bottleneck of States' petitions within EPA, permitting States to bypass stalled or inactive agency decisionmaking procedures and move on to the judicial-appeals process for section 126 petitions,

Option D-2: Amend the International Provisions of the Clean Air Act.

Section 115 of the Clean Air Act was designed to address local pollution effects occurring near an international border. However, an EPA administrator who chooses to implement section 115 can require further control of *any* air pollutant from any number of States that may contribute to an international pollution problem. The section provides no guidance on what levels or kinds of transboundary pollution are impermissible, how to allocate control responsibilities among States, or how to revise SIPS to require control of pollutants for which NAAQS do not exist. At present, the open-endedness of the authority delegated by section 115 makes it an unwieldy and potentially a politically volatile tool for controlling such long-range transported air pollutants as acid deposition and ozone.

The section could be amended to provide more specific instructions and guidelines to the EPA Administrator. For example, Congress could direct the Administrator to consult with the Department of State to designate an appropriate international agency or establish a bilateral commission to determine the magnitude of the problem and the levels of control to be required. For addressing air pollution transport to and from Canada, Congress might direct the Administrator to refer the problem to the International Joint Commission, established by Canada and the United States in 1909 to monitor transboundary pollution problems.

Activating section 115, however, could conflict with other bilateral mechanisms for dealing with transboundary pollution problems. In the case of U.S.-Canadian acid deposition problems, initiating action under section 115 might interfere with ongoing talks with Canada under the 1980 Memorandum of Intent on Transboundary Air Pollution.