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Managing transborder pollution Acid Rain. Part 1 and Part 2

Jurgen Schmandt

The Institute for U.S.-Canada Business Studies

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Managing Trans-border Pollution

Acid Rain

(Part 1 of 2)

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About the Module

Acid rain -- precipitation of unusually high acidity caused by sulfates and nitrates picked up from the atmosphere--occurs in nature but is today overwhelmingly a product of certain technologies. Control of acid rain is essentially a problem of incorporating emission controls and/or other changes in those technologies. The technical engineering solutions are well known. The most persistent problems are political, not technical. When emissions cross borders and cause acid rain in other jurisdictions than the one in which the emissions originate, the politics of control become problems of diplomacy. This module presents material on just such a situation, that between Canada and the U.S.

Both Canada and the U.S. are producers and consumers of acid rain. Both "export" acid rain to the others' jurisdiction. But as with everything else concerning U.S.-Canada relations, these similarities are less important than the asymmetries involved. Canadian emissions account for a small per cent of acid rainfall in the U.S.; U.S. emissions produce 70 per cent of Canadian acid rain in some provinces. For Canada, therefore, control of U.S. emissions amounts to control of the major portion of acid rain within its own jurisdiction.

The subject is a long and complicated chapter in the history of Canada-U.S. relations. This module can only pres-

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ent aspects of it.

A useful point of departure is to define the interests on both sides of the border. In this perspective, environmental diplomacy is not much different from trade negotiations. In trade talks, producers who wish to liberalize trade seek alliances with like-minded groups in their trading partners to produce an international agreement that governments can use to provide political cover against protectionists. Similarly, environmental groups in each jurisdiction seek allies with a view to using an international agreement to reduce domestic production of pollutants. Unlike trade, however, where Canada-U.S. interests are similar, the asymmetries in the acid rain program meant that the Canadian coalitions were far more successful than their U.S. domestic counterparts in achieving their national goals.

The module begins with "Acid Rain Milestones", a chronology of Canadian and U.S. attempts to find a joint solution. The reading shows the number of levers a small country has to try to control the policies of a large neighbor--and how difficult it is to create any movement despite considerable activity. Note in this connection that the chronology covers two U.S. administrations (Presidents Carter and Reagan) and four Canadian: Prime Minis-

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Introduction

The Acid Rain Relationship

Cheap and abundant electricity, along with oil, are the blood and oxygen of modern industrial society. Apart from hydro, i.e. water powered generation, oil and coal fires virtually all the electricity produced in North America. But our cities of light and powerful factory machinery generate harmful emissions causing acid rain. Power plants and factories emit 90 to 95 per cent of the sulfur dioxide and 57 per cent of the nitrogen oxides in the U.S. The use of tall smokestacks, ironically, often built to meet local environmental control standards, ensures that 60 per cent of the sulfur dioxide emissions travel long distances--long range, transported by air, pollutants, or LRTAP.

The other major output of nitric oxide is the massive automobile traffic in major urban areas.

As these pollutants are carried by the wind, they form so-called secondary pollutants such as nitrogen dioxide, nitric acid vapor and droplets containing solutions of sulfuric acid along with sulfate and nitrate salts which fall to earth as rain, snow, fog, dew and even solid particles where they are absorbed at or near the surface. Scientists call this process acid deposition. Everyone else calls it acid rain. When the the acidity reaches a certain concentration (measured in terms of the ratio of acids and bases in solution called pH--neutral is Ph 7, basic or alkaline solutions have pH higher than 7, acids have pH values below 7), especially when the pH is less than 5.1, there are a number of harmful effects. The acid:

o damages statues, buildings, car finishes;

o kills fish, aquatic plants and microorganisms in lakes and streams;

o harms salmon and trout;

o damages trees and roots;

o poisons mountain streams and urban drinking water,to name but a few.

Acid rain from LRTAP is a serious problem in the northeastern U.S. ,Canada, as well as Austria, Finland, the Netherlands, Norway and Sweden. More than 50 per cent of the acid deposition in the heavily populated areas of the U.S. and southeastern Canada originates in the seven central and upper midwestern states--Ohio, Indiana. Pennsylvania, Illinois, Misssouri, West Virginia and Tennessee. The acidity of this precipitation is in the range of pH 4.0 to 4.2, some 30 to 40 times the acidity of the normal precipitation in these areas several decades ago. About 75 per cent of the acid deposition in Canada originates in the U.S. About 15 per cent of the acid rain in the northeastern U.S. originates in Canada.

Canadians reckon the damage from this import as follows: 48,000 Canadian lakes at risk, endangering a $1.1 billion sport fishing industry and a $10 billion a year tourism industry, as well as damage to forestry and related industries that earn some $14 billion a year and provide 10 per cent of Canadian jobs. The National Academy of Sciences estimates U.S. damage from acid deposition to be in the range of $6 billion a year. Estimates of the costs of reducing the pollutants depend on the technology and range from $1.2 billion to $20 billion. Large as is the economic effect of this pollution, no convincing case has been made that acid rain is a threat to human life, unlike other pollution such as toxic waste. This affects the political priority of the issue of controls.

There are are thus several dimensions to the acid rain problem: the science, the policy or weight to be assigned science in national policy, the political process for deciding policy and the administrative aspect, or implementation of policy.

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ters Trudeau, Clark, Trudeau (again), Turner and Mulroney. Outweighing environmental concerns were domestic priorities in both countries -- a supply-side revolution in the U.S. that involved an attack on the powers of most regulatory agencies and, in Canada, a protracted period of internal debate about the role of Quebec in confederation, followed by the election of a conservative government anxious to find a way to ensure Canadian access to U.S. markets. The period also includes the years 1981-82, during which both countries experienced the worst recession since the 1930s.

The chronology illustrates many issues in science policy as well as diplomacy: the question of when evidence is "credible" and when knowledge is adequate to become the basis for policy; what constitutes "safe" or "acceptable" limits to harmful emissions; the interplay of the legal and political systems in bringing about public policy outcomes, to name just a few.

The next reading presents a history of Canada-U.S. negotiations on acid rain in which the interplay of these factors is described.

These elements can be explored in greater detail by examining an early product of acid rain diplomacy, the "Joint Report of the Special Envoys on Acid Rain," by Drew Lewis, U.S.A. and William Davis, Canada.

Besides dealing with the changing priorities of domestic policies, Canadian policy makers realized they could only make a credible appeal in the United States if they themselves brought about reductions in Canadian emissions by the same percentage they would request from the U.S. This raised special problems, as Canadian provinces, which have considerably more power than U.S. states, had to be brought into agreement. How this was achieved is set out in the fourth reading, a series of newspaper articles covering the agreement. The resulting policy, updated from 1985 to include additional pressure on the U.S., is set out in the next reading, "Stop Acid Rain: The Canadian Program".

The sixth reading, "The Great Lakes Water Quality Agreement: A Model for Controlling Acid Rain?" suggests that Canada and the U.S. actually had in place some bilateral machinery that might have been able to resolve the matter without all the high level politicking. Was there a reason why leaders on both sides apparently preferred to become personally identified with acid rain rather than just refer it quietly to this machinery?

As well, there is a business management question: what happens when a company has to adjust to emission controls? The seventh reading, taken from the "Report of the Ontario/Canada Task Force for the Development and Evaluation of Air Pollution Abatement Options for Inco Limited and Falconbridge Nickel Mines, Limited in the Regional Municipality of Sudbury, Ontario" (Fall, 1982), allows students to examine the alternatives facing the Inco smelter.

Finally, after many years of frustration, U.S. environmental forces managed to get presidential commitment to dealing with acid rain. The resulting 1990 amendments to the clean air act are described in general terms in the press backgrounder and highlights set out in the eighth reading. The reading taken from the 1990 amendments, Title IV - Acid Deposition Control, includes what many specialists in the area regard as the most unusual aspect of this bill, namely the list of all point source emitters in the U.S. Is this section of the bill practical? Is it a success for forces opposed to acid rain?

... Acid Rain continued

For the last 20 years, public, i.e. voter, consciousness of environmental protection has steadily grown in both Canada and the United States. Generally speaking, voters now expect to enjoy a safe environment as a matter of entitlement. In other words, a clean environment is seen as a matter of right, not something to trade off against more employment or greater return on investment. But while true of the environment in general, this sentiment is not true of each and every environmental issue. The pace of change on individual issues is a matter of interest group politics.

In both Canada and the United States since the 1960s, special interests have replaced political parties as the arbiters of the public agenda. An issue becomes important and legislation is introduced in direct proportion to the strength of particular interest groups. The progress of legislation through the government's policy machinery and, in the U.S., through the legislative process too, is also determined largely by the relative strengths of interests affected by the choice at issue. (In Westminster-style parliaments like that of Canada, the government of the day usually controls the legislature; in the U.S., the separation of powers means the government of the day must lobby along with others to influence the legislators).

Solution of the acid rain issue depends to a large extent upon the balance of forces represented by interest groups. Although of course all environmental issues ultimately affect all citizens, in the short run the actual issue contest is between producers of goods whose processes exude waste into the environment and pressure groups who object to that practice. In essence, all environmental issues are contests about paying costs. Industrial waste is a byproduct of our standard of

living. Its costs are not fully covered by the costs of production nor the price paid by the consumer: the costs waste poses are external to private transactions (and therefore known to economists as external costs) and paid by society in general--through publicly maintained storage sites, through higher insurance premiums and/or the absorption of harmful effects. In the case of acid rain, the costs are generally absorbed by those whose interests are harmed by the degradation of the lakes and forests. It is the aim of environmentalists and their supporters to ensure producers "internalize" the costs. This generally requires expensive equipment that extracts harmful particles from waste or engineering to build "closed" systems that exude no waste.

A related issue associated with environmental costs is that of the so-called "free rider". As the name implies, a "free rider" benefits from the actions of others. To the extent that we benefit from environmental clean-ups but do not participate in the campaign to achieve it, we are free riders. Whenever a measure has so-called joint benefits that spread beyond those who actually pay the costs, there is a powerful inducement to wait for others to resolve the problem: this is the so-called free rider problem that bedevils all public policy solutions.

One function of the political system in advanced societies is to address areas where private market incentives produce externalities and free riding. Ideological considerations aside, votes provide the incentive for politicians to impose costs and benefits through public policy that offset the allocations of costs or dis-benefits generated by private markets. Voting districts (ridings in Canada) in which voters are upset about pollution will generally have representatives who bring these concerns to bear on public policy.

Opposing companies can use their economic power to offset the political power of numbers by saying that the proposed measure will force them to reduce activity in the complaining areas--in effect, passing the costs of compliance back onto the constituents. (In practice, there are many nuances to this process, for other commercial interests will usually be in favor of the measures proposed--makers of pollution control equipment, for example--who may be encouraged to expand in the same constituencies).

The politics of these issues is therefore a complex balancing of costs and benefits by government, business, and even individual citizens who are trying to decide how deeply to involve themselves. By a similar logic, the system forces issue managers to trade off among issues as well as within issues in order to maintain a permanent coalition of support. There is thus a contest over issue priorities as well as issue outcomes. As elections approach, office seekers will seek to broaden their appeal in order to deny support to rivals; between elections, office holders may have more flexibility to do some of the things particular groups of supporters want to see happen. But the influence of television, polling and the tremendous expense of modern campaigning have forced a kind of "permanent campaign" mentality upon all incumbents. Observers who have remarked on this phenomenon attribute to it what they perceive as a general ineffectiveness of government.

Whether or not these diagnoses are correct with respect to Canada or the United States, it will be evident that the challenge of achieving passage of effective environmental legislation in a cross-border jurisdiction is considerable. For, in essence, it requires the sending jurisdiction to absorb costs for which there are no obvious, offsetting benefits. Like-minded allies within the sending jurisdiction will be necessary, but if they were sufficiently powerful to resolve the issue, then the issue would already have been resolved.

A brief survey of the interest groups involved in each country is provided in the appendix to this introduction.

In considering the political and administrative problems posed by acid rain, students should consider some of the following particular issues:

o What is the public impact of acid rain? How should it be measured and how should its impact be communicated--is it life threatening, for example?

o How good is the Canadian program of controls: Did binational diplomacy impose more controls on Canada than that country might otherwise have adopted? An aspect of this is the so called "shining example" school of diplomacy which holds that one should first put one's own house in order. How shrewd is this kind of advice in dealing with the United States?

After considering the readings, students can also be asked to assess the Canadian effort in the U.S. --could Canada have been more effective? What about reciprocity: How would Canadians react to similar public pressure from the U.S.? What about the asymmetries involved? Perhaps most important of all, students should be asked to consider the U.S. response and the 1990 Clean Air Amendments.

Finally, there are questions about the future: Have we really learned how to manage the environment beyond short-term political responses? How will we reconcile the ceilings of 50 per cent of current (1990) emissions with economic growth?

"...the challenge of achieving ...effective environmental legislation in a cross-border jurisdiction is considerable ."

See Appendix, overleaf

Appendix: Acid Rain Interest Groups in Canada and the United States

This appendix reprints with the kind permission of its publishers the discussion in Jurgen Schmandt, Judith Clarkson and Hilliard Roderick, eds., *Acid Rain and Friendly Neighbors: The Policy Dispute Between Canada and the United States*, Duke University Press, 1988, pp.117-134.

National Clean Air Coalition The National Clean Air Coalition (NCAC) is examined as representative of the "environmental" position in the United States. (The term "environmental" is used here to identify the position of groups that support more stringent control laws.) The problem of acid rain has caused other groups that are directly affected to join with traditional environmentalists. These groups consist of health-care groups, cottage owners, fishermen, and outdoor recreation industry associations who believe that acid rain poses a threat to human health or who could lose their recreational enjoyment or their livelihoods if acid rain is not abated. NCAC presents a position common to environmentalists, health groups, and the victim industries.[22] It asserts that the benefits of controls outweigh the costs, that the costs of controlling acid rain are reasonable, and that control will not cause U.S. coal production to decline significantly.[23] Scientific and ethical concerns primarily determine NCAC's position, but most arguments are about the economics of controls.

According to NCAC, the benefits of a control program would be large: less damage to lakes and fish; lower risks to forests; improved visibility; reduced corrosion of buildings, monuments, and water pipes; and a margin of safety against poorly understood health risks.[24] Since many of the suspected dangers involve long-term, subtle changes in the biosphere, dollar figures cannot begin to estimate damages appropriately. Yet even the partial cost estimates of acid rain damages are large. One study estimates $5 billion per year in damages in the eastern United States alone.[25]

The environmental groups represented by NCAC are in full agreement on the acid rain issue. They concede to opponents of a legislative program to control acid rain that gaps in knowledge of atmospheric chemistry, pollutant transport, and acid rain do exist. However, NCAC's claim of a cause-and-effect relationship between industrial

emissions and acid rain is supported by many independent scientists who have studied the problem.[26] According to the National Wildlife Federation (NWF), a member of NCAC: "The vast majority of knowledgeable scientists recognize that, despite the lack of complete information, we know enough about the causes, behavior, effects, and cures of acid rain to not only warrant, but compel immediate action to control the problem."[27]

NCAC is critical of cost-benefit studies by the utility industry, such as those done by the American Electric Power Service Company (AEP) and the Edison Electric Institute (EEI), which assert that pollution controls would raise utility rates astronomically while offering uncertain benefits. It charges that the AEP and EEI analyses exaggerate impacts of controls on the utility industry by ignoring tradeoffs between states, inflating the price of coal, and overpricing the costs of emissions control devices. NCAC members call these distortions a part of the "informational haze" surrounding the utility industry's response.[28] Another element of the informational haze is the utility industry's suggestion that the problem is a Canadian conspiracy, designed to give Canadian electrical power exporters an unfair competitive advantage over U.S. utilities.[29] According to NCAC, this argument, along with scientific uncertainty, is used to "generate a smokescreen, hiding from public view the virtual unanimity of the knowledgeable and independent scientific community about the causes of acid rain. . . . In this connection, it is important to recall where the acid rain issue began —not in a political speech or scare headline, but in the scientific community."[30] On the other hand, an ICF, Inc., study commissioned by the NCAC and NWF was criticized for significantly underestimating the costs of compliance.[31] Differences between ICF and industry cost estimates are discussed more fully in the section on the Center for Clean Air Policy.

NCAC's political activities include testifying before congressional committees, informing legislators of the merits of relevant positions, and, most important, grass-roots public education. Public education is accomplished by furnishing member groups and individuals with analyses of pending bills and by promoting media coverage.

U.S. Industry

The U.S. "industry" groups discussed here include the Electric Power Research Institute (EPRI), the Edison Electric Institute, the National Coal Association (NCA), and the American Electric Power Service Company. (Again, the term "industry" is loosely used to designate those industries perceived to be polluters and opponents of the SO_2 control measures under consideration.) This list, while not exhaustive, is representative. The United Mine Workers Union (UMW), for example, is involved in the debate and could represent a powerful political force, but their position is not substantially different from that of the NCA. The Tennessee Valley Authority (TVA) is discussed as a "quasi industry" group since TVA is a public enterprise that works both as a utilities provider and a guardian of resources.

The utility and coal industry groups involved in the debate take several approaches to the problem. For example, EPRI, as a research organization, generally presents its findings in more objective, less politically charged terms than does EEI, which is primarily a political lobbying organization. EEI, AEP, NCA, and UMW discourage action on the basis of scientific uncertainty, but these groups emphasize much more heavily the economic and political arguments. Through various cost-benefit analyses, these groups argue that costs of electric power will rise significantly, that dislocation in the already troubled coal industry will be aggravated, and that the costs of regulation will fall inequitably to certain regions and industries. NCA and EEI both promote public education on the merits of their arguments, but their efforts on this front have not been as successful as those of the NCAC. The industry groups are generally more successful at lobbying legislators than educating the public.

As an electricity producer, TVA shares many concerns with the privately owned utilities. TVA, however, has conceded many of the environmentalists' claims about the causes and effects of acid rain. The recent experiences of TVA in installing control equipment and promoting conservation suggest that utility industry cost-benefit analyses overestimate the costs of regulation and that environmental groups underestimate these costs. Although TVA has not taken an explicit position on whether controls should be imposed, spokesmen have suggested that significant emissions reductions are possible at moderate costs.

More recently, as support for strengthening provisions has increased, the debate has focused on the nature of the measures to be adopted. As a result, industry groups are not necessarily speaking with one voice. Several new lobbying groups have formed, some with the specific intent of protecting the interests of low-sulfur coal producers. For instance, although the NCA purports to represent the entire coal industry, its position actually favors eastern high-sulfur producers. Consequently, the western low-sulfur coal industry has formed its own organization, the Alliance for Clean Energy. Its main goal is to

ensure that any legislation including acid rain provisions allows for switching to low-sulfur coal rather than requiring scrubbers. Similarly, western utilities, realizing that EEI represents the interests of the midwestern utility and coal companies, formed a consortium and hired a Washington attorney following a 1984 proposal to extend controls nationwide.[32]

Electric Power Research Institute EPRI is concerned with the scientific aspects of the debate. Its research also addresses some economic questions and is based on a particular set of assumptions. EPRI is approaching the problem comprehensively, and is supplying much of the data on which other industry-sponsored groups base their positions. However, unlike the National Academy of Sciences and other independent research groups, EPRI urges no immediate implementation of SO_2 and NO_x emissions control measures. While conceding that the electric utility industry is a major source of SO_2 and NO_x, precursors to acidic deposition, EPRI maintains that specific cause-and-effect relationships have yet to be determined.[33]

EPRI's research covers many aspects of acid rain, including pollution emissions, atmospheric processes and deposition, ecological effects, economic assessments, emissions control technologies for SO_2 and NO_x, advanced clean-coal generation technologies, and fuel planning. EPRI is involved in three demonstration projects for fluidized-bed combustion technology, as well as the Cool Water project to demonstrate the integrated gasification combined cycle. Between 1974 and 1986 the utilities industry provided EPRI with $350 million for acid deposition research-and-development activities; $180 million is anticipated for the subsequent three years. Of this, approximately $30 million is destined for environmental effects, $50 million for developing control technologies, and $95 million for alternative clean-coal technologies.[34]

Environmental studies since 1978 have focused on the nature of emissions, how they are incorporated into clouds, how they are transported, what chemical processes occur, and what materials are deposited. Early work in the Adirondack Mountains examined the vulnerability of lakes to acidification. A predictive model (ILWAS) was developed to assess the relationship between the acidity of deposition and that of surface water. Two conclusions were reached: (1) controlling SO_2 emissions alone may not be sufficient to control acidification; and (2) the depth and composition of soil till affects buffering capacity.[35]

EPRI maintains that these conclusions call into question much of the data environmentalists cite estimating the number of lakes endangered by acid rain. Since most acid lakes are found in regions with granite bedrock, many previous investigators had designated large regions of the United States and Canada that have granite bedrock as acid sensitive. However, EPRI examined three lakes located on surficial deposits brought in by glaciers, and found that they had pHs of 7.0, 5.5, and 4.5. The most acidic of the lakes received more surface and shallow subsurface flows from its watershed; the least acidic lake received a large fraction of its inflow from deep seepage. The implication of these findings is that the use of bedrock geology alone to delineate areas sensitive to acid rain is not always sufficient. EPRI researchers believe that "incorporation of some of the results [of these investigations] into the current sensitivity maps would have the effect of reducing the number of lakes that are indeed susceptible to acid precipitation at this time."[36]

At this point in the debate over acid rain, EPRI recognizes a number of "potential problems." Most significant is the acidification of lakes, although EPRI maintains that the relationship to acid rain is yet to be determined with certainty. EPRI's main concern is the lack of quantification in relating emissions to acid deposition. Also significant, EPRI admits, is the documented damage to certain types of plants. Beyond these two problems "there are hypothesized problems of effects on forest productivity, soil acidity, and damage to materials and statuary." EPRI is extending its studies to the factors responsible for forest decline, crop productivity, soil chemistry, and effects on materials. This research is slow to yield results, and much more remains to be done. So far the research has raised more questions than it has answered, the most important of which are: What level of source emissions will cause what precipitation pH values? For a given reduction in source emissions, what will be the change in precipitation pH? How many lakes are nonsupportive of fish due to acid rain? How many lakes will become supportive of fish for a given level of reduction in source emissions? At what level of precipitation acidity will the fertilizing effects of sulfur and nitrogen be outweighed by the harmful effects of hydrogen ions on agricultural crops and forests?

EPRI maintains that any action on the other steps in the process is premature and unwise at this time. "Without answers to these questions, we cannot determine what mitigation strategies may be required; nor can we determine the effectiveness of any remedial measures for acid precipitation effects."[37]

Naturally, environmental groups disagree with many of EPRI's conclusions, and some probably see EPRI's constant warnings about uncer-

tainty as more of industry's informational haze. Unlike other industry groups, however, EPRI has acknowledged the potential seriousness of the problem and is seeking answers to the important questions concerning acid rain. The real source of conflict between environmental groups and EPRI is that, in the face of uncertainty about environmental damage, environmentalists would rather err on the side of protecting the environment, and EPRI would rather err on the side of the economic status quo. If we act prematurely, EPRI argues, we may waste scarce resources on control measures that are unnecessary or ineffective.

Edison Electric Institute EEI often cites EPRI research and conclusions in support of their policy suggestions, but they always do so to minimize the seriousness of the problem and to emphasize the seriousness of the economic burden that further controls would impose on utility companies and consumers. It is logical that EEI should support utility interests, but their position would seem less suspect to environmentalists and policymakers if their resistance to the environmental position was not so comprehensive. EEI has sought to discount practically every claim of damage to the environment, even at the cost of their own credibility. In House hearings on acid precipitation in 1981, Al Courtney, speaking on behalf of EEI, disputed the causes of acidification, the contribution of power plant emissions, and whether imposing a heavy financial burden was justified in the absence of assured benefits to the public.[38]

All of EEI's questioning of the scientific basis for the fears of acid rain goes ultimately to support the economic argument against the controls proposed by the major control bills. EEI warns against the economic risks of premature regulatory programs, arguing that too many uncertainties exist to establish regulatory requirements. "The expenses associated with a significant emissions reduction will be very great . . . [and] simply cannot be justified at the present time in light of the highly speculative nature of the benefits that might result from additional controls."[39]

Much of EEI's argument depends upon inflated cost estimates. A survey of twenty-four utility companies conducted by EEI in the early 1980s concluded that electric bills in some parts of the United States might rise by as much as 50 percent if proposed amendments to the Clean Air Act requiring reductions in sulfur dioxide emissions were enacted.[40] In a more recent analysis of HR 4567, a House bill that would require each state to reduce acid rain pollutants, EEI found that annual costs of implementing the program approached $9 billion, as compared to an OTA estimate of $3.8–$4.9 billion.[41] Using EPA data, EEI claims that total SO_2 emissions dropped 28 percent between 1973 and 1985, while coal consumption increased 80 percent. Because changes in rainfall acidity during this time period could not be detected, EEI advocates "continued research, direct mitigation of acidic conditions in lakes, and development and deployment of new clean coal technologies."[42]

National Coal Association NCA is a traditional lobby representing the interests of coal producers who oppose amendments to the Clean Air Act designed to control acid rain. NCA, like EEI, expends much effort pointing out the scientific uncertainties in the debate, as well as the abuses of scientific material by environmentalists and the press. Unlike EEI, however, NCA has acknowledged the problem as serious, both in current and potential impacts. NCA points out the scientific uncertainties not to suggest that no action need be taken, but that the appropriate action is yet to be determined. Underlying NCA's arguments is the conviction that the coal industry is serving as a scapegoat under the provisions of the current control bills.

Much of NCA's concern revolves around what it perceives to be serious economic consequences to be encountered if further regulations are imposed. Indeed, much of NCA's argument relies upon the results of impact studies by the UMW and the Peabody Coal Company that may overstate the impacts of regulation. A UMW study cited by Bagge estimates that 89,000 miners would lose jobs under one of the pending control bills. However, the UMW study fails to consider that some losses would be offset by increased low-sulfur coal production and by jobs created in pollution control. Further, the study ignores the jobs in outdoor recreation and tourism that will be lost if acid rain is not curbed. Similarly, NCA distributes Peabody Coal Company estimates of increased costs to utilities of $8.5 billion annually.[43] This estimate is well outside the reasonable limits defined by Congressional Research Service studies.[44]

The ultimate thrust of NCA's arguments, however, is more political than economic or scientific, and NCA has raised several points relating to the fairness of the proposed political solutions. All of the pending control legislation is aimed mainly at coal-burning stationary sources. Research suggests, however, that oil-burning sources produce nitrogen and sulfur compounds that are more readily converted to acids in the atmosphere.[45] Yet coal-burning utilities alone are being targeted to bear the entire burden of control, while oil-burning plants and smelters are exempt from regulation. In addition, NCA has pointed out

geographic inequities that, in the past, would have resulted in mid-western coal-producing states bearing a disproportionate share of the cost of control. These concerns have since been addressed, at least to some extent; much of the legislation introduced since 1984 provides for some form of national cost sharing (see chapter 7).

NCA has also been concerned about accusations and "inflammatory rhetoric" from Canada.[46] NCA publicly discounts any Canadian conspiracy to capture a share of the U.S. electricity market by promoting pollution control legislation that would raise U.S. production costs. However, NCA has, in the past, found Canadian accusations and criticism of U.S. pollution control efforts irresponsible, given the shortcomings of Canadian environmental protection and the large amounts expended by the United States in implementing the Clean Air Act.

In recent testimony before the Senate Subcommittee on Environmental Protection, NCA asserted the efficacy of the existing provisions of the Clean Air Act and argued that no additional measures were necessary. In NCA's view, additional controls would cost a great deal of money and yield marginal benefits. Four reasons were given for the success of the current program in reducing SO_2 emissions, and for why continuing reductions should be expected: (1) new-source performance standards; (2) the shift in demand to regions with low-sulfur coal; (3) substitution of lower-sulfur coal in power plants throughout the country; and (4) addition of scrubbers to plants not subject to new-source performance standards.[47]

American Electric Power Service Company AEP of Columbus, Ohio, generates more power than any other electric utility company and has been regarded as an efficient operator of its coal-fired plant network. AEP consists of eight electric public-utility operating companies serving customers in approximately three thousand communities in seven states in the east-central and midwestern United States. While other electric companies in the northern United States and Canada were hurt by the slowdown in the growth of electricity use over the last decade, AEP sales have grown, mostly through wholesale sales to other utilities. Neighboring utilities often buy peak-period power from AEP more cheaply than they are able to produce the power themselves.

In 1982, however, AEP's overall electricity sales were off 12 percent and sales to other utilities dropped more than 20 percent. Also, AEP has a 25.5 percent interest in a troubled nuclear plant that is under construction. These reasons make new expenditures on emissions controls difficult for AEP to bear. AEP spokesmen state that the Midwest offers few attractions to industry over other areas of the country. One advantage, however, is relatively low electricity rates, which pending clean air legislation could wipe out. The loss of this advantage could cause some industries to relocate. AEP believes that not enough is known about the effects of acid rain to justify such high costs and is against any kind of amendment to the Clean Air Act that would mandate reductions in SO_2 emissions.

AEP has circulated a report entitled "Economic Impact on the AEP System of Compliance with the [1981] Mitchell Bill." The analysis purports to assess the measures that would be needed to achieve the required ten-million-ton SO_2 emission reductions, the annual cost of such measures, and the extent to which those costs would increase the electric bills of AEP's consumers. The estimates given in this report are almost an order of magnitude higher than estimates in other industry and nonindustry analyses and, when reflected in electrical rates, result in a startling 63.3 percent increase.[48] The estimates have been published in newspaper and magazine ads, distributed on pamphlets with utility bills, and circulated to congressmen involved with reauthorization of the Clean Air Act.

The AEP estimates are based on several misconceptions about the proposed amendments to the Clean Air Act. Nearly all other cost estimates indicate that rate changes would not approach the AEP estimates.[49] Even if utility bills increased as much as AEP estimates, the rates would still be lower than those paid in the areas of the country hardest hit by acid rain. With recent bills (such as HR 4567) limiting local residential rate increases to 10 percent, it is going to be more difficult for AEP to make a case against controls. However, this fact has not stopped a lobbying organization, Citizens for the Sensible Control of Acid Rain, from claiming that acid rain controls will result in 30 percent rate increases. This group, founded in 1983 to fight acid rain controls, is supported by utility companies, who contributed nearly $3 million between September 1985 and June 1986. American Electric Power topped the list of contributors at $1.5 million.[50]

Tennessee Valley Authority TVA is a public enterprise. Its role as utility provider and guardian of resources for the Tennessee valley makes it an interesting comparison with utility interest groups. Traditionally TVA has been aligned with other utility interests on regulatory matters. On the acid rain issue, however, TVA's position departs from that of the privately owned utilities on most major points. Several reasons for this departure are possible; one important factor was the presence of S. David Freeman, a recognized expert in energy and conservation issues, on the TVA board. Freeman, who left TVA in 1984, has

made the board more sensitive to its role as guardian of resources.[51]

TVA's position is stated in testimony submitted to congressional committees and in position papers circulated by TVA.[52] Its departure from the position of the utility interests on the scientific aspects of the debate is evident from a TVA position paper: "TVA recognizes the likelihood of a relationship between acid precipitation and the total load of SO_2 and NO_x in the atmosphere. TVA also recognizes that long-range transport and transformation of pollutants in the plumes of fossil-fueled boilers of all types produce sulphate and nitrate particles which are believed to be linked to acid precipitation. Moreover, acid precipitation is not only a local problem, but a regional, national, and international problem that cannot be adequately addressed by present requirements under the Clean Air Act."[53]

TVA's position on the ethical argument is implicit in the broader understanding of regulatory costs and benefits that it supports. In another position paper, discussing the impact of two particular control bills, TVA states: "These costs [of complying] can be estimated reliably within a range that reflects varying operating assumptions. Benefits are more difficult to measure but nonetheless significant. This is especially the case if long-term and regional benefits are included in addition to more easily quantified local benefits. TVA believes that any discussion of pending acid rain legislation should take into account these benefits as well as costs."[54]

This broader understanding of long-term, widely ranging (and not necessarily quantifiable) costs and benefits has been lacking in most utility industry statements. TVA estimates that costs to rate payers could increase by 3–13 percent as a result of acid rain control amendments, depending on the particular bill and on varying operating assumptions.[55] This range stands in considerable contrast to AEP's estimate of increases up to 66 percent, even though both TVA and AEP have about the same coal-fired capacity.[56]

TVA is also arguing the political issue of the fairness of the kind of regulation that is proposed in pending acid rain bills:

> TVA believes that any bill that attempts to reduce emissions across the board is unfair by tending to discount control measures already in place. More specifically, TVA believes that legislation must recognize that a major contribution to the total load of SO_2 is produced by generally older and smaller stationary sources currently operating at high levels of SO_2 emissions from untreated high-sulphur coals. TVA believes that a workable legislative approach to reduction of these pollutants is best found by capping the pollutants at all stationary sources. A cap on individual source emissions in the range of 4 to 5 pounds of SO_2 per million BTUs represents a reasonable level of control.[57]

Although there does not seem to be any movement by policymakers to accommodate TVA's argument, one could argue that TVA has increased its credibility and its chances for influencing the specifics of regulation by conceding key points on the other aspects of the debate.

The Center for Clean Air Policy

The Center for Clean Air Policy, created by a number of state governors, hosted a series of analytical studies over a sixteen-month period directed at two distinct aspects of the acid rain debate: (1) the costs of various control options for two major utilities, AEP and TVA; and (2) a dialogue between the interested parties in order to identify areas where agreement could be reached. The following discussion is taken from the ensuing publication, *Acid Rain: Road to a Middleground Solution*.[58]

In preparing cost estimates, three main policy options were chosen for analysis. Each was analyzed under various implementation strategies by ICF, Inc. AEP and TVA together accounted for almost 10 percent of the total electricity generated and about 17 percent of the SO_2 emissions in 1985. Cost estimates to each entity were generated by ICF, and the assumptions used in deriving these estimates were compared with those used by the utilities. The data presented for AEP illustrate the problems associated with projecting the cost of implementing a nationwide emissions control program. Annualized cost estimates to AEP associated with SO_2 reductions of 0.9–1.1 million tons (under a national reduction scenario of a ten-million-ton reduction) were estimated by ICF to be $0.2–$0.5 billion. This would result in average electricity rate increases of 3–9 percent and is considerably less than AEP's least-cost estimate of $0.9 billion. The main areas of disagreement in these two estimates derived from differences in assumptions concerning: the changing rate of utilization of various plants; annualization rates for control costs (over 20–30 years rather than 10 years); and projections for low-sulfur coal premiums (a factor of two, resulting in less reliance on scrubbers in the ICF scenarios).

The dialogue process involved representatives from thirty diverse organizations, including environmentalists, utilities, states, and consumer groups. The goal was to define where the group could agree and where areas of major disagreement persisted. Because most participants had to settle for options that they considered less than optimal (but not totally unacceptable), the effort usually resulted in the

selection of each participant's second or third choice. In this way broad areas of agreement could be discerned. These included: the need to encompass a wide range of environmental benefits; a reduction target of 8–10 million tons of SO_2 emissions; the inclusion of all sources emitting more than 100 tons of SO_2 per year; maximum flexibility in selecting the control option; and tonnage reduction requirements as opposed to average emission rate reductions.

Disagreement persisted over the question of whether the regional economic impacts of controls were sufficient to justify subsidies. Representatives from the lower Midwest were willing to forgo this concession if controls were based on reduction allocations per state and not targeted specifically at utility emissions. However, no consensus was forthcoming on how a suitable formula could be derived.

Canada: Policy from the Outside In

The major Canadian environmental and industrial groups substantially agree on the scientific and ethical arguments about acid rain. Both concur that there is enough scientific evidence to conclude that acid rain is a danger to the environment and that man-made emissions are a major contributor to the problem. Both groups now take the position that, in the face of uncertainty about environmental effects of emissions, it is better to err on the side of the environment than on the side of short-term economic benefit. Although the costs of abatement may be great, the two groups agree that U.S. and Canadian industry should begin to control emissions either by switching to alternative fuel sources, by conservation measures, or by equipping existing and new coal-burning plants with emissions control equipment. The major Canadian environmental and industrial groups also agree that some cooperative action must be taken soon by the two governments.

Canadian environmental and industrial groups recognize airborne pollutants as a major cause of acid rain and recommend reducing emissions in order to protect the fishing, tourism, and forestry industries in the eastern provinces and in the northeastern United States. Both groups acknowledge that Canada does contribute to the acid rain problem, and the major Canadian industries involved in the problem have initiated steps to limit SO_2 emissions, the presumed major source of acid rain. It is also recognized that acid rain is harmful (and primarily man-made), that SO_2 emissions can be transported long distances, and that acid rain is lowering pH levels in lakes and rivers in eastern North America to the point where they can no longer support fish life.

Canadian interest began in 1971, when R. J. Beamish and Harold Harvey published their report entitled "Acidification of the La Cloche Mountain Lakes," which documented the decrease in fish life in lakes in the Killarney Park wilderness region in northern Ontario.[59] Beamish and Harvey had studied the region since 1966, when they tried stocking the lakes in order to reestablish the level of sport fishing for which the area had once been acclaimed. When none of the four thousand pink salmon that Harvey and Beamish introduced survived the first year, they decided to measure the acidity of the area's lakes.

During the summers of 1969–71 Beamish and Harvey tested sixty lakes in the region and discovered that the pH level averaged 4.4, a dramatic drop from the 6.8 pH measured ten years earlier. The ten-year pH change in the Killarney lakes represented a more than hundredfold increase in acidity. Although Harvey's report concentrated on his observations of declining fish life in the Killarney lakes, he also referred to the 1971 Swedish Royal Ministry for Foreign Affairs and Royal Ministry of Agriculture report linking the acidification of Swedish lakes with pollution from industrial sources upwind in England and other parts of Europe. According to the Swedish study, pollutants could remain airborne much longer and thus travel much farther than had previously been believed. Since the Killarney lakes are located downwind from the International Nickel Company's (INCO) smelter at Sudbury, Ontario, Harvey suspected that airborne pollutants from the smelter could be responsible for the increased acidity of, and consequent declining fish life in the Killarney lakes. Thus Harvey introduced the term "acid rain" into North American terminology.

Despite Harvey's predictions of potentially dangerous damage to the Canadian environment, few Canadians were roused into action. Not until 1976, when Ross Howard, a reporter for the *Toronto Star*, wrote articles on acid rain based on conversations with Harvey did public reaction force government officials and industry leaders to rethink environmental policies.[60]

Canadian Environmentalists

Canadian Coalition on Acid Rain CCAR represents more than fifty groups, mostly from eastern Canada.[61] Founded in June 1981, CCAR does not advertise itself as an environmental group. (Less than one-third of the member groups are primarily environmental groups.) It has no official (but a close informal) link with NCAC in the United States, and has never officially supported any specific amendments to

the Clean Air Act. Funding for its Canadian activities is provided by the Canadian government, although it is not officially linked with the government. CCAR is primarily interested in informing the public and government and business leaders on both sides of the border of the dangers of acid rain. By remaining independent and disseminating information, CCAR believes it remains credible and convincing.

CCAR applauds the attempts by INCO and Ontario Hydro to limit SO_2 emissions. In 1983 Michael Perley, co-director of CCAR, stated that: "INCO and Ontario Hydro have recognized the correlation between SO_2 emissions and acidic lakes, and have aggressively pursued policies to reduce SO_2 beyond the nonappealable orders issued by the provincial government of Ontario."[62] Perley was confident that both of the major contributors to the acid rain problem on the Canadian side of the border are serious in reaching reduction goals. However, CCAR doubts that either company would have agreed to the reductions mandated by the provincial government of Ontario if the three major political parties were not in full agreement on the subject. With no political backing, INCO and Ontario Hydro had little choice.[63]

According to CCAR, Ontario Hydro is not spending any money on abatement equipment because the company is transferring from coal- to nuclear-powered generating plants.[64] The transfer can be made easily for three reasons. First, Ontario Hydro has been planning to convert to nuclear power since the first shock of oil price hikes, and several new plants are being brought on-line. Second, the company does not have to deal with the encumbering and expensive regulations adhered to in the United States. Because Canada does not guarantee freedom of information, does not require environmental impact statements, and does not recognize citizens as having any standing in court on environmental matters, Ontario Hydro can choose cost-effective methods with few administrative obstacles. Finally, Ontario Hydro is a regulated company of the Crown and can pass any price hike due to construction costs on to consumers.

CCAR maintains that officials from INCO have been considerate and modest about the company's attempts to reduce SO_2. Nevertheless, CCAR was concerned about what would happen when production at the Sudbury plant was resumed after an upturn in the nickel market. INCO has installed abatement measures at the plant, but CCAR believes that Canadian citizens will pay for them in several ways. First, INCO will write off about 50 percent of the cost of abatement equipment; second, INCO will write off another 20–25 percent on energy efficiency; and third, the remaining costs will come in the form of a handout from the Canadian government.[65]

CCAR firmly believes, based on the studies available, that SO_2 and NO_x emissions are the main cause of acid rain. They insist that some controls are immediately necessary on both sides of the border and they are working to inform anyone who will listen. They believe that the states presently not affected by acid rain (the western and deep southern states) are the key to a conflict resolution, and they are trying to educate leaders and groups from those areas about the evidence gathered by many concerned scientists.

Canadian Industry

The Canadian firms discussed here, Ontario Hydro Electric Company and INCO, Ltd., were selected for three reasons. First, both are located in eastern Canada, where the major impacts are felt. Second, both are among the largest public and private emitters of SO_2 in eastern Canada. In fact, Ontario Hydro is the major utility in eastern Canada that burns a significant amount of coal for energy. Finally, both are major examples of the cooperation between Canadian industry and the government in reducing SO_2 emissions.

INCO, Ltd. The twelfth-largest company in Canada, with $4 billion in assets, INCO, Ltd. (formerly International Nickel Company) has dominated the world nickel markets since 1902. INCO once produced over 90 percent of the world's supply of nickel and remains the world's largest single producer. Headquartered in Toronto and New York, INCO owns mines and smelters throughout the world, including the world's largest smelter in Sudbury, Ontario.

At one time INCO's Sudbury smelter was the most photographed and discussed source of SO_2 emissions in North America. Throughout the sixties more than 6,000 tons of SO_2 poured out of the stacks at Sudbury each day—the largest source on the continent. By 1970 the yellow-brown skies over Sudbury were causing recurring violations of ambient air standards, prompting the provincial government of Ontario to press for reforms. By 1973 INCO had reduced emissions to 3,600 tons per day, mostly by constructing a mill to extract sulfur from the nickel ore before smelting. No further steps were taken until 1978, when a joint U.S.-Canadian report triggered a flood of attention and publicity about acid rain. Realizing that INCO could not achieve the previously ordered reductions (to 750 tons per day by 1979), the government of Ontario imposed a nonappealable regulation to reduce emissions to 2,500 tons per day beginning in September 1980. The regulation required INCO to further reduce

emissions to 1,950 tons per day by January 1, 1983.[66]

During the final months of 1982 and much of 1983, INCO's smelter in Sudbury was closed as a result of depressed world nickel prices. Following ten consecutive quarters of losses, it resumed production in late 1983. Environmentalists were concerned that INCO would not meet the proposed standards when the Sudbury plant reopened, but when it returned to full production INCO's emissions of SO_2 averaged about 1,900 short tons per day. This reduction was achieved mainly through relatively cheap ($14 million) milling modifications that reduce the sulfur content of nickel before smelting.[67] INCO does not consider environmental regulation as a significant contributor to its economic woes, but continued economic losses could damage efforts to implement emissions-reducing technology.

New, stricter SO_2 reduction targets imposed in 1985 require a number of technological improvements in order to reduce the amount of sulfur entering the furnace and increase the amount of sulfur captured from gaseous emissions. INCO reports that it has spent more than $100 million on research and development in this decade.[68] However, if these newer, more efficient technologies are not available to meet reduction target deadlines, depressed nickel prices may make it necessary for the government to subsidize control costs. The federal government has allocated $150 million for emissions controls for the Canadian smelting industry.

U.S. utilities and midwestern politicians claim that, while INCO's proposal to install a process that "has the potential of converting as much as 80 percent of the sulfur in the nickel concentrate into a continuous stream of sulfur dioxide suitable for conversion into sulfuric acid"[69] appears promising, the costs involved are too great. They believe that INCO's only reason for announcing the plan was to deflect criticism toward coal-fired electric generating plants in the United States.[70] Furthermore, skeptics believe that the process will never be implemented and that it may be an attempt to sway the U.S. public to force legislative mandates for reductions in SO_2 and NO_x emissions. INCO officials maintain that they favor the incorporation of emissions reduction targets for SO_2 and NO_x as a part of the reauthorization of the Clean Air Act, and counter criticism by saying that they, at least, admit they are a part of the problem and are proposing measures to remedy the situation. INCO supports the March 1984 decision of the Canadian government to reduce emissions unilaterally below 1980 allowable levels by 25 percent by 1990 and by 50 percent by 1994.

Ontario Hydro Electric Company The first emissions reductions imposed on Ontario Hydro in 1981 required a 50 percent reduction by 1990 (as discussed in chapter 6, more stringent reductions were imposed in 1985). As a result, Ontario Hydro chairman Hugh Macauley announced a greater reliance on nuclear power, effective conservation programs, and expansion of hydroelectric power. He maintained that these measures constitute a better environmental and economic alternative to a policy of installing scrubbers on an increased number of coal-fired plants, which contribute only about 3–5 percent of the acid rain falling on sensitive areas in Ontario.

Ontario Hydro is prepared to add scrubbers, if necessary, to existing coal-fired plants that are currently washing and burning low-sulfur coal. But coal is the swing fuel of Ontario Hydro's system and is generally used only to meet peak and intermediate loads.[71] Because the coal-fired plants are used less and less as a result of decreased demand, and because twelve new nuclear plants will be coming on-line during the coming decades, Ontario Hydro may be able to shut down existing coal-fired plants totally and thus eliminate SO_2 and NO_x emissions. From Ontario Hydro's perspective, the best available technology for reducing acid rain is the Candu nuclear reactor.

Ontario Hydro has been criticized for backing away from early commitments to employ scrubbers on coal-fired plants. Critics charge that Ontario Hydro has failed to set a good example (by installing scrubbers), and has intensified the reluctance of American utilities to initiate any control strategy. The American utilities can point out that, while Ontario Hydro may advocate control strategies, the company has not taken any real or costly steps toward implementing one. Some critics believe that Ontario Hydro's position on scrubbers is designed to place pressure on American utilities to adopt costly control strategies, thus allowing Ontario Hydro to undersell the American utilities in eastern U.S. markets.

This "Canadian conspiracy" speaks more for the ability of Canadian utilities to shift from coal-fired plants to nuclear and hydroelectric plants than for their greater concern for the environment. A report by the Congressional Research Service states: "More importantly, if U.S. utilities look to Canada for nuclear power, it is more of a commentary on the state of the U.S. nuclear industry than on acid rain legislation. Acid rain legislation provides American nuclear power with the same incentives as Canadian nuclear power. If U.S. utilities decide to get nuclear power from future Canadian plants, it will be due to their assessment that the nuclear option in the United States is not an option for them, and therefore the regulatory, technical, and political dif-

ficulties in obtaining power from Canada are worth the risks."[72]

But even if Canada possesses excess electricity for sale in the United States, regulatory, technical, and political difficulties inside Canada would severely hinder any export sales. From a regulatory standpoint, Canada avoids long-term, firm export contracts in order to ensure sufficient electricity for its own demand.[73] Export contracts are generally short-term and seasonal. (Canadian domestic demand peaks in winter, while U.S. demand usually peaks in summer.) There are two situations, however, under which electricity for export would be available. The first possibility would be if the Canadian government projections for domestic electricity demand are significantly higher than actual demand. The second would occur if the building of Canadian nuclear power plants is partially dedicated to export.

The first scenario has a logical basis: If Canada were to have excess electrical power, it could be sold in U.S. markets. However, this would require that new cables be built across the border, creating more regulatory and international problems than the project may be worth. The second scenario would have serious political implications, chief among them being the likelihood that the Canadian people may wonder why Canada should assume the risks of nuclear power plants while the United States consumes the electricity.

Acid Rain Milestones

A chronology of significant stages in the evolution of a Canada-U.S. approach to the reduction of acid rain.

Discussion Note

This reading sets out a chronology of Canadian and U.S. attempts to find a solution to the acid rain problem. The chronology shows the number of levers a small country has to try to control the policies of a large neighbor--and how difficult it is to create any movement despite considerable activity. Note in this connection that the chronology covers two U.S. administrations (Presidents Carter and Reagan) and four Canadian: Prime Ministers Trudeau, Clark, Trudeau (again), Turner and Mulroney.

Outweighing environmental concerns were domestic priorities in both countries -- a supply-side revolution in the U.S. that involved an attack on the powers of most regulatory agencies and , in Canada, a protracted period of internal debate about the role of Quebec in confederation, followed by the election of aConservative government anxious to ensure Canadian access to U.S. markets. The period also includes the years 1981-82, during which both countries experienced the worst recession since the 1930s.

The chronology illustrates many issues in science policy as well as diplomacy: the question of evidence and when knowledge is adequate to become the basis for policy; what constitutes "safe" or "acceptable" limits to harmful emissions; the interplay of the legal and political systems in bringing about public policy outcomes, to name just a few. Students could be asked to identify different phases of the chronology and whether there was a change in U.S. or Canadian approaches during this period. Students can also be asked to describe the strategies of each player. Finally, the issue of "sovereignty" and limits to one nation's "right" to participate in the political processes of another should also be discussed.

Acid Rain Milestones

Acid rain is one of the most serious environmental problems facing Canada today. Since airborne chemicals cause acid rain, environmental damage often occurs many miles from the sources of pollutants. As a result, solving Canada's acid rain problem depends on the implementation of an American program involving emission reduction targets and schedules that, in conjunction with those already imposed under the Canadian Acid Rain Control Program, will protect the Canadian environment from acid rain damage. The following milestones or events (listed in chronological order) show the history of Canadian and U.S. efforts to find a solution to the acid rain problem.

July 1978 — Recognizing the international dimension of the acid rain problem, Canada and the U.S. establish a Bilateral Research Consultation Group (BRCG) on the long-range transport of air pollutants (LRTAP). The group's mandate is to facilitate information exchange, coordinate research between the two countries, and develop a scientific data base from which both countries can formulate solutions.

December 1978 — At the invitation of the U.S., Canada discusses a Congressional Resolution that calls for a cooperative agreement on transboundary air pollution. Both countries decide to develop papers outlining agreed principles on transboundary pollution, and to request the BRCG to indicate the extent of transboundary pollution caused by Canada and the U.S.

July 1979 — Canada and the U.S. announce their intention to develop a cooperative agreement on transboundary air quality.

October 15, 1979 — The BRCG releases its first report, which shows that large areas of North America are sensitive to damage from acid precipitation, and delineates the extent of scientific knowledge on the causes and effects. The report observes decreases in the number and variety of fish species in lakes and rivers of Ontario and the Atlantic provinces, and links spawning failure of Atlantic salmon to acid rain. Some evidence also suggests that agriculture and forest productivity are endangered.

August 5, 1980 — Canada and the U.S. sign a Memorandum of Intent (MOI) Concerning Transboundary Air Pollution. The MOI states the intention of both nations to develop a bilateral agreement on transboundary air quality and to vigorously enforce existing air pollution legislation. It also establishes five Work Groups to develop the scientific and technical basis for an agreement.

January 13, 1981 — The EPA Administrator concludes that acid rain damage from transboundary air pollution is occurring in both Canada and the U.S., and initiates the international air pollution control provisions of the U.S. Clean Air Act.

June 23, 1981 — Canada and the U.S. begin formal negotiations on a bilateral agreement on transboundary air pollution.

February 23, 1982 — On the basis of scientific research, Canada proposes to the U.S. that both countries take actions to reduce acid deposition in vulnerable areas to 20 kilograms per hectare per year (about half the 1980 levels) by 1986.

June 15, 1982 — The U.S. rejects Canada's emission reduction proposal as premature.

October 24-25, 1982 — The Canadian Secretary of State for External Affairs and the U.S. Secretary of State agree to exchange papers on acid rain abatement options and scientific issues.

February 21, 1983 — After two and a half years of preparation, discussion and peer review, the Canada-U.S. MOI Work Groups release their reports and refer them to the Royal Society of Canada and the U.S. Office of Science and Technology Policy for further peer review.

May 1983 — The Royal Society of Canada releases its review of the MOI Work Group reports and concludes that prompt emission reduction action by the two federal governments is required. The conclusion is supported by the evidence in the MOI reports and by studies carried out by the international scientific community.

June 21, 1983 — The Annual Conference of New England Governors and Eastern Canadian Premiers passes resolutions supporting the Canadian deposition target (20 kilograms per hectare per year).

August 23, 1983 — Canada and the U.S. sign an agreement to participate in the Cross Appalachian Tracer Experiment, to demonstrate the long-range transport of air pollutants by winds over eastern North America.

March 20-21, 1984 — Canada hosts an international meeting with nine European countries, and the U.S. as an observer. An accord is reached to reduce sulphur dioxide emissions by at least 30 per cent by 1993.

July 1984 — The U.S. Office of Science and Technology Policy Peer Review Panel concludes its examination of the MOI Work Group reports and supports the initiation of sulphur dioxide controls.

March 6, 1985 — The Prime Minister announces that total sulphur dioxide emissions in Canada's seven easternmost provinces will be reduced by 50 per cent by 1994. This program will reduce acid fallout in Canada and will reduce the amount of acid rain pollution Canada exports to the U.S. by half.

March 17, 1985 — The Prime Minister and the U.S. President appoint Special Envoys on Acid Rain. The Envoys' mandate is to pursue legal and regulatory consultation on pollutants linked to acid rain, enhance research cooperation and information exchange between Canada and the U.S., and identify ways to improve the environment in both countries.

April 10-12, 1985 — The New England Governors announce they will develop an acid rain control program similar to Canada's.

July 9, 1985 — Under the aegis of the UN Economic Commission for Europe, Canada, the Soviet Union and 17 European countries sign a sulphur dioxide emission control protocol requiring a 30 per cent reduction in emissions or transboundary flows by 1993.

July 26, 1985 — The U.S. District Court for the District of Columbia rules the EPA must implement the international air pollution provisions of the U.S. Clean Air Act. The Court orders the EPA to require seven midwestern and border stat to reduce emissions.

July 27, 1985 — A U.S. Congressional Research Service study concludes that Canada's air pollution control efforts surpass those of the U.S.

September 15-20, 1985 — Canada hosts an International Symposium on Acid Precipitation in Muskoka, Ontario, which is attended by more than 600 scientists from 18 countries including the U.S.

October 25, 1985 — The EPA Administrator acknowledges that Canadian law meets the reciprocity requirements of the U.S. Clean Air Act in terms of providing protection from transboundary air pollution.

January 9, 1986 — The Special Envoys release their report, which concludes that acid rain presents a serious environmental problem in both countries, and is a serious transboundary problem. The Envoys make twelve recommendations to move both countries toward a long-term solution to the acid rain problem.

March 19, 1986 — The Prime Minister and the U.S. President endorse the Envoys' findings and conclusions, and agree to implement their recommendations.

June 25, 1986 — The Bilateral Advisory and Consultative Group (BACG), which was formed to oversee the implementation of the Envoys' recommendations, holds its first meeting. The BACG agrees to prepare a report on new scientific findings, and to review opportunities afforded under existing legislation for emission reductions.

September 18, 1986 — U.S. Appeal Court overturns the July 1985 decision of the U.S. District Court saying the EPA did not follow due process in initiating the international air pollution provisions of the U.S. Clean Air Act.

January 6, 1987 — The U.S. Administration issues its 1988 budget proposals, which indicate spending of over $6 billion on clean coal technology initiatives that meet the Envoys' recommendations.

January 21, 1987 — The U.S. Vice President visits Ottawa at the request of the Prime Minister to discuss Canada's dissatisfaction with the pace and substance of U.S. action to implement the Envoys' report. The same day, a Congressional Research Service report concludes that the nine projects to be funded through the U.S. Administration's clean coal technology program do not meet the Envoys' criteria.

January 23, 1987 — Canada issues an assessment of U.S. clean coal technology initiatives, and concludes that they do not coincide with the Envoys' criteria, particularly since only limited reductions in transboundary emissions are likely.

March 18, 1987 — The U.S. President announces he will seek funding to fully satisfy the Envoys' report. He establishes an advisory panel with Canadian membership, on clean coal technology projects and asks the Vice President's task force on regulatory reform for a report within six months on the regulatory impediments to U.S. action on acid rain.

April 6, 1987 — The Prime Minister supports the U.S. President's initiative but reiterates Canada's interest in emission reductions. In an address to the Canadian Parliament, the President says he will consider the Prime Minister's proposal to develop a bilateral acid rain accord similar to the Great Lakes Water Quality agreement (which contains targets and schedules).

April 8, 1987 — Canadian and U.S. scientists issue a joint report on the state of scientific knowledge on acid deposition.

May 22, 1987 — The BACG meets in Washington to follow-up on the President's April commitment regarding an accord. Canada presents an outline of elements essential to an accord, including scheduled reductions in acid rain emissions.

September 16, 1987 — The U.S. National Acid Precipitation Assessment Program (NAPAP) interim assessment report concludes that acid rain damage is neither widespread nor worsening, and that no new abatement measures are necessary.

September 17, 1987 — The Canadian Environment Minister dismisses the NAPAP interim assessment as flawed, incomplete and misleading.

January 7, 1988 — The Canadian Environment Minister releases Canada's critique of the NAPAP interim assessment report saying the report should be discarded as a basis for U.S. policy decisions on acid rain reduction.

January 25, 1988 — The BACG meets in Washington to discuss the U.S. response to Canada's proposal. The U.S. accepts much of Canada's proposal but rejects the need for scheduled reductions in acid rain emissions. Canada tables a proposed agreement.

March 28, 1988 — In a speech to the America's Society the Prime Minister says nothing less than targeted, mandated reductions in acid rain emissions in the United States will suffice.

April 27, 1988 — The Prime Minister addresses a Joint Meeting of the U.S. Congress where he invites the leadership of Congress and the Administration to conclude an accord with agreed emission reduction schedules and targets. The Prime Minister presents the U.S. President with an eight-point outline of what Canada wants in a bilateral accord. The President instructs the Secretary of State to discuss the proposal as a matter of priority with the Secretary of State for External Affairs.

April 27-28, 1988 — Under the aegis of the UN Economic Commission for Europe, Canada, the United States, and 33 European countries agree on a protocol requiring countries to freeze their NO_x emissions and subsequently reduce them to non-damaging levels.

June 8, 1988 — The Canadian Environment Minister announces a $1.5 million communications effort aimed at persuading American tourists of the need to take action to reduce acid rain emissions.

For more information on acid rain, contact:
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History of Canada-U.S. Negotiations

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Discussion Note

In practical terms, how do governments of two jurisdictions with close economic ties pursue joint environmental policies? This reading sets out the negotiation process up to 1988, the last year of the Reagan Administration. It raises a number of issues, such as the right of foreign interests to lobby Congress, the likely reasons for the reluctance of legislators to embrace what opinion polls had suggested could be a winning issue, as well as the trade off between immediate economic gains and additional controls in an issue that was apparently not life threatening.

A question for students of the U.S. process: What advice would they give the Government of Ontario; should it have been seeking to lobby the U.S. government to try to get more results from the U.S. system?

Negotiations On Acid Rain

Introduction

The current disagreement between the United States and Canada over acid rain illustrates the difficulties involved in resolving a bilateral dispute between two nations. Canada and the United States are closely allied on many issues of mutual concern and have cooperated in the past to resolve conflicts. However, the acid rain issue presents unusual complexities and, based upon the current status of the formal negotiations, it is unlikely that an agreement will emerge in the near future. This chapter traces the origins, progress, and present status (spring 1988) of the acid rain negotiations between the United States and Canada and examines the major areas of disagreement.

The Beginning of Negotiations

The foundation for agreements on environmental matters between Canada and the United States was laid on January 11, 1909, with the signing of the Boundary Waters Treaty. This agreement established the International Joint Commission (IJC) and adopted a number of fundamental principles in the regulation of international waters separating the two countries.[1] The accomplishments of the IJC and its role in alerting the governments to the threat of acid rain are described in chapter 8.

Momentum toward a bilateral agreement on acid rain did not develop in the United States until 1978, when the Great Lakes Water Quality Agreement was concluded under the auspices of the IJC. One part of the agreement stipulated that each government would take appropriate measures to control, abate, and prevent pollution from airborne contaminants, and consult on remedial measures. This section had been included in the agreement as a result of IJC studies during 1972–78 showing that a high proportion of pollutants entering the Great Lakes came from the atmosphere. Congress also placed a rider on the Foreign Relations Authorization Act of 1978, directing the Department of State to begin negotiations with Canada on an air quality agreement.[2] This congressional concern was prompted both by the IJC reports and by Canadian plans to construct two new oil-fired thermal generating plants across the border from Montana and Minnesota.[3] In October 1978 the Bilateral Research Consultation Group on the Long-Range Transport of Airborne Pollutants was formed subsequent to correspondence between the Department of State and the Canadian embassy. This group was given the task of consulting on ongoing research efforts and facilitating an exchange of technical information on the long-range transport of air pollutants.[4]

Following a further exchange of notes between the governments in November 1978, informal bilateral talks took place on December 15, 1978, and again on June 20, 1979. At these talks discussion papers on the major aspects of the issue were exchanged. The discussions led to a joint statement released in Ottawa on July 26, 1979,[5] in which the parties made reference to two earlier environmental agreements. One, the Boundary Waters Treaty, obligates both governments to ensure that "boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property."[6] Second, both governments supported Principle 21 of the 1972 Stockholm Declaration on the Human Environment, which declares that states have the "responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or areas beyond the limits of national jurisdiction."[7] The joint statement commits both governments to the development of a cooperative bilateral agreement on air quality, moving the discussions beyond the informal stage. This commitment is as yet unfulfilled, but remains binding on both partners.

The statement concludes with a list of principles or practices that were to be addressed in the formal negotiations. These include prevention and reduction of harmful transboundary air pollution; development and implementation of control strategies; expanded notification and consultation practices; increased technical research and exchanges of scientific information; expanded monitoring and evalua-

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tion; long-term environmental assessments; consideration, as part of an agreement, of institutional arrangements, equal access, nondiscrimination, liability, and compensation; and actual implementation measures.

Canadian hopes for fast progress in reaching an agreement were diminished when, in February 1980, the Carter administration announced a program to convert over one hundred oil-fired power plants, located in different parts of the country, to coal. Once implemented, the plan would have substantially increased U.S. sulfur dioxide emissions. Although President Carter realized that his decision would harm U.S.-Canadian environmental relations, the goal of energy self-sufficiency took precedence. The conversion plan ultimately failed in Congress, but damage to the negotiations had been done.[8]

The Memorandum of Intent on Transboundary Air Pollution

Despite the setback, negotiations continued and a Memorandum of Intent on Transboundary Air Pollution (MOI) was signed on August 5, 1980. This agreement committed both governments to develop a bilateral agreement and, in the interim, to take preliminary actions to control transboundary air pollution. The major provisions are: "(1) to develop a bilateral agreement which will reflect and further the development of effective domestic control programs and other measures to combat transboundary air pollution; (2) to facilitate the conclusion of such an agreement as soon as possible; and (3) pending conclusion of such an agreement, to take interim actions available under current authority to combat transboundary air pollution."[9]

The MOI established a joint coordinating committee to begin preparatory discussions immediately and formal negotiations no later than June 1, 1981. The committee would oversee work groups in charge of investigating particular issues. Generally, the MOI formalized the 1979 joint statement. It went further in the control measures section, however, since it committed both governments to reduce transboundary pollution by developing national control measures and enforcing existing controls. The exact language of these provisions is important to note. Both countries agreed to: "(a) develop domestic area pollution control policies and strategies, and, as necessary and appropriate, seek legislative or other support to give effect to them; (b) promote vigorous enforcement of existing laws and regulations as they require limitations of emissions from new, substantially modified and existing facilities in a way which is responsive to the problems of transboundary air pollution."[10]

Negotiations during the First Reagan Term

During the spring of 1981 progress slowed. The new Reagan administration appointees in the Interior Department and the Environmental Protection Agency (EPA) disagreed with their Canadian counterparts over the extent and danger of acid rain, asserting that further research was necessary prior to implementing costly control measures. The Canadian minister of the environment, John Roberts, repeatedly expressed concern that the United States was not living up to the provisions of the MOI.[11] Roberts charged that the use of cost-benefit analyses to determine control levels, as suggested by the United States, was unacceptable when applied to transboundary pollution. He further complained that no new interim controls, as specified in the MOI, were being implemented or even contemplated by the U.S. government. Also surfacing was the suggestion that Canada might use its supplies of hydroelectric power, a significant amount of which is exported to the U.S., as a lever to force U.S. acceptance of a bilateral acid rain treaty.[12] In April, however, Roberts met with Secretary of the Interior James Watt and was assured that negotiations would begin on schedule and that no changes would be made to the U.S. Clean Air Act that could harm Canada. (The act was up for reauthorization and had been viewed by the new administration as a prime vehicle for granting regulatory relief to industry.) Secretary Watt promised that the government's power to control acid rain would not be curtailed.[13]

The growing reluctance by the Reagan administration to begin formal negotiations was in part responsible for a hearing on May 20, 1981, before two subcommittees of the House Committee on Foreign Affairs.[14] The U.S. chairman of the Coordinating Committee on Transboundary Air Pollution, Ray C. Ewing (who was also the deputy assistant secretary of state for European affairs), was one of the witnesses. He assured the committees that formal negotiations would begin as scheduled the following month, and that Congress would be consulted fully during the course of these negotiations. This last assurance, according to committee staff, was never fulfilled.

Outside of recounting past actions, the one notable point made by Ewing was that more research was needed to confirm the cause-and-effect relationship in the acid rain issue.[15] This position was later to emerge as the principal stand of the U.S. negotiating team and is a primary reason for the presently stalled negotiations. Mr. Ewing noted a close link between the reauthorization of the Clean Air Act and the negotiation of a bilateral transboundary air pollution agreement,[16] but did not say how the administration would handle the linkage. In

response to concerns from committee members that the negotiations could proceed indefinitely and therefore would not be concluded in conjunction with the reauthorization of the Clean Air Act, Ewing could only reaffirm the administration's commitment to conduct serious negotiations on the issue and to endeavor to conclude an agreement as soon as possible. Over the next several months it became clear that the Reagan administration did indeed intend to link the Clean Air Act reauthorization with acid rain negotiations, thus further reducing the chances of a timely bilateral agreement.

The first formal negotiating session took place on June 23, 1981. The meeting, and a second session in November, consisted primarily of an exchange of ideas and a review of the available scientific data. Draft portions of an agreement were exchanged. At the third session in February 1982 Canada submitted its first formal proposal: Canada would reduce sulfur dioxide emissions by 50 percent by 1990 if the United States would take similar action. The United States preferred a longer time frame for developing solutions, with U.S. policy to be shaped in response to future research. The Canadians agreed with the need for a flexible, long-term strategy, provided it would not be used to prevent interim action.[17] Specifically, the Canadians criticized the lack of any proposals for new air pollution control measures from the Reagan administration. The Canadian negotiators felt that their government was taking concrete steps to reduce sulfur dioxide emissions from Canadian industries and utilities, while the United States was attempting to lessen existing environmental controls. The Reagan administration's deregulation program, like the Carter coal plan before it, took priority over acid rain within the U.S. administration. While the Canadians sought a long-term agreement and immediate control measures, the United States proposed continued cooperation in research, which would clarify the uncertainties and lay the groundwork for effective programs to deal with the problem.

In October 1982 Secretary of State George Shultz met with Canadian External Affairs Minister Allan MacEachen concerning the negotiations, and agreed to exchange papers on key points relating to acidic deposition. In January 1983 these papers were formally exchanged. The Canadians reiterated their claim that sulfur dioxide emissions from coal-burning plants were the major causes for fish kills in freshwater lakes, as well as crop and forest damage. Again, a mutual 50 percent reduction in emissions was suggested. The U.S. position remained that more research was required before expensive control measures would be considered.[18]

April 1983 saw another meeting between External Affairs Minister MacEachen and Secretary Shultz in Washington, but little progress was made toward resolving the dispute. They decided, however, to have scientific advisers compare notes and make plans for another meeting in the summer.

Hopes for a timely resolution of the issue were revived when President Reagan appointed William D. Ruckelshaus to succeed Anne Burford as administrator of the EPA in May 1983. The president directed that acid rain be the first priority for the new EPA administrator. Despite cutbacks in other areas, funding for acid rain research was doubled.[19] Ruckelshaus stated at the time that: "My understanding now is that there is no question that there is a problem of acid deposition that impacts on certain lakes in the northeastern part of this country and in Canada and that a major contribution to the cause of that is man-made."[20] But he also noted that he was uncertain how to go about fashioning a program that might provide relief for acid rain-stricken areas.

Throughout the summer of 1983 Ruckelshaus worked to develop a control program that would have a chance of being backed by a large enough coalition of interests. By September he had developed a plan that called for modest reductions in emissions from coal-fired power plants. When presented to the Cabinet Council on Natural Resources and Environment, the plan met stiff opposition from Budget Director David Stockman and Energy Secretary Donald Hodel. Stockman and Hodel blocked any new controls, stating that Ruckelshaus's proposal would be too costly to electric power companies and their ratepayers.[21] In hearings before the U.S. Senate Committee on Environment and Public Works, Ruckelshaus accepted the president's judgment to defer controls, and pointed out that an eventual SO_2 control strategy would require several elements: improved information on what new controls would buy; a reasonable consensus among the most affected parties; and a system for sharing the cost of controls by the entire nation.[22] The *Washington Post* reported that Ruckelshaus told the Canadians not to expect action soon.[23]

In his State of the Union Address in January 1984, President Reagan restated the administration's "research before action" strategy. In response, the Canadian government sent a formal note registering its disappointment with the U.S. position and asking how the U.S. government planned to honor previous commitments, which had been restated by President Reagan during his visit to Canada in 1981, to control transboundary air pollution. At the time the president had stated before the Canadian House of Commons: "We want to continue to work cooperatively to understand and control the air and water

pollution that respects no borders." The Canadian note three years later accused the U.S. government of no longer honoring this commitment: "The continued delay in adopting effective abatement measures is not acceptable to Canada. Canada considers that the decision [to limit action to increased research] fails to take full account of U.S.A. undertakings and ignores protecting the North American environment."[24]

The Special Envoys on Acid Rain

After the election of a more conservative administration in 1984, the Canadian government toned down its attacks on the Reagan administration and is now trying to advance negotiations through quiet diplomacy. On March 17 and 18, 1985, Prime Minister Brian Mulroney and President Ronald Reagan met in Quebec City to discuss a wide range of bilateral issues. At that meeting acid rain was recognized by both leaders as a serious concern affecting bilateral relations. Each agreed to appoint a special envoy to review the issue and report to them prior to their next summit meeting in the spring of 1986. Drew Lewis, former secretary of transportation, and William Davis, former premier of Ontario, were assigned four specific tasks: (1) to pursue consultation on laws and regulations related to pollutants thought to be linked to acid rain; (2) to enhance cooperation in research efforts, including research on clean-fuel technology and smelter controls; (3) to pursue means to increase exchange of relevant scientific information; and (4) to identify efforts to improve the U.S. and Canadian environment.[25]

After a year of studying the problem and meeting with representatives of all the interested parties—government, industry, and nonprofit organizations—they concluded that:

1. *Acid rain is a serious problem in both the United States and Canada.* Acidic emissions transported through the atmosphere undoubtedly are contributing to the acidification of sensitive areas in both countries. The potential for long-term socioeconomic costs is high.
2. *Acid rain is a serious transboundary problem.* Air pollutants emitted by sources in both countries cross their mutual border, thus causing a diplomatic as well as an environmental problem.
3. *At the present time, there are only a limited number of potential avenues for achieving major reductions in acidic air emissions*, and they all carry high socioeconomic costs.[26]

Keeping in mind that the envoys' mandate was not to find a final solution to the bilateral problem of acid rain, recommendations were made in three general areas:

1. *Innovative control technologies.* The U.S. government should implement a five-year, $5 billion control technology commercial demonstration project, funded jointly by the federal government and industry. Projects should be selected according to their ability to produce the greatest emissions reductions at the least cost at the greatest number of facilities. This research effort should be overseen by a panel headed by a senior U.S. cabinet official and should include representatives from the Department of State, state governments, and Canada.
2. *Co-operative activities.* Opportunities should be found in existing clean air legislation in each country for addressing environmental concerns related to transboundary air pollution. Diplomatic channels should be used to convey contemplated changes in these laws or regulations to the other country. Acid rain should remain high on the agenda in meetings between the president and prime minister, and a bilateral advisory group on transboundary air pollution should be established using both diplomatic and environmental management officials.
3. *Research.* The following areas were identified as those that would help to dispel some of the remaining uncertainty associated with acid deposition: development of a dry deposition monitoring network; development of models for predicting watershed responses to acid deposition; quantification of the relationship between changes in surface water chemistry and changes in aquatic biota; investigation of the potential link between forest decline and acid rain; quantification of the extent of current damage to structures; and determination of the potential health effects associated with increased solubility of heavy metals in acidified water.[27]

Because the report acknowledged the seriousness of the transboundary environmental problem but did not recommend immediate action, it has received a mixed reception. Canadians were particularly disappointed. Nevertheless, Canadian Ambassador Allan Gotlieb lobbied hard to secure White House endorsement prior to the March 1986 summit meeting between President Reagan and Prime Minister Mulroney. However, the whole process appears to have been an exercise in diplomatic niceties, without achieving concrete results. At the time, $800 million had been secured for clean-coal technology research in the United States, but Congress has not appropriated any more money since then. In his 1988 budget the president did request the

federal government's share of a $5 billion clean-coal technology development program. However, the Canadians responded by saying that the request did not fulfill the commitment made by the president to implement the terms of the special envoys' joint report. They see the initiative as falling short in three major areas: (1) it will not provide any measurable reduction in transboundary pollution prior to 1995; (2) no significant reductions in transboundary air pollution flows will be apparent for at least twenty-five years, whereas clean-coal technology initiatives that met the criteria delineated in the envoys' report could result in cleaner, more cost-effective technologies within ten years; (3) of the $6.8 billion requested, $5.3 billion is earmarked for projects that meet one of the technical criteria, and only $1.7 billion of expenditures meet all of the technical criteria of the envoys' report.[28]

In April 1987 President Reagan said he would consider negotiating an acid rain accord. Responding to this initiative, the following month the Canadians submitted a conceptual paper as the basis for negotiation. On January 25, 1988, following extensive interagency review in the United States, a joint meeting was arranged in Washington between U.S. and Canadian officials. A full draft accord was submitted by the Canadians; but with the U.S. side still refusing to consider reduction targets or a timetable for controls, there is little possibility of a settlement emerging from this meeting.[29]

The Canadian negotiating position remains unchanged. A Canadian diplomat summed it up in three points on which agreement is sought from the United States: (1) a significant reduction in sulfur dioxide emissions; (2) a commitment to a deposition maximum of eighteen pounds of sulfate per acre per year; and (3) the creation of a bilateral mechanism to review new scientific information and to monitor the state of the environment.[30]

In the first edition of this book we stated that "the impasse within the Reagan administration over national as well as international acid rain controls persists to this day (spring 1985). Congress also remains unable to achieve a consensus on acid rain legislation. No action was taken during the election year, and the 1984 election did not push the issue to the forefront of public attention, thus precluding a national debate of the issue and a possible settlement in the near future." The situation in spring 1988 has changed very little. As discussed in chapter 7, Congress is somewhat closer to coming to a bipartisan agreement over acid rain controls, but the administration persists in its position that more research is needed. In fact, as discussed in chapter 2, the official position of the administration, as delineated in the interim report of the National Acid Precipitation Assessment Program, appears to be a step backward. It seems unlikely that the Reagan administration will change its position during the last year of its tenure.

Issues and Perspectives

Scientific Uncertainties

The present impasse in the negotiations is attributable to disagreements over a wide range of issues. As chapter 2 shows, scientific experts generally agree on what is known about acid rain and what can and cannot be concluded from the available information. The major differences between the U.S. and the Canadian positions arise from different views about the urgency of corrective action and whether damage can be reversed. The United States has adopted the stance that gaps in knowledge about the chemistry and transport of acid deposition make it unwise, at this time, to impose costly legislative remedies to control sulfur dioxide emissions. Limited resources should be spent on research and development of more effective control equipment rather than on a control program of unproven effectiveness.

There has been some evolution in the U.S. position. In the early years of the Reagan administration, highly placed officials such as former EPA administrator Anne Burford pointed out that "several rigorous studies cast doubts on the theories" that the major causes of acid rain are coal-fired industries.[31] Her successor at EPA accepted the consensus of scientific assessments that man-made emissions are a major cause of acid rain. He added: "If acid rain controls were cheap, there wouldn't be any disagreement on the science."[32] Even so, he was unable to convince the president and his advisers that additional air pollution abatement measures should be taken to reduce the long-range air pollution. William Ruckelshaus was replaced as EPA administrator by Lee Thomas, whose views are much more in tune with the administration's position. Thomas has testified before Congress that the Clean Air Act in its present form provides adequate protection against air pollution. He opposes all the major provisions for strengthening the act, maintaining that additional controls for acid rain precursors are not necessary at the present time.

The Canadian position is that interim controls are needed to protect the environment from irreversible damage while further studies

are conducted. Research is needed to evaluate and improve abatement efforts, but not as a substitute for control measures. Furthermore, there is a perception among the Canadians that some U.S. environmental officials believe only those studies that support the U.S. position. Canadians point out that U.S. officials discounted a major EPA study on acid rain that strongly linked emissions from midwestern coal-burning utilities to the destruction of lakes and their fish populations in both the United States and Canada.[33]

Before a meeting of the U.S. Air Pollution Control Association, Canadian Environment Minister Roberts declared: "In Canada we are deeply disappointed with the state of negotiations. . . . The foot-dragging and interference in the development of scientific information has reached frustrating proportions. The administration's rejection of our proposal to reduce sulfur dioxide emissions in eastern North America by 50 percent by 1990 and a clear indication that it may be some considerable period of time before it will even be able to discuss control actions, is a bitter pill to swallow."[34]

Since then, even stronger accusations have come from Canadian officials. In a speech before the National Academy of Sciences in Washington, D.C., Raymond Robinson, head of Canada's Federal Environmental Assessment and Review Office, accused the Reagan administration of "blatant efforts to manipulate acid rain work groups."[35] Robinson also charged that the Reagan administration was suppressing scientific information concerning acid rain, that money for mutually agreed-upon clean-up programs was being withheld, and that the United States was still not cooperating in the spirit of previous agreements and had not committed itself to the intent of the MOI to conduct serious negotiations.

In a 1984 demarche to the U.S. government, Canada pointed out that over three thousand scientific studies on acid rain have been conducted, resulting in "sufficient scientific evidence ... by prestigious scientific bodies in North America and Europe on which to initiate controls programs." The press release summarizing the official note adds that the available evidence has been found sufficient to justify controls in many countries: "Like Canada, Germany, Finland, Sweden, Norway, Denmark, France, Austria, and Switzerland have all agreed, on the basis of the available and overwhelming scientific evidence, to adopt programs to cut back sulphur dioxide emissions."[36]

The recent release of the interim report of the Interagency Task Force on Acid Rain appears to be a step backward on the part of the Reagan administration.[37] In contrast to previous scientific assessments, and inconsistent with the spirit of the special envoys' report, it concludes that acid rain is not a serious problem and that it is too early to determine whether abatement action is necessary. In a letter to EPA administrator Lee Thomas, Canadian Minister of the Environment Tom McMillan characterized the report as "flawed, incomplete and misleading."[38]

Format of the Agreement

A bilateral acid rain agreement could be in the form of a formal treaty or an informal executive agreement. The Canadian government prefers a formal treaty for several reasons. A treaty requires the consent of the U.S. Senate and becomes national law. Under these circumstances U.S. clean air laws would be required to reflect the provisions of the treaty (which the Canadians hope will contain strict source emissions standards) and would be enforceable in U.S. courts. Similarly, a treaty containing such standards would provide for clear, definable avenues whereby Canadians or Americans could contest particular pollution control actions or inactions. A treaty would also facilitate the Canadian federal government's control over provincial actions (subject naturally to political considerations). At present, control of ambient air quality and stationary source emissions are provincial responsibilities. As discussed in detail in chapter 6, control authority only devolves upon the Canadian federal government when there is an international obligation or a health danger. An informal executive agreement would not give the Canadian federal government such authority.

The treaty format, however, has its drawbacks. In the United States the treaty approval process can be long and drawn out. The Senate has been reluctant in recent years to approve formal treaties. Given past failures of treaties concerning fishing rights, maritime boundaries, and the Law of the Sea, an acid rain treaty may never receive Senate approval. A treaty is also less flexible than an agreement. Incorporating specific emissions standards in a treaty would inhibit both governments' flexibility in shaping future environmental regulations. A requirement for scrubber technology on plants would discourage development of new and better control technologies. Similarly, a treaty provision setting emissions levels would be hard to change if new information became available suggesting different levels.

On the U.S. side, an executive agreement can be acted upon by the president alone. The president could enter into an agreement in order to diffuse charges of inaction and improve bilateral relations without waiting for legislation introducing a new air pollution control policy.

It is unlikely that the current administration will opt for this approach. But even if a new administration were politically more inclined to reach an agreement with Canada, it would have to examine carefully whether meaningful reductions in acid deposition can be reached within the framework of existing legislation. This point is addressed later in this chapter in the analysis of Section 115 of the Clean Air Act.

In either case there would still remain the question of enforcement. Canadians point to the recent unwillingness of the EPA to enforce existing pollution standards. Conversely, the U.S. government has criticized Canada for not using available emission control technology. (Since that time Canada has made significant progress in strengthening its clean air laws; see chapter 6.) A solution would be to establish an independent advisory commission to oversee domestic actions in both countries and report its findings of compliance or noncompliance. Though neither country would be inclined to grant such a commission enforcement powers, an independent body would be valuable as an impartial way for evaluating compliance. Another alternative would be to make each country's environmental control agency responsible for oversight. The agencies could make reports to their respective legislative bodies and chief executives as to compliance with the agreement. Whatever alternative is selected, it will work only if domestic law backs up the international agreement.

Political Considerations

Political Developments The elections of 1980 had an important effect on the progress of the negotiations. The Canadian government became concerned that the Reagan administration would not faithfully carry out agreements reached with the Carter administration. Although President Reagan assured former prime minister Trudeau that the United States is committed to achieving a transboundary air pollution agreement, other statements and actions of the president and his associates indicate that the Reagan deregulation program has a higher priority. The Reagan administration has argued for relaxing provisions in the Clean Air Act; has cut back appropriations and staffing for the EPA; has refused to consider various international agreements on fishing rights and the Law of the Sea; and has repeatedly called for continued research prior to implementing any control measures to reduce sulfur dioxide emissions. These administration attitudes and actions have strained harmonious bilateral relations. The 1984 election of Brian Mulroney as prime minister of Canada and the return of Reagan to the White House may have led to better personal relations between the heads of state, but it has not produced significant progress on the acid rain issue.

Environmental Perspectives Polls have shown that Americans and Canadians alike are concerned about environmental protection. Concern tends to be highest when a problem is viewed as affecting the entire nation and posing a direct threat, in particular to human health, to large numbers of individuals. The evidence on acid rain in either country does not suggest that these conditions are met. But perceptions are a different matter. Canadians definitely view acid rain as a serious national threat. A high degree of public awareness has helped in building a national consensus and surprisingly strong cooperation between industry and government in dealing with the problem. Many Canadians live downwind from U.S. air pollution and therefore are pressing hard for a bilateral air quality agreement. Concern in the United States is likely to increase when coal-fired plants are in full operation at Poplar River, Saskatchewan, and Atikokan, Ontario (both within fifty miles of the U.S. border), bringing transboundary pollution to areas in Montana and Minnesota. Although some Canadians still view their wilderness area as unlimited, concern about its future will increase further should Canadian forests (supplying pulp and paper mills) be damaged and harm to lakes (for fishing and tourism) become more widespread.

American environmentalists are equally concerned over environmental degradation, but attention to acid rain is not yet as intense as the earlier response to such dangers as the use of pesticides and industrial chemicals, water pollution, local air pollution, habitat destruction, and species preservation. During the 1970s Canada followed the U.S. lead in environmental policy. For years the acid rain problem depended on Scandinavian leadership. Acid rain is now an issue around which a variety of Canadian groups, including environmentalists, have coalesced, and Canada has taken the lead in North America. In the long run, however, U.S.-Canadian environmental relations must be built around the fact that both countries share the same atmosphere and environment.

Perspectives on Bilateral Relations Bilateral relations take on different levels of importance in Canada and the United States. For Canada, relations with the United States are the most crucial aspect of foreign policy. Most Canadians live near the U.S. border and are inundated by U.S. culture, economics, and politics through television, movies, mag-

azines, and newspapers. The United States is Canada's principal trading partner, and the two nations are closely allied on defense matters. Virtually everyone in Canada is aware of the current state and scope of U.S.-Canadian bilateral relations.

In comparison, most Americans have at best only a limited knowledge of Canada and U.S. relations with Canada. The vast range of U.S. international commitments relegates Canada to a less-than-premier position. Bilateral relations with Canada are more often than not considered to be of secondary or lesser importance in U.S. foreign policy. Often U.S.-Canadian cultural, economic, and political similarities, coupled with Canada's relatively small population, have produced a condescending attitude on the part of U.S. foreign policymakers. This has led to the erroneous assumption that Canada will always support U.S. foreign policy initiatives in order to maintain harmonious bilateral relations. The Vietnam War showed that this is not always the case, and continued persistence in this assumption will be detrimental to the progress of the acid rain negotiations. Past bilateral agreements have addressed either mutual concerns (e.g., boundary waters) or issues that were of predominant interest to the United States (e.g., certain fishing and maritime boundary treaties). In the case of acid rain, the United States may have to shoulder more of the costs of control and the Canadians may reap more of the benefits. This will test the nature of cooperation between the neighboring nations.

Linkage Presently, as a matter of principle, neither country favors linking acid rain to other bilateral issues. Both believe that bilateral disputes should be resolved on their individual merits and not by the threat of action (or inaction) by one of the parties in regard to nonrelated concerns. Even so, if negotiations remain stalled Canada may feel compelled to seek redress in some indirect way for the costs believed to be inflicted on the Canadian environment by American industries and utilities. However, both sides can employ this method, and by doing so could damage bilateral relations on the entire range of issues between the two countries.

Although linkage is undesirable, it cannot be overlooked. Neither nation can realistically be expected to give ground on one bilateral issue without receiving satisfaction on other issues. If Canadian-U.S. relations are to remain cooperative and friendly, both sides must realize that the costs of not concluding an acid rain agreement extend far beyond that one issue. Canada and the United States each have an interest in a variety of actions under consideration by the other government. The United States, for example, is interested in Canada

relaxing the restrictions contained in its National Energy Policy and the Foreign Investment Review Agency; in continuing close mutual defense efforts; and in obtaining extended rights to Canadian offshore fishing areas. Canada, on the other hand, is concerned with transboundary air pollution; Great Lakes water quality; the Garrison diversion project; and plans to build a major oil refinery and supertanker port at Eastport, Maine, as well as other environmental and trade issues. Both nations, in fact, view trade and associated economic issues as areas of mutual concern.

Canadian Lobbying Efforts The lack of progress on the diplomatic front in concluding a bilateral acid rain agreement has led the Canadians to pursue other avenues by which to influence U.S. policy on this matter. How effective lobbying will be is as yet unclear. Canadian Environment Minister Roberts has traveled extensively in the United States, speaking to the press and various professional organizations and publicizing Canadian concerns for continued, constructive negotiations. The Canadian Environmental Department also sponsored two controversial films on acid rain that were distributed to interested organizations within the United States. Even though the Canadian Department of External Affairs has discouraged direct participation of cabinet members and civil servants in the American political arena, various officials have testified before congressional committees on reauthorization of the Clean Air Act. A prominent legal firm in Washington has been engaged by the Canadian embassy to monitor environmental issues in Congress that relate to Canadian concerns and to advise the embassy on appropriate lobbying action.[39] Acid rain awareness programs have been started at fifteen Canadian consulates in the United States, and tours have been arranged for legislators, staff members, and journalists to visit acid rain-damaged areas in Canada.

Perhaps the most interesting tactic has been the formation of the Canadian Coalition on Acid Rain (CCAR), the first registered Canadian lobbyist in the United States working for a nongovernment, nonbusiness, citizens' organization. Representing more than fifty separate organizations with membership approaching two million Canadians, CCAR has furthered efforts to publicize the acid rain issue in the United States and pressure American legislators to adopt a regulatory program on acid rain as part of the reauthorization of the Clean Air Act.[40] So far these lobbying efforts have had little visible effect upon the course of the formal negotiations. It is perhaps due to a growing sense of desperation that the Canadians have adopted this type of strategy. Reasoning that the formal negotiations

are stalled, Canada is trying out new methods to influence U.S. policy on acid rain.

Section 115 of the Clean Air Act

An important issue in diplomatic negotiations has been the question of the usefulness of existing provisions, in particular Section 115 of the Clean Air Act, as a means for controlling acid rain between Canada and the United States.[41] The Act states:

> a. Whenever the Administrator, upon receipt of reports, surveys, or studies from any duly constituted international agency, has reason to believe that any air pollutant or pollutants emitted in the United States cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare in a foreign country, or whenever the Secretary of State requests him to do so with respect to such pollution which the Secretary of State alleges is of such a nature, the Administrator shall give formal notification thereof to the Governor of the State in which such emissions originate.
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> b. The notice of the Administrator shall be deemed to be a finding under Section 110(a)(2)(H)(ii) which requires a plan revision with respect to so much of the applicable implementation plan as is inadequate to prevent or eliminate the endangerment referred to in subsection (a). Any foreign country so affected by such emissions of pollutants shall be invited to appear at any public hearing associated with any revision of the appropriate portion of the applicable implementation plan.
>
> c. This section shall apply only to a foreign country which the Administrator determines has given the United States essentially the same rights with respect to the prevention or control of air pollution occurring in that country as is given that country by this section.[42]

The reciprocity provision contained in subsection (c) has led to Canadian action. In December 1980 the Canadian Parliament passed Bill C-51 (an amendment to the Canadian Clean Air Act), which is remarkably similar to Section 115 of the Clean Air Act. Upon its passage the EPA administrator acknowledged that it met the reciprocity requirement, thus clearing the way for the potential use of Section 115.

The Canadian federal government, which has limited constitutional powers in environmental policy, had previously used its international obligations to involve itself in provincial air pollution cases. Actions taken include reductions of sulfur dioxide at INCO, Ltd., monitoring of discharges at the Poplar River power plant, and scaling down the size of the Atikokan power plant. This cooperation between the federal and provincial governments was intended to show the United States that Canada has taken action to reduce its own sulfur dioxide emissions. Although the federal government is not in a position to force a province to implement pollution control measures with which it does not agree, continuing cooperative efforts to reduce emissions by 50 percent suggest that this does not create a barrier to further progress.

Another question is whether or not Section 115 and Bill C-51 are the appropriate means for dealing with transboundary air pollution. As an interim action their use would be appropriate. The MOI of 1980 specifically required that each country take interim actions to control transboundary air pollution, utilizing existing domestic legislation. Thus, the use of these provisions would be an appropriate means to meet an international obligation the United States entered into in 1980, until such time as a formal agreement has been concluded.

But there are questions concerning the use of Section 115. For example, what is meant by the words "endangers public health or welfare in a foreign country"? As long as scientific uncertainties remain or as long as the administration does not recognize a direct cause-and-effect relationship between sulfur dioxide emissions in the United States and acid rain in Canada, it is unlikely that Section 115 will be utilized. To prevent reevaluation of state implementation plans, the EPA administrator or the secretary of state need only state that no definable problem exists. Under present conditions, therefore, Section 115 of the Clean Air Act will not be used in place of a negotiated, bilateral, transboundary air pollution agreement. If attitudes or administrations change, the EPA, working in concert with affected states (and Canada), could draw up specific measures to implement the provisions of Section 115.

Conclusions

Negotiations, both informal and formal, toward concluding a transboundary air quality agreement have been in progress since 1978. Initially, progress was made in identifying issues, organizing research groups, and concluding interim agreements. Serious setbacks occurred, however, when the United States decided to embark upon power plant conversions to coal and when the Reagan administration began its deregulation drive, under which acid rain became a secondary issue. The negotiations came to a virtual standstill when U.S. negotiators claimed that scientific uncertainties concerning acidic deposition had to be resolved before costly sulfur dioxide control measures could be adopted.

In order to restart productive negotiations, both sides must recog-

nize that the dispute affects the entire range of U.S.-Canadian relations. Leaving this issue unresolved will eventually lead to the deterioration of bilateral relations in other areas. This could result in a de facto linkage to other bilateral issues and the inability to resolve them successfully. A formal treaty or executive agreement on acid rain control will be needed to specify the rights and responsibilities of both sides, giving both nations avenues to address grievances in the other country. Political goodwill and cooperation between Canada and the United States will both be needed to resolve this serious bilateral dispute.

Special Envoys' Joint Report

This reading reprints the *Joint Report of the Special Envoys on Acid Rain,* by Drew Lewis, U.S.A. and William Davis, Canada.

Discussion Note

This reading is one of the earliest products of acid rain diplomacy. It sets out the history of bilateral approaches to acid rain and summarizes the approach of each nation to date.

Was it a sign of progress or a further indication that U.S. policy makers were still unready to take on the coal and other interests opposed to stronger regulation?

I. BACKGROUND

The United States and Canada share a long tradition of mutual friendship and co-operation and share similar points of view on many international issues. We are also each other's largest trading partners, an economic relationship involving billions of dollars' worth of manufactured goods, services, and raw materials. These common bonds between close neighbors and good friends are valued aspects of a shared history on which both countries continue to build.

Over the past two decades, scientists and government officials on both sides of our border have become aware of the serious environmental problems associated with airborne pollutants transported over long distances. The most serious of these problems is acid rain. Although we do not understand all the mechanisms of the formation and transport of acid rain or the full extent of its effects, it is clear that those causes and effects are shared by both countries. Air emissions from sources in both the United States and Canada have increased significantly the deposition of sulfates and nitrates on both U.S. and Canadian ecosystems.

On March 17 and 18, 1985, Prime Minister Brian Mulroney and President Ronald Reagan met in Quebec City to discuss a wide range of bilateral issues such as mutual defense, trade, and the environment. That meeting, later referred to as the "Shamrock Summit," was viewed as a unique opportunity to reinforce ties between the two countries. At that meeting acid rain was recognized by both leaders as a serious concern affecting bilateral relations.

Noting the 75-year history of environmental co-operation between the two countries, the President and the Prime Minister expressed their determination to address current U.S.-Canadian environmental issues, including acid rain, in the same spirit of responsibility and co-operation. Consequently, each agreed to appoint a personal Special Envoy to examine the acid rain issue and report back before their next meeting, scheduled for the spring of 1986. For the first time, Special Envoys appointed by both the U.S. and Canadian governments were to review jointly this serious environmental issue affecting both nations. These special appointments emphasized the need for both countries to work together to resolve a shared transboundary problem.

II. U.S.-CANADIAN ENVIRONMENTAL RELATIONS

While of relatively recent origin, Canadian and U.S. efforts to address problems associated with the long-range transboundary transport of airborne pollutants have occurred within the context of a 75-year tradition of environmental co-operation.

The cornerstone of our bilateral environmental relaitonship is Article IV of the *Boundary Waters Treaty* of 1909, wherein each country agreed not to pollute boundary waters to the injury of health or property in the other country. With the Article IV obligation as a foundation, both countries have built a long tradition of generally successful resolution of a wide variety of transboundary environmental problems, both through the International Joint Commission and on a government-to-government basis. Notable among recent achievements have been the *Great Lakes Water Quality Agreements* of 1972 and 1978, which were ambitious joint efforts to improve Great Lakes water quality throught the adoption and gradual refinement of water quality objectives, both general and specific.

Bilateral efforts to protect transboundary air quality date to the Trail Smelter case in 1949. An arbitration panel established to resolve an air pollution problem caused by the Trail Smelter held that "no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another."

Both Canada and the United States also subscribe to Principle 21 of the 1972 *Stockholm Declaration* which, like Article IV and the Trail Smelter case, provided that States have the responsibility "to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States." Additionally, both countries are parties to the 1979 *Convention on Long-Range Transboundary Air Pollution*, under which signatory States from the Economic Commission for Europe (ECE) expressed a determination to "endeavour to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution."

Acid rain became recognized as an important bilateral environmental problem in the mid-1970s. The first response of both the U.S. and Canadian governments was to establish in 1978 the Bilateral Research Consultation Group to report on the extent and significance of long-range air pollution problems, including acid rain, with special reference to the overall transboundary pollutant flux.

In 1978, the U.S. Congress passed a formal resolution which called upon the President to "make every effort to negotiate a co-operative agreement with the Government of Canada aimed at preserving the mutual airshed of the United States and Canada." Subsequent to this Resolution, representatives from the two governments mapped out a comprehensive strategy designed to lead in a step by step manner to the goal of a bilateral air quality agreement.

On July 16, 1979, both governments issued a *Joint Statement on Transboundary Air Quality* in which they recognized "the importance and urgency" of transboundary air pollution problems, including acid rain, and pledged to work toward "a co-operative bilateral agreement on air quality" in accordance with certain declared principles and practices. Then, on August 5, 1980, a *Memorandum of Intent* (MOI) was signed, in which both governments explicitly recognized the seriousness of the acid rain problem, and committed themselves to work toward a bilateral air quality agreement "as soon as possible." They further agreed to set up a framework for negotiations. Five bilateral working groups were established to provide expert scientific and technical advice to a Co-ordinating Committee, which was to commence formal negotiations not later than June 1, 1981. Pending conclusion of the agreement, both countries agreed to take appropriate interim actions to "promote the vigorous enforcement of existing laws and regulations . . . in a way which is responsive to the problems of transboundary air pollution."

Although a bilateral air quality agreement was not reached, considerable scientific and diplomatic activity took place subsequent to the MOI. For example, bilateral co-operation continued at the level of co-ordination of scientific research. The executive committee of the U.S. National Acid Precipitation Assessment Program (MAPAP) and the Canadian Research and Monitoring Co-ordination Committee have met annually to exchange information, co-ordinate research, and plan co-operative research activities.

The new initiative resulting from the appointment of the Special Envoys significantly furthers the development of a bilateral response to the North American transboundary air pollution problem. The foundations of that response — the *Joint Statement* and the *Memorandum of Intent* — are already in place. A precedent for that response already exists in the *Great Lakes Water Quality Agreements*. What remains is to borrow from that precedent and build upon those foundations a bilateral accord which will jointly address a common problem in the best tradition of U.S.-Canadian environmental relations.

III. THE SPECIAL ENVOYS

On March 17, 1985, President Reagan appointed Drew Lewis, former Secretary of Transportation, to be U.S. Special Envoy on Acid Rain. Prime Minister Mulroney appointed William Davis, former Premier of Ontario. As Special Envoys, our overall responsibility was very clear: we were to assess the international environmental problems associated with transboundary air pollution, and then recommend actions that would help solve them. Even though domestic acid rain is causing widespread concern in both countries, we were committed to working together to address the problem expressly in terms of its international implications.

In order to support this overall responsibility, we were assigned four specific tasks:

1. to pursue consultation on laws and regulations related to pollutants thought to be linked to acid rain;
2. to enhance co-operation in research efforts, including research on clean fuel technology and smelter controls;
3. to pursue means to increase exchange of relevant scientific information; and
4. to identify efforts to improve the U.S. and Canadian environments.

Soon after our appointments, we began an intensive educational effort designed to provide us with a quick but comprehensive overview of this scientifically complex issue. We were afforded access to the foremost authorities on acid rain, and all principal research findings were made available to us. We reviewed data and conclusions and attended a variety of briefings and presentations. To date, we or our staffs have met, either individually or jointly, with key people from government, industry, labor, academia, and the environmental and scientific communities. The individuals and groups we have met include:

- senior officials in Washington and Ottawa;
- U.S. cabinet members and Canadian cabinet ministers;
- U.S. and Canadian environmental officials;
- Members of Congress and Parliament;
- U.S. governors and Canadian premiers;
- scientists and researchers in the United States and Canada;
- industrial leaders, notably those in the utility, coal mining, and ore smelting sectors;

- representatives of organized labor, unions, and concerned groups of citizens; and
- leaders of environmental organizations.

We have also made site visits to a power plant in western Pennsylvania and to a research facility in Muskoka, Canada. We have responded to requests for dozens of statements and interviews; we have corresponded with various interest groups and private citizens in both countries.

In short, since March 1985 we have immersed ourselves in the scientific, economic, and political aspects of the acid rain issue. We have not emerged from that experience as experts on all aspects of acid rain. However, we have gained a clearer understanding of the major issues involved and are now in a position to make recommendations for appropriate future activities.

The two most important things we learned can be stated simply:

- **Acid rain is a serious environmental problem in both the United States and Canada.** Acidic emissions transported through the atmosphere undoubtedly are contributing to the acidification of sensitive areas in both countries. The potential for long-term socio-economic costs is high.
- **Acid rain is a serious transboundary problem.** Air pollutants emitted by sources in both countries cross their mutual border, thus causing a diplomatic as well as an environmental problem.

At the same time, we also learned something very important about potential solutions to the acid rain problem:

- **At the present time, there are only a limited number of potential avenues for achieving major reductions in acidic air emissions,** and they all carry high socio-economic costs.

Thus acid rain is not only an environmental and technical problem, but also one with far-ranging socio-economic and political implications which are different in the United States and Canada.

IV. U.S.-CANADIAN EXPERIENCE WITH ACID RAIN

There is no question that acid rain is an environmental problem shared by both the United States and Canada. Emission sources in both countries contribute to acid deposition in both countries.

Yet the shared nature of this problem should not obscure the fact that each of the two countries contributes to this problem in different ways, is affected by it in different ways, and therefore must respond to it in different ways.

In fact, one of the most positive benefits of the Special Envoy process has been the insight it has given us regarding both the similarities and the differences of the U.S. and Canadian experience with acid rain.

It is not the intent of the Special Envoy process to hide or gloss over the differences in the perceptions and policies of our two countires with respect to acid rain. Quite the contrary. We believe it is important that both the similarities and differences in these perspectives and policies be openly acknowledged and understood. It was not until we each had an understanding of the other country's point of view that we were in a position to formulate findings and recommendations. For this reason we have chosen to include in this report the following summaries of the U.S. and Canadian perspectives on acid rain.

A. U.S. Perspective on Acid Rain

Acid rain is a popular term used to describe a very complex chemical and atmospheric phenomenon that is more properly called acid deposition. It occurs when emissions of sulfur and nitrogen compounds are transported through the atmosphere, transformed by atmospheric chemical processes, and then deposited back again on earth in either a wet or a dry form. The interactions among these four factors — emissions, transport, transformation, and deposition — determine how much acidity is deposited in any particular area. The form and amount of this deposition, interacting with the unique sensitivities of specific receptor areas, together determine the nature and extent of environmental damage. In other words, the extent and magnitude of any damage caused by acid deposition are a function of all the steps of a very complex environmental process.

1. Emissions

Some of the sulfur and nitrogen compounds that are the precursors of acid rain are emitted by natural sources. Sulfur and nitrogen are natural components of the sea, soils, and organic matter; consequently, both sulfur and nitrogen compounds are regularly released to the atmosphere through organic and inorganic processes.

However, in the United States natural emissions of sulfur and nitrogen compounds are relatively insignificant contributors to acid rain. It has been estimated that in the eastern United States natural emissions of sulfur compounds are approximately three percent as large as man-made emissions. In the west they are probably somewhat larger, but still much less than 25 percent of man-made sulfur emissions. Even a major natural disaster such as the volcanic eruptions at Mount St. Helens emits relatively little sulfur compared to human activities. The total sulfur emitted by Mount St. Helens between March 1980 and March 1981, the period of greatest volcanic activity, was approximately the same as the annual sulfur emissions from two large coal-fired powerplants.

Clearly, man-made emissions of sulfur and nitrogen compounds contribute far more to acid rain in the United States than natural sources. They are emitted in much larger quantities and from a variety of widely distributed sources. Sulfur compounds are emitted into the air whenever the sulfur naturally present in fossil fuels and some ores is burned. The major sources of U.S. sulfur emissions are coal-fired electric powerplants, industrial boilers and processes, and ore smelting. Nitrogen oxides, on the other hand, are formed and released into the air when any kind of fuel is burned, because nitrogen and oxygen present in the air combine at high combustion temperatures. The major sources of U.S NOx emissions are transportation vehicles and industrial fuel combustion.

In 1983, U.S. SO_2 emissions were dominated by electric utility boilers, which emitted 14 million tons, more than 67 percent of the total 20.8 million tons emitted nationwide. Industrial boilers and processes emitted another 5.2 million tons (25 percent of total national emissions), of which 1.1 million tons were emitted by non-ferrous smelters. All other sources contributed the remaining eight percent of total national SO_2 emissions.

The amount of SO_2 emitted in 1983 represents a 28 percent decline from the peak level — 28.7 million tons — emitted in 1973. Electric utility SO_2 emissions declined by 19 percent between 1973 and 1983, and industrial emissions declined by 46 percent.

U.S. SO_2 emissions are concentrated along the Ohio River Valley in Illinois, Indiana, Ohio, Kentucky, West Virginia, and Pennsylvania. Those six states are among only ten in the country that emit more than one million tons of SO_2 annually. In 1980, 51 powerplants in those states emitted 25 percent of total U.S. SO_2. Two other high-emitting states, Missouri and Tennessee, are adjacent to the other six, and together those eight states emit 46 percent of all U.S. SO_2.

Recent trend data indicate that the nationwide pattern of SO_2 emissions has shifted. Between 1970 and 1980, virtually all increases in SO_2 emissions occurred in southeastern states. All but one of the states south of Missouri and Tennessee experienced increases in annual SO_2 emissions, while SO_2 emissions from all states northeast of Ohio and West Virginia decreased. Despite this gradual shift in emissions density toward the southeast, U.S. SO_2 emissions are still concentrated in the Ohio River Valley.

Total U.S. NOx emissions peaked during the 1970s and then declined slightly. In 1979, U.S NOx emissions totalled 21.1 million tons; by 1983 they had fallen to 19.4 million tons. Between 1970 and 1983 transportation NOx rose by 16 percent, and utility NOx rose by 40 percent. Overall, U.S. NOx emissions increased by only seven percent, from 18.1 to 19.4 million tons, between 1970 and 1983.

Although NOx emissions tend to be more evenly distributed over the United States than SO_2 emissions, the states along the Ohio River are especially high emitters of NOx as well as SO_2. Three of the five highest NOx-emitting states — Illinois, Ohio, and Pennsylvania — are also among the highest SO_2-emitting states. Thus national emissions of both SO_2 and NOx are concentrated in the Ohio River Valley and the immediately adjacent states. Ten states in the central and upper midwestern section of the United States — i.e., Missouri, Illinois, Indiana, Tennessee, Kentucky, Michigan, Ohio, Pennsylvania, New York, and West Virginia — emit 53 percent of total U.S. SO_2 and 30 percent of total U.S. NOx.

2. Transport and Transformation

Our understanding of the transportation of these pollutants in the atmosphere is a function of our general understanding of meteorological processes, supplemented by mathematical modelling. Under many meteorological conditions pollutants can be carried for hundreds of kilometers before they are deposited. Because of the high variability of both horizontal and vertical transport under different meteorological conditions, any given source can contribute to acid deposition over a very wide area.

As these pollutants move through the atmosphere, they can undergo significant chemical change. There can be dozens of different chemical reactions, some occurring simultaneously and others sequentially, which convert SO_2 and NOx to their acidic forms. The variability of the reactants involved in this chemical process, the presence or absence of clouds and water, and the availability of sunlight all contribute to the variability of atmospheric transformation.

3. Deposition

The process by which sulfates and nitrates are deposited out of the atmosphere back to earth is most commonly called "acid rain." Although rainfall is, in fact, one major way by which acidic compounds are removed from the atmosphere, they are also deposited by snow, sleet and fog. All these forms of deposition are collectively called acid precipitation. In addition to these various kinds of wet deposition, sulfur and nitrogen compounds can also be deposited in a dry form as either particulates or gases. The relative contribution of wet and dry deposition to acid rain is uncertain, but it is thought to vary significantly from location to location. Both wet deposition and dry deposition are believed to contribute to environmental damage, but their relative significance may vary from one kind of environmental effect to another.

Reliably quantifying the amount of acid deposited is a difficult task, especially if levels of acid deposition are to be compared at different times or at different places. Several different chemical species — e.g., sulphate ions, nitrate ions, and hydrogen ions — can be measured as an indicator of deposition, but they are not directly comparable. Because acid compounds are deposited in both wet and dry forms, an accurate quantification of acid deposition at any location would have to include both forms. Yet dry deposition is much more difficult to measure than wet deposition. Whereas a fairly good wet deposition monitoring system is in place (170 locations in the National Atmospheric Deposition Program (NADP) system), dry deposition data are much less precise, and there is yet to be deployed a national dry deposition monitoring network.

Furthermore, the levels of deposition measured at any given site are not easily comparable to levels of deposition at another site. Deposition patterns at a single site often show marked variations over time, depending on rainfall patterns and meteorological conditions. Acid deposition rates can vary widely within the same region; monitors only a few miles apart can measure markedly different rates of acid deposition over the same time period. These different problems, together with the fact that there was little interest in measuring deposited acidity until the 1970s, has limited current understanding of the patterns of acid deposition, especially insofar as those patterns can be compared from time to time and from place to place.

Despite all these limitations and uncertainties, it is possible to draw some general conclusions about acid deposition patterns in the United States. On the basis of data collected by several different monitoring networks, it is possible to compare the total wet deposition in 1980 of sulfate, nitrate, and hydrogen ions across the United States. The deposition patterns for all three are strikingly similar; the rates of highest deposition are found along a line stretching from the upper Ohio River Valley to northern New York. Areas of high acid deposition extend northeast and southwest from this core area, which encompasses parts of Indiana, Ohio, Pennsylvania, West Virginia, and New York. This area of highest acid deposition also coincides with the U.S. area receiving rainfall with the lowest pH.

For the United States as a whole, the total amount of sulfate wet-deposited in the eastern half of the country over one year is approximately five times greater than the amount of sulfate wet-deposited in the western United States. Approximately three times as much nitrate is wet-deposited in the east as in the west. The pH of rainfall is also lower in the east than in the west.

Beyond these generalities, however, it is very clear that there is a solid link between acidic emissions and acid deposition in the United States. The areas of highest acid deposition coincide with or are downwind and to the northeast of the areas of highest emissions.

4. Effects

The adverse effects of acid rain have been most clearly demonstrated in aquatic ecosystems. After acidifying compounds have been deposited in a watershed, they can be transported by surface runoff or through ground water aquifers to lakes or streams in the area. If the soils in these watersheds have only a limited natural ability to assimilate acidity, then prolonged acid deposition can result in surface water acidification. Such acidification can damage aquatic ecosystems, and in some circumstances it can result in the complete loss of game fish and other aquatic species.

For the past several years U.S. scientific attention has been focused on a number of acidified clear-water lakes in New York and New England. These lakes are found in areas with both high levels of acid deposition

and little natural capacity to neutralize acidity. Until recently, there was no scientifically sound basis for determining whether these lakes were an isolated and unique phenomenon, or whether they were indicative of more widespread surface water acidity in the United States.

The U.S. government, through the Environmental Protection Agency and the National Acid Precipitation Assessment Program, has initiated a national surface water survey to project the population and distribution of lakes and streams at different levels of pH and acid neutralizing capacity. The final results of Phase I of the eastern lake survey are expected early in 1986. However, some preliminary results are now available.

The survey results are based on 1,620 statistically selected lakes found in potentially sensitive areas in the eastern United States. For sensitive areas in the New England area, the survey analysis estimates that 260 lakes (four percent of the total) have a pH lower than 5.0, with a 95 percent confidence that this number does not exceed 343. Approximately 1,360 lakes (19 percent of the total) are estimated to have acid neutralizing capacities below 50 micro-equivalents per litre (μel). The 95 percent upper bound confidence level is 1,533 lakes. The population of lakes with a μel level below 200 is estimated to be 60 percent of the total number of lakes. These data indicate that although the current number of acidic lakes is relatively small, the number of potentially sensitive lakes is relatively large. On the basis of this survey data alone it cannot be predicted what future acidification, if any, would occur if current levels of deposition were to continue. However, major research efforts are underway to address this issue.

Other areas covered by the survey include the upper midwest and the Florida peninsula. Survey data from the upper midwest reveal no acidic lakes. However, data from the Florida study area show a substantial number of lakes with a pH below 5.5 (20 percent of lakes surveyed) and below 5.0 (12 percent of lakes surveyed). The significance of the Florida data is still under review.

The extent to which acid deposition contributes to forest damage is much less well understood. In fact, it is not certain in what circumstances acid deposition may have significant detrimental effects on forest resources. However, forest damage is an area of major concern, and intensive research is being carried out by both U.S and Canadian scientists. This concern is reinforced by unexplained but unprecedented decline observed in some European forests. Scientists have developed several hypotheses to explain the observed symptoms, and many of these hypotheses involve acid deposition and related air pollutants.

Some changes in U.S. forests have been documented. For example, red spruce growing at higher altitudes in the Appalachian Mountains of New England and the Carolinas have been observed to lose their needles, and some have died prematurely. Some southern pine forests growing at lower elevations in the southeast appear to have experienced growth decline over the last decade. It may be the result of a single factor, or a combination of factors. Air pollution — including acid rain — may be involved either directly or indirectly. Field surveys and mechanisms research are now being inititated that will help to understand this problem better, but at this time the relationship between acid rain and forest damage in the United States is only conjectural.

The potential for acid deposition to degrade building materials is well recognized. Carbonate stone like marble and limestone, carbonate-based paints, and metals like galvanized steel all can be eroded and weakened in the presence of dilute acids like those found in acid deposition. The damage thus caused not only can result in economic loss, but the loss of cultural and historic resources as well. However, the extent of such damage in the United States is not known. Until materials inventories, acid deposition patterns, and the damage functions of specific materials are better understood, it will not be possible to accurately quantify the effects of acid rain on building materials in the United States. Without this quantification, it is difficult to determine the significance of acid deposition damage to building materials.

Finally, acid rain is not known to cause direct human health effects. However, indirect effects resulting from human ingestion of heavy metals dissolved by acids are of some concern. The theoretical mechanisms by which acid deposition could expose people to heavy metals are generally understood; however, to date the available data do not indicate any general occurrence of elevated exposures.

Acidic water can dissolve lead out of lead pipe and soldered joints, thus increasing the amount of lead in drinking water. A survey of New England water systems serving more than 25 people each does not indicate that heavy metal concentrations in the drinking water exceed health standards. Less is known about private water supply systems, and further investigation is warranted.

It is also thought that acidified lake and stream water can contribute to higher levels of dissolved mercury in the water, which in turn can increase mercury concentrations in fish. Although elevated mercury levels have been observed in some fish caught in certain New York lakes, it is not known whether mercury was naturally present in those waters or was primarily the result of acid deposition. In any event, no incidents of human health problems associated with heavy metals dissolved by acid deposition have been reported in the United States.

5. Current U.S. Response

The United States passed major legislation to protect air quality 15 years ago. The *Clean Air Act* of 1970 and the major amendments passed in 1977 have resulted in an air pollution control effort that has served as a model for many other industrialized nations, and has led to significant, measurable improvements in air quality in many parts of the United States.

Probably the single most important feature of the *Clean Air Act* is the establishment of National Ambient Air Quality Standards (NAAQS) for the most common air pollutants. The NAAQS require that ambient concentrations of those pollutants be limited to a level that protects public health and welfare. These national standards for both SO_2 and NOx have been in effect for more than ten years.

The individual states are responsible for ensuring that the NAAQS are met within their borders. In order to attain the federal standards locally, the states set emission limits on existing facilities. At this time, about 98 percent of the counties in the United States are in compliance with the national standards for SO_2 and NOx.

Another part of the *Clean Air Act* sets emission limits for different classes of new stationary sources. The Congress included this provision in the belief that emissions from new sources could be controlled at much lower cost than emissions from existing sources, and that the requirement to control new sources would encourage the development of more efficient and cost-effective control technologies. Furthermore, the control of new sources could lead to cleaner air as old facilities are replaced by new ones. To date, the United States has set New Source Performance Standards to control the emissions of SO_2 and NOx from coal-fired power plants, large industrial boilers, smelters, nitric acid plants, sulfuric acid plants, stationary gas turbines and petroleum refineries.

Besides controlling several kinds of stationary sources, the *Clean Air Act* also limits air emissions from new mobile sources. Standards to limit the emissions of NOx from new cars and light-duty trucks were first implemented in 1973, and they have been tightened since then.

These federal and state actions undoubtedly have helped preserve and protect air quality in the United States, an especially remarkable accomplishment considering the strength of the U.S. economy and the extent of U.S. industrialization. Total national emissions of SO_2 and NOx are well below what they would have been without controls. Total U.S. SO_2 emissions increased by about 56 percent between 1940 and 1970. After reaching their peak in 1973, total U.S. SO_2 emissions declined by about 28 percent between 1973 and 1983, despite the fact that electric utility coal consumption increased by about 60 percent during the same period. Flue-gas-scrubbing systems are now operating on over 47,000 megawatts of coal-fired electricity-generating capacity.

Between 1940 and 1970, total U.S. NOx emissions increased by more than 200 percent. Since 1970, however, total U.S. NOx emissions have remained fairly constant. Emissions from U.S. cars and trucks actually declined by nine percent between 1978 and 1983, despite a five percent increase in the number of vehicle-miles driven.

Yet during the same decade that the United States was making these advances in the control of SO_2 and NOx emissions, scientists, government officials, the Congress, and the American public became increasingly aware of acid rain, an environmental problem clearly linked to emissions of SO_2 and NOx. At the same time, the international aspect of acid rain was causing more and more concern. The attainment of national standards for SO_2 and NOx and the installation of SO_2 and NOx controls on new emission sources were not enough to prevent transboundary air pollution from contributing to environmental degradation in Canada.

There are several reasons why the *Clean Air Act*, as presently written, is not an especially good tool for controlling transboundary air pollution. For example, the NAAQS control ambient concentrations, not total loadings, but transboundary pollution is a total loadings problem. In fact, some of the techniques used in the past to attain ambient standards actually may increase total loadings. Tall smokestacks sometimes have been constructed to disperse emitted pollutants over wider areas and thus attain ambient standards locally. These tall smokestacks cause two problems: they allow more total pollutants to be emitted under applicable law; and they allow those pollutants to be transported further.

The New Source Performance Standards have been only marginally effective in reducing the total amount of acidic air emissions, because older facilities are not being replaced by new ones as quickly as once assumed. For example, most coal-fired powerplants once were believed to have useful lives of 35 to 40 years. It now appears that many old coal-fired powerplants may continue to operate for up to 60 or more years.

The fact that the *Clean Air Act* may not provide adequate protection for acid-sensitive ecosystems in both the United States and Canada has led several members of the U.S. Congress to propose new acid rain legislation. Several proposed bills have been debated in the Senate and the House of Representatives. None of them has been enacted into law, because none of them has been able to overcome the formidable barriers presented by conflicting economic and political interests.

In the United States the acid rain issue has been as politically divisive as any environmental issue the country has faced. The proposed solutions have pitted one region of the country against another; they have threatened the livelihood of coal miners in the east; they have raised the possibility of further increases in electricity rates in the industrial portions of the United States hardest hit by the recent recession.

The acid rain issue has been especially difficult to resolve precisely because proposed solutions must choose from a limited menu of control options. At this time, only three emission control techniques are proven and available for reducing SO_2 emissions from coal-fired powerplants: coal-washing, coal-switching, and flue-gas-scrubbing. However, one of these techniques could not be used to achieve substantial SO_2 reductions, and the other two impose different kinds of socio-economic costs, all of which are very high.

Coal-washing is a physical cleaning process by which inorganic sulfur is removed from high-sulfur coal, usually at or near the mine. This process is already being applied to some U.S. coal, because the costs of cleaning can be offset by lower transportation costs, higher combustion efficiencies, and lower boiler maintenance costs. However, coal-washing removes less than half the sulfur in high-sulfur coal; it is not used at all to clean low-sulfur coal. So its usefulness as an acid rain control technique is very limited.

Pound for pound of SO_2 removed, switching from high-sulfur to low-sulfur coal is usually the cheapest control option for coal-fired boilers. However, low-sulfur coal is much more plentiful in the western half of the United States; thus even though some low-sulfur coal is mined in the east, coal-switching would cause markets for western coal to increase, and markets for eastern high-sulfur coal to decrease. Eastern coal miners could be thrown out of work, and the communities in which they live — communities that were especially hard-hit during the recent recession — would suffer even more.

Flue-gas-scrubbing is a process by which sulfur is scrubbed out of the exhaust gases emitted by coal-fired boilers. Although the process is very expensive, especially when retrofitted on existing smokestacks, it allows the relatively clean combustion of high-sulfur coal. Thus the use of scrubbers to control SO_2 would not cost high-sulfur coal miners their jobs. However, it would raise the electricity rates of the businesses and families served by the utilities that install scrubbers.

Clearly, none of these control options provides a simple solution to the acid rain problem. Coal-washing cannot eliminate enough SO_2 to achieve a major reduction; coal-switching would cost high-sulfur coal miners their jobs; flue-gas-scrubbing would raise utility rates sharply. The availability of cheaper, more efficient control technologies would improve our ability to formulate a national response that is politically and economically acceptable.

The long-term value of control technology research has already been recognized by the U.S. government. Both the U.S. Department of Energy and the Environmental Protection Agency are managing research programs that are investigating a wide range of different control technologies. Taken together, this research offers the best hope for a long-term solution to the acid rain problem.

In the summer and fall of 1983, the U.S. government carried out a thorough review of the current status of acid rain knowledge and the options available for its management. From that review, the United States concluded that, although it was clear that acid rain was a serious concern both in the United States and Canada, it lacked the information needed to make a prudent decision on the need for or design of additional emission controls.

This policy was not a decision either for or against additional controls, but instead a choice to defer such a decision until a more adequate scientific and technical base was established. It is not U.S policy to wait for definitive answers on all major acid rain uncertainties before making a decision to act. Decisions on acid rain, like other environmental decisions,

will always have to be made in the face of some scientific uncertainty. The United States is committed to act to control acid rain once it is reasonably certain that that action will achieve its intended results, and those results will justify the social and economic costs entailed.

B. Canadian Perspective on Acid Rain

1. Scientific Consensus

The Canadian public and governmental response to acid rain has been driven by the evidence of cumulative damage, the huge long-term socio-economic costs of allowing the damage to continue, and the view of the problem as presented by the community of international scientists. While recognizing that there are gaps in scientific knowledge, and that research should continue, Canadians generally have found very persuasive both the scientific findings and the urgent calls for action by many of these scientists.

In the past several years, thousands of scientific studies have been carried out and reports written on all aspects of the issue of acid rain. In addition, a number of syntheses and analyses of that work have been conducted. A careful review of the scientific literature indicates that there is a broad consensus within the knowledgeable scientific community on certain components of the acid deposition phenomenon. There follows a brief synthesis of the main areas of consensus. This is not intended to provide a complete picture of acid rain, much less the broader issue of pollutants transported long distances. Instead it seeks to lay out a basis of existing scientific consensus on which policy decisions may confidently be based.

Acid rain is not a natural phenomenon. About 90 percent of atmospheric SO_2 and NOx comes from man-made sources. Sulphur compounds are responsible for about two-thirds of the acidity in precipitation but produce most of the long-term acidity in sensitive water bodies.

While not part of the man-made problem, it should be noted that there are some locations where buildup of organic acids causes acidity of water and soil. Such acidification is different chemically from the man-made variety, and usually builds up very slowly. As a result, biological changes are also very gradual and are an integral part of the natural aging of such regions.

Man-made emissions of sulfur and nitrogen oxides move with major weather systems and are often transported many hundreds of kilometers. Transit time in the atmosphere increases the likelihood of chemical transformation from oxides to acid-producing sulfates and nitrates. Acid deposition is the result of these acidifying compounds coming out of the air through rain, snow, or dry deposition.

Large areas of North America — in particular, eastern North America — are underlain by rocks and soils that make these areas vulnerable to acidification. In these areas, deposition of acidic pollutants over time acidifies streams, lakes, and soils.

As acid rain changes the chemistry of those ecosystems, it also alters their biology. Specifically, many important species that depend on the water become extinct as it turns acid. Some are of economic and cultural importance.

Over many years, deposition of man-made acids has increased the acid content of surface waters in vulerable parts of industrialized countries. In some of those areas, highly acidified lakes can no longer support some species of fish and other life forms. There is a clear and direct relationship between increasing acidification and the deleterious changes in biological populations.

Acid rain also is acidifying some soils in these vulnerable regions. In the process, it may leach away nutrients and bring about changes to biological organisms that help maintain the productivity of the soil. In exceptional circumstances, acid rain can leach nutrients directly from tree foliage.

Recently, widespread damage to forests has been observed in eastern North America and in Europe (where it is much more advanced). This decline phenomenon is spreading rapidly. It is incompletely explained, but the damage is spatially linked with major pollution emission regions. The contribution of acidic pollutants to this problem has not been satisfactorily determined but is generally perceived in the scientific community to be a contributing factor, together with other pollutants, notably ozone. There is mounting evidence that this tree "dieback," as well as serious growth retardation, are beginning to increase dramatically in some species.

Toxic heavy metals emitted and deposited more or less in conjunction with acidic pollutants, or mobilized from soils and rocks by the heightened acidity of circulating water, have a variety of toxic effects on plants and animal life. There is evidence of increased concentrations of certain heavy metals in acidifying water.

The pollutants that cause acid rain, while suspended in the atmosphere, reduce the amount of sunlight and so contribute to slower growth of crops and forests. They also reduce visibility, a fact of special importance in tourist regions.

Corrosion of materials is accelerated by fallout from the atmosphere of sulfur dioxide gas and other pollutants.

Because of day-to-day variability in weather patterns, atmospheric modelling and direct observation do not usually enable precise linkages to be made between individual emission sources and individual deposition-receptors. But on a broader scale, and over time, fairly accurate links can be made. Also, on a continental, multi-year scale, the relationship between total emissions and total deposition is almost linear. Thus a major, generalized reduction in emissions of sulfur and nitrogen oxides in eastern North America over several years would bring about a commensurate reduction in deposition of acidifying compounds.

At current rates of emission of acid-forming pollutants, acidification of sensitive environments will continue even if there is no increase in total emissions. Consequently, acid rain and its environmental, biological, and economic consequences will similarly continue. Indeed, damaging acidification of many ecosystems would continue even with some decreases in total emissions, although any significant reduction would slow the rate of acidification.

Observation of acid-sensitive surface waters offers guidance on acceptable levels of acid rain. By and large, moderately sensitive systems in eastern North America tend not to exhibit increased acidity if the total annual deposition of wet sulfate is below 20 kilograms per hectare. Thus, although the dry fraction of acid deposition is not yet being measured effectively, empirical data show that, in linking total acid loadings to acidification of sensitive waters, the wet sulfate fraction generally is an acceptable yardstick.

There is consensus in the international scientific community that the scientific data base is adequate to assess the immediate as well as the long-term implications of continuing, high-volume emissions of acid-causing pollutants and resulting acidification of sensitive ecosystems. The scientific data base is similarly adequate for the selection of effective emission reduction strategies to reduce substantially the effects of acid deposition.

2. Sources

The Special Envoys have been directed to examine the problem of acid rain in its international, transboundary context. A Canadian analysis of the sources of acid rain similarly must encompass the transboundary and the domestic components. After all, of the acid rain affecting eastern Canada, about one-half originates in the United States and one-half in Canada. In the regions of particular concern in Canada, such as the Muskoka-Haliburton tourist and recreation area in Ontario, two-thirds of the acid rain originates in the United States. Overall, the United States exports about four times as much SO_2 as it imports from Canada each year.

Air pollution became a major public concern in Canada, as it did in many industrialized countries, in the period of high industrial growth following the second world war. By the 1970s, many countries, Canada included, had passed clean air laws, which addressed in the main the most serious air pollution problem of the day: poor air quality, chiefly in urban centres, and its impact on human health. One of the ways of doing so, and often the cheapest, was the erection of tall smokestacks, to enable air currents to disperse pollutants more widely.

As a result, any progress in reducing acid precursor emissions has come almost entirely from attempts to meet local air quality standards. These attempts have met with a measure of success: in central and eastern Canada, for example, total SO_2 emissions dropped from 5,640 kilotonnes in 1970 to 4,516 kilotonnes in 1980. Fewer than one percent of Canadian regions currently fail to meet air quality objectives (including, in most acid-sensitive regions, a strict one-hour SO_2 standard).

But this downward trend may not continue. If additional steps are not taken, Canada estimates that the total of SO_2 emissions potentially affecting its acid-sensitive regions will rise by about 10 percent by the year 2000.

There are three main reasons for this:

1. Since local air quality is generally quite good in most localities, the principal legal imperative to bring down emissions has largely been satisfied;
2. Economic growth and other factors are resulting in expansion of some of the major sources of acid gas emissions; and
3. Some old and heavily polluting facilities, chiefly high-sulfur coal-burning power plants, are not being replaced as quickly as anticipated by new, cleaner facilities.

Another way of looking at the total loading of acidic pollutants in Canada is by industrial sector. Thus, about one-half of the acid rain falling on Canada results from emissions from coal-burning power plants, another quarter from smelters, and the remainder from other industrial sources and transportation.

Although in recent years there has been a reduction in total SO_2 emissions affecting Canada, what is significant is that they remain near their historical peak. The emissions of the other main acid-causing gas, NOx, are continuing to rise significantly. Total emissions will need to be cut sharply if the adverse effects of acid deposition are to be reversed.

Another factor in the increasing acidity of rainfall is a change in the way in which coal is burned. Although total usage of the coal that contributes to the Canadian acid rain problem has not increased significantly, seasonal use has changed dramatically. Summertime coal consumption is now much greater than it was several decades ago, due to increased use of air conditioning. Summertime heat and humidity hasten the transformation of SO_2 and NOx emissions into acid rain. And the construction of tall stacks means that the pollutants travel greater distances, damaging previously pristine regions.

Thus, even though overall coal consumption has not changed greatly, the sulfates and nitrates that cause acidity have increased significantly.

In summary, between 1940 and 1970, man-made emissions of SO_2 impacting on Canada rose by about two-thirds. Implementation of clean air laws produced a generalized reduction over the past 15 years. It is the Canadian perception that, unless additional measures such as the new Canadian reduction program are implemented, the total emissions of SO_2 affecting Canada will increase into the next century. NOx emissions will increase at an even higher rate.

3. Impacts

The various economic and ecological consequences of acid rain are discussed elsewhere in this report. What makes transported air pollutants, and especially acid rain, such a vexing issue in Canada is the fear of long-term, essentially irreversible, harm to sensitive environments, and consequent disruption of communities and lifestyles.

The long-term socio-economic impacts of acid rain in Canada should be viewed in the following terms:

- More than four-fifths of Canadians live in areas of high acid deposition. Many of them live, work, or spend leisure time in acid-sensitive regions.
- The fishery, tourism, and forestry resources potentially at risk due to acid rain sustain about eight percent of Canada's gross national product.
- Of the two million lakes in Quebec and Ontario, 43 pecent are vulnerable to acidification.
- About 90,000 jobs are at risk in the eastern Canadian commercial fisheries.
- Of the 16,000 fishing camps and lodges in Ontario, 600 may be closed because of acid rain by the year 2000.
- More than 70 million hectares (or about one-half) of Canada's productive forests are in areas receiving high levels of acid rain. These forests generated 14 billion dollars' worth of forest products in 1982.

Such gross statistics do not begin to reflect adequately the current frustration and potential long-term harm in affected communities.

In general, acid-sensitive regions are relatively sparsely populated, not highly industrialized, and heavily dependent for their economy and lifestyles on a healthy and productive environment. Canadians living there perceive that their future is being put at risk because areas of high industrial activity are keeping their production costs down by exporting pollution. This perception of inequity and increasing long-term harm, especially when some of the pollution crosses the international border, is at the root of the Canadian view that emissions of acid gases impacting on Canadian territory must be reduced to levels that the environment can accommodate.

4. Co-operative Actions

Acid rain has become a politically sensitive issue in both the United States and Canada. Because of the large costs of substantially reducing the emission of pollutants that produce acid rain, the much less easily quantified, but also very large, economic, social, and aesthetic costs of inaction, and both the perception and the reality of incomplete scientific understanding, effective policy responses have not been easy to come by.

In Canada, for a number of reasons, it has been easier to move toward major reductions of the pollutants primarily responsible for excess acidity in precipitation. Canada has now embarked on such a program.

In the United States, many factors have combined to make a national response more difficult to achieve. Canada recognizes these difficulties, particularly when proposals involve legislative initiatives. At the same time, Canada believes the U.S. *Clean Air Act* affords opportunities, through implemented or as yet unused regulatory mechanisms, to take significant steps toward reducing emissions of acid gases.

5. Current Canadian Response

Air pollution control in Canada is a shared, concurrent responsibility of the federal and provincial governments. The provinces are primarily responsible for controlling emissions which impact within their borders, while the federal government is responsible for international air pollution. Both levels of government play a role in interprovincial air pollution.

Except for pollutants dangerous to human health, Canadian air pollution control programs are generally designed to achieve specified environmental quality objectives rather than prescribing the use of specific technologies. Air quality objectives for SO_2 have been published by the federal government for the guidance of the provinces. The Canadian acceptable levels result in air quality that is at least as healthy as that in most industrialized countries, while the Canadian desirable levels are among the most stringent anywhere. In addition, the one-hour (rather than 24-hour) standard helps deal with total loadings by reducing opportunities for excessively high emissions.

The following table summarizes Canadian SO_2 air quality objectives:

SELECTED CANADIAN SO_2 AMBIENT AIR QUALITY REQUIREMENTS

(micrograms per cubic metre)

Averaging Period	Canadian Objectives		Ontario
	Desirable	Acceptable	Requirements
Annual	30	60	55
24-hour	150	300	275
1-hour	450	900	690

Most provinces base their control programs on the acceptable level; two use the desirable level.

Thus sulfur dioxide, as a local air quality problem, has been controlled successfully in Canada. This was achieved through a variety of actions including emission containment, use of tall smokestacks, use of low-sulfur fuels, intermittent control procedures, and fuel regulations.

Canadian non-ferrous smelters have used selective mining and mineral separation preparation practices, sulfur containment, and changes in process technology to reduce emissions. Regulations limiting the sulfur content of fuels have reduced non-utility fuel use emissions. Canadian utilities have used natural gas, low-sulfur coal, coal-blending, coal-washing, nuclear and hydraulic generation, and load management to limit increases in emissions.

The above summarizes the Canadian response to the problems of local air quality. While this is not a response to the problem of acid rain (and indeed exacerbated that problem by use of dispersion techniques), it serves as a foundation on which current acid rain mitigation programs are being erected.

The reductions of air pollutants that have occurred in Canada since 1970 have not alleviated the long-range transport and long-term loading problems of which acid rain is a part. Canada has therefore determined that substantial further emission reductions must take place to stem the damage being caused by acid rain. Accordingly, a Canadian acid rain abatement program is being put in place.

The scale of the Canadian program is based on the scientific evidence that most moderately sensitive regions can be adequately protected if annual loading of wet sulfate is kept below 20 kilograms per hectare. Reducing loadings to that level for most eastern Canadian acid-sensitive regions requires a reduction in impacting SO_2 emissions of close to 50 percent from 1980 levels. The scale of reductions agreed for central and eastern Canada has been set on that basis, and as the Canadian component of an adequate abatement program.

In March 1985, the Environment Ministers of the governments of Canada, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland agreed to reduce SO_2 emissions from the 1980 base by approximately 50 percent by 1994. At the same time, they agreed to an initial interprovincial allocation of reductions.

A tabular summary of past and projected changes in total central and eastern Canadian SO_2 emissions by sector follows:

SULPHUR DIOXIDE EMISSIONS

(thousands of metric tonnes per year)

	1970	1980	1990	1994
Smelters	3,810	2,720	2,000	1,150
Utilities	470	730	450	450
Non-utility Fuel Use	950	580	400	300
Other	410	490	400	400
Total	5,640	4,520	3,250	2,300

The provinces are in the process of enacting regulations to implement the new program. The two largest provincial emitters of acid gases, Quebec and Ontario, have now done so. Together they account for three-fourths of eastern Canadian SO_2 emissions.

The main elements of the Quebec and Ontario programs are summarized in the following tables.

QUEBEC
SO_2 Emission Controls
Legal Limits and Effective Dates

(thousands of metric tonnes per year)

	1980	1990
Noranda	552	275
Murdochville	91	65
Other Industrial Sources	135	116
Fuel Combustion	258	102
Transportation	49	39
Total	1,085	597

ONTARIO
New Package of SO_2 Emission Controls
Legal Limits and Effective Dates

(thousands of metric tonnes per year)

	1980	1994
Ontario Hydro	452	175
Inco	1,155	265*
Falconbridge	154	100
Algoma (Wawa)	161	125
Other Sources	272	220
Total	2,194	885

* In addition, an even tighter objective has been set at 175 kilotonnes/year by 1994. Inco's December 1988 report must describe in detail the technology and design which could be used to meet this lower objective and its cost.

In addition, the Ontario government is preparing a regulation to control new or modified boilers. It will place a one percent sulfur content constraint on the fuel or will require that an equivalent amount of SO_2 be removed from flue gas.

As part of this abatement program, the federal government is taking several steps in co-operation with provinces and the private sector:

- Limits have been set for new motor vehicle emissions to bring them to U.S. standards by September 1987.
- $25 million have been allocated to cost-share with industry the development and demonstration of new processes and pollution control techniques for non-ferrous smelters.
- $150 million have been allocated to cost-share, with provinces and industry, the implementation of these new techniques.
- A $30 million federal-provincial scientific research program is continuing, and is aimed in part at monitoring the efficacy of the Canadian abatement program.

These planned reductions are significant not only for their size, but also for the policy judgments on which they are based. They go beyond traditional concerns with improving local air quality, and address specifically the total pollution loading issue which is the cause of acid rain.

V. RECOMMENDATIONS

In preparing our recommendations to both governments, we have been conscious of the wide differences between our two countries on this issue, differences that are based not just on perception but also on certain underlying political, social, economic, and geographic realities. We have also kept in mind that our mandate was not to find a final solution to this bilateral problem, but to find ways in which our two countries can begin to move together to deal effectively with this vexing issue.

Both nations want to see progress on acid rain. For such progress to be possible, and if it is to result in part from the work of the Special Envoys, our recommendations must be realistic. They must not ask either country to make a sudden, revolutionary change in its position. They must not call for immediate abandonment of major policy stands. They must instead point the way to a resumption of fruitful bilateral dialogue and constructive action that will help us relieve the stress that this issue has created, and reduce the flow of airborne pollutants across our common border.

A. Innovative Control Technologies

A significant impediment to the development of a U.S. consensus on acid rain is the high cost of the available control options. Because the impacts of different options fall on different interest groups, political positions have become polarized, and it has become increasingly difficult to find a common ground for action. If the menu of control options were expanded, and if the new options were significantly cheaper yet highly efficient, it would be easier to formulate an acid rain control plan that would have broader public appeal.

Recommendation

Therefore, the U.S. government should implement a five-year, five-billion-dollar control technology commercial demonstration program. The federal government should provide half the funding — 2.5 billion dollars — for projects which industry recommends, and for which industry is prepared to contribute the other half of the funding.

Because this technology demonstration program is meant to be part of a long-term response to the transboundary acid rain problem, prospective projects should be evaluated according to several specific criteria. The federal government should co-fund projects that have the potential for the largest emission reductions, measured as a percentage of

SO_2 or NOx removed. Among projects with similar potential, government funding should go to those that reduce emissions at the cheapest cost per ton. More consideration should be given to projects that demonstrate retrofit technologies applicable to the largest number of existing sources, especially existing sources that, because of their size and location, contribute to transboundary air pollution. In short, although the primary purpose of this research program is to demonstrate the kinds of technologies that would be needed for any future acid rain control program, it should also result in some near-term reductions in U.S. air emissions that affect Canadian ecosystems.

Furthermore, special consideration should be given to technologies that can be applied to facilities currently dependent on the use of high-sulfur coal. Because the scrubbers currently available to clean high-sulfur coal are very expensive, there is an economic incentive for sources to switch to low-sulfur coal as a method of reducing emissions. However, coal-switching imposes significant socio-economic costs on high-sulfur coal miners, their families, and their communities. The commecial demonstration of innovative technologies that clean high-sulfur coal will help to reduce the economic consequences of any future acid rain control program.

We further recommend that a panel, headed by a senior U.S. cabinet official, be established to oversee this research demonstration program and select the projects to be co-funded by the federal government. The U.S. Environmental Protection Agency and Department of Energy should provide the technical expertise necessary to select demonstration projects. Other members of the panel should be drawn from the Department of State and state governments. Canada also should be invited to send a representative to sit on this panel.

In this connection, we note a somewhat similar approach being taken in Canada. There, the major industrial sources of acidic emissions are smelters. As part of the Canadian acid rain mitigation program, federal and provincial governments are co-operating financially with industry to develop and implement advanced technologies designed to improve smelter efficiency and reduce pollution.

Recommendation

The results of the Canadian technology development program should be shared with the United States.

B. Co-operative Activities

The Special Envoys have recognized the need to put in place mechanisms to help both governments deal with this issue in such a way that differences are not exaggerated and oppportunities for co-operation and agreement seized.

1. Domestic Legislation and Regulations

The U.S. and Canadian Clean Air Acts, and other legislation and regulations that delimit the emissions of airborne pollutants, were designed and are being implemented primarily to respond to air quality needs within each country. But both Acts recognize that special controls might be required to deal with pollutants that cross the interntional boundary.

Various scientific experiments, measurements, and observations demonstrate the reality of the transboundary flow of airborne pollutants. As a consequence, the interpretation by regulatory agencies of relevant domestic legislation can have an impact, albeit unintended, on the nature and quantity of pollutants that cross that border.

Recommendation

Both the United States and Canada should review their existing air pollution programs and legislation to identify opportunities, consistent with existing law, for addressing environmental concerns related to transboundary air pollution. The results of these reviews should be made available to the chief environmental officials of both countries for their consideration in the management of their respective programs.

In implementing air pollution legislation, agencies in both countries have tended to focus on local, domestic parameters. But clean air regulations obviously can have a transboundary effect. Therefore prior notice and consultation on such rulemaking is essential.

Recommendation

Agencies contemplating changes to laws or regulations that may alter the flow of transboundary pollutants should give timely notice of their intent to agencies of the other country through diplomatic channels.

2. Bilateral Consultation and Information Exchange

Acid rain, and other forms of long-range, transboundary air pollution, comprise a complex phenomenon with important political, economic, social, and environmental implications for both countries. Both domestically and as a bilateral issue, therefore, acid rain is not susceptible to

a quick-fix response. It must be assumed that it will remain on the bilateral agenda for some time, and that its intrinsic importance will dictate that it be handled at the highest levels.

Additionally, the Parliament of Canada and the U.S. Congress have maintained a keen interest in this issue. While their principal focus has been on legislation in response to perceived domestic problems, both bodies have shown an awareness of the transboundary flow of airborne pollutants and its political and diplomatic ramifications. Both bodies have passed ammendments to the Clean Air Acts explicitly recognizing the potential for damage by pollutants crossing the international boundary and setting out means for reciprocal action designed to control pollutants deemed to cause such damage.

Recommendation

Acid rain should remain high on the agenda of meetings between the President and Prime Minister. They should be prepared to intercede personally from time to time to resolve difficulties and ensure progress. The U.S. cabinet official heading the technology development panel and a Canadian cabinet official would jointly advise the President and Prime Minister.

Heretofore preparations and briefings of Cabinet officers on acid rain have been separate and unilateral; henceforth, at least some of those briefings should be prepared on a co-operative basis. Moving in this way toward common perspectives for political-level discussions is a way to broaden the areas of accord.

Recommendation

Our two governments should establish a bilateral advisory and consultative group on transboundary air polution. Such a group, comprising both diplomatic and environmental management officials, should provide the forum for discussions and first-level consultations on issues related to transboundary pollution. It should also provide advice to the directors of each country's environmental programs and to the Secretary of State and Secretary of State for External Affairs.

C. Research

Scientific information provides a basis for determining the most effective actions to address the damage caused by acid rain and other long-range, transboundary air pollutants. There are several areas where research would be of special value to decision makers in guiding the development of environmental policies.

The following research recommendations are not listed in priority order. The decisions on which areas are of greatest concern are a matter of public policy to be determined by each nation. However, through the combined efforts of our two countries, active research efforts should be pursued in each of the areas listed.

1. Deposition Monitoring

Although methods for monitoring wet deposition are well established and extensive standardized networks are in place across North America, total deposition is not being measured adequately. Dry deposition has been measured at specific sites using a variety of techniques, but no comprehensive monitoring network for dry deposition is currently in place. Measurements of dry deposition would permit more accurate evaluation of the total impact of acid deposition.

Recommendation

Standard, accurate methods to measure dry deposition should be developed and monitoring networks deployed. The networks should be of sufficient size and adequate statistical design, and implemented with adequate quality assurance and quality control procedures, in order to enable researchers to measure total acid deposition for sensitive areas across North America.

2. Rates of Aquatic Change

Concern over the effects of acid deposition first began with the observation that atmospheric deposition is causing the acidification of surface waters and subsequent adverse effects on aquatic biota. Although much research has been conducted during the last decade, our understanding of what changes in water quality would result from a change in acid deposition in a variety of watershed types is still incomplete. The factors controlling watershed processes are also not well known. Information on dynamic watershed processes would improve our ability to predict changes in water quality from current and future deposition levels.

Recommendation

Process-level data from different watershed types would be of help for determining current and potential future effects of acid deposition on surface waters. Models for predicting watershed response to acid deposition should be developed and tested empirically. In addition, an adequate acid deposition data base on watershed characteristics should be developed to exercise the models for selected North American sensitive areas.

3. Aquatic Biology

Concern over the change in surface water chemistry due to acid rain stems from the subsequent potential for effects on aquatic biota, particularly fish. Effects of specific pH levels have been ivestigated, but the effects of chronic or slow acidification, and the relationships between trace metals and fish species, have not been adquately detemined. The loss of fish in acidified surface waters may be one of the last effects to be observed. Effects on biota other than fish should also be considered.

Recommendation

The environmental damage of surface water acidification should be understood in terms of biological changes. This would help to quantify the relationship between changes in surface water chemistry and changes in aquatic biota more clearly. Special attention should be focused on both rates and types of biological change.

4. Forest Effects

Forest and tree declines in North America and in Europe have been documented in areas that receive high levels of atmospheric deposition. The concern about the possible effects of acid rain on forests is prompted by some provocative, albeit largely circumstantial, evidence. Despite the existence of observed changes in forest growth in certain areas, it is unknown to what degree, if any, current levels of acid rain are affecting the growth and productivity of forests in North America.

Recommendation

Research should be accelerated to investigate the potential link between forest and tree decline and acid rain as a causal or contributing factor.

5. Materials Damage

Materials damage is one of the few effects of air pollution that has the potential to be quantified economically. Fewer resources have been expended on this area of research than on the biological effects of atmospheric transport; estimates of damage have varied widely, but some have gone as high as several billion dollars annually. Equally of concern is the possibility that irreplaceable cultural resources may be damaged or destroyed.

Recommendation

The effects of acid rain on materials should receive increased attention so that the quantification of the extent of current damage, the resources at risk, and the prognosis for future damage can be improved.

6. Role of Heavy Metals

Heavy metals such as lead, mercury, cadmium, and arsenic become more soluble in solution at lower pH. All of these metals can be toxic to both aquatic biota and humans. The increased corrosivity of acidic water on water storage and distribution systems may also pose a potential health risk. The extreme toxicity of these metals warrants concern.

Recommendation

The mobilization, transport and flux of heavy metals in acidified surface waters should be investigated to determine their environmental toxicity. Special emphasis should be placed on potential effects on human health and on possible mitigation strategies. The role of these metals in aquatic and forest damages also needs more attention.

Bringing the Provinces Onside

This selection of news stories from *The Globe & Mail* chronicles the issues and the process involved in bringing Canada's provinces into line on national targets for reductions of sulfuric emissions.

Discussion Note

Besides dealing with the changing priorities of domestic policies, Canadian policy makers realized they could only make a credible appeal in the United States if they themselves brought about reductions in Canadian emissions by the same percentage they would request from the U.S. This raised special problems, as Canadian provinces, which have considerably more power than U.S. states, had to be brought into agreement. How this was achieved is set out in the third reading, a series of newspaper articles covering the agreement.

Of particular interest in this process is the role of the federal government in using its spending power to induce the principal emitting provinces to develop detailed programs. The fact that provincially-owned utilities, such as Ontario Hydro, would be affected clearly posed an obstacle to a successful outcome. Students of formal decision-making may find it interesting to compare the process to a Groves mechanism and other approaches to the willingness-to-pay (WTP) problem. (For an excellent treatment of these problems, see Howard Raiffa, *The Art and Science of Negotiation*, Belknap/Harvard,[1982], esp. Chapter 20.),

Bringing the Provinces Onside

Forging the Alliance

This series of articles from the Globe & Mail chronicles the process and strategy used in the management of the Canadian federal system to obtain concrete outcomes on the control of acid rain. The articles describe the issues, the influence of the United States and the role of federal funding in inducing provincial agreement and compliance during 1985, the year in which agreement was formalized. We pick up the story in....

February

TUE FEB.05,1985 PAGE: M3
BYLINE: MICHAEL KEATING
CLASS: News
DATELINE: WORDS: 981

Officials start negotiating on fight against acid rain

By MICHAEL KEATING

A meeting of provincial environment officials in Montreal today is the first step in a detailed federal Government strategy for negotiating who will pay the immense cost of cleaning up acid rain, The Globe and Mail has learned.

A confidential federal strategy paper sets out a schedule of negotiations on sharing the cost of last year's promise to roll back sulphur air pollution in Eastern Canada by 50 per cent in a decade.

It lists federal, provincial and international meetings on acid rain as well as negotiations with Canada's big nickel and copper smelters, power companies and the auto industry.

The first meeting, between provincial environment ministers and officials from Manitoba to Newfoundland, starts this morning in a downtown Montreal hotel. They have already indicated to Ottawa that they will sign an agreement to carve up the job of regulating sulphur pollution, the main cause of acid rain.

Other important events listed in the strategy paper include the presentation of a federal action plan on acid rain to the Cabinet in Ottawa this month, and a meeting in March between Prime Minister Brian Mulroney and U.S. President Ronald Reagan, at which acid rain will be discussed.

One of the main issues to be tackled is how to reduce sulphur emissions at old smelters and coal-burning power plants. These plants churn out the bulk of the gas which turns into sulphuric acid rain and attacks the environment and human health. Automobile exhaust produces other corrosive gases.

Acid rain has been described as the greatest threat to the Canadian environment, and cleanup costs will be massive. They are estimated at $2- billion in equipment and cleaner fuels, but the added costs of financing and running the new equipment could push the bill to $600-million a year for 20 years.

The provinces agreed last year that they will be responsible for the costs of cleaning up power plants, which could mean higher power rates. However, the provincial governments are expecting Ottawa to be more specific on its promise to help finance the smelter cleanup, which is expected to cost from $750-million to $1-billion in capital costs alone.

The western provinces will observe today's meeting but have not yet started a major sulphur control program of their own. They are still researching the effects of the pollution in the West.

The federal and eastern provincial governments must achieve a 50 per cent cut in the 4.6 million tonnes a year of sulphur pollution that was allowed in Eastern Canada in 1980, the year from which controls are calculated.

The next stage of controls, to be negotiated this year, will likely force smelting companies to overhaul, rebuild or add pollution removal equipment to

Continued...

their old plants. In return, this is expected to produce a clean and efficient smelting industry which will be more competitive in world metal markets.

The federal Government is to help pay the costs of the smelter cleanup and must decide how much public money it can recover from a clean industry in the future.

The utility companies are looking at strategies ranging from using more hydro or nuclear power to buying cleaner but more expensive Western Canadian coal, which would help that part of the economy. They are also looking at installing equipment which "scrubs" pollution out before it hits the smokestacks.

The federal target is to have most work start by about 1988 at the latest so equipment would be in place by 1994. This leaves three years to research some promising new cleanup technologies which are still in laboratory or pilot scale.

In the case of cars, Canada is ready to move to the tougher U.S. standards for controlling tailpipe pollution. There have been widespread complaints that 80 per cent of the cars built in Canada are made to U.S. standards for export but the clean cars are not required in this country.

The federal working schedule to put together an acid rain program includes a series of meetings running into the fall:

. On Feb. 20 a federal acid rain action plan is to go to Cabinet committee and the next day it is to be presented to Cabinet. A decision is expected within a week on the federal role in financing the smelter cleanup.

. By the second week of March Mr. Mulroney is expected to advise the provinces of the Cabinet decision.

. On March 17, Mr. Mulroney has a crucial date with Mr. Reagan in Quebec City and has said publicly that acid rain will be at the top of the negotiating list. Canada's acid rain strategy will work completely only if U.S. pollution which blows north as acid rain is also controlled.

. This winter Environment Minister Suzanne Blais-Grenier will be pressing for meetings with her counterpart in the Reagan administration.

. In April, Mrs. Blais-Grenier is to negotiate with Manitoba, Ontario and Quebec on how to share the cost of cleaning up the smelters and on their plans for reducing pollution from power plants.

. In May, Canada will attend an economic summit in Bonn at which acid rain, which is destroying European forests, is expected to be high on the agenda.

. Also in May, Mrs. Blais-Grenier is to meet smelting industry officials, many of whom are saying that they cannot afford the costs of cleaning up. She is also to meet New Brunswick, Nova Scotia and Newfoundland on their plans to reduce power plant gases.

. By June, Ottawa hopes to have formal agreements from provinces on exactly which polluters will be controlled and what laws they will use or pass to enforce the cleanup.

. In early summer, Canada is to sign an acid rain control protocol of the Economic Commission for Europe in Helsinki.

. By August, the federal and provincial environment ministers are to meet again to confirm their detailed plans.

WED FEB.06,1985 PAGE: P1
BYLINE: MICHAEL KEATING
CLASS: News
DATELINE: Montreal PQ WORDS: 1125

Eastern provinces to find joint approach Acid rain agreement hailed as victory

By MICHAEL KEATING
Globe and Mail Reporter

MONTREAL - *Canadian environment ministers claimed "a victory for the ecology of Eastern Canada" yesterday as they announced a partial agreement to share the cleanup of acid rain.*

Quebec Environment Minister Adrien Ouellette added that the agreement by federal and provincial governments to set provincial targets for pollution control was a major step in the battle against acid rain.

"It was a historic meeting," said federal Environment Minister Suzanne Blais-Grenier. The ministers or their representatives from six eastern provinces had agreed to carve up the responsibility for reducing acid rain and to find "a joint approach to financing the enormous sums to pay for the cuts," she said.

Mrs. Blais-Grenier said public opinion polls show that people are willing to see tax dollars used to clean up pollution if the polluters are too poor to do all the work themselves.

"We have reached another milestone in the long and agonizing battle to reduce sulphur emissions in Canada," said Ontario Environment Minister Andrew Brandt.

There have been estimates that it will cost as much as $600-million a year for 20 years to pay the acid rain cleanup bill.

Although the environment ministers agreed almost 18 months ago to a

February, cont'd...

50 per cent reduction in sulphuric acid air pollution east of Saskatchewan, they have yet to iron out all the details.

Yesterday's agreement still does not account for about 14 per cent of the 2.3 million tonnes that are to be cut by 1994.

The Canadian Coalition on Acid Rain said late yesterday that the agreement lacked dollars and details.

''There is not much new," coalition spokesman Adele Hurley said. ''What we needed was money and regulations and we did not get either."

It will cost more than $500- million to clean up only two of Canada's biggest polluting smelters, said Michael Perley of the coalition, and governments will probably have to pick up 20 to 30 per cent of the bill.

Tough government action against Canada's own sources of acid rain is considered essential to convince the U.S. Government to clean up its acid pollution, which is responsible for about half the acid rain falling on Eastern Canada.

Prime Minister Brian Mulroney will be meeting President Ronald Reagan in Quebec City in five weeks and has promised to put acid rain at the top of his agenda.

Canada's acid rain control program will not work without joint U.S. action.

Mr. Brandt said yesterday's agreement ''will strengthen the hand of the Prime Minister when he meets with Mr. Reagan."

Mrs. Blais-Grenier also said yesterday that Mr. Mulroney will be announcing increased pollution controls for Canadian cars, probably before the March 17 meeting with Mr. Reagan.

Critics of Canada's pollution have long pointed out that Canadian cars emit three to seven times as much pollution as U.S. vehicles.

Mrs. Blais-Grenier said that Mr. Mulroney last week sent clear signals to the public that Ottawa is ready to share the cost of the cleanup.

Still to be negotiated is how the cost will be shared by the companies, mainly big copper and nickel smelters, and by the federal and provincial governments.

The aim is to lower the sulphur fallout to no more than two grams a year on every square metre of land and water in eastern Canada. This is the level at which scientists believe the majority of wildlife can survive, although in sensitive areas the pollution would still be strong enough to kill some species.

Canada's cleanup plan is to reduce the amount of sulphur dioxide pollution in the eastern half of the country by one-half by 1994 from the 1980 allowable levels of 4.6 million tonnes.

Most of the cuts will come from the dozen or so big sources, which include huge nickel and copper smelters and coal- burning power plants. There is sulphur in the ores smelted and the coal burned and it turns into sulphur dioxide gas.

In the air, the gas mixes with water to form sulphuric acid rain, snow, sleet, fog or dew. It also falls to ground as dry sulphur and can mix with water to form acid.

Nitrogen oxides pollution from power plants and car exhausts is also seen as important in the formation of nitric acid rain. The aim is to start pollution controls by 1988 at the latest in most cases to meet the 1994 deadline.

Ontario, which has some of the biggest polluters in Canada, had sulphur dioxide pollution of about 2.2 million tonnes allowable in 1980 but has promised to cut that by about 30 per cent by 1990. That is expected to increase to 50 per cent by 1994, making nearly half of the Canadian sulphur rollback.

Inco Ltd. in Sudbury has long been the largest source of sulphur dioxide pollution in North America. It was allowed 1.1 million tonnes a year in 1980 and has been capped at 730,000 tonnes a year recently when production was low because of poor nickel markets.

It will likely be ordered to cut back to 350,000 tonnes a year. The neighboring Falconbridge Nickel Mines plant will be held to 154,000 tonnes a year.

Ontario Hydro is under provincial orders to reduce its sulphur emissions to 390,000 tonnes by next year, and to 260,000 tonnes in 1990.

Following the Montreal meeting, Ontario is expected to order Hydro to roll sulphur back to as low as 175,000 tonnes by 1994. Quebec is expected to cut its pollution by 45 per cent to reach 600,000 tonnes a year by 1990.

The Noranda Mines Ltd. smelter in Rouyn is the second largest sulphur dioxide polluter in North America. Quebec has announced it will be ordered to cut its pollution of 552,000 tonnes a year in half by 1990.

Manitoba is apparently ready to roll back its sulphur pollution by close to 40 per cent from the 738,000 tonnes allowed in 1980. The Inco Ltd. smelter in Thompson, Man., has been the fourth largest North American sulphur polluter. It was allowed 414,000 tonnes in 1980 but will be capped at about 200,000 to 250,000 tonnes a year.

Hudson Bay Mining and Smelting Co. Ltd. in Flin Flon, was allowed 293,000 tonnes in 1980 and will likely be reduced to around 185,000 tonnes.

Nova Scotia says that most of its pollution, which is mainly from coal-fired power plants, blows out over the Atlantic Ocean. It is, however, expected to cut its pollution slightly from the 1980 levels of 219,000 tonnes to 200,000 tonnes.

New Brunswick is expected to reduce pollution by around 14 per cent from 1980 to 1990 to reach 185,000 tonnes.

Newfoundland is expected to reduce 1980 levels by about 25 per cent to reach 45,000 tonnes a year in 1990.

Next story follows...

THU, FEB. 07, 1985 PAGE: M3
BYLINE: MICHAEL KEATING
CLASS: News
DATELINE: WORDS: 817

Analysis

Canada's acid rain strategy not likely to inspire Reagan

By MICHAEL KEATING

A major aim of Tuesday's federal-provincial acid rain control agreement was to give Canada more leverage in bargaining for U.S. pollution controls next month.

The promises by six provinces to roll back their sulphuric acid pollution by specific amounts over the next nine years will slow the environmental destruction of Eastern Canada and the Northeastern United States.

But whether it will help convince U.S. President Ronald Reagan to take similar action is very uncertain.

Prime Minister Brian Mulroney has said the U.S. acid rain controls are at the top of his negotiating list when he meets Mr. Reagan in Quebec City on March 17. The reason is that about half the acid rain falling on Canada blows north from U.S. smokestacks, and without U.S. controls, Canada's environment will continue to wither and die.

Even total controls of Canadian pollution would not be enough to save areas close to the U.S. border, Canadian scientists say.

Since 1980, Canada's acid rain control strategy has been based on each country rolling back its sulphur pollution by half. Scientific studies say this would save most of the North American environment from destruction.

Federal and provincial governments have been inching toward the 50 per cent rollback at home - all the while trying to coax the United States into similar action. Since Mr. Reagan took office in 1981, the U.S. response has been that it wants more evidence of the costs of acid rain damage before it will commit billions of dollars to a further cleanup.

Over the past four years, Ottawa has pleaded, cajoled and finally blustered at Washington in a vain effort to change the U.S. position.

When the Conservatives took office last fall, they rolled back the clock to the days of polite requests for U.S. action, saying that shouting at the White House was getting Canada nowhere.

At the same time, the new Government picked up the acid rain control program it had inherited from the Liberals, and at the Tuesday meeting in Montreal announced the long-awaited next stage. However, the change of federal governments delayed the Canadian action plan by several months, and barring an exceptional effort it will still be far from complete before the March 17 meeting. Still to be announced are the specific laws controlling each polluter and the amount of money federal and provincial governments will put into the control programs to help industry pay for the multi-billion dollar cleanup.

Canadians have to take actions that "show we are willing to put our money where our advocacy has been," Michael Perley of the Canadian Coalition on Acid Rain said yesterday.

Only the sight of laws being passed and money committed will convince the United States that Canada is truly serious about the cleanup, he added.

Mr. Perley is far from optimistic that even full Canadian action will sway the Reagan Administration from its present stance.

"What signal has Canada had that the Reagan Administration is going to move off its position of more research? None," Mr. Perley said.

Mr. Reagan recently increased his research budget for acid rain by 35 per cent. But the acting head of the U.S. Environmental Protection Agency, Lee Thomas, also said he is not prepared to recommend a shift from research to actual controls based on what is now known about the problem.

Former Canadian Environment Minister Charles Caccia said that with all the goodwill and Canadian action he can muster, Mr. Mulroney has no guarantee of U.S. cooperation on acid rain after March 17.

"The Americans will do it when they are ready no matter whether we hire Mozart to play a minuet for the meeting," Mr. Caccia said. "They will do it when international pressure makes it too hard to stay out (of international control programs), or when the domestic cost gets too high," he added.

Mr. Perley said there is a faint glimmer of hope for Canada in a U.S. court case over what is called the tall stacks issue.

In a complex lawsuit, a U.S. judge is to rule on whether big acid rain polluters will have to install new anti-pollution equipment. The judge is waiting for new regulations for these polluters to be proposed by the EPA.

Mr. Perley and other Canadian acid rain experts say the Reagan Administration could quietly propose tighter pollution controls to the court without having to make a high-profile policy change required by introducing an acid rain control bill.

If March 17 and the U.S. court bring no relief

from the U.S. acid rain forecast, Canada faces two unpalatable choices.

One is to wait for a change in U.S. policy, and this could mean waiting for another presidential election in nearly four years. The other is to go back to the drawing board on its own control program and consider cutting more than half the sulphur pollution from Canadian sources.

SAT FEB.09,1985 PAGE: N5
CLASS: News SOURCE: CP
DATELINE: Quebec PQ WORDS: 314

Quebec sets curbs on auto, smelter fumes

QUEBEC (CP) - *The Quebec Government announced new regulations yesterday to control smelter emissions and automobile exhaust designed to cut the province's contribution to acid rain.*

The regulations should reduce by 45 per cent sulphur dioxide emissions from the province's smelters over the next five years, said Environment Minister Adrien Ouellette.

The regulations, to come into effect about the end of the month, specifically hit two smelters considered to be the biggest industrial polluters in Quebec. The Horne Foundry in northwest Quebec and the Gaspe Copper Mines smelter in Murdochville are both owned by Noranda Mines Ltd.

The regulations also make it an offence to tamper with anti-pollution devices on cars. After 1986, it will be illegal to sell or use cars without emission controls.

Violators will be subject to fines of $20,000 for companies, $1,000 for individuals or a maximum jail term of one month.

The emission regulations won't apply to vehicles modified to use propane and natural gas or cars used during international racing competitions.

Violations of the smelter controls can bring corporate fines of up to $100,000 and jail sentences for individuals of as much as six months.

The Environment Department identified automobile exhaust and smelter sulphur emissions as the principal causes of acid rain. Earlier in the week, Quebec and six other provinces reached an agreement with the federal Government on a cost-sharing formula to pay for acid rain control.

The federal-provincial agreement is intended to limit sulphur dioxide emissions to 20 kilograms per hectare per year. Mr. Ouellette said the new regulations are the province's contribution to the pact.

The federal-provincial agreement, which did not contain specific measures, was made final in advance of a meeting next month between Prime Minister Brian Mulroney and President Ronald Reagan.

At the Quebec City meeting, the two leaders are expected to discuss the international aspects of controlling acid rain.

SAT FEB.16,1985 PAGE: B1
BYLINE: KIMBERLEY NOBLE
CLASS: ROB
DATELINE: WORDS: 1515

Cutting sulphur dioxide output a question of who foots the bill

By KIMBERLEY NOBLE

For the past two years, environmentalists have turned up at the annual meeting of Inco Ltd. to ask for cuts in the amount of acid-rain-causing sulphur dioxide spewed from the company's smelters in Sudbury, Ont., and Thompson, Man.

Last year's request was easily defeated by a shareholder vote of 70.2 million to 57,744.

This year, the voting question is moot - not because the company has found a solution, but because a recent acid rain agreement means the decision to reduce emissions is no longer up to Inco shareholders.

On Feb. 5, federal Environment Minister Suzanne Blais- Grenier and six provincial environment ministers said they would work jointly to cut sulphur dioxide from domestic sources in half by 1994.

Although both levels of government have met before, deciding a year ago to act independently of the U.S. Administration to reduce sulphur dioxide emissions by 2.2 million tonnes - half the 1980 level of 4.7 million tonnes - last week's agreement is the first to allocate firm reductions on a province-by- province basis.

From this point on, discussions with the industry will begin to get serious. Companies identified as heavy polluters - Inco, Falconbridge Ltd., Noranda Inc. and Hudson Bay Mining and Smelting Co. Ltd., all of Toronto - must soon choose when and how to cut emissions.

They will have to begin installing new equipment by 1988 if the deadline

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is to be met.

Studies show that half of the acid rain falling in Canada originates in the United States, mostly from coal-burning power plants. But of domestic sources, non-ferrous (nickel, copper, lead and zinc) smelters are by far the worst polluters. Using 1980 figures, such plants sent 2.125 million tonnes of sulphur dioxide into the air, almost half of the total.

Power generators accounted for only 745,000 tonnes, according to statistics from the Canadian Coalition on Acid Rain. Although Ontario Hydro's contribution has increased slightly in recent months while some nuclear plants have been closed or curtailed, smelters still spew out about 60 per cent of the sulphur dioxide in Eastern Canada.

Sulphur dioxide combines with moisture in the air to form a weak sulphuric acid solution, deposited as acid rain hundreds of miles from its source. Acid rain has been blamed for the environmental death of lakes, damage to forests and buildings, and respiratory health problems.

Money is the big question mark in the acid rain cleanup program.

Depending on how much of the public purse the two levels of government decide to spend, Canada's major nickel and copper smelter operators may have to spend more than $1-billion on capital equipment to clean the air.

"We still say it's a curious time to look at funding pollution abatement equipment," said John Reid, senior adviser to the Mining Association of Canada. "Nobody's made any money yet. We would want to see two or three quarters of profitability before considering any approach to the companies."

Ontario, where industrial and other sources poured out 2.2 million tonnes of sulphur dioxide in 1980, plans to reduce its emissions by more than 50 per cent. Quebec is to cut pollution by 45 per cent and Manitoba by 40 per cent from 738,000 tonnes. Scheduled reductions in the Maritime provinces, where the main source is coal-fired utilities, range from 25 per cent in Newfoundland to less than 10 per cent in Nova Scotia.

Environment officials say the new agreement does not pinpoint individual industries, but three Canadian smelters have long been identified as the largest, second- and fourth-largest sources of industrial air pollution in North America. Inco's huge smelting complex at Copper Cliff, Ont., near Sudbury, is the largest single source of sulphur dioxide emissions in North America. The 1,500-foot superstack, once seen as a way of restoring the area landscape by sending emissions miles into the atmosphere, now provides environmentalists with a symbol for industrial pollution. The superstack and the nearby iron ore recovery plant were together allowed to emit 1.1 million tonnes in 1980, although actual levels were well below that at about 800,000 tonnes. The two plants are now held to a daily maximum of 1,950 tonnes, averaged out by dividing total emissions by the number of working days, but have long been targeted for further reductions.

Noranda's Horne copper smelter, located in Rouyn-Noranda in northern Quebec, has received much less publicity outside the province, but is described as Quebec's equivalent to Inco's Sudbury operation. Although the Horne for years operated under its own self- imposed limits - emitting about 552,000 tonnes in the 1980 base year and about 500,000 tonnes in 1984 - this changed last fall when the Quebec Environment Ministry ordered the company to reduce sulphur dioxide emissions by 50 per cent by 1989 or face penalties up to $100,000 a day and possible jail terms.

Ranking fourth in North America for sulphur dioxide emissions is Inco's Thompson nickel smelter. One of the world's largest and relatively modern smelters, it still sends about 200,000 tonnes of sulphur dioxide into the atmosphere a year.

Other plants targeted for reduction of current emission levels are Falconbridge's Sudbury nickel and copper smelter, which underwent a major environmental improvement program in 1978, and the antiquated copper-zinc smelter operated by Hudson Bay Mining and Smelting in Flin Flon, Man.

The federal Department of Energy, Mines and Resources task force report into the nickel and copper smelting industries, released last spring, said the "twin challenges" lay in finding a way to improve productivity and international competitiveness and reduce sulphur dioxide emissions to safe environmental levels at the same time.

The report, which also examined the severe financial and marketing problems that face nickel and copper producers, set the cost of installing new equipment designed to contain or eliminate sulphur dioxide emissions at approximately $1.1-billion in 1982 dollars.

Nickel and copper producers reported about $1-billion in losses during the recession, the report said. Although results have improved, the mining industry cannot afford extensive capital programs.

Some companies could recover their costs through increased operating efficiencies; others would find operating costs for money-losing operations onerous.

For example, even at a cost of at least $500-million, a new nickel smelter or modernization of the plant at Sudbury would improve Inco's long- term profitability, the EMR study said.

Inco's improved pyrrhotite rejection process, which increases the amount of sulphur that can be extracted from the ore before gases reach the stack, was recommended as a low-cost method that could be installed at the Thompson operation. A similar application by Falconbridge, combined with other technologies, could significantly reduce sulphur dioxide emissions while maintaining plant productivity.

Noranda could lose about $15-million if forced to build a sulphuric acid recovery plant at the Horne. Treating the gas from the

February, cont'd....

Horne smelter could cut emissions in half, but it would also dump 325,000 tonnes of sulphuric acid on a weak market, Noranda executives said. The company still predicts a turnaround in the copper market by 1990, but has threatened to close the smelter and put 1,200 employees out of work if it cannot get concessions from the Quebec Government.

"It's all a question of timing," said Frank Frantisak, Noranda's vice- president of environmental services. The company spent about $168-million in 1982 and 1983 on environmental improvements and research, and has already installed an acid recovery plant at its smelter in Murdochville on the Gaspe peninsula.

He said Noranda's ability to comply with the new regulations will depend on how strictly the Government enforces its 1989 deadline, and on the amount of financial assistance forthcoming from both levels of government.

"This is what we hoped would come out of (the Feb. 5) meeting," said Michael Perley, spokesman for the acid rain coalition, an organization with about two million members from business, environmental, tourism and public interest groups. A December, 1984, analysis by Environment Canada detailed a number of possibilities, including loans, grants and publicly issued pollution control bonds.

Suggestions have been made that interim financing will involve a formula that will provide assistance in the short term, to be recouped when nickel and copper markets pick up.

Companies and government departments are continuing their research. The Department of Regional Industrial Expansion is examining ways to provide grants for testing new pollution abatement technologies.

Noranda and the Quebec Government, adversaries as recently as last September, are conducting a joint $3- million study into the feasibility of the acid plant at Rouyn-Noranda. Intensive discussions since the fall "have given us a better understanding of the constraints applied to a custom copper smelter," said Jean Piette, director of strategic and policy planning for the Quebec Environment Ministry.

"We have learned that it is a very special situation." Noranda has to compete with other smelters worldwide - many in developing countries that do not have stringent environmental control measures. And some industrialized countries such as Japan have erected trade barriers to protect domestic industries. "We have to maintain the flexibility that will allow them to operate properly and profitably," Mr. Piette said.

March

THU MAR.07,1985
PAGE: P4
BYLINE: JEFF SALLOT
CLASS: News
DATELINE: Ottawa ONT WORDS: 787

Vehicle exhaust standards tightened $150 million slated for smelter cleanup

By JEFF SALLOT
Globe and Mail Reporter

OTTAWA - The federal Government announced tougher motor-vehicle emission standards and financial assistance of up to $150-million for the smelting industry yesterday as part of a long-term acid-rain cleanup campaign. The new standards for cars and light-duty trucks, which will come into effect in the fall of 1987 for the 1988 model year, are intended to reduce emissions of nitrogen oxide pollutants by 45 per cent. They could add as much as $200 to the price of a new vehicle for pollution-control equipment, federal officials say.

The new standards are the same as those already in force in the United States. Environment Minister Suzanne Blais-Grenier said Ottawa will contribute up to $150-million over 10 years to help modernize the smelting industry, which is one of the major sources of pollution causing acid rain. The announcement yesterday was part of the federal Government's buildup to the summit meeting in Quebec City in 10 days between Prime Minister Brian Mulroney and U.S. President Ronald Reagan.

Mr. Mulroney intends to press Mr. Reagan to do more to reduce air pollution coming from the United States, but has said in recent months he cannot push the United States too hard unless Canadians are willing to do more themselves. Yesterday's an-

Continued...

March, cont'd...

nouncement was also timed to keep an election promise by Mr. Mulroney to have an acid rain program in place by the end of a new Conservative Government's first six months. The six months ended yesterday.

Mr. Mulroney told the Commons that the program announced yesterday was ''the most comprehensive and helpful program ever initiated by the Government of Canada to rid this country of the savagery of acid rain. . . . " Environmentalists did not greet the announcement with the same enthusiasm as Mrs. Blais- Grenier showed in making it. She said it is ''the most ambitious environmental program that this country has ever put forward and is one that is not equalled anywhere."

Michael Perley, a spokesman for the Canadian Coalition on Acid Rain, said the coalition ''can live with the delay" until 1987 in implementing the vehicle emission standards, and the $150-million for the smelting industry ''starts the ball rolling."

Kai Millyard, a senior researcher at Pollution Probe, said much more money will have to be made available for the acid rain-cleanup program. Ontario Environment Minister Morley Kells, whose province is the source of most of the air pollutants emitted in Canada, said he was pleased with this ''first major initiative" by the federal Government.

U.S. Government sources said that in many respects their Government has gone further than Canada on air pollution with-measures such as tighter curbs on octane-boosting tetraethyl lead additive for gasoline.

Canadian officials said they are delaying the new vehicle emission standards until Sept. 1, 1987, because industry needs time to make the adjustment. The industry facing the greatest-problems will be the oil refining business, which will face greater demand for lead-free gasoline, which creates fewer pollutants.

Canadian car manufacturers already make vehicles for export to the U.S. market that meet the U.S. standards for emissions.

A senior Canadian Environment Department official said at a briefing that the $150-million in capital to modernize smelters is a maximum. The amount Ottawa will provide could be less if the smelting industry enjoys an economic turnaround and becomes profitable. The official estimated that the smelting industry would need from $700- million to $750-million in capital improvements to reduce air pollution sufficiently to meet the target set by federal and provincial environment ministers last month to cut emissions in half by 1994.

It was unclear from the announcement in Ottawa how much provincial governments might be expected to pay to help their smelting industries.

The provinces are also facing possible major expenditures to reduce air pollution from their coal-burning electrical generating plants.

Mrs. Blais-Grenier said in a prepared statement that Ottawa will contribute more than $300-million within the next 10 years to fight acid rain.

Her officials acknowledged under questioning, however, that only the announcement of the $150-million for the smelting industry is ''new money."

The rest is for previously announced programs, such as $70-million for technology development for cleaner coal power generation and $25- million that has already been earmarked for development of improved smelting technology.

In an era of federal budget trimming, ''maintaining a budget is not a bad thing," the Environment official said, speaking to reporters on condition that he not be identified by name.

The Government intends to give the acid rain cleanup program a high profile with the creation of an acid rain office, which was also announced yesterday.

July

SAT JUL.20,1985
PAGE: P17 (ILLUS)
BYLINE: CHRISTIE McLAREN
CLASS: News
DATELINE: WORDS: 738

Davis non-committal on support for Ontario anti-pollution plans

By CHRISTIE McLAREN

William Davis, Canada's acid rain ambassador, has refused to say whether he supports the Ontario Government's plans to make further cuts in the sulphur dioxide pollution that causes acid rain.

Both Mr. Davis, Ontario's former Progressive Conservative premier, and James Bradley, the new Liberal Environment Minister, were diplomatically non-committal as they emerged from a meeting yesterday afternoon in which they discussed the province's plans.

But Mr. Davis, pressed by reporters, said he did not have enough specific information from Mr. Bradley about the proposed-pollution reductions to comment.

"With great respect, Mr. Bradley has made certain general statements. I do not know of any definitive statements that he has made with respect to any possible further emission-level reductions.

"I can only assume that the minister . . . will be

July, cont'd...

assessing what is going to be the posture of the Government. . . . If you wish to ask me then, I might be prepared to answer, but in all the years of political life I have not dealt with potential, hypothetical things that may or may not happen."

Mr. Bradley went into the 90-minute meeting saying that the Liberal Government's promise to require more reductions in sulphur dioxide emissions by 1994 - beyond Tory standards - would provide Mr. Davis with "new ammunition" to strengthen Canada's bargaining position in the United States.

Although Mr. Bradley has promised that he will require more cuts in sulphur dioxide emissions, he has not said how large a reduction he is seeking, from which polluters, or how the multi-million-dollar costs of the measure will be divided. (Yesterday, he said the figures will be available this fall, after talks with industry and studies by the Environment Ministry.)

Mr. Davis also refused to comment when asked whether he agrees that Ontario Hydro and Inco Ltd. should make larger reductions in sulphur dioxide pollution by 1994 than already pledged.

But, in what sounded like a defence of Inco, he added that "it should be pointed out that there are existing (pollution-control) orders (under which Inco operates) . . . the reduction levels in percentage terms have been increased. Inco has announced a voluntary reduction by 1994 which would be a 50 per cent reduction over the levels that are under the existing (control) order, which would amount to a 70 per cent reduction from the base year of 1980."

He said he is in a position to tell U.S. acid rain envoy Drew Lewis that Inco is making "very real progress" which, if matched by the United States, "would go a long way to reducing the problem."

When a reporter suggested he was not demonstrating strong support for the Liberal initiative, Mr. Davis appeared to become angry.

"Let's be fair," he said. "No question you're going to ask .. . is going to put me in a position or (Mr. Bradley) in a position of my not being supportive of further reductions in emissions levels. I'm supportive of any reduction in emission levels. We all are."

Mr. Davis said he does not know whether Inco's 1994 commitment will be good enough for Mr. Bradley until such time as the minister studies the issue further.

"I do not know of any further definitive statements Mr. Bradley has made. Don't portray me as not being supportive of what the minister is trying to do."

Mr. Davis acknowledged that some U.S. politicians have criticized Canada and Ontario for failing to take significant action against acid rain pollution. He said Canada has done more to correct the problem than the United States.

Before the meeting, Mr. Bradley said he was concerned that Ottawa had softened its previously strong position on acid rain. That concern was sparked when federal Environment Minister Suzanne Blais-Grenier said last week that she understood the U.S. Government's refusal to sign an international agreement pledging more reductions in sulphur dioxide emissions by 1994, because the Americans have already made large cuts in air pollution.

Mr. Bradley said he left his meeting with Mr. Davis feeling assured that "there appears to be a strong federal Government commitment in that one specific environmental field, at the very least."

Asked whether she has urged Mr. Davis to put more pressure on the Reagan Administration, Mrs. Blais- Grenier said Mr. Davis is"well aware of the problem. He's a real politician; he knows very well what can be achieved."

October

FRI OCT.04,1985
PAGE: A14
BYLINE: CHRISTIE McLAREN
CLASS: News
DATELINE: WORDS: 768

'Politics' clouding agreement : Ministers talk privately on acid rain

BY CHRISTIE McLAREN
The Globe and Mail

The federal and Ontario environment ministers say they will lock themselves in a room - without their officials - until they break a major deadlock over the financing of Ontario's acid-rain clean-up program.

"The vicious circle has to be broken," federal Environment Minister Thomas McMillan said yesterday. "We've had meetings, but not a meeting of minds."

"We're prepared to lock ourselves in a room if necessary," Ontario Environment Minister James Bradley told a news conference at the end of the two-day annual meeting of the Canadian Council of Resource and Environment Ministers in Toronto.

Their dispute is over the $150- million fund that Ottawa intends to distribute among the seven eastern provinces, which have agreed to cut acidic air pollution in half by 1994. The federal Government says it will not reveal how it

Continued...

October, cont'd...

intends to distribute the money until the provinces reveal detailed clean-up plans, expected later this year. Ontario says it cannot provide a detailed plan until it knows how much federal money will be available.

The two ministers said they have asked their officials to "clear the decks" of all appointments in the next few days to leave them free to meet.

At the news conference, Mr. McMillan revealed another possible source of their disagreement when he rejected a proposal for a cost- effective clean-up - produced by Ontario - in favor of one that may be more expensive, blaming it on politics.

A computer analysis produced earlier this year by Ontario's Environment Ministry suggests that the most economic way to achieve the cuts is for industries in Ontario and Manitoba to bear the brunt of the pollution cutbacks.

But the original agreement between the governments last February called for the cutbacks to be spread more evenly among the provinces.

Mr. McMillan argued that "the Atlantic Provinces want to be part of the solution, even if they're not part of the problem .. . so it's a bit of a political question here."

The ministers' stalemate and the absence of announcements from most of the provinces about how they will cut sulphur-dioxide pollution show that little progress has been made in the eight months since the provinces agreed to the cuts last February, the Canadian Coalition on Acid Rain said.

"It's eight months later and nothing happened there," coalition spokesman Adele Hurley said in an interview. By now, she said, the governments should have detailed plans explaining the size of the cuts expected from the industries that pollute.

Blaming the stalemate partly on bureaucrats who are not giving their ministers enough detailed information about the possible sources of pollution cuts, Ms Hurley said the bright spot about the conference is that Mr. McMillan and Mr. Bradley are going to hammer out a solution in private.

"They've obviously concluded amongst themselves that their officials are getting in their way."

Last February's agreement stipulates that Manitoba, Ontario, Quebec and the four Atlantic Provinces cut their total sulphur-dioxide emissions in half by 1994 - to 2.25-million tonnes a year from 4.5-million tonnes. The governments have already agreed to reduce sulphur- dioxide emissions to 2.6-million tonnes a year.

But their goal to protect the environment from acidification - no more than 20 kilograms of sulphur dioxide per hectare of land per year - can only be achieved if they find a way to cut at least 300,000 more tonnes of sulphur dioxide.

Quebec is the only province that has produced a plan showing which industries will be required to make which cuts. Manitoba and the Atlantic Provinces are reportedly close to completing their plans, Mr. McMillan said.

But Ontario's computer model says that the most cost-effective way to reach the total target is for Ontario and Manitoba to bear the brunt of the cutbacks, and Nova Scotia and New Brunswick would no longer have to make cutbacks at all.

An Ontario official said it is cheaper to make major pollution cutbacks and install expensive pollution-cutting equipment at the biggest industrial polluters, instead of requiring small cuts from many smaller industries.

Mr. Bradley said Ontario has offered to absorb the extra 300,000 tonnes.

However, Mr. McMillan told reporters the missing 300,000 tonnes is "a red herring" and said he wants to stick with the February agreement, which spreads the cuts more evenly between all seven provinces.

However, said Ms Purley of the acid-rain coalition, the cutback program "must be dictated by environmental protection and protection of sensitive areas, not by some political distribution of reductions which will not protect the environment."

December

MON DEC.09,1985
PAGE: A3
CLASS: News
DATELINE: WORDS: 466

Minister's strategy against acid rain meeting resistance

Canadian Press

Ontario's Liberal Government, which says protection of the environment is one of its major priorities, will try again this week to reach agreement on a controversial plan for strict controls on the province's major acid rain-producing industries.

The staff of Environment Minister James Bradley has been working for months on a program aimed primarily at Inco Ltd. and Ontario Hydro, but sources say he has been unable to sell the package to some of his Cabinet colleagues. Angered that an earlier proposal was leaked to a Toronto newspaper, Mr. Bradley said only that he hopes the unveiling of his program will come ''before

December, cont'd...

the end of this year or early next year.''

The original plan was to announce details this Thursday, but the ministry program was not passed by the Cabinet last week - meaning that at this week's Cabinet meeting Mr. Bradley will have to either amend his submission or present his arguments again.

Sources said most of the opposition is coming from Northern Development Minister Rene Fontaine, whose ministry feels that putting unrealistically strict control orders on Inco could mean a loss of jobs in Sudbury, and Energy Minister Vince Kerrio, who believes tougher controls would place a substantial financial burden on Hydro.

The point of contention is not what the program would cost - a total of up to $170-million in federal and provincial money over the next eight years - but what emission controls Inco and Hydro would have to meet.

Industrial opponents, who say the reduction levels proposed by the Environment Ministry are beyond the realm of possibility, are privately accusing the Liberals of playing politics on the acid rain issue.

Besides appearing tough on polluters - something the Liberals accused the former Conservative government of not doing - the Government wants to send a message to the United States, which is responsible for most of the acid rain that falls in Ontario.

The Environment Ministry's program stems from an agreement signed last February between the federal Government and the six eastern provinces that acid rain pollution would be cut in half by 1994. Ottawa set up a $150- million fund to be distributed to the provinces to help them meet the target.

Inco announced this year it would voluntarily cut emissions from its Sudbury nickel smelter - the largest single source of acid rain in North America - to 350,000 tonnes by 1994 from an annual level of about 700,000 tonnes.

But Mr. Bradley has said he wants Inco, Hydro and other industries such as Falconbridge Ltd. and Algoma Steel Corp. Ltd. to cut back their emissions further than the 50 per cent level.

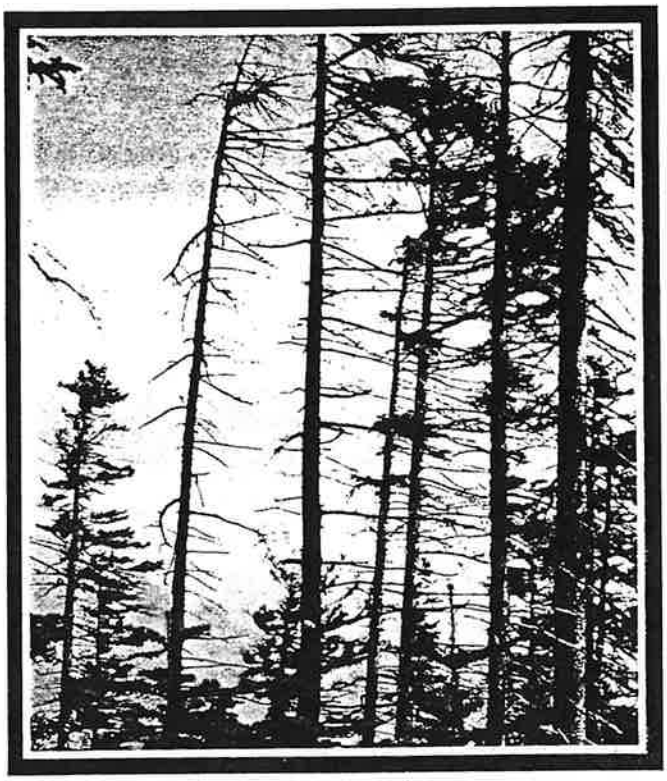
While not entirely happy with the program, Algoma and Falconbridge are said to be putting up less opposition than Hydro and Inco.

Stopping Acid Rain: The Canadian Program

A publication of a Canadian program designed to persuade opinion leaders that Canada is doing its part to control acid rain.

Discussion Note

This publication represents a further Canadian attempt to persuade U.S. public opinion that acid rain was important, that Canada was doing its part to control air quality appropriately and that the U.S. should do its part as well. The Canadian program should be compared to the measures later proposed for the U.S. in the 1990 amendments to the Clean Air Act described elsewhere in this module.



Canada's Most Serious Environmental Problem

Acid rain is the most serious environmental problem facing Canada today. Acid rain kills fish and other aquatic life in lakes and streams. It is a threat to waterfowl. It erodes historic buildings and monuments. And there is evidence that it may affect the health of people, particularly children, with lung and other respiratory problems.

Canada has been a leader in the fight to combat acid rain pollution by controlling emissions of sulphur dioxide (SO_2) and oxides of nitrogen (NO_x). With the signing of the seventh and final federal-provincial acid rain agreement in early 1988, Canada now has in place tough new standards designed to cut in half acid rain-causing emissions from sources within eastern Canada by 1994. The seven agreements are the core of the **Canadian Acid Rain Control Program** – a significant demonstration of environmental cooperation among the federal and provincial governments, industry, and environmental interest groups. In support of the Program, each province is implementing an abatement program with targets and schedules to achieve its commitments.

The Canadian Acid Rain Control Program is only one of many ways in which Canada is fighting acid rain pollution. Since the causes of acid rain are airborne chemicals, environmental damage occurs many miles from the source of the pollutants. In fact, the people and areas most affected are often the least connected with the problem. As a result, acid rain cannot be stopped by any one nation, or by any one level of government or sector of society on its own. Canada is therefore acting on other fronts to combat acid rain. The major objective is a negotiated accord with the United States, whose pollution accounts for half of the acid rain falling on Canada. Canada is seeking American agreement for a program involving emission reduction targets and schedules that, in conjunction with those already imposed on Canadian utilities and industry, will protect the Canadian environment from acid rain damage.

In international areas, Canada also continues to provide leadership in controlling emissions of SO_2 and NO_x. On October 19, 1987, in a speech to the United Nations General Assembly, the Hon. Tom McMillan, Minister of the Environment, announced Canada's intention to press for a Law of the Air that would provide the same kind of international management of chemicals in the atmosphere that the Law of the Sea provides for protection of the world's oceans.

A Problem For the Entire World

From the Great Lakes region of Canada and the United States, to the Black Forest of Europe, to the Yangtze River of China, many forms of environmental destruction have been traced to acid rain.

"Clean rain" is naturally slightly acidic at a level of about pH 5.6. The acid rain falling on vulnerable areas of eastern Canada is up to 30 times more acidic. The primary source of these destructive acid rain-causing emissions is sulphur dioxide from smelters and power stations. Nitrogen oxides emitted from transportation sources and fuel combustion can also contribute to the problem.

Canada has pursued the twin goals of SO_2 and NO_x reductions as vigorously as any nation in the world. The Helsinki Protocol on Acid Rain was signed in July 1985 by 22 countries, including Canada. This agreement was a direct result of a 1983 meeting, hosted by Canada, at which 10 countries committed themselves to a 30 per cent reduction in the level of their 1980 transboundary emissions of sulphur dioxide by 1993. Part of the success of the Helsinki Protocol is its pragmatic approach – setting emission control targets and schedules based on what is required to protect the environment. This has become Canada's hallmark in international negotiations and discussions on acid rain, as well as other issues of atmospheric pollution.

The Canadian Acid Rain Control Program

The Canadian Acid Rain Control Program is the result of a partnership of governments, industry and environmental interest groups through which acid rain-causing emissions are reduced according to set targets and schedules. The objectives of the Program were established with the full commitment of the provinces and industry.

The primary goal of the Program is to reduce acid fallout to less than 20 kilograms per hectare per year in all vulnerable areas. To achieve this, sulphur dioxide emissions in eastern Canada must be reduced from the 1980 allowable level of 4.6 million tonnes to 2.3 million tonnes, and the transboundary flow of SO_2 from the United States must be reduced to 2 million tonnes. Scientists believe that at this level of emissions and transboundary flows, the critical load of acid rain that can be tolerated by the environment will not be exceeded. No further damage would occur and areas already damaged would begin to recover.

Environmental Quality and Emission Control Objectives

- *Maximum wet deposition of acid fallout of 20 kilograms per hectare per year in all vulnerable areas;*
- *50% reduction in sulphur dioxide emissions in eastern Canada by 1994;*
- *New and tougher nitrogen oxide emission standards for cars and trucks to reduce NO_x pollutants;*
- *Development and application of new process and pollution control technologies;*
- *Increased use of low sulphur coal, and the cleaner, more efficient use of coal by utilities;*
- *Research and monitoring to further understand the impacts of acid rain pollution, and to verify the effectiveness of emission reductions;*
- *Reduction in the transboundary flow of U.S. SO_2 emissions into eastern Canada to no more than 2 million tonnes (50% of the 1980 level);*
- *Leadership internationally, particularly within the United Nations Economic Commission for Europe, to control NO_x emissions.*

Progress Through Partnership

When the Canadian Acid Rain Control Program got under way in 1985, there were no specific emission reduction plans. There were also no government funds for development and demonstration of new technologies or for clean-up at key emission sites. Car and truck emission standards had not been tightened in almost 10 years and significant quantities of lead were still being allowed in automotive fuels. The price differentials between leaded and unleaded fuels had also not been addressed.

Three years later, there has been substantial progress. Of greatest importance is the fact that the seven provincial governments east of Saskatchewan have signed agreements with the federal government, committing themselves to specific emission reduction targets and schedules. The provinces have also committed themselves to enforcing the targets and schedules through their own legislation and to achieving their emission reductions by 1994.

By the beginning of 1988, Canada had already spent more than $15 billion on controlling air pollution. The Canadian Acid Rain Control Program will cost the private sector and provincial utilities about $500 million per year for the next 20 years.

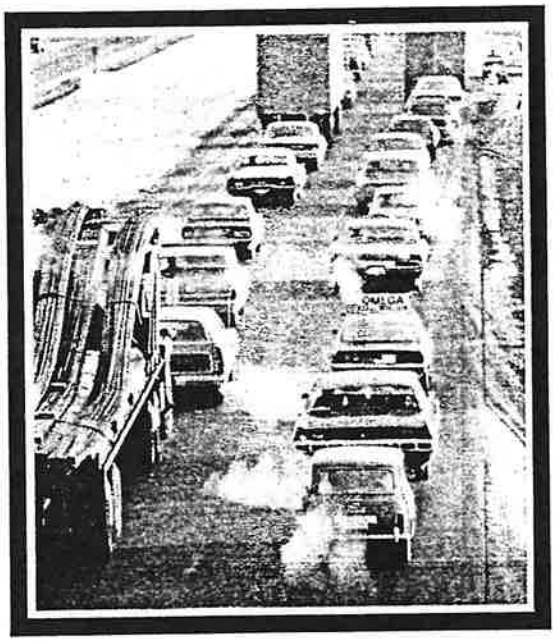
Federal Initiatives Within Canada

The federal government has committed more than $330 million to help the provinces implement their programs under the Canadian Acid Rain Control Program. The federal activities funded under the Program include:

- $150 million to assist companies in implementing specific abatement programs;
- $25 million for technology development and demonstration projects at non-ferrous smelters;
- $70 million to develop cleaner and more efficient ways to use coal;
- $90 million to continue vital research and monitoring of the effects of acid rain.

The federal government has also acted in other related areas as well:

- In order to reduce NO_x emissions, new state-of-the-art standards have been imposed, reducing allowable emissions from new cars and light-duty trucks by 67%, and from heavy-duty trucks by 50%.
- Leaded gas will be virtually eliminated by regulation. In the meantime, the equalization of excise taxes on both types of gasoline will reduce the economic incentive to use leaded gas.



- Under the auspices of the Deputy Prime Minister, an Action Committee on Western Canadian Low Sulphur Coal has been formed. The Committee is reviewing recommendations for increased government and industry support for methods to improve the use of low sulphur coal.

The Provincial Effort

Under the Canadian Acid Rain Control Program, the provinces are putting measures in place to reduce total annual SO_2 emissions from the Saskatchewan/Manitoba border east to 2.3 million tonnes by 1994.

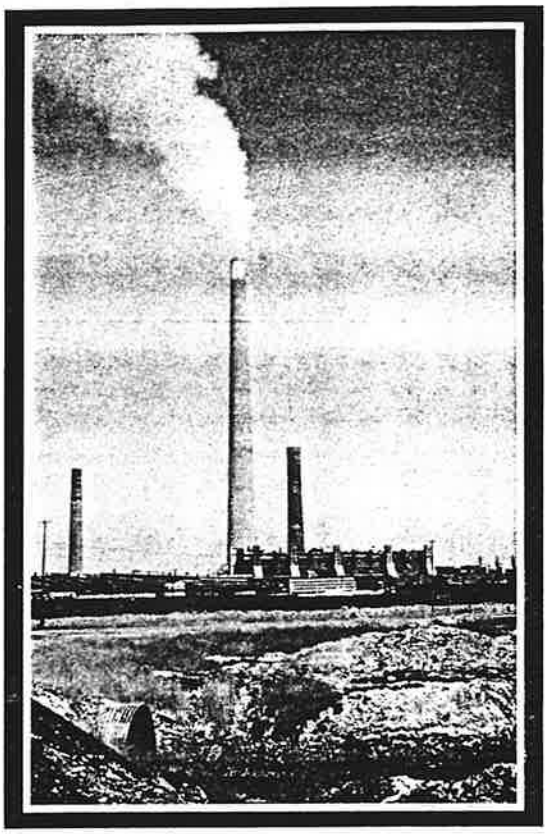
Nearly 80 per cent of the total Canadian emission abatement effort target will be achieved in Ontario and Québec alone. With the cooperation and assistance of the federal government, both Ontario and Québec programs have been moving ahead vigorously. Manitoba and the Atlantic provinces are similarly contributing to this country-wide effort. Even the Western provinces that are least affected by acid rain are taking preventive measures. For example, all new power plants in Alberta and Saskatchewan are meeting stringent emission limits.

Québec

- In 1985, the Québec government issued regulations designed to reduce Québec's SO_2 emissions by 45%, more than 400,000 tonnes, by 1990 — four years earlier than the 1994 deadline.
- Noranda has announced further emission reductions for its Rouyn-Noranda plant, which will bring Québec's overall reductions to 55% by 1995.
- All new smelting facilities must control at least 95% of their sulphur dioxide emissions.
- Québec is working actively on all aspects of acid rain research, particularly on the problem of forest decline.

Ontario

- Ontario has committed itself to reducing its total SO_2 emissions by 60% by 1994.
- About 80% of Ontario's SO_2 emissions come from four corporate sources: Ontario Hydro, Inco, Falconbridge and Algoma Steel's Wawa iron ore plant. The Ontario Countdown Acid Rain program requires that these corporations reduce SO_2 emissions by an average of 65% by 1994.
- Ontario has placed limits on NO_x emissions from coal-fired power plants owned by Ontario Hydro.



Manitoba

- More than 95% of Manitoba's SO_2 emissions are from two sources: Inco's smelter at Thompson and the Hudson Bay Mining and Smelting facilities in Flin Flon. Manitoba will reduce total emissions from these two sources by 40% by 1994.

Atlantic Provinces

- The four provinces have signed agreements with the federal government to reduce their SO_2 emissions by between 10% and 25%.
- Along with Québec, the Atlantic provinces have adopted an SO_2 emission control plan with the New England states through the Conference of Eastern Premiers and New England Governors. This plan includes commitments to cooperate with industry and other levels of government in research and monitoring programs, and to foster further public understanding.

Industry and Utilities

The experience gained over the past three years has demonstrated that major clean-up measures are both technically and economically feasible. Cleaning up does not have to cripple an industry's competitiveness. In fact, environmental clean-up can be part of an industry's future strategy.

A new industrial sector is growing up around the development of new control technologies. Companies in established industries have demonstrated that modernization to reduce pollution can also produce profits.

Each company must decide how to meet abatement targets and schedules in the context of its own competitive requirements. Their decisions have led to technological innovation, with plant modernization that has helped improve atmospheric quality while improving corporate productivity. Governments are cooperating with industry on research to improve and develop more new technologies to lower the costs of abatement, while at the same time increasing emission control.

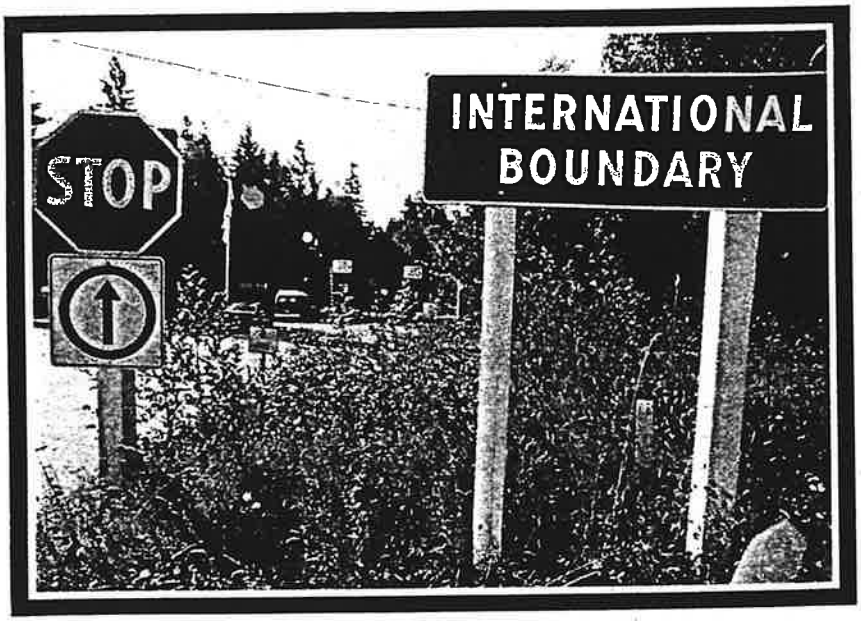
New technologies and newly constructed smelters are pointing the way to the future:

- Inco's operation at Thompson, Manitoba, now controls 45% of the sulphur content of the ore. At Sudbury, Inco controls 70%; Falconbridge, 84%. By 1994, Inco (Thompson) will contain about 70%, Falconbridge and Inco (Sudbury) more than 90%.
- The Kidd Creek Mines zinc and copper operation near Timmins, Ontario captures more than 95% of its sulphur dioxide emissions while Canadian Electrolytic Zinc of Valleyfield, Québec and Brunswick Mining and Smelting's lead plant at Belledune, N.B. each contains about 95%.
- Noranda Mines has begun construction of a new sulphuric acid plant at Rouyn Noranda, Québec, that will capture 96% of emissions from its reactor. This will reduce emissions from Noranda's smelter by 50%. About 6,000 direct and indirect jobs will be maintained in the area and during the peak construction phase, 260 construction workers will be employed. Noranda has announced that it will reduce emissions from this plant by a further 20% by 1995.
- Ontario Hydro is installing low NO_x burners in all of its coal-fired plants. It is also testing new systems that could result in cost-effective reductions in SO_2 emissions from utility boilers.
- TransAlta, Saskatchewan Power Corporation, Nova Scotia Power Corporation, Maritime Electric and the New Brunswick Electric Power Commission are all testing advanced combustion systems with low SO_2 emissions.

An International Effort

Canada has a long history as an international leader in the fight against air pollution. Just one year after the formation of the federal Department of the Environment, Canada was active in negotiating and helping draft the 1972 Stockholm Declaration on the Human Environment that propelled environmental issues into the international arena. Most recently:

- Canada was a leader in the successful conclusion of a 1985 international protocol to reduce sulphur dioxide emissions by 30% by 1993.
- At Montréal in September 1987, a major protocol was signed under which more than 20 countries agreed to cut in half their consumption and production of ozone-damaging chlorofluorocarbons (CFCs) by 1999.
- Canada has worked in Geneva to forge a consensus on NO_x emission controls among the 35 European and North American members of the United Nations Economic Commission for Europe.
- Canada organized a world conference on chemical alteration to the atmosphere, held in Toronto in June 1988.



- Canada will vigorously pursue an international Law of the Air that would protect the world's atmosphere in the same way that the Law of the Sea provides for the cooperative management of the world's ocean resources.

Air pollution knows no boundaries. This has been confirmed by Canada's own experience with transboundary acid rain pollution, and has contributed to Canada's role as an international activist in the field.

Efforts with the United States

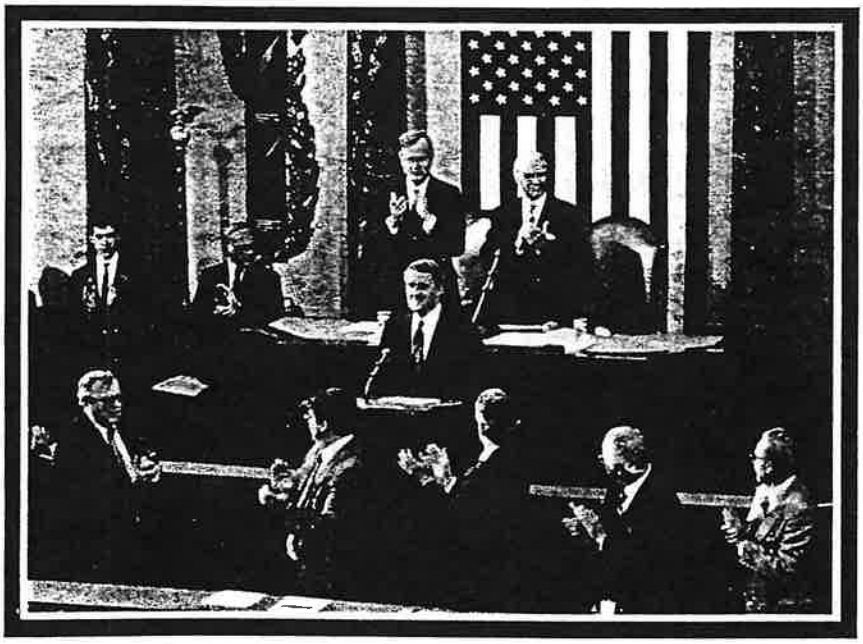
Solving Canada's acid rain problem depends on U.S. actions. Acid rain pollution from American industry and utilities contributes half of the acid rain in eastern Canada. In some areas, the fallout from the United States amounts to 70 per cent of the total.

In his April 1988 speech to a joint session of the U.S. Congress, Prime Minister Brian Mulroney called acid rain an *"escalating ecological tragedy"* in both Canada and the United States. He added that *"the one thing acid rain does not do is discriminate. It is despoiling your environment as inexorably as it is ours. It is damaging your environment from Michigan to Maine, and threatens marine life on the Eastern Seaboard."* The Prime Minister stressed that *"there is no dispute that this is a serious problem that remains to be fully resolved. Persistence will pay. We have been, and will continue to be, very persistent."*

Canada acknowledges responsibility for some of the acid rain that falls in the United States. By the time Canada's program reaches its projected targets, Canada's export of acid rain to the United States will have been cut by an amount in excess of 50 per cent. Canada is pressing the United States to do nothing more than what Canada itself has done, and seeks a commitment from the United States to establish its own emission reduction targets and schedules. Such action would allow the United States to fulfill an international obligation not to damage the environment of its neighbours. The U.S. Administration has resisted adopting the targets and schedules that Canada believes are the only practical ways to deal with the problem. While progress has been slow, Canada will continue its efforts with the U.S. Administration and Congress, as well as with the American public.

As a result of efforts by the Canadian government and its allies in the United States, American public awareness and concern have grown dramatically over the past few years. According to a recent public opinion poll, 9 out of 10 Americans think that the effects of acid rain are serious. This high level of public concern is encouraging and Prime Minister Mulroney has stated that an agreement between Canada and the United States to control acid rain is inevitable.

Many state governments are proceeding with control legislation in the absence of federal action. New York, New Hampshire, Wisconsin, Minnesota and Massachusetts either have implemented or are considering acid rain control programs. In addition, New York, Wisconsin, Minnesota, Michigan and Washington have signed acid rain or environmental cooperation agreements with neighbouring provinces.



The relationship between economic progress and environmental pollution has existed since the Industrial Revolution. And while the impacts of this relationship have been neglected for so long, it is now accepted that clean air, pure water and healthy soil are put at risk whenever technology is devoted to purely economic goals.

In response to the growing environmental crisis facing the world, the World Commission on Environment and Development (Brundtland Commission) has articulated the concept of "sustainable development" – economic development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development requires decisive political action in managing environmental resources and resolving environmental problems in a manner consistent with meeting the needs of future generations.

Canada has taken up this challenge and has accepted that future economic growth is dependent upon adopting sound environmental policies and working with the world community to ensure that sustainable development is a factor in all international economic decision-making.

Through the Canadian Acid Rain Control Program, Canada has created a genuine partnership involving all levels of government, the private sector, the utilities, environmental interest groups, and the public. This partnership is committed not only to resolving a Canadian environmental issue but also to working with the international community to reduce acid rain pollution throughout the world and rid our common environment of the threat of acid rain.

"The Great Lakes Water Quality Agreement: A Model for Controlling Acid Rain?"

This reading looks at existing bilateral machinery for water quality control to assess its suitability for air quality too.

Discussion Note

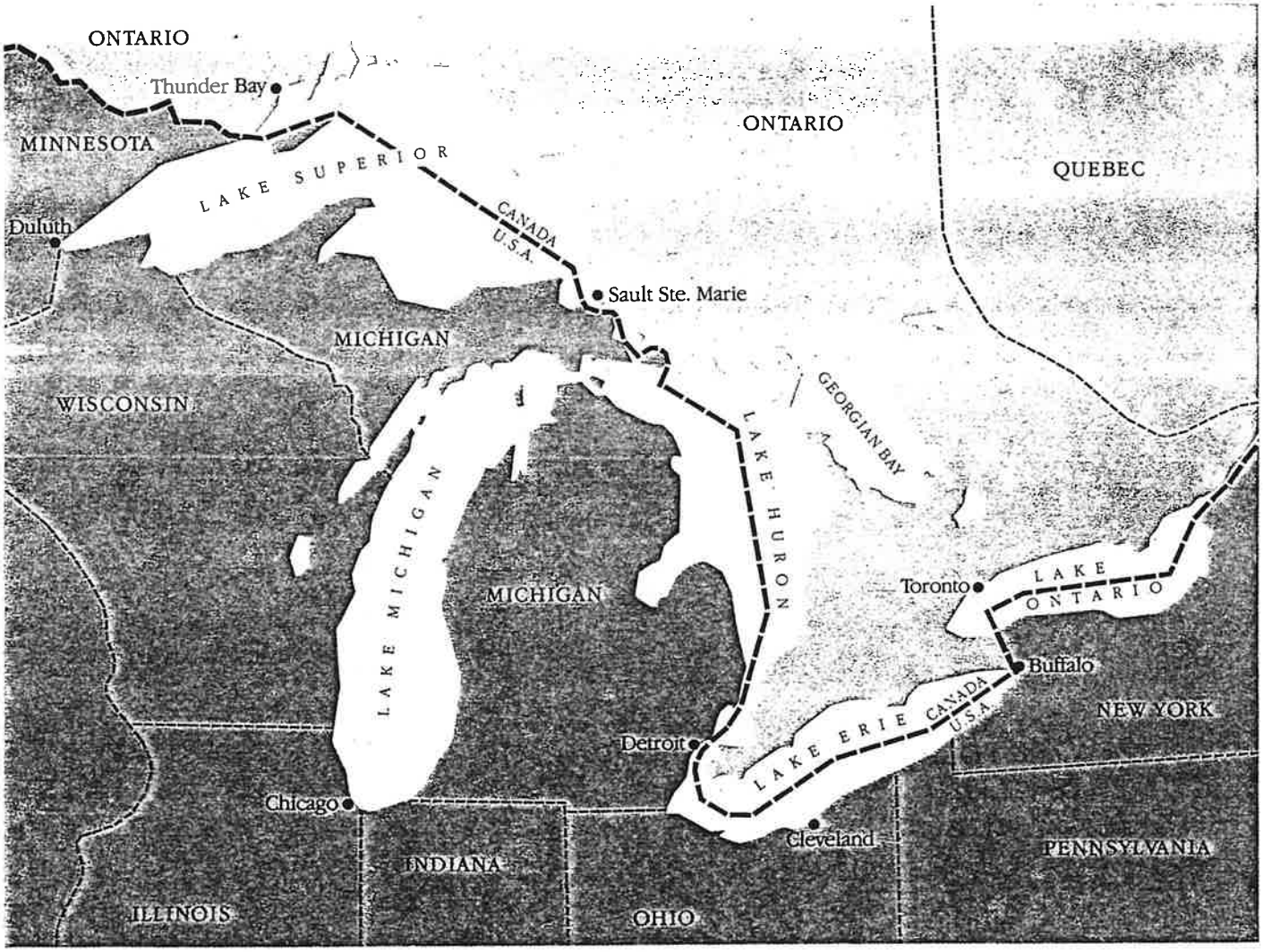
Does this reading suggest that Canada and the U.S. actually had in place some bilateral machinery that might have been able to resolve the matter without all the high level politicking? Was there a reason why leaders on both sides apparently preferred to become personally identified with acid rain rather than just refer it quietly to this machinery?

CANADA - UNITED STATES

Acid Rain

The Great Lakes Water Quality Agreement

A Model for Controlling Acid Rain?



Cooperation between Canada and the United States in protecting the Great Lakes points the way for cooperation to reduce transborder flows of acid rain.

Canada and the United States take pride in sharing the world's longest undefended border. One consequence of this extensive contact is that transboundary environmental problems and concerns are a fact of life for Canada and the United States. Given these circumstances, the two countries have created a number of successful mechanisms to manage such problems. The Boundary Waters Treaty of 1909 and the International Joint Commission created by the Treaty illustrate how the two governments can cooperate in dealing with transboundary environmental issues.

More recently, pollution in the Great Lakes provided both the challenge and the opportunity for the two governments to further this process of cooperation and joint management of a transboundary environmental problem. By the late 1960s it had become clear that pollution of the Lakes was becoming a serious problem. Vast growths of algae appeared which depleted the oxygen and effectively choked the Lakes, severely threatening aquatic life. The culprit was phosphorus, a substance widely used in laundry detergents.

While the calls for remedial action grew louder, it was clear that pollution respects no boundaries and that if the Lakes were to be saved, local and even national action alone would not be enough. In recognition of the need for international cooperation Canada and the United States negotiated the Great Lakes Water Quality Agreement of 1972. This historic document established general and specific objectives, as well as specific programs and measures, to restore and enhance the quality of Great Lakes waters.

Most importantly, however, the Great Lakes Water Quality Agreement established a regime of targets and schedules for the reduction of phosphorus enter-

ing the Lakes. Loadings of phosphorus from municipal, industrial and agricultural sources into Lakes Erie and Ontario, the most severely affected, were to be cut by approximately 50 percent by 1976. Although the original target date of 1976 proved to be ambitious, the desired reductions in phosphorus loadings were largely achieved by the early 1980s.

The 1972 Agreement showed that it was possible for two sovereign governments to cooperate in solving a very difficult transboundary environmental problem, a valuable lesson for the even greater challenges that lay ahead. By the mid-1970s, it was apparent that the Great Lakes were under attack from another, more deadly menace: toxic chemical buildup.

Canada and the United States concluded that the Agreement should be amended to deal with the emerging threat from toxic chemicals, and in 1978 a revised Great Lakes Water Quality Agreement was signed. Under it the two governments adopted the policies of "virtual elimination" of persistent toxic substances from the Great Lakes, and zero discharge as a means of controlling the introduction of these substances into the Lakes. The revised Agreement also contained an important new concept: a commitment to protect the *ecosystem* of the Great Lakes basin.

A Protocol was attached in 1987 to strengthen and update the Agreement in the areas of atmospheric pollution, groundwater, land runoff (non-point sources) and sediments. Provisions were also added for the cleanup of pollution "hot-spots" around the Lakes and for the development of management plans for open-lake waters, designed to reduce the most critical pollutants found in the Great Lakes.

The concept of ecosystem protection adopted by Canada and the United States a decade ago in managing the Great Lakes is fully in keeping with the principle recently accepted by the United Nations of economic growth through sustainable development. National responsibility to control transboundary pollution is also based on principles of international law such as Principle 21 of the Stockholm Declaration on the Human Environment, which holds, in part, that all nations have "the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states."

While much work lies ahead, the framework of formal and informal cooperation through which Canada and the United States implement the Great Lakes Water Quality Agreement will help to ensure that its goals and requirements are met. The Agreement, with its commitment to a joint effort to control a transboundary environmental problem and to specific pollution reduction targets and schedules, is a valuable model for the resolution of common environmental problems, such as acid rain.

Canada and the United States have, over the last 80 years, achieved an enviable record in dealing cooperatively and successfully with shared environmental problems. Acid rain is the one anomaly in this otherwise outstanding record.

The Governments of the United States and Canada have agreed that acid rain is a serious environmental problem and a transboundary problem. In recognition of this fact, Canada has put in place an acid rain control program that, by 1994, will reduce Canadian sulphur-dioxide emissions by 50 percent from 1980 base-case levels. Both the Canadian and American environments will benefit from these reductions, which will result in reduced long-range transport of the emissions throughout eastern Canada and the northeastern United States. To date, the United States does not have a comparable program to reduce its emissions of sulphur dioxide, and the Canadian environment continues to suffer from cross-border air-borne pollutants as a consequence.

As with the problem of pollution of the Great Lakes, what is needed is to deal with the acid rain problem cooperatively and to establish commitments to reduce the sulphur-dioxide emissions which cause acid rain, on the basis of agreed targets and a timetable. Such commitments would be set out in a bilateral accord between Canada and the United States. Negotiation of such an accord would be a very important step in solving this serious problem.

About this Part of the Module

This part of the acid rain module contains two examples of operational adjustment: The Nickel Mines Air Pollution Abatement Options (p.3) and the 1990 Clean Air Act Amendments (p.43).

Managing Trans-border Pollution

Acid Rain

(Part 2 of 2)

Nickel Mines Air Pollution Abatement Options

This reading reprints excerpts from the *"Report of the Ontario/Canada Task Force for the Development and Evaluation of Air Pollution Abatement Options for Inco Limited and Falconbridge Nickel Mines, Limited in the Regional Municipality of Sudbury, Ontario"* (Fall, 1982)

Discussion Note

This reading allows students to examine the alternatives facing the Inco smelter and to decide on a course of action. Further reference to the Inco problem and the task force report from which this reading is taken can be found in the selection of articles in "Bringing the Provinces Onside" elsewhere in this module, especially "Cutting sulphur dioxide a question of who foots the bill".

2. HISTORICAL REVIEW OF SULPHUR DIOXIDE EMISSIONS AND THEIR CONTROL AT INCO LIMITED AND FALCONBRIDGE LIMITED

Abstract

Prior to the introduction of modern smelting practices, the Sudbury ores were roasted in open heaps. This practice, which terminated in 1929, caused elevated ground level concentrations of sulphur dioxide in nearby populated areas. Complaints from the residents regarding damages and nuisance from sulphur fumes prompted the Provincial Government to intervene. Consequently, in 1915, an Order-in-Council was passed by which all patents, issued to settlers of land within a defined area, had a clause exempting the mining companies from liability due to smoke damages. In addition, efforts were made to relocate the roast yards further away from populated areas. Early government involvement also resulted in the introduction of legislation (The Damages By Sulphur Fumes Arbitration Act) to facilitate the settlement of claims resulting from injury to vegetation by sulphur fumes and in the formation of the Sulphur Dioxide Committee to determine if smelter gases were causing injury to forest growth.

Before the issuance of the first Control Order on Inco Limited in 1970 to control SO_2 emissions from its Sudbury operations, the Company had already implemented a number of programs which resulted in a gradual increase in the degree of sulphur containment. These programs, however, were largely oriented at increasing production capacity in a cost effective manner. They comprised pyrrhotite rejection, liquid SO_2 production and sulphuric acid manufacture. These sulphur containment practices resulted in an overall increase in SO_2 containment (sulphur contained/sulphur in ore) from about 20% in 1955 to about 30% in 1969. Further improvements by Inco Limited have resulted in increasing its overall sulphur dioxide containment to about 66% in the late 1970's. Increased containment, through additional pyrrhotite rejection, is expected in order for the Company to meet more stringent SO_2 emission limits in 1983. The basic Inco Limited smelting process, however, is substantially the same as it was 50 years ago. Inco Limited is currently testing, on a commercial scale, a new smelting process at its Thompson smelter in Manitoba for possible application in Sudbury. This process, if implemented, would effect significant reductions in SO_2 emissions to the atmosphere.

Prior to the issuance of the first Control Order on Falconbridge Limited in 1969 to reduce SO_2 emissions from its smelting operations at Falconbridge, the Company reduced its overall emissions largely through pyrrhotite separation and rejection. This sulphur containment practice effected reductions in SO_2 emissions to the atmosphere on a nickel production basis. The commissioning of a new smelting

process at Falconbridge (fluid bed roaster/electric furnace smelting, sulphuric acid production) in 1978 has resulted in an improvement in overall sulphur dioxide containment (sulphur contained/sulphur in ore) from about 17% in 1953 to about 84% in 1980. These figures include 5% of the sulphur in the ore that remains in the matte which is shipped to Norway.

This new smelting process enabled the Company to meet overall SO_2 emission requirements imposed by the Provincial Government. However, the Company will not be able to comply with the last item in its current control program which requires meeting the provincial half-hour SO_2 standard at point of impingement. The Company has undertaken a research and development program aimed at effecting further reductions in smelter SO_2 emissions at Falconbridge.

2.1 The Environmental Problem

The primary historical problem has been due to SO_2 and its associated compounds. Over the years, elevated concentrations and deposition rates of these pollutants have seriously affected the Sudbury area biosphere. This adverse impact on the environment began with the commencement of smelting operations in 1888 and has continued to this day, albeit at significantly reduced levels from the 1950's and 1960's. In addition, the transport of these pollutants over long distances, with the consequent impact on areas removed from Sudbury, has been recognized. Thus, the environmental problem is characterized by local and long distance components. Over the intervening years, various process changes by the Companies and abatement control programs imposed by provincial agencies have resulted in significant reductions in the emissions of SO_2 and other contaminants.

Additional concerns have also been identified in relation to the workroom environment and occupational exposure with respect to the smelting operations in the Sudbury area.

2.2 History of Smelter Technology in the Sudbury Area

It was not until 1888 that the first smelter was constructed at Copper Cliff.

During the years 1888 to 1929, ore was roasted in open heaps of various sizes. In the construction of these heaps, green ore was piled on a thick layer of wood which was then set alight. The fire was sufficiently hot to ignite the sulphur in the ore and the reaction became self-sustaining. Burning or roasting took from one to seven months to complete, depending upon the size of the heap. The roasted ore was then taken to the smelters for further processing. Approximately 28 million tons (25 million tonnes) of ore were smelted between 1890 and 1930 and it is estimated that approximately 11.2 million tons (10.2 million tonnes) of sulphur dioxide were emitted over this period. The practice of open roasting, which was largely responsible for damage to property and nuisance to residents, ceased in 1929 with the closure of the O'Donnell roast yard.

Throughout the mining history of Sudbury, over 100 companies initiated operations but most either failed or amalgamated to form larger companies. By 1930, all smelter operations had ceased to exist except for those of the International Nickel Company of Canada (now Inco Limited) located at Copper Cliff and at Coniston (Coniston smelter built in 1913). Only one company has successfully started up and grown since then, that company being Falconbridge Limited which was established at Falconbridge in 1930.

2.2.1 Inco Limited: Smelter Development

Until 1930, the treatment of the Sudbury nickel ores involved hand sorting to eliminate some of the barren rock, followed by open heap roasting and blast furnace smelting. The first attempts at effecting some management of SO_2 emissions comprised the relocation of roast yards further away from populated areas. Concurrently, smelters were built with progressively taller stacks.

The 50 year period following 1930 has seen prolific process innovations and witnessed phenomenal expansion in production capacity. Several of these technical changes have resulted in SO_2 emission reductions or management. The installation of multi-hearth roasters allowed the cessation of open heap roasting. Tall stacks and subsequent process operations aided in reducing the severity and frequency of ground level SO_2 fumigations, while dispersing smelter gases from the immediate industrial area.

In the 1930's, off-gases from copper converters were treated in a sulphuric acid plant to produce sulphuric acid. Later, excess off-gas from the copper flash furnace was also treated in this plant.

Pyrrhotite separation technology, developed in the 1940's, improved smelter efficiency while removing some of the sulphur from the concentrate feed. However, the subsequent roasting of pyrrhotite resulted in elevated SO_2 emissions. By 1958, Inco Limited was beginning to divert some of these SO_2 emissions to acid plants, producing sulphuric acid.

The early 1950's also saw the installation of a commercial scale SO_2 liquefaction plant to treat some of the emissions from the copper flash furnace at the Copper Cliff smelter.

These sulphur containment practices resulted in an overall increase in SO_2 containment from about 20% (sulphur contained/sulphur in the ore) in 1955 to about 30% in 1969.[1] A full chronology of these technical innovations is given in Appendix 2.1.

On the basis of the emissions data up to 1980, daily SO_2 emission rates (five-year means) from Inco Limited at its Sudbury operations ranged from about 2,300 tonnes to about 5,400 tonnes (see Figure 2.1). This wide range is believed to reflect variations in production rates and the

[1] CURLOOK, W. June 4, 1980. Remarks at the Ontario Ministry of the Environment Public Meeting to Discuss Proposed Control Order. Presented by Walter Curlook, President, Inco Metals (1980).

implementation of the programs listed above including the commissioning of the Iron Ore Recovery Plant (IORP) in 1956. Annual SO_2 emissions from Inco Limited dating back to the 1940's and 1950's are also presented in Table 2.1. In addition, the percentage contributions from Inco Limited sources to the total emissions of major pollutants in the Sudbury Basin over the period 1973 to 1981 are presented in Table 2.2.

Over the last twenty-five years, Inco Limited has investigated and, in some cases, implemented new technologies which have eventually proven to be technically or economically unfeasible. While requiring years of research and tens of millions of dollars in capital expenditures, these investments have made minimal impact on SO_2 emissions. The major areas of research included:

1957-58	production of elemental sulphur from IORP SO_2 emissions;
1967	construction of a fluid bed roaster at the Copper Cliff smelter to modernize the plant and produce strong off-gas to make acid;
1968-78	$14 million spent for research on hydrometallurgical treatment of nickel concentrates;
1977	nickel flash furnace and acid plant.

Notwithstanding the above complications, substantial progress, which will be described in subsequent sections, has been made since 1970 in the containment of sulphur.

2.2.2 Falconbridge Limited: Smelter Development

Prior to the issuance of the first Control Order on Falconbridge Limited in 1969, the Company reduced its SO_2 emissions largely through pyrrhotite separation and rejection. This sulphur containment practice effected reductions in SO_2 emissions to the atmosphere on a nickel production basis. For example, in 1940, the ratio of tonnes of sulphur emitted per tonne of nickel produced was about 7.8, whereas, in 1970, the ratio had decreased to about 5.2, resulting in a 33% improvement in sulphur containment expressed on the basis of nickel production. However, the overall SO_2 emissions to the atmosphere were higher in the 1950's, 1960's, and early 1970's compared to those in the 1940's (see Figure 2.1 and Table 2.1) due to higher production levels and the commissioning of the pyrrhotite treatment plant in 1953. The percentage contributions from Falconbridge Limited to the total emissions of major pollutants in the Sudbury Basin over the period 1973 to 1981 are presented in Table 2.2.

Falconbridge also devoted research time and capital resources in an attempt to develop smelter improvements which, unfortunately, proved to be unsuccessful. These included: a nickel/iron refinery with elemental sulphur recovery; a roasting/briquetting process that would produce strong off-gas suitable for acid production; and hydrometallurgical research. In the mid-1960's, the Company undertook the pilot plant development and economic evaluation of a process to convert SO_2 roaster off-gas to elemental sulphur. At that time, there were expectations that about 90% of the sulphur present in fluid bed roaster off-gases would be recovered, thereby effecting significant reductions in overall SO_2 emissions to the atmosphere.

2.3 Regulating Emissions

2.3.1 Early Government Involvement

With the development of the mining industry around Sudbury came the growth of the city itself, the need for a service sector and a source of agricultural commodities. Consequently, the number of complaints from residents regarding damages and nuisance from sulphur fumes also grew. To relieve the pressure from these complaints, the Canadian Copper Company and the Mond Nickel Company petitioned the Minister of Mines to have certain lands withdrawn from further agricultural settlement. In 1915, an Order-in-Council was passed by which all patents, issued to settlers of land within the withdrawn area, consisting of approximately twelve townships, had a clause exempting the mining companies from liability due to smoke damages.

As early as 1921, the Provincial Government introduced legislation (The Damages By Sulphur Fumes Arbitration Act, 1921) to facilitate the settlement of claims resulting from injury to vegetation by smelter fumes. This Act was repealed and replaced by The Damages By Sulphur Fumes Arbitration Act, 1924. The first Sulphur Fumes Arbitrator took office in 1925.

In 1944, the Sulphur Dioxide Committee, initially known as the Committee on the Investigation of Sulphur Smoke Conditions and Alleged Forest Damage in the Sudbury Region, was formed at the request of the Department of Lands and Forests with representatives from the Department of Lands and Forests, Department of Mines, Inco Limited, Falconbridge Limited and other agencies acting in advisory capacities. The primary objectives of the Committee were to determine if sulphur dioxide and other smelter gases were causing injury to forest growth, and if so, the area over which this condition extended and the remedies that could be applied. The first SO_2 ambient concentration monitoring network was established in the Sudbury area in the mid-1940's. This

network permitted investigators to relate visible vegetation (forest) injury to measured ambient SO_2 levels and to determine the aerial extent of this impact. The objectives of this Committee were only partly realized since its work was terminated in 1972 at which time the bulk of its activities was taken over by the Ministry of the Environment.

2.3.2 Inco Limited

In July of 1970, the first Control Order to limit SO_2 emissions from its Sudbury operations was issued to Inco Limited. The control program required the construction of a 381 m stack and a stepwise reduction in SO_2 emissions from 5,200 tons (4,716 tonnes) per day to 750 tons (680 tonnes) per day by December 31, 1978 from the Copper Cliff smelter. Negotiations between the Company and the Ontario Ministry of the Environment resulted in a rescheduling of the emission targets as witnessed in the Amending Control Orders issued in 1972 and 1973. When it became apparent that the 750 tons (680 tonnes) per day limit for the smelter would not be met, the existing Order was revoked in the fall of 1977 and in July 1978 a new Control Order was issued.

The new Control Order required that sulphur dioxide emissions from the Copper Cliff smelter be limited to 3,600 tons (3,265 tonnes) per day and required control of operations (at both the Iron Ore Recovery Plant and the Copper Cliff smelter) to ensure compliance with specified ground level SO_2 concentrations (0.25 ppm hourly average for emissions from the Iron Ore Recovery Plant complex alone; 0.50 ppm hourly average for emissions from the Copper Cliff smelter complex either alone or in combination with emissions from the Iron Ore Recovery Plant complex and fugitive smelter emissions). This Order was dated to expire on June 30, 1982. The rationale for the extension in time of the emission limit of 3,600 tons (3,265 tonnes) per day from the smelter was largely based on several factors. By the end of 1977, the extent and severity of the acid rain problem was becoming more apparent and information on the metal content of rainfall was becoming available, highlighting a further potential problem. Therefore, from an environmental point of view, any control program developed for the smelter had to be evaluated in light of a number of potential environmental implications. This situation was further complicated by a lack of hard scientific data to clearly define the extent and nature of these environmental problems, thereby not allowing for corrective measures to be defined. Consequently, it was judged best to await the results of the Sudbury Environmental Study, established by the Ministry in 1973 to provide the scientific data necessary to determine the reductions in SO_2 emissions required to achieve environmentally acceptable levels for the local environment, before mandating further emission reductions.

In September of 1980, an Amendment to the July 1978 Control Order was issued. At the same time, Regulation 712/80, which required the Company to limit sulphur dioxide emissions from the Copper Cliff smelter to less than 2,500 tons (2,268 tonnes) per working day immediately, with a reduction to 1,950 tons (1,769 tonnes) per working day by 1983, was passed.

The basis for these new requirements developed after 1978 as a result of a preliminary assessment of the potential environmental implications associated with the operation of the Copper Cliff smelter. It was believed that action was required to reduce emissions of sulphur dioxide from the smelter and to minimize environmental problems associated with possible production increases. It was recognized by the Ministry that the steps in this proposed program would not totally solve local or continental environmental problems but that they would form a basis for further control requirements as additional data became available.

In summary, the Company was able to meet all the control requirements as specified by the Ministry except for the last step (reduction of sulphur dioxide emissions from the Copper Cliff smelter from 3,600 tons (3,265 tonnes) per day to 750 tons (680 tonnes) per day) by closing the Coniston smelter; building additional acid plant capacity at the Iron Ore Recovery Plant; building the Clarabelle concentrator; and modifying the old Copper Cliff concentrator for more efficient pyrrhotite removal. In so doing, the Company improved its overall sulphur dioxide containment (expressed as sulphur contained/sulphur in ore) from about 30% in the late 1960's to about 70% in the late 1970's.[2] Inco's ongoing smelter improvements and actions taken in response to Regulation 712/80 are discussed in Section 2.4.1.

2.3.3. Falconbridge Limited

The first Control Order to limit sulphur dioxide emissions from the Falconbridge smelter operations was issued to Falconbridge Limited in November, 1969. This control program required a 55% reduction in SO_2 emissions by December 31, 1975 from 1,028 tons (932 tonnes) per calendar day in 1969 to 465 tons (422 tonnes) per calendar day in 1975 on an annualized average basis.

2 Ibid.

The technology Falconbridge had planned to use to meet the control terms proved to be unsatisfactory and, in 1973, a new Control Order was issued. This Order entailed a scheduled stepwise reduction in SO_2 emissions to 465 tons (422 tonnes) per day by May 31, 1979 and further required the Company to meet ambient SO_2 concentrations of 0.3 ppm (830 ug m^{-3}) averaged over 30 minutes by December 31, 1983.

Falconbridge proposed to meet these requirements through the installation of a two-line fluid bed roasting/electric furnace smelting system with a single sulphuric acid plant to treat roaster off-gases from both lines.

A lengthy strike and adverse economic conditions forced the Company to ask for an extension of the schedule. This was duly granted and embodied in an Amending Control Order in 1977. In essence, under the revised program, Falconbridge Limited constructed both smelting lines at the same time instead of sequentially as originally proposed.

The first line electric furnace smelting process (with acid plant) was started up in May 1978 and was operated along with the blast furnace until July of 1978, at which time the smelter was shut down for summer vacation. Following summer vacation, the one-line smelter operated alone, i.e the old smelter operation was discontinued almost one year ahead of Order requirements. Pyrrhotite roasting on the second line to produce market sulphuric acid commenced in September of 1978 and continued until November of 1979.

The second line of the smelter was prepared for the treatment of concentrate for early 1980 and both lines are currently operating on a copper/nickel concentrate producing matte and sulphuric acid. Emission levels below 465 tons (422 tonnes) per day are being maintained.

In summary, the Company was unable to meet the schedule of the initial control program laid out in 1969 due to the failure of the new process technology that would have ensured compliance. However, it was able to meet the overall SO_2 emission requirements of the control program (emission target of 465 tons (422 tonnes) per day) largely through the installation of a new smelting process with sulphur fixation as sulphuric acid and, to a lesser degree, through more efficient separation and rejection of pyrrhotite. In so doing, the Company improved its overall sulphur dioxide containment (expressed as sulphur contained/sulphur in ore) from about 17% in 1953 to about 84% in 1980. About 5% of the sulphur in the ore remains in the matte which is shipped to a refinery in Norway. This 5% is included in the overall SO_2 containment figure given above.

2.4 Current Status

2.4.1 Inco Limited

The control program presently in effect for Inco Limited (1980 Control Order and Regulation 301 (R.R.O. 1980)) requires the Company to emit no more than 2,500 tons (2,268 tonnes) per working day from the Copper Cliff smelter complex (under Regulation 301 (R.R.O. 1980)) averaged over twelve month periods ending at each calendar quarter. This emission level is to be met, over a twelve month period, up to the period ending at the end of the third quarter of 1983, that is up to and including the period from October 1, 1982 to September 30, 1983. Thereafter, emissions during each twelve month period, ending at the end of the fourth calendar quarter of 1983 (i.e. January 1, 1983 to December 31, 1983) and ending at each calendar quarter thereafter, shall not exceed, on the average, 1,950 tons (1,769 tonnes) per working day.

SO_2 emissions from the Iron Ore Recovery Plant, as required by the 1980 Control Order, cannot exceed 250 tons (227 tonnes) per working day. In addition to these restrictions on total SO_2 emissions, the Copper Cliff smelter complex and the Iron Ore Recovery Plant require control of their operations to ensure compliance with specified SO_2 ground level concentrations. To date, the Company has been able to comply with these total SO_2 emission limits largely as a result of reduced production levels in light of poor metal market conditions. The 1,950 tons (1,769 tonnes) per working day emission level for the Copper Cliff smelter complex will be met with additional pyrrhotite rejection at the Copper Cliff mill.

The Company is currently testing a commercial scale roast/reduction smelting process at Thompson, Manitoba, for possible application at Copper Cliff. The process would produce a high strength SO_2 off-gas suitable for the manufacture of sulphuric acid. This technology has the potential for increasing metal recoveries, improving work-place conditions, increasing productivity and reducing emissions. The Thompson tests have cost approximately $26 million to date and should be completed in 1982.

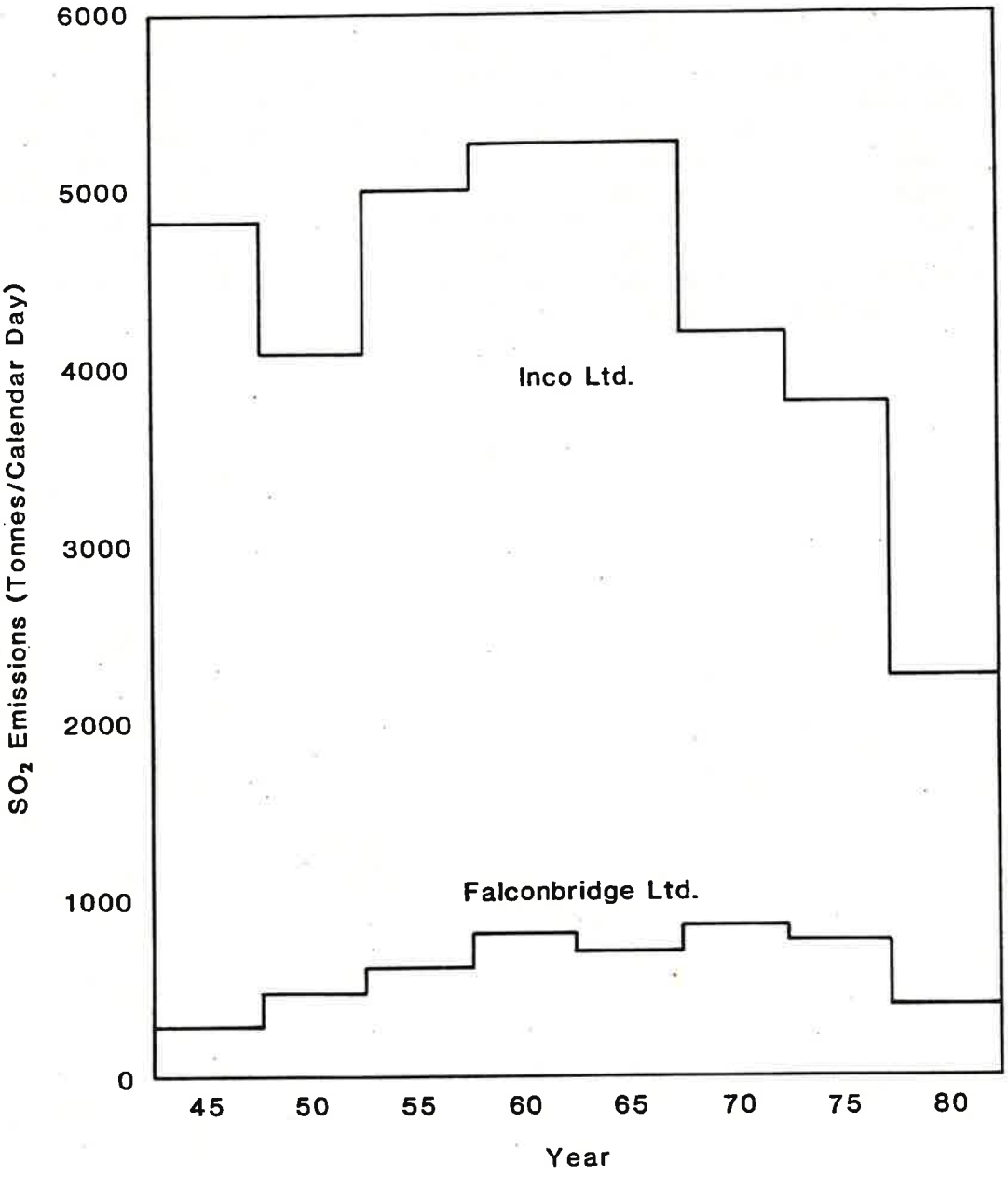
2.4.2 Falconbridge Limited

To date, the control program presently in effect for Falconbridge Limited (1977 Amending Control Order) has been met. The final requirement of this Order is for the Company to reduce emissions of SO_2 from the Falconbridge smelter complex by December 31, 1983, so that, in the aggregate, they comply with the standards prescribed in Schedule 1 of Regulation 15 under The Environmental Protection Act, 1971. This standard for SO_2 is a ground level concentration of 0.3 ppm (830 ug m^{-3}) at point of impingement for a half hour average.

As required by this Amending Control Order, the Company submitted a report in December 1980 addressing how it was intending to reduce emissions to comply with this SO_2 standard. In the spring of 1981, Company representatives advised that a reduction in total SO_2 emissions could not be effected by December 31, 1983 to comply with the final requirement of the 1977 Amending Control Order. The Ministry was further advised that the Company had undertaken a metallurgical research and development program with the aim of further reducing SO_2 emissions from the Falconbridge smelter complex. This research program involves higher degrees of roasting in the fluid bed roasters, slag cleaning, SO_2 absorption from dilute gas streams, a converter gas study and an acid plant capacity study. In addition, the feasibility of adopting an intermittent emissions reduction program analogous to the one used by Inco Limited will be investigated. The Company estimates that this research program will cost over $5 million and may be completed by the end of 1984.

FIGURE 2.1

POSTWAR SO_2 EMISSIONS FROM SUDBURY AREA SMELTERS



*SO_2 Emissions (Tonnes/Calendar Day) Averaged Over 5 Year Intervals

TABLE 2.1

SULPHUR DIOXIDE EMISSIONS FROM THE INCO LIMITED AND FALCONBRIDGE LIMITED OPERATIONS IN THE SUDBURY BASIN

YEAR	SULPHUR DIOXIDE EMISSIONS (Tonnes Per Calendar Day)* INCO	FALCONBRIDGE
1940	4647	278
1950	4766	462
1955	5024	
1956	5614	800
1957	5837	
1958	3508 (4707)	780
1959	5673	
1960	6218	816
1961	6086	
1962	4893	756
1963	4582	
1964	5129	646
1965	6166	
1966 (strike year - Inco)	5104 (5447)	790
1967	5711	813
1968	5755	935
1969 (strike year - Inco and Falconbridge)	3589 (5552)	651 (880)
1970	5454	929
1971	5118	992
1972 **	4162 (4416)	885 (915)
1973 ***	3249 (3448)	751
1974	3331	707
1975 (strike year - Inco and Falconbridge)	3282 (3385)	534 (668)
1976 +	3340	523 (560)
1977 +	3115	548 (619)
1978 +(strike year - Inco)	1553 (2613)	321 (374)++
1979 +(strike year - Inco)	1118 (1933)	241 (251)
1980 +	2225	337 (351)
1981 **	1981 (2146)	312 (334)

* Tonnes per operating day within parentheses. For the other years, the smelters were operating every day of the year.
** Summer vacation shutdown (Inco and Falconbridge).
*** Summer vacation shutdown (Inco).
\+ Production shutdown (Falconbridge).
++ New smelting process implemented that year.

TABLE 2.2

% SOURCE CONTRIBUTIONS OF MAJOR POLLUTANTS EMITTED IN THE SUDBURY BASIN (1973-1981)

SOURCE	POLLUTANT			
	SO_2	SO_4	METALS	TOTAL PARTICULATE
Inco 381 m Stack	78	77	55	75
Inco IORP 191 m stack	5	18	32	16
Fugitive Emissions (Copper Cliff smelter)	1-2	1	9	3-4
Falconbridge smelter 93 m stack	16	5	4	6

APPENDIX 2.1

INCO SMELTING HISTORY

1883	Sudbury ore body discovered during the construction of the CPR railway.
1888	First smelting operations begun at Copper Cliff.
1903	Canadian Copper Company and Orford Copper Company united to form the International Nickel Company.
1913	International Nickel Company's Coniston smelter built with a 121 meter smoke stack.
1929	The closing of the last open heap roasting operations. International Nickel Company integrated with the Mond Nickel Company to form the International Nickel Company of Canada (later changed to INCO Limited).
1930	The opening of the International Nickel Company Copper Cliff smelter with stacks (by the mid 1930's) reaching 106 and 152 meters.
mid 1930's	Acid plant constructed at the Copper Cliff smelter, initially for the treatment of off-gases from the copper converters and later, for treatment of excess off-gas from the flash furnaces together with converter off-gas.
1946	First successful tests of separation of pyrrhotite by magnetic means.
1947	Laboratory tests on ammonia leaching of pyrrhotite showed promising results. Pilot plant tests undertaken on flash smelting of copper concentrates, 20 tons (18.1 tonnes) per day (tpd).
1949	Started pilot plant at Coniston for the roasting and ammonia leaching of pyrrhotite.
1952	New 500 tons (454 tonnes) per day oxygen flash furnace and 375 tons (340 tonnes) per day oxygen plant commissioned at Copper Cliff. Commercial scale production of liquefied sulphur dioxide started by CIL at Copper Cliff.

early 1950's	Coniston sinter plant commissioned with a 114 meter stack.
1953	1,000 tons (907 tonnes) per day copper flash furnace installed, replacing 500 tons (454 tonnes) per day unit. Commenced construction of first unit of Iron Ore Recovery Plant (IORP).
1955-56	Started operation of first two units of IORP, capacity 1,000 tons (907 tonnes) per day of pyrrhotite, producing 260,000 tons (235,820 tonnes) per year of iron ore pellets. Emissions dispersed by a 194 meter stack.
1958	First acid plant commissioned at the IORP, with a capacity of 400 tons (363 tonnes) per day.
1963	Completed first major expansion of IORP, capacity increased to 3,000 tons (2,721 tonnes) per day pyrrhotite, producing 800,000 tons (725,600 tonnes) per year of iron ore pellets. Second acid plant commissioned at IORP; capacity increased to 1,000 tons (907 tonnes) per day.
1967	Started construction of No. 1 fluid bed roaster on No. 1 reverberatory furnace to begin modernization of the Copper Cliff smelter and to produce a strong SO_2 gas for eventual recovery as sulphuric acid.
1967	Third acid plant commissioned at IORP raising acid capacity to 2,500 tons (2,268 tonnes) per day. Old acid plant at smelter shut down; capacity replaced by IORP capacity. Started major expansion of IORP, intended to raise pyrrhotite treatment to 4,500 tons (4,082 tonnes) per day to produce 1,150,000 tons (1,043,050 tonnes) per year of iron ore pellets. Completion of construction of new Frood-Stobie concentrator.
1968	Expanded copper flash furnace to 1,500 tons (1,361 tonnes) per day.
1969-71	Built Clarabelle concentrator and modified the old Copper Cliff concentrator for more efficient pyrrhotite separation.

APPENDIX 2.1 (continued)

1972	The new 381 meter "super stack" was commissioned at the Copper Cliff smelter. A mineral dressing test centre, primarily for studies on pyrrhotite separation and rejection, was built. The Coniston smelter was permanently shut down.
1973	Adoption (voluntary) of an itermittent SO_2 emission reduction program to improve Sudbury area ambient air quality by meteorological forecasting and reducing smelter operations during periods unfavourable for atmospheric dispersion.
1974	IORP acid plant capacity increased to about 3,000 tons (2,721 tonnes) per day.

APPENDIX 2.2

FALCONBRIDGE SMELTING HISTORY

1930	The establishment of the new Falconbridge Nickel Mines smelter with emissions dispersed through a 94 m stack.
1953	Commissioning of the pyrrhotite treatment plant with emissions vented through a 137 meter stack.
1972	Nickel/iron refinery permanently shut down.
1978	First line of new fluid bed roaster/electric furnace smelter with acid plant is started up.
1980	Second line of fluid bed roaster/electric furnace smelter commissioned.

8. ABATEMENT PROGRAMS FROM A FINANCIAL PERSPECTIVE

Abstract

Some emission abatement options require large capital expenditures on new plants and equipment. In some cases, operating cost savings in the future act to offset the initial capital outlay and may eventually provide a return on the committed capital.

Prior to making an investment decision, a company would conduct in-depth analyses of risk, overall profitability, ability to finance and impacts on other operations. This Task Force did not have sufficient information or resources to conduct such an in-depth analysis. However, the Task Force has examined the magnitude of the costs of the various abatement programs.

The potential effects of taxes, leverage and revenues from acid, among others, could alter the financial attractiveness of these programs, but these effects have not been examined here.

Where several options might achieve a given level of abatement, the Task Force selected for further study those that appear to be cost effective. The economic viability of each cost effective option was tested using internal rate of return as the main criterion.

For Inco, roast/reduction smelting (RRS) is the only option which can be justified solely on economic grounds. For Falconbridge, only one option, increased pyrrhotite rejection, appears to be economically viable.

The effects of the eight least cost abatement programs on production costs (cents per pound of nickel) and unit abatement cost (dollars per tonne of SO_2 removed) were estimated. The incremental costs of the programs for Inco range from 2.2 cents to 20.2 cents per pound of nickel. Cost per tonne of SO_2 removed varies from $18 to $81.

For Falconbridge, the incremental production costs of the five least cost abatement programs range from a savings of 4.2 cents per pound to a cost of 14.7 cents per pound. The cost per tonne of SO_2 removed ranges from a savings of $72 to a cost of $159.

8.1 Introduction

Inco and Falconbridge can achieve various levels of SO_2 abatement by more than one method. Each firm would prefer the method that appears to offer the largest contribution to profits over time or, in the absence of projected profits, the method that appears to cost the least to install and maintain.

In Section 8.2, various technically sound primary and secondary abatement programs for each firm are examined and those which yield the highest profit contribution or lowest cost for each successive abatement level under consideration (i.e. the most cost effective program) are selected.

In Section 8.3, the economic viability of the various programs selected are examined. A program may be considered economically viable if it promises to yield a sufficiently large return on invested capital to compensate the providers of that capital (i.e. the firm, private investors and the banks) for the technical and economic risks of an industrial investment and for the uncertainty of making accurate projections of cash flows far into the future. For the purposes of this section, nominal percentage returns (i.e. including inflation) were calculated on nominal (i.e. inflated) cash flows.

Section 8.4 profiles the abatement programs in terms of unit abatement costs and incremental production costs. An annualized pre-tax cost is calculated for each option. This set of values is used to estimate both the cost per tonne of SO_2 abated and the additional production cost per pound of nickel associated with each abatement program.

Forecasts of prices, inflation and other economic factors were drawn from Chapter 7 in this report. Estimates of cost increases and cost savings associated with individual abatement programs were taken from Chapters 4 and 6.

8.2 Cost Effective Abatement Programs

Fifty-four abatement programs which might be applied to the Sudbury operations of Inco Limited and eight abatement programs which might be applied to those of Falconbridge Limited were identified. To reduce this relatively large number of programs to a more workable level, a criterion of cost effectiveness was applied. A cost effective program was defined as one which yields the highest profit contribution or lowest overall cost for a given abatement level. The measure of a program's contribution to profit or overall cost used in this exercise is the net present value (NPV) of its estimated cash flow stream.

Each program has a cost stream associated with it. Each stream includes the capital outlay for plant and equipment and the expected operating and maintenance costs which may continue indefinitely once the equipment begins to function. Operating and maintenance costs associated with a given option may be offset by cost savings achieved through the use of more efficient equipment. Components of each cashflow stream (Appendices 8.1 and 8.2) were escalated using inflation forecasts discussed in Chapter 7. The stream of estimated future cash flows obtained in this way forms the basis for the economic evaluation of each program.

It is difficult to compare directly the cash flow streams associated with different programs without recognizing the time value of money. This concept argues that one dollar today is worth more in its ability to command goods and services than one dollar one year from today. The value of the future dollar is, in fact, discounted. By discounting each future cash inflow or outflow by an appropriate discount rate, the cash flow stream may be reduced to a single value, the cumulative net present value or NPV.

The selection of an appropriate discount rate is highly subjective. A nominal discount rate of 16.5% (i.e. including inflation of 6.5%) was used. This rate lies between the current rate of inflation (i.e. about 11%) and the rate which currently might be applied to a relatively high risk capital investment in the private sector (i.e. about 25%).

The Task Force selected for further analysis that program which, for a given level of emission reduction, had the highest NPV.

8.2.1 Inco

By applying the cost effective criterion, the number of programs for Inco's Sudbury operations was reduced from fifty-four to eight. These programs are displayed in Table 8.1. Cumulative net present values reported in Table 8.1 include each program's estimated capital cost.

8.2.2 Falconbridge

The number of cost effective programs which might be applied to Falconbridge's Sudbury operations were reduced from eight to five. These are displayed in Table 8.2.

Of the cost effective programs for Falconbridge, only increased pyrrhotite rejection results in savings and yields a NPV of $37.4 million (Cdn). All the others impose costs on the Company because each involves a stream of net cash outflows.

Pyrrhotite rejection would reduce the volume of the concentrate currently being processed which would result in lowering the recovery (production) costs of nickel and its by-products. These costs may be offset further by increased mining costs. (See Chapter 6).

8.3 Economic Viability of Abatement Programs

In the simplest terms, a program may be considered economically viable if it pays back over time more than the capital cost of its program with due regard to the time value of money. Cumulative net present value, discussed in Section 8.2 is one such measure of a program's viability. However, it suffers from the disadvantage that it is calculated using an arbitrarily selected discount rate. This disadvantage may be overcome by calculating an internal rate of return.

The internal rate of return is that discount rate which, when applied to a cash flow stream, would yield a net present value of zero. It is analogous to the annual interest rate applied to a savings deposit or to a guaranteed investment certificate and its use allows the identification of programs which utilize committed capital more efficiently.

The internal rate of return is a very sensitive indicator of a program's economic viability. Where a cash flow stream consists almost entirely of cash outflows, the internal rate of return rapidly approaches an infinitely large negative percentage. Where a stream consists almost entirely of cash inflows, the internal rate of return rapidly approaches an infinitely large positive percentage. To rank a program near these extremes, a less sensitive measure such as the net present value may be employed. Tax effects and leverage (i.e. financing a portion of a capital investment by borrowing) can usually improve a firm's return on its portion of a capital investment, particularly under a scenario of steadily increasing or consistently high inflation. The potential effects of these two additional variables were not assessed in this test of a program's ability to stand alone.

Internal rates of return were estimated for the cost effective programs. A firm with unlimited funds would invest in mutually exclusive programs in order of descending rates of return above some threshold value. A nominal return of 16.5% per annum was selected as the threshold value which a firm might choose.

8.3.1 Inco

Estimated internal rates of return are displayed in Table 8.3. In a no-risk environment, any program which offers a positive return would be considered economically viable. In a more risky environment, nominal returns in excess of 16.5% per annum might be considered economically viable.

Based on the estimated internal rates of return in the present risky environment, the roast/reduction smelting (RRS) abatement program appears to be economically viable. However, had the costs for all programs been estimated as comprehensively as those of the Inco alternative, the rates of return displayed in Table 8.3 for all other programs might be lower. Indeed, the internal rates of return for roast/reduction smelting could approach that of the Inco alternative.

Prospects of a much higher sustained nickel price on world markets might encourage the firm to lower its threshold criteria for project acceptance and, under these circumstances, the firm might find several of the programs worth considering. Unfortunately, higher real nickel prices are not expected within the next two decades.

8.3.2 Falconbridge

Internal rates of return could not be calculated on the Falconbridge options because each cash flow stream consists almost entirely of cash outflows or cash savings. Consequently in Table 8.2, net present values are calculated by discounting the cash stream at the threshold rate of 16.5% as a test of economic viability.

The only economically viable program for Falconbridge appears to be increased pyrrhotite rejection. Adoption of this program would force Falconbridge to forego some future acid sales. None of the other programs can be considered economically viable in the long run.

8.4 Annualized Cost Methods

This method permits the abatement programs for Inco and Falconbridge to be viewed from two perspectives:

- the anticipated impact on production costs in cents per pound;

- the cost in dollars per tonne of SO_2 removed.

The annualized cost was calculated as follows:

- The annual cost of amortizing the inflated capital investment over a twenty-year period was calculated at an arbitrarily selected discount rate of 10%. This step is analogous to calculating the annual payment, including interest, which would be required on a twenty-year mortgage. The result was expressed in 1982 dollars.

- Estimates of annual operating and maintenance costs (or cost savings) in 1982 dollars were added to (or subtracted from) the annualized capital cost.

Data for calculating the annualized costs were drawn from Chapters 4 and 6. For reasons previously discussed, the Task Force acknowledges that these estimates are not comprehensive but are useful for purposes of comparison.

Annualized costs were all calculated on a pre-tax basis.

8.4.1 Inco

Annualized costs have been used to calculate the cost per unit of abatement and the incremental nickel production costs. The results are summarized in Table 8.4.

The incremental cost per lb of nickel produced for the Inco abatement programs ranges from 2.2 cents to 20.2 cents. The cost per tonne of SO_2 removed ranges from $18 to $81. The Inco alternative would increase the cost per lb of nickel produced by 7.5 cents and affect SO_2 removal at a cost of $72.20 per tonne. By comparison, the roast/reduction smelting program would increase the cost of production by 2.2 cents at a cost per tonne of SO_2 removal of $18.40. The unit costs shown in Table 8.4 assume that the firm will operate at an annual production level of 280 million pounds of nickel for at least the next 20 years.

8.4.2 Falconbridge

Results are summarized in Table 8.5. The incremental cost per lb of nickel produced for Falconbridge abatement programs ranges from an expected decrease of 4.2 cents per lb to an increase of 14.7 cents per lb.

With respect to the expected decrease in production cost by pyrrhotite rejection, the related cost per tonne of SO_2 removed is an implied reduction of $72 per tonne of SO_2 removed for an annual emission level of 267 tonnes of SO_2 per day. The remaining abatement programs result in an increase in cost per tonne of SO_2 removed from $64 to $159. The latter achieves an emission level of 36 tonnes of SO_2 per day.

8.5 Conclusions

For various emission reduction levels, an abatement program has been identified as technically feasible and cost effective for both Companies. Based on the cost effective programs outlined, emission levels of 1,045 to 43 tonnes per day for Inco and 267 to 36 tonnes per day for Falconbridge are possible.

Based on the preceding analysis, only two abatement programs (RRS at Inco and increased pyrrhotite rejection at Falconbridge) satisfied the Task Force criterion for economic viability. Higher real nickel prices would encourage the firms to lower the threshold criterion by which they judge the economic viability of major programs.

TABLE 8.1

INCO COST EFFECTIVE ABATEMENT PROGRAMS[1]

PROGRAM	EMISSION REDUCTIONS[2] (tonnes/day of SO_2)	CAPITAL COST ($/millions)[3]	NET PRESENT VALUE[4] ($/millions)[3]
RRS	913	264.4	17.9
RRS + IORP	1,086	305.4	-54.5
RRS + RWGT + IORP	1,182	373.0	-119.1
CCM + RRS	1,523	339.4	-116.5
CCM + RRS + IORP	1,696	380.0	-188.4
CCM + RRS + RWGT + IORP	1,802	380.4	-252.6
CCM + RWGT + RRS + IORP	1,831	448.5	-282.8
(CCM + RRS) + RWGT + IORP	1,927	524.0	-343.5
IRRA (Inco alternative)	1,064	430.0	-104.6

1 Based on 54 technically feasible abatement programs described in Chapter 4 (Appendix 4.1), eight programs were identified as least cost. The Inco alternative (IRRA) is provided for comparison purposes and details of the difference in cost estimation are outlined in Chapter 4 (Appendix 4.2).

2 Assuming an annual nickel production level of 280 million lb.

3 1982 Canadian dollars.

4 Cumulative net present value at a discount rate of 16.5% for a planning horizon to the year 2015.

TABLE 8.2

FALCONBRIDGE COST EFFECTIVE ABATEMENT PROGRAMS[1]

PROGRAM	EMISSION REDUCTIONS[1] (tonnes/day SO_2)	CAPITAL COST ($/millions)[2]	NET PRESENT VALUE[3] ($/millions)[2]
Pyrrhotite Rejection	139	3.5	37.4
Increased Roast	154	22.0	-29.9
Direct Conversion to Acid	263	52.0	-73.7
Roast/Reduction Smelting	318	46.0	-78.0
Pyrrhotite Rejection Plus Weak Gas Treatment.	370	35.0	-114.0

1 Assuming an annual nickel production level of 88 million lb.
2 1982 Canadian dollars.
3 Cumulative net present value at a discount rate of 16.5% for the planning horizon to the year 2020.

TABLE 8.3

INTERNAL RATE OF RETURN
INCO ABATEMENT PROGRAMS

PROGRAM	INTERNAL RATE OF RETURN (%) ON CAPITAL INVESTMENT AT PLANNING HORIZON[1] INTERNAL FINANCING
RRS	18.0%
RRS + IORP	13.5%
RRS + RWGT + IORP	9.8%
CCM + RRS	11.6%
CCM + RRS + IORP	8.4%
CCM + RRS + RWGT + IORP	5.1%
CCM + RWGT + RRS + IORP	4.4%
(CCM + RRS) + RWGT + IORP	0.5%
IRRA (Inco Alternative)	14.4%

1 Planning horizon is year 2015.

TABLE 8.4

SUMMARY OF FINANCIAL REVIEW OF INCO ABATEMENT PROGRAMS[1]

PROGRAMS	EMISSION REDUCTIONS[2]	ANNUALIZED COST	INCREASED COST PER TONNE SO_2 REMOVED	INCREASED PRODUCTION COST PER LB NICKEL
	tonnes/day	$/millions[3]	$ per tonne[3]	cents[3]
RRS	913	6.1	18.40	2.2
RRS + IORP	1086	16.4	41.40	5.9
RRS + RWGT + IORP	1182	28.7	66.50	10.2
CCM + RRS	1523	20.3	36.50	7.2
CCM + RRS + IORP	1696	30.6	49.90	10.9
CCM + RRS + RWGT + IORP	1802	42.8	65.00	15.3
CCM + RWGT + RRS + IORP	1831	44.4	66.00	15.9
(CCM + RRS) + RWGT + IORP	1927	56.7	81.00	20.2
IRRA	1064	25.6	72.20	7.5

1 Based on 54 technically feasible abatement programs, eight were identified as cost effective. The Inco alternative is provided for comparison.
2 Annual production level of 280 million lbs of nickel.
3 1982 Canadian dollars.

TABLE 8.5

SUMMARY OF
FINANCIAL REVIEW OF FALCONBRIDGE
ABATEMENT PROGRAMS[1]

PROGRAMS	EMISSION REDUCTIONS[2]	ANNUALIZED COST	INCREASED COST PER TONNE SO_2 REMOVED	INCREASED PRODUCTION COST PER LB NICKEL
	tonnes/day	$/millions[4]	$ per tonne[4]	cents[4]
Pyrrhotite Rejection	139	-3.6 [3]	-72.00	-4.2
Increased Roast	154	3.5	64.00	4.1
Direct Conversion to Acid	263	9.1	94.00	10.3
Roast/Reduction Smelting	318	12.6	111.00	14.4
Pyrrhotite Rejection Plus Weak Gas Treatment	370	12.8	159.00	14.7

1 Eight abatement programs were identified as technically feasible; five were identified as cost effective.
2 Annual production level of 88 million lbs of nickel.
3 Reduction in costs.
4 1981 Canadian dollars.

APPENDIX 8.1

SUMMARY OF CAPITAL AND OPERATING COST ASSUMPTIONS FOR INCO ABATEMENT PROGRAMS

Copper Circuit Modification
- installed and operational by 1986
- construction during 1984, 1985, 1986
- $75 m. (1982)[1] - $22.5, $30, $22.5
- increased operating cost of $5.35 m.
- increased acid production of 345.7 tonnes (000's) per annum

RWGT on Copper Circuit Modification (alone)
- installed and operational by 1991
- construction during 1989, 1990, 1991
- $75 m. (1982)[1] - $22.698, $30.264, $22.698
- increased operating cost of $4.975 m.
- increased acid production of 69.9 tonnes (000's) per annum

NRWGT on CCM (alone)
- installed and operational by 1991
- construction during 1989, 1990, 1991
- $68.4 m. (1982)[1] - $20.52, $27.63, $20.52.
- increased operating cost of $5.7 m.
- no increase in acid production

Roast/Reduction Smelting
- installed and operational by 1991
- construction during 1987, 1988, 1989, 1990, 1991
- $264.4 m. (1982)[1] - $26.44, $52.88, $79.52, $66.1, $39.66
- operating cost savings of $24.9 m. (annual) (Appendix 8.3)
- increased acid production of 542.4 tonnes (000's) per annum

RWGT on RRS
- installed and operational by 1994
- construction during 1992, 1993, 1994
- $68.1 m. (1982)[1] - $20.43, $27.24, $20.43
- operating cost increase of $4.266 m.
- increased acid production of 122.6 tonnes (000's) per annum

NRWGT on RRS
- installed and operational by 1994
- construction during 1992, 1993, 1994
- $56.8 m. (1982)[1] - $17.04, $22.72, $17.04
- increased operating cost of $4.6 m.
- no increase in acid production

1 All costs are given in 1982 Canadian dollars.

Outokumpu Flash Furnace
- installed and operational by 1988
- construction during 1986, 1987, 1988
- $271 m. (1982)[1] - $81.3, $108.4, $81.3
- operating cost savings of $21.50 m. (Appendix 8.3)
- increased acid production of 498.0 tonnes (000's) per annum

RWGT on OFF (alone)
- installed and operational by 1991
- construction during 1989, 1990, 1991
- $69.0 m. (1982)[1] - $20.7, $27.6, $20.7
- increased operating cost of $4.383 m.
- increased acid production of 79.3 tonnes (000's) per annum

NRWGT ON OFF
- installed and operational by 1991
- construction during 1989, 1990, 1991
- $56.5 m. (1982)[1] - $16.95, $22.6, $16.95
- increased operating cost of $5.466 m.
- no increase in acid production

Inco Alternative (RRS using IORP)[2]
- operational by 1992
- construction for six years ending in 1992:
  1987, 1988, 1989, 1990, 1991, 1992
- $430 m. (1982)[1] $43.0, $43.0, $64.5, $64.5, $86.0, $129.0
- operating cost savings of $24.9 m. (Appendix 8.3)
- decrease in acid production of 215.7 tonnes (000's) per annum

NRWGT on IORP
- installed and operational by 1991
- construction during 1989, 1990, 1991
- $41.0 m. (1982)[1] - $12.3, $16.4, $12.3
- increased operating cost of $5.646 m. ($54.7)
- no increase in acid production

All Programs
- planning horizon extends to year 2015
- additional revenues from potentially more efficient metal recoveries were ignored as well as potential revenues lost through the rejection of ores with high sulphur content
- smelter acid was assumed to yield a net back of zero to the firm
- additional mine development costs associated with some options were not assessed

1 All costs are given in 1982 Canadian dollars.
2 Inco alternative has a higher capital cost of $250 to $300 million than roast/reduction smelting due to need for materials handling equipment and other factors not considered in roast/reduction smelting. However, operating cost savings were estimated to be on the same basis. A detailed discussion of the differences is contained in Appendix 4.2.

APPENDIX 8.2

SUMMARY OF CAPITAL AND OPERATION COST ASSUMPTIONS FALCONBRIDGE

Increased Pyrrhotite Rejection
- immediate effect in 1983
- capital construction of $3.5 m. in 1990 to be operation in 1991
- operating savings of $2.8 m. increasing to $4.2 million in 1990
- decrease in acid production of up to 90.8 tonnes (000's) per annum

Increased Roast
- immediate effect in 1983
- capital construction required of $4.5 m. in 1983 followed by $10.95 m. in 1989 and $10.95 m. in 1990
- operating cost of $.4 m. increasing to $1.2 m. in 1990
- increased acid production of up to 92.7 tonnes (000's) per annum

Roast/Reduction Smelting
- installed and operational by 1990
- capital construction - 1988, 1989, 1990
- $46 m. (1982)[1] - $13.68, $18.24, $13.685
- increased acid production by 190.5 tonnes (000's) per annum

Direct Conversion to Acid
- installed and operational by 1986
- capital construction - 1983, 1984, 1985, 1986
- $52 m. (1982)[1] - $5.19, $10.38, $20.76, $15.57
- increased operating cost of $3.3 m
- increased acid production of 158.4 tonnes (000's) per annum

Regenerative Weak Gas Treatment
- installed and operational by 1986
- capital construction - 1984, 1985, 1986
- $48 m. (1982)[1] - $14.49, $19.32, $14.49
- increased operating cost from $12.4 m. to 14.0 m.
- increased acid production by 210.9 tonnes (000's) per annum

Non-Regenerative Weak Gas Treatment
- installed and operational by 1986
- capital construction - 1984, 1985, 1986
- $47 m. (1982)[1] - $13.95, $18.6, $13.95
- increased operating cost of $15.1 m.
- no increased acid production

Pyrrhotite Rejection (RWGT plus)
- installed and operational by 1987
- capital costs/construction - 1985, 1986, 1987
- $35 m. (1982)[1] - $10.35, $13.8, $10.35
- increased operating cost of $9.0 m.
- increased acid production of 45.2 tonnes (000's) per annum

[1] All costs are given in 1982 Canadian dollars.

APPENDIX 8.2 (continued)

Increased Roast (RWGT plus)

- installed and operational by 1987
- capital/construction - 1985, 1986, 1987
- $62 m. (1982)[1] - $18.66, $24.88, $18.66
- increased operating cost of $14.4 m.
- increased acid production of 215.7 tonnes (000's) per annum

All Programs

- planning horizon extends to year 2020
- additional revenues from potentially more efficient metal recoveries were ignored as well as potential revenues lost through the rejection of ores with high sulphur content
- smelter acid was assumed to yield a net back of zero to the firm
- additional mine development costs associated with some options were not assessed

[1] All costs are given in 1982 Canadian dollars.

APPENDIX 8.3

SUMMARY OF ANTICIPATED COST SAVINGS

Additional Cost of Materials
(Paste, Catalyst + Maintenance Materials of 4.6 million per annum)

	Actual Cost
- RRS	5.92
- OFF	5.3

Decrease in Labour Cost (Inco Estimated Present Process Cost of $28.3 million minus Labour Force Estimates for Operating and Maintenance, but excluding Supervisory/ Administration Staff)

	Decreased Cost	Actual Cost
- RRS	20.7	(7.6)
- OFF	21.3	(7.0)

Decrease in Energy Cost for Smelters, Converters, Indirect (Waste Heat Boilers) Energy, Acid Plant, Coke (reduction +/heat value) minus Steam Credit from Present Process Cost of $28.73 million per annum

	Decreased Cost	Actual Cost
- RRS	18.6	10.13
- OFF	23.2	5.58

	SNC
- RRS	24.91
- OFF	21.5

9. REVIEW OF THE ENVIRONMENTAL SITUATION

Abstract

The impact of Sudbury's emissions on the natural environment is examined in two different regimes - local, (i.e. within about 100 km) and at longer distances (i.e. greater than about 150 km). On the local scale, the deterioration of Sudbury's forests and lakes caused by emissions of sulphur compounds and associated trace metals commenced with the opening of the Basin's smelting operations in 1888. Smelter production increased throughout the 1930's, the 1950's and the 1960's with an associated increase in emissions of sulphur compounds and trace metals. Again, those industrial developments were followed by increased environmental damage. Erosion, which had started with earlier forest damage, continued to strip the protective soil cover away and eventually the vegetation thinned and disappeared. Recently, SO_2 vegetation injury from frequent high sulphur dioxide ground level concentrations of short duration has been largely ameliorated by abatement practices and the commissioning of the tall stack in 1972.

Nearly a century of smelting has severely damaged many of the local lakes, exhausting their ability to neutralize additional acid input. These affected lakes represent the end result of past and present Sudbury area emissions. Taller stacks have transferred the bulk of present SO_2 emissions out of the Sudbury area to other regions of Ontario and northeastern North America where they now contribute to the acidic deposition problem.

The acidified water bodies in the Sudbury area are expected to continue to respond favourably to decreases in SO_2 emissions from the smelters. However, to protect and improve these lakes as well as lakes in other areas, a further significant reduction in the SO_2 emissions from sources far away from Sudbury is also required.

The additional problem of metals, mobilized by the interaction of acidic compounds with the environment, can only be solved by decreasing current metal emissions and by a general transboundary acid gas control program. Such a program would include SO_2 controls on the Sudbury smelters.

Metal contamination of soils and lakes is an additional concern in the near field, i.e. closer to Sudbury. Reductions of copper and nickel emissions by about 90% are required to protect the Sudbury aquatic environment.

The emissions from Sudbury also have an impact on ecosystems which are far removed from its sources. In recent years, the contribution of these and other sources in eastern North America to the impact on various ecosystems

has been the focus of public concern. Sudbury's emissions are shown to be a part of the long range transport of "acid rain" and for many of the sensitive ecosystems identified by the Canada/US Memorandum of Intent Work Groups, Sudbury is recognized as a significant single contributor to the deposition of sulphur compounds. For instance, in the Muskoka-Haliburton region of Southern Ontario, Sudbury contributes about 19% of the total sulphur deposition, while in Southern Nova Scotia, its contribution is about 6%.

The damage to ecosystems from long range transport can be varied, covering structural deterioration, damage to lakes and fisheries, lower crop yields or alterations in forest growth. Damage is also occurring over large geographic areas; thus, the economic impact may be quite severe. While a reduction in loadings which lead to acidification can be achieved by dramatically reducing Sudbury's emissions, no sensitive ecosystem can be fully protected without reductions in the emissions from other U.S. and Canadian sources.

The impact of current fugitive smelter emissions on the workplace environment is briefly discussed with respect to the occupational threshold limit values of the Ontario Ministry of Labour. Better containment of off-gases, especially from the converters, is expected to reduce SO_2 and particulate levels in the workplace.

The 1990 Amendments to the Clean Air Act

This reading reprints parts of the legislation and explantory material introduced by the U.S. government to control acid rain.

Discussion Note

This reading comprises a brief overview of the proposed amendments as well as Title IV which explains the mechanisms envisaged for the purpose of controlling acid deposition.

Noteworthy in this respect are the so-called market mechanisms, including transferrable allowances and interpollutant trading.

Students should read the relevant sections of the bill and then evaluate how these mechanisms might be expected to work, whether they will be effective and, in particular, how effective they are in reconciling pollution control and economic growth. Finally, students can be asked to assess whether these provisions would form the basis of a bilateral treaty with Canada on acid rain control. How does this program compare in effectiveness to the Canadian program?

THE WHITE HOUSE

WASHINGTON

THE CLEAN AIR ACT AMENDMENTS OF 1989: HIGHLIGHTS

* The President's bill is consistent with the letter and spirit of the President's fact sheet of June 12, 1989.

Acid Rain:

* The President's bill will achieve a true 10 million ton reduction in annual sulfur dioxide emissions from 1980 levels by the year 2000. By requiring new sources of pollution in future years to be offset by reductions from existing sources, the bill ensures that this 10 million ton reduction is permanent.

* The President's bill contains one to two million tons more SO2 reductions than the leading competing legislation in the House.

* The President's bill contains a workable and innovative trading system, so that utilities can use market mechanisms to seek the most cost-effective reductions.

Non-attainment:

* Through a series of cost effective controls on sources of urban ozone, the President's bill would bring the overwhelming majority of American cities into attainment with the health-based ozone standard by the year 2000.

* Those cities with the most serious ozone problems would be required to reduce ozone-causing emissions by 3 percent per year to ensure that steady progress is made toward meeting the nation's clean air standards.

* The President's bill contains tougher standards for hydrocarbons, nitrogen oxides, and carbon monoxide from automobile tailpipes. It also contains provisions to reduce evaporative emissions from running losses, tailpipe emissions from light duty trucks, emissions which occur during refueling, and pollution from urban buses.

* The President's clean fuels program will bring clean burning alternative fuels and clean-fueled vehicles into the market, thus reducing smog-producing and toxic air emissions in America's most polluted cities and providing a longer-term reconciliation between the automobile and the environment.

Air Toxics:

* The President's bill puts forth a set schedule by which regulations to reduce public health risk from emissions of airborne toxic chemicals will be promulgated.

* The regulations will be set on the basis of "Maximum Achievable Control Technology" (MACT), a concept contained in several pending pieces of Congressional legislation, which would require existing sources of air toxics to achieve the same emissions standards as those achieved by the best performing plants now operating. New sources would be subject to an even tougher standard, matching that set by the best performing source.

Enforcement:

* The bill contains tough new penalties for those who violate our clean air laws.

THE WHITE HOUSE

WASHINGTON

THE CLEAN AIR ACT AMENDMENTS OF 1989

BILL OVERVIEW

Overview

The Administration's bill implements the proposals made in the President's speech and fact sheet of June 12, 1989.

The bill would guarantee by the year 2000 a permanent reduction of 10 million tons in sulfur dioxide from 1980 levels; would sharply reduce pollutants that contribute to urban ozone; and would establish a set schedule for regulation of toxic air emissions using the Maximum Achievable Control Technology (MACT).

The bill would also establish a system of marketable permits to allow acid rain reductions to be achieved in the least costly manner. And it would stiffen penalties for those who violate our clean air laws.

The bill allows for both environmental protection and economic growth, two long-standing concerns often considered at odds with each other. By incorporating both concerns in these clean air proposals, the President seeks to break the gridlock which has characterized the debate on clean air for the past several years.

The bill has seven titles:

Title I: Non-Attainment With Standards for Ozone, Carbon Monoxide, and Particulate Matter

Title I of the Clean Air Act Amendments of 1989 addresses both the particular air pollution problems -- for example, urban smog, carbon monoxide, and particulate matter -- that have been most difficult to solve in recent years, as well as basic structural problems in the current Clean Air Act. The title would replace the current structure in the Act with an updated approach that will address all current and future efforts to attain national ambient air quality standards (NAAQS).

Title I would establish a set of general requirements that would apply to the air quality plans for all areas of the country. It sets forth a process for areas to be designated as in "attainment" or "non-attainment" for a pollutant. Title I contains various requirements that would apply specifically to areas designated non-attainment for the six pollutants for which EPA has already set NAAQS: ozone, carbon monoxide, particulate matter, lead, sulfur oxides, and nitrogen dioxide.

For ozone non-attainment areas, one of the major focuses of the current Clean Air Act debate, the title proposes attainment deadlines of 1995, 2000, or 2010 depending on the severity of th problem. Virtually all American cities would be required to com into attainment by the year 2000. As part of the Administration's proposal to reduce emissions of volatile organic compound in the most serious ozone non-attainment areas, the bill would require those areas to reduce these emissions by three percent per year beginning with the year of enactment. This requirement will ensure that steady progress toward attainment is achieved. In addition, this bill requires EPA to issue guidelines on control technology applicable to seven types of industrial facilities, which States will then use to develop emission control requirements for these facilities. The bill also calls upon EPA to study means of controlling emissions from consumer and commercial solvents and, based on the results of the study, to issue regulations as appropriate. Each of these provisions will give the States a major role in achieving the emission reductions needed to bring clean air to our cities.

Depending on the severity of the problem, title I would require carbon monoxide non-attainment areas to reach attainment by 1995 or 2000. Particulate matter non-attainment areas would generally be required to attain that standard by 1994 or 2001. Title I also contains a series of tough sanctions for areas that fail to comply with the requirements of the Act.

Title II: Mobile Sources

Title II contains provisions relating to mobile sources. The provisions in this title would establish programs for the use of vehicles operated on clean alternative fuels. The clean fuels program proposed here is perhaps the most innovative and far-reaching component of the President's non-attainment proposals. It is designed to provide a long-term reconciliation of the environment and automobile so that Americans can continue to enjoy economic growth, freedom in using their motor vehicles, and clean air. Perhaps more importantly, it will lead to dramatic reductions in mobile source air toxic emissions.

The Administration proposes that a portion of the motor vehicle fleet in the most serious non-attainment cities be comprised of new vehicles that operate on clean burning fuels. This could include methanol, ethanol, natural gas, electricity, propane, reformulated gasoline or any comparable low emission fuel. In the nine major urban areas where current data show the greatest concentrations of ozone, the plan calls for the phased-in introduction of alternative fuels, and clean-fueled vehicle sales according to the following schedule: 500,000 vehicles in 1995; 750,000 vehicles in 1996; and 1,000,000 vehicles each year from 1997 through 2004.

The major metropolitan areas affected by the plan are: Los Angeles, Houston, New York City, Milwaukee, Baltimore, Philadelphia, Greater Connecticut, San Diego, and Chicago. If these areas are able to demonstrate that they can achieve equivalent reductions in pollution through other measures, the plan would allow them to "opt out" of the clean-fueled vehicle and alternative fuels program. The plan would also allow other cities to be included in the program at the state's request.

The bill would also require that new urban buses in cities with population of over one million operate exclusively on clean fuels. This requirement will be phased in from 1991 to 1994.

The title includes several specific provisions affecting mobile sources, including:

- New cold temperature carbon monoxide emissions standards (10 gram per mile for vehicles tested at 20 degrees Fahrenheit) for cars and trucks.

- New regulations to reduce evaporative emissions from running losses.

- A tighter NOx tailpipe standard for automobiles (a reduction from 1.0 gpm to 0.7 gpm).

- Authority to require that cars and trucks include emission control diagnostics systems to alert vehicle owners to the need for repairs of emission control systems.

- A requirement that the Administrator of EPA issue regulations to reduce fuel volatility to 9.0 pound per square inch Reid vapor pressure (RVP), with the authority to require a stricter standard in certain areas as needed to achieve the same emissions reductions by 1992.

- A reduction in the sulfur content of diesel fuels used by heavy-duty vehicles.

- A requirement that the Administrator issue a rule to allow automakers to engage in "emissions trading" and fuel refiners to engage in "fuel pooling", thus giving these companies the flexibility to meet set emissions standards through the most efficient combination of control measures.

This title of the bill also contains a number of provisions to increase penalties for violators of clean air laws.

The alternative fuels program proposed in these amendments, combined with other motor vehicles and fuel measures in the bill, is expected to shrink the contribution of vehicles to the ozone problem from the current 40 percent to ten percent. This represents not only an alternative to some of the more disruptive

driving controls currently being considered by some states, but also a bold and innovative means of reconciling continued use of the automobile by a growing society with the need for cleaner air.

Title III: Air Toxics

This title sets forth both a schedule and a means for regulating the emission of hazardous air emissions from stationary sources.

The title sets forth a list of chemicals and chemical categories to be controlled, most of them contained on the SARA Title III Toxic Release Inventory.

In the first phase, the bill gives the Administrator of EPA the authority to issue regulations which would require the maximum achievable degree of reductions in emissions by major sources.

The MACT is defined for new sources as the best emissions control achieved in practice by a similar source. For existing sources, MACT would be at least as stringent as emissions contro achieved by the best performing similar sources. This definitio is nearly identical to that contained in H.R. 4, the leading proposal currently pending in Congress. It should be noted that this definition of MACT is designed to be at least as stringent as the definition of a competing term of art, "Best Available Control Technology" (BACT).

The title sets forth a schedule for regulating sources of toxic air emissions so as to ensure progress. The bill requires regulation of initially listed sources on the following schedule

- 10 categories within two years;
- 25 percent of the categories within four years;
- 50 percent of the categories within seven years; and
- all remaining categories designated as needed by the Administrator within 10 years of enactment.

The bill requires the regulations issued by EPA to focus on those sources that pose the greatest threat to public health first.

The bill also provides for a second phase of air toxics regulation to address any residual risk that remains after the application of MACT. Seven years after issuance of MACT, the Administrator of EPA will evaluate the risks to public health which remain after applying the MACT standard. If the Administrator finds that the residual risk from a given source poses an "unreasonable risk" to public health, he then must promulgate a standard within two years to control further that source.

Title IV: Permits

Title IV of the Clean Air Act Amendments of 1989 would build on existing state or interstate air pollution control agencies' programs by requiring these agencies to submit to the Administrator of EPA comprehensive programs for permitting stationary sources. This comprehensive program is patterned generally after the permitting program that now applies to point sources of water pollution under the Clean Water Act.

The title would require EPA to issue regulations governing permit programs, which would include requirements for adequate state authority and for the collection of reasonable permit fees. Each state would be required to submit a permit program to the Administrator not later than three years after enactment.

Title V: Acid Rain

This title contains provisions to implement the President's program to achieve a 10 million ton reduction in sulfur dioxide emissions by the year 2000 from 1980 levels. Nine million tons of this reduction would be required of electric utilities; while one million tons would come from non-utility sources. Most models suggest that the one million tons from non-utility sources has already been achieved since 1980, and virtually all competing pieces of legislation on Capitol Hill take credit for this reduction.

In the first phase, fossil fuel electric generating stations of over 100 megawatts are required to limit their emissions after 1995 to 2.5 lbs. per million BTU. They would receive a number of emissions allowances which would be fully tradeable within a state and within a utility system in the first phase, consistent with the President's pledge.

In the second phase, all electric generating units larger than 75 megawatts with emissions rates greater than 1.2 lbs/MBTU would receive a number of permits equal to 1.2 lbs. per million BTU times their average annual fuel consumption from 1985 to 1987.

Cleaner plants, which had emissions rates lower than 1.2 lbs/MBTU, would be required to stay at their low emissions rates, but would be allowed to increase their fuel consumption (and therefore operating capacity). This provision allows growth among cleaner plants.

Companies which seek to build new, "greenfield" plants wou be required to trade for offsetting emissions allowances to bui these plants, in addition to meeting normal NSPS reqirements. They would be able to purchase these offsets from utility plant in any region of the country which shut down, whose control actions earn them excess credits, or from industrial plants whi elect to reduce SO_2 (or NOx) and earn credits for doing so. By requiring these offsets, the bill ensures that the 10 million t reduction called for in the bill is permanent.

In the second phase, the emissions allowances granted to a class of plants would be fully tradeable across state lines.

The bill contains a series of provisions designed to allow the introduction of Clean Coal Technology (CCT), in which the Administration has proposed a major investment. Plants which a repowered using clean coal technology would receive emissions allowances which allow them to expand their capacity beyond current operations while still providing for cleaner air. The bill calls for a three-year extension of the deadlines in Phase II (to 2003) for plants that adopt clean coal technologies, and proposes a series of incentives designed to smooth the introduction of clean coal technologies into the market place.

Title VI: Enforcement

Title VI would enhance and clarify EPA's enforcement authorities under the Act. The bill would expand enforcement under the Act to give EPA authority to assess penalty actions i appropriate cases (with penalties up to $200,000, or higher if agreed upon between EPA and the Department of Justice). In addition, the bill would authorize EPA to implement a system of field citations to help deal with minor violations very quickly Fines ranging up to $5,000 could be assessed for violations by factories and commercial facilities that EPA inspectors view in the field.

The bill would stiffen criminal sanctions (e.g., longer imprisonment, higher fines, and double sanctions) for intentior violators of air toxics laws. Additional enforcement provisior relating to mobile sources, including anti-tampering provisions are contained in Title II.

Title VII: Miscellaneous Provisions

Title VII contains a small number of miscellaneous provisions, including a provision establishing a board to investigate major releases of chemicals to the air.

In total, this proposed legislation makes deep, early cuts in air pollution nationwide, and continues that progress forwar into the 21st century.

TITLE IV—ACID DEPOSITION CONTROL

SEC. 401. ACID DEPOSITION CONTROL.

The Clean Air Act is amended by adding the following new title after title III:

"TITLE IV—ACID DEPOSITION CONTROL

"SEC. 401. FINDINGS AND PURPOSES.

"(a) FINDINGS.—The Congress finds that—

"(1) the presence of acidic compounds and their precursors in the atmosphere and in deposition from the atmosphere repre-

sents a threat to natural resources, ecosystems, materials, visibility, and public health;

"(2) the principal sources of the acidic compounds and their precursors in the atmosphere are emissions of sulfur and nitrogen oxides from the combustion of fossil fuels;

"(3) the problem of acid deposition is of national and international significance;

"(4) strategies and technologies for the control of precursors to acid deposition exist now that are economically feasible, and improved methods are expected to become increasingly available over the next decade;

"(5) current and future generations of Americans will be adversely affected by delaying measures to remedy the problem;

"(6) reduction of total atmospheric loading of sulfur dioxide and nitrogen oxides will enhance protection of the public health and welfare and the environment; and

"(7) control measures to reduce precursor emissions from steam-electric generating units should be initiated without delay.

"(b) PURPOSES.—The purpose of this title is to reduce the adverse effects of acid deposition through reductions in annual emissions of sulfur dioxide of ten million tons from 1980 emission levels, and, in combination with other provisions of this Act, of nitrogen oxides emissions of approximately two million tons from 1980 emission levels, in the forty-eight contiguous States and the District of Columbia. It is the intent of this title to effectuate such reductions by requiring compliance by affected sources with prescribed emission limitations by specified deadlines, which limitations may be met through alternative methods of compliance provided by an emission allocation and transfer system. It is also the purpose of this title to encourage energy conservation, use of renewable and clean alternative technologies, and pollution prevention as a long-range strategy, consistent with the provisions of this title, for reducing air pollution and other adverse impacts of energy production and use.

"SEC. 402. DEFINITIONS.

"As used in this title:

"(1) The term 'affected source' means a source that includes one or more affected units.

"(2) The term 'affected unit' means a unit that is subject to emission reduction requirements or limitations under this title.

"(3) The term 'allowance' means an authorization, allocated to an affected unit by the Administrator under this title, to emit, during or after a specified calendar year, one ton of sulfur dioxide.

"(4) The term 'baseline' means the annual quantity of fossil fuel consumed by an affected unit, measured in millions of British Thermal Units ('mmBtu's'), calculated as follows:

"(A) For each utility unit that was in commercial operation prior to January 1, 1985, the baseline shall be the annual average quantity of mmBtu's consumed in fuel during calendar years 1985, 1986, and 1987, as recorded by the Department of Energy pursuant to Form 767. For any utility unit for which such form was not filed, the baseline

shall be the level specified for such unit in the 1985 National Acid Precipitation Assessment Program (NAPAP) Emissions Inventory, Version 2, National Utility Reference File (NURF) or in a corrected data base as established by the Administrator pursuant to paragraph (3). For non-utility units, the baseline is the NAPAP Emissions Inventory, Version 2. The Administrator, in the Administrator's sole discretion, may exclude periods during which a unit is shutdown for a continuous period of four calendar months or longer, and make appropriate adjustments under this paragraph. Upon petition of the owner or operator of any unit, the Administrator may make appropriate baseline adjustments for accidents that caused prolonged outages.

"(B) For any other nonutility unit that is not included in the NAPAP Emissions Inventory, Version 2, or a corrected data base as established by the Administrator pursuant to paragraph (3), the baseline shall be the annual average quantity, in mmBtu consumed in fuel by that unit, as calculated pursuant to a method which the administrator shall prescribe by regulation to be promulgated not later than eighteen months after enactment of the Clean Air Act Amendments of 1990.

"(C) The Administrator shall, upon application or on his own motion, by December 31, 1991, supplement data needed in support of this title and correct any factual errors in data from which affected Phase II units' baselines or actual 1985 emission rates have been calculated. Corrected data shall be used for purposes of issuing allowances under the title. Such corrections shall not be subject to judicial review, nor shall the failure of the Administrator to correct an alleged factual error in such reports be subject to judicial review.

"(5) The term 'capacity factor' means the ratio between the actual electric output from a unit and the potential electric output from that unit.

"(6) The term 'compliance plan' means, for purposes of the requirements of this title, either—

"(A) a statement that the source will comply with all applicable requirements under this title, or

"(B) where applicable, a schedule and description of the method or methods for compliance

and certification by the owner or operator that the source is in compliance with the requirements of this title.

"(7) The term 'continuous emission monitoring system' (CEMS) means the equipment as required by section 412, used to sample, analyze, measure, and provide on a continuous basis a permanent record of emissions and flow (expressed in pounds per million British thermal units (lbs/mmBtu), pounds per hour (lbs/hr) or such other form as the Administrator may prescribe by regulations under section 412).

"(8) The term 'existing unit' means a unit (including units subject to section 111) that commenced commercial operation before the date of enactment of the Clean Air Act Amendments of 1990. Any unit that commenced commercial operation before

the date of enactment of the Clean Air Act Amendments of 1990 which is modified, reconstructed, or repowered after the date of enactment of the Clean Air Act Amendments of 1990 shall continue to be an existing unit for the purposes of this title. For the purposes of this title, existing units shall not include simple combustion turbines, or units which serve a generator with a nameplate capacity of 25MWe or less.

"(9) The term 'generator' means a device that produces electricity and which is reported as a generating unit pursuant to Department of Energy Form 860.

"(10) The term 'new unit' means a unit that commences commercial operation on or after the date of enactment of the Clean Air Act Amendments of 1990.

"(11) The term 'permitting authority' means the Administrator, or the State or local air pollution control agency, with an approved permitting program under part B of title III of the Act.

"(12) The term 'repowering' means replacement of an existing coal-fired boiler with one of the following clean coal technologies: atmospheric or pressurized fluidized bed combustion, integrated gasification combined cycle, magnetohydrodynamics, direct and indirect coal-fired turbines, integrated gasification fuel cells, or as determined by the Administrator, in consultation with the Secretary of Energy, a derivative of one or more of these technologies, and any other technology capable of controlling multiple combustion emissions simultaneously with improved boiler or generation efficiency and with significantly greater waste reduction relative to the performance of technology in widespread commercial use as of the date of enactment of the Clean Air Act Amendments of 1990. Notwithstanding the provisions of section 409(a), for the purpose of this title, the term 'repowering' shall also include any oil and/or gas-fired unit which has been awarded clean coal technology demonstration funding as of January 1, 1991, by the Department of Energy.

"(13) The term 'reserve' means any bank of allowances established by the Administrator under this title.

"(14) The term 'State' means one of the 48 contiguous States and the District of Columbia.

"(15) The term 'unit' means a fossil fuel-fired combustion device.

"(16) The term 'actual 1985 emission rate', for electric utility units means the annual sulfur dioxide or nitrogen oxides emission rate in pounds per million Btu as reported in the NAPAP Emissions Inventory, Version 2, National Utility Reference File. For nonutility units, the term 'actual 1985 emission rate' means the annual sulfur dioxide or nitrogen oxides emission rate in pounds per million Btu as reported in the NAPAP Emission Inventory, Version 2.

"(17)(A) The term 'utility unit' means—

"(i) a unit that serves a generator in any State that produces electricity for sale, or

"(ii) a unit that, during 1985, served a generator in any State that produced electricity for sale.

"(B) Notwithstanding subparagraph (A), a unit described in subparagraph (A) that—

"(i) was in commercial operation during 1985, but

"(ii) did not, during 1985, serve a generator in any State that produced electricity for sale

shall not be a utility unit for purposes of this title.

"(C) A unit that cogenerates steam and electricity is not a 'utility unit' for purposes of this title unless the unit is constructed for the purpose of supplying, or commences construction after the date of enactment of this title and supplies, more than one-third of its potential electric output capacity and more than 25 megawatts electrical output to any utility power distribution system for sale.

"(18) The term 'allowable 1985 emissions rate' means a federally enforceable emissions limitation for sulfur dioxide or oxides of nitrogen, applicable to the unit in 1985 or the limitation applicable in such other subsequent year as determined by the Administrator if such a limitation for 1985 does not exist. Where the emissions limitation for a unit is not expressed in pounds of emissions per million Btu, or the averaging period of that emissions limitation is not expressed on an annual basis, the Administrator shall calculate the annual equivalent of that emissions limitation in pounds per million Btu to establish the allowable 1985 emissions rate.

"(19) The term 'qualifying phase I technology' means a technological system of continuous emission reduction which achieves a 90 percent reduction in emissions of sulfur dioxide from the emissions that would have resulted from the use of fuels which were not subject to treatment prior to combustion.

"(20) The term 'alternative method of compliance' means a method of compliance in accordance with one or more of the following authorities:

"(A) a substitution plan submitted and approved in accordance with subsections 404 (b) and (c);

"(B) a Phase I extension plan approved by the Administrator under section 404(d), using qualifying phase I technology as determined by the Administrator in accordance with that section; or

"(C) repowering with a qualifying clean coal technology under section 409.

"(21) The term 'commenced' as applied to construction of any new electric utility unit means that an owner or operator has undertaken a continuous program of construction or that an owner or operator has entered into a contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction.

"(22) The term 'commenced commercial operation' means to have begun to generate electricity for sale.

"(23) The term 'construction' means fabrication, erection, or installation of an affected unit.

"(24) The term 'industrial source' means a unit that does not serve a generator that produces electricity, a 'nonutility unit' as defined in this section, or a process source as defined in section 410(e).

"(25) The term 'nonutility unit' means a unit other than a utility unit.

"(26) The term 'designated representative' means a responsible person or official authorized by the owner or operator of a unit to represent the owner or operator in matters pertaining to the holding, transfer, or disposition of allowances allocated to a unit, and the submission of and compliance with permits, permit applications, and compliance plans for the unit.

"(27) The term 'life-of-the-unit, firm power contractual arrangement' means a unit participation power sales agreement under which a utility or industrial customer reserves, or is entitled to receive, a specified amount or percentage of capacity and associated energy generated by a specified generating unit (or units) and pays its proportional amount of such unit's total costs, pursuant to a contract either—

"(A) for the life of the unit;

"(B) for a cumulative term of no less than 30 years, including contracts that permit an election for early termination; or

"(C) for a period equal to or greater than 25 years or 70 percent of the economic useful life of the unit determined as of the time the unit was built, with option rights to purchase or re-lease some portion of the capacity and associated energy generated by the unit (or units) at the end of the period.

"(28) The term 'basic Phase II allowance allocations' means:

"(A) For calendar years 2000 through 2009 inclusive, allocations of allowances made by the Administrator pursuant to section 403 and subsections (b)(1), (3), and (4); (c)(1), (2), (3), and (5); (d)(1), (2), (4), and (5); (e); (f); (g)(1), (2), (3), (4), and (5); (h)(1); (i) and (j) of section 405.

"(B) For each calendar year beginning in 2010, allocations of allowances made by the Administrator pursuant to section 403 and subsections (b)(1), (3), and (4); (c)(1), (2), (3), and (5); (d)(1), (2), (4) and (5); (e); (f); (g)(1), (2), (3), (4), and (5); (h)(1) and (3); (i) and (j) of section 405.

"(29) The term 'Phase II bonus allowance allocations' means, for calendar year 2000 through 2009, inclusive, and only for such years, allocations made by the Administrator pursuant to section 403, subsections (a)(2), (b)(2), (c)(4), (d)(3) (except as otherwise provided therein), and (h)(2) of section 405, and section 406.

"SEC. 403. SULFUR DIOXIDE ALLOWANCE PROGRAM FOR EXISTING AND NEW UNITS.

"(a) ALLOCATIONS OF ANNUAL ALLOWANCES FOR EXISTING AND NEW UNITS.—(1) For the emission limitation programs under this title, the Administrator shall allocate annual allowances for the unit, to be held or distributed by the designated representative of the owner or operator of each affected unit at an affected source in accordance with this title, in an amount equal to the annual tonnage emission limitation calculated under section 404, 405, 406, 409, or 410 except as otherwise specifically provided elsewhere in this title. Except as provided in sections 405(a)(2), 405(a)(3), 409 and 410, beginning January 1, 2000, the Administrator shall not allocate

annual allowances to emit sulfur dioxide pursuant to section 405 in such an amount as would result in total annual emissions of sulfur dioxide from utility units in excess of 8.90 million tons except that the Administrator shall not take into account unused allowances carried forward by owners and operators of affected units or by other persons holding such allowances, following the year for which they were allocated. If necessary to meeting the restrictions imposed in the preceding sentence, the Administrator shall reduce, pro rata, the basic Phase II allowance allocations for each unit subject to the requirements of section 405. Subject to the provisions of section 416, the Administrator shall allocate allowances for each affected unit at an affected source annually, as provided in paragraphs (2) and (3) and section 408. Except as provided in sections 409 and 410, the removal of an existing affected unit or source from commercial operation at any time after the date of the enactment of the Clean Air Act Amendments of 1990 (whether before or after January 1, 1995, or January 1, 2000) shall not terminate or otherwise affect the allocation of allowances pursuant to section 404 or 405 to which the unit is entitled. Allowances shall be allocated by the Administrator without cost to the recipient, except for allowances sold by the Administrator pursuant to section 416. Not later than December 31, 1991, the Administrator shall publish a proposed list of the basic Phase II allowance allocations, the Phase II bonus allowance allocations and, if applicable, allocations pursuant to section 405(a)(3) for each unit subject to the emissions limitation requirements of section 405 for the year 2000 and the year 2010. After notice and opportunity for public comment, but not later than December 31, 1992, the Administrator shall publish a final list of such allocations, subject to the provisions of section 405(a)(2). Any owner or operator of an existing unit subject to the requirements of section 405(b) or (c) who is considering applying for an extension of the emission limitation requirement compliance deadline for that unit from January 1, 2000, until not later than December 31, 2000, pursuant to section 409, shall notify the Administrator no later than March 31, 1991. Such notification shall be used as the basis for estimating the basic Phase II allowances under this subsection. Prior to June 1, 1998, the Administrator shall publish a revised final statement of allowance allocations, subject to the provisions of section 405(a)(2) and taking into account the effect of any compliance date extensions granted pursuant to section 409 on such allocations. Any person who may make an election concerning the amount of allowances to be allocated to a unit or units shall make such election and so inform the Administrator not later than March 31, 1991, in the case of an election under section 405 (or June 30, 1991, in the case of an election under section 406). If such person fails to make such election, the Administrator shall set forth for each unit owned or operated by such person, the amount of allowances reflecting the election that would, in the judgment of the Administrator, provide the greatest benefit for the owner or operator of the unit. If such person is a Governor who may make an election under section 406 and the Governor fails to make an election, the Administrator shall set forth for each unit in the State the amount of allowances reflecting the election that would, in the judgment of the Administrator, provide the greatest benefit for units in the State.

"(b) ALLOWANCE TRANSFER SYSTEM.—Allowances allocated under this title may be transferred among designated representatives of the owners or operators of affected sources under this title and any other person who holds such allowances, as provided by the allowance system regulations to be promulgated by the Administrator not later than eighteen months after the date of enactment of the Clean Air Act Amendments of 1990. Such regulations shall establish the allowance system prescribed under this section, including, but not limited to, requirements for the allocation, transfer, and use of allowances under this title. Such regulations shall prohibit the use of any allowance prior to the calendar year for which the allowance was allocated, and shall provide, consistent with the purposes of this title, for the identification of unused allowances, and for such unused allowances to be carried forward and added to allowances allocated in subsequent years, including allowances allocated to units subject to Phase I requirements (as described in section 404) which are applied to emissions limitations requirements in Phase II (as described in section 405). Transfers of allowances shall not be effective until written certification of the transfer, signed by a responsible official of each party to the transfer, is received and recorded by the Administrator. Such regulations shall permit the transfer of allowances prior to the issuance of such allowances. Recorded pre-allocation transfers shall be deducted by the Administrator from the number of allowances which would otherwise be allocated to the transferor, and added to those allowances allocated to the transferee. Pre-allocation transfers shall not affect the prohibition contained in this subsection against the use of allowances prior to the year for which they are allocated.

"(c) INTERPOLLUTANT TRADING.—Not later than January 1, 1994, the Administrator shall furnish to the Congress a study evaluating the environmental and economic consequences of amending this title to permit trading sulfur dioxide allowances for nitrogen oxides allowances.

"(d) ALLOWANCE TRACKING SYSTEM.—(1) The Administrator shall promulgate, not later than 18 months after the date of enactment of the Clean Air Act Amendments of 1990, a system for issuing, recording, and tracking allowances, which shall specify all necessary procedures and requirements for an orderly and competitive functioning of the allowance system. All allowance allocations and transfers shall, upon recordation by the Administrator, be deemed a part of each unit's permit requirements pursuant to section 408, without any further permit review and revision.

"(2) In order to insure electric reliability, such regulations shall not prohibit or affect temporary increases and decreases in emissions within utility systems, power pools, or utilities entering into allowance pool agreements, that result from their operations, including emergencies and central dispatch, and such temporary emissions increases and decreases shall not require transfer of allowances among units nor shall it require recordation. The owners or operators of such units shall act through a designated representative. Notwithstanding the preceding sentence, the total tonnage of emissions in any calendar year (calculated at the end thereof) from all units in such a utility system, power pool, or allowance pool

agreements shall not exceed the total allowances for such units for the calendar year concerned.

"(e) NEW UTILITY UNITS.—After January 1, 2000, it shall be unlawful for a new utility unit to emit an annual tonnage of sulfur dioxide in excess of the number of allowances to emit held for the unit by the unit's owner or operator. Such new utility units shall not be eligible for an allocation of sulfur dioxide allowances under subsection (a)(1), unless the unit is subject to the provisions of subsection (g)(2) or (3) of section 405. New utility units may obtain allowances from any person, in accordance with this title. The owner or operator of any new utility unit in violation of this subsection shall be liable for fulfilling the obligations specified in section 411 of this title.

"(f) NATURE OF ALLOWANCES.—An allowance allocated under this title is a limited authorization to emit sulfur dioxide in accordance with the provisions of this title. Such allowance does not constitute a property right. Nothing in this title or in any other provision of law shall be construed to limit the authority of the United States to terminate or limit such authorization. Nothing in this section relating to allowances shall be construed as affecting the application of, or compliance with, any other provision of this Act to an affected unit or source, including the provisions related to applicable National Ambient Air Quality Standards and State implementation plans. Nothing in this section shall be construed as requiring a change of any kind in any State law regulating electric utility rates and charges or affecting any State law regarding such State regulation or as limiting State regulation (including any prudency review) under such a State law. Nothing in this section shall be construed as modifying the Federal Power Act or as affecting the authority of the Federal Energy Regulatory Commission under that Act. Nothing in this title shall be construed to interfere with or impair any program for competitive bidding for power supply in a State in which such program is established. Allowances, once allocated to a person by the Administrator, may be received, held, and temporarily or permanently transferred in accordance with this title and the regulations of the Administrator without regard to whether or not a permit is in effect under title V or section 408 with respect to the unit for which such allowance was originally allocated and recorded. Each permit under this title and each permit issued under title V for any affected unit shall provide that the affected unit may not emit an annual tonnage of sulfur dioxide in excess of the allowances held for that unit.

"(g) PROHIBITION.—It shall be unlawful for any person to hold, use, or transfer any allowance allocated under this title, except in accordance with regulations promulgated by the Administrator. It shall be unlawful for any affected unit to emit sulfur dioxide in excess of the number of allowances held for that unit for that year by the owner or operator of the unit. Upon the allocation of allowances under this title, the prohibition contained in the preceding sentence shall supersede any other emission limitation applicable under this title to the units for which such allowances are allocated. Allowances may not be used prior to the calendar year for which they are allocated. Nothing in this section or in the allowance system regulations shall relieve the Administrator of the Adminis-

trator's permitting, monitoring and enforcement obligations under this Act, nor relieve affected sources of their requirements and liabilities under this Act.

"(h) COMPETITIVE BIDDING FOR POWER SUPPLY.—Nothing in this title shall be construed to interfere with or impair any program for competitive bidding for power supply in a State in which such program is established.

"(i) APPLICABILITY OF THE ANTITRUST LAWS.—

"(1) Nothing in this section affects—

"(A) the applicability of the antitrust laws to the transfer, use, or sale of allowances, or

"(B) the authority of the Federal Energy Regulatory Commission under any provision of law respecting unfair methods of competition or anticompetitive acts or practices.

"(2) As used in this section, 'antitrust laws' means those Acts set forth in section 1 of the Clayton Act (15 U.S.C. 12), as amended.

"(j) PUBLIC UTILITY HOLDING COMPANY ACT.—The acquisition or disposition of allowances pursuant to this title including the issuance of securities or the undertaking of any other financing transaction in connection with such allowances shall not be subject to the provisions of the Public Utility Holding Company Act of 1935.

"SEC. 404. PHASE I SULFUR DIOXIDE REQUIREMENTS.

"(a) EMISSION LIMITATIONS.—(1) After January 1, 1995, each source that includes one or more affected units listed in table A is an affected source under this section. After January 1, 1995, it shall be unlawful for any affected unit (other than an eligible phase I unit under section 404(d)(2)) to emit sulfur dioxide in excess of the tonnage limitation stated as a total number of allowances in table A for phase I, unless (A) the emissions reduction requirements applicable to such unit have been achieved pursuant to subsection (b) or (d), or (B) the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions, except that, after January 1, 2000, the emissions limitations established in this section shall be superseded by those established in section 405. The owner or operator of any unit in violation of this section shall be fully liable for such violation including, but not limited to, liability for fulfilling the obligations specified in section 411.

"(2) Not later than December 31, 1991, the Administrator shall determine the total tonnage of reductions in the emissions of sulfur dioxide from all utility units in calendar year 1995 that will occur as a result of compliance with the emissions limitation requirements of this section, and shall establish a reserve of allowances equal in amount to the number of tons determined thereby not to exceed a total of 3.50 million tons. In making such a determination, the Administrator shall compute for each unit subject to the emissions limitation requirements of this section the difference between:

"(A) the product of its baseline multiplied by the lesser of each unit's allowable 1985 emissions rate and its actual 1985 emissions rate, divided by 2,000, and

"(B) the product of each unit's baseline multiplied by 2.50 lbs/mmBtu divided by 2,000,

and sum the computations. The Administrator shall adjust the foregoing calculation to reflect projected calendar year 1995 utilization of the units subject to the emissions limitations of this title that the Administrator finds would have occurred in the absence of the imposition of such requirements. Pursuant to subsection (d), the Administrator shall allocate allowances from the reserve established hereinunder until the earlier of such time as all such allowances in the reserve are allocated or December 31, 1999.

"(3) In addition to allowances allocated pursuant to paragraph (1), in each calendar year beginning in 1995 and ending in 1999, inclusive, the Administrator shall allocate for each unit on Table A that is located in the States of Illinois, Indiana, or Ohio (other than units at Kyger Creek, Clifty Creek and Joppa Steam), allowances in an amount equal to 200,000 multiplied by the unit's pro rata share of the total number of allowances allocated for all units on Table A in the 3 States (other than units at Kyger Creek, Clifty Creek, and Joppa Steam) pursuant to paragraph (1). Such allowances shall be excluded from the calculation of the reserve under paragraph (2).

"(b) SUBSTITUTIONS.—The owner or operator of an affected unit under subsection (a) may include in its section 408 permit application and proposed compliance plan a proposal to reassign, in whole or in part, the affected unit's sulfur dioxide reduction requirements to any other unit(s) under the control of such owner or operator. Such proposal shall specify—

"(1) the designation of the substitute unit or units to which any part of the reduction obligations of subsection (a) shall be required, in addition to, or in lieu of, any original affected units designated under such subsection;

"(2) the original affected unit's baseline, the actual and allowable 1985 emissions rate for sulfur dioxide, and the authorized annual allowance allocation stated in table A;

"(3) calculation of the annual average tonnage for calendar years 1985, 1986, and 1987, emitted by the substitute unit or units, based on the baseline for each unit, as defined in section 402(d), multiplied by the lesser of the unit's actual or allowable 1985 emissions rate;

"(4) the emissions rates and tonnage limitations that would be applicable to the original and substitute affected units under the substitution proposal;

"(5) documentation, to the satisfaction of the Administrator, that the reassigned tonnage limits will, in total, achieve the same or greater emissions reduction than would have been achieved by the original affected unit and the substitute unit or units without such substitution; and

"(6) such other information as the Administrator may require.

"(c) ADMINISTRATOR'S ACTION ON SUBSTITUTION PROPOSALS.—(1) The Administrator shall take final action on such substitution proposal in accordance with section 408(c) if the substitution proposal fulfills the requirements of this subsection. The Administrator may approve a substitution proposal in whole or in part and with such modifications or conditions as may be consistent with the orderly functioning of the allowance system and which will ensure the emissions reductions contemplated by this title. If a proposal does

not meet the requirements of subsection (b), the Administrator shall disapprove it. The owner or operator of a unit listed in table A shall not substitute another unit or units without the prior approval of the Administrator.

"(2) Upon approval of a substitution proposal, each substitute unit, and each source with such unit, shall be deemed affected under this title, and the Administrator shall issue a permit to the original and substitute affected source and unit in accordance with the approved substitution plan and section 408. The Administrator shall allocate allowances for the original and substitute affected units in accordance with the approved substitution proposal pursuant to section 403. It shall be unlawful for any source or unit that is allocated allowances pursuant to this section to emit sulfur dioxide in excess of the emissions limitation provided for in the approved substitution permit and plan unless the owner or operator of each unit governed by the permit and approved substitution plan holds allowances to emit not less than the units total annual emissions. The owner or operator of any original or substitute affected unit operated in violation of this subsection shall be fully liable for such violation, including liability for fulfilling the obligations specified in section 411 of this title. If a substitution proposal is disapproved, the Administrator shall allocate allowances to the original affected unit or units in accordance with subsection (a).

"(d) ELIGIBLE PHASE I EXTENSION UNITS.—(1) The owner or operator of any affected unit subject to an emissions limitation requirement under this section may petition the Administrator in its permit application under section 408 for an extension of 2 years of the deadline for meeting such requirement, provided that the owner or operator of any such unit holds allowances to emit not less than the unit's total annual emissions for each of the 2 years of the period of extension. To qualify for such an extension, the affected unit must either employ a qualifying phase I technology, or transfer its phase I emissions reduction obligation to a unit employing a qualifying phase I technology. Such transfer shall be accomplished in accordance with a compliance plan, submitted and approved under section 408, that shall govern operations at all units included in the transfer, and that specifies the emissions reduction requirements imposed pursuant to this title.

"(2) Such extension proposal shall—

"(A) specify the unit or units proposed for designation as an eligible phase I extension unit;

"(B) provide a copy of an executed contract, which may be contingent upon the Administrator approving the proposal, for the design engineering, and construction of the qualifying phase I technology for the extension unit, or for the unit or units to which the extension unit's emission reduction obligation is to be transferred;

"(C) specify the unit's or units' baseline, actual 1985 emissions rate, allowable 1985 emissions rate, and projected utilization for calendar years 1995 through 1999;

"(D) require CEMS on both the eligible phase I extension unit or units and the transfer unit or units beginning no later than January 1, 1995; and

"(E) specify the emission limitation and number of allowances expected to be necessary for annual operation after the qualifying phase I technology has been installed.

"(3) The Administrator shall review and take final action on each extension proposal in order of receipt, consistent with section 408, and for an approved proposal shall designate the unit or units as an eligible phase I extension unit. The Administrator may approve an extension proposal in whole or in part, and with such modifications or conditions as may be necessary, consistent with the orderly functioning of the allowance system, and to ensure the emissions reductions contemplated by the title.

"(4) In order to determine the number of proposals eligible for allocations from the reserve under subsection (a)(2) and the number of allowances remaining available after each proposal is acted upon, the Administrator shall reduce the total number of allowances remaining available in the reserve by the number of allowances calculated according to subparagraphs (A), (B) and (C) until either no allowances remain available in the reserve for further allocation or all approved proposals have been acted upon. If no allowances remain available in the reserve for further allocation before all proposals have been acted upon by the Administrator, any pending proposals shall be disapproved. The Administrator shall calculate allowances equal to—

"(A) the difference between the lesser of the average annual emissions in calendar years 1988 and 1989 or the projected emissions tonnage for calendar year 1995 of each eligible phase I extension unit, as designated under paragraph (3), and the product of the unit's baseline multiplied by an emission rate of 2.50 lbs/mmBtu, divided by 2,000;

"(B) the difference between the lesser of the average annual emissions in calendar years 1988 and 1989 or the projected emissions tonnage for calendar year 1996 of each eligible phase I extension unit, as designated under paragraph (3), and the product of the unit's baseline multiplied by an emission rate of 2.50 lbs/mmBtu, divided by 2,000; and

"(C) the amount by which (i) the product of each unit's baseline multiplied by an emission rate of 1.20 lbs/mmBtu, divided by 2,000, exceeds (ii) the tonnage level specified under subparagraph (E) of paragraph (2) of this subsection multiplied by a factor of 3.

"(5) Each eligible Phase I extension unit shall receive allowances determined under subsection (a)(1) or (c) of this section. In addition, for calendar year 1995, the Administrator shall allocate to each eligible Phase I extension unit, from the allowance reserve created pursuant to subsection (a)(2), allowances equal to the difference between the lesser of the average annual emissions in calendar years 1988 and 1989 or its projected emissions tonnage for calendar year 1995 and the product of the unit's baseline multiplied by an emission rate of 2.50 lbs/mmBtu, divided by 2,000. In calendar year 1996, the Administrator shall allocate for each eligible unit, from the allowance reserve created pursuant to subsection (a)(2), allowances equal to the difference between the lesser of the average annual emissions in calendar years 1988 and 1989 or its projected emissions tonnage for calendar year 1996 and the product of the unit's baseline multi-

plied by an emission rate of 2.50 lbs/mmBtu, divided by 2,000. It shall be unlawful for any source or unit subject to an approved extension plan under this subsection to emit sulfur dioxide in excess of the emissions limitations provided for in the permit and approved extension plan, unless the owner or operator of each unit governed by the permit and approved plan holds allowances to emit not less than the unit's total annual emissions.

"(6) In addition to allowances specified in paragraph (5), the Administrator shall allocate for each eligible Phase I extension unit employing qualifying Phase I technology, for calendar years 1997, 1998, and 1999, additional allowances, from any remaining allowances in the reserve created pursuant to subsection (a)(2), following the reduction in the reserve provided for in paragraph (4), not to exceed the amount by which (A) the product of each eligible unit's baseline times an emission rate of 1.20 lbs/mmBtu, divided by 2,000, exceeds (B) the tonnage level specified under subparagraph (E) of paragraph (2) of this subsection.

"(7) After January 1, 1997, in addition to any liability under this Act, including under section 411, if any eligible phase I extension unit employing qualifying phase I technology or any transfer unit under this subsection emits sulfur dioxide in excess of the annual tonnage limitation specified in the extension plan, as approved in paragraph (3) of this subsection, the Administrator shall, in the calendar year following such excess, deduct allowances equal to the amount of such excess from such unit's annual allowance allocation.

"(e)(1) In the case of a unit that receives authorization from the Governor of the State in which such unit is located to make reductions in the emissions of sulfur dioxide prior to calendar year 1995 and that is part of a utility system that meets the following requirements: (A) the total coal-fired generation within the utility system as a percentage of total system generation decreased by more than 20 percent between January 1, 1980, and December 31, 1985; and (B) the weighted capacity factor of all coal-fired units within the utility system averaged over the period from January 1, 1985, through December 31, 1987, was below 50 percent, the Administrator shall allocate allowances under this paragraph for the unit pursuant to this subsection. The Administrator shall allocate allowances for a unit that is an affected unit pursuant to section 405 (but is not also an affected unit under this section) and part of a utility system that includes 1 or more affected units under section 405 for reductions in the emissions of sulfur dioxide made during the period 1995–1999 if the unit meets the requirements of this subsection and the requirements of the preceding sentence, except that for the purposes of applying this subsection to any such unit, the prior year concerned as specified below, shall be any year after January 1, 1995 but prior to January 1, 2000.

"(2) In the case of an affected unit under this section described in subparagraph (A), the allowances allocated under this subsection for early reductions in any prior year may not exceed the amount which (A) the product of the unit's baseline multiplied by the unit's 1985 actual sulfur dioxide emission rate (in lbs. per mmBtu), divided by 2,000, exceeds (B) the allowances specified for such unit in Table A. In the case of an affected unit under section 405 described

in subparagraph (A), the allowances awarded under this subsection for early reductions in any prior year may not exceed the amount by which (i) the product of the quantity of fossil fuel consumed by the unit (in mmBtu) in the prior year multiplied by the lesser of 2.50 or the most stringent emission rate (in lbs. per mmBtu) applicable to the unit under the applicable implementation plan, divided by 2,000, exceeds (ii) the unit's actual tonnage of sulfur dioxide emission for the prior year concerned. Allowances allocated under this subsection for units referred to in subparagraph (A) may be allocated only for emission reductions achieved as a result of physical changes or changes in the method of operation made after the date of enactment of the Clean Air Act Amendments of 1990, including changes in the type or quality of fossil fuel consumed.

"(3) In no event shall the provisions of this paragraph be interpreted as an event of force majeur or a commercial impractibility or in any other way as a basis for excused nonperformance by a utility system under a coal sales contract in effect before the date of enactment of the Clean Air Act Amendments of 1990

"TABLE A.—AFFECTED SOURCES AND UNITS IN PHASE I AND THEIR SULFUR DIOXIDE ALLOWANCES (tons)

State	Plant Name	Generator	Phase I Allowances
Alabama	Colbert	1	13,570
		2	15,310
		3	15,400
		4	15,410
		5	37,180
	E.C. Gaston	1	18,100
		2	18,540
		3	18,310
		4	19,280
		5	59,840
Florida	Big Bend	1	28,410
		2	27,100
		3	26,740
	Crist	6	19,200
		7	31,680
Georgia	Bowen	1	56,320
		2	54,770
		3	71,750
		4	71,740
	Hammond	1	8,780
		2	9,220
		3	8,910
		4	37,640
	J. McDonough	1	19,910
		2	20,600
	Wansley	1	70,770
		2	65,430
	Yates	1	7,210
		2	7,040
		3	6,950
		4	8,910
		5	9,410
		6	24,760
		7	21,480
Illinois	Baldwin	1	42,010

"TABLE A.—AFFECTED SOURCES AND UNITS IN PHASE I AND THEIR SULFUR DIOXIDE ALLOWANCES (tons)—Continued

State	Plant Name	Generator	Phase I Allowances
		2	44,420
		3	42,550
	Coffeen	1	11,790
		2	35,670
	Grand Tower	4	5,910
	Hennepin	2	18,410
	Joppa Steam	1	12,590
		2	10,770
		3	12,270
		4	11,360
		5	11,420
		6	10,620
	Kincaid	1	31,530
		2	33,810
	Meredosia	3	13,890
	Vermilion	2	3,880
Indiana	Bailly	7	11,180
		8	15,630
	Breed	1	18,500
	Cayuga	1	33,370
		2	34,130
	Clifty Creek	1	20,150
		2	19,810
		3	20,410
		4	20,080
		6	20,380
	E. W. Stout	5	19,360
		5	3,880
		6	4,770
		7	23,610
	F. B. Culley	2	4,290
		3	16,970
	F. E. Ratts	1	8,330
		2	8,480
	Gibson	1	40,400
		2	41,010
		3	41,080
		4	40,320
	H. T. Pritchard	6	5,770
	Michigan City	12	23,310
	Petersburg	1	16,430
		2	32,380
	R. Gallagher	1	6,490
		2	7,280
		3	6,530
		4	7,650
	Tanners Creek	4	24,820
	Wabash River	1	4,000
		2	2,860
		3	3,750
		5	3,670
		6	12,280
	Warrick	4	26,980
Iowa	Burlington	1	10,710
	Des Moines	7	2,320
	George Neal	1	1,290
	M.L. Kapp	2	13,800
	Prairie Creek	4	8,180
	Riverside	5	3,990
Kansas	Quindaro	2	4,220

"TABLE A.—AFFECTED SOURCES AND UNITS IN PHASE I AND THEIR SULFUR DIOXIDE ALLOWANCES (tons)—Continued

State	Plant Name	Generator	Phase I Allowances
Kentucky	Coleman	1	11,250
		2	12,840
		3	12,340
	Cooper	1	7,450
		2	15,320
	E.W. Brown	1	7,110
		2	10,910
		3	26,100
	Elmer Smith	1	6,520
		2	14,410
	Ghent	1	28,410
	Green River	4	7,820
	H.L. Spurlock	1	22,780
	Henderson II	1	13,340
		2	12,310
	Paradise	3	59,170
	Shawnee	10	10,170
Maryland	Chalk Point	1	21,910
		2	24,330
	C.P. Crane	1	10,330
		2	9,230
	Morgantown	1	35,260
		2	38,480
Michigan	J.H. Campbell	1	19,230
		2	23,060
Minnesota	High Bridge	6	4,270
Mississippi	Jack Watson	4	17,910
		5	36,700
Missouri	Asbury	1	16,190
	James River	5	4,850
	Labadie	1	40,110
		2	37,710
		3	40,310
		4	35,940
	Montrose	1	7,390
		2	8,200
		3	10,090
	New Madrid	1	28,240
		2	32,480
	Sibley	3	15,580
	Sioux	1	22,570
		2	23,690
	Thomas Hill	1	10,250
		2	19,390
New Hampshire	Merrimack	1	10,190
		2	22,000
New Jersey	B.L. England	1	9,060
		2	11,720
New York	Dunkirk	3	12,600
		4	14,060
	Greenidge	4	7,540
	Milliken	1	11,170
		2	12,410
	Northport	1	19,810
		2	24,110
		3	26,480
	Port Jefferson	3	10,470
		4	12,330

"TABLE A.—AFFECTED SOURCES AND UNITS IN PHASE I AND THEIR SULFUR DIOXIDE ALLOWANCES (tons)—Continued

State	Plant Name	Generator	Phase I Allowances
Ohio	Ashtabula	5	16,740
	Avon Lake	8	11,650
		9	30,480
	Cardinal	1	34,270
		2	38,320
	Conesville	1	4,210
		2	4,890
		3	5,500
		4	48,770
	Eastlake	1	7,800
		2	8,640
		3	10,020
		4	14,510
		5	34,070
	Edgewater	4	5,050
	Gen. J.M. Gavin	1	79,080
		2	80,560
	Kyger Creek	1	19,280
		2	18,560
		3	17,910
		4	18,710
		5	18,740
	Miami Fort	5	760
		6	11,380
		7	38,510
	Muskingum River	1	14,880
		2	14,170
		3	13,950
		4	11,780
		5	40,470
	Niles	1	6,940
		2	9,100
	Picway	5	4,930
	R.E. Burger	3	6,150
		4	10,780
		5	12,430
	W.H. Sammis	5	24,170
		6	39,930
		7	43,220
	W.C. Beckjord	5	8,950
		6	23,020

"TABLE A.—AFFECTED SOURCES AND UNITS IN PHASE I AND THEIR SULFUR DIOXIDE ALLOWANCES (tons)—Continued

State	Plant Name	Generator	Phase I Allowances
Pennsylvania	Armstrong	1	14,410
		2	15,430
	Brunner Island	1	27,760
		2	31,100
		3	53,820
	Cheswick	1	39,170
	Conemaugh	1	59,790
		2	66,450
	Hatfield's Ferry	1	37,830
		2	37,320
		3	40,270
	Martins Creek	1	12,660
		2	12,820
	Portland	1	5,940
		2	10,230
	Shawville	1	10,320
		2	10,320
		3	14,220
		4	14,070
	Sunbury	3	8,760
		4	11,450
Tennessee	Allen	1	15,320
		2	16,770
		3	15,670
	Cumberland	1	86,700
		2	94,840
	Gallatin	1	17,870
		2	17,310
		3	20,020
		4	21,260
	Johnsonville	1	7,790
		2	8,040
		3	8,410
		4	7,990
		5	8,240
		6	7,890
		7	8,980
		8	8,700
		9	7,080
		10	7,550
West Virginia	Albright	3	12,000
	Fort Martin	1	41,590
		2	41,200
	Harrison	1	48,620
		2	46,150
		3	41,500
	Kammer	1	18,740
		2	19,460
		3	17,390
	Mitchell	1	43,980
		2	45,510
	Mount Storm	1	43,720
		2	35,580
		3	42,430

"TABLE A.—AFFECTED SOURCES AND UNITS IN PHASE I AND THEIR SULFUR DIOXIDE ALLOWANCES (tons)—Continued

State	Plant Name	Generator	Phase I Allowances
Wisconsin	Edgewater	4	24,750
	La Crosse/Genoa	3	22,700
	Nelson Dewey	1	6,010
		2	6,680
	N. Oak Creek	1	5,220
		2	5,140
		3	5,370
		4	6,320
	Pulliam	8	7,510
	S. Oak Creek	5	9,670
		6	12,040
		7	16,180
		8	15,790

"(f) ENERGY CONSERVATION AND RENEWABLE ENERGY.—

"(1) DEFINITIONS.—As used in this subsection:

"(A) QUALIFIED ENERGY CONSERVATION MEASURE.—The term 'qualified energy conservation measure' means a cost effective measure, as identified by the Administrator in consultation with the Secretary of Energy, that increases the efficiency of the use of electricity provided by an electric utility to its customers.

"(B) QUALIFIED RENEWABLE ENERGY.—The term 'qualified renewable energy' means energy derived from biomass, solar, geothermal, or wind as identified by the Administrator in consultation with the Secretary of Energy.

"(C) ELECTRIC UTILITY.—The term 'electric utility' means any person, State agency, or Federal agency, which sells electric energy.

"(2) ALLOWANCES FOR EMISSIONS AVOIDED THROUGH ENERGY CONSERVATION AND RENEWABLE ENERGY.—

"(A) IN GENERAL.—The regulations under paragraph (4) of this subsection shall provide that for each ton of sulfur dioxide emissions avoided by an electric utility, during the applicable period, through the use of qualified energy conservation measures or qualified renewable energy, the Administrator shall allocate a single allowance to such electric utility, on a first-come-first-served basis from the Conservation and Renewable Energy Reserve established under subsection (g), up to a total of 300,000 allowances for allocation from such Reserve.

"(B) REQUIREMENTS FOR ISSUANCE.—The Administrator shall allocate allowances to an electric utility under this subsection only if all of the following requirements are met:

"(i) Such electric utility is paying for the qualified energy conservation measures or qualified renewable energy directly or through purchase from another person.

"(ii) The emissions of sulfur dioxide avoided through the use of qualified energy conservation measures or qualified renewable energy are quantified in accord-

ance with regulations promulgated by the Administrator under this subsection.

"(iii)(I) Such electric utility has adopted and is implementing a least cost energy conservation and electric power plan which evaluates a range of resources, including new power supplies, energy conservation, and renewable energy resources, in order to meet expected future demand at the lowest system cost.

"(II) The qualified energy conservation measures or qualified renewable energy, or both, are consistent with that plan.

"(III) Electric utilities subject to the jurisdiction of a State regulatory authority must have such plan approved by such authority. For electric utilities not subject to the jurisdiction of a State regulatory authority such plan shall be approved by the entity with ratemaking authority for such utility.

"(iv) In the case of qualified energy conservation measures undertaken by a State regulated electric utility, the Secretary of Energy certifies that the State regulatory authority with jurisdiction over the electric rates of such electric utility has established rates and charges which ensure that the net income of such electric utility after implementation of specific cost effective energy conservation measures is at least as high as such net income would have been if the energy conservation measures had not been implemented. Upon the date of any such certification by the Secretary of Energy, all allowances which, but for this paragraph, would have been allocated under subparagraph (A) before such date, shall be allocated to the electric utility. This clause is not a requirement for qualified renewable energy.

"(v) Such utility or any subsidiary of the utility's holding company owns or operates at least one affected unit.

"(C) PERIOD OF APPLICABILITY.—Allowances under this subsection shall be allocated only with respect to kilowatt hours of electric energy saved by qualified energy conservation measures or generated by qualified renewable energy after January 1, 1992 and before the earlier of (i) December 31, 2000, or (ii) the date on which any electric utility steam generating unit owned or operated by the electric utility to which the allowances are allocated becomes subject to this title (including those sources that elect to become affected by this title, pursuant to section 410).

"(D) DETERMINATION OF AVOIDED EMISSIONS.—

"(i) APPLICATION.—In order to receive allowances under this subsection, an electric utility shall make an application which—

"(I) designates the qualified energy conservation measures implemented and the qualified renewable energy sources used for purposes of avoiding emissions,

"(II) calculates, in accordance with subparagraphs (F) and (G), the number of tons of emissions avoided by reason of the implementation of such measures or the use of such renewable energy sources; and

"(III) demonstrates that the requirements of subparagraph (B) have been met.

Such application for allowances by a State-regulated electric utility shall require approval by the State regulatory authority with jurisdiction over such electric utility. The authority shall review the application for accuracy and compliance with this subsection and the rules under this subsection. Electric utilities whose retail rates are not subject to the jurisdiction of a State regulatory authority shall apply directly to the Administrator for such approval.

"(E) AVOIDED EMISSIONS FROM QUALIFIED ENERGY CONSERVATION MEASURES.—For the purposes of this subsection, the emission tonnage deemed avoided by reason of the implementation of qualified energy conservation measures for any calendar year shall be a tonnage equal to the product of multiplying—

"(i) the kilowatt hours that would otherwise have been supplied by the utility during such year in the absence of such qualified energy conservation measures, by

"(ii) 0.004,

and dividing by 2,000.

"(F) AVOIDED EMISSIONS FROM THE USE OF QUALIFIED RENEWABLE ENERGY.—The emissions tonnage deemed avoided by reason of the use of qualified renewable energy by an electric utility for any calendar year shall be a tonnage equal to the product of multiplying—

"(i) the actual kilowatt hours generated by, or purchased from, qualified renewable energy, by

"(ii) 0.004,

and dividing by 2,000.

"(G) PROHIBITIONS.—(i) No allowances shall be allocated under this subsection for the implementation of programs that are exclusively informational or educational in nature.

"(ii) No allowances shall be allocated for energy conservation measures or renewable energy that were operational before January 1, 1992.

"(3) SAVINGS PROVISION.—Nothing in this subsection precludes a State or State regulatory authority from providing additional incentives to utilities to encourage investment in demand-side resources.

"(4) REGULATIONS.—Not later than 18 months after the date of the enactment of the Clean Air Act Amendments of 1990 and in conjunction with the regulations required to be promulgated under subsections (b) and (c), the Administrator shall, in consultation with the Secretary of Energy, promulgate regulations under this subsection. Such regulations shall list energy conservation measures and renewable energy sources which may be

treated as qualified energy conservation measures and qualified renewable energy for purposes of this subsection. Allowances shall only be allocated if all requirements of this subsection and the rules promulgated to implement this subsection are complied with. The Administrator shall review the determinations of each State regulatory authority under this subsection to encourage consistency from electric utility to electric utility and from State to State in accordance with the Administrator's rules. The Administrator shall publish the findings of this review no less than annually.

"(g) CONSERVATION AND RENEWABLE ENERGY RESERVE.—The Administrator shall establish a Conservation and Renewable Energy Reserve under this subsection. Beginning on January 1, 1995, the Administrator may allocate from the Conservation and Renewable Energy Reserve an amount equal to a total of 300,000 allowances for emissions of sulfur dioxide pursuant to section 403. In order to provide 300,000 allowances for such reserve, in each year beginning in calendar year 2000 and until calendar year 2009, inclusive, the Administrator shall reduce each unit's basic Phase II allowance allocation on the basis of its pro rata share of 30,000 allowances. If allowances remain in the reserve after January 2, 2010, the Administrator shall allocate such allowances for affected units under section 405 on a pro rata basis. For purposes of this subsection, for any unit subject to the emissions limitation requirements of section 405, the term 'pro rata basis' refers to the ratio which the reductions made in such unit's allowances in order to establish the reserve under this subsection bears to the total of such reductions for all such units.

"(h) ALTERNATIVE ALLOWANCE ALLOCATION FOR UNITS IN CERTAIN UTILITY SYSTEMS WITH OPTIONAL BASELINE.—

"(1) OPTIONAL BASELINE FOR UNITS IN CERTAIN SYSTEMS.—In the case of a unit subject to the emissions limitation requirements of this section which (as of the date of the enactment of the Clean Air Act Amendments of 1990)—

"(A) has an emission rate below 1.0 lbs/mmBtu,

"(B) has decreased its sulfur dioxide emissions rate by 60 percent or greater since 1980, and

"(C) is part of a utility system which has a weighted average sulfur dioxide emissions rate for all fossil fueled-fired units below 1.0 lbs/mmBtu,

at the election of the owner or operator of such unit, the unit's baseline may be calculated (i) as provided under section 402(d), or (ii) by utilizing the unit's average annual fuel consumption at a 60 percent capacity factor. Such election shall be made no later than March 1, 1991.

"(2) ALLOWANCE ALLOCATION.—Whenever a unit referred to in paragraph (1) elects to calculate its baseline as provided in clause (ii) of paragraph (1), the Administrator shall allocate allowances for the unit pursuant to section 403(a)(1), this section, and section 405 (as basic Phase II allowance allocations) in an amount equal to the baseline selected multiplied by the lower of the average annual emission rate for such unit in 1989, or 1.0 lbs./mmBtu. Such allowance allocation shall be in lieu of any allocation of allowances under this section and section 405.

"SEC. 405. PHASE II SULFUR DIOXIDE REQUIREMENTS.

"(a) APPLICABILITY.—(1) After January 1, 2000, each existing utility unit as provided below is subject to the limitations or requirements of this section. Each utility unit subject to an annual sulfur dioxide tonnage emission limitation under this section is an affected unit under this title. Each source that includes one or more affected units is an affected source. In the case of an existing unit that was not in operation during calendar year 1985, the emission rate for a calendar year after 1985, as determined by the Administrator, shall be used in lieu of the 1985 rate. The owner or operator of any unit operated in violation of this section shall be fully liable under this Act for fulfilling the obligations specified in section 411 of this title.

"(2) In addition to basic Phase II allowance allocations, in each year beginning in calendar year 2000 and ending in calendar year 2009, inclusive, the Administrator shall allocate up to 530,000 Phase II bonus allowances pursuant to subsections (b)(2), (c)(4), (d)(3)(A) and (B), and (h)(2) of this section and section 406. Not later than June 1, 1998, the Administrator shall calculate, for each unit granted an extension pursuant to section 409 the difference between (A) the number of allowances allocated for the unit in calendar year 2000, and (B) the product of the unit's baseline multiplied by 1.20 lbs/mmBtu, divided by 2000, and sum the computations. In each year, beginning in calendar year 2000 and ending in calendar year 2009, inclusive, the Administrator shall deduct from each unit's basic Phase II allowance allocation its pro rata share of 10 percent of the sum calculated pursuant to the preceding sentence.

"(3) In addition to basic Phase II allowance allocations and Phase II bonus allowance allocations, beginning January 1, 2000, the Administrator shall allocate for each unit listed on Table A in section 404 (other than units at Kyger Creek, Clifty Creek, and Joppa Steam) and located in the States of Illinois, Indiana, Ohio, Georgia, Alabama, Missouri, Pennsylvania, West Virginia, Kentucky, or Tennessee allowances in an amount equal to 50,000 multiplied by the unit's pro rata share of the total number of basic allowances allocated for all units listed on Table A (other than units at Kyger Creek, Clifty Creek, and Joppa Steam). Allowances allocated pursuant to this paragraph shall not be subject to the 8,900,000 ton limitation in section 403(a).

"(b) UNITS EQUAL TO, OR ABOVE, 75 MWE AND 1.20 LBS/MMBTU.—(1) Except as otherwise provided in paragraph (3), after January 1, 2000, it shall be unlawful for any existing utility unit that serves a generator with nameplate capacity equal to, or greater, than 75 MWe and an actual 1985 emission rate equal to or greater than 1.20 lbs/mmBtu to exceed an annual sulfur dioxide tonnage emission limitation equal to the product of the unit's baseline multiplied by an emission rate equal to 1.20 lbs/mmBtu, divided by 2,000, unless the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions.

"(2) In addition to allowances allocated pursuant to paragraph (1) and section 403(a)(1) as basic Phase II allowance allocations, beginning January 1, 2000, and for each calendar year thereafter until and including 2009, the Administrator shall allocate annually for each unit subject to the emissions limitation requirements of para-

graph (1) with an actual 1985 emissions rate greater than 1.20 lbs/mmBtu and less than 2.50 lbs/mmBtu and a baseline capacity factor of less than 60 percent, allowances from the reserve created pursuant to subsection (a)(2) in an amount equal to 1.20 lbs/mmBtu multiplied by 50 percent of the difference, on a Btu basis, between the unit's baseline and the unit's fuel consumption at a 60 percent capacity factor.

"(3) After January 1, 2000, it shall be unlawful for any existing utility unit with an actual 1985 emissions rate equal to or greater than 1.20 lbs/mmBtu whose annual average fuel consumption during 1985, 1986, and 1987 on a Btu basis exceeded 90 percent in the form of lignite coal which is located in a State in which, as of July 1, 1989, no county or portion of a county was designated nonattainment under section 107 of this Act for any pollutant subject to the requirements of section 109 of this Act to exceed an annual sulfur dioxide tonnage limitation equal to the product of the unit's baseline multiplied by the lesser of the unit's actual 1985 emissions rate or its allowable 1985 emissions rate, divided by 2,000, unless the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions.

"(4) After January 1, 2000, the Administrator shall allocate annually for each unit, subject to the emissions limitation requirements of paragraph (1), which is located in a State with an installed electrical generating capacity of more than 30,000,000 kw in 1988 and for which was issued a prohibition order or a proposed prohibition order (from burning oil), which unit subsequently converted to coal between January 1, 1980 and December 31, 1985, allowances equal to the difference between (A) the product of the unit's annual fuel consumption, on a Btu basis, at a 65 percent capacity factor multiplied by the lesser of its actual or allowable emissions rate during the first full calendar year after conversion, divided by 2,000, and (B) the number of allowances allocated for the unit pursuant to paragraph (1): Provided, That the number of allowances allocated pursuant to this paragraph shall not exceed an annual total of five thousand. If necessary to meeting the restriction imposed in the preceding sentence the Administrator shall reduce, pro rata, the annual allowances allocated for each unit under this paragraph.

"(c) COAL OR OIL-FIRED UNITS BELOW 75 MWE AND ABOVE 1.20 LBS/MMBTU.—(1) Except as otherwise provided in paragraph (3), after January 1, 2000, it shall be unlawful for a coal or oil-fired existing utility unit that serves a generator with nameplate capacity of less than 75 MWe and an actual 1985 emission rate equal to, or greater than, 1.20 lbs/mmBtu and which is a unit owned by a utility operating company whose aggregate nameplate fossil fuel steam-electric capacity is, as of December 31, 1989, equal to, or greater than, 250 MWe to exceed an annual sulfur dioxide emissions limitation equal to the product of the unit's baseline multiplied by an emission rate equal to 1.20 lbs/mmBtu, divided by 2,000, unless the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions.

"(2) After January 1, 2000, it shall be unlawful for a coal or oil-fired existing utility unit that serves a generator with nameplate capacity of less than 75 MWe and an actual 1985 emission rate equal to, or greater than, 1.20 lbs/mmBtu (excluding units subject to sec-

tion 111 of the Act or to a federally enforceable emissions limitation for sulfur dioxide equivalent to an annual rate of less than 1.20 lbs/mmBtu) and which is a unit owned by a utility operating company whose aggregate nameplate fossil fuel steam-electric capacity is, as of December 31, 1989, less than 250 MWe, to exceed an annual sulfur dioxide tonnage emissions limitation equal to the product of the unit's baseline multiplied by the lesser of its actual 1985 emissions rate or its allowable 1985 emissions rate, divided by 2,000, unless the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions.

"(3) After January 1, 2000, it shall be unlawful for any existing utility unit with a nameplate capacity below 75 MWe and an actual 1985 emissions rate equal to, or greater than, 1.20 lbs/mmBtu which became operational on or before December 31, 1965, which is owned by a utility operating company with, as of December 31, 1989, a total fossil fuel steam-electric generating capacity greater than 250 MWe, and less than 450 MWe which serves fewer than 78,000 electrical customers as of the date of enactment of the Clean Air Act Amendments of 1990 to exceed an annual sulfur dioxide emissions tonnage limitation equal to the product of its baseline multiplied by the lesser of its actual or allowable 1985 emission rate, divided by 2,000, unless the owner or operator holds allowances to emit not less than the units total annual emissions. After January 1, 2010, it shall be unlawful for each unit subject to the emissions limitation requirements of this paragraph to exceed an annual emissions tonnage limitation equal to the product of its baseline multiplied by an emissions rate of 1.20 lbs/mmBtu, divided by 2,000, unless the owner or operator holds allowances to emit not less than the unit's total annual emissions.

"(4) In addition to allowances allocated pursuant to paragraph (1) and section 403(a)(1) as basic Phase II allowance allocations, beginning January 1, 2000, and for each calendar year thereafter until and including 2009, inclusive, the Administrator shall allocate annually for each unit subject to the emissions limitation requirements of paragraph (1) with an actual 1985 emissions rate equal to, or greater than, 1.20 lbs/mmBtu and less than 2.50 lbs/mmBtu and a baseline capacity factor of less than 60 percent, allowances from the reserve created pursuant to subsection (a)(2) in an amount equal to 1.20 lbs/mmBtu multiplied by 50 percent of the difference, on a Btu basis, between the unit's baseline and the unit's fuel consumption at a 60 percent capacity factor.

"(5) After January 1, 2000, it shall be unlawful for any existing utility unit with a nameplate capacity below 75Mwe and an actual 1985 emissions rate equal to, or greater than, 1.20 lbs/mmBtu which is part of an electric utility system which, as of the date of the enactment of the Clean Air Act Amendments of 1990, (A) has at least 20 percent of its fossil-fuel capacity controlled by flue gas desulfurization devices, (B) has more than 10 percent of its fossil-fuel capacity consisting of coal-fired units of less than 75Mwe, and (C) has large units (greater than 400 Mwe) all of which have difficult or very difficult FGD Retrofit Cost Factors (according to the Emissions and the FGD Retrofit Feasibility at the 200 Top Emitting Generating Stations, prepared for the United States Environmental Protection Agency on January 10, 1986) to exceed an annual sulfur diox-

ide emissions tonnage limitation equal to the product of its baseline multiplied by an emissions rate of 2.5 lbs/mmBtu, divided by 2,000, unless the owner or operator holds allowances to emit not less than the unit's total annual emissions. After January 1, 2010, it shall be unlawful for each unit subject to the emissions limitation requirements of this paragraph to exceed an annual emissions tonnage limitation equal to the product of its baseline multiplied by an emissions rate of 1.20 lbs/mmBtu, divided by 2,000, unless the owner or operator holds for use allowances to emit not less than the unit's total annual emissions.

"(d) COAL-FIRED UNITS BELOW 1.20 LBS/MMBTU.—(1) After January 1, 2000, it shall be unlawful for any existing coal-fired utility unit the lesser of whose actual or allowable 1985 sulfur dioxide emissions rate is less than 0.60 lbs/mmBtu to exceed an annual sulfur dioxide tonnage emission limitation equal to the product of the unit's baseline multiplied by (A) the lesser of 0.60 lbs/mmBtu or the unit's allowable 1985 emissions rate, and (B) a numerical factor of 120 percent, divided by 2,000, unless the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions.

"(2) After January 1, 2000, it shall be unlawful for any existing coal-fired utility unit the lesser of whose actual or allowable 1985 sulfur dioxide emissions rate is equal to, or greater than, 0.60 lbs/mmBtu and less than 1.20 lbs/mmBtu to exceed an annual sulfur dioxide tonnage emissions limitation equal to the product of the unit's baseline multiplied by (A) the lesser of its actual 1985 emissions rate or its allowable 1985 emissions rate, and (B) a numerical factor of 120 percent, divided by 2,000, unless the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions.

"(3)(A) In addition to allowances allocated pursuant to paragraph (1) and section 403(a)(1) as basic Phase II allowance allocations, at the election of the designated representative of the operating company, beginning January 1, 2000, and for each calendar year thereafter until and including 2009, the Administrator shall allocate annually for each unit subject to the emissions limitation requirements of paragraph (1) allowances from the reserve created pursuant to subsection (a)(2) in an amount equal to the amount by which (i) the product of the lesser of 0.60 lbs/mmBtu or the unit's allowable 1985 emissions rate multiplied by the unit's baseline adjusted to reflect operation at a 60 percent capacity factor, divided by 2,000, exceeds (ii) the number of allowances allocated for the unit pursuant to paragraph (1) and section 403(a)(1) as basic Phase II allowance allocations.

"(B) In addition to allowances allocated pursuant to paragraph (2) and section 403(a)(1) as basic Phase II allowance allocations, at the election of the designated representative of the operating company, beginning January 1, 2000, and for each calendar year thereafter until and including 2009, the Administrator shall allocate annually for each unit subject to the emissions limitation requirements of paragraph (2) allowances from the reserve created pursuant to subsection (a)(2) in an amount equal to the amount by which (i) the product of the lesser of the unit's actual 1985 emissions rate or its allowable 1985 emissions rate multiplied by the unit's baseline ad-

justed to reflect operation at a 60 percent capacity factor, divided by 2,000, exceeds (ii) the number of allowances allocated for the unit pursuant to paragraph (2) and section 403(a)(1) as basic Phase II allowance allocations.

"(C) An operating company with units subject to the emissions limitation requirements of this subsection may elect the allocation of allowances as provided under subparagraphs (A) and (B). Such election shall apply to the annual allowance allocation for each and every unit in the operating company subject to the emissions limitation requirements of this subsection. The Administrator shall allocate allowances pursuant to subparagraphs (A) and (B) only in accordance with this subparagraph.

"(4) Notwithstanding any other provision of this section, at the election of the owner or operator, after January 1, 2000, the Administrator shall allocate in lieu of allocation, pursuant to paragraph (1), (2), (3), (5), or (6), allowances for a unit subject to the emissions limitation requirements of this subsection which commenced commercial operation on or after January 1, 1981 and before December 31, 1985, which was subject to, and in compliance with, section 111 of the Act in an amount equal to the unit's annual fuel consumption, on a Btu basis, at a 65 percent capacity factor multiplied by the unit's allowable 1985 emissions rate, divided by 2,000.

"(5) For the purposes of this section, in the case of an oil- and gas-fired unit which has been awarded a clean coal technology demonstration grant as of January 1, 1991, by the United States Department of Energy, beginning January 1, 2000, the Administrator shall allocate for the unit allowances in an amount equal to the unit's baseline multiplied by 1.20 lbs/mmBtu, divided by 2,000.

"(e) OIL AND GAS-FIRED UNITS EQUAL TO OR GREATER THAN 0.60 LBS/MMBTU AND LESS THAN 1.20 LBS/MMBTU.—After January 1, 2000, it shall be unlawful for any existing oil and gas-fired utility unit the lesser of whose actual or allowable 1985 sulfur dioxide emission rate is equal to, or greater than, 0.60 lbs/mmBtu, but less than 1.20 lbs/mmBtu to exceed an annual sulfur dioxide tonnage limitation equal to the product of the unit's baseline multiplied by (A) the lesser of the unit's allowable 1985 emissions rate or its actual 1985 emissions rate and (B) a numerical factor of 120 percent divided by 2,000, unless the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions.

"(f) OIL AND GAS-FIRED UNITS LESS THAN 0.60 LBS/MMBTU.—(1) After January 1, 2000, it shall be unlawful for any oil and gas-fired existing utility unit the lesser of whose actual or allowable 1985 emission rate is less than 0.60 lbs/mmBtu and whose average annual fuel consumption during the period 1980 through 1989 on a Btu basis was 90 percent or less in the form of natural gas to exceed an annual sulfur dioxide tonnage emissions limitation equal to the product of the unit's baseline multiplied by (A) the lesser of 0.60 lbs/mmBtu or the unit's allowable 1985 emissions, and (B) a numerical factor of 120 percent, divided by 2,000, unless the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions.

"(2) In addition to allowances allocated pursuant to paragraph (1) as basic Phase II allowance allocations and section 403(a)(1), beginning January 1, 2000, the Administrator shall, in the case of any

unit operated by a utility that furnishes electricity, electric energy, steam, and natural gas within an area consisting of a city and 1 contiguous county, and in the case of any unit owned by a State authority, the output of which unit is furnished within that same area consisting of a city and 1 contiguous county, the Administrator shall allocate for each unit in the utility its pro rata share of 7,000 allowances and for each unit in the State authority its pro rata share of 2,000 allowances.

"(g) UNITS THAT COMMENCE OPERATION BETWEEN 1986 AND DECEMBER 31, 1995.—(1) After January 1, 2000, it shall be unlawful for any utility unit that has commenced commercial operation on or after January 1, 1986, but not later than September 30, 1990 to exceed an annual tonnage emission limitation equal to the product of the unit's annual fuel consumption, on a Btu basis, at a 65 percent capacity factor multiplied by the unit's allowable 1985 sulfur dioxide emission rate (converted, if necessary, to pounds per mmBtu), divided by 2,000 unless the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions.

"(2) After January 1, 2000, the Administrator shall allocate allowances pursuant to section 403 to each unit which is listed in table B of this paragraph in an annual amount equal to the amount specified in table B.

TABLE B

Unit	Allowances
Brandon Shores	8,907
Miller 4	9,197
TNP One 2	4,000
Zimmer 1	18,458
Spruce 1	7,647
Clover 1	2,796
Clover 2	2,796
Twin Oak 2	1,760
Twin Oak 1	9,158
Cross 1	6,401
Malakoff 1	1,759

Notwithstanding any other paragraph of this subsection, for units subject to this paragraph, the Administrator shall not allocate allowances pursuant to any other paragraph of this subsection, Provided that the owner or operator of a unit listed on Table B may elect an allocation of allowances under another paragraph of this subsection in lieu of an allocation under this paragraph.

"(3) Beginning January 1, 2000, the Administrator shall allocate to the owner or operator of any utility unit that commences commercial operation, or has commenced commercial operation, on or after October 1, 1990, but not later than December 31, 1992 allowances in an amount equal to the product of the unit's annual fuel consumption, on a Btu basis, at a 65 percent capacity factor multiplied by the lesser of 0.30 lbs/mmBtu or the unit's allowable sulfur dioxide emission rate (converted, if necessary, to pounds per mmBtu), divided by 2,000.

"(4) Beginning January 1, 2000, the Administrator shall allocate to the owner or operator of any utility unit that has commenced construction before December 31, 1990 and that commences commercial operation between January 1, 1993 and December 31, 1995, allow-

ances in an amount equal to the product of the unit's annual fuel consumption, on a Btu basis, at a 65 percent capacity factor multiplied by the lesser of 0.30 lbs/mmBtu or the unit's allowable sulfur dioxide emission rate (converted, if necessary, to pounds per mmBtu), divided by 2,000.

"(5) After January 1, 2000, it shall be unlawful for any existing utility unit that has completed conversion from predominantly gas fired existing operation to coal fired operation between January 1, 1985 and December 31, 1987, for which there has been allocated a proposed or final prohibition order pursuant to section 301(b) of the Powerplant and Industrial Fuel Use Act of 1978 (42 U.S.C. 8301 et seq, repealed 1987) to exceed an annual sulfur dioxide tonnage emissions limitation equal to the product of the unit's annual fuel consumption, on a Btu basis, at a 65 percent capacity factor multiplied by the lesser of 1.20 lbs/mmBtu or the unit's allowable 1987 sulfur dioxide emissions rate, divided by 2,000, unless the owner or operator of such unit has obtained allowances equal to its actual emissions.

"(6)(A) Unless the Administrator has approved a designation of such facility under section 410, the provisions of this title shall not apply to a "qualifying small power production facility" or "qualifying cogeneration facility" (within the meaning of section 3(17)(C) or 3(18)(B) of the Federal Power Act) or to a "new independent power production facility" as defined in section 416 except that clause (iii) of such definition in section 416 shall not apply for purposes of this paragraph if, as of the date of enactment,

"(i) an applicable power sales agreement has been executed; or

"(ii) the facility is the subject of a State regulatory authority order requiring an electric utility to enter into a power sales agreement with, purchase capacity from, or (for purposes of establishing terms and conditions of the electric utility's purchase of power) enter into arbitration concerning, the facility;

"(iii) an electric utility has issued a letter of intent or similar instrument committing to purchase power from the facility at a previously offered or lower price and a power sales agreement is executed within a reasonable period of time; or

"(iv) the facility has been selected as a winning bidder in a utility competitive bid solicitation.

"(h) OIL AND GAS-FIRED UNITS LESS THAN 10 PERCENT OIL CONSUMED.—(1) After January 1, 2000, it shall be unlawful for any oil- and gas-fired utility unit whose average annual fuel consumption during the period 1980 through 1989 on a Btu basis exceeded 90 percent in the form of natural gas to exceed an annual sulfur dioxide tonnage limitation equal to the product of the unit's baseline multiplied by the unit's actual 1985 emissions rate divided by 2,000 unless the owner or operator of such unit holds allowances to emit not less than the unit's total annual emissions.

"(2) In addition to allowances allocated pursuant to paragraph (1) and section 403(a)(1) as basic Phase II allowance allocations, beginning January 1, 2000, and for each calendar year thereafter until and including 2009, the Administrator shall allocate annually for each unit subject to the emissions limitation requirements of paragraph (1) allowances from the reserve created pursuant to subsection

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(a)(2) in an amount equal to the unit's baseline multiplied by 0.050 lbs/mmBtu, divided by 2,000.

"(3) In addition to allowances allocated pursuant to paragraph (1) and section 403(a)(1), beginning January 1, 2010, the Administrator shall allocate annually for each unit subject to the emissions limitation requirements of paragraph (1) allowances in an amount equal to the unit's baseline multiplied by 0.050 lbs/mmBtu, divided by 2,000.

"(i) UNITS IN HIGH GROWTH STATES.—(1) In addition to allowances allocated pursuant to this section and section 403(a)(1) as basic Phase II allowance allocations, beginning January 1, 2000, the Administrator shall allocate annually allowances for each unit, subject to an emissions limitation requirement under this section, and located in a State that—

"(A) has experienced a growth in population in excess of 25 percent between 1980 and 1988 according to State Population and Household Estimates, With Age, Sex, and Components of Change: 1981–1988 allocated by the United States Department of Commerce, and

"(B) had an installed electrical generating capacity of more than 30,000,000 kw in 1988,

in an amount equal to the difference between (A) the number of allowances that would be allocated for the unit pursuant to the emissions limitation requirements of this section applicable to the unit adjusted to reflect the unit's annual average fuel consumption on a Btu basis of any three consecutive calendar years between 1980 and 1989 (inclusive) as elected by the owner or operator and (B) the number of allowances allocated for the unit pursuant to the emissions limitation requirements of this section: Provided, That the number of allowances allocated pursuant to this subsection shall not exceed an annual total of 40,000. If necessary to meeting the 40,000 allowance restriction imposed under this subsection the Administrator shall reduce, pro rata, the additional annual allowances allocated to each unit under this subsection.

"(2) Beginning January 1, 2000, in addition to allowances allocated pursuant to this section and section 403(a)(1) as basic Phase II allowance allocations, the Administrator shall allocate annually for each unit subject to the emissions limitation requirements of subsection (b)(1), (A) the lesser of whose actual or allowable 1980 emissions rate has declined by 50 percent or more as of the date of enactment of the Clean Air Act Amendments of 1990, (B) whose actual emissions rate is less than 1.2 lbs/mmBtu as of January 1, 2000, (C) which commenced operation after January 1, 1970, (D) which is owned by a utility company whose combined commercial and industrial kilowatt-hour sales have increased by more than 20 percent between calendar year 1980 and the date of enactment of the Clean Air Act Amendments of 1990, and (E) whose company-wide fossil-fuel sulfur dioxide emissions rate has declined 40 per centum or more from 1980 to 1988, allowances in an amount equal to the difference between (i) the number of allowances that would be allocated for the unit pursuant to the emissions limitation requirements of subsection (b)(1) adjusted to reflect the unit's annual average fuel consumption on a Btu basis for any three consecutive years between 1980 and 1989 (inclusive) as elected by the owner or operator and (ii)

the number of allowances allocated for the unit pursuant to the emissions limitation requirements of subsection (b)(1): Provided, That the number of allowances allocated pursuant to this paragraph shall not exceed an annual total of 5,000. If necessary to meeting the 5,000-allowance restriction imposed in the last clause of the preceding sentence the Administrator shall reduce, pro rata, the additional allowances allocated to each unit pursuant to this paragraph.

"(j) CERTAIN MUNICIPALLY OWNED POWER PLANTS.—Beginning January 1, 2000, in addition to allowances allocated pursuant to this section and section 403(a)(1) as basic Phase II allowance allocations, the Administrator shall allocate annually for each existing municipally owned oil and gas-fired utility unit with nameplate capacity equal to, or less than, 40 MWe, the lesser of whose actual or allowable 1985 sulfur dioxide emission rate is less than 1.20 lbs/mmBtu, allowances in an amount equal to the product of the unit's annual fuel consumption on a Btu basis at a 60 percent capacity factor multiplied by the lesser of its allowable 1985 emission rate or its actual 1985 emission rate, divided by 2,000.

"SEC. 406. ALLOWANCES FOR STATES WITH EMISSIONS RATES AT OR BELOW 0.80 LBS/MMBTU.

"(a) ELECTION OF GOVERNOR.—In addition to basic Phase II allowance allocations, upon the election of the Governor of any State, with a 1985 state-wide annual sulfur dioxide emissions rate equal to or less than, 0.80 lbs/mmBtu, averaged over all fossil fuel-fired utility steam generating units, beginning January 1, 2000, and for each calendar year thereafter until and including 2009, the Administrator shall allocate, in lieu of other Phase II bonus allowance allocations, allowances from the reserve created pursuant to section 405(a)(2) to all such units in the State in an amount equal to 125,000 multiplied by the unit's pro rata share of electricity generated in calendar year 1985 at fossil fuel-fired utility steam units in all States eligible for the election.

"(b) NOTIFICATION OF ADMINISTRATOR.—Pursuant to section 403(a)(1), each Governor of a State eligible to make an election under paragraph (a) shall notify the Administrator of such election. In the event that the Governor of any such State fails to notify the Administrator of the Governor's elections, the Administrator shall allocate allowances pursuant to section 405.

"(c) ALLOWANCES AFTER JANUARY 1, 2010.—After January 1, 2010, the Administrator shall allocate allowances to units subject to the provisions of this section pursuant to section 405.

"SEC. 407. NITROGEN OXIDES EMISSION REDUCTION PROGRAM.

"(a) APPLICABILITY.—On the date that a coal-fired utility unit becomes an affected unit pursuant to sections 404, 405, 409, or on the date a unit subject to the provisions of section 404(d) or 409(b), must meet the SO_2 reduction requirements, each such unit shall become an affected unit for purposes of this section and shall be subject to the emission limitations for nitrogen oxides set forth herein.

"(b) EMISSION LIMITATIONS.—(1) Not later than eighteen months after enactment of the Clean Air Act Amendments of 1990, the Administrator shall by regulation establish annual allowable emission limitations for nitrogen oxides for the types of utility boilers listed

below, which limitations shall not exceed the rates listed below: Provided, That the Administrator may set a rate higher than that listed for any type of utility boiler if the Administrator finds that the maximum listed rate for that boiler type cannot be achieved using low NOx burner technology. The maximum allowable emission rates are as follows:

"(A) for tangentially fired boilers, 0.45 lb/mmBtu;

"(B) for dry bottom wall-fired boilers (other than units applying cell burner technology), 0.50 lb/mmBtu.

After January 1, 1995, it shall be unlawful for any unit that is an affected unit on that date and is of the type listed in this paragraph to emit nitrogen oxides in excess of the emission rates set by the Administrator pursuant to this paragraph.

"(2) Not later than January 1, 1997, the Administrator shall, by regulation, establish allowable emission limitations on a lb/mmBtu, annual average basis, for nitrogen oxides for the following types of utility boilers:

"(A) wet bottom wall-fired boilers;

"(B) cyclones;

"(C) units applying cell burner technology.

"(D) all other types of utility boilers.

The Administrator shall base such rates on the degree of reduction achievable through the retrofit application of the best system of continuous emission reduction, taking into account available technology, costs and energy and environmental impacts; and which is comparable to the costs of nitrogen oxides controls set pursuant to subsection (b)(1). Not later than January 1, 1997, the Administrator may revise the applicable emission limitations for tangentially fired and dry bottom, wall-fired boilers (other than cell burners) to be more stringent if the Administrator determines that more effective low NOx burner technology is available: Provided, That, no unit that is an affected unit pursuant to section 404 and that is subject to the requirements of subsection (b)(1), shall be subject to the revised emission limitations, if any.

"(c) REVISED PERFORMANCE STANDARDS.—(1) Not later than January 1, 1993, the Administrator shall propose revised standards of performance to section 111 for nitrogen oxides emissions from fossil-fuel fired steam generating units, including both electric utility and nonutility units. Not later than January 1, 1994, the Administrator shall promulgate such revised standards of performance. Such revised standards of performance shall reflect improvements in methods for the reduction of emissions of oxides of nitrogen.

"(d) ALTERNATIVE EMISSION LIMITATIONS.—The permitting authority shall, upon request of an owner or operator of a unit subject to this section, authorize an emission limitation less stringent than the applicable limitation established under subsection (b)(1) or (b)(2) upon a determination that—

"(1) a unit subject to subsection (b)(1) cannot meet the applicable limitation using low NO_x burner technology; or

"(2) a unit subject to subsection (b)(2) cannot meet the applicable rate using the technology on which the Administrator based the applicable emission limitation.

The permitting authority shall base such determination upon a showing satisfactory to the permitting authority, in accordance with

regulations established by the Administrator not later than eighteen months after enactment of the Clean Air Act Amendments of 1990, that the owner or operator—

"(1) has properly installed appropriate control equipment designed to meet the applicable emission rate;

"(2) has properly operated such equipment for a period of fifteen months (or such other period of time as the Administrator determines through the regulations), and provides operating and monitoring data for such period demonstrating that the unit cannot meet the applicable emission rate; and

"(3) has specified an emission rate that such unit can meet on an annual average basis.

The permitting authority shall issue an operating permit for the unit in question, in accordance with section 408 and part B of title III—

"(i) that permits the unit during the demonstration period referred to in subparagraph (2) above, to emit at a rate in excess of the applicable emission rate;

"(ii) at the conclusion of the demonstration period to revise the operating permit to reflect the alternative emission rate demonstrated in paragraphs (2) and (3) above.

Units subject to subsection (b)(1) for which an alternative emission limitation is established shall not be required to install any additional control technology beyond low NO_x burners. Nothing in this section shall preclude an owner or operator from installing and operating an alternative NO_x control technology capable of achieving the applicable emission limitation. If the owner or operator of a unit subject to the emissions limitation requirements of subsection (b)(1) demonstrates to the satisfaction of the Administrator that the technology necessary to meet such requirements is not in adequate supply to enable its installation and operation at the unit, consistent with system reliability, by January 1, 1995, then the Administrator shall extend the deadline for compliance for the unit by a period of 15 months. Any owner or operator may petition the Administrator to make a determination under the previous sentence. The Administrator shall grant or deny such petition within 3 months of submittal.

"(e) EMISSIONS AVERAGING.—In lieu of complying with the applicable emission limitations under subsection (b) (1), (2), or (d), the owner or operator of two or more units subject to one or more of the applicable emission limitations set pursuant to these sections, may petition the permitting authority for alternative contemporaneous annual emission limitations for such units that ensure that (1) the actual annual emission rate in pounds of nitrogen oxides per million Btu averaged over the units in question is a rate that is less than or equal to (2) the Btu-weighted average annual emission rate for the same units if they had been operated, during the same period of time, in compliance with limitations set in accordance with the applicable emission rates set pursuant to subsections (b) (1) and (2).

"If the permitting authority determines, in accordance with regulations issued by the Administrator not later than eighteen months after enactment of the Clean Air Act Amendments of 1990; that the conditions in the paragraph above can be met, the permitting au-

thority shall issue operating permits for such units, in accordance with section 408 and part B of title III, that allow alternative contemporaneous annual emission limitations. Such emission limitations shall only remain in effect while both units continue operation under the conditions specified in their respective operating permits.

"SEC. 408. PERMITS AND COMPLIANCE PLANS.

"(a) PERMIT PROGRAM.—The provisions of this title shall be implemented, subject to section 403, by permits issued to units subject to this title (and enforced) in accordance with the provisions of title V, as modified by this title. Any such permit issued by the Administrator, or by a State with an approved permit program, shall prohibit—

"(1) annual emissions of sulfur dioxide in excess of the number of allowances to emit sulfur dioxide the owner or operator, or the designated representative of the owners or operators, of the unit hold for the unit,

"(2) exceedances of applicable emissions rates,

"(3) the use of any allowance prior to the year for which it was allocated, and

"(4) contravention of any other provision of the permit.

Permits issued to implement this title shall be issued for a period of 5 years, notwithstanding title V. No permit shall be issued that is inconsistent with the requirements of this title, and title V as applicable.

"(b) COMPLIANCE PLAN.—Each initial permit application shall be accompanied by a compliance plan for the source to comply with its requirements under this title. Where an affected source consists of more than one affected unit, such plan shall cover all such units, and for purposes of section 502(c), such source shall be considered a 'facility'. Nothing in this section regarding compliance plans or in title V shall be construed as affecting allowances. Except as provided under subsection (c)(1)(B), submission of a statement by the owner or operator, or the designated representative of the owners and operators, of a unit subject to the emissions limitation requirements of sections 404, 405, and 407, that the unit will meet the applicable emissions limitation requirements of such sections in a timely manner or that, in the case of the emissions limitation requirements of sections 404 and 405, the owners and operator will hold allowances to emit not less than the total annual emissions of the unit, shall be deemed to meet the proposed and approved compliance planning requirements of this section and title V, except that, for any unit that will meet the requirements of this title by means of an alternative method of compliance authorized under section 404 (b), (c), (d), or (f) section 407 (d) or (e), section 409 and section 410, the proposed and approved compliance plan, permit application and permit shall include, pursuant to regulations promulgated by the Administrator, for each alternative method of compliance a comprehensive description of the schedule and means by which the unit will rely on one or more alternative methods of compliance in the manner and time authorized under this title. Recordation by the Administrator of transfers of allowances shall amend automatically all applicable proposed or approved permit applications, compliance plans and permits. The Administrator may also require—

"(1) for a source, a demonstration of attainment of national ambient air quality standards, and

"(2) from the owner or operator of two or more affected sources, an integrated compliance plan providing an overall plan for achieving compliance at the affected sources.

"(c) FIRST PHASE PERMITS.—The Administrator shall issue permits to affected sources under sections 404 and 407.

"(1) PERMIT APPLICATION AND COMPLIANCE PLAN.—(A) Not later than 27 months after the date of the enactment of the Clean Air Act Amendments of 1990, the designated representative of the owners or operators, or the owner and operator, of each affected source under sections 404 and 407 shall submit a permit application and compliance plan for that source in accordance with regulations issued by the Administrator under paragraph (3). The permit application and the compliance plan shall be binding on the owner or operator or the designated representative of owners and operators for purposes of this title and section 402(a), and shall be enforceable in lieu of a permit until a permit is issued by the Administrator for the source.

"(B) In the case of a compliance plan for an affected source under sections 404 and 407 for which the owner or operator proposes to meet the requirements of that section by reducing utilization of the unit as compared with its baseline or by shutting down the unit, the owner or operator shall include in the proposed compliance plan a specification of the unit or units that will provide electrical generation to compensate for the reduced output at the affected source, or a demonstration that such reduced utilization will be accomplished through energy conservation or improved unit efficiency. The unit to be used for such compensating generation, which is not otherwise an affected unit under sections 404 and 407, shall be deemed an affected unit under section 404, subject to all of the requirements for such units under this title, except that allowances shall be allocated to such compensating unit in the amount of an annual limitation equal to the product of the unit's baseline multiplied by the lesser of the unit's actual 1985 emissions rate or its allowable 1985 emissions rate, divided by 2,000.

"(2) EPA ACTION ON COMPLIANCE PLANS.—The Administrator shall review each proposed compliance plan to determine whether it satisfies the requirements of this title, and shall approve or disapprove such plan within 6 months after receipt of a complete submission. If a plan is disapproved, it may be resubmitted for approval with such changes as the Administrator shall require consistent with the requirements of this title and within such period as the Administrator prescribes as part of such disapproval.

"(3) REGULATIONS; ISSUANCE OF PERMITS.—Not later than 18 months after the date of the enactment of the Clean Air Act Amendments of 1990, the Administrator shall promulgate regulations, in accordance with title V, to implement a Federal permit program to issue permits for affected sources under this title. Following promulgation, the Administrator shall issue a permit to implement the requirements of section 404 and the allowances provided under section 403 to the owner or operator of

each affected source under section 404. Such a permit shall supersede any permit application and compliance plan submitted under paragraph (1).

"(4) FEES.—During the years 1995 through 1999 inclusive, no fee shall be required to be paid under section 502(b)(3) or under section 110(a)(2)(L) with respect to emissions from any unit which is an affected unit under section 404.

"(d) SECOND PHASE PERMITS.—(1) To provide for permits for (A) new electric utility steam generating units required under section 403(e) to have allowances, (B) affected units or sources under section 405, and (C) existing units subject to nitrogen oxide emission reductions under section 407, each State in which one or more such units or sources are located shall submit in accordance with title V, a permit program for approval as provided by that title. Upon approval of such program, for the units or sources subject to such approved program the Administrator shall suspend the issuance of permits as provided in title V.

"(2) The owner or operator or the designated representative of each affected source under section 405 shall submit a permit application and compliance plan for that source to the permitting authority, not later than January 1, 1996.

"(3) Not later than December 31, 1997, each State with an approved permit program shall issue permits to the owner or operator, or the designated representative of the owners and operators, of affected sources under section 405 that satisfy the requirements of title V and this title and that submitted to such State a permit application and compliance plan pursuant to paragraph (2). In the case of a State without an approved permit program by July 1, 1996, the Administrator shall, not later than January 1, 1998, issue a permit to the owner or operator or the designated representative of each such affected source. In the case of affected sources for which applications and plans are timely received under paragraph (2), the permit application and the compliance plan, including amendments thereto, shall be binding on the owner or operator or the designated representative of the owners or operators and shall be enforceable as a permit for purposes of this title and title V until a permit is issued by the permitting authority for the affected source. The provisions of section 558(c) of title V of the United States Code (relating to renewals) shall apply to permits issued by a permitting authority under this title and title V.

"(4) The permit issued in accordance with this subsection for an affected source shall provide that the affected units at the affected source may not emit an annual tonnage of sulfur dioxide in excess of the number of allowances to emit sulfur dioxide the owner or operator or designated representative hold for the unit.

"(e) NEW UNITS.—The owner or operator of each source that includes a new electric utility steam generating unit shall submit a permit application and compliance plan to the permitting authority not later than 24 months before the later of (1) January 1, 2000, or (2) the date on which the unit commences operation. The permitting authority shall issue a permit to the owner or operator, or the designated representative thereof, of the unit that satisfies the requirements of title V and this title.

"(f) UNITS SUBJECT TO CERTAIN OTHER LIMITS.—The owner or operator, or designated representative thereof, of any unit subject to an emission rate requirement under section 407 shall submit a permit application and compliance plan for such unit to the permitting authority, not later than January 1, 1998. The permitting authority shall issue a permit to the owner or operator that satisfies the requirements of title V and this title, including any appropriate monitoring and reporting requirements.

"(g) AMENDMENT OF APPLICATION AND COMPLIANCE PLAN.—At any time after the submission of an application and compliance plan under this section, the applicant may submit a revised application and compliance plan, in accordance with the requirements of this section. In considering any permit application and compliance plan under this title, the permitting authority shall ensure coordination with the applicable electric ratemaking authority, in the case of regulated utilities, and with unregulated public utilities.

"(h) PROHIBITION.—(1) It shall be unlawful for an owner or operator, or designated representative, required to submit a permit application or compliance plan under this title to fail to submit such application or plan in accordance with the deadlines specified in this section or to otherwise fail to comply with regulations implementing this section.

"(2) It shall be unlawful for any person to operate any source subject to this title except in compliance with the terms and requirements of a permit application and compliance plan (including amendments thereto) or permit issued by the Administrator or a State with an approved permit program. For purposes of this subsection, compliance, as provided in section 504(f), with a permit issued under title V which complies with this title for sources subject to this title shall be deemed compliance with this subsection as well as section 502(a).

"(3) In order to ensure reliability of electric power, nothing in this title or title V shall be construed as requiring termination of operations of an electric utility steam generating unit for failure to have an approved permit or compliance plan, except that any such unit may be subject to the applicable enforcement provisions of section 113.

"(i) MULTIPLE OWNERS.—No permit shall be issued under this section to an affected unit until the designated representative of the owners or operators has filed a certificate of representation with regard to matters under this title, including the holding and distribution of allowances and the proceeds of transactions involving allowances. Where there are multiple holders of a legal or equitable title to, or a leasehold interest in, such a unit, or where a utility or industrial customer purchases power from an affected unit (or units) under life-of-the-unit, firm power contractual arrangements, the certificate shall state (1) that allowances and the proceeds of transactions involving allowances will be deemed to be held or distributed in proportion to each holder's legal, equitable, leasehold, or contractual reservation or entitlement, or (2) if such multiple holders have expressly provided for a different distribution of allowances by contract, that allowances and the proceeds of transactions involving allowances will be deemed to be held or distributed in accordance with the contract. A passive lessor, or a person who has an equitable

interest through such lessor, whose rental payments are not based, either directly or indirectly, upon the revenues or income from the affected unit shall not be deemed to be a holder of a legal, equitable, leasehold, or contractual interest for the purpose of holding or distributing allowances as provided in this subsection, during either the term of such leasehold or thereafter, unless expressly provided for in the leasehold agreement. Except as otherwise provided in this subsection, where all legal or equitable title to or interest in an affected unit is held by a single person, the certification shall state that all allowances received by the unit are deemed to be held for that person.

"SEC. 409. REPOWERED SOURCES.

"(a) AVAILABILITY.—Not later than December 31, 1997, the owner or operator of an existing unit subject to the emissions limitation requirements of section 405 (b) and (c) may demonstrate to the permitting authority that one or more units will be repowered with a qualifying clean coal technology to comply with the requirements under section 405. The owner or operator shall, as part of any such demonstration, provide, not later than January 1, 2000, satisfactory documentation of a preliminary design and engineering effort for such repowering and an executed and binding contract for the majority of the equipment to repower such unit and such other information as the Administrator may require by regulation. The replacement of an existing utility unit with a new utility unit using a repowering technology referred to in section 402(2) which is located at a different site, shall be treated as repowering of the existing unit for purposes of this title, if—

"(1) the replacement unit is designated by the owner or operator to replace such existing unit, and

"(2) the existing unit is retired from service on or before the date on which the designated replacement unit enters commercial operation.

"(b) EXTENSION.—(1) An owner or operator satisfying the requirements of subsection (a) shall be granted an extension of the emission limitation requirement compliance date for that unit from January 1, 2000, to December 31, 2003. The extension shall be specified in the permit issued to the source under section 408, together with any compliance schedule and other requirements necessary to meet second phase requirements by the extended date. Any unit that is granted an extension under this section shall not be eligible for a waiver under section 111(j) of this Act, and shall continue to be subject to requirements under this title as if it were a unit subject to section 405.

"(2) If (A) the owner or operator of an existing unit has been granted an extension under paragraph (1) in order to repower such unit with a clean coal unit, and (B) such owner or operator demonstrates to the satisfaction of the Administrator that the repowering technology to be utilized by such unit has been properly constructed and tested on such unit, but nevertheless has been unable to achieve the emission reduction limitations and is economically or technologically infeasible, such existing unit may be retrofitted or repowered with equipment or facilities utilizing another clean coal technology or other available control technology.

"(c) ALLOWANCES.—(1) For the period of the extension under this section, the Administrator shall allocate to the owner or operator of the affected unit, annual allowances for sulfur dioxide equal to the affected unit's baseline multiplied by the lesser of the unit's federally approved State Implementation Plan emissions limitation or its actual emission rate for 1995 in lieu of any other allocation. Such allowances may not be transferred or used by any other source to meet emission requirements under this title. The source owner or operator shall notify the Administrator sixty days in advance of the date on which the affected unit for which the extension has been granted is to be removed from operation to install the repowering technology.

"(2) Effective on that date, the unit shall be subject to the requirements of section 405. Allowances for the year in which the unit is removed from operation to install the repowering technology shall be calculated as the product of the unit's baseline multiplied by 1.20 lbs/mmBtu, divided by 2,000, and prorated accordingly, and are transferable.

"(3) Allowances for such existing utility units for calendar years after the year the repowering is complete shall be calculated as the product of the existing unit's baseline multiplied by 1.20 lbs/mmBtu, divided by 2,000.

"(4) Notwithstanding the provisions of section 403(a) and (e), allowances shall be allocated under this section for a designated replacement unit which replaces an existing unit (as provided in the last sentence of subsection (a)) in lieu of any further allocations of allowances for the existing unit.

"(5) For the purpose of meeting the aggregate emissions limitation requirement set forth in section 403(a)(1), the units with an extension under this subsection shall be treated in each calendar year during the extension period as holding allowances allocated under paragraph (3).

"(d) CONTROL REQUIREMENTS.—Any unit qualifying for an extension under this section that does not increase actual hourly emissions for any pollutant regulated under the Act shall not be subject to any standard of performance under section 111 of this Act. Notwithstanding the provisions of this subsection, no new unit (1) designated as a replacement for an existing unit, (2) qualifying for the extension under subsection (b), and (3) located at a different site than the existing unit shall receive an exemption from the requirements imposed under section 111.

"(e) EXPEDITED PERMITTING.—State permitting authorities and, where applicable, the Administrator, are encouraged to give expedited consideration to permit applications under parts C and D of title I of this Act for any source qualifying for an extension under this section.

"(f) PROHIBITION.—It shall be unlawful for the owner or operator of a repowered source to fail to comply with the requirement of this section, or any regulations of permit requirements to implement this section, including the prohibition against emitting sulfur dioxide in excess of allowances held.

"SEC. 410. ELECTION FOR ADDITIONAL SOURCES.

"(a) APPLICABILITY.—The owner or operator of any unit that is not, nor will become, an affected unit under section 403(e), 404, or 405, or that is a process source under subsection (d), that emits sulfur dioxide, may elect to designate that unit or source to become an affected unit and to receive allowances under this title. An election shall be submitted to the Administrator for approval, along with a permit application and proposed compliance plan in accordance with section 408. The Administrator shall approve a designation that meets the requirements of this section, and such designated unit, or source, shall be allocated allowances, and be an affected unit for purposes of this title.

"(b) ESTABLISHMENT OF BASELINE.—The baseline for a unit designated under this section shall be established by the Administrator by regulation, based on fuel consumption and operating data for the unit for calendar years 1985, 1986, and 1987, or if such data is not available, the Administrator may prescribe a baseline based on alternative representative data.

"(c) EMISSION LIMITATIONS.—Annual emissions limitations for sulfur dioxide shall be equal to the product of the baseline multiplied by the lesser of the unit's 1985 actual or allowable emission rate in lbs/mmBtu, or, if the unit did not operate in 1985, by the lesser of the unit's actual or allowable emission rate for a calendar year after 1985 (as determined by the Administrator), divided by 2,000.

"(d) PROCESS SOURCES.—Not later than 18 months after enactment of the Clean Air Act Amendments of 1990, the Administrator shall establish a program under which the owner or operator of a process source that emits sulfur dioxide may elect to designate that source as an affected unit for the purpose of receiving allowances under this title. The Administrator shall, by regulation, define the sources that may be designated; specify the emissions limitation; specify the operating, emission baseline, and other data requirements; prescribe CEMS or other monitoring requirements; and promulgate permit, reporting, and any other requirements necessary to implement such a program.

"(e) ALLOWANCES AND PERMITS.—The Administrator shall issue allowances to an affected unit under this section in an amount equal to the emissions limitation calculated under subsection (c) or (d), in accordance with section 403. Such allowance may be used in accordance with, and shall be subject to, the provisions of section 403. Affected sources under this section shall be subject to the requirements of sections 403, 408, 411, 412, 413, and 414.

"(f) LIMITATION.—Any unit designated under this section shall not transfer or bank allowances produced as a result of reduced utilization or shutdown, except that, such allowances may be transferred or carried forward for use in subsequent years to the extent that the reduced utilization or shutdown results from the replacement of thermal energy from the unit designated under this section, with thermal energy generated by any other unit or units subject to the requirements of this title, and the designated unit's allowances are transferred or carried forward for use at such other replacement unit or units. In no case may the Administrator allocate to a source designated under this section allowances in an amount greater than

the emissions resulting from operation of the source in full compliance with the requirements of this Act. No such allowances shall authorize operation of a unit in violation of any other requirements of this Act.

"(g) IMPLEMENTATION.—The Administrator shall issue regulations to implement this section not later than eighteen months after enactment of the Clean Air Act Amendments of 1990.

"(h) SMALL DIESEL REFINERIES.—The Administrator shall issue allowances to owners or operators of small diesel refineries who produce diesel fuel after October 1, 1993, meeting the requirements of subsection 211(i) of this Act.

"(1) ALLOWANCE PERIOD.—Allowances may be allocated under this subsection only for the period from October 1, 1993, through December 31, 1999.

"(2) ALLOWANCE DETERMINATION.—The number of allowances allocated pursuant to this paragraph shall equal the annual number of pounds of sulfur dioxide reduction attributable to desulfurization by a small refinery divided by 2,000. For the purposes of this calculation, the concentration of sulfur removed from diesel fuel shall be the difference between 0.274 percent (by weight) and 0.050 percent (by weight).

"(3) REFINERY ELIGIBILITY.—As used in this subsection, the term 'small refinery' shall mean a refinery or portion of a refinery—

"(A) which, as of the date of enactment of the Clean Air Act Amendments of 1990, has bona fide crude oil throughput of less than 18,250,000 barrels per year, as reported to the Department of Energy, and

"(B) which, as of the date of enactment of the Clean Air Act Amendments of 1990, is owned or controlled by a refiner with a total combined bona fide crude oil throughput of less than 50,187,500 barrels per year, as reported to the Department of Energy.

"(4) LIMITATION PER REFINERY.—The maximum number of allowances that can be annually allocated to a small refinery pursuant to this subsection is one thousand and five hundred.

"(5) LIMITATION ON TOTAL.—In any given year, the total number of allowances allocated pursuant to this subsection shall not exceed thirty-five thousand.

"(6) REQUIRED CERTIFICATION.—The Administrator shall not allocate any allowances pursuant to this subsection unless the owner or operator of a small diesel refinery shall have certified, at a time and in a manner prescribed by the Administrator, that all motor diesel fuel produced by the refinery for which allowances are claimed, including motor diesel fuel for off-highway use, shall have met the requirements of subsection 211(i) of this Act.

"SEC. 411. EXCESS EMISSIONS PENALTY.

"(a) EXCESS EMISSIONS PENALTY.—The owner or operator of any unit or process source subject to the requirements of sections 403, 404, 405, 406, 407 or 409, or designated under section 410, that emits sulfur dioxide or nitrogen oxides for any calendar year in excess of the unit's emissions limitation requirement or, in the case of sulfur

dioxide, of the allowances the owner or operator holds for use for the unit for that calendar year shall be liable for the payment of an excess emissions penalty, except where such emissions were authorized pursuant to section 110(f). That penalty shall be calculated on the basis of the number of tons emitted in excess of the unit's emissions limitation requirement or, in the case of sulfur dioxide, of the allowances the operator holds for use for the unit for that year, multiplied by $2,000. Any such penalty shall be due and payable without demand to the Administrator as provided in regulations to be issued by the Administrator by no later than eighteen months after the date of enactment of the Clean Air Act Amendments of 1990. Any such payment shall be deposited in the United States Treasury pursuant to the Miscellaneous Receipts Act. Any penalty due and payable under this section shall not diminish the liability of the unit's owner or operator for any fine, penalty or assessment against the unit for the same violation under any other section of this Act.

"(b) EXCESS EMISSIONS OFFSET.—The owner or operator of any affected source that emits sulfur dioxide during any calendar year in excess of the unit's emissions limitation requirement or of the allowances held for the unit for the calendar year, shall be liable to offset the excess emissions by an equal tonnage amount in the following calendar year, or such longer period as the Administrator may prescribe. The owner or operator of the source shall, within sixty days after the end of the year in which the excess emissions occurred, submit to the Administrator, and to the State in which the source is located, a proposed plan to achieve the required offsets. Upon approval of the proposed plan by the Administrator, as submitted, modified or conditioned, the plan shall be deemed at a condition of the operating permit for the unit without further review or revision of the permit. The Administrator shall also deduct allowances equal to the excess tonnage from those allocated for the source for the calendar year, or succeeding years during which offsets are required, following the year in which the excess emissions occurred.

"(c) PENALTY ADJUSTMENT.—The Administrator shall, by regulation, adjust the penalty specified in subsection (a) for inflation, based on the Consumer Price Index, on the date of enactment and annually thereafter.

"(d) PROHIBITION.—It shall be unlawful for the owner or operator of any source liable for a penalty and offset under this section to fail (1) to pay the penalty under subsection (a), (2) to provide, and thereafter comply with, a compliance plan as required by subsection (b), or (3) to offset excess emissions as required by subsection (b).

"(e) SAVINGS PROVISION.—Nothing in this title shall limit or otherwise affect the application of section 113, 114, 120, or 304 except as otherwise explicitly provided in this title.

"SEC. 412. MONITORING, REPORTING, AND RECORDKEEPING REQUIREMENTS.

"(a) APPLICABILITY.—The owner and operator of any source subject to this title shall be required to install and operate CEMS on each affected unit at the source, and to quality assure the data for sulfur dioxide, nitrogen oxides, opacity and volumetric flow at each such unit. The Administrator shall, by regulations issued not later

than eighteen months after enactment of the Clean Air Act Amendments of 1990, specify the requirements for CEMS, for any alternative monitoring system that is demonstrated as providing information with the same precision, reliability, accessibility, and timeliness as that provided by CEMS, and for recordkeeping and reporting of information from such systems. Such regulations may include limitations or the use of alternative compliance methods by units equipped with an alternative monitoring system as may be necessary to preserve the orderly functioning of the allowance system, and which will ensure the emissions reductions contemplated by this title. Where 2 or more units utilize a single stack, a separate CEMS shall not be required for each unit, and for such units the regulations shall require that the owner or operator collect sufficient information to permit reliable compliance determinations for each such unit.

"(b) FIRST PHASE REQUIREMENTS.—Not later than thirty-six months after enactment of the Clean Air Act Amendments of 1990, the owner or operator of each affected unit under section 404, including, but not limited to, units that become affected units pursuant to subsections (b) and (c) and eligible units under subsection (d), shall install and operate CEMS, quality assure the data, and keep records and reports in accordance with the regulations issued under subsection (a).

"(c) SECOND PHASE REQUIREMENTS.—Not later than January 1, 1995, the owner or operator of each affected unit that has not previously met the requirements of subsections (a) and (b) shall install and operate CEMS, quality assure the data, and keep records and reports in accordance with the regulations issued under subsection (a). Upon commencement of commercial operation of each new utility unit, the unit shall comply with the requirements of subsection (a).

"(d) UNAVAILABILITY OF EMISSIONS DATA.—If CEMS data or data from an alternative monitoring system approved by the Administrator under subsection (a) is not available for any affected unit during any period of a calendar year in which such data is required under this title, and the owner or operator cannot provide information, satisfactory to the Administrator, on emissions during that period, the Administrator shall deem the unit to be operating in an uncontrolled manner during the entire period for which the data was not available and shall, by regulation which shall be issued not later than eighteen months after enactment of the Clean Air Act Amendments of 1990, prescribe means to calculate emissions for that period. The owner or operator shall be liable for excess emissions fees and offsets under section 411 in accordance with such regulations. Any fee due and payable under this subsection shall not diminish the liability of the unit's owner or operator for any fine, penalty, fee or assessment against the unit for the same violation under any other section of this Act.

"(e) PROHIBITION.—It shall be unlawful for the owner or operator of any source subject to this title to operate a source without complying with the requirements of this section, and any regulations implementing this section.

"SEC. 413. GENERAL COMPLIANCE WITH OTHER PROVISIONS.

"Except as expressly provided, compliance with the requirements of this title shall not exempt or exclude the owner or operator of any source subject to this title from compliance with any other applicable requirements of this Act.

"SEC. 414. ENFORCEMENT.

"It shall be unlawful for any person subject to this title to violate any prohibition of, requirement of, or regulation promulgated pursuant to this title shall be a violation of this Act. In addition to the other requirements and prohibitions provided for in this title, the operation of any affected unit to emit sulfur dioxide in excess of allowances held for such unit shall be deemed a violation, with each ton emitted in excess of allowances held constituting a separate violation.

"SEC. 415. CLEAN COAL TECHNOLOGY REGULATORY INCENTIVES.

"(a) DEFINITION.—For purposes of this section, 'clean coal technology' means any technology, including technologies applied at the precombustion, combustion, or post combustion stage, at a new or existing facility which will achieve significant reductions in air emissions of sulfur dioxide or oxides of nitrogen associated with the utilization of coal in the generation of electricity, process steam, or industrial products, which is not in widespread use as of the date of enactment of this title.

"(b) REVISED REGULATIONS FOR CLEAN COAL TECHNOLOGY DEMONSTRATIONS.—

"(1) APPLICABILITY.—This subsection applies to physical or operational changes to existing facilities for the sole purpose of installation, operation, cessation, or removal of a temporary or permanent clean coal technology demonstration project. For the purposes of this section, a clean coal technology demonstration project shall mean a project using funds appropriated under the heading 'Department of Energy—Clean Coal Technology', up to a total amount of $2,500,000,000 for commercial demonstration of clean coal technology, or similar projects funded through appropriations for the Environmental Protection Agency. The Federal contribution for a qualifying project shall be at least 20 percent of the total cost of the demonstration project.

"(2) TEMPORARY PROJECTS.—Installation, operation, cessation, or removal of a temporary clean coal technology demonstration project that is operated for a period of five years or less, and which complies with the State implementation plans for the State in which the project is located and other requirements necessary to attain and maintain the national ambient air quality standards during and after the project is terminated, shall not subject such facility to the requirements of section 111 or part C or D of title I.

"(3) PERMANENT PROJECTS.—For permanent clean coal technology demonstration projects that constitute repowering as defined in section 402(l) of this title, any qualifying project shall not be subject to standards of performance under section 111 or to the review and permitting requirements of part C for any pollutant the potential emissions of which will not increase as a result of the demonstration project.

"(4) EPA REGULATIONS.—Not later than 12 months after the date of enactment, the Administrator shall promulgate regulations or interpretive rulings to revise requirements under section 111 and parts C and D, as appropriate, to facilitate projects consistent in this subsection. With respect to parts C and D, such regulations or rulings shall apply to all areas in which EPA is the permitting authority. In those instances in which the State is the permitting authority under part C or D, any State may adopt and submit to the Administrator for approval revisions to its implementation plan to apply the regulations or rulings promulgated under this subsection.

"(c) EXEMPTION FOR REACTIVATION OF VERY CLEAN UNITS.—Physical changes or changes in the method of operation associated with the commencement of commercial operations by a coal-fired utility unit after a period of discontinued operation shall not subject the unit to the requirements of section 111 or part C of the Act where the unit (1) has not been in operation for the two-year period prior to the enactment of the Clean Air Act Amendments of 1990, and the emissions from such unit continue to be carried in the permitting authority's emissions inventory at the time of enactment, (2) was equipped prior to shut-down with a continuous system of emissions control that achieves a removal efficiency for sulfur dioxide of no less than 85 percent and a removal efficiency for particulates of no less than 98 percent, (3) is equipped with low-NO_x burners prior to the time of commencement, and (4) is otherwise in compliance with the requirements of this Act.

"SEC. 416. CONTINGENCY GUARANTEE; AUCTIONS, RESERVE.

"(a) DEFINITIONS.—For purposes of this section—

"(1) The term 'independent power producer' means any person who owns or operates, in whole or in part, one or more new independent power production facilities.

"(2) The term 'new independent power production facility" means a facility that—

"(A) is used for the generation of electric energy, 80 percent or more of which is sold at wholesale;

"(B) is nonrecourse project-financed (as such term is defined by the Secretary of Energy within 3 months of the date of the enactment of the Clean Air Act Amendments of 1990);

"(C) does not generate electric energy sold to any affiliate (as defined in section 2(a)(11) of the Public Utility Holding Company Act of 1935) of the facility's owner or operator unless the owner or operator of the facility demonstrates that it cannot obtain allowances from the affiliate; and

"(D) is a new unit required to hold allowances under this title.

"(3) The term 'required allowances' means the allowances required to operate such unit for so much of the unit's useful life as occurs after January 1, 2000.

"(b) SPECIAL RESERVE OF ALLOWANCES.—Within 36 months after the date of the enactment of the Clean Air Act Amendments of 1990, the Administrator shall promulgate regulations establishing a Special Allowance Reserve containing allowances to be sold under

this section. For purposes of establishing the Special Allowance Reserve, the Administrator shall withhold—

"(1) 2.8 percent of the allocation of allowances for each year from 1995 through 1999 inclusive; and

"(2) 2.8 percent of the basic Phase II allowance allocation of allowances for each year beginning in the year 2000

which would (but for this subsection) be issued for each affected unit at an affected source. The Administrator shall record such withholding for purposes of transferring the proceeds of the allowance sales under this subsection. The allowances so withheld shall be deposited in the Reserve under this section.

"(c) DIRECT SALE AT $1,500 PER TON.—

"(1) SUBACCOUNT FOR DIRECT SALES.—In accordance with regulations under this section, the Administrator shall establish a Direct Sale Subaccount in the Special Allowance Reserve established under this section. The Direct Sale Subaccount shall contain allowances in the amount of 50,000 tons per year for each year beginning in the year 2000.

"(2) SALES.—Allowances in the subaccount shall be offered for direct sale to any person at the times and in the amounts specified in table 1 at a price of $1,500 per allowance, adjusted by the Consumer Price Index in the same manner as provided in paragraph (3). Requests to purchase allowances from the Direct Sale Subaccount established under paragraph (1) shall be approved in the order of receipt until no allowances remain in such subaccount, except that an opportunity to purchase such allowances shall be provided to the independent power producers referred to in this subsection before such allowances are offered to any other person. Each applicant shall be required to pay 50 percent of the total purchase price of the allowances within 6 months after the approval of the request to purchase. The remainder shall be paid on or before the transfer of the allowances.

TABLE 1.—NUMBER OF ALLOWANCES AVAILABLE FOR SALE AT $1,500 PER TON

Year of Sale	Spot Sale (same year)	Advance Sale
1993–1999		25,000
2000 and after	25,000	25,000

Allowances sold in the spot sale in any year are allowances which may only be used in that year (unless banked for use in a later year.) Allowances sold in the advance sale in any year are allowances which may only be used in the 7th year after the year in which they are first offered for sale (unless banked for use in a later year.)

"(3) ENTITLEMENT TO WRITTEN GUARANTEE.—Any independent power producer that submits an application to the Administrator establishing that such independent power producer—

"(A) proposes to construct a new independent power production facility for which allowances are required under this title;

"(B) will apply for financing to construct such facility after January 1, 1990, and before the date of the first auction under this section;

"(C) has submitted to each owner or operator of an affected unit listed in table A (in section 404) a written offer to purchase the required allowances for $750 per ton; and

"(D) has not received (within 180 days after submitting offers to purchase under subparagraph (C)) an acceptance of the offer to purchase the required allowances

shall, within 30 days after submission of such application, be entitled to receive the Administrator's written guarantee (subject to the eligibility requirements set forth in paragraph (4)) that such required allowances will be made available for purchase from the Direct Sale Subaccount established under this subsection and at a guaranteed price. The guaranteed price at which such allowances shall be made available for purchase shall be $1,500 per ton, adjusted by the percentage, if any, by which the Consumer Price Index (as determined under section 502(b)(3)(B)(v)) for the year in which the allowance is purchased exceeds the Consumer Price Index for the calendar year 1990.

"(4) ELIGIBILITY REQUIREMENTS.—The guarantee issued by the Administrator under paragraph (3) shall be subject to a demonstration by the independent power producer, satisfactory to the Administrator, that—

"(A) the independent power producer has—

"(i) made good faith efforts to purchase the required allowances from the owners or operators of affected units to which allowances will be allocated, including efforts to purchase at annual auctions under this section, and from industrial sources that have elected to become affected units pursuant to section 410; and

"(ii) such bids and efforts were unsuccessful in obtaining the required allowances; and

"(B) the independent power producer will continue to make good faith efforts to purchase the required allowances from the owners or operators of affected units and from industrial sources.

"(5) ISSUANCE OF GUARANTEED ALLOWANCES FROM DIRECT SALE SUBACCOUNT UNDER THIS SECTION.—From the allowances available in the Direct Sale Subaccount established under this subsection, upon payment of the guaranteed price, the Administrator shall issue to any person exercising the right to purchase allowances pursuant to a guarantee under this subsection the allowances covered by such guarantee. Persons to which guarantees under this subsection have been issued shall have the opportunity to purchase allowances pursuant to such guarantee from such subaccount before the allowances in such reserve are offered for sale to any other person.

"(6) PROCEEDS.—Notwithstanding section 3302 of title 31 of the United States Code or any other provision of law, the Administrator shall require that the proceeds of any sale under this subsection be transferred, within 90 days after the sale, without charge, on a pro rata basis to the owners or operators of

the affected units from whom the allowances were withheld under subsection (b) and that any unsold allowances be transferred to the Subaccount for Auction Sales established under subsection (d). No proceeds of any sale under this subsection shall be held by any officer or employee of the United States or treated for any purpose as revenue to the United States or to the Administrator.

"(7) TERMINATION OF SUBACCOUNT.—If the Administrator determines that, during any period of 2 consecutive calendar years, less than 20 percent of the allowances available in the subaccount for direct sales established under this subsection have been purchased under this paragraph, the Administrator shall terminate the subaccount and transfer such allowances to the Auction Subaccount under subsection (d).

"(d) AUCTION SALES.—

"(1) SUBACCOUNT FOR AUCTIONS.—The Administrator shall establish an Auction Subaccount in the Special Reserve established under this section. The Auction Subaccount shall contain allowances to be sold at auction under this section in the amount of 150,000 tons per year for each year from 1995 through 1999, inclusive and 250,000 tons per year for each year beginning in the calendar year 2000.

"(2) ANNUAL AUCTIONS.—Commencing in 1993 and in each year thereafter, the Administrator shall conduct auctions at which the allowances referred to in paragraph (1) shall be offered for sale in accordance with regulations promulgated by the Administrator, in consultation with the Secretary of the Treasury, within 12 months of enactment of the Clean Air Act of 1990. The allowances referred to in paragraph (1) shall be offered for sale at auction in the amounts specified in table 2. The auction shall be open to any person. A person wishing to bid for such allowances shall submit (by a date set by the Administrator) to the Administrator (on a sealed bid schedule provided by the Administrator) offers to purchase specified numbers of allowances at specified prices. Such regulations shall specify that the auctioned allowances shall be allocated and sold on the basis of bid price, starting with the highest-priced bid and continuing until all allowances for sale at such auction have been allocated. The regulations shall not permit that a minimum price be set for the purchase of withheld allowances. Allowances purchased at the auction may be used for any purpose and at any time after the auction, subject to the provisions of this title.

TABLE 2—NUMBER OF ALLOWANCES AVAILABLE FOR AUCTION

Year of Sale	Spot Auction (same year)	Advance Auction
1993	[1] 50,000	100,000
1994	[1] 50,000	100,000
1995	[1] 50,000	100,000
1996	150,000	100,000
1997	150,000	100,000

TABLE 2—NUMBER OF ALLOWANCES AVAILABLE FOR AUCTION—Continued

Year of Sale	Spot Auction (same year)	Advance Auction
1998	150,000	100,000
1999	150,000	100,000
2000 and after	100,000	100,000

Allowances sold in the spot sale in any year are allowances which may only be used in that year (unless banked for use in a later year), except as otherwise noted. Allowances sold in the advance auction in any year are allowances which may only be used in the 7th year after the year in which they are first offered for sale (unless banked for use in a later year.)

[1] Available for use only in 1995 (unless banked for use in a later year.)

"(3) PROCEEDS.—(A) Notwithstanding section 3302 of title 31 of the United States Code or any other provision of law, within 90 days of receipt, the Administrator shall transfer the proceeds from the auction under this section, on a pro rata basis, to the owners or operators of the affected units at an affected source from whom allowances were withheld under subsection (b). No funds transferred from a purchaser to a seller of allowances under this paragraph shall be held by any officer or employee of the United States or treated for any purpose as revenue to the United States or the Administrator.

"(B) At the end of each year, any allowances offered for sale but not sold at the auction shall be returned without charge, on a pro rata basis, to the owner or operator of the affected units from whose allocation the allowances were withheld.

"(4) ADDITIONAL AUCTION PARTICIPANTS.—Any person holding allowances or to whom allowances are allocated by the Administrator may submit those allowances to the Administrator to be offered for sale at auction under this subsection. The proceeds of any such sale shall be transferred at the time of sale by the purchaser to the person submitting such allowances for sale. The holder of allowances offered for sale under this paragraph may specify a minimum sale price. Any person may purchase allowances offered for auction under this paragraph. Such allowances shall be allocated and sold to purchasers on the basis of bid price after the auction under paragraph (2) is complete. No funds transferred from a purchaser to a seller of allowances under this paragraph shall be held by any officer or employee of the United States or treated for any purpose as revenue to the United States or the Administrator.

"(5) RECORDING BY EPA.—The Administrator shall record and publicly report the nature, prices and results of each auction under this subsection, including the prices of successful bids, and shall record the transfers of allowances as a result of each auction in accordance with the requirements of this section. The transfer of allowances at such auction shall be recorded in accordance with the regulations promulgated by the Administrator under this title.

"(e) CHANGES IN SALES, AUCTIONS, AND WITHHOLDING.—Pursuant to rulemaking after public notice and comment the Administrator may at any time after the year 1998 (in the case of advance sales or advance auctions) and 2005 (in the case of spot sales or spot auctions) decrease the number of allowances withheld and sold under this section.

"(f) TERMINATION OF AUCTIONS.—The Administrator may terminate the withholding of allowances and the auction sales under this section if the Administrator determines that, during any period of 3 consecutive calendar years after 2002, less than 20 percent of the allowances available in the auction subaccount have been purchased. Pursuant to regulations under this section, the Administrator may by delegation or contract provide for the conduct of sales or auctions under the Administrator's supervision by other departments or agencies of the United States Government or by nongovernmental agencies, groups, or organizations.".

SEC. 402. FOSSIL FUEL USE.

(a) CONTRACTS FOR HYDROELECTRIC ENERGY.—Any person who, after the date of the enactment of the Clean Air Act Amendments of 1990, enters into a contract under which such person receives hydroelectric energy in return for the provision of electric energy by such person shall use allowances held by such person as necessary to satisfy such person's obligations under such contract.

(b) FEDERAL POWER MARKETING ADMINISTRATION.—A Federal Power Marketing Administration shall not be subject to the provisions and requirements of this title with respect to electric energy generated by hydroelectric facilities and marketed by such Power Marketing Administration. Any person who sells or provides electric energy to a Federal Power Marketing Administration shall comply with the provisions and requirements of this title.

SEC. 403. REPEAL OF PERCENT REDUCTION.

(a) REPEAL.—Section 111(a)(1) of the Clean Air Act is amended to read as follows:

> *"(1) The term 'standard of performance' means a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.".*

(b) REVISED REGULATIONS.—Not later than three years after the date of enactment of the Clean Air Act Amendments of 1990, the Administrator shall promulgate revised regulations for standards of performance for new fossil fuel fired electric utility units commencing construction after the date on which such regulations are proposed that, at a minimum, require any source subject to such revised standards to emit sulfur dioxide at a rate not greater than would have resulted from compliance by such source with the applicable standards of performance under this section prior to such revision.

(c) APPLICABILITY.—The provisions of subsections (a) and (b) apply only so long as the provisions of section 403(e) of the Clean Air Act remain in effect.

(d) BACT DETERMINATIONS.—Section 169(3) of the Clean Air Act is amended by inserting: ", clean fuels," after "including fuel cleaning," and by adding the following at the end thereof: "Emissions from any source utilizing clean fuels, or any other means, to comply with this paragraph shall not be allowed to increase above levels that would have been required under this paragraph as it existed prior to enactment of the Clean Air Act Amendments 1990.".

SEC. 404. ACID DEPOSITION STANDARDS.

Not later than 36 months after the date of enactment of this Act, the Administrator of the Environmental Protection Agency shall transmit to the Committee on Environment and Public Works of the Senate and the Committee on Energy and Commerce of the House of Representatives a report on the feasibility and effectiveness of an acid deposition standard or standards to protect sensitive and critically sensitive aquatic and terrestrial resources. The study required by this section shall include, but not be limited to, consideration of the following matters:

(1) identification of the sensitive and critically sensitive aquatic and terrestrial resources in the United States and Canada which may be affected by the deposition of acidic compounds;

(2) description of the nature and numerical value of a deposition standard or standards that would be sufficient to protect such resources;

(3) description of the use of such standard or standards in other Nations or by any of the several States in acid deposition control programs;

(4) description of the measures that would need to be taken to integrate such standard or standards with the control program required by title IV of the Clean Air Act;

(5) description of the state of knowledge with respect to source-receptor relationships necessary to develop a control program on such standard or standards and the additional research that is on-going or would be needed to make such a control program feasible; and

(6) description of the impediments to implementation of such control program and the cost-effectiveness of deposition standards compared to other control strategies including ambient air quality standards, new source performance standards and the requirements of title IV of the Clean Air Act.

SEC. 405. NATIONAL ACID LAKES REGISTRY.

The Administrator of the Environmental Protection Agency shall create a National Acid Lakes Registry that shall list, to the extent practical, all lakes that are known to be acidified due to acid deposition, and shall publish such list within one year of the enactment of this Act. Lakes shall be added to the registry as they become acidic or as data become available to show they are acidic. Lakes shall be deleted from the registry as they become nonacidic.

SEC. 406. INDUSTRIAL SO_2 EMISSIONS.

(a) REPORT.—Not later than January 1, 1995 and every 5 years thereafter, the Administrator of the Environmental Protection Agency shall transmit to the Congress a report containing an inventory of national annual sulfur dioxide emissions from industrial sources (as defined in title IV of the Act), including units subject to section 405(g)(6) of the Clean Air Act, for all years for which data are available, as well as the likely trend in such emissions over the following twenty-year period. The reports shall also contain estimates of the actual emission reduction in each year resulting from promulgation of the diesel fuel desulfurization regulations under section 214.

(b) 5.60 MILLION TON CAP.—Whenever the inventory required by this section indicates that sulfur dioxide emissions from industrial sources, including units subject to section 405(g)(5) of the Clean Air Act, may reasonably be expected to reach levels greater than 5.60 million tons per year, the Administrator of the Environmental Protection Agency shall take such actions under the Clean Air Act as may be appropriate to ensure that such emissions do not exceed 5.60 million tons per year. Such actions may include the promulgation of new and revised standards of performance for new sources, including units subject to section 405(g)(5) of the Clean Air Act, under section 111(b) of the Clean Air Act, as well as promulgation of standards of performance for existing sources, including units subject to section 405(g)(5) of the Clean Air Act, under authority of this section. For an existing source regulated under this section, "standard of performance" means a standard which the Administrator determines is applicable to that source and which reflects the degree of emission reduction achievable through the application of the best system of continuous emission reduction which (taking into consideration the cost of achieving such emission reduction, and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated for that category of sources.

(c) ELECTION.—Regulations promulgated under section 405(b) of the Clean Air Act shall not prohibit a source from electing to become an affected unit under section 410 of the Clean Air Act.

SEC. 407. SENSE OF THE CONGRESS ON EMISSION REDUCTIONS COSTS.

It is the sense of the Congress that the Clean Air Act Amendments of 1990, through the allowance program, allocates the costs of achieving the required reductions in emissions of sulfur dioxide and oxides of nitrogen among sources in the United States. Broad based taxes and emissions fees that would provide for payment of the costs of achieving required emissions reductions by any party or parties other than the sources required to achieve the reductions are undesirable.

SEC. 408. MONITOR ACID RAIN PROGRAM IN CANADA.

(a) REPORTS TO CONGRESS.—The Administrator of the Environmental Protection Agency, in consultation with the Secretary of State, the Secretary of Energy, and other persons the Administrator deems appropriate, shall prepare and submit a report to Congress on January 1, 1994, January 1, 1999, and January 1, 2005.

(b) CONTENTS.—The report to Congress shall analyze the current emission levels of sulfur dioxide and nitrogen oxides in each of the provinces participating in Canada's acid rain control program, the amount of emission reductions of sulfur dioxide and oxides of nitrogen achieved by each province, the methods utilized by each province in making those reductions, the costs to each province and the employment impacts in each province of making and maintaining those reductions.

(c) COMPLIANCE.—Beginning on January 1, 1999, the reports shall also assess the degree to which each province is complying with its stated emissions cap.

SEC. 409. REPORT ON CLEAN COAL TECHNOLOGIES EXPORT PROGRAMS.

The Secretary of Energy in consultation with the Secretary of Commerce shall provide a report to the Congress within one year of enactment of this legislation which will identify, inventory and analyze clean coal technologies export programs within United States Government agencies including the Departments of State, Commerce, and Energy and at the Export-Import Bank and the Overseas Private Investment Corporation. The study shall address the effectiveness of interagency coordination of export promotion and determine the feasibility of establishing an interagency commission for the purpose of promoting the export and use of clean coal technologies.

SEC. 410. ACID DEPOSITION RESEARCH BY THE UNITED STATES FISH AND WILDLIFE SERVICE.

There are authorized to be appropriated to the United States Fish and Wildlife Service of the Department of the Interior an amount equal to $500,000 to fund research related to acid deposition and the monitoring of high altitude mountain lakes in the Wind River Reservation, Wyoming, to be conducted through the Management Assistance Office of the United States Fish and Wildlife Service located in Lander, Wyoming and the University of Wyoming.

SEC. 411. STUDY OF BUFFERING AND NEUTRALIZING AGENTS.

There are authorized to be appropriated to the United States Fish and Wildlife Service of the Department of the Interior an amount equal to $250,000 to fund a study to be conducted in conjunction with the University of Wyoming of the effectiveness of various buffering and neutralizing agents used to restore lakes and streams damaged by acid deposition.

SEC. 412. CONFORMING AMENDMENT.

Section 110(f)(1) of the Clean Air Act is amended by inserting "or of any requirement under section 411 (concerning excess emissions penalties or offsets) of title IV of the Act" after "implementation plan".

SEC. 413. SPECIAL CLEAN COAL TECHNOLOGY PROJECT.

(a) DEMONSTRATION PROJECT.—The Secretary of Energy shall, subject to appropriation, as part of the Secretary's activities with respect to fossil energy research and development under the Department of Energy Organization Act (Public Law 95–91) consider funding at least 50 percent of the cost of a demonstration project to design, construct, and test a technology system for a cyclone boiler that will serve as a model for sulfur dioxide and nitrogen oxide reduction technology at a combustion unit required to meet the emissions reductions prescribed in this bill. The Secretary shall expedite approval and funding to enable such project to be completed no later than January 1, 1995.

The unit selected for this project shall be in a utility plant that (1) is among the top 10 emitters of sulfur dioxide as identified on Table A of section 404; (2) has 3 or more units, 2 of which are cyclone boiler units; and (3) has no existing scrubbers.

(b) AUTHORIZATION.—There are authorized to be appropriated such sums as may be necessary to carry out this section, to remain available until expended.