Report of the Special Committee on Acid Rain

Stan Darling, M.P.
Chairman

September 1988

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HOUSE OF COMMONS

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Chairman: Stan Darling

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Président: Stan Darling

Minutes of Proceedings and Evidence of the Special Committee on

Acid Rain

Procès-verbaux et témoignages du Comité spécial sur les

Pluies acides

RESPECTING:

Examination of a draft report on the Order of Reference

INCLUDING:

The First Report to the House

CONCERNANT:

Examen du projet de rapport sur l'ordre de renvoi

Y COMPRIS:

Le premier rapport à la Chambre

Second Session of the Thirty-third Parliament, 1986-87-88

Deuxième session de la trente-troisième législature, 1986-1987-1988

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SPECIAL COMMITTEE ON ACID RAIN

Chairman
Stan Darling

Vice-Chairman
Marc Ferland

Members

Pauline Browes
Charles Caccia
Robert A. Corbett
Lynn McDonald
Alan Redway

Other Members of Parliament who participated in the Committee's study:

Bill Blaikie
Gabriel Desjardins
Gary Gurbin
John Parry
Keith Penner
Gordon Towers

(Quorum 4)

Pursuant to Standing Order 94(4)

On Friday, September 16, 1988:

Alan Redway replaced Gabriel Desjardins.

Staff

Marion Wrobel,
Tom Curren
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Clerk of the Committee

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The Special Committee on
Acid Rain

has the honour to present its

FIRST REPORT

In accordance with its Order of Reference of Thursday, October 9, 1986, your Committee has agreed to make the following report:

ORDER OF REFERENCE

Thursday, October 9, 1986

ORDERED,—That a Special Committee of the House of Commons, consisting of Messrs. Blaikie, Caccia, Corbett, Darling, Desjardins, Ferland and Gurbin, be appointed to act as a Special Committee on Acid Rain;

That the Committee be empowered to hold hearings to review all aspects of acid rain;

That the evidence adduced by the Special Committee on Acid Rain in the First Session of the present Parliament be deemed to have been referred to the Committee;

That the Committee have all of the powers provided to Standing Committees pursuant to Standing Order 96(1) and that the provisions of Standing Order 98 and sections 2, 3, 4, 5, and 6 of Standing Order 94 be suspended, unless otherwise agreed to by the Committee; and

That the Committee have the power to adjourn from place to place in Canada and the United States, and the power to retain staff, subject to budgetary approval by the Board of Internal Economy.

ATTEST

MICHAEL B. KIRBY

For the Clerk of the House of Commons

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PREFACE

The creation of the Special Committee on Acid Rain in June 1985, and its re-establishment in October 1986, recognized the continuing seriousness that this pollutant poses for the Canadian environment and the need for a determined effort by all Members of Parliament to work toward a solution. In a sense, also, the Special Committee represents a continuation of the work of the Sub-committee on Acid Rain which was first established in 1980, and reported to the House of Commons through the Standing Committee on Fisheries and Forestry.

The Sub-committee on Acid Rain produced its first major report, *Still Waters*, in the fall of 1981 and made 38 recommendations to the federal government. The second major report of the Sub-committee, *Time Lost*, was presented in June 1984. That report contained 16 recommendations. The federal government's response to all these recommendations is assessed in Appendix II of this present report.

In 1980, the concern about acid rain was growing rapidly and the Sub-committee concluded that, even then, the time for study of the problem had ended and the need for immediate action was clear and unequivocal. Then, as now, the major source of sulphur dioxide (SO_2) emissions in Canada was the non-ferrous smelting industry, particularly the large smelters in Ontario, Quebec and Manitoba. The fossil fuel-fired power plants of Ontario Hydro, and also those in Nova Scotia and New Brunswick, were seen as important sources of SO_2 and also of nitrogen oxides (NO_x).

The transportation sector, as a source of NO_x and other air pollutants, was also a major concern in 1980. Motor vehicle emissions caught the Sub-committee's attention because Canada's tailpipe emission standards were significantly less stringent than those enforced in the United States, in spite of the integrated nature of the North American automobile industry.

The Sub-committee recommended large reductions in emissions of SO_2 and NO_x in Canada and, in doing so, rejected the notion advanced by many polluters that their emissions were not significant in the total North American context. Perhaps the strongest message in *Still Waters* was that Canada had to "put its own house in order," in terms of acid rain pollutants, before we could hope to persuade the Americans to control their emissions, which account for up to 70% of the acid rain falling in some regions of Canada.

In 1984, the Sub-committee reiterated its belief that acid rain posed "the greatest threat to the North American environment in the recorded history of this continent." While the awareness of the acid rain problem had increased in the three years since *Still Waters*, only limited progress had been made toward a solution to the problem. In February 1982, the Environment Minister, Mr. Roberts, stated that Canada was prepared to reduce SO_2 emissions in eastern Canada by 50%, provided the United States instituted parallel action. The Americans rejected the Canadian proposal.

Another important initiative at this time was the accord reached between Canada and nine European countries to reduce SO_2 emissions by at least 30% by 1993. Although the United States had observer status at this meeting, it declined to participate in the accord.

On the whole, however, the Sub-committee was not satisfied that Canada was attacking domestic acid rain emissions in an aggressive manner. The non-ferrous smelting sector had not moved toward significantly greater emission controls, and the situation was exacerbated by low world prices for nickel and other metals. Also, no progress had been made in the matter of tailpipe emissions from motor vehicles.

The thrust of the Sub-committee's second major report, *Time Lost*, centred on stricter standards for NO_x and other pollutants from motor vehicles, and on ways to assist the smelting sector in financing controls for its SO_2 emissions. All 16 of the recommendations in *Time Lost* dealt with these two issues.

A great deal of government activity has taken place since the publication of *Time Lost* in June 1984. Although the acid rain problem in North America is a long distance from a final solution, Canada has made important progress in the control of domestic SO_2 and NO_x emissions.

While the Reagan Administration has resisted all appeals, from within and outside the United States, to develop an acid rain control program, there is optimism that the next administration will be more inclined to deal constructively with the issue.

This report summarizes the activities of the Special Committee on Acid Rain since 1986 and provides a discussion of the major issues that arose from our hearings. In doing so, we are providing for the reader an overview of the Canadian position on acid rain and the progress we, as a country, have made in dealing with this environmental threat.

CHAPTER ONE

THE FEDERAL-PROVINCIAL AGREEMENTS

The control of sulphur dioxide (SO_2) emissions in Canada is a joint federal-provincial program. It is up to the provincial governments to impose the legislation or regulation needed to control intra-provincial pollution. The federal government has jurisdiction over extra-provincial pollution; it has the responsibility to negotiate international agreements and it can act whenever public health and safety are endangered.[1] The role of the federal government has been to coordinate the overall effort and to provide for smelter abatement financing, jointly with the provinces.

The Committee undertook an investigation of the status of the federal-provincial agreements in order to determine whether the verbal commitments made by Ministers of the Environment in 1985 would be honoured. Our study commenced in December 1986 with the Minister of the Environment, the Hon. Tom McMillan, testifying. We heard subsequently from the Environment Ministers of Manitoba, Ontario, Newfoundland and Labrador, Nova Scotia and New Brunswick. We also received testimony from officials of Ontario Hydro, New Brunswick Power and Nova Scotia Power. The hearings on this subject concluded in April 1987, when the Hon. Richard Hatfield, Premier of New Brunswick, appeared before the Committee.

A. Ontario

In December 1985, the government of Ontario announced a program designed to control the emissions of acid rain-causing pollutants in the province. This program has come to be known as the Countdown Acid Rain Program[2] and it came into effect on January 4, 1986 with a series of control requirements upon the four largest corporate polluters in the province.

The Ontario program is, in many ways, a unilateral program. It was put in place well before any formal agreement was signed with the federal government. The federal-provincial agreement made on March 10, 1987 establishes the maximum federal and provincial financial contribution to smelter modernization. Both parties agreed to make available up to $85 million.

The program consists of five regulations: one for each of the major corporate polluters and one for the control of sulphur emissions from industrial boilers. This latter regulation restricts the sulphur content of the fuels used in new or modified boilers. Even without this regulation, a certain amount of fuel switching has been taking place in the face of changing fuel prices.

The purpose of the Countdown Acid Rain Program is to reduce total Ontario SO_2 emissions to 885 kilotonnes per year by 1994 and, if possible, to cut these emissions further to 795 kt per year. In 1980, the base level of emissions for the province was 2,194 kt of SO_2. The actual level of emissions in that year was 1,772 kt of SO_2.

1. Algoma Steel

Algoma Steel operates an iron ore sintering plant in Wawa, Ontario. This operation has been limited to SO_2 emissions of no more than 285 kilotonnes per year, although actual emissions have tended to be well below those limits. Ontario Regulation 663/85 limits emissions to 180 kt per year until 1993 and to only 125 kt per year as of 1994.

The demand for the company's product has been weak and the company's financial performance has been poor over the past five years. Acid gas control at the sintering plant is therefore mostly a matter of recognizing this reduced output and limiting production capacity accordingly. The capacity of the sintering plant has been reduced by 55%.

The regulation, and the statements of the provincial minister before this Committee,[3] make it clear that the company would have to install control technology in the event that the market conditions improve and the company again wishes to operate at higher capacity levels. Algoma must file reports with the Ontario Ministry of Environment every six months with respect to its emissions projection. It must indicate the technologies that would be used to control SO_2 emissions, should this be necessary.

The recent purchase of Algoma Steel by Dofasco has altered the future prospects for the operations at Sault Ste Marie and may affect operations at the Wawa sintering plant. If this merger results in greater use of Algoma's production capacity, then the sintering plant at Wawa might require means other than production cutbacks to meet its SO_2 limits.[4]

2. INCO

The INCO smelter at Copper Cliff, Ontario has become a symbol of acid rain pollution, it being, historically, the largest single source of SO_2 emissions in North America. The nickel-copper smelter emits large amounts of SO_2 which are contained in the ore. Its emissions in the past have been far higher, however. Today the company contains over 70% of the sulphur originating in the ore: in the 1960s, it contained only about 20%. The Ontario regulations require the company to increase the degree of abatement over and above the high levels it is already achieving.

Ontario Regulation 660/85 limits emissions to 685 kt in 1986 and 265 kt in 1994. INCO must also report on the possibility of meeting even stricter limits: 525 kt in 1990 and 175 kt at some time in the future.

It is not yet known just how the company plans to meet these requirements at its Ontario smelter. INCO has made it clear in the past that for technical and economic reasons it wishes to avoid using methods which produce sulphuric acid. The acid is usually thought of as a valuable by-product in the production of smelter products and the control of acid gas emissions. The location of the Canadian smelters, the location of major markets, and the high transportation and handling costs associated with this product, however, make it an unattractive option for SO_2 control. This analysis is consistent with the findings of the Energy, Mines and Resources Canada (EMR) study on the non-ferrous smelting sector and it highlights the rationale for finding new production and control processes for this industry.[5]

Several options are available to the firm to reduce its emissions. One approach is to reduce further the amount of sulphur which enters the smelting process. If larger amounts of sulphur can be rejected from the ore, then the process of controlling the release of SO_2 from the smelting process becomes less expensive. If this does not prove to be a complete solution, then other process changes must be considered. These include the bulk smelting of both nickel and copper ores, or an improved capture of converter gases.

By the end of 1988, the company must be able to present the government with a technological solution to the control orders. It has so far stated that the 265 kt limit does appear to be feasible. Although the company has not outlined its method of control, informed observers feel that the company will use bulk smelting of copper-nickel concentrates.

At the time of writing the Report, *Time Lost*, in June 1984, the Sub-committee on Acid Rain was informed by INCO that a promising technique for capturing greater amounts of SO_2 entailed the use of Roast Reduction Smelting for the nickel circuit. To this end the company was then engaging in a major research project at its Thompson, Manitoba facility. The company frequently extolled the virtues of this technique to that Sub-Committee, yet this approach seems to have fallen by the wayside as INCO has found other methods of reducing production costs and controlling emissions.

3. Falconbridge

Falconbridge Limited also operates a nickel-copper smelter in the Sudbury area. At present, the plant captures a significant portion of the sulphur in the ore to produce sulphuric acid. The operations of the firm are modern and efficient. The Sudbury plant employs a different production process than the INCO Copper Cliff operation. Falconbridge uses fluid bed roasters whereas INCO uses multi-hearth roasters and reverberatory furnaces.

In 1985, the Ontario government imposed a new control order on Falconbridge (Regulation 661/85). This regulation reduces the legal limit for SO_2 emissions to 100 kt per year starting in 1994. The legal limit under which the plant is currently operating is 154 kt per year, although the company is actually emitting substantially less. In 1986, actual emissions of SO_2 amounted to about 90 kt.

Like INCO, Falconbridge is looking to increased pyrrhotite rejection as a means of reducing future emissions. In addition, the company is considering a method of increasing the capture of SO_2 during the roasting process and producing sulphuric acid from the gas.

The Ontario government seems satisfied with the progress made at the plant so far and with the reports the company has presented on its control plans. Unlike INCO, where current emissions are close to the current legal limit, Falconbridge is far below those limits and is even below the 1994 limit set for the plant. Most of this reduction at the present time is due to decreased capacity utilization. As a result, the government is not requesting that Falconbridge provide contingency plans as has been the case with INCO.

4. Funds for Smelter Modernization

The federal government has made available up to $150 million for smelter modernization and pollution control as part of the acid rain abatement program. The allocation and disbursement of these funds is conditional upon demonstrated need on the part of the firms concerned. In some cases the provincial allocation of the total amount was made even before a federal-provincial agreement was signed. For example, on February 19, 1987, the Ontario Minister of Environment indicated in his presentation to the Committee that the federal government had assigned up to $85 million for Ontario pollution control and that the Ontario government was prepared to make available an equal amount. The Canada/Ontario Agreement which contains the same provisions was not signed until March 10, 1987. The actual amount of these funds going to either of the two smelters will not be determined until the end of 1988 when both must provide details of the technology to be used in meeting their 1994 limits. As a consequence of the recent significant increase in nickel prices, the federal government may conclude that no financial assistance is needed.

5. Ontario Hydro

Ontario Hydro is the largest provincial electrical utility in Canada. It also has the largest absolute amount of coal-fired generating capacity in the country and, as a result, is the leading source of acid gas emissions in this sector. It operates three coal-fired generating plants in southern Ontario as well as two smaller plants in the northwestern part of the province.

Ontario Regulation 662/85 limits the acid rain-causing emissions of Ontario Hydro. Sulphur dioxide emissions are not to exceed 370 kt per year as of 1986, 240 kt per year as of 1990 and 175 kt as of 1994. Total acid gas emissions (i.e., SO_2 + NO_x) are not to exceed 430 kt per year as of 1986, 280 kt per year as of 1990 and 215 kt per year as of 1994. This regulation and the limits it establishes are intended to control the utility's emissions in perpetuity. Ontario Hydro must report to the government by the end of 1988 on the methods it proposes to use in order to meet the emissions limits set forth in this regulation.

The utility's strategy for the control of acid gas emissions is in two parts: increased nuclear capacity and other control measures. The first deals with the period up to the early 1990s and it relies mainly on the replacement of coal-fired generating capacity with new nuclear capacity. This should continue until about 1992 when the last of the nuclear units comes

on stream at Darlington. Once that happens, coal consumption should be half of what it is today.

The control approach in the 1980s contains other measures as well, although their total impact on emissions is not nearly as great as that of the increased nuclear capacity. The average sulphur content in the coal used by the utility was approximately 1.75% in 1982. By 1992, this should decline to just under 1% as more and more low sulphur coal is used.[6] Further declines in the average sulphur content of the coal input is limited by three factors. In the first place, there are technical limits to the amount of low-sulphur coal that can be burned in the existing boilers. Secondly, the utility has contractual obligations for the purchase of higher sulphur coals from the United States. Finally, the cost of transporting western Canadian low-sulphur coal is very high.

The utility has also started a program to install low-NO_x burners at the Nanticoke generating facility.

In the mid-1990s, Ontario Hydro expects to face increasing pressure on its ability to supply the province's demand for electricity. The nuclear program of the utility will end with the completion of the last Darlington unit. Alternative control strategies must then be applied as the amount of coal use is again expected to increase. Retrofit technology for the Lakeview, Lambton and Nanticoke stations may be required.

It appears that new nuclear generating units have been ruled out as a long-term solution to the tight emissions limits. It is likely then that coal-fired units will increasingly be used at high-capacity utilization rates, making feasible and economic, the installation of retrofit control technologies. By the end of the century, Ontario Hydro expects to have spent a cumulative amount of about $5,000 million, resulting in electricity charges being about 5% higher than they would have been otherwise.

These expenditures would result from the installation of a number of control technologies. In its presentation to the Committee, the utility stated its active consideration of four options: wet limestone scrubbers; lime spray dryer process; limestone dual alkali process; and limestone injection into burners. These alternatives range from well-tried scrubbers to the more novel technique of limestone injection.

When the Ontario government first imposed its regulations on Ontario Hydro in December 1985, to limit the emissions of acid gases, the regulations contained a banking provision whereby the utility could exceed

its yearly emissions limit as long as offsetting reductions took place in other years. This was tantamount to an averaging provision accorded this polluter and no others.

These provisions were severely criticized by environmental groups as well as Members of this Committee. Such sentiments were expressed to the utility and the Minister of the Environment for the Province of Ontario, the Hon. James Bradley, when they appeared before us. Subsequently, the control order on Ontario Hydro was revised and the banking provision dropped.

a. Low-Sulphur Coal from Western Canada

The concern over Ontario Hydro's SO_2 emissions has prompted several calls for the greater use of western Canadian coal which tends to have a low sulphur content. A federal-provincial task force examined the issue and presented a report in June 1986.(7) Proponents cite the fact that the increased use of low-sulphur Canadian coal generates benefits in several ways. It obviously helps to reduce acid rain-causing emissions; but this is also true of American low-sulphur coal just as it is true of other abatement methods. The use of western Canadian coal has the added benefit of creating employment directly in a domestic sector and promoting direct spending in the country. This economic benefit is claimed to be in addition to any environmental benefit.

Ontario Hydro already buys significant amounts of western Canadian low-sulphur coal. The southern Ontario generating stations were designed to burn high-sulphur coals and the cleaner fuel can only be used if blended equally with the dirty coal. Moreover, the utility is currently paying an extra $70 million per year to buy Canadian coal as opposed to low-sulphur American coal.(8)

The issue of purchasing greater amounts of western Canadian coal domestically is a matter of regional development: it is not an environmental matter, *per se*. The acid rain control program of Ontario Hydro is not dependent upon the use of low-sulphur coal in general or Canadian low-sulphur coal in particular. As the Ontario government has pointed out, it is the utility's job to cut its emissions in the most efficient manner possible. Cost-effective abatement is the guiding principle of the Canadian acid precipitation abatement program and any use of western Canadian coal must be consistent with this principle.

B. Quebec

In 1980, total SO_2 emissions in the province of Quebec amounted to 1,100 kilotonnes. Over 50% of these emissions originated at the Horne smelter in Rouyn-Noranda. In February 1985, the province agreed to reduce its total emissions to 600 kt per year by the end of 1990 and this decision has been enshrined in the Canada/Quebec agreement, signed on March 20, 1987. Clearly, a significant portion of the abatement effort has to take place at the Horne smelter for this target to be met.

At various times, starting in 1984, the government of Quebec announced its intention to cut the emissions of the Horne smelter significantly, ranging from 40% to 50%. The EMR study released in the same year examined two alternatives which would be used to substantially reduce emissions. Capturing gases from the reactor to produce sulphuric acid would reduce emissions by about 43% while the capture of both reactor and converter gases would reduce SO_2 emissions by about 64%.

According to the news release[9] issued jointly by the federal and Quebec governments, the smelter at Rouyn-Noranda is to reduce its emissions by 50% by 1990. Each of the three parties, namely the federal and Quebec governments and Noranda Inc., are to contribute $41.6 million towards the capital cost of a new acid plant. According to the news release, this 50% cut in emissions is in accordance with the 1985 regulations imposed on the company.

This agreement is the first to actually specify the dollar amount of financing to be made available to a specific corporation since this represents the first of the polluters to actually present an abatement plan. The details of the assistance package are not presented in the agreement.

The other large point source for SO_2 emissions in the province is the Gaspé copper smelter at Murdochville. As of 1990, it is limited to 65 kt of SO_2 emissions, about two-thirds of its 1980 allowable levels. The company is capable of meeting this goal at full capacity. Recently, its emissions have been well below the 1990 limit as a result of production cutbacks.

In 1980, 208 kt of SO_2 were emitted by industrial boilers and 50 kt from commercial boilers. In addition, aluminum production emitted 40 kt of SO_2 and sulphite pulping another 30 kt.[10] To meet the 1990 goal limit of 600 kt of SO_2 emissions, emissions from sources other than the two major smelters must decline 40% from the 1980 base.

The Committee has not had the benefit of testimony by Quebec government officials. Unlike other provincial officials who were invited before the Committee, those from Quebec declined to appear.

C. Manitoba

The province of Manitoba has agreed to reduce its emissions to a level not in excess of 550 kt of SO_2 per year by 1994. This level was agreed to at the February 1985 meeting of Ministers of environment and it has now been put in writing with the signing of the Canada/Manitoba agreement of April 10, 1987.

In testimony before this Committee[11] on February 5, 1987, the Manitoba Minister of Environment and Workplace Safety and Health, the Hon. Gerard Lecuyer, presented draft regulations which would limit the emissions from the two major polluting sources. The INCO smelter at Thompson and the Hudson Bay Mining and Smelting (HBMS) operation at Flin Flon account for virtually all of the SO_2 emissions in the province. These regulations were subject to a process of public comment and were altered as a result.

These two smelters are relatively dirty operations when compared to other such plants in Canada. Neither complex contains any of the SO_2 produced in the smelter although both do reject some of the sulphur in the ore prior to entering the smelting circuit.

Manitoba is the one province where the allowable emissions used as the 1980 base far exceed the actual emissions in that year and every year since the mid-1970s. Since about 1978, actual emissions have consistently been lower than the limits set for 1994. Manitoba Regulation 165/88, filed on March 31 1988, imposes the following emissions limits for SO_2: for INCO, 300 kt per year immediately and 220 kt per year as of 1994; and for HBMS, 293 kt per year immediately and 220 kt per year as of 1994.

These limits leave the province with more than adequate breathing room after 1994 to accommodate new pollution sources. The 1994 limits on the two major sources add up to 440 kt of SO_2 per year, out of a provincial limit of 550 kt per year. An annual allowance of 110 kt of SO_2 emissions from other sources is far in excess of current provincial requirements. In 1984, other sources accounted for only 13 kt of SO_2 emissions.

Government financial assistance for this abatement effort has still not been resolved. Of the $150 million federal fund for smelter abatement, as

little as $23 million might actually be available to the province, the remainder having been allotted to Ontario and Quebec. The Flin Flon smelter's future is still in doubt. It is one of the oldest copper smelters in the world and is characterized by low energy efficiency and high operating costs.

The most promising control method at the Flin Flon operation appears to be the installation of a zinc pressure leach circuit. Energy, Mines and Resources Canada[12] has identified this as a technology which would remove all SO_2 emissions from the zinc circuit and produce elemental sulphur as a by-product. It would also reduce operating costs. The company is seeking $130 million in government assistance to meet its abatement target.

D. Newfoundland and Labrador

The Province of Newfoundland and Labrador is the second smallest source of SO_2 emissions in Canada. The 1980 base level of emissions is listed at 59 kt of SO_2, which represents the actual level of emissions fairly accurately. The agreement signed jointly by the province and the federal government limits emissions to 45 kt of SO_2 in 1994 in accordance with the 1985 commitments. Although this agreement does not include an emissions cap, it does contain a unique feature whereby all future industrial sources must make use of state-of-the-art emissions control technology.

The province has not introduced regulations or legislation in order to meet this commitment. The industrial sector which contributes to these emissions (the iron ore and pulp and paper industries) have been striving to reduce costs in recent years. This has been largely accomplished by conserving fuel usage through the introduction of new technologies. According to provincial officials, these economic pressures have in fact led to a decline in acid emissions, negating any need for legislative action. Since 1981, provincial emissions have been below the 1994 limit.

The leading single point source of SO_2 emissions in the province is the thermal generating station at Holyrood on the Avalon Peninsula. This station emitted 18 kt of SO_2 in 1980 but considerably less since then. It is used as a peaking and reserve unit—rarely does it operate in the summer months, for example. Thus control measures at this facility would be expensive for the abatement they would achieve.

E. Prince Edward Island

The province of Prince Edward Island is by far the least polluting province in Canada, due to its size and its industrial base. The 1980 base level of sulphur emissions was 6 kt per year and the province has agreed to reduce this to 5 kt per year by 1994. The federal-provincial agreement of March 9, 1987 says nothing about the manner by which this limit will be achieved. Emissions in the province, however, have been well below this target throughout the 1980s, and the government is confident that these trends will continue. Thus no specific regulatory action is needed.

There is one interesting feature about SO_2 emissions in the province. Virtually all of the island's electrical power is now supplied by New Brunswick. This is equivalent to transferring 6 kt of emissions from the accounts of P.E.I. to New Brunswick. P.E.I. gets credit for being a low-emissions province while New Brunswick is criticized for its high level of pollution. New Brunswick officials have pointed this out several times to the Committee. The analogy to the United States is very strong here. The New England states are not large polluters, but one reason for this is the fact that they import a great deal of power from the midwest states. It is one thing to reduce local emissions by importing available clean energy. It is quite another to reduce local emissions by importing dirty energy.

F. Nova Scotia

Nova Scotia is the last of the eastern Canadian provinces to have signed an agreement with the federal government for the control of SO_2 emissions. This occurred on February 12, 1988 and it commits the province to meet the targets previously agreed to. In appearances before the Committee, the provincial Minister of Environment, the Hon. Laird Stirling, and officials of Nova Scotia Power gave the impression that the province could not live up to its verbal commitment of 1985 to cut SO_2 emissions from 219 kt per year to 204 kt per year by 1994. It was also inferred by the Committee that the province would require some sort of assistance package to enable the electrical utility to reduce its emissions.

The Minister cited several factors to argue that an extensive abatement effort in the province would not be required within the spirit of the 1985 agreements and to indicate why even the agreed-to reductions might be difficult for the province to achieve. In the first place, the essence of the Canadian program was based on the use of source-receptor relationships to ensure that the program would be achieved at least cost. Deposition in Nova

Scotia is largely from external sources and its own SO_2 emissions are largely deposited on non-sensitive areas. Developments in the pulp and paper industry and the closure of an oil refinery have reduced provincial emissions below the 1980 base level and even below the 1994 targets. Utility emissions did, however, increase from the 1980 level, reaching a high of 148 kt in 1984. Furthermore, the Canadian abatement program deals only with SO_2 and the province therefore gets no credit for having installed state-of-the-art NO_x control technology.

The control program in the province was to have relied at least partly on the availability of eastern Canadian natural gas, an alternative which is now delayed. No federal money is available to the province, in contrast to central Canadian provinces which have non-ferrous smelters. Nova Scotia Power is investigating the use of a circulating fluidized bed boiler to control emissions, but this technology is novel and therefore risky as well as being very expensive.

The provincial government expressed its reluctance to impose emissions limits on the provincial utility which will increase the costs of electricity, just as it is reluctant to undertake any initiatives which would affect negatively the province's coal industry.

The presentation by the Minister was one of the few to address the question of post-1994 controls. On this point the Minister again stressed the matter of point-receptor strategies, arguing that control strategies imposed on the province must be consistent with that approach. There is no obvious reason, according to the Minister, for the use of best available technology for new point sources of SO_2 in the province.

It appeared at the time of the hearing, that Nova Scotia had no intention of signing a federal-provincial agreement. The Committee requested that the Premier, the Hon. John Buchanan, testify before it to explain his government's position. Although the Premier never appeared before the Committee, the provincial government has now signed an agreement with the federal government. That agreement committed the government of Canada to "support the continued research and refinement of new technologies for combustion and cleaning of Nova Scotia coal."

G. New Brunswick

New Brunswick was also very reluctant to sign an agreement with the federal government outlining its responsibilities towards SO_2 control. On February 17, 1987, testimony by the Minister of Municipal Affairs and the

Environment, the Hon. Robert Jackson, and officials from New Brunswick Power left the Committee with the impression that the province would not live up to 1985 commitments and, indeed, might substantially increase SO_2 emissions by 1994. Both witnesses argued that the 1980 base levels of emissions do not adequately reflect the true situation in the province.

The province had agreed in 1985 to reduce its total SO_2 emissions to 185 kt per year by 1994 from a base level of 215 kt per year. In 1980 and 1981, actual emissions exceeded that base level although they have since declined to a level of about 160 kt in 1984. Officials from the province argued before this Committee that the provincial utility had control options available in the early 1980s which will cease to exist a decade hence. Consequently, an abatement effort that appears to be a 14% cut is in fact closer to a 50% cut.

The New Brunswick argument is as follows: In 1980, the province produced 219 kt of SO_2, of which 122 kt came from New Brunswick Power. But in that year, the utility imported significant amounts of interruptible power from Hydro Quebec. This energy has no SO_2 associated with it, coming as it does from hydro generation in Quebec. If that electricity had been generated in New Brunswick from its existing capacity, total emissions from the utility would have been 100 kt higher and total provincial SO_2 emissions would have been 319 kt. By 1990, these imports of secondary power from Quebec are not expected to be available and in the absence of any control efforts, New Brunswick Power emissions in 1994 would be 356 kt of SO_2. To meet the 1994 provincial limit of 185 kt, the utility must not exceed about 140 kt of emissions, almost 60% less than the estimated uncontrolled levels for that year. What has been seen as a minor, and relatively inexpensive, abatement effort in New Brunswick would be in fact a very major and expensive effort, according to the utility company.

The provincial utility, New Brunswick Power, presented the Committee with a number of control options for the 1990s which could be used in the absence of further imports from Hydro Quebec. These included a reduction in exports of about 700 megawatts, coal washing, and the conversion of the Coleson Cove station to low-sulphur coal. These alternatives would limit the utility's emissions to 225 kt of SO_2 in 1994, still about 85 kt higher than that needed to meet the provincial target for that year.

It soon became clear to the Committee that the provincial officials were setting the stage for a retraction of the original commitments made in 1985. As a result, it was decided to invite Premier Richard Hatfield to

appear before the Committee to explain the position of his government on this subject. He did consent to testify before the Committee where he announced on April 2, 1987 that the province would live up to the original commitment to reduce emissions to 185 kt of SO_2 per year by 1994 and that the New Brunswick government would negotiate an agreement with the federal government on that basis. An agreement between the two governments was signed on October 8, 1987. In it, the federal government promises to support clean coal technology as in the agreement with Nova Scotia. No specific amount of federal money is mentioned in the agreement. If New Brunswick Power employs a technological option to control its emissions, it will likely be a form of circulating fluidized bed combustion as considered by Nova Scotia or a limestone injection method as being examined by Ontario Hydro.[13]

H. Federal Financing for Abatement: The Utilities and New Technology

The concern over New Brunswick and Nova Scotia's commitment to the Canadian Acid Precipitation Abatement Program has focused attention on the role of federal financing for emissions controls at provincially-owned electrical utilities, particularly when such controls make use of emerging new technologies. According to the federal Minister of Environment, it has always been recognized that no federal funds would be made available for utility controls. This view has in fact been challenged by both provinces.

The two provinces are actively investigating the possibility of employing new burner technologies to control SO_2 emissions: in both cases the most promising technology that they mentioned to the Committee is circulating fluidized bed combustion. This is a new process by which air is injected into the combustion chamber, causing the fuel to literally float up and down, hence the name. The combustion temperature is lower than that found in conventional boilers and, as a result, NO_x emissions are significantly reduced. More importantly, this technique allows for a limestone-based sorbent to be mixed with the fuel, resulting in an SO_2 capture of about 90%. Such a capture efficiency is equal to that of the most effective scrubbers.

Circulating fluidized bed combustion can be thought of as a second generation technology. It is a variant of pressurized fluidized bed combustion which is more advanced than the type currently being tested by the Tennessee Valley Authority in the United States. Combustion takes place under pressure, with the ash being recycled into the combustion chamber. This ensures that all the coal is burned and thus increases boiler efficiency.

New Brunswick Power is investigating the use of coal shale as a sorbent. This product is widely available in the province and has some heating value which limestone lacks. It is thus part sorbent and part fuel.

Nova Scotia has also testified that this particular technology is being considered.

Testimony by the United Mine Workers called for the use and development of technologies which could burn high-sulphur coal in an environmentally sound manner and for federal financial assistance to ensure that this technology is used and that coal-mining jobs are not lost.[14] The purpose of the union's brief was to ensure that the quest for reduced emissions in the east does not lead to job losses in the coal mining community. This theme also characterized the testimony of officials from Nova Scotia and New Brunswick.

Ontario Hydro has also indicated to this Committee that its control strategy for the latter part of the 1990s and beyond might include new technological options. One of these is a technique called limestone injection into burners. This particular technology has several promising features. It controls both SO_2 and NO_x emissions with a potential for 50% to 70% abatement. It is designed to be used as a retrofit option which is much less expensive than scrubbers; operating costs are low and capital costs are only 10% to 15% that of scrubber capital costs.

Unlike SO_2, NO_x emissions tend not to originate in the fuel. Rather, they are a consequence of high temperature combustion. Technologies which control NO_x creation do so by lowering combustion temperature and controlling the supply of air in the combustion chamber.

Just as the huge INCO smokestack at Copper Cliff has become a symbol of acid rain pollution, the scrubber has become the symbol of abatement at thermal power plants. The debate over the commitment to control acid rain emissions has at times become a game of counting scrubbers. Nevertheless, it is entirely possible that significant abatement at Canadian utilities will be achieved in the future without the installation of any scrubbers. The Canadian effort should not then be denigrated because of the absence of such scrubbers.

Abatement of SO_2 emissions at Canada's provincial utilities is likely to take many forms, with each operation choosing that technique most suited to its particular circumstances. Provincial governments might also require that abatement options take into account other considerations such

as the protection of local mining employment. That is their decision to make and they would bear whatever costs their decisions entail.

But this leaves several questions still to be answered. Should federal financing be made available and, if so, should it be available for only certain types of abatement alternatives? The federal government has provided some funding for research into methods designed to burn coal cleanly under the now-defunct National Energy Program and it has now promised to continue supporting such programs. Some funding for circulating fluidized bed combustion research has been made available to New Brunswick Power.

Ontario Hydro is also looking to such novel abatement techniques and if such funding is to be a part of the national control strategy, the Ontario utility should also benefit from federal financing. But federal funding for technological development in these areas amounts to a promotion of control strategies which can still make use of high-sulphur coal and this appears to contradict stated intentions by the federal government to promote greater use of western Canadian low-sulphur coal.

I. Energy Conservation and the Environment

Maintaining any upper limit on acid rain-causing emissions can be an expensive and technologically challenging matter. The extent to which it is expensive and difficult depends upon the degree to which firms must install and use costly control technology. This approach is necessary when the economy produces pollutants which it then must capture. An alternative is simply not to produce the pollutants in the first place. The challenge is to avoid producing pollutants while at the same time continuing to enjoy the standard of living that is associated with the production and consumption of goods and services that can otherwise result in pollution.

The Committee has had access to information on energy conservation and its role in reducing acid rain-causing emissions. For example, from 1973 to 1986, increases in the efficiency in which Canadians use energy saved 150 million barrels of oil, 14 billion cubic metres of natural gas and 175,000 Gwh of electricity in 1986. These savings are estimated to have eliminated 200 kt of NO_x emissions and 450 kt of SO_2 emissions in that year.

North Americans tend to use energy very intensively. Some commentators refer to us as energy gluttons. Per dollar of Gross National Product (GNP), we use about twice as much energy as Japan and industrialized European countries; Canada also uses more energy than the United States.

The increased productivity referred to above is evident when we examine the change in energy intensity over time. In Canada, our relative energy use declined 6% from 1973 to 1985. Over the same period, relative energy use fell 23% in the United States and 15% in Europe. On balance then, it appears that Canada still has scope for further reductions.[17]

The report on the energy options process, entitled *Energy and Canadians: Into the 21st Century*, submitted to the Minister of Energy, Mines and Resources in August of this year, attributed this increased energy efficiency to government programs, stiffer gasoline consumption standards and higher energy prices. It concluded that a market-based approach was best for achieving economically-efficient energy use. That report did, however, argue that a government has an important role to play in this endeavour, by removing institutional barriers to energy conservation and by identifying and promoting areas where such conservation can take place.[18]

The consumption of energy produces pollutants; but it does so in varying degrees. Some sources of energy are inherently cleaner than others and some forms of energy consumption are much more efficient than other alternatives. The effect of energy conservation on acid rain-causing emissions does not constitute a simple and straightforward relationship: it depends upon the forms of energy which are conserved. Stated more directly, it is not always the dirtiest forms of energy or energy use which are curtailed when conservation takes place.

Canadian electricity tends to be cleaner than American electricity because we rely less upon fossil fuel generation and more on hydro and nuclear generation. Conservation in Canada, then, will have a smaller beneficial impact than conservation in the United States, unless any surplus is exported to that country. The same is true of electricity conservation in the various provinces of Canada which rely primarily upon hydro or nuclear generation.

Energy conservation saves energy; it only results in lowered emissions indirectly. For energy conservation to result in emissions reductions requires a set of incentives in addition to those which promote energy conservation. It is necessary to ensure that, under a conservation regime, clean energy sources are retained and dirty energy sources are eliminated. Without an appropriate set of incentives, the opposite can occur.

Energy is not the only area where conservation can reduce acid rain-causing emissions. In *Time Lost*, it was noted that recycled copper

accounted for about one-third of Canada's copper supply in 1980. Had that copper been produced from ore at our smelters, it could have produced an additional one millions tonnes of SO_2 emissions.

In both of these cases, energy conservation and recycling, it is obvious that a great deal of scope exists for large-scale reduction in the production of acid rain-causing emissions. The International Energy Agency estimates that energy conservation could contribute a further 30% reduction in Canadian energy use, if market distortions and other barriers are removed. Until now, the focus of our environmental programs has been to capture these emissions after they have been produced. While this is useful and desirable, an important and complementary strategy has thus far not received the attention and policy stimulus that it deserves.

Footnotes

(1) Canada, House of Commons, Sub-Committee on Acid Rain, *Still Waters: The Chilling Reality of Acid Rain*, Ottawa, 1981, p. 79.

(2) This Program is outlined in: "Summary and Analysis of the First Progress Reports by Ontario's Four Major Sources of Sulphur Dioxide," Ministry of the Environment, Toronto, undated.

(3) The position of the Ontario government is that "... if economic conditions change and the company wishes to increase production again, technical reduction methods or procedures such as those previously examined would have to be in place before production could increase to a level which would result in a violation." *Ibid.*, p. 51. See also Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, February 19, 1987, 6:36.

(4) K. Romain, "Dofasco bid may include mill for the Soo," *Globe and Mail*, July 20, 1988, p. B1, B2; and C. Languedoc, "Dofasco's Algoma takeover would create steel colossus," *Financial Post*, July 19, 1988.

(5) Energy, Mines and Resources Canada, *Canada's Non-Ferrous Metals Industry: Nickel and Copper—A Special Report*, Ottawa, 1984.

(6) Ontario Hydro, "Brief Presented to the House of Commons Special Committee on Acid Rain," Toronto, February 17, 1987.

(7) Federal/Provincial Task Force on the Expanded Use in Ontario of Low-Sulphur Western Canadian Coal, *Western Canadian Low-Sulphur Coal: Its Expanded use in Ontario*, Technical Report, Ottawa, June 1986.

(8) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, February 17, 1987.

(9) "Agreement Between Canada, Quebec and Noranda Inc. Regarding the Financing of the Sulphuric Acid Plant at the Rouyn-Noranda Copper Smelter," Montreal, March 20, 1987.

(10) Environment Canada, *Sulphur Dioxide Emission Trends in Quebec (1970-1984)*, Ottawa, April 23, 1987, mimeo.

(11) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, February 5, 1987, 3:7.

(12) Energy, Mines and Resources Canada (1984).

(13) M. Courpas and L.B. Parker, *Canada's Progress on Acid Rain Control: Shifting Gears or Stalled in Neutral*?, Congressional Research Service, Washington, D.C., April 20, 1988, p. CRS-30.

(14) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, April 15, 1987, 11:26.

(15) International Energy Agency, *Energy Conservation in IEA Countries*, Organization for Economic Cooperation and Development, Paris, 1987.

(16) Energy Options Advisory Committee, T.E. Kierans, Chairman, *Energy and Canadians: Into the 21st Century*, Energy, Mines and Resources Canada, Ottawa, 1988, p. 97-101.

CHAPTER TWO

STATEMENT ON THE JOINT REPORT OF THE SPECIAL ENVOYS

During the Quebec City summit in March of 1985, Prime Minister Brian Mulroney and President Ronald Reagan announced the establishment of two special envoys to study, and report on, the issue of acid rain in North America. This envoy process was to be a mechanism for breaking the apparent stalemate over acid rain that existed between the two nations at that time. Mr. William Davis was appointed the Canadian special envoy while Mr. Drew Lewis was the American choice. The Committee met with Messrs. Davis and Lewis in Bracebridge, Ontario in the fall of 1985.

In January of 1986, the special envoys on acid rain issued a joint report which the Committee examined and evaluated. Our statement was tabled in the House of Commons on February 13, 1986 as the first Report of this Committee.

The Committee felt ambivalent toward the Envoys' Report. It was an important step forward in the sense that the report, and its eventual endorsement by the President, amounted to the first admission by the Reagan Administration that acid rain was a serious environmental problem, and that it was international in scope. It cited the well-documented and clearly demonstrated impact of acid rain on aquatic ecosystems and noted the potential for materials damage, causing not only economic harm but the loss of historical treasures. It also argued that the existing *U.S. Clean Air Act* was not a good instrument for combatting acid rain. That *Act* is based on ambient air quality goals rather than total loadings; the latter are more relevant to acid rain. The report further noted that the use of tall stacks to enhance local environmental quality has contributed to the acid rain problem as has the use of tight New Source Performance Standards (NSPS) which have increased the life expectancy of old and dirty power plants. This line of reasoning could be viewed as an admission that new legislative or regulatory actions are needed.

It also called for significantly increased action on the part of the Americans, but not on the part of Canadians. We could view this as an implicit vote of confidence in our own program.

The major American initiative recommended in the report was a five-year, U.S. $5 billion program to provide commercial-scale

demonstrations of clean coal combustion technology. The intent of such a program was to provide an economically more acceptable alternative to scrubbers as a means by which dirty coal can be used in an environmentally-acceptable manner.

The call for such a demonstration program can be interpreted as an admission of the need for significant clean-up. Indeed, the report of the envoys never claimed that acid rain controls were not beneficial; rather it argued against prompt American action on the grounds that existing technology carried with it high socio-economic costs. It is also important as a potential source of lower-cost abatement.

The true usefulness of the Envoys' Report, however, is limited by its lack of targets and timetables for SO_2 reduction. Without such a formula, the Envoys' Report could not be viewed as a real basis for acid rain clean-up.

Since that time, nothing has occurred to suggest that the Committee's view of the Envoys' Report was misguided. Little in the way of research and development spending has taken place. The technological frontier of abatement shows no sign of being conquered. More importantly, the report of the special envoys never became the focus of legislative initiatives. Indeed, that report relinquished any opportunity to initiate interim abatement measures, through the existing *U.S. Clean Air Act*, or through other means.

CHAPTER THREE

NITROGEN OXIDES

The oxides of nitrogen, commonly known as NO_x, are an important factor in the acid rain problem and in air pollution, generally. They are also important in the generation of ground-level ozone, a secondary pollutant which can have significant environmental and health effects.

Each year, Canada emits about 1.8 million metric tons (tonnes) of NO_x from man-made sources (1980 data). The seven provinces east of the Saskatchewan-Manitoba border comprise the region of most concern for acid rain. Annual emissions trends for NO_x in eastern Canada for 1970-1984 are shown in Table 1.

The transportation sector was the major emitter of NO_x in eastern Canada in 1980 and 1984, accounting for about 70% of total emissions in those two years. For Canada overall, the transportation sector accounts for about 65% of total NO_x emissions. In this sector, in 1984, light-duty motor vehicles produced almost one-half of the emissions and heavy-duty vehicles about 23%.

Fuel combustion by stationary sources comprises the second major emissions category for NO_x, accounting for just over 26% of the eastern Canadian total. In this category, power generation by utilities is the major source, accounting for about 54% of the total.

In addition to domestic NO_x production, a substantial quantity of this pollutant is received by Canada from sources in the United States, particularly from the midwestern states where coal-fired electricity generation is prevalent. Similarly, a portion of Canada's NO_x emissions is deposited in the United States. Total annual production of NO_x in the United States from anthropogenic sources is estimated to be between 17 and 19.7 million tonnes (1982 data).[1]

Preliminary estimates by Environment Canada of the transboundary flow of NO_x indicates the following: (a) the amount of nitrogen deposited in Canada south of the 60th parallel from United States sources is about two-thirds of total deposition; (b) about one-third of the approximately 1.8 million tonnes of Canada's annual domestic NO_x production is deposited in the United States; (c) the total deposition of NO_x in Canada is about 3.5 to 4 million tonnes.[2]

TABLE 1
EASTERN CANADA NITROGEN OXIDES* EMISSION TRENDS (1970-1984)

Emissions (Tonnes)

Category/Sector	1970	1972	1974	1976	1978	1980	1981	1982	1983	1984
Industrial Process	16,755	17,761	26,578	15,983	19,805	20,465	21,055	20,965	20,635	20,505
Sub-Total	16,755	17,761	26,578	15,983	19,805	20,465	21,055	20,965	20,635	20,505
Fuel Combustion/Stationary Sources										
Power Generation by Utilities	113,400	124,610	120,350	148,880	142,320	157,810	144,170	161,220	151,520	151,220
Residential Fuel Combustion	46,642	47,069	48,413	44,533	41,599	39,690	34,722	33,835	27,835	28,304
Commercial Fuel Combustion	37,876	44,070	36,145	29,242	26,920	25,146	24,291	22,653	22,759	20,697
Industrial Fuel Combustion	117,230	118,600	125,860	121,095	122,660	110,370	106,700	87,100	78,440	78,050
Sub-Total	315,148	334,349	330,768	343,750	333,499	333,016	309,883	304,808	280,554	278,271
Transportation										
Light-Duty Vehicles	290,123	339,066	389,267	368,507	369,433	352,878	352,528	351,270	360,412	344,204
Heavy-Duty Vehicles	61,483	85,539	89,826	119,759	160,595	191,914	199,174	191,677	192,687	168,085
Aircraft	14,550	18,790	24,440	25,190	25,120	25,930	24,316	22,340	21,936	23,696
Railroads	55,020	61,850	69,640	65,700	65,020	59,750	60,950	54,710	51,180	54,920
Marine	13,611	30,968	24,869	22,756	22,391	29,237	24,177	19,678	19,085	18,160
Off-Road Use of Gasoline	27,040	25,460	17,820	16,620	10,800	11,276	9,698	9,079	9,047	9,307
Other Diesel Engines	70,980	85,060	116,730	116,850	155,750	126,580	129,009	113,361	119,709	118,286
Sub-Total	532,807	646,733	732,592	735,382	809,059	797,565	799,852	762,115	774,056	736,658
Solid Waste Incineration	436	1,061	1,065	1,104	1,142	2,913	2,913	2,913	2,913	2,913
Sub-Total	436	1,061	1,065	1,104	1,142	2,913	2,913	2,913	2,913	2,913
Miscellaneous**	7,014	5,255	6,098	7,248	8,304	8,305	8,305	8,305	8,305	8,305
Sub-Total	7,014	5,255	6,098	7,248	8,304	8,305	8,305	8,305	8,305	8,305
TOTAL	872,160	1,005,159	1,097,100	1,103,467	1,171,859	1,162,264	1,142,008	1,099,106	1,086,463	1,046,652

*Expressed as NO_2.
**Excludes Forest Fires.
Source: Environment Canada, April 30,1987.

There is some debate over the relative importance of NO_x in the acid rain problem. Originally, it was believed that the acidifying potential of NO_x was about one-half that of sulphur oxides (SO_x), on a molecule-for-molecule basis. The perceived greater importance of SO_x in the acid rain problem has resulted in the concentration of regulatory effort in Canada on the control of sulphur dioxide (SO_2), the predominant oxide of sulphur. (The Canadian sulphur dioxide control program is discussed in Chapter 1 of this report.) Reduction of emissions of sulphur dioxide in the United States, to reduce transboundary flow of sulphate into Canada, is also the focus of ongoing bilateral negotiations between the two countries.

Canada has adopted an acid rain policy based on the relationship between sulphur dioxide emissions and the deposition of wet sulphate in eastern Canada, a policy married to the concept of "critical loadings." Environment Canada has determined that an annual rate of deposition of wet sulphate of 20 kg per hectare, or less, will serve to protect all but the most sensitive aquatic ecosystems. While there is not unanimous agreement that this level of deposition is low enough to protect the environment over the longer term, the concept itself is both practical and useful in that it permits regulators to identify a specific goal on which to base their decisions.

The Committee, in the course of our public hearings, has attempted to determine what might be an appropriate target level of nitrogen deposition that will not overwhelm the assimilative capacity of the Canadian environment. Testimony given by officials of Environment Canada indicates that the department doubts that NO_x emissions are causing environmental damage in Canada, although their precise total effects have not yet been clarified.

The following is a quote from Dr. Hans Martin, Senior Adviser with the department's Federal LRTAP Liaison Office:

> The nitrogen compounds in the atmosphere have not clearly been associated with (environmental) deterioration... We are now struggling to provide (the Committee) with... guidance on nitrogen, hydrocarbons, ozone, and ammonia: the whole complex of nitrogen compounds. We have not yet worked out the implications of these compounds, particularly in the forests, and therefore we cannot provide you with the strictest and clearest guidance. We do not have a crisis.(3)

Testimony from Alex Manson, Senior LRTAP Manager with Environment Canada, states that environmental problems with nitrogen compounds have not been observed where the deposition rate is less than 15 kg per hectare per year. The maximum nitrogen deposition rate recorded in eastern Canada is about 10 kg.(4)

Clearly, however, there are concerns about NO_x emissions that have not yet been laid to rest. As Dr. Martin suggests, the complex environmental chemistry of nitrogen compounds, hydrocarbons and ozone has not been satisfactorily delineated, particularly the role that NO_x plays in the generation of ground-level ozone and the effects of this secondary pollutant, in combination with other atmospheric chemicals, in the increasingly important problem of forest decline in North America. For Canadians, the serious decline of the sugar maple in Quebec and Ontario over the past decade is a major concern.

Serious concern about the effects of nitrate deposited from the atmosphere on the aquatic environment was expressed to the Committee by Dr. David Schindler, a Research Scientist with the Freshwater Institute of the Department of Fisheries and Oceans. Dr. Schindler is an expert on the nitrogen cycle in aquatic systems.

There is an increase, almost on a world-wide basis, in the nitrate content of fresh waters. Much of this nitrate is deposited from the atmosphere. In lake Superior, for example, the atmospheric contribution amounts to about 60%. Similar findings have been made in the 1000-lake survey in Norway where the nitrate content of fresh waters has been increasing dramatically.(5)

Although, as noted above, the acidifying potential of nitric acid is considered to be about one-half that for sulphuric acid in freshwater systems, Dr. Schindler suggested that the two acids have comparable acidifying potential in cold-water lakes. This occurs because the biological activity which metabolizes nitrogen is inhibited in cold-water systems.(6) This observation increases concern for the effects of NO_x and nitric acid in cold systems, a concern that clearly is pertinent to the Canadian situation.

Although there may be doubts about the severity of the threat currently posed by NO_x for the Canadian environment, Canada has made important progress, domestically, in controlling this group of pollutants. In the international forum, also, there has been encouraging progress in the development of a 35-nation protocol on NO_x, designed to prevent an increase in emissions above present levels.

A. Motor Vehicle Emissions

Canada's principal source of NO_x is the transportation sector and, within that sector, light-duty motor vehicles. The development in the 1970s of catalytic convertors, which significantly reduced emissions of NO_x, hydrocarbons and carbon monoxide from automobiles, provided an

opportunity to attack two problems: first, ground-level air pollution and, second, the contribution of vehicular NO_x to the North American acid rain problem.

Unfortunately, the federal government was slow to seize the opportunity to reduce motor vehicle emissions. In the first report of the House of Commons Sub-committee on Acid Rain, *Still Waters*, released in October 1981, a major recommendation was for the adoption of stricter emission standards for light-duty motor vehicles, comparable to those enforced in the United States since June 1981 by the Environmental Protection Agency.(7) The recommendation was not implemented.

In the Sub-committee's second report, *Time Lost*, tabled in June 1984, the same recommendation was made, and again was not implemented by the federal government.(8) However, by June 1984, Environment Canada and the Department of Transport were engaged in a Social and Economic Impact Analysis (SEIA) of the adoption of more stringent motor vehicle emission controls. The Sub-committee's principal criticism of this process was that it was taking an agonizingly long time to move from study to activity.

Substantial progress in this area has been made since 1984. New light-duty motor vehicle emissions standards for automobiles and light trucks took effect on September 1, 1987, and applied to all new vehicles sold in Canada, whether domestic or imported, as of that date. These more stringent regulations are expected to reduce vehicular emissions by about 45% by the end of the present century; specifically, total emission reductions for NO_x by the year 2000 will be 2.0 million tonnes, and for hydrocarbons 1.5 million tonnes. The new standards and their effects are summarized in Table 2.

Also, new heavy-duty vehicle standards will take effect on December 1, 1988. Under these new standards, emissions of NO_x and hydrocarbons will be reduced by 31.1% and 15.6%, respectively. Tonnage reductions by the year 2000 are estimated to be 1.32 million tonnes for NO_x and 195,000 tonnes for hydrocarbons. A summary of the new heavy-duty standards is presented in Table 3.

There are several points about Canada's NO_x control program for motor vehicles which must be noted. First, the current control measures will keep Canada's emissions at, or slightly below, 1987 levels only until about 1995, assuming there are no unanticipated events that result in an emissions increase in the interim. Current projections see NO_x emissions rising by about 20% between 1995 and 2005 because of increases in the Canadian

population, increases in the number of motor vehicles, increased energy production from fossil fuels, and increased overall economic activity.

Holding NO_x emissions at 1987 levels after 1995 will be an expensive undertaking; Environment Canada projects the total annual cost at between $700 million and $1.2 billion, in 1987 dollars. This is only a preliminary estimate because no specific course of action has been decided upon and the department has stated that extensive study and consultation must be carried out before a strategy can be developed.

TABLE 2

LIGHT DUTY VEHICLE EMISSION STANDARDS

	Former (Grams/Mile)	Effective Sept. 1/87 (Grams/Mile)
Cars		
Hydrocarbons	2	0.41
Carbon Monoxide	25	3.4
Nitrogen Oxides	3.1	1.0
Evaporative Emissions (Grams/Test)	24	2.0
Diesel Particulate Emissions	-	0.20
Light Trucks		
Hydrocarbons	2	0.80
Carbon Monoxide	25	10
Nitrogen Oxides		3.1
Loaded Vehicle Weight 1701 kg or less		1.2
Loaded Vehicle Weight Over 1701 kg		1.7
Evaporative Emissions (Grams/Test)	24	2.0
Diesel Particulate Emissions	-	0.26

Source: Transport Canada, Brief to the House of Commons Special Committee on Acid Rain, May 10, 1988.

TABLE 3

HEAVY-DUTY MOTOR VEHICLE EMISSION STANDARDS

(Grams per Megajoule)

	CURRENT	EFFECTIVE DEC. 1/88	
	Vehicle Weight Over 2721.6 kg	Vehicle Weight 6350.3 kg or Less	Vehicle Weight Over 6350.3 kg
Gasoline Fuelled			
Hydrocarbons plus Nitrogen Oxides	6.0	-	-
Hydrocarbons	-	0.41	0.71
Carbon Monoxide	15	5.36	13.8
Nitrogen Oxides	-	2.2	2.2
Evaporative Emissions (Grams/Test)	-	3.0	4.0
Diesel Fuelled			
Hydrocarbons plus Nitrogen Oxides	6.0	-	-
Hydrocarbons	-	0.48	0.48
Carbon Monoxide	15	5.77	5.77
Nitrogen Oxides	-	2.2	2.2
Particulates	-	0.22	0.22

Source: Transport Canada, Brief to the House of Commons Special Committee on Acid Rain, May 10, 1988.

That having been stated, there are certain approaches and target activities that are under consideration by government. In this important policy area, Environment Canada is the responsible department. Initiatives under consideration by the department include the following:

(1) the application of best available control technology on all new and existing industrial boilers;

(2) the implementation of comprehensive in-use motor vehicle inspection and maintenance programs;

(3) the application of emissions control standards on light-duty vehicles similar to those required currently in the state of California which has the most stringent standards in the world;

(4) the retro-fitting of low-NO_x burners on all existing fossil-fuel fired power plants;

(5) the application of state-of-the-art control technology on all new fossil-fuelled power plants.[9]

In their appearance before the Committee in May 1988, officials of Transport Canada stated that the department, which has regulatory authority for motor vehicle emissions standards under the *Motor Vehicle Safety Act*, was studying a number of regulatory initiatives which could affect NO_x emissions in the future.

One approach is the drafting of stricter heavy-duty emissions standards set at the 1991 and 1994 levels currently under consideration in the United States. When they are adopted in December of this year, Canada's heavy-duty emission standards will be stricter than those in the United States, but the EPA has drafted standards which are dependent upon the development of new technology by industry. A second initiative by Transport Canada is the review of motorcycle emission standards and the development of a regulatory impact analysis and suitable test methods. Motorcycle emissions are currently unregulated in Canada.[10]

While there is no question that the current motor vehicle emission standards have reduced the air pollution burden in Canada, in terms of both ambient air quality standards and the quantity of NO_x falling back to earth as acidic precipitation, there is the problem of ensuring that vehicles with state-of-the-art emission-control devices may not be optimally maintained during their lifetimes.

Transport Canada officials stated that the deliberate misfuelling of motor vehicles has become a minimal problem with new cars, partly because leaded gasoline is less available than it was and partly because the new generation of vehicles performs best with unleaded fuel. In Ontario, leaded fuel is no longer cheaper than lead-free, removing the temptation to misfuel in the country's largest market for automobiles. Similarly, the technological complexity of new vehicles is such that owners are discouraged from

tampering with emission control systems because of the effect that such tampering might have on overall vehicle performance and fuel economy.[11]

However, a better inspection and maintenance system could have positive benefits for reducing vehicle NO_x and other tailpipe emissions. This area is already under consideration by Environment Canada, as noted above.

B. The International NO_x Protocol

In July 1985, building on discussions held in Munich in June 1984, Canada and 20 other countries signed a protocol in Helsinki calling for a 30% reduction in emissions or transboundary movement of SO_2 from 1980 base case levels. The protocol is an instrument of the United Nations Economic Commission for Europe (ECE) Convention on long-range transboundary air pollution. The United States and the United Kingdom declined to sign the SO_2 protocol.

Through 1987 and into the present year, Canada and the other 34 nations of the ECE have been meeting in Geneva to develop a protocol on emissions and transboundary movement of NO_x. Canada's approach to the protocol has been based on a "freeze" of NO_x emissions by individual countries at 1987 levels through "application of best available control technology on new mobile and major stationary sources, and accelerated development of further control measures based on environmental quality targets."[12]

In late 1987 and early 1988, news media reports from Geneva generated some controversy when it was stated that Canada was supporting an American position by refusing to agree to an across-the-board 30% reduction in current NO_x emission levels. Some critics suggested that Canada had abandoned its "high moral ground" in acid rain control by not agreeing to the proposed 30% cut in emissions. At first glance, the criticism seemed justified. The Committee therefore scheduled public hearings to clarify the issue.

This report has already shown that Canada's efforts in reducing NO_x emissions have been successful, especially in reducing pollutants at ground level through attainment of National Ambient Air Quality Standards under the *Clean Air Act*. (This legislation has now been rolled into the *Canadian Environmental Protection Act*, CEPA.) We have also noted that Canada was tardy in adopting stricter motor vehicle emission standards and that the United States was the world leader in this field. However, motor vehicle

emissions in North America are today more strictly regulated than anywhere else in the world. Also, leaded gasoline is being phased out in North America, a situation quite different from that in many countries in Europe, for example, where unleaded gasoline is still very limited in supply.

The Minister of Environment Canada, Mr. McMillan, appeared before the Committee on April 21 and responded to the various criticisms of the government's position at the ECE meetings. With regard to the proposed 30% reduction, the government regards this as completely arbitrary and not related to specific environmental goals. The following statement by the Minister is pertinent to our discussion:

> Keep in mind that most of the European countries have no NO_x controls on their motor vehicles... Our automobiles... are 300% cleaner than those in Europe. The Europeans would have to slash their emissions by something like 60% to have the high quality of air that we enjoy in this country.(13)

The Minister also noted that a 30% reduction in NO_x emissions in Canada, below the already low levels, would be beyond current technological capability.

An important point in Canada's negotiating position at Geneva was the request for a freeze of NO_x emissions at 1987 levels. The United States argued for a freeze at levels that prevailed in 1987 "or any previous year." The Americans also argued for a "credit clause" which would recognize that they had achieved large reductions in NO_x emissions in advance of most other countries.

Canada opposed these positions. First, the "or any previous year" provision could have meant that the United States could have chosen 1978 when that country's NO_x emissions were at their highest. The net effect of this choice would have been an increase in NO_x emissions in the United States, including an increase in transboundary flows of nitrogen pollutants into Canada. The credit clause was opposed for a similar reason; namely, that the United States would have been allowed to increase its NO_x emissions over 1987 levels.

The negotiations toward an ECE NO_x protocol have since made significant progress. On August 6, President Reagan agreed to a proposal to freeze nitrogen oxides emissions at "1987 levels or any previous year," but with the added provision that transboundary fluxes of NO_x "for the period from 1 January 1987 to 1 January 1996 do not exceed transboundary fluxes for the calendar year 1987."(14) The other ECE nations had already agreed

to proceed with the signing of the protocol on October 31, 1988 in Sofia, Bulgaria, with or without United States participation.

United States agreement to the terms of the draft proposal is important to Canada because the freeze on transboundary fluxes of NO_x will effectively freeze U.S. emissions at 1987 levels since it is impossible to distinguish transboundary flows from national emission levels. Also, there is a provision in the protocol for renegotiating toward reductions in NO_x emissions below 1987 levels. Although there is no fixed date for such negotiations, they will probably take place prior to January 1996. This is an important point for Canada, because North American NO_x emissions are expected to begin rising above 1987 levels in the mid-1990s unless new and better control technologies are put in place.

The Committee believes that Canada's position during negotiations of the NO_x protocol was both responsible and consistent with the federal government's efforts to reduce levels of acid rain precursors, domestically and through international agreement. In retrospect, the negative news media comments on Canada's position during the negotiations appear to have been inaccurate and ill-advised.

In summary, although the Committee is pleased that Canada has made significant progress in controlling vehicular NO_x emissions and has, moreover, taken a responsible stand in the negotiation of an international NO_x protocol, there remain areas of concern that are unresolved. These relate to the unanswered questions about the significance of NO_x in the acid rain equation, and the question of the continued availability of leaded gasoline in Canada.

We have noted that there is disagreement about the seriousness of NO_x as a contributor to environmental damage through precipitation. While the considered opinions of Environment Canada are reassuring, the stated uncertainty about safe levels of nitrogen deposition in the Canadian environment, particularly in eastern and northern Canada, underline the need for cautious vigilance in this matter.

We have the statement of Environment Canada that the cost to maintain 1987 emission levels after 1995 will be very high, and will depend, in part, on the development and adoption of new technologies. The Committee is concerned, however, that 1987 levels may not, in fact, be adequate to protect the Canadian environment, and that evidence may yet be developed to show that stricter controls are needed.

Footnotes

(1) United States National Acid Precipitation Assessment Program, *NAPAP Interim Assessment, Volume II: Emissions and Controls*, Washington, D.C., 1987, p. 1-44.

(2) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, April 21, 1988, 19:9.

(3) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, December 9, 1987, 18:39-40.

(4) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, December 9, 1987, 18:42.

(5) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, June 23, 1988, 22:11.

(6) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, June 23, 1988, 22:12-13.

(7) Canada, House of Commons, Sub-committee on Acid Rain, *Still Waters: The Chilling Reality of Acid Rain*, Ottawa, 1981, p. 47.

(8) Canada, House of Commons, Sub-committee on Acid Rain, *Time Lost*, Ottawa, 1984, p. 17.

(9) Environment Canada, *Nitrogen Oxide (NO_x)—The Canadian Perspective*, Backgrounder, Ottawa (undated), p. 3.

(10) Transport Canada, *Regulation of New Motor Vehicle Emissions*, Brief to the House of Commons Special Committee on Acid Rain, Ottawa, May 10, 1988, p. 3.

(11) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, May 10, 1988, 20:8.

(12) Environment Canada, *Nitrogen Oxide (NO_x)—The Canadian Perspective*, Backgrounder, Ottawa (undated), p. 2.

(13) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, April 21, 1988, 19:8.

(14) Michael Weisskopf, "Reagan Agrees to Freeze U.S. Emissions of Pollutant—Way Is Cleared for Acid-Rain Treaty," *The Washington Post*, August 6, 1988.

CHAPTER FOUR

VISIT OF THE SPECIAL COMMITTEE ON ACID RAIN TO WASHINGTON, D.C., 23 AND 24 JUNE 1987

The House of Commons Special Committee on Acid Rain travelled to Washington, D.C. to meet with Members of Congress, United States government officials, industry representatives and environmental groups. The purpose of the trip was to familiarize Members of the Special Committee with the political climate in the American capitol and to impress upon American leaders the need for acid rain controls which would complement the program put in place in Canada.

Several topics seemed to dominate the interest of the various groups that the Committee met. These included the usefulness of the U.S. $5 billion Clean Coal Technology Demonstration Program; the debate over the benefits of environmental controls vs. the costs of clean-up; the regional nature of the acid rain conflict in the United States; and the bilateral conflict between Canada and the United States in this regard.

A. Clean Coal Technology (CCT)

The implementation of any significant abatement program in the United States will entail significant economic and social costs. It is these costs, and their distribution among the regions of the United States, that opponents of controls use to argue against significant further clean-up. Regions which rely heavily on the mining of high-sulphur coal for employment also tend to have high rates of unemployment and are among the poorest areas in the United States. One way of protecting these jobs is to employ control strategies which require the extensive use of scrubbers. This technology, however, carries a heavy price which reduces support for abatement efforts. For many political representatives of these coal-producing regions, the development of new technologies which can inexpensively control emissions from dirty coal is a necessary condition before further abatement can take place.

The concept of CCT as a solution to acid rain in the long run is, therefore, very appealing to those who are linked economically, or politically, to the coal industry in the American midwest. It is also the focus of American Administration action on acid rain. Representative Boucher of Virginia expressed his strong support for the program. Mr. Negroponte of

the State Department noted that the recommendations of the Special Envoys' Report would be a guideline for any State Department program. The National Coal Association supported CCT and saw it as a basis for emissions reductions.

Proponents of strong acid rain controls also saw a role for clean coal technology, but noted that Congress has been tightfisted in providing funding. Representative Sikorski and Senator Mitchell both saw benefits from this program. Mr. Ned Helme of the Alliance for Acid Rain Control stated his preference for public funding for the development of clean coal technology over the use of an electricity tax to fund abatement efforts.

A notable exception to this view came from Representative Silvio Conte of Massachusetts. He is a strong supporter of acid rain controls and Canada's position on this matter; but he is adamantly against clean coal technology, referring to it as a "rip-off." He believes that there is no evidence that the program will lead to emissions reductions, that it will lead to a delay in eventual emissions reductions, and he is, therefore, trying to reduce its funding.

This position may have some merit. Opponents of controls often are promoters of clean coal technology. This program is essentially a product of the Reagan Administration whose opposition to strong abatement efforts is well known. It is supported by Senator Byrd, another strong opponent of controls. As Bill Blaikie of the Committee noted, there is a tendency for those who view controls unfavourably to hide behind the Envoys' Report and to use CCT as a delaying tactic. Mr. Negroponte of the State Department argued that CCT is an expensive delaying tactic and it is unlikely, then, that the proposal would have been conceived for such a reason. Nevertheless, little in the way of productive developments were observed by June of 1987 with respect to CCT.

B. Costs and Benefits of Controls

The United States *Clean Air Act* (CAA) is primarily a health-based piece of legislation. Once the ambient standards were set to control deleterious health effects, attainment was required, regardless of the costs of control. Acid rain controls are seen as primarily an environmental issue. Since health effects are regarded as a minor component of total damages from acid rain, any legislation must meet a cost-benefit test. Opponents of controls claim that the benefits of control do not outweigh the costs of achieving the targets.

The Members of the Special Committee noted several times their dismay that the cost of abatement always figures prominently in discussions, yet the cost of inaction is rarely mentioned. Although qualitative aspects of environmental damage are usually mentioned by proponents of controls, even these groups and individuals have done little to quantify the costs of acid rain damage.

One of the few individuals to attempt such an assessment of environmental costs is Professor Crocker of the University of Wyoming. It was mentioned that, in 1986, he had reduced his estimate of damages in the eastern United States to $3.5 billion from and earlier $5 billion estimate.

C. Regional Conflict

In the United States, it is largely regional interests which determine political positions on acid rain. The north-east suffers much of the consequences of acid rain and produce little of the emissions. Politicians from this region support controls. Mid-western politicians do not support controls. Their constituents would pay the abatement costs for what they see as a highly localized problem. Western politicians are sometimes confronted with local problems, such as that associated with the Nacozari smelter in Mexico. Generally, they support controls on mid-western sources as long as their constituents do not have to pay for such controls.

Congressional legislation must foster alliances without antagonizing prospective allies. Representative Sharp of Indiana expressed his view that the "polluter pays principle" will eventually win out in legislation. Mr. Ned Helme of the Alliance for Acid Rain Control also expressed his dislike for a national electricity tax and noted that western states are firmly against such a provision. Thirty-eight prospective votes would be lost in Congress if such a provision were included in control legislation.

D. The Canadian Role

The Government of Canada wants a reduction in American exports of SO_2 to a level which is consistent with our acid rain control program. This can be achieved through an environmental treaty between the two countries or it could be the by-product of acid rain legislation passed through the United States Congress. In this regard Canada has become allied with American proponents of controls. Our nation has also then become a target of those who oppose greater controls. They question our motives, our sincerity, and our ability to deliver the promised Canadian SO_2 reductions.

The Members of the Special Committee were warned that the electricity export conspiracy theory was still popular in some circles as is the complaint that not one scrubber is to be found in Canada. These were refuted by noting that Canada has traditionally been a large exporter of electricity to the United States, that most SO_2 emissions in Canada come from non-ferrous smelters where scrubbers are not an effective means of control, and that Canadian utilities do not rely on coal burning to the degree that American utilities do—a different approach to SO_2 control is therefore called for.

The Canadian regulatory system differs from the American one and those who are unfamiliar with our approach may not have much faith in its efficacy. Opponents of American control measures tend to use this regulatory differential to denigrate the Canadian acid rain program, arguing that the federal government has no power to enforce the program. This argument did carry some weight in 1987 since New Brunswick and Nova Scotia had not yet signed agreements with the federal government to control SO_2 emissions. By this time, however, Premier Hatfield had appeared before the Special Committee and promised to sign an agreement to reduce SO_2 emissions to 185 kilotonnes per year by 1994. Moreover, it was noted that these two provinces will contribute a very small proportion of SO_2 reductions. The bulk of reductions are to come from Ontario and Quebec, and these reductions were never in doubt.

Canadians feel that we would gain by allying ourselves with American environmentalists, who also expect to get something out of such an alliance. At times, however, this can be strained. Senator Mitchell argued that, in some important ways, Canadian pressure on the United States has been insufficient. He said that the relationship between Prime Minister Mulroney and President Reagan is not more important than a resolution of this problem. He further noted that the only positive statements on acid rain that the President had made were in Canada. The pressure in the United States on the President never proved to be sufficient for him to move forward in this area.

CHAPTER FIVE

REPORT ON THE VISIT OF THE SPECIAL COMMITTEE ON ACID RAIN TO WASHINGTON, D.C., 7 AND 8 JUNE 1988

A. Overview

The Committee visited Washington for discussions with members of Congress, government officials and environmental groups. This year, the Committee could debate from the position that the Canadian government has achieved agreements with all seven eastern provinces for a comprehensive sulphur dioxide reduction program by 31 December 1994.

The first observation that the Committee made was that there is a strong consensus that the United States will, sooner rather than later, adopt acid rain control legislation. The situation is complex, given that there are two Houses of Congress and a number of individual bills in each of the House of Representatives and the Senate. Some of these bills are stalled in the committee stage; one, the Mitchell Bill (Senator George Mitchell, D-Maine), has been reported by the Senate Committee on Environment and Public Works as Bill S.1864. The bill has not made it to the floor of the Senate, however, having been stalled at the report stage by the Senate Majority Leader (Senator Robert Byrd, D-West Virginia).

A second observation relates directly to the first; the interest in, and understanding of, acid rain has increased markedly since the first visit to Washington of the House of Commons Sub-committee on Acid Rain in the fall of 1980. As the Chairman of the Special Committee noted during discussions, in 1980 acid rain was seen by environmentalists as "the best-kept secret in the United States." Since that time, legislative activity has increased markedly, discussion of the issue is widespread, and there is a sense that the two major opponents of legislation, Representative John Dingell (D-Michigan) and Senator Byrd, are fighting essentially rearguard actions.

B. The United States Clean Air Act (CAA) and Acid Rain

The United States *Clean Air Act* is, in a sense, a health act, rather than an environmental protection act. The legislation has not, to date, been used directly to control acid rain, although some of the National Ambient Air Quality Standards (NAAQS) have had the effect of reducing acid rain precursor pollutants; examples include sulphur dioxide (SO_2) and nitrogen

dioxide (NO_2). In general, the CAA has not been used to control acid rain pollutants *per se*, because the United States federal courts have ruled conclusively that the Environmental Protection Agency (EPA), which administers the CAA, may not allocate SO_2 and NO_x emission reductions because of uncertainties associated with source-receptor relationships in the complex acid rain phenomenon.

The source-receptor quandary also frustrates the application of Section 115 of the CAA, which deals with international air pollution. The EPA does not have to act in this case unless the origin(s) of the substances causing damage in a foreign country can be precisely identified. Since this is not possible at the present time, the Administrator of the EPA is unable to give formal notice to a state governor to effect appropriate emissions reductions to alleviate the problem.

The United States has a serious problem with ambient concentrations of ground-level ozone and carbon monoxide (CO), the main ingredients of urban smog. The problem is especially serious in the northeast and in the Los Angeles basin area. These high concentrations raise concerns for human health, the principal basis of the CAA. Approximately 60 United States cities are in non-compliance for these two pollutants. By 31 August of this year, the Congress must deal with this problem. One way of resolving it is to grant another extension of the compliance deadline, even though this would be politically embarrassing. It is generally agreed that some non-compliance areas (notably Los Angeles) will not be able to attain the ambient standard in this century, unless drastic and economically-crippling measures are taken.

Ozone pollution is not associated with sulphur dioxide; rather, it is a product of complex reactions between oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight and heat. In some circumstances, reducing the levels of NO_x pollution will reduce ozone formation. However, because NO_x is an ozone scavenger under certain conditions, a reduction in NO_x emissions alone may exacerbate the ozone pollution situation. For this reason, it is normally preferable to reduce NO_x emissions by controlling mobile sources, since the technology employed will also control hydrocarbons, including some VOCs.

Canada does have an interest in the ozone problem in the United States, however, and for two reasons. First, a reduction in ambient ozone concentrations in the United States will likely entail a reduction in NO_x emissions at source, and some reduction in transboundary flow of this pollutant into Canada. Second, if the ozone non-attainment problem is not

solved, the CAA may have to be amended. If this were to happen, the "door is open" for further amendments to the Act, possibly including amendments designed to control acid rain through legislated emissions reductions of SO_2 and NO_x. In this way, some of the provisions in the acid rain bills currently stalled in the Congress might come forward for debate on the floor of the House or the Senate.

The EPA is studying the possible need for new NAAQS under the CAA. One pollutant under consideration is acid aerosols, which may be the cause of respiratory problems in humans. This pollutant is the closest to acid rain which the EPA believes may be having an effect on human health, thus bringing it under the aegis of the CAA. Officials of the EPA informed the Committee that the extensive literature on acid aerosols is currently being reviewed by medical experts who may decide to make a recommendation to the EPA Administrator to establish an ambient standard.

The need for a stricter standard on ambient SO_2 is also under consideration by EPA. It is possible that a new one-hour standard may be established to protect the health of exercising asthmatics. Also under consideration is a standard for fine particulates, principally sulphates, to reduce visibility problems in areas of heavy pollution. While neither of these initiatives addresses directly the acid rain issue, new standards for each pollutant will have the effect of lowering SO_2 emissions at source and will effect some reduction in acid rain.

One aspect of the CAA of interest to the Committee is the fact that the EPA does not use cost-benefit analyses when setting National Ambient Air Quality Standards. Only the "benefit" side of the equation is considered when establishing standards designed to protect human health. (State Department officials stated to the Committee that some American regulations have effectively valued a human life at more than a billion dollars.) Therefore, it is probable that regulations such as the NAAQS are more stringent now than they would be if a formal cost-benefit analysis were carried out for each standard.

In summary, one can conclude that the legislation currently in place in the United States is not adequate to deal with the acid rain problem, except indirectly through the promulgation of ambient air quality standards designed to safeguard human health. The EPA is an administrative body bound by legislative strictures and, one might suggest, happy to be so in this particular case. The official, and oft-stated, position of the EPA is that acid rain is a serious environmental problem, but not one which presents an imminent hazard to people or to the ecosystem. Therefore, new legislation,

not bound to the precise source-receptor burden-of-proof onus that constrains action under the CAA, and which regards acid rain as a unique pollutant phenomenon, may be necessary to deal with the issue in a satisfactory manner.

C. Acid Rain Legislation in the United States Congress

There are a number of acid rain control bills currently before the United States Congress, as noted above. Most have not cleared the relevant House or Senate Committee; the Mitchell Bill (S.1864) is an exception but it, in turn, has been unable to proceed to the floor of the Senate for a vote.

The legislative process in the United States Congress is very different from that in Canada's parliamentary system. In the Congress, consensus politics is the rule, and complex negotiations between legislators typically take place before a specific bill, or a compromise bill, is eventually voted into law.

An aspect of the system in the United States that engenders some consternation among Canadians is the fact that the legislative process is designed so that an individual state can block or delay legislation that is seen to be contrary to its interests. If the legislator has a position of power in the Congress, his ability to frustrate the will of other legislators is increased significantly. Thus, Senator Byrd and Representative Dingell, who, respectively, occupy the positions of Senate Majority Leader and Chairman of the House Energy and Commerce Committee, have been able to delay acid rain legislation to the present time.

The situation in the Congress is further complicated by the lack of consensus among legislators generally on what is acceptable in acid rain control legislation. One common theme on Capitol Hill is that acid rain is a regional, rather than a national, issue in the United States. Senator Stafford (D-Vermont) said, for example, that the northeastern states feel they are victims of acid rain brought about by the desire for cheap electrical power in the U.S. midwest.

Many western and southern legislators have a similarly regional opinion. Their view was declaimed by Representative Jack Fields (R-Texas) whose office stated that these states do not contribute to the acid rain problem in the northeast and are not generally affected by acid rain themselves. Further, Representative Fields' position is that his state has dealt with its own environmental problems, at considerable effort and expense by state taxpayers.

The obvious conflict that grows out of this approach to acid rain is over the funding of the eventual cleanup program. Those who see the problem as regional hold that the "polluter-pays" approach must guide the development of acid rain legislation. Those who see acid rain as a national issue believe that all states should help pay for the cleanup through some sort of cost-sharing arrangement.

There is an emerging feeling in Washington that none of the current acid rain control bills will be passed by the Congress. Rather, it is felt that a compromise bill will be developed to obtain consensus among the various competing camps. Whether any bill will, in fact, be passed in the present session of Congress is questionable. The most optimistic outlook was a 50% chance for a bill to pass; other spokespersons put the chances at about 30%.

As noted above, Sen. Mitchell's Bill has been reported by the Senate Committee on Environment and Public Works as S.1864. Senator Byrd has refused to bring it to the floor of the Senate. That may be just as well, since a maximum of 48 Senators are currently willing to vote in favour of that bill, according to Sen. Tim Wirth (D-Colorado), at least three votes short of a majority. The Mitchell Bill is regarded, in political jargon, as very "liberal," in part because it calls for involvement of all 50 states, and a total annual reduction of 12 million tons of SO_2 below 1980 emission levels, in three phases: 5 million tons by 1 January 1993; a second 5 million tons by 1 January 1998; and a final 2 million tons by 1 January 2000. It is by far the most expensive of all the bills currently before Congress.

A "moderate" acid rain bill, S.316, has been co-sponsored by Senators Proxmire (D-Wisconsin) and Simpson (R-Wyoming). This bill affects only the 31 states east of the Mississippi River and calls for an annual 10 million ton reduction in SO_2 emissions by 31 December 1997. Senator Simpson is not currently supporting the Mitchell Bill. Negotiations between the two Senators are ongoing, but there is no certainty that an agreement can be reached in time to secure the passage of a bill before the end of the present session of Congress.

Another facet of the machinations in the Senate is the planned retirement of Senator Byrd as Senate Majority Leader after the end of the current session. Senator Mitchell is seen as a leading contender for that position, and there seems to be a feeling that he will moderate his stand on a number of issues in the interim, acid rain control included. It was suggested to the Committee that Senator Mitchell would not attempt to

circumvent Senator Byrd's authority in order to achieve a vote on his acid rain bill.

In the House of Representatives, the situation is just as complex. The Sikorski (D-Minnesota)—Waxman (D-California) Bill, H.R.2666, which calls for an annual 9 million ton reduction in SO_2 by 1997, has been stalled in the Health and Environment Subcommittee of the House Committee on Energy and Commerce. Representative Dingell is Chairman of the House Committee, and Representative Waxman is Chairman of the Sub-committee. Acid rain legislation in the House must originate in Representative Waxman's Sub-committee. At present, the bill does not have the votes to report it out of that Sub-committee. Moreover, once the bill leaves that Sub-committee, it must be reviewed by the Sub-committee on Energy and Power, chaired by Representative Sharp (D-Indiana); the Sikorski-Waxman Bill has even less support in this latter Sub-committee.

A possible compromise bill has been introduced by Representative Cooper (D-Tennessee) as H.R.4331. This bill mandates a 10 million ton two-stage reduction in annual SO_2 emissions by 2003; an initial reduction of 3.5 million tons would be required by 1997. This bill is rated by the Alliance for Acid Rain Control as "more moderate" than any other currently under consideration. The midwestern states favour the Cooper Bill because the modest initial reduction in SO_2 emissions will protect coal mining jobs in the high-sulphur coal areas; after 2000, clean coal technologies will have come on stream, and the larger reductions in SO_2 emissions can be effected even with the use of high-sulphur coal.

The Committee also encountered spokespersons who were, and are, willing to accept lower levels of SO_2 controls than are required under any of the current bills before Congress. For example, the Alliance for Acid Rain Control stated their willingness to settle for small initial pollutant reductions and an extended time frame for eventual larger controls. Ned Helme, Executive Director of the Alliance, as well as Representatives Boehlert (R-New York) and Swift (D-Washington), noted that Congress could have legislated a 5 million ton annual reduction in SO_2 six years ago, but the legislation was voted down by members who wanted a minimum 10 million ton reduction, supported by environmental groups such as the National Clean Air Coalition. The result, Mr. Helme noted, is that nothing at all has been achieved to date.

D. Energy Conservation and SO_2 Control

Energy conservation was mentioned as a possible scenario for SO_2 control, and it was noted that the introduction of energy-efficient lighting could reduce electricity demand sufficiently to close down the 40 dirtiest power plants. It was also asserted that this new energy-efficient technology was cost-effective over its lifetime, and the only reason that builders and owners of buildings don't make use of it is their excessive concern with short-term profits. This view was disputed by Dr. Larry Parker of the Congressional Research Service (CRS). A possible explanation for this discrepancy in views is the fact that conservation advocates may not be taking into account the interest cost on the initial investment in new lighting fixtures.

A more interesting feature of Dr. Parker's comments on this subject was his claim that conservation will not effect major reductions in SO_2 emissions. He noted that clean sources of electrical power are the most expensive sources. Since conservation reduces the demand for electricity, suppliers will respond by curtailing the use of those expensive sources. Without some regulatory action, or other economic measures, there is no incentive for power producers to reduce the output of "dirty" electricity in favour of "clean" power in the face of a reduced demand for electricity.

E. The Cuomo-Celeste Proposal

Governors Cuomo of New York and Celeste of Ohio have proposed an acid rain abatement program which would amend the CAA to reduce sulphur dioxide emissions by 10 million tons per year by 2003. The novel feature of this proposal is the way in which it would finance cost-sharing for the abatement program.

At present, the United States government purchases imported petroleum and stores it for future emergencies under the authority of the "Strategic Petroleum Reserve Program." About $650 million per year is appropriated for this purpose. Under the Cuomo-Celeste proposal, importers of oil would be required to set aside 2% of their imports for this strategic reserve, and the federal government ostensibly would save $650 million per year which could then be applied to subsidizing the acid rain cleanup program.

There are several features of this proposal which make its success doubtful. The most damaging is the accounting sleight-of-hand which is used to supply $650 million for acid rain control. The federal government owns the oil that is stored under this program. The $650 million annual

expenditure is largely an investment in the stock of oil and will be recouped when the oil eventually is sold. By transferring the cost of this program to the private sector, the government does not actually save $650 million per year. Its true savings amount only to storage and interest costs, minus any appreciation in the price of the oil.

Since the intent of the program is to buy oil when petroleum prices are low and sell it when shortages might occur (concurrent with an upward pressure on prices), the program might actually cost the government nothing. The Cuomo-Celeste proposal entails, in fact, a major *increase* in annual federal government expenditures over the long term, an increase which might not receive Congressional approval.

By transferring the cost of the strategic reserve to oil importers, the Cuomo-Celeste proposal imposes a tariff on imported oil. It is extremely likely that such a tariff contravenes the Canada-United States Free Trade Agreement. Since Canada supplies about 13% of American petroleum imports, an amount which may grow under free trade, the set-aside provisions that importers are faced with would have to be altered in order to maintain the goals of the strategic reserve program.

Also, the proposal attempts to shift acid rain abatement costs to an entirely different industry than the one which produces the bulk of the SO_2 problem. In that sense, it is inefficient from an economic point of view and probably unacceptable from a political point of view since it may create a whole new set of opponents to acid rain controls, namely the petroleum industry in the United States and their supporters in Congress.

The Cuomo-Celeste proposal is, in the words of Representative Scheuer (D-New York), "outside the legislative loop" of the United States Congress. As such, it is at best an interesting and perhaps provocative initiative, but has limited real value.

The proposal does have some useful political value, however, its weaknesses notwithstanding. As was noted by Ambassador Gotlieb during a briefing session with the Committee, this is perhaps the first time that a midwestern governor has admitted that acid rain is a serious environmental problem that should be dealt with on an urgent basis. Second, it is important that the governor of a "receptor" or "victim" state has agreed that the costs of cleanup should be shared by his state. Finally, the proposal says that acid rain is a national problem, and this might have some positive effect on the debate in the United States over whether acid rain has national or regional status.

CHAPTER SIX

THE NAPAP INTERIM ASSESSMENT

The United States National Acid Precipitation Program (NAPAP) was authorized by the Congress under the *Acid Precipitation Act* of 1980. The Act directed NAPAP to develop a comprehensive 10-year research plan on acidic precipitation, guided by an Interagency Task Force representing 12 federal agencies, the directors of four National Laboratories, and four Presidential Appointees.

The activities of NAPAP cover most aspects of acidic precipitation, including a monitoring network, impact studies, and economic assessments. Two areas of interest to acid rain researchers and regulators were specifically excluded; namely, health and visibility. In the United States, these come under the purview of other government agencies. In the NAPAP Interim Assessment Report, however, a review of available research on health and visibility was included, although not by a specialist in these fields.

On September 17, 1987, NAPAP presented its Interim Assessment Report. Almost immediately, the report, particularly the Executive Summary, came under intense criticism from individuals and groups in both the United States and Canada. The major criticism involved allegations that the Executive Summary, the portion of the report that would be most widely read, was politically biased and did not fairly represent the scientific facts, even as they were presented in the other three volumes of the report. A senior United States State Department official, John Negroponte, said that the NAPAP Interim Assessment supported Administration policies on acid rain and that additional emission reductions in the United States were not necessary at the present time.

The Executive Summary suggests that five basic conclusions can be drawn from the scientific data assembled by NAPAP:

(1) The effects of acid rain are neither widespread nor serious.

(2) There will be no abrupt changes in the effects of acid rain for the next several decades.

(3) Emission levels of sulphur dioxide have been nearly constant since the 1920s, are currently stable, and will decrease substantially over the next three to four decades

through the application of new technologies due to market forces.

(4) The effects of acid rain are less than were anticipated 10 years ago.

(5) Sufficient uncertainties remain to preclude determining whether abatement action is needed, or the nature of that action.

In the opinion of the Canadian government, all of these conclusions are seriously at variance with the majority scientific judgement and, indeed, misrepresent the scientific information contained in the main body of the NAPAP report itself. Why this was done, and who was responsible for the biased views contained in the Executive Summary, remain a mystery. We quote Minister McMillan on this point:

> I do not think there is any kind of conspiracy to cook the evidence among all the different agencies within the U.S. government which participated in the NAPAP report. Something was lost between the time the main body of the report was prepared and the executive summary was produced. Who is the culprit? Who used the scientific evidence so selectively when it came to preparing the executive summary? We take issue with some facets of the broader study, especially its incompleteness, but we think it is basically sound science as far as it goes.(1)

Environment Canada has prepared a comprehensive response to the NAPAP Interim Assessment, including the Executive Summary and the supporting volumes of scientific data. This response is available to the public and it is unnecessary to include that analysis in this present report.(2) However, some of the more obvious criticisms may be noted here.

A basic point concerns the definition of acidity in a lake. The NAPAP Executive Summary chose a pH of 5.0 as the threshold for determining lake acidity. Environment Canada states that both Canadian and American scientists have shown that biological effects from acidification occur for some aquatic species near pH 6.0, with some species disappearing from the ecosystem in the range of pH 6.0 to 5.0. Most fish species stop reproducing at a pH of 5.3 or 5.6 and some 30-50% of a lake's natural biota are gone by pH 5.0.(3) The Canadian view, one shared by scientists in other countries including the United States, is that pH 6.0 is a more accurate threshold for acidification.

A second major criticism concerns the NAPAP claim that lakes in eastern North America are at a "steady state" with respect to acidification. Canadian and American data indicate that this is simply not the case. Studies on acid-sensitive lakes in Ontario, as well as in the Adirondacks in

New York State, indicate that acidity has continued to increase in recent years and that alkalinity (the buffering capacity) continues to decrease in these lakes. These lake systems, then, are not in equilibrium. Also, it must be emphasized that even if these sensitive lakes have stabilized at a lower than natural pH, this chemical stability is not matched by biological stability. To quote Dr. Schindler:

> ...there is a biological lag in reaching steady state. That is, once you stabilize a lake at any low pH condition, it is probably going to be 20 or 30 years before the biological community stabilizes. Organisms will keep dying.[4]

If the lake stays at a low enough pH for a sufficient period of time, certain sensitive species will simply die out because they have been unable to reproduce. The attainment of chemical stability of a lake is irrelevant; the acidity of the lake has to be reversed.

A final point which we will mention concerns the assertion by NAPAP that emissions of SO_2 in the United States will decline substantially over the next 30 to 40 years, as a result of market forces and the adoption of new control technologies by polluting industries. The Canadian government believes that U.S. emissions of SO_2 are more likely to increase, rather than decrease, over the next 15 to 20 years. It is anticipated that older coal-fired power plants, which are essentially uncontrolled for emissions, will continue in use through refurbishing. In the absence of economic incentives or specific regulations, there will be only a limited application of advanced pollution control and combustion technologies on existing power plants over the next 30 to 40 years.

The significance of the NAPAP Interim Assessment for Canada is a matter of debate. On one level, the inaccuracies and evident bias in the Executive Summary suggest a lack of good faith on the part of some who work in the NAPAP organization. Whether there is effective control, or untoward influence, over NAPAP at the political level is a moot point, and impossible to verify.

It is a matter of concern that the Interim Assessment can, and may, be used by members of the Congress or by the next Administration to support acid-rain policies inimical to Canada's interests. On the other hand, one can take a measure of hope from the fact that many members of the U.S. scientific community have gone on record as being critical of the NAPAP report. It is possible that the report may now be generally viewed as a seriously flawed document, and that may serve to limit its usefulness for those opposed to pollution controls in the ongoing debate between Canada and the United States.

Footnotes

(1) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, October 27, 1987, 16:27.

(2) Federal/Provincial Research and Monitoring Coordinating Committee (RMCC), *A Critique of the U.S. National Acid Precipitation Assessment Program's Interim Assessment Report*, Ottawa, December 1987, 33 pp. (Copies available from Dr. H.C. Martin, Secretary, RMCC, Atmospheric Environment Service, Environment Canada, 4905 Dufferin Street, Downsview, Ontario M3H 5T4).

(3) Leslie Roberts, "Federal Report on Acid Rain Draws Criticism," *Science*, Vol. 237, 18 September 1987, p. 1404.

(4) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, Ottawa, June 23, 1988, 22:31.

CHAPTER SEVEN

ACID RAIN AND HUMAN HEALTH

Since the acid-rain problem emerged in North America about a decade ago, there have been concerns that acidic precipitation might be causing harm to human health, in addition to the more obvious effects on the environment at large. The major concern is for respiratory effects on people living in areas of significant acidic deposition. There are also secondary concerns, which include the contamination of drinking water by toxic metals from plumbing or from soils, as a consequence of water acidity.

The Committee has held several hearings on the issue of acid rain and human health. The issue is complex because of the number of toxicants that humans are exposed to in everyday life, some voluntary like smoking and alcohol consumption, others involuntary such as pesticide residues on food and trace chemicals in drinking water. Diet, lifestyle and heredity are also major determinants of the health status of an individual. It is clearly a difficult task to identify, in this collection of factors, the role played in human disease by transported mixtures of acidic air pollutants, and associated chemical species, at low concentrations in the atmosphere.

Acidic precipitation is associated with the LRTAP phenomenon, the long range transport of atmospheric pollutants. In LRTAP, the chemical mixture includes both primary and secondary pollutants. In the first category are the acid rain precursors, sulphur dioxide and oxides of nitrogen, together with ozone. All of these pollutants were regulated under the *Clean Air Act* under ambient air quality standards, until that act was repealed and its authority rolled into the *Canadian Environmental Protection Act* (CEPA). Concentrations of these pollutants associated with LRTAP are quite low, well below the levels set to protect ambient air quality.

The second group of air pollutants associated with LRTAP are chemical derivatives and transformation products which include such species as sulphuric acid and ammonium sulphate. These may appear in the atmosphere as particulate matter, that is, in the form of small airborne liquid or solid particles. These small particulates can invade the human respiratory passages and be deposited deep in the lung.

Although Canadian health authorities do not consider any single study associating LRTAP pollutants with health effects to be conclusive in

establishing a causal relationship, the evidence obtained from a number of comparable studies carried out in Canada, the United States, and in Europe, indicates that a causal relationship may well exist. At the very least, the growing body of evidence has prompted medical researchers and governments to study more closely the possible effects of low concentrations of acidic air pollutants on human health.

Because the complexity of pollutant mixtures in the LRTAP phenomenon makes controlled laboratory studies very difficult, medical researchers have carried out studies in the field. These epidemiological studies must be meticulously planned to take into account the many variables that influence human health, so that any observed effects may be ascribed to the pollutants under examination.

A region of Canada which has yielded valuable medical information is southwestern Ontario, which has the highest levels of acidic air pollution in Canada. Studies in this region have shown an association between "summer haze"—periods of elevated concentrations of sulphates and ozone, together with high temperatures—and an increased frequency of hospital admissions.(1)

Another study involved a comparison of matched groups of school children in southern Ontario and New Zealand. Dr. David Bates, in testimony before the Committee, commented on the study:

> ...the reactivity of the airways in the children in southern Ontario was significantly greater than in New Zealand by a factor of about two. These are... difficult studies to do, and they raise the question of whether the precursors of acid rain, including ozone and probably sulphuric acid, are altering a level of airway reactivity which might well have something to do with asthma.(2)

A third study has linked chronic exposure to low levels of transported acidic air pollutants with respiratory problems. A group of 1,400 Canadian children living in two communities were examined for incidence of respiratory diseases and tested for lung function. The two communities were Tillsonburg, Ontario which receives high levels of acidic air pollution; and Portage la Prairie, Manitoba which has relatively clean air.

There were two major findings in this study. First, the Tillsonburg children had higher frequencies of chest colds, inhalant allergies, stuffy noses, and coughs with phlegm. Second, and perhaps more important, the same children had 2% lower lung function measurements than the group in Manitoba. This small, but statistically significant, difference may have serious implications for these children's long-term respiratory fitness.(3)

In his appearance before the Committee, Dr. Bates expressed concern about the fact that hospital admissions for asthma have been rising in Canada and the United States since 1978. Also, the prescribing of drugs for asthma in Canada and in the United States and in parts of Europe has gone up by a factor of two since 1980. There are substantial economic costs associated with both these situations. The issue is not simple, however, and Dr. Bates expressed caution in interpreting the data at this point:

> We do not know what is behind (these observations), and there is a major international effort now to understand why more people are going to hospital for asthma in the United States and Canada... There are many reasons (why) this might be occurring, and air pollution might be part of it... But I suspect that a good deal of what is occurring is in fact called asthma. Whether or not it is asthma is another question.(4)

Studies of transported air pollutants are continuing, to determine their chronic and acute health effects. Testimony presented to the Committee by Dr. Claire Franklin of Health and Welfare Canada refers to a major study involving Canada and the United States:

> ...we have recently been awarded quite a large grant through the National Institute of Environmental Health Sciences, which is an arm of the National Institute of Health in the United States. It is a collaborative study that we are doing in conjunction with researchers at Harvard University. This is a $5 million study that will take place over the next five years.(5)

Canada's contribution to this study is about $1 million in funding, and includes medical research personnel and support facilities. Also, about one-quarter of the communities to be studied are located in Canada; the rest are in the United States. The main purpose of the study is to determine the impact of acid aerosols on human health.(6)

The question of acid aerosols is becoming more important in the debate over the health effects of acid rain. In his testimony, Dr. Bates discussed acid aerosols and described for the Committee the difficulties and high costs involved in monitoring the levels of acid aerosols in the environment.(7) When the Committee visited Washington in June 1988, we were told by officials of the United States Environmental Protection Agency that a National Ambient Air Quality Standard for acid aerosols, as a criteria pollutant under the (U.S.) *Clean Air Act*, was a possibility.

Acid aerosols are not precisely defined at this point. An aerosol is defined as a suspension of liquid or solid particles in a gas. A rough definition of an acid aerosol might be "a suspension of *acidic* liquid or solid particles in air." In practice, the main chemical species occurring in acid

aerosols appear to be strong acid sulphates, particularly sulphuric acid and ammonium bisulphate. Other acid species, especially nitric acid (from NO_x), may be important in some situations, particularly in the acid fogs of western coastal cities of the United States.

On June 8, 1988, a science advisory panel of the United States EPA recommended that the Agency should indeed set a standard on acid aerosols to protect public health, an action which involves listing it as a criteria pollutant under the United States *Clean Air Act*. If this happens, the Agency is required under the Act to propose a rule (regulation) within 12 months.[8]

There are several implications of this decision for Canada. A standard for acid aerosols in the United States could lead to emission reductions for both SO_2 and NO_x from that country, if it is determined that such reductions are necessary to meet domestic standards. While these actions might not meet the 50% SO_2 emission-reductions goal needed to protect the Canadian environment, they should at least be helpful.

Second, the American action should be taken under consideration in Canada to determine if a similar standard needs to be established under the *Canadian Environmental Protection Act*. If acid aerosols are shown to be a quantifiable health problem in Canada, it will be important also to determine whether the precursor emissions come from Canada or from across the border, and in what proportions.

Finally, the Committee is encouraged that important medical studies are underway in Canada to determine the health effects of acidic air pollutants. However, we wish to record in this Report the opinion of Dr. Bates that the health research side of the acid rain equation has been much smaller than the environmental research component.

> Canada has put, I estimate, a hundred times more money into studies relating to fish and lakes and trees than it has put into studies relating to human health... That means there are going to be few studies (on health) and little information... I think (environmental research) is certainly appropriate but has totally outweighed any effort to discover adverse effects of (acidic) pollution on (the health of) people.[9]

The Committee believes that the principal concern of government should be the health of its citizens. This view does not in any way diminish our unanimous concern for the environmental effects of acid rain and, by logical extension, their detrimental impact on the economy and the national welfare.

Footnotes

(1) Environment Canada, *Health Effects of Acid Rain*, Ottawa (undated).

(2) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, June 28, 1988, p. 23:9.

(3) Environment Canada, *Health Effects of Acid Rain*, Ottawa (undated).

(4) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, June 28, 1988, p. 23:8-9.

(5) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, December 9, 1987, p. 18:17-18.

(6) *Ibid.*, p. 18:18, 24.

(7) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, June 28, 1988, p. 23:6-8.

(8) Marjorie Sun, "Acid Aerosols Called Health Hazard," *Science*, Vol. 240, 24 June 1988, p. 1727.

(9) Canada, House of Commons, Special Committee on Acid Rain, *Minutes of Proceedings and Evidence*, June 28, 1988, p. 23:22-23.

CHAPTER EIGHT

RECOMMENDATIONS

The Canadian Acid Precipitation Abatement Program is designed to ultimately achieve a deposition level of 20 kg/ha/year of wet sulphate in the territory stretching from the Muskoka-Haliburton region in Ontario to the Quebec City area. According to Environment Canada's 1985 deposition data, the region within this band receives more than the target level of wet sulphate. Large portions receive more than 25 kg/ha/year and some parts receive more than 30 kg/ha/year.

A deposition level of 20 kg/ha/year will protect a moderately-sensitive aquatic system. Where the buffering capacity of the environment is lower, this target is insufficient to prevent damage from acid precipitation. As a consequence, some lakes and rivers will continue to suffer damage even after the Canadian program is fully in place, and a complementary American program has been enacted. The Committee considers this to be unacceptable and therefore we view the stated goals as only an interim measure.

The actual number of lakes and rivers to be sacrificed under this "interim" goal is unknown. According to officials of Environment Canada, the number is, in fact, very low. Meeting the 20 kg goal in the area noted above will also reduce deposition levels elsewhere in eastern Canada. We are informed that this goal will result in deposition levels of 12-15 kg/ha/year in Atlantic Canada, and 10-12 kg/ha/year in areas just north of this Muskoka-Quebec City band.

Acid rain is not just a problem for aquatic systems. Recent evidence indicates that acid rain affects all aspects of human life and all facets of the environment. Basing our support for an abatement program on the fact that the economic benefits of control exceed the costs requires that we examine more than aquatic affects. The economic damage to water systems is likely to be quite small in the overall scheme of things.

What if we discover that a deposition target of 20 kg/ha/year is insufficient to achieve the environmental goals Canadians have established for this acid rain program? In such a case, the existing program here, and the basis of our negotiations with the Americans must change. The

abatement effort in North America must be able to respond to such new scientific findings.

The Committee believes that the Canadian program does not constitute the ultimate in acid rain programs. It must first be determined whether the program actually achieves its stated goals, and we must continue our environmental research to determine whether lower deposition levels are needed and if techniques exist to meet those lower levels.

The planned 1994 reductions, which through negotiations to date, have been allocated to the various provinces, have failed to deal with 174 kt of So_2 emissions. The Committee understands that certain economic events may occur which would enable the 1994 target to be met. Nevertheless, a system of post-1994 controls cannot be put in place until this remaining tonnage is dealt with. We, therefore, make the following recommendations:

1. **Federal-provincial agreements have been signed to achieve a target of 2,300 kt of So_2 emissions in 1994. Of the necessary reductions, 174 kt have yet to be allocated to the provinces. The Committee recommends that the federal and provincial governments allocate the remaining 174 kt of So_2 emissions reductions by December 31, 1989.**

2. **The Committee recommends that deposition targets set out in the Canadian program be subject to a reduction as new scientific evidence or techniques of control emerge.**

The essence of the Canadian program is to reduce and eliminate acid precipitation. The Committee, therefore, makes the following recommendations:

3. **The Committee recommends that the federal government sign agreements with the provinces by December 31, 1994 setting out lower emissions levels than those that are currently established.**

4. **The Committee recommends that the federal government, in cooperation with the provinces, must devise a formula or strategy to take into account new sources of So_2 emissions in the future. These new sources must be taken into account when setting new, reduced emissions limits.**

5. **(a) The Committee recommends the signing of a bilateral agreement with the United States on So_2 emissions**

which must reduce by at least 50% transboundary flows of that pollutant, based on 1980 levels.

(b) The Committee recommends that any negotiated agreement with the United States shall contain provisions which recognize the necessity and possibility for reducing deposition and emission targets in the future.

The Committee has formulated the above recommendations in such a way as to ensure that the current acid rain program is viewed as the base upon which further reductions can take place. In other words, the state of the environment which this achieves should never be allowed to deteriorate, while measures to enhance it should be pursued wherever possible. The formulation of a strategy to deal with new sources of pollution is necessary to achieve such a policy of non-degradation.

The primary goal of environmental policy in general, and the acid rain program in particular, is to achieve deposition levels which minimize or eliminate environmental damage. If we achieve deposition levels below those considered to be environmentally benign, non-degradation requires that increased deposition not be allowed. Environmental protection dictates required emissions reductions. The concept of non-degradation prohibits emissions increases, simply because they are undesirable.

The Canadian Acid Precipitation Abatement Program relies mainly upon the control and reduction of emissions from a small number of large polluters. Individual controls could therefore be tailored to each operation. New sources of emissions can also be treated this way. It would require, however, further negotiations with provinces and existing polluters to decide where the offsets are to come from.

The system of regulations which achieved the cuts in emissions originally may not be the best system to use as the economy attempts to operate under the new lower levels of pollution. Environment Canada is actively pursuing the examination of other regulatory options which might be more suitable to the task at hand and be acceptable to governments which would impose the regulations, the industries which would be regulated by them, and the public which will enjoy the benefits or suffer the consequences. In *Still Waters*, the Sub-committee on Acid Rain recommended that a wide variety of innovative regulatory instruments be considered.

The Committee notes that such an examination of regulatory systems is useful and necessary. These alternatives could be examined by various bodies who are concerned with environmental matters. Two examples of such bodies are the Canadian Council of Resource and Environment Ministers (CCREM) and the multi-sector roundtables which the CCREM proposed be established.

A system of environmental controls is only as good as the extent of compliance. An abatement program which is very stringent on paper, but which is not complied with, has no value. Since compliance is very expensive in many cases, it is important that the regulatory system not create any incentives for non-compliance or for delayed compliance. In this regard, a system of economic sanctions or penalties is important. The federal-provincial agreements contain no provisions for penalties.

6. The Committee recommends that the federal government undertake to control future acid rain-causing emissions under the aegis of the *Canadian Environmental Protection Act*. To do so, it must:

(a) list oxides of sulphur as a toxic substance under the Act; and

(b) write regulations, or negotiate agreements with the provinces, to control emissions at the source.

The Committee recommends that these regulations come into force as soon as possible but not later than January 1, 1995.

Recommendation 6 places the control of sulphur oxides under CEPA after 1994. After that time, federal regulations would control these pollutants where a province does not satisfy the federal government that its own regulations are sufficient. In either event, the point sources of SO_x pollution would be subject to the penalties specified in the Act for non-compliance.

There is at present no agreement between the federal government and the provinces of British Columbia, Saskatchewan and Alberta to reduce So_2 emissions in western Canada. While the volumes of emissions are considerably lower than in eastern Canada, the Committee recognizes that there are many areas of extreme sensitivity and, as well, certain threats posed to human health.

7. The Committee recommends that the federal government should initiate, in cooperation with the three western provinces, a program to assess the scope of the acid rain problem in western Canada, potential remedial actions and whether or not federal-provincial agreements are required.

The Committee recognizes that the reduction of anthropogenic emissions of So_2 is a global imperative. An important factor in the complex international political process is the development of international political protocols to control various types of pollution. In July 1985, Canada and 20 other countries signed the Helsinki Protocol calling for a 30% reduction in So_2 emissions by 1993. The United States, the United Kingdom and Poland did not sign the Protocol.

8. The Committee recommends that, in the spirit of global cooperation on environmental problems, the federal government should intensify efforts to encourage the United States, the United Kingdom and Poland to sign the Helsinki Protocol to reduce So_2 emissions by 30% by 1993. In addition, the government should convene a meeting of the Helsinki Protocol nations to seek a reduction beyond the current agreement.

Canada's acid rain control program is based on the "critical loading" principal, and it has been determined that a deposition level of 20 kg/ha/year of wet sulphate will protect moderately-sensitive aquatic systems in this country. It is believed that this level of deposition will also protect the environment generally. No similar critical loading level has been determined for nitrogen derived from NO_x. The Committee believes that it is important to determine this level so that a comprehensive acid rain control program covering both sulphur and nitrogen deposition can be developed.

9. The Committee recommends that Environment Canada should establish, as soon as possible, a critical loading level for nitrogen in the Canadian environment and establish a deposition level that will protect the environment from damage and protect human health from the effects of water acidification due to nitrogen deposition.

Although the main concern of the Special Committee is the elimination of the acid-rain threat to the Canadian environment, we are cognizant that nitrogen oxides emissions are associated with three other

pollution problems, namely: local air quality degradation as a consequence of nitrogen dioxide levels; ozone generation through reactions between NO_x and volatile organic compounds (VOC) in the presence of sunlight; and the contribution to the "greenhouse effect" by nitrous oxide which comprises about 5% of the NO_x emissions.

Information provided by Environment Canada suggests that the effect of NO_x on local air quality is not a major concern and that the contribution to the greenhouse effect is small relative to that of other pollutants. The major problem with NO_x emissions, apart from that of environmental acidification, lies with ozone, a secondary pollutant in the complex of atmospheric chemical reactions. While a substantial proportion of the ozone pollution in Ontario, Quebec and the Atlantic Provinces is a consequence of transboundary flows of pollutants from the United States, Canadian-sourced NO_x is not an insignificant part of the problem.

It seems clear to the Committee that a level of NO_x emissions that might not be significant in terms of environmental acidification might still pose an environmental and human-health threat in the form of ozone pollution. We are also aware that ozone control is not achieved simply by reducing the atmospheric levels of NO_x without a parallel reduction in the levels of VOC. The Committee believes, therefore, that the allowable level of NO_x emissions in Canada should be established to effect control of *both* acidification and ozone pollution.

10. (a) Having established the critical loading level for nitrogen in Canada, Environment Canada should determine the level of emissions reductions necessary to stay below that critical loading level.

(b) The Committee recommends that Environment Canada should establish whether transboundary flows of nitrogen are significant contributors to the Canadian acid rain problem.

(c) In cooperation with the provinces, Environment Canada should also establish strategies for the reduction and control of ground-level ozone pollution.

The major source of NO_x in Canada is the transportation sector. This being the case, it is essential, in the Committee's view, that Canada always enforce the application of the best available emissions-control technology for motor vehicles sold in Canada. The Committee has known for some time that tailpipe emission standards in California are the most stringent in the

world. The adoption of the available technology to achieve these standards throughout Canada and the United States will be very expensive but will become necessary to protect the environment in the future. In the meantime, it is possible that new emission-control technology will be developed in North America, or elsewhere, to achieve lower emissions of NO_x and other pollutants. Wherever, and whenever, improved emission control technology is developed for motor vehicles, it should be evaluated for possible adoption in Canada.

11. The Committee recommends that the federal government should ensure that there is no unnecessary delay in the adoption of the best emission control technology for light-duty and heavy-duty vehicles when such new technology becomes available.

The best available control technology is not useful if the systems, and the vehicles on which they are installed, are not appropriately maintained and serviced. It is essential, therefore, to establish an effective inspection and maintenance program for motor vehicles to ensure that emission-control systems perform up to specifications. In Canada, such programs fall under provincial jurisdiction. However, the Committee believes it is appropriate that the federal government, through Transport Canada, should be actively involved in the development and implementation of such programs at the provincial level.

12. The Committee recommends that the federal government, through Environment Canada and Transport Canada, should work cooperatively with the provincial governments to develop and implement in-use motor vehicle inspection and maintenance programs to ensure that emission control systems continue to perform at optimal levels. The federal government's participation could include some funding, technological and informational support, and the cooperative development of a prototype inspection and maintenance program.

Not all motor vehicles in Canada currently are regulated for tailpipe emissions under the *Motor Vehicle Safety Act* (MSVA) or under other legislation. Included in this unregulated category are motorcycles, which can be regulated under the MVSA, and various off-road vehicles, which cannot, at present, be regulated under that legislation. Although motorcycles are not major sources of NO_x and other pollutants, they are part of the overall problem and should be made part of the eventual solution to acid rain.

Off-road vehicles, and a variety of primarily diesel-fuelled engines used in agriculture, mining, forestry, construction, and other activities, do represent a significant source of NO_x emissions.

There is limited information on this group of vehicles and engines at the present time. It is known that they represent a great variety of sizes and types and the seriousness of their pollutant emissions varies greatly. Some of these large engines (both stationary and vehicular) will essentially comply with the new heavy-duty vehicle standards, when these become effective on December 1, 1988, because of new standards and technologies adopted by their manufacturers to bring their on-road vehicles into compliance with the MVSA.

The first step in the regulatory process is the preparation of a Social and Economic Impact Analysis (SEIA) of the proposed regulation of motorcycles, off-road vehicles and stationary engines. Such an analysis would have to compile detailed information on the number and types of engines involved, where they are located, how large their emissions are, and an estimate of the environmental and health effects of the emissions. The SEIA would also determine under what legislation the regulation could be imposed, whether the regulation of these engines is cost-effective in comparison with other actions which might produce the same desired results, and an assessment of the technology which could be used, or developed, to effect the desired emission reductions.

13. The Committee recommends that the federal government, through the Departments of Environment and Transport, should develop and publish a Social and Economic Impact Analysis for the possible regulation of tailpipe emissions from motorcycles, off-road vehicles, and stationary engines so as to bring about an eventual reduction in NO_x and other pollutant emissions from these sources.

The 35-nation ECE NO_x protocol is an optimistic sign that the industrialized nations are finally taking responsibility for a comprehensive international approach to environmental pollution. The Committee believes it is important to build on this initiative and to progress beyond a freeze on NO_x emissions and work towards significant reductions in international levels of NO_x pollution.

14. The Committee recommends that the federal government, through Environment Canada and External Affairs, must continue to take a leading role in future negotiations on the

ECE NO_x protocol to ensure the success of the present agreement, and to work towards an amended agreement which will mandate real reductions in future NO_x emissions below 1987 levels.

The attempt to identify and quantify the health effects of acid rain has shown that accurate and accessible hospital records are essential for the pursuance of epidemiological studies. The Committee believes that the computerization of hospital records across Canada will yield important dividends for health research, not only for the acid rain problem, but for all environment-linked illnesses.

15. The Committee recommends that the federal government, through Health and Welfare Canada, should urge the provincial governments to computerize hospital admission records and hospital emergency department visits to facilitate comprehensive epidemiological studies of environmentally-induced diseases.

In testimony before the Special Committee, Dr. David Bates stated that episodes of significant acid aerosol pollution have been recorded in Ontario and there is a growing concern for the effects of this pollutant on human health. This concern is shared by officials at the United States Environmental Protection Agency. The EPA is currently considering a recommendation to establish a National Ambient Air Quality Standard for acid aerosols under the U.S. *Clean Air Act.*

The Committee believes that Canadian health authorities should carry out an independent evaluation of the potential impact of acid aerosols on human health, but maintain close communication with their American colleagues on this issue. The goal of such an evaluation should be to determine whether Canada needs to establish an air quality standard for acid aerosols under the *Canadian Environmental Protection Act.*

16. The Committee recommends that Environment Canada should study the problem of acid aerosols to determine if this pollutant should be regulated under the *Canadian Environmental Protection Act.*

Canada's original, and principal concerns for the effects of acid rain have been concentrated on environmental impacts, particularly the impacts on freshwater systems and forest productivity. The Committee believes that these concerns were, and are, well-placed. In recent years, however, the

subtle, but significant, effects of acidic pollutants on human health have become more important in the total picture.

Dr. David Bates, in his most recent appearance before the Special Committee, stated that the funding traditionally provided for Environmental research has been vastly greater than that provided for research on the health impacts of acid rain. Looked at in historical context, this is not surprising, since the most readily observed impacts are in the environmental area and the effects on health are often hard to demonstrate. Testimony obtained from officials of Health and Welfare Canada discusses long-term epidemiological studies currently being funded by the department. Also, the Committee is aware that some other health-related studies are under way, for example, the problem of potable water contamination by toxic metals.

Information provided by Health and Welfare Canada indicates that health-related research has been funded over the past several years at about one million dollars per year. The research program, which comes under the department's Environmental and Occupational Toxicology Division, is staffed at the level of three person-years (PY). More staff and funding are needed to carry out a truly effective research program; it has been suggested that an appropriate staffing level would be at least six PYs, together with an increase in funding.

An interesting piece of information provided to the Committee is that Health and Welfare Canada receives an additional one million dollars per year (approximate) for health-related research from the United States National Institute for Environmental Health Sciences (NIEHS). This funding is being provided for a five-year epidemiological study by the department in collaboration with Harvard University.

The irony of this funding arrangement is not lost on the Committee, considering the huge quantities of acidic pollutants that flow into Canada from the United States. More seriously, however, the Committee is concerned that Health and Welfare Canada receives as much funding for acid-rain research from the United States as it does from Treasury Board. The provision of funding by a foreign government clearly is a compliment to the expertise and reputation of Canada's health science community. However, we cannot downplay our concern that federal government funding for health research in the area of acid rain may be lower than is appropriate.

17. The Committee recommends that the federal government increase the Canadian program of research on the impact of acid rain on human health.

APPENDIX I

AN INTRODUCTION TO ACID RAIN

Acid rain, or acidic precipitation, is an environmental pollutant which derives primarily from industrial activities. The phenomenon has actually been known since the mid-seventeenth century when the effects of industrial smoke, mainly from coal-burning, were observed on the health of people and plants in England. It was also observed that pollutants crossed the Channel between England and France. In 1872, the English scientist, Angus Smith, first used the term "acid rain" in a publication entitled *Air and Rain: The Beginnings of a Chemical Climatology.*

The pollutants of most concern in the acid rain problem of today are the oxides of sulphur and nitrogen, commonly known as SO_x and NO_x. The most common chemical species are sulphur dioxide (SO_2) and nitrogen dioxide (NO_2). These chemicals, and others, mix in the atmosphere in extremely complex reactions to form acids, and acid precursors. The two acids of most concern are sulphuric acid (H_2SO_4) and nitric acid (HNO_3). These are strong acids which dissociate completely in water to release the hydrogen ions (H^+) which are, in fact, the source of acidity.

North American industry and consumers generate huge quantities of SO_2 and NO_x. The most comprehensive data on emissions for the United States and Canada are for 1980 which is also the "base year" against which emission reductions have been established for the Canadian acid-rain abatement program.

Total Canadian emissions of SO_2 in 1980 were some 4.6 million metric tons (tonnes). Almost 50% of the total came from the non-ferrous smelting sector. Total U.S. SO_2 emissions for the same year were about 24 million tonnes; thermal power generation accounted for some two-thirds of the total in that country. Thus, emission sources in the two countries are strikingly different. It should be noted also that Canada, on a per capita basis, produces about twice as much SO_2 as does the United States. There is a notable regional character in SO_2 emissions in North America, with some 80% of total emissions coming from the seven provinces east of the Saskatchewan-Manitoba border, and from the 31 states east of the Mississippi River.

NO_x emissions in 1980 are estimated to have been 1.7 and 21 million tonnes in Canada and the United States, respectively. In both countries, the transportation sector and thermal power plants are the largest sources, with the latter sector relatively more important in the United States. Emissions of NO_x are more evenly distributed over the continent than SO_2.

Acid rain potentially may affect all sectors of the environment, including human health. The most persuasive evidence has been assembled for aquatic systems and it is now well known that freshwater bodies begin to show biological damage at about pH 6, a very moderate level of acidity. The effects of acid rain on terrestrial ecosystems, including forests and agricultural lands, are less easy to determine but it is feared that forests, in particular, are being damaged by acid rain and by associated pollutants such as ozone. It is also known that man-made materials are susceptible to damage from acid rain and from associated air pollutants. Not only is the dollar cost of acid-rain damage to buildings and other structures very high, but many of humankind's most treasured artifacts, including sculpture and historic sites, are threatened with destruction.

Since 1980, the total amounts of sulphur and nitrogen emissions in North America have decreased somewhat but the overall problem of acid rain remains, and rigorous control programs are needed on both sides of the border to effect an acceptable level of abatement. Negotiations continue between Canada and the United States in an effort to develop and implement a bilateral accord which will bring about a coordinated plan to solve this serious environmental problem.

APPENDIX II

THE RESPONSE TO THE RECOMMENDATIONS IN THE TWO REPORTS OF THE HOUSE OF COMMONS SUB-COMMITTEES ON ACID RAIN, *STILL WATERS* (1981) AND *TIME LOST* (1984)

A. *STILL WATERS* [38 Recommendations]

RECOMMENDATION 1 - National Energy Program

The Sub-committee recommends that grants from the National Energy Program's Utility Off-Oil Fund for conversion of oil-fired electricity plants to coal be made conditional upon the installation of the best available emission control technology for oxides of sulphur and nitrogen.

RECOMMENDATION 2 - Coal-Fired Power Plants

The Sub-committee recommends that all conversions of oil-fired electricity plants to coal in Canada, whether or not such conversions are financed in whole or in part by government funds, be carried out utilizing the best available emission control technology for oxides of sulphur and nitrogen.

No conversion of oil-fired plants were carried out under the National Energy Program (NEP). The NEP was terminated by the federal government in 1985.

RECOMMENDATION 3 - Nova Scotia Power Corporation

The Sub-committee recommends that the Lingan Generating Station operated by the Nova Scotia Power Corporation at Cape Breton be compelled to utilize the best available emission control technology for oxides of sulphur and nitrogen. This recommendation applies to generating units presently in operation and to those units planned or under construction.

In making this recommendation, the Sub-committee was principally interested in the use of flue-gas scrubbers for SO_2 control. The Lingan facility does not use scrubbers, but does use low-NO_x burners which could be described as "best available technology" for that pollutant.

RECOMMENDATION 4 - Coal-Fired Power Plants

The Sub-committee recommends that all new coal-fired electricity plants planned or under construction in Canada be compelled to utilize the best available emission control technology for oxides of sulphur and nitrogen.

In April 1981 the Minister of Environment Canada issued "Thermal Power Generation Emissions — National Guidelines for New Stationary Sources." These guidelines indicated maximum quantities of nitrogen oxides (NO_x), particulate matter and sulphur dioxide (SO_2) to be emitted from "fossil fuel-fired steam-driven electricity generating units." The emission limits recommended in the guidelines are described as "achievable using control methods now available to the industry for the abatement of the specified air pollutants": in other words, by use of the best available technology.

To date, only the Alberta government has issued regulations incorporating the thermal power guidelines. However, no new coal-fired plants are planned for Alberta at this time. Saskatchewan has constructed a new coal-fired power plant which uses low-NO_x burners, sorbent injection to capture SO_2, and also uses low-sulphur coal as fuel.

RECOMMENDATION 5 - Ontario Hydro

The Sub-committee recommends that the Federal Government urge the Ontario Ministry of the Environment to compel Ontario Hydro to utilize the best available technology to control emissions of sulphur and nitrogen oxides at all existing and new coal-fired electrical generating stations in that province.

Ontario Hydro has not yet installed flue-gas scrubbers at any of its coal-fired power plants. The utility does use low-NO_x burners, however. Also, Ontario Hydro now operates under Ontario Regulation 662/85 which mandates that total acid gas emissions will be reduced from a maximum of 430 kilotonnes (kt) in 1986 to 215 kt per year by 1994. The utility has not decided on the technology it will use.

RECOMMENDATIONS 6 & 7 - INCO Limited

The Sub-committee recommends that the INCO Limited smelter at Copper Cliff, Ontario be compelled to reduce its sulphur dioxide emissions to 750 tonnes per day and that this level be attained within five years.

The Sub-committee recommends that the INCO Limited smelter at Thompson, Manitoba be compelled to reduce its sulphur dioxide emissions to 220 tonnes per day and that this level be attained within five years.

RECOMMENDATION 8 - Falconbridge Nickel Mines Limited

The Sub-committee recommends that the Falconbridge Nickel Mines Limited smelter at Sudbury, Ontario be compelled to reduce its sulphur dioxide emissions to 210 tonnes per day and that this level be attained within five years.

RECOMMENDATION 9 - Noranda Mines Limited (Mines Gaspé)

The Sub-committee recommends that the Noranda Mines Limited (Mines Gaspé) smelter at Murdochville, Quebec be compelled to reduce its sulphur dioxide emissions to 115 tonnes per day and that this level be attained within five years.

RECOMMENDÁTION 10 - Noranda Mines Limited (Horne Division); Hudson Bay Mining Smelting Company Limited

The Sub-committee recommends that the Federal Government, in full consultation with concerned Provincial Governments and industry officials, convene a Task Force to study appropriate technologies and economic initiatives to implement an 80 per cent sulphur containment objective at the non-ferrous smelters operated by Noranda Mines Limited (Horne Division) at Noranda, Quebec and by Hudson Bay Mining and Smelting Company Limited at Flin Flon, Manitoba. The Task Force should be convened immediately and should report within a six-month period.

These recommendations were not implemented. However, as discussed elsewhere in this present report, the non-ferrous smelting sector is included in the Canadian sulphur dioxide abatement program and each smelter will be required to meet specific control targets by 1994.

RECOMMENDATION 11 - Motor Vehicles

The Sub-committee recommends that NO_x emission control standards for new motor vehicles sold in Canada be made at least as stringent as those enforced in the United States by the Environmental Protection Agency as of June 1981.

RECOMMENDATION 12 - Motor Vehicle Safety Act

The Sub-committee recommends that legislative authority to regulate motor vehicle emissions through standards applicable to manufacturers and distributors be transferred from the *Motor Vehicle Safety Act* to the *Clean Air Act* and hence from the Ministry of Transport to the Department of Environment which already has significant responsibilities in the area of air pollution.

Recommendation 11 has been met, as discussed elsewhere in this report. Both light-duty and heavy-duty motor vehicles are, or soon will be, required to meet NO_x emission standards equal to, or stricter than, those enforced in the United States. Recommendation 12 has not been implemented. The *Clean Air Act* has now been rolled into the *Canadian Environmental Protection Act* (CEPA).

RECOMMENDATION 13 - Forests

The Sub-committee recommends that Environment Canada continue an intensive research program into the effects that acid rain is having on Canadian forests. The Sub-committee further recommends that the Federal Government conduct a thorough review of the structure and funding of the Canadian Forestry Service to determine if there is a need for increases in funding and/or person years to effectively deal with the research requirements necessitated by the acid rain problem.

This recommendation has, in essence, been implemented. The Canadian Forestry Service (recently upgraded to a separate government department) has a comprehensive research program for acid rain.

RECOMMENDATION 14 - Agriculture

The Sub-committee recommends that Agriculture Canada develop a comprehensive research program to study the effects of acid rain on crops and soils in Canada. This research program should include studies of the effects of acid rain precursors and ozone on crops and particular attention should be given to the effects that current fertilization practices are having on soils to render them more sensitive to cumulative acid loadings.

Agriculture Canada has continued to include research on the effects of precipitation acidity on soils and crops within the Department's overall research program.

RECOMMENDATION 15 - Liming

The Sub-committee recommends that liming, as a mitigative strategy against acid rain damage, be considered by governments only for selected waterbodies to raise the pH of the water to restore and/or protect desirable fish populations. The Sub-committee emphasizes that liming must not be regarded as a substitute for the control of acid rain-causing emissions at source.

No large-scale liming projects are being carried on in Canada. Environment Canada supports the use of liming only as a short-term mitigative measure.

RECOMMENDATION 16 - Drinking Water

The Sub-committee recommends that the federal Department of Health and Welfare and the Department of Environment, in cooperation with provincial authorities, accord high priority to a research program to identify levels and species of toxic metals in potable water supplies in Canada with special emphasis being given to those areas under greatest impact from acid precipitation.

Health and Welfare Canada, in consultation with the Department of Energy, Mines and Resources, maintains an ongoing research program within the LRTAP Health Effects Section on the contamination of drinking water by toxic metals.

RECOMMENDATION 17 - Mercury in Fish

The Sub-committee recommends that the Federal Government examine its research program to ensure that adequate funding is being provided for research to determine the relationship between acidic precipitation and mercury contamination of fish in sensitive lakes and streams. We further recommend that suitable public health monitoring programs be initiated to determine the degree of risk faced by those populations whose diet contains large amounts of fish from sensitive areas.

The problem of mercury contamination of fish has been extensively researched in Canada and extensive information has been made available to the public. The provincial governments are also active in this area, particularly with respect to sport fish in Ontario and Quebec.

RECOMMENDATION 18 - Monitoring

The Sub-committee recommends that Environment Canada, in consultation with appropriate provincial ministries, carry out a comprehensive review of all aspects of monitoring acidic precipitation in Canada. Of particular importance is the need for standardized methodology to permit ready comparison of results obtained by the various monitoring systems operating in Canada.

RECOMMENDATION 19 - Monitoring

The Sub-committee recommends that Environment Canada accelerate its efforts to make Canadian and United States precipitation chemistry monitoring systems compatible in terms of providing data of acceptable comparability.

RECOMMENDATION 20 - Monitoring

The Sub-committee recommends that the Federal Government provide appropriate funding for an effective research program to develop an accurate and reliable method for the monitoring of dry deposition.

The monitoring of acid rain in Canada has advanced since 1981 to a very high level and compatibility has been achieved among the various systems, including those in Canada and the United States. Monitoring methods for dry deposition still need extensive improvement, in spite of the efforts made to date. An important issue in monitoring, still to be resolved, is whether the systems will be adequate to verify the effects of the planned abatement programs.

RECOMMENDATION 21 - Alberta

The Sub-committee recommends that the Government of Alberta accord maximum priority to the control of acid rain-causing pollutants from industries in the province. The Sub-committee recommends that the Provincial Government adopt as its guiding policy a goal of zero increase in acid rain-causing emissions over present levels up to the year 2000, and an annual decrease by a prescribed amount each year thereafter.

The provincial government and the Energy Resources Conservation Board (ERCB) of Alberta endorsed the first part of the recommendation. However, the ERCB rejected the second part of the recommendation as being "not practical or realistic" and incompatible with expected growth in

Alberta's population, natural gas production, power generation, or increased exploitation of the tar sands.

RECOMMENDATION 22 - Clean Air Act

The Sub-committee recommends that the Federal Government develop comprehensive National Emission Guidelines (compulsory once adopted by a province) to cover all facilities, whether existing, converted, or new, which are sources of sulphur dioxide and nitrogen oxides, and hence of acid rain.

RECOMMENDATION 23 - Clean Air Act

The Sub-committee recommends that the *Clean Air Act* be amended to enable the Federal Government to develop National Emission Standards to cover sources of sulphur dioxide and nitrogen oxides resulting in interprovincial air pollution and acid rain.

RECOMMENDATION 24 - Clean Air Act

The Sub-committee recommends that where appropriate the Federal Government invoke ss. 20 and 21 of the *Clean Air Act* which allow the Minister of the Environment to recommend Specific Emission Standards to the Cabinet which would be applicable to works, undertakings, or businesses in a particular industry or region within a province which has, by federal-provincial agreement, accepted National Ambient Air Quality Objectives.

As noted earlier, the *Clean Air Act* has been rolled into CEPA. The thermal power guidelines remain the only set of guidelines applicable to acid rain. Under CEPA, a priority list of chemicals is being prepared under the National Release Regulations and both oxides of sulphur (SO_x) and ozone may be included on this list.

RECOMMENDATION 25 - Notice and Comment

The Sub-committee recommends that an appropriate uniform notice and comment procedure be provided for in the *Clean Air Act* and that it be applicable at the earliest possible moment in the development of National Ambient Air Quality Objectives, National Emission Standards, Specific Emission Standards and National Emission Guidelines.

Environment Canada publishes annually a "regulatory agenda" in the Canada Gazette. The CEPA also has provisions for notice and comment in Sections 10, 48 and 62.

RECOMMENDATION 26 - Environmental Protection Legislation

The Sub-committee recommends that the following elements be included in environmental protection legislation to effectively reduce pollution in general, and particularly acid rain-causing air pollution:

1) **The imposition of penalties high enough to ensure there is no benefit from saved costs of compliance in cases of non-compliance.**

2) **The creation of a tribunal which would have exclusive jurisdiction over environmental law prosecutions.**

3) **The creation of class action suits, private prosecutions and citizen civil suits.**

4) **The provision of a funding mechanism for class action suits which would otherwise not be instituted due to inadequate financial resources on the part of the initiators.**

The CEPA provides for both fines (up to one million dollars) and for imprisonment (up to five years) for environmental offences. In addition, the Act provides for an "additional fine," under Section 129, equal to estimated monetary benefits accrued by a polluter. Parts (2) and (3) of the recommendation fall under provincial jurisdiction and have not been implemented. Part (4), dealing with funding for class action suits, is under review by Treasury Board.

RECOMMENDATION 27 - Environmental Protection Legislation

Pending consideration and implementation of the reforms advocated in the previous recommendation, the Sub-committee recommends that effective steps be taken to apply existing environmental protection legislation, particularly as it relates to acid rain-causing air emissions. Among the steps that should be immediately taken by governments and the courts are:

1) **The provision of additional legal and technical staff to environment departments.**

2) **The acceleration of court proceedings.**

3) **The harmonization of federal and provincial enforcement of environmental protection legislation.**

Environment Canada responded to parts (1) and (2) of this recommendation as follows:

1) The department supports the intent of this recommendation but states that provision of legal staff to environment departments is the responsibility of the Department of Justice who would support such additions if the need could be demonstrated.

2) The acceleration of court proceedings is a matter to be addressed by the courts.

With respect to part (3) of the recommendation, the CEPA has an "equivalency provision" in Sections 34 and 63 which is designed to harmonize federal and provincial enforcement.

RECOMMENDATION 28 - Regulatory Alternatives

The Sub-committee recommends that governments consider innovative acid rain control regulatory alternatives which have been tried with some success in other countries — for example, the Bubble Concept, Emission Offsets and Credits, etc. The Sub-committee further recommends that such regulatory alternatives should not be adopted where their effect would be to allow an overall increase in air emissions above the desired levels.

As discussed in this present report, Environment Canada has yet to develop policy instruments to control acid rain-causing emissions after 1994. We note that the 1987 Report of the National Task Force on Environment and Economy recommended that new regulatory tools such as emissions fees, tradeable discharge rights, performance deposits, etc., be considered and adopted where appropriate.

RECOMMENDATION 29 - Access to Information

The Sub-committee recommends that appropriate legislative provision be made to permit public access to all records and data pertaining to the discharge of contaminants into the Canadian environment.

Such information is available under the *Access to Information Act*; however, confidential third-party information is still not available to the public.

RECOMMENDATION 30 - Canada-U.S.A. Agreement

The Sub-committee recommends that Canada and the United States reach an agreement on the necessary legislation and mechanisms to substantially reduce transboundary air pollution, particularly as it relates to acid rain, by the end of 1982.

No agreement has been reached with the United States on acid rain although negotiations have continued.

RECOMMENDATION 31 - U.S. Emissions

The Sub-committee recommends that governments, public interest groups, and individual Canadians in general explore and utilize all possible political, legal, administrative and media channels to ensure that acid rain-causing emissions originating in the United States are substantially reduced and that a Canada-U.S. agreement on the long-range transportation of air pollutants is signed by the end of 1982.

RECOMMENDATION 32 - International Parliamentary Associations

The Sub-committee recommends that the acid rain problem and its transboundary implications be publicized and discussed at appropriate meetings of International Parliamentary Associations attended by Canadian legislators. Of particular importance are the annual meetings of the Canada-United States Interparliamentary Group.

RECOMMENDATIONS 33 and 34 - Public Awareness

The Sub-committee recommends that Environment Canada, in cooperation with appropriate provincial authorities, continue and expand its public awareness and information program on acid rain to alert and educate the Canadian public, particularly in those provinces and regions of Canada where the issue has not yet attained sufficient prominence.

The Sub-committee recommends that a major public awareness and information program is necessary to generate public concern

in the United States about the acid rain problem and the threat it poses to the Canadian and American environments. The present program should be continued and expanded and consideration should be given to inviting influential American media representatives to Canada so they can be apprised of the transboundary effects of U.S.-sourced air pollution.

In essence, these recommendations have been implemented.

RECOMMENDATION 35 - Accelerated Capital Cost Allowance

The Sub-committee recommends that Accelerated Capital Cost Allowances continue to be granted for air pollution control devices and that these allowances be extended to new plants.

This recommendation has not been implemented.

RECOMMENDATION 36 - Polluter-Pay Principle

The Sub-committee recommends that the polluter-pay principle apply to the cost of installing abatement equipment in any future production facilities whose operations have the potential to emit oxides of sulphur or nitrogen.

This recommendation has been met, at least in part. It is arguable that, in the arrangements between Noranda and the federal and provincial governments for SO_2 control at the Horne smelter, the polluter-pay principle may not have been strictly applied.

RECOMMENDATION 37 - Sulphur By-Products

The Sub-committee recommends that the Federal Government, in cooperation with the Provincial Governments and the private sector, convene a Task Force on sulphur by-product utilization with the aim of developing a national marketing strategy for sulphur products. Such a marketing strategy would involve finding new uses for sulphur products and may include the formation of a marketing board for sulphur and sulphur products.

RECOMMENDATION 38 - Canadian Phosphate Deposits

The Sub-committee recommends that Canadian phosphate deposits be developed as a market for the sulphuric acid produced by control of sulphur dioxide in non-ferrous smelters.

These recommendations have not been implemented.

B. *TIME LOST* [16 Recommendations]

RECOMMENDATIONS 1 & 2 - Motor Vehicle Emission Standards

The Sub-committee recommends that the emission standards in Canada for nitrogen oxides (NO_x) be changed from 3.1 grams per vehicle mile to 1.0 gvm; for hydrocarbons (HC) from 2.0 gvm to 0.41 gvm; and for carbon monoxide (CO) from 25.0 gvm to 7.0 gvm. The Sub-committee recommends that the new emission control standards should be required for the 1986 model year.

New light-duty vehicle emission standards were adopted under the *Motor Vehicle Safety Act* effective September 1, 1987.

RECOMMENDATION 3 - Lead in Gasoline

The Sub-committee recommends that lead be gradually phased out as a gasoline additive and that leaded gasoline be banned in Canada by 1995.

The federal government recently stated that lead will be phased out as a gasoline additive by 1990, except for some marine and farm engines which need lead as a lubricant.

RECOMMENDATION 4 - Heavy-duty Vehicles

The Sub-committee recommends that Transport Canada consult fully with the United States Environmental Protection Agency to ensure that Canadian and American emission standards for heavy-duty vehicles are compatible.

New heavy-duty vehicle emissions will become effective December 1, 1988 and will be more stringent than those enforced in the United States at the present time.

RECOMMENDATION 5 - Motor Vehicle Emission Standards

The Sub-committee recommends that legislative authority to regulate motor vehicle emissions through standards applicable to manufacturers and distributors be transferred from the *Motor Vehicle Safety Act* to the *Clean Air Act* and hence from the Ministry of Transport to the Department of Environment which already has significant responsibilities in the area of air pollution.

This recommendation was not implemented.

RECOMMENDATION 6 - Scientific Research

The Sub-committee recommends that Regulation 2900 of the *Income Tax Act* be re-written to permit commercial-scale testing as a qualifying expenditure for the purposes of computing the scientific research deduction and the additional allowance for scientific research. These changes are to apply to expenditures incurred after 31 December 1979.

RECOMMENDATIONS 7, 8 & 9 - Accelerated Capital Cost Allowances

The Sub-committee recommends that equipment used in the abatement of SO_2 and NO_x emissions be eligible for a 100% write-off in the year in which the capital expenditures are made. The Sub-committee recommends that equipment used in the control of acid gas emissions be eligible for an additional capital cost allowance equal to 10% of the expenditures on such equipment. This allowance is to be made available in the year in which the expenditures are incurred and is limited to properties purchased by 31 December 1994. The Sub-committee recommends that, upon approval by the Minister of the Environment, the one-year capital write-off should apply to *all* properties which effect a significant reduction in acid gas emissions, whether or not the capital expenditure is primarily environment-related.

RECOMMENDATION 10 - Carry-Back Provisions

The Sub-committee recommends that the *Income Tax Act* be amended to increase loss carry-back provisions to 7 years for all losses.

RECOMMENDATION 11 - Tax Credit Financing

The Sub-committee recommends that the Departments of Finance and Environment consider the feasibility of allowing investors to take deductions for pollution-control expenditures incurred by firms in the non-ferrous smelting sector.

RECOMMENDATIONS 12, 13, 14 & 15 - Direct Abatement Grants

The Sub-committee recommends that the Federal Government provide assistance to the non-ferrous smelting industry through a

system of one-time *taxable* grants for capital expenditures associated with SO_2 abatement.

The Sub-committee recommends that the following formula be used to allocate these grants:

1) **a basic grant of $350 for every tonne per year (tpy) of SO_2 reduction from actual 1980 emission levels;**

2) **an additional grant of $100 for every tonne per year of SO_2 reduction from actual 1980 levels in excess of a 50% reduction.**

These per unit grants are to be adjusted according to changes in the Gross National Expenditure Implicit Price Index for machinery and equipment in order to maintain the purchasing power of these grants.

The Sub-committee recommends that these funds be disbursed on a dollar-for-dollar basis as construction expenditures are undertaken. Disbursements are to be made on the basis of estimated SO_2 reductions from 100% of rated capacity utilization.

RECOMMENDATION 16 - Qualifying Expenditures

The Sub-committee recommends that qualifying expenditures for capital cost allowances and the investment tax credit not be reduced by amounts received under the SO_2 abatement grant system.

Recommendations 6 through 16 were not implemented. The Canadian Acid Precipitation Abatement Program uses alternative means by which government assistance might be granted for pollution abatement in the non-ferrous smelting industry.

APPENDIX III

A CHRONOLOGY OF EVENTS IN THE ACID RAIN STORY

1. 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.

2. 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.

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

4. 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.

5. 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.

6. 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.*

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

8. 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.

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

10. 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.

11. 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.

12. 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.

13. 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).

14. 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.

15. September 29, 1983 — Canadian federal and provincial environmental ministers agree to an abatement strategy which, in conjunction with emission controls in the U.S., would limit wet sulphate to 20 kg/hec/year.

16. October 16, 1983 — The third meeting between the External Affairs Minister and U.S. Secretary of State. The Canadian

Environment Minister and the EPA Administrator also attend, and exchange views on acid rain controls. The Environment Minister, Mr. Caccia, expresses Canada's disappointment and impatience over lack of U.S. policy to control acid rain.

17. 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.

18. 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.

19. March 6, 1985 — The Prime Minister announces that total sulphur dioxide emissions in Canada's seven easternmost provinces will be reduced by 50 percent 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.

20. 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.

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

22. 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.

23. July 26, 1985 — The U.S. District Court for the District of Columbia rules that 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 states to reduce emissions.

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

25. 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.

26. 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.

27. 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.

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

29. 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.

30. September 18, 1986 — U.S. Appeal Court overturns the July 1983 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.*

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

32. 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.

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

34. 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.

35. 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).

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

37. 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.

38. 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.

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

40. January 6, 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.

41. 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.

42. 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.

43. 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.

44. 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.

45. 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.

APPENDIX IV

GLOSSARY

Acid: A concentration of hydrogen ions (H+) in solution. Acidity is expressed on a numerical pH scale. An acidic solution has a pH less than 7.0.

Acid rain: Precipitation, including rain, snow, sleet, hail, etc., with a pH less than about 5.6. Acid rain consists of "wet deposition" and "dry deposition."

Acid rain precursor: A material such as SO_2 or NO_x which is transformed in the atmosphere to become a component of acid rain.

Aerosol: A suspension of liquid or solid particles in a gas.

Alkalinity: A measure of water's ability to neutralize added acids by the reaction of hydrogen ions with carbonate, bicarbonate, and hydroxide ions.

Base: The opposite of acid; depends on the concentration of hydroxyl ions (OH-) in solution. A basic alkaline solution has a pH greater than 7.0.

Buffer: A chemical which, in solution, will resist changes in pH or, if added to a solution, will change the pH of that solution. In nature, limestone (calcium carbonate) will act as a buffer against acid rain to maintain or raise the pH of a waterbody.

Dry deposition: A process whereby particles such as fly ash, sulphates and nitrates, and gases such as sulphur dioxide and nitric oxide are deposited on, or absorbed onto, surfaces. The dry particles or gases can be converted into acids after deposition when they contact water.

Fluidized-bed combustion: A method of combustion in which air blown up through orifices in the floor of the firebox suspends particles as a fluidized bed. The particles consist of fuel and a sorbent such as limestone.

Leaching: A natural process by which water dissolves minerals out of rocks. The leaching of heavy metals, such as mercury, into water supplies is believed to be a serious consequence of acid rain.

Limestone: A sedimentary rock consisting chiefly of calcium carbonate. Limestone is an effective buffer against acid rain.

Matte: The product of a reverberatory furnace in a smelter; matte is metal with some contained sulphur and must be further refined to obtain the pure metal.

Metallurgy: The process of extracting metals from their ores.

Nonferrous smelting: The smelting, roasting, and sintering of sulphur-containing ores, such as those containing copper or nickel, and scrap materials.

National Ambient Air Quality Objectives: Prescribed by the federal government under the *Canadian Environmental Protection Act* to reflect regional air quality goals in three ranges—"tolerable," "acceptable," and "desirable." They are not source-specific but are geographical area-specific. They are applicable to specific air contaminants. They are enforceable by the provinces once adopted by them as part of their environmental laws in virtue of a federal-provincial agreement under the federal *Canadian Environmental Protection Act.*

National Emission Guidelines: Enacted by the federal government under the *Canadian Environmental Protection Act* to indicate the quantity and concentration beyond which an air contaminant should not be emitted into the atmosphere by a stationary or other type of source. These guidelines are source-specific and are only enforceable by a province when they are adopted under provincial environmental law.

National Emission Standards: Enacted by the federal government under the *Canadian Environmental Protection Act* to establish maximum rates of air contaminants that may be emitted by a stationary source if such an emission is a threat to human health or would cause Canada to violate an international obligation it has undertaken in reference to air pollution abatement. Such Standards do not require provincial adoption to be enforceable; in other words, they may be directly enforced by the federal government.

Particulate matter: Matter in the form of small airborne liquid or solid particles.

pH: A numerical expression of the concentration of hydrogen ions in solution. The units are expressed as the negative logarithm of the hydrogen ion concentration: pH 0 to 7 is acidic, pH 7.0 is neutral and pH 7 to 14 is basic or alkaline.

Pollution rights: A system of marketable permits allowing the bearer to emit a specified level of pollutants. Under this rights system, the government controls the total level of emissions, but not the distribution of these emissions among firms.

Pyrrhotite: An iron sulphide which is associated with nickel. The nickel ores in Sudbury, for example, are pyrrhotite. This ore is also known as sulphide ore.

Reverberatory furnace: A long, flat furnace used in smelting copper concentrates to produce matte.

Sedimentary rocks: Secondary rocks formed from material which is derived from other rocks and which is laid down under water. Examples are limestone, shale and sandstone.

Sorbent: An additive used to enhance sulphur dioxide removal, e.g. lime.

Specific Emission Standards: Where a National Ambient Air Quality Objective has been adopted, the federal government may adopt and enforce Specific Emission Standards under the *Canadian Environmental Protection Act* to establish maximum rates of air contaminants emitted by a stationary source under federal jurisdiction.

Ton: Also known as a short ton, it contains 2,000 pounds. One ton equals 0.9072 tonne.

Tonne: A metric ton, or tonne, contains 1,000 kilograms, or 2,204.623 pounds. One tonne equals 1.1023 tons.

Wet deposition: A process of precipitation whereby acidic chemicals, including dilute sulphuric and nitric acids and sulphates, are deposited in rain, snow, etc.

APPENDIX V

COMMITTEE WITNESSES

The following is a list of witnesses who appeared before the Special Committee:

Tuesday, December 2, 1986 (Issue No. 1)

From Environment Canada:

Hans Martin, Senior Advisor, Federal LRTAP Liaison Office;

Alex Manson, Senior LRTAP Manager;

Vic Shantora, Associate Director, Industrial Programs Branch.

Thursday, January 29, 1987 (Issue No. 2)

From the Canadian Coalition on Acid Rain:

Adele Hurley, Executive Coordinator;

Michael Perley, Executive Coordinator.

Thursday, February 5, 1987 (Issue No. 3)

From the Province of Manitoba:

The Honourable Gérard Lécuyer, Minister of Environment and Workplace Safety and Health;

Thomas Owen, Deputy Minister, Department of Environment and Workplace Safety and Health.

Tuesday, February 10, 1987 (Issue No. 4)

From the Province of Nova Scotia:

The Honourable Laird Stirling, Minister of Environment;

John Underwood, Environmental Analyst, Department of Environment.

From Nova Scotia Power:

Dan Brown, Vice-President, Planning;

Osmundo Betancourt, Manager of Environmental Policy and Programs.

From the Province of Newfoundland:

The Honourable John Butt, Minister of the Environment;

David Jeans, Assistant Deputy Minister, Department of Environment.

Thursday, February 12, 1987 (Issue No. 5)

The Honourable Tom McMillan, Minister of the Environment.

Tuesday, February 17, 1987 (Issue No. 5)

From the Province of New Brunswick:

The Honourable Robert Jackson, Minister of Municipal Affairs and Environment;

David Besner, Director, Environmental Services Branch, Department of Environment;

Jim Knight, Chief, Air Quality Section, Department of Environment.

From Ontario Hydro:

Arvo Niitenberg, Executive Vice-President of Operations;

A.R. Holt, Director of Fuels;

Ron Taborek, Coordinator of the Acid Control Program.

Thursday, February 19, 1987 (Issue No. 6)

From the Province of Ontario:

The Honourable Jim Bradley, Minister of Environment;

Wayne Scott, Coordinator, Acid Precipitation in Ontario Study, Ministry of Environment.

Tuesday, March 3, 1987 (Issue No. 7)

From New Brunswick Power:

G. Linwood Titus, Vice-President, Planning and Development;

Frederick Meth, Head Environmental Planning, System Planning Division.

Thursday, March 26, 1987 (Issue No. 9)

From the Izaak Walton League of America:

Paul Hansen, Acid Rain Coordinator.

Thursday, April 2, 1987 (Issue No. 10)

From the Province of New Brunswick:

The Honourable Richard Hatfield, Premier;

The Honourable Robert C. Jackson, Minister of Municipal Affairs and Environment;

David Besner, Director, Environmental Services Branch, Department of Environment.

Wednesday, April 15, 1987 (Issue No. 11)

From the United Mine Workers of America:

Bob Burchell.

Tuesday, May 12, 1987 (Issue No. 12)

Individual Presentation:

Dr. Martha Kostuch.

Wednesday, May 27, 1987 (Issue No. 13)

From the Electric Vehicle Association of Canada:

Norman Wood, President.

From Powerplex Technologies:

Duncan Newman, General Manager;

David Sedgwick.

From Brown, Boverie and Cie:

Dr. Wilfred Fischer.

From the Government and Industrial Relations Committee:

Arthur Bailey, Chairman.

Wednesday, June 3, 1987 (Issue No. 14)

From the Canadian Coalition on Acid Rain:

Adele Hurley, Executive Coordinator;

Michael Perley, Executive Coordinator.

Thursday, June 11, 1987 (Issue No. 15)

From the Department of External Affairs, United States Branch:

Donald W. Campbell, Assistant Deputy Minister;

Brian Buckley, Director, United States Transboundary Division;

Len Mader, Deputy Director, United States Transboundary Division.

From Environment Canada:

Robert Slater, Assistant Deputy Minister, Planning;

Alex Manson, Senior Manager, Acid Rain.

Thursday, June 18, 1987 (Issue No. 15)

From the Kemic Bioresearch Laboratories Limited:

Dr. Peter Mullen.

Tuesday, October 27, 1987 (Issue No. 16)

The Honourable Tom McMillan, Minister of the Environment.

From Environment Canada:

Howard Ferguson, Assistant Deputy Minister, Atmospheric Environment Service;

Hans Martin, Senior Advisor, Federal LRTAP Liaison Office.

Tuesday, December 8, 1987 (Issue No. 17)

From l'Union des producteurs agricoles:

Jacques Proulx, President;

Louis Ménard, Secretary to the Committee on Acid Rain.

Wednesday, December 9, 1987 (Issue No. 18)

From Environment Canada:

Hans Martin, Senior Advisor, Federal LRTAP Liaison Office;
Alex Manson, Senior LRTAP Manager.

From the Canadian Forestry Service:

Paul Addison, Scientific Advisor, Environmental Forestry;
Carl Winget, Director General, Science Directorate.

From Health And Welfare Canada:

Dr. Claire Franklin, Chief of Environmental and Occupational Toxicology;
Mark Raizenne, Respiratory Physiologist.

Thursday, April 21, 1988 (Issue No. 19)

From Environment Canada:

Hans Martin, Senior Advisor, Federal LRTAP Liaison Office;
Robert Slater, Assistant Deputy Minister, Planning;
Vic Shantora, Associate Director, Industrial Programs Branch.

Tuesday, May 10, 1988 (Issue No. 20)

From Transport Canada:

S.C. Wilson, Director General, Road Safety and Motor Vehicle Regulation;
Lui Hrobelsky, Chief, Energy and Emission Engineering.

Thursday, May 12, 1988 (Issue No. 21)

From Environment Canada:

Robert Slater, Assistant Deputy Minister, Policy;
Julyan Reid, Director General, External Relations;
Wayne Draper, Chief, Oil, Gas, and Energy Division, Conservation and Protection;
Hans Martin, Senior Advisor, Federal LRTAP Liaison Office.

Tuesday, May 31, 1988 (Issue No. 22)

From The Department of External Affairs:

Donald W. Campbell, Assistant Deputy Minister, United States Branch;
Rod Bell, Deputy Director, United States Transboundary Division.

From Environment Canada:

Robert Slater, Assistant Deputy Minister, Policy;
Alex Manson, Senior LRTAP Manager.

Thursday, June 23, 1988 (Issue No. 22)

From the Department of Fisheries and Oceans:

David Schindler, Research Scientist, Freshwater Institute.

Tuesday, June 28, 1988 (Issue No. 23)

From the University of British Columbia:

Dr. David Bates, Professor Emeritus of Medicine, Department of Health Care and Epidemiology.

Tuesday, September 20, 1988 (Issue No. 24)

From Environment Canada:

Alex Manson, Senior LRTAP Manager.

REQUEST FOR GOVERNMENT RESPONSE

In accordance with the provisions of Standing Order 99(2), your Committee requests that the government table a comprehensive response to this report.

A copy of the relevant Minutes of Proceedings and Evidence of the Special Committee on Acid Rain (*Issues Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 and 24, which includes this Report*) is tabled.

Respectfully submitted,

STAN DARLING
Chairman

MINUTES OF PROCEEDINGS

WEDNESDAY, SEPTEMBER 14, 1988 (40)

[*Text*]

The Special Committee on Acid Rain met *in camera* at 3:44 o'clock p.m., this day, in Room 307 of the West Block, the Chairman, Stan Darling, presiding.

Members of the Committee present: Pauline Browes, Charles Caccia, Robert A. Corbett, Stan Darling, Marc Ferland and Lynn McDonald.

In attendance: *From the Library of Parliament*: Tom Curren and Marion Wrobel, Research officers.

The Committee resumed consideration of its Order of Reference dated Thursday, October 9, 1986 relating to acid rain. (*See Minutes of Proceedings and Evidence of Tuesday, November 18, 1986, Issue No. 1.*)

The Committee proceeded to examine a draft report.

At 5:50 o'clock p.m., the Committee adjourned to the call of the Chair.

Janice Hilchie

Clerk of the Committee

TUESDAY, SEPTEMBER 20, 1988 (41)

The Special Committee on Acid Rain met *in camera* at 9:12 o'clock a.m., this day, in Room 307 of the West Block, the Chairman, Stan Darling, presiding.

Members of the Committee present: Pauline Browes, Charles Caccia, Stan Darling, Marc Ferland, Lynn McDonald and Alan Redway.

In attendance: *From the Library of Parliament*: Tom Curren and Marion Wrobel, Research officers.

The Committee resumed consideration of its Order of Reference dated Thursday, October 9, 1986 relating to acid rain. (*See Minutes of Proceedings and Evidence of Tuesday, November 18, 1986, Issue No. 1.*)

The Committee resumed consideration of a draft report.

At 11:39 o'clock a.m., the Committee adjourned until later that day.

AFTERNOON SITTING (42)

The Special Committee on Acid Rain resumed *in camera* at 3:38 o'clock p.m., this day, in Room 307 of the West Block, the Chairman, Stan Darling, presiding.

Members of the Committee present: Pauline Browes, Charles Caccia, Stan Darling, Marc Ferland, Lynn McDonald and Alan Redway.

In attendance: *From the Library of Parliament*: Tom Curren and Marion Wrobel, Research officers.

Witness: *From Environment Canada*: Alex Manson, Senior LRTAP Manager.

The Committee resumed consideration of its Order of Reference dated Thursday, October 9, 1986 relating to acid rain. (*See Minutes of Proceedings and Evidence of Tuesday, November 18, 1986, Issue No. 1.*)

The Committee resumed consideration of a draft report.

The witness made a statement and answered questions.

At 5:25 o'clock p.m., the Committee adjourned to the call of the Chair.

Ellen Savage
Committee Clerk

WEDNESDAY, SEPTEMBER 21, 1988 (43)

The Special Committee on Acid Rain met *in camera* at 3:41 o'clock p.m., this day, in Room 307 of the West Block, the Chairman, Stan Darling, presiding.

Members of the Committee present: Charles Caccia, Stan Darling, Marc Ferland, Lynn McDonald and Alan Redway.

In attendance: *From the Library of Parliament*: Tom Curren and Marion Wrobel, Research officers.

The Committee resumed consideration of its Order of Reference dated Thursday, October 9, 1986 relating to acid rain. (*See Minutes of Proceedings and Evidence of Tuesday, November 18, 1986, Issue No. 1.*)

The Committee resumed consideration of a draft report.

At 4:04 o'clock p.m., it was agreed,—That the meeting be suspended.

At 4:35 o'clock p.m., the Committee resumed.

At 5:37 o'oclock p.m., the Committee adjourned to the call of the Chair.

Ellen Savage

Committee Clerk

TUESDAY, SEPTEMBER 27, 1988 (44)

The Special Committee on Acid Rain met *in camera* at 11:09 o'clock a.m., this day, in Room 307 of the West Block, the Chairman, Stan Darling, presiding.

Members of the Committee present: Pauline Browes, Charles Caccia, Stan Darling, Marc Ferland and Alan Redway.

In attendance: *From the Library of Parliament*: Tom Curren and Marion Wrobel, Research officers.

The Committee resumed consideration of its Order of Reference dated Thursday, October 9, 1986 relating to acid rain. (*See Minutes of Proceedings and Evidence of Tuesday, November 18, 1986, Issue No. 1.*)

The Committee resumed consideration of a draft report.

At 12:32 o'clock p.m., the Committee adjourned until later that day.

AFTERNOON SITTING (45)

The Special Committee on Acid Rain resumed *in camera* at 3:38 o'clock p.m., this day, in Room 307 of the West Block, the Chairman, Stan Darling, presiding.

Members of the Committee present: Pauline Browes, Charles Caccia, Stan Darling, Marc Ferland and Alan Redway.

In attendance: *From the Library of Parliament*: Tom Curren and Marion Wrobel, Research officers.

The Committee resumed consideration of its Order of Reference dated Thursday, October 9, 1986 relating to acid rain. (*See Minutes of Proceedings and Evidence of Tuesday, November 18, 1986, Issue No. 1.*)

The Committee resumed consideration of a draft report.

At 5:17 o'clock p.m., the Committee adjourned to the call of the Chair.

Ellen Savage
Diane Tremblay-Bernier
Committee Clerks

WEDNESAY, SEPTEMBER 28, 1988 (46)

The Special Committee on Acid Rain met *in camera* at 3:40 o'clock p.m., this day, in Room 307 of the West Block, the Chairman, Stan Darling, presiding.

Members of the Committee present: Pauline Browes, Charles Caccia, Robert Corbett, Stan Darling, Marc Ferland, Lynn McDonald and Alan Redway.

In attendance: *From the Library of Parliament*: Tom Curren and Marion Wrobel, Research officers.

The Committee resumed consideration of its Order of Reference dated Thursday, October 9, 1986 relating to acid rain. (*See Minutes of Proceedings and Evidence of Tuesday, November 18, 1986, Issue No. 1.*)

The Committee resumed consideration of a draft report.

It was agreed,—That the draft report be adopted as the First Report of the Committee.

It was agreed,—That the Committee seek a comprehensive response to the report.

It was agreed,—That 5,000 copies of the report be printed.

It was agreed,—That the Chairman be authorized to table the report in the House.

It was agreed,—That the report be printed with a special cover.

At 4:35 o'clock p.m., the Committee adjourned to the call of the Chair.

Ellen Savage
Committee Clerk