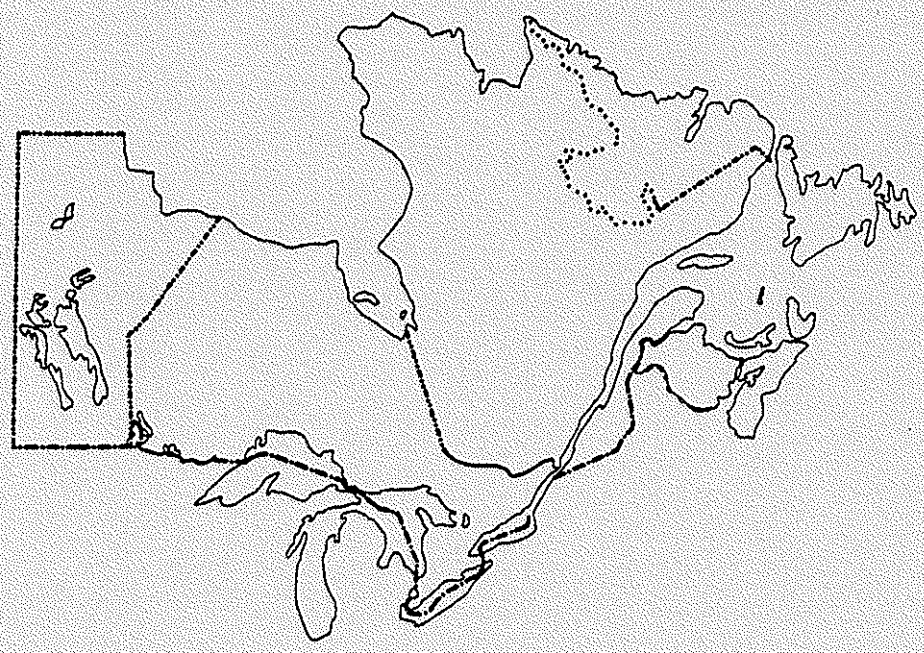
Environment Canada Environnement Canada

ANNUAL REPORT ON THE FEDERAL-PROVINCIAL AGREEMENTS FOR THE EASTERN CANADA ACID RAIN PROGRAM

1991



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CANADA'S GREEN PLAN

Canada

ERRATA

Please note the following changes in this report:

- Introduction: The bilateral Canada-United States Air Quality Agreement on Transboundary Air Pollution was actually signed in March, 1991.

- In Table 1 - Note 6, should read: The total of objectives under current federal-provincial agreements is 2349 kilotonnes. Reducing the remaining 49 kilotonnes will be achieved by amending these agreements.

- Most of the content of this report is based on information obtained from the provinces' reports for the 1991 calendar year.

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The Eastern Canada Acid Rain Control Program, 1991

Introduction

This report is the third in a series documenting progress in reducing emissions of sulphur dioxide (SO_2) under the Eastern Canada Acid Rain Control Program. The report updates emissions data to the end of 1991 and summarizes recent major program achievements.

The Program was initiated in 1985 and subsequently formalized in seven federal–provincial agreements. These agreements set out specific SO_2 emission reduction targets and timetables for each of the parties. The Program aims, by 1994, to reduce SO_2 emissions in the seven eastern provinces to 2300 kilotonnes. This reduction is 40 percent less than 1980, when 3818 kilotonnes were emitted. For its part in the agreements, the federal government is seeking reductions in transboundary flows of SO_2 from the United States, and supporting research and development projects in SO_2 reduction technologies.

To date, most emission reduction has been sought at the major individual sources, such as non-ferrous metals smelters and fossil-fuelled power plants, which accounted for 80 percent of the SO_2 emissions in eastern Canada in 1980. This approach has resulted in a wide range of province-specific and source-specific emission-reduction measures. The report therefore covers provincial as well as industrial progress.

An important year, 1991 saw much progress under the Eastern Canada Acid Rain Control Program. A major, new, acid-rain program being developed in the United States will reinforce Canadian efforts. Also, the need for joint, coordinated action led in 1990 to the bilateral Canada-United States Air Quality Agreement on Transboundary Air Pollution, which includes Canadian and American program targets as principal elements. As well, 1991 was the first full year of Canada's Green Plan, which builds on the Program's success and sets the future course of action on acid rain after 1994.

The reported emissions reflect the most recent provincial estimates, shown in Figure 1 and summarized in Table 1. These data indicate an SO_2 emissions total of 2447 kilotonnes in 1991, representing a 36 percent reduction from 1980 emissions. Table 2 provides additional SO_2 emissions data from smelters and fossil-fuelled power plants, which are the major individual sources. The substantial progress made in 1991 on several major capital projects to reduce SO_2 emissions, and the completion of new emissions abatement facilities, help to ensure that Canada's Program objectives will be met.

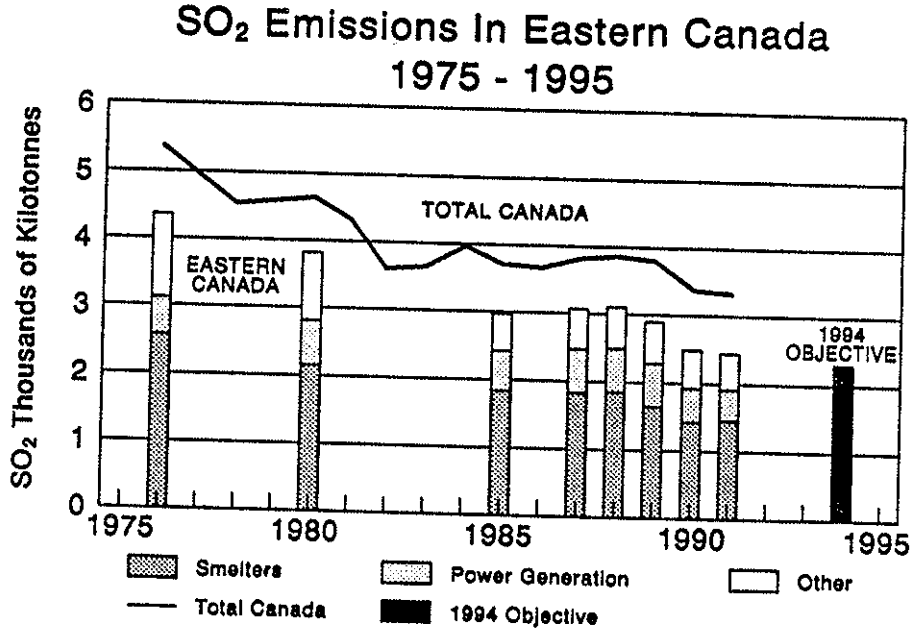

TABLE 1

TOTAL SO_2 EMISSIONS IN EASTERN CANADA, BY PROVINCE,[1] (KILOTONNES)

	1980	1988	1989	1990	1991	1994
	(Actual)					(Emissions limits)
MANITOBA						
Primary metals	463	550	499	500	543	—
Other	21	16	16	16	16	—
Total	484	566	515	516	559	550
ONTARIO						
Primary metals	1096	798	776	730	695	—
Power generation	396	321	305	195	167	—
Other	272	249	252	241	233	—
Total	1764	1368	1333	1166	1095	885
QUEBEC						
Primary metals	641	478	341	189	210	—
Other	457	234	205	202	168	—
Total	1098	712	546	391	378	500[2]
NEW BRUNSWICK						
Primary metals	15	23	23	6	9	—
Power generation	123	158	177	141	130	—
Other	80	29	29	34	33	—
Total	218	210	229	181	172	175[3]
NOVA SCOTIA						
Power generation	125	147	146	143	144	—
Other	68	36	37	35	33	—
Total	193	183	183	178	177	189[4]
NEWFOUNDLAND						
Power generation	18	18	26	23	15	—
Other	38	27	23	24	47	—
Total	56	45	49	47	62	45
PRINCE EDWARD ISLAND						
Total[5]	5	3	3	3	4	5
EASTERN CANADA						
Primary metals	2215	1849	1639	1425	1457	—
Power generation	662	644	654	502	456	—
Other	941	594	565	555	534	—
Total	3818	3087	2858	2482	2447	2349[6]

1 Data for 1988, 1989, 1990 and 1991 are taken from the annual reports by the provinces on their SO_2 control programs, as required by the federal–provincial agreements. The emissions levels represent the best estimate available at the time of writing the report. Note that even historical year estimates may be revised as better inventory data are made available.

2 This revised emission limit reflects amendments to a federal-provincial agreement: from 600 kilotonnes beginning in 1990 to 500 kilotonnes beginning in 1994.

3 This revised emission limit reflects a renegotiated federal–provincial agreement from the original value of 185 kilotonnes.

4 This revised emission limit reflects a renegotiated federal-provincial from the original value of 204 kilotonnes.

5 This value includes a component of power-generation emissions.

6 The total Eastern Canada Acid Rain Control Program limit is 2300 kilotonnes for 1994. The total of objectives under current federal–provincial agreements is 2464 kilotonnes. Reducing the remaining 164 kilotonnes will be achieved by amending these agreements.

TABLE 2

A) MINERAL EXTRACTION—MAJOR SO_2 SOURCES (KILOTONNES)

	1980	1988	1989	1990	1991	1994
	(Actual)					(Emissions limits)
MANITOBA						
Inco Ltd. (Thompson)	215	284	250	247	250	220
Hudson Bay Mining and Smelting Co. (Flin Flon)	248	266	249	253	293	220
ONTARIO						
Inco Ltd. (Copper Cliff)	812	658	637	617	572	265
Falconbridge (Sudbury)	123	60	68	70	70	100
Algoma (Wawa)	161	80	71	43	53	125
QUEBEC						
Noranda (Horne)	552	425	292	146	165	166
Noranda (Murdochville)	91	58	49	43	45	65
NEW BRUNSWICK						
Noranda (Belledune)	15	23	23	6	8	---

B) ELECTRIC POWER GENERATION—MAJOR SO_2 SOURCES (KILOTONNES)

	1980	1988	1989	1990	1991	1994
	(Actual)					(Emissions limits)
Ontario Hydro	396	321	305	195	167	175
New Brunswick Power	123	158	177	141	130	123
Nova Scotia Power	125	147	146	143	144	145

Provincial and Industrial Action

Manitoba (1994 target: 550 kilotonnes)

Manitoba has two principal sources of SO_2 emissions: the Inco Ltd. smelter in Thompson and the Hudson Bay Mining and Smelting Co. Ltd. (HBMS) smelter in Flin Flon. As part of the Eastern Canada Acid Rain Control Program, both are required to reduce their annual SO_2 emission to below 220 kilotonnes, beginning January 1, 1994. (Other minor sources of emissions typically account for about 3 percent of annual provincial SO_2 emissions.)

Primary Metals

To comply with its SO_2 emission limit, Inco Ltd. has been optimizing its pyrrhotite-rejection process and intends to change its metallurgical process by 1994.

For its part, HBMS Ltd. announced, on December 13, 1991, a new zinc pressure leaching system and a major modification to the copper smelter. These changes will reduce SO_2 emissions by at least 25 percent and also substantially reduce other emissions such as particulates. As well, HBMS will use much less heavy oil and coal at the facility. Together, these improvements will help HBMS to meet its SO_2 limit.

The emissions from these smelters depend on market fluctuations of base metal prices, and vary annually, as shown in tables 1 and 2.

Research and Monitoring

As well as moving forward in reducing SO_2 emissions, Manitoba continued to work on other aspects of the acid-rain problem. The province monitored acid precipitation at three sites, surveyed acidity of snow pack, monitored receptors at federal and provincial sites, and continued to study coniferous forest regeneration in soils damaged by smelter emissions.

Ontario (1994 limit: 885 kilotonnes)

In 1985, Ontario announced the Countdown Acid Rain Program, which targeted major stationary SO_2 sources such as smelters and fossil-fuelled power plants. In 1991, the four corporate sources regulated under the Countdown program were in full compliance with their emission limits, summarized in Table 2.

Primary Metals

Inco Ltd. completed a mill rationalization program to provide a concentrate with higher metals content, and commissioned the first flash furnace at the Copper Cliff site. These changes, integrated with the new acid plant, are expected to reduce SO_2 emissions a further 100 kilotonnes in 1992.

Falconbridge at Sudbury announced process changes that it believes could reduce SO_2 emissions a further 25 kilotonnes annually from the 1994 regulatory limit of 100 kilotonnes. The company is confident that this lower emission target can be achieved before 1998.

At the Algoma iron-ore sintering plant in Wawa, a combination of process feed changes and production rationalization will enable the company to keep its annual SO_2 emissions below 80 kilotonnes—well under the 1994 regulatory limit of 125 kilotonnes.

Power Generation

The provincial electric utility, Ontario Hydro, is building two flue-gas desulphurization scrubbers at the existing coal-burning Lambton station. These will capture over 90 percent of SO_2 emissions from half the station. The scrubbers are expected to operate early in 1994. Hydro has also installed flue-gas conditioning equipment at all operating units of the Lambton, Nanticoke and Lakeview coal-burning power plants to allow them to use low-sulphur coal without impeding the performance of the existing particulate emission-control systems.

Research and Monitoring

Ontario's scientific program continued to monitor the Countdown program's effectiveness in reducing sulphate deposition levels, and the associated recovery of some aquatic ecosystems. The scientific program also completed a survey of hardwood decline across the province. As well, work under the North American Maple Project continued in 1991, with results indicating that sugar maple conditions improved from 1988 to 1990, and that wet sulphate deposition seems to have had no major effect on sugar maple in the areas sampled. Work also continued on source–receptor modelling using the Atmospheric Deposition and Oxidants Model.

Quebec (1994 limit: 500 kilotonnes)

In Quebec, the Eastern Canada Acid Rain Control Program had 1990 as its target date. Therefore, 1991 was the second full-compliance year of the provincial SO_2 control program. As in 1990, Quebec's SO_2 emissions in 1991 were well below the provincial objective for the 1990-1993 period of 600 kilotonnes, totalling 378 kilotonnes in 1991.

Primary Metals

New facilities at the Noranda Horne smelter performed exceptionally well, limiting emissions to 165 kilotonnes—about half the objective for this facility at the outset of the program. Noranda continues to investigate SO_2 reduction/capture schemes and has announced that it aims to reduce plant emissions to 55 kilotonnes by the end of the decade.

To some extent, slightly increased SO_2 emissions in some industrial sectors were offset by decreases elsewhere, due to slow economic conditions. In some cases, permanent plant closures will eliminate emissions from outdated equipment or processes.

Power Generation

The only major fossil-fuelled power plant in the province is the 600-megawatt Tracy oil-burning facility. This plant is being evaluated for a major rehabilitation program and was not much used in 1991. The annual emissions limit for Tracy was set in 1990 at 18 kilotonnes and its 1991 emissions totalled 11 kilotonnes.

Research and Monitoring

Quebec continued its research and monitoring efforts, including its part of the North American Maple Project, and detailed studies of fish populations in acid-sensitive lakes.

In 1991, Quebec sampled 64 lakes in the Rouyn-Noranda region that were previously sampled in 1982 to detect any improvement in water quality due to reduced acid deposition. The data reveal reduced sulphate in lake waters, particularly close to the Noranda Smelter.

At the end of 1991, Quebec had widened its precipitation and air pollution sampling network to 56 sites. In the decade to 1991, samples from these sites revealed that although wet sulphate deposition has declined by 20 percent in the Abitibi region (close to the Noranda Smelter), unfortunately, in the southern part of the province,

little reduction has been observed. Continuing vigilance will be required to verify progress in emission-control programs in Canada and the United States.

New Brunswick (1994 target: 175 kilotonnes)

In New Brunswick, burning fossil fuel to produce electricity accounts for nearly 75 percent of total SO_2 emissions. Other major sources include pulp and paper mills, the Noranda Brunswick Smelter at Belledune and the Irving Oil refinery at Saint John.

Power Generation

New Brunswick Power, the province's electric utility, is heavily interconnected with neighbouring systems in Canada and the United States and is called upon to assist other utilities facing shortages or unplanned outages. As documented in tables 1 and 2, this buying and selling of power results in substantial annual fluctuations in the demand for New Brunswick Power electricity and hence SO_2 emissions.

New Brunswick has developed a comprehensive policy on SO_2 emitted by the electric power sector and established an annual emissions ceiling of 123 kilotonnes for New Brunswick Power.

New Brunswick Power initially minimized its fossil-fuel generation by using its nuclear capacity and buying electricity from neighbouring utilities. It is now building a 450-megawatt coal-burning power plant at Belledune, equipped with a wet limestone scrubber. The power plant is expected to be in service in November 1993. As well, an existing 312-megawatt coal and oil-burning power plant, Dalhousie, is being converted to burn a water–bitumen mixture, Orimulsion, and will be retrofitted with a wet limestone flue-gas scrubber. This project will likely come into service in November 1994. Other SO_2 control measures include using 1-percent-sulphur fuel oil at the Courtenay Bay generating station, and implementing conservation and demand management programs. These developments will ensure that New Brunswick Power will meet commitments to its customers while complying with the provincial SO_2 limits.

Pulp and Paper

In 1990, pulp and paper mills in New Brunswick completed modernization programs designed to bring them into compliance with provincial regulations. This sector is expected to maintain SO_2 emissions levels below 20 kilotonnes per year.

Primary Metals

The Brunswick metals smelter in Belldune captures more than 80 percent of its SO_2 emissions. In addition, recently upgraded equipment and operating procedures to cope with local air quality conditions have reduced the last two years' emissions.

Oil

The Irving Oil refinery at Saint John, the largest refinery in North America, continues to operate at a high throughput and maintains its emissions well below the annual provincial limit of 8 kilotonnes.

Research and Monitoring

New Brunswick has been actively monitoring acid deposition since the early 1980s and has expanded its coverage to include some 20 stations. Of great interest, this work indicates deposition patterns that contrast substantially with the regional or national ones previously published by numerous sources. Specifically, New Brunswick has monitored 25 to 30 kilograms of SO_2 per hectare per year along the southern coast, with a rapidly declining gradient to the north. Levels of about 10 to 14 kilograms of SO_2 per hectare per year occur across the northern half of the province. These findings agree with predictions made by the Federal–Provincial Research and Monitoring Coordinating Committee, the National Acid Precipitation Assessment Program and the Royal Society of Canada that the sensitive ecosystems of southern New Brunswick are still at risk despite current emission-reduction commitments.

Nova Scotia (1994 target: 189 kilotonnes)

Nova Scotia Power accounts for approximately 80 percent of the province's SO_2 emissions. Other major sources include petroleum refining and the pulp and paper industry.

Power Generation

The province established an initial annual SO_2 emissions target for Nova Scotia Power of 160 kilotonnes, and the utility subsequently agreed to a reduced target of 145 kilotonnes. In 1991, Nova Scotia Power's SO_2 emissions were below this target. In the revised agreement covering the period 1994 to the year 2000 the utility's target is still 145 kilotonnes. The utility has since embarked on a long-range program to cut annual SO_2 emissions to less than 90 kilotonnes by the year 2010. The program will: complete the world's largest, circulating fluidized-bed combustor at Point Aconi, designed to achieve 90 percent SO_2 removal; expand the

use of low-sulphur coal and oil at existing power plants; expand demand management; and test and demonstrate emission-control technologies. The other major industrial sources are not expected to increase their emissions substantially.

Research and Monitoring

Nova Scotia continued to monitor acid deposition at two sites. Data collected at these sites and at sites operated by Environment Canada indicate a slight decrease in overall acid deposition in the province; however, deposition levels continue to be higher than those needed to protect sensitive aquatic ecosystems.

Newfoundland (1994 target: 45 kilotonnes)

In Newfoundland, two major sources account for most of the province's emissions of SO_2: the 500-megawatt, heavy-oil burning, Holyrood power plant and the Come-by-Chance oil refinery.

Power Generation

In 1991, the province and its electric utility, Newfoundland and Labrador Hydro, agreed to limit annual SO_2 emissions to 25 kilotonnes. However, since only this facility provides the island with non-hydro electricity, the limitation applies to years with normal or above-normal rainfall. Emission reductions may be achieved by using low-sulphur fuels. In 1991, Holyrood's SO_2 emissions totalled only 15 kilotonnes.

Oil

The Come-by-Chance oil refinery has been refining crudes higher in sulphur than in previous years. As a result, sulphur oxide emissions have increased from previous levels. The province is working with the refinery to ensure that provincial air-quality standards are met, and to reduce SO_2 emissions to the 45-kilotonne provincial emissions target.

Prince Edward Island (1994 objective: 5 kilotonnes)

Virtually all of Prince Edward Island's SO_2 emissions are from fossil-fuel combustion, much of it at the 71-megawatt Charlottetown power plant. Since most of the electricity used in the province comes from New Brunswick via underwater cable, the Island capacity is not used extensively. Energy conservation programs and programs to encourage the use of biomass fuel have further reduced the need for

sulphur-bearing fossil fuels. The province therefore expects its emissions to continue to be below the 5-kilotonne objective.

Acid Rain Program Highlights for 1991

The previous section summarized provincial and industrial actions to reduce SO_2 emissions and monitor progress. In addition to these actions, several federal government departments and the provinces have collaborated on applying new emission-control technologies, conducting scientific research and monitoring ecosystems. The need to reduce acidic pollutant inflows, particularly from major source areas in the United States, has also led to international and bilateral initiatives by the Government of Canada.

The first year of the Canada–United States Air Quality Agreement on Air Quality was 1991. This agreement formalized both countries' obligations to implement domestic acid-gas control measures, to address transboundary issues and to cooperate in a wide range of technical and scientific areas. In 1990, the United States proposed amending its *Clean Air Act* to include major new provisions that will roughly halve its power-plant SO_2 emissions by the year 2000. In 1991, the United States elaborated, in detailed regulatory and program form, on how this commitment would be met. The proposed regulations specify emissions limitations at over 100 existing power plants, and an innovative emissions-trading scheme. A detailed public review of these proposals was undertaken and the finalization of regulations is expected in 1992.

Other 1991 highlights of Canadian activities:

- In November 1991 in Montréal, Environment Canada, the Ministry of Environment of Quebec, the Air and Waste Management Association and the *Ordre des ingénieurs du Québec* co-sponsored a two-day symposium on acid precipitation and ozone smog in Quebec.

- Quebec hosted a conference in Montréal on acid-rain research. Conference findings projected that, by 2003, 77 percent of acid lakes in Quebec will see their pH levels improve to over 5.5, and fully 50 percent are expected to return to a non-acid state (pH greater than 6). Quebec researchers published a number of scientific papers and reports on acid-rain effects on water quality, aquatic life and forests.

- Environment Canada released a major report and database on lake-water quality in Quebec and on data gathered throughout the 1980s at the Lac Laflamme calibrated watershed.

- Environment Canada, Forestry Canada and the University of New Brunswick continued their work developing and applying a biophysical model to assess and quantify the long-term effect of acidic deposition on forests and forest productivity.

- In response to increasing concern over the possible role of nitrogen oxides in Canadian acid rain, Environment Canada initiated an assessment of existing data on surface water chemistry to define the real and potential effect of nitrogen deposition in southeastern Canada. This work may identify the need for further research and monitoring.

- The Canadian Electrical Association, the national association of electric utilities, continued its program of research, development and demonstration of technologies to reduce SO_2 and nitrogen oxide emissions at power plants. Much of this work was conducted in collaboration with federal–provincial government agencies, including contributions from Energy, Mines and Resources Canada and Environment Canada. The association is reviewing sorbent-injection processes, researching low-temperature catalysts for nitrogen oxide control, and improving desulphurization processes, to minimize associated wastewater and waste-disposal problems.

- Continuing sampling and monitoring at a network of 157 lakes and 27 rivers indicates that sulphate levels at many sites are declining. This has yet to translate into measurable water quality improvements at many sites.

- The Atmospheric Environment Service of Environment Canada operates a nation-wide acid-rain monitoring network (CAPMON). This network has detected decreases in the concentrations of sulphate in precipitation since the early 1980s. For example, at Kejimkujik National Park in southwestern Nova Scotia, average sulphate levels recorded from 1989 to 1991 were about 20 percent less than from 1980 to 1982.

- A major eight-volume acid-rain assessment report on the state of science and technology was released by Environment Canada early in 1991. It reviews more than a decade of research on acid rain and air pollution in Canada and

examines progress made in reducing SO_2 emissions. The report concludes that the control programs in Canada and the United States will result in major improvements, but stresses that continuing efforts and vigilance will be needed throughout the 1990s to ensure that controls are implemented and to verify that the environment is recovering.

- Canada continued to play an important role in reviewing the international United Nations protocols on SO_2 and nitrogen oxides.

Conclusion

This year, 1991, was an important one for the Eastern Canada Acid Rain Control Program. It marked the passing of the first full decade of work with a major assessment report. It also saw the development of new regulatory initiatives in the United States and the implementation of a bilateral agreement to cooperate on solving the North American acid-rain problem. Scientific research continued and revealed the first signs of recovery, reinforcing support for continued action and watchfulness. Research and development by governments and industries is now resulting in the successful application of advanced technologies for acid-gas controls. These measures ensure that Canada's Program objectives will be met. The course is set for the rest of the 1990s.