

2001

2001 Annual Progress Report  
on

**The Canada-Wide  
Acid Rain Strategy  
for Post-2000**



December 2002

## National Library of Canada cataloguing in publication data

Main entry under title:

2001 annual progress report on the Canada-Wide Acid Rain Strategy for Post-2000

Text in English and French on inverted pages.

Title on added t.p.: Rapport d'étape annuel 2001 concernant la Stratégie pancanadienne sur les émissions acidifiantes après l'an 2000.

Issued also on the Internet.

ISSN 1488-948X

ISBN 0-662-66963-0

Cat. no. En40-11/39-2001

1. Acid rain – Canada – Periodicals.
2. Environmental monitoring – Canada – Periodicals.
3. Pollution – Canada – Measurement – Periodicals.
- I. Canada. Environment Canada.

TD195.54 2001

363.738'67'097105

### ***The Canada-Wide Acid Rain Strategy for Post-2000***

In October 1998, federal, provincial and territorial Energy and Environment Ministers signed *The Canada-Wide Acid Rain Strategy for Post 2000*. The primary long-term goal of *The Strategy* is “to meet the environmental threshold of critical loads for acid deposition across Canada”. As steps towards the achievement of this goal, *The Strategy* calls for a number of actions, including:

- pursuing further emission reduction commitments from the U.S.;
- establishing new sulphur dioxide (SO<sub>2</sub>) emission reduction targets in eastern Canada;
- preventing pollution, and keeping “clean” areas clean;
- ensuring the adequacy of acid rain science and monitoring programs; and,
- annually reporting on SO<sub>2</sub> and nitrogen oxides (NO<sub>x</sub>) emissions and forecasts, on compliance with international commitments, and on progress in implementing *The Strategy*.

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## **The Canada-Wide Acid Rain Strategy for Post-2000**



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## Introduction

This annual report on *The Canada-Wide Acid Rain Strategy for Post-2000* (hereafter referred to as *The Strategy*) reviews progress in 2001 on key areas of *The Strategy* implementation. As required under *The Strategy*, it also reviews compliance with international commitments related to acid rain, and reports on emissions of SO<sub>2</sub> and NO<sub>x</sub>, the key acid rain-causing pollutants, for the year 2000 as well as forecasts for future years for these same pollutants.

## Progress in 2001

### 1. Reducing emissions that cause acid rain

One of the principal commitments of *The Strategy* was that Ontario, Quebec, New Brunswick and Nova Scotia establish new targets and timetables for SO<sub>2</sub> emission reductions. As was indicated in the *2000 Annual Progress Report* (released in May 2001), Ontario announced its new emission target in early 2000 and Quebec and New Brunswick in early 2001. Nova Scotia's target was not known at the time of the 2000 report's release, but was announced as part of that province's new energy strategy in December 2001. This completed the development of new provincial targets for SO<sub>2</sub> emissions in eastern Canada, as called for in *The Strategy*. The following table shows these new targets, and the schedules for their achievement. Previous commitments (emission caps) under the Eastern Canada Acid Rain Program are provided for comparison.

Work is now focussing on the negotiation of bilateral agreements between the federal government and each province to formalize these new reduction targets. As part of this process, an overall emission target for the Sulphur Oxide Management Area (SOMA) of eastern Canada will also be identified, based on the new provincial emission caps. Canada will incorporate the new SOMA target into the United Nations Economic Commission for Europe (UNECE) Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone upon ratification.

Another key obligation under *The Strategy* is to seek further emission reduction commitments from the United States. Progress in this area is being pursued through the Canada – United States Air Quality Committee and its subcommittees, which are responsible for overseeing the implementation of the 1991 Canada – United States Air Quality Agreement (AQA). Under the guidance of these groups, joint modelling and other analytical work to investigate the transboundary impacts of particulate matter (PM) was initiated in 1999, and continues into 2002. The Air Quality Committee and subcommittees will consider acid rain effects in their analyses of SO<sub>2</sub> reductions required to address PM (dealing with PM will inevitably require reductions in emissions of SO<sub>2</sub>, which is both a precursor of PM and an acidifying pollutant). Work in this area is expected to culminate in discussions in 2004 on a possible PM Annex under the AQA. This would be the instrument for achieving further SO<sub>2</sub> emission reduction commitments from the United States.

**TABLE 1: SO<sub>2</sub> REDUCTION TARGETS FOR ONTARIO, QUEBEC, NEW BRUNSWICK AND NOVA SCOTIA**

	Former Eastern Canada Acid Rain Program Cap	New Target Under <i>The Canada-Wide Acid Rain Strategy</i>	Timeline for new target
<b>Ontario</b>	885 kt	• 442.5 kt (50% reduction)	2015 <sup>a</sup>
<b>Quebec</b>	500 kt	• 300 kt (40% reduction) • 250 kt (50% reduction)	2002 2010
<b>New Brunswick</b>	175 kt	• 122.5 kt (30% reduction) • 87.5 kt (50% reduction)	2005 2010
<b>Nova Scotia</b>	189 kt	• 142 kt (25% reduction) • 94.5 kt (50% cumulative reduction goal) <sup>b</sup>	2005 2010

<sup>a</sup> Ontario has proposed and is consulting on the proposal to advance this timeline to 2010.

<sup>b</sup> Ninety-four and a half kilotonnes is a reduction target and not a cap. Nova Scotia's commitment is to reduce SO<sub>2</sub> emissions by 25% from the existing cap by 2005 and to further reduce emissions to achieve a cumulative reduction goal of 50% by 2010 from existing sources.

There are a number of federal legislative proposals as well as industry and stakeholder proposals for multi-pollutant emission reductions currently under consideration in the United States. These proposals indicate willingness by the United States to take further actions to address the issue of acid rain. One among these is President Bush's recent "Clear Skies" initiative that sets out proposed new reduction targets for SO<sub>2</sub>, NO<sub>x</sub> and mercury in 2010 and 2018.

The outcome of the debate in the U.S. on this and other similar initiatives will set the stage for future discussions on emission reductions under the AQA.

## 2. Science and monitoring

A number of atmospheric modelling scenarios have been run in the past, using the Acid Deposition and Oxidant Model (ADOM), to provide information on the magnitude and location of SO<sub>2</sub> emission reductions required to reach critical loads. These critical loads were calculated for wet sulphate (SO<sub>4</sub>) deposition to aquatic ecosystems, as aquatic ecosystems are thought to be the most sensitive to acid deposition. As a result, critical loads for sulphate deposition are defined as the amount of sulphate that can be deposited on an area and still maintain 95% of the lakes in the region at or above a pH of 6. Critical loads for wet sulphate deposition in eastern Canada range from less than 8 to over 20 kilograms per hectare per year.



In 2001-02, an additional ADOM simulation was run, with the purpose of predicting the changes in acid deposition that would result from the new eastern Canada SO<sub>2</sub> emission targets, when combined with various hypothetical emission reduction levels in the United States.

Figure 1 illustrates the effect of the new eastern Canada targets when combined with a U.S. cut in total SO<sub>2</sub> emissions of 50%. In this scenario, the area of eastern Canada that continues to exceed critical loads is reduced to a band extending across central Ontario and central Quebec, covering 247,000 square kilometres (km<sup>2</sup>).

This represents a significant reduction in the area exceeding critical loads, compared to the base case of no further SO<sub>2</sub> emission reductions beyond those called for under the AQA. This base-case scenario is illustrated in Figure 2 in

which almost 800,000 km<sup>2</sup> would continue to receive damaging levels of acid rain.

The overall aim of the science and monitoring program is to verify that emission reductions are having the desired environmental effect and that emission control measures are adequate to protect sensitive ecosystems. The program follows the recommendations of *The 1999 Review of Acid Rain Science Programs in Canada* and it provides information used in public reports such as State-of-the-Environment reports and Progress Reports under the AQA.

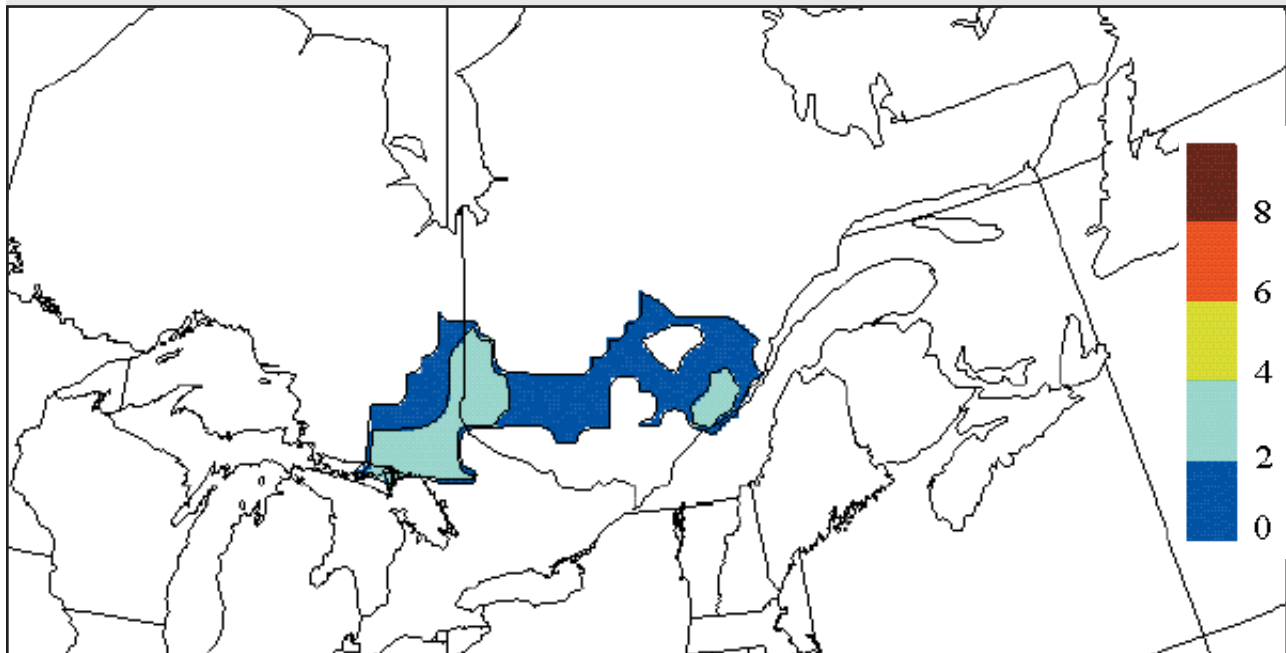
The next full scientific assessment of the acid rain problem in Canada is scheduled for 2004.

It will address basic questions such as:

- Are we meeting the targets?
- Are they having the desired effects?
- Are further controls required?
- Will NO<sub>x</sub> reductions compensate for the need to reduce SO<sub>2</sub>?

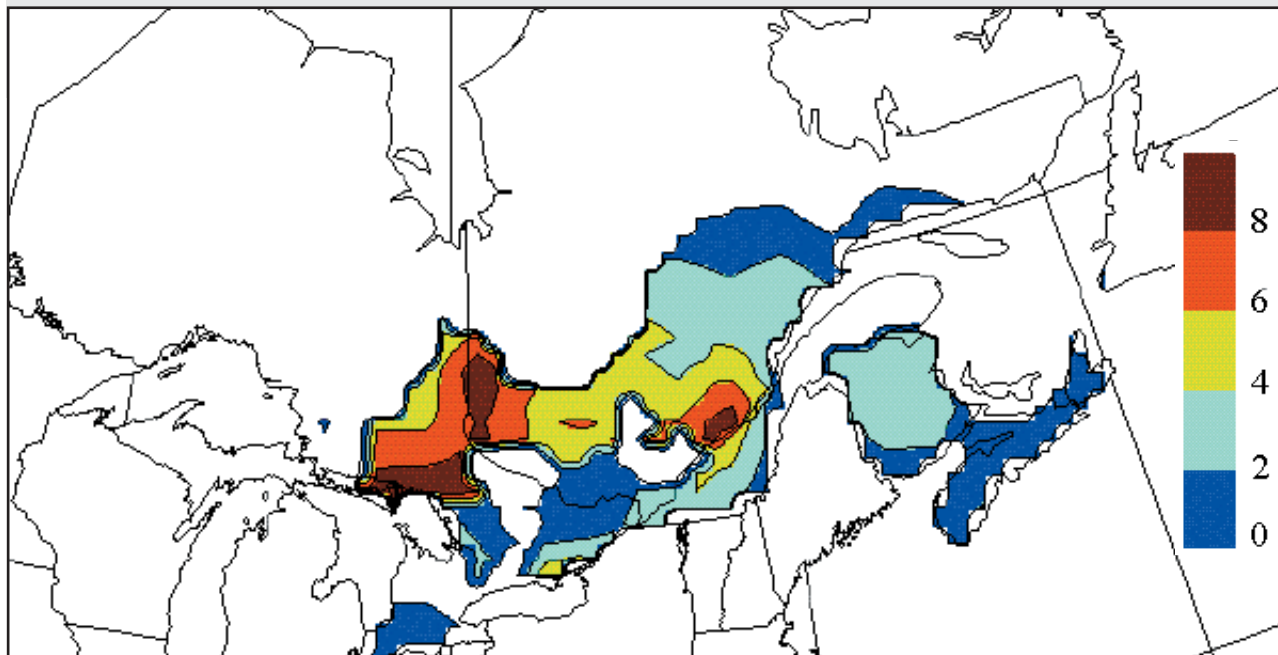
**FIGURE 1**

Area expected to receive wet SO<sub>4</sub> deposition above critical loads (in kilograms per hectare per year) with targeted SO<sub>2</sub> emission reductions of 50% in Ontario, Quebec, New Brunswick and Nova Scotia, in combination with a hypothetical U.S. emission reduction of 50%, beyond existing commitments under the 1991 Canada – United States Air Quality Agreement.



**FIGURE 2**

Area of eastern Canada expected to receive wet SO<sub>4</sub> deposition above critical loads (in kilograms per hectare per year) in 2010, without further controls beyond provisions in the 1991 Canada – United States Air Quality Agreement.



In order to answer these questions, a collaborative federal-provincial science and monitoring program continues to:

- a) *Monitor air and precipitation chemistry.*  
In the past year, a new Canadian Air and Precipitation Monitoring Network (CAPMoN) site was established near Muskoka (Ont.) and two other prospective new sites surveyed - Pickle Lake (Ont.) and near James Bay (Que.).
- b) *Monitor the chemistry of a few selected lakes and rivers in eastern Canadian areas affected by acid rain. Some waterfowl surveys are also carried out.*
- c) *Conduct research to improve estimates of deposition of nitrogen species.*
- d) *Conduct research into ecosystem recovery processes, particularly to estimate when changes can be expected.*

- e) *Refine estimates of sulphur and nitrogen critical loads for both aquatic and forest ecosystems, with special new efforts to determine critical loads for nitrogen deposition.*

The data generated by *The Strategy's* science and monitoring programs will verify some of the effects of important reductions in SO<sub>2</sub> in the U.S. between 1995 and 2000, as a result of the first phase of the 1990 Clean Air Act Amendments. As well, these data will identify the collateral benefits of the Canada – United States Ozone Annex and the new U.S. PM standards.

## Compliance with International Commitments

As indicated in Table 2, Canada continues to meet or exceed all of its current international requirements related to emissions of SO<sub>2</sub> and NO<sub>x</sub>.

## Reporting on Emissions and Forecasts

Table 3 shows SO<sub>2</sub> emissions for 2000, by province and for major sectors and forecasts for the years 2005 and 2010. Table 4 shows emissions and forecasts for NO<sub>x</sub> for the same years.

**TABLE 2: INTERNATIONAL COMMITMENTS AND COMPLIANCE ON SO<sub>2</sub> AND NO<sub>x</sub> IN 2000**

Commitment	Compliance in 2000
<p><b>1991 Canada-United States Air Quality Agreement</b></p> <ul style="list-style-type: none"> <li>cap on SO<sub>2</sub> emissions in seven eastern provinces of 2.3 million tonnes by 1994, until 2000</li> <li>national cap on SO<sub>2</sub> emissions of 3.2 million tonnes by 2000 onward</li> <li>national reduction of 100 kilotonnes in NO<sub>x</sub> emissions from stationary sources from forecast levels<sup>1</sup> by 2000</li> </ul>	<ul style="list-style-type: none"> <li>eastern Canada SO<sub>2</sub> emissions were approximately 1.6 million tonnes (29% below the cap).</li> <li>national SO<sub>2</sub> emissions were approximately 2.5 million tonnes (20% below the cap).</li> <li>national NO<sub>x</sub> emissions from stationary sources have been reduced by over 100 kilotonnes from forecast levels</li> </ul>
<p><b>1985 UN ECE Sulphur Protocol</b></p> <ul style="list-style-type: none"> <li>permanent national cap of 3.2 million tonnes of SO<sub>2</sub> by 1993</li> </ul>	<ul style="list-style-type: none"> <li>national SO<sub>2</sub> emissions were approximately 2.5 million tonnes (20% below the cap)</li> </ul>
<p><b>1994 UN ECE Sulphur Protocol</b></p> <ul style="list-style-type: none"> <li>regional cap of 1.75 million tonnes of SO<sub>2</sub> by 2000 in the Sulphur Oxide Management Area (SOMA), plus the permanent national cap</li> </ul>	<ul style="list-style-type: none"> <li>SO<sub>2</sub> emissions in the SOMA were 1.2 million tonnes, or 33% below the SOMA cap. National SO<sub>2</sub> emissions were approximately 2.5 million tonnes, well below the national cap of 3.2 million tonnes</li> </ul>
<p><b>1988 UN ECE NO<sub>x</sub> Protocol</b></p> <ul style="list-style-type: none"> <li>stabilize NO<sub>x</sub> emissions at 1987 levels<sup>2</sup> by 1994</li> </ul>	<ul style="list-style-type: none"> <li>in 1994, national NO<sub>x</sub> emissions were less than the 1987 level; and current emissions remain below this level</li> </ul>
<p>1. Historical emissions and projections are subject to change as methodologies for estimating and forecasting emissions improve.                  2. 1987 levels are under review.</p>	

**TABLE 3: TOTAL SO<sub>2</sub> EMISSIONS BY PROVINCE AND SECTOR (KILOTONNES)**

							Forecast	
	1994-99 cap	2005 cap	2010-15 cap <sup>3</sup>	1990	1995	2000	2005	2010
<b>British Columbia</b>								
Upstream oil and gas						125	126	118
Transportation						27	29	31
Non-ferrous mining and smelting						17	20	23
Other						28	28	29
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>152</b>	<b>173</b>	<b>197</b>	<b>203</b>	<b>201</b>
<b>Alberta</b>								
Upstream oil and gas						260	238	230
Oil sands						94	117	162
Electric power generation						130	129	131
Other						32	37	40
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>567</b>	<b>609</b>	<b>516</b>	<b>521</b>	<b>563</b>
<b>Saskatchewan</b>								
Electric power generation						119	119	120
Upstream oil and gas						10	11	11
Other						12	13	14
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>88</b>	<b>130</b>	<b>142</b>	<b>143</b>	<b>145</b>
<b>Manitoba</b>								
Non-ferrous mining and smelting						352	432	432
Other						11	10	11
<b>Total</b>	<b>550<sup>1</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>516</b>	<b>365</b>	<b>363</b>	<b>442</b>	<b>443</b>
<b>Ontario*</b>								
Non-ferrous mining and smelting						255	303	245
Other Industrial sources						135	148	159
Electric power generation						165	158	131
Other						51	35	37
<b>Total</b>	<b>885</b>	<b>N/A</b>	<b>442.5</b>	<b>1,166</b>	<b>616</b>	<b>606</b>	<b>644</b>	<b>572</b>
<b>Quebec</b>								
Non-ferrous mining and smelting (copper and zinc)						134	100	80
Aluminum industry						42	51	51
Pulp and paper						24	26	20
Other						94	94	91
<b>Total</b>	<b>500</b>	<b>300</b>	<b>250</b>	<b>391</b>	<b>363</b>	<b>294</b>	<b>271</b>	<b>242</b>
<b>New Brunswick</b>								
Non-ferrous mining and smelting						12	14	
Electric power generation						97	53	
Pulp and paper						13	8	
Other						9	20	
<b>Total</b>	<b>175</b>	<b>122.5</b>	<b>87.5</b>	<b>181</b>	<b>114</b>	<b>131</b>	<b>95</b>	<b>87.5<sup>4</sup></b>

**TABLE 3: TOTAL SO<sub>2</sub> EMISSIONS BY PROVINCE AND SECTOR (KILOTONNES) (cont'd)**

							Forecast	
	1994-99 cap	2005 cap	2010-15 cap <sup>3</sup>	1990	1995	2000	2005	2010
<b>Nova Scotia</b>								
Electric power generation						138		
Other Industrial						13		
Other						14		
<b>Total</b>	<b>189</b>	<b>142</b>	<b>94.5</b>	<b>178</b>	<b>166</b>	<b>165</b>	<b>142<sup>4</sup></b>	<b>94.5<sup>5</sup></b>
<b>Prince Edward Island</b>								
Electric power generation						2	2	2
Other						2	2	2
<b>Total</b>	<b>5</b>	<b>N/A</b>	<b>N/A</b>	<b>4</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>4</b>
<b>Newfoundland</b>								
Petroleum refining						22	17	17
Electric power generation						11	14	14
Iron ore mining						8	7	8
Other						8	10	11
<b>Total</b>	<b>45<sup>1</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>66</b>	<b>65</b>	<b>49</b>	<b>48</b>	<b>50</b>
<b>Yukon</b>								
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>&lt;0.5</b>	<b>&lt;0.5</b>	<b>&lt;0.5</b>	<b>&lt;0.5</b>
<b>Northwest Territories</b>								
Mining and rock quarrying						0	0	0
Upstream oil and gas						1	5	5
Other						1	1	1
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>17</b>	<b>16</b>	<b>2</b>	<b>6</b>	<b>6</b>
<b>Nunavut<sup>2</sup></b>								
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
<b>SOMA</b>								
<b>Total</b>	<b>1,750</b>	<b>N/A</b>	<b>N/A</b>	<b>1,916</b>	<b>1,214</b>	<b>1,161</b>	<b>1,119</b>	<b>976</b>
<b>Canada</b>								
<b>Total</b>	<b>3,200</b>	<b>N/A</b>	<b>N/A</b>	<b>3,326</b>	<b>2,620</b>	<b>2,470</b>	<b>2,519</b>	<b>2,408</b>

1. Cap applied to 1994 only.
2. Numbers for Nunavut will be reported separately in the future, but for now are included in the NWT totals.
3. Caps for Quebec, New Brunswick and Nova Scotia are for 2010; cap for Ontario is for 2015.
4. Represents the provincial emission cap; breakdown by sector not available.
5. Nova Scotia's forecast 94.5 kt by 2010 is a reduction target for existing sources and is not meant to be a cap.

Note: Numbers may not add due to rounding.

N/A = Not applicable

Source: July 2002. Data provided by the Emissions and Projections Working Group of the Canadian Council of Ministers of the Environment (CCME). Data for Alberta, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, and Newfoundland are preliminary actual data provided by each province for 2000. For all other sources in 2000, data are forecasted values.

\* Ontario has committed to reducing its SO<sub>2</sub> emissions by 50% from its Eastern Canada Acid Rain Program commitment of 885 kt by 2015. These further reductions are not included in the above projections.

**TABLE 4: TOTAL ANTHROPOGENIC NO<sub>x</sub> EMISSIONS BY PROVINCE AND SECTOR (KILOTONNES)**

	Cap for 1994 and beyond	1995	2000	Forecast	
				2005	2010
<b>British Columbia</b>					
Stationary sources			75	73	70
Transportation			214	189	183
<b>Total</b>	<b>N/A</b>	<b>294</b>	<b>289</b>	<b>262</b>	<b>253</b>
<b>Alberta</b>					
Stationary sources			515	588	694
Transportation			227	167	132
<b>Total</b>	<b>N/A</b>	<b>686</b>	<b>742</b>	<b>755</b>	<b>826</b>
<b>Saskatchewan</b>					
Stationary sources			91	93	96
Transportation			85	60	53
<b>Total</b>	<b>N/A</b>	<b>173</b>	<b>176</b>	<b>153</b>	<b>149</b>
<b>Manitoba</b>					
Stationary sources			15	19	17
Transportation			58	40	35
<b>Total</b>	<b>N/A</b>	<b>79</b>	<b>73</b>	<b>59</b>	<b>52</b>
<b>Ontario**</b>					
Stationary sources			200	166	152
Transportation			355	294	256
<b>Total</b>	<b>N/A</b>	<b>515</b>	<b>555</b>	<b>460</b>	<b>408</b>
<b>Quebec</b>					
Stationary sources			53	57	60
Transportation			297	219	200
<b>Total</b>	<b>N/A</b>	<b>363</b>	<b>350</b>	<b>276</b>	<b>260</b>
<b>New Brunswick</b>					
Stationary sources			34	31	28
Transportation			44	43	44
<b>Total</b>	<b>N/A</b>	<b>68</b>	<b>78</b>	<b>74</b>	<b>72</b>
<b>Nova Scotia</b>					
Stationary sources			42	45	46
Transportation			39	28	25
<b>Total</b>	<b>N/A</b>	<b>76</b>	<b>80</b>	<b>73</b>	<b>71</b>
<b>Prince Edward Island</b>					
Stationary sources			2	2	2
Transportation			8	6	5
<b>Total</b>	<b>N/A</b>	<b>8</b>	<b>10</b>	<b>7</b>	<b>7</b>
<b>Newfoundland</b>					
Stationary sources			30	26	24
Transportation			16	19	22
<b>Total</b>	<b>N/A</b>	<b>44</b>	<b>46</b>	<b>45</b>	<b>46</b>

**TABLE 4: TOTAL ANTHROPOGENIC NO<sub>x</sub> EMISSIONS BY PROVINCE AND SECTOR (KILOTONNES) (cont'd)**

	Cap for 1994 and beyond	1995	2000	Forecast	
				2005	2010
<b>Yukon</b>					
Stationary sources			2	2	2
Transportation			4	2	2
<b>Total</b>	<b>N/A</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>4</b>
<b>Northwest Territories</b>					
Stationary sources			9	16	18
Transportation			3	2	2
<b>Total</b>	<b>N/A</b>	<b>9</b>	<b>12</b>	<b>18</b>	<b>19</b>
<b>Nunavut<sup>1</sup></b>					
Stationary sources					
Transportation					
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
<b>Canada</b>					
<b>Total</b>	<b>1987 level<sup>2</sup></b>	<b>2,322</b>	<b>2,416</b>	<b>2,187</b>	<b>2,167</b>

1. Numbers for Nunavut will be reported separately in the future, but for now are included in the NWT totals.

2. 1987 levels are under review.

Notes: Stationary sources include both point and area sources.

Numbers may not add due to rounding.

N/A = Not applicable.

Source: July 2002. Data provided by the Emissions and Projections Working Group of the Canadian Council of Ministers of the Environment (CCME). Data for Alberta, Manitoba, Ontario, Quebec, New Brunswick and Newfoundland are preliminary actual data provided by the province for 2000 (except for Transportation for New Brunswick and Newfoundland, which are from the latest forecast). All other sources in 2000 are forecasted values.

\*\* Through the Anti-Smog Action Plan, Ontario has committed to reducing its NO<sub>x</sub> emissions by 45% from its 1990 base-level of 659 kt by 2015. Again, these further reductions are not included in the above projections.

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# Notes