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2004-2005 Progress Report on **The Canada-Wide Acid Rain Strategy for Post-2000**

Federal/Provincial/Territorial
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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 United States;
- Establishing new sulphur dioxide (SO_2) 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_2 and nitrogen oxides (NO_X) emissions and forecasts, on compliance with international commitments, and on progress in implementing *The Strategy*.

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Introduction

Each year since the Energy and Environment Ministers signed *The Canada-Wide Acid Rain Strategy for Post-2000* (hereafter called *The Strategy*), an annual report has been produced to keep decision-makers and the public informed on progress in implementing the commitments under *The Strategy*. Annual reports also present current and projected sulphur dioxide (SO_2) and nitrogen oxides (NO_X) emission levels in Canada and report on compliance with international emission reduction commitments. The Acid Rain Task Group of the Canadian Council of Ministers of the Environment (CCME) is responsible for preparing the annual reports, as their mandate is to coordinate implementation of *The Strategy*. This is the sixth report in that series.

This report updates the reader on actions taken in 2004 and 2005 to implement the key elements of *The Strategy*. This includes:

- Efforts by Ontario, Quebec, New Brunswick and Nova Scotia to reduce provincial emissions to below their new SO_2 reduction targets;
- Actions taken by the federal government to secure further SO_2 emission reductions from the US;
- Initiatives developed to keep-clean-areas-clean and prevent acid rain from becoming a problem; and
- New acid rain science and monitoring activities.

In 2004, the Acid Rain Task Group decided to conduct a review of *The Strategy*, nominally a five-year review since October 2003 marked the five year anniversary of the signing of *The Strategy*. As part of the five-year review, the Task Group reviewed progress implementing the recommendations from the *1999 Review of Acid Rain Science Programs in Canada*. A short summary of the outcome of this review of progress can be found in section 4 - *Federal/Provincial/Territorial Acid Deposition Science and Monitoring Activities*.

In February 2005, the Task Group hosted a multi-stakeholder workshop focused on taking stock and identifying next steps for acid rain, including a discussion of the five-year review and the major findings of the 2004 Canadian Acid Deposition Science Assessment. A short summary of recommendations from stakeholders on things to consider improving in *The Strategy* is included in this report.

Readers can find the five-year review, past annual progress reports on *The Strategy*, the February 2005 workshop summary and presentations, and additional information on the CCME Acid Rain Task Group website at http://www.ccme.ca/ourwork/air.html?category_id=31.

As a framework for dealing with acidifying pollutants, *The Strategy* set a long-term goal of achieving the threshold of critical loads for acid deposition across Canada. The *2004 Canadian Acid Deposition Assessment* reveals that acid deposition continues to exceed critical loads across much of eastern Canada. Therefore, the control of acidifying emissions has not occurred to the extent necessary to reduce acid deposition to below harmful levels and allow recovery of aquatic and terrestrial ecosystems. Section 4 of this report presents highlights from the *Assessment*;

details can be found in the *2004 Canadian Acid Deposition Science Assessment - Summary of Key Results* at http://www.msc-smc.ec.gc.ca/saib/acid/acid_e.html.

Progress in 2004/2005

1. Reducing Domestic Acidifying Emissions

Nova Scotia

The new Nova Scotia Air Quality Regulations were promulgated in February 2005, implementing the SO_2 and NO_X reduction commitments announced in the provincial Energy Strategy (2001). The new regulations include several measures to reduce SO_2 emissions. The previous provincial annual SO_2 cap was reduced by 25% to 141,750 tonnes, and includes a corresponding 25% cap reduction for the province's largest SO_2 emitter (Nova Scotia Power, NSPI), beginning in 2005.

The Energy Strategy set out a target 50% reduction in SO_2 emissions from existing (2001) sources (to 94,500 tonnes) by 2010. The new Air Quality Regulations require a further 25% reduction in NSPI's SO_2 emission cap in 2010 and the submission of SO_2 emission reduction plans by large industrial emitters, and establish a 2% sulphur content limit for heavy fuel oil consumed in the province. These measures will establish a gap between the emission target for existing sources and the new provincial cap.

The Energy Strategy additionally includes a commitment to reduce NO_X emissions by 20% from 2000 levels by 2009. The new regulations place a corresponding cap on NO_X emissions from the largest electricity generating utility (NSPI). Additional reductions in NO_X emissions are anticipated from the transportation sector, mainly through implementation of federal vehicle, engine and fuel measures.

New Brunswick

New Brunswick is committed to meeting its *Canada-Wide Acid Rain Strategy for Post-2000* SO_2 emission caps of 122.5 kilotonnes (kt) by 2005 and 87.5 kt by 2010. The majority of the reductions will be realized through the Electric Power Generating Sector. New Brunswick's largest emission source, the Coleson Cove generating station near Saint John, has recently (July 2005) completed an upgrade that will significantly reduce emission rates of SO_2, NO_X and particulate matter (PM) by as much as 77%, 70% and 75% respectively. The installation of pollution control equipment and the subsequent reduction in emissions will be an integral component in New Brunswick successfully achieving its SO_2 emission reduction commitments.

The recent announcement of the refurbishment of the Point LePreau nuclear generating station, while not an emission reduction project, will negate the need to generate the required electricity from additional fossil-fuelled sources and add the associated emissions to the New Brunswick airshed.

Quebec

In Quebec, Falconbridge Horne Smelter (formerly Noranda Inc.) maintains its commitment for 2006 to increase to 90% the recovery of SO_2 emissions from its copper foundry with Rouyn-Noranda compared to the 75% rate of recovery already reached. Moreover, the Murdochville smelter, formerly owned by Noranda Inc, completely ceased its operations in April 2002, which resulted in a permanent reduction in SO_2 emissions. The forecasts of the emissions for 2005 and subsequent years were adjusted as a result.

Sulphur dioxide emissions in Quebec are already below the provinces annual SO_2 emissions ceiling of 250 kt, to be achieved by 2010. Efforts are underway to maintain this success, including the following initiatives:

- Lowering the maximum sulphur content in heavy fuel oil from 2 to 1.5 % proposed in the draft Air Quality Regulations published in the November 2005 edition of the Gazette Officielle du Québec;
- Combustion optimization and improving the energy efficiency of industrial boilers; and
- Increasing the use of residual biomass as a fuel.

Ontario

Ontario is committed to reducing its SO_2 emissions by 50% from its Countdown Acid Rain cap of 885 kilotonnes/year and its NO_X emissions by 45% from 1990 levels by 2015.

In June 2004, Ontario announced a comprehensive *Five-Point Plan for Cleaner Air* to reduce industrial emissions of harmful air pollutants. As a result in 2005, two new regulations were promulgated that require industry to reduce their emissions of harmful air pollutants. The first regulation (O. Reg. 194/05 Industry Emissions – Nitrogen Oxides and Sulphur Dioxide) applies tough NO_X and SO_2 limits to more industrial sectors than ever before and makes the NO_X and SO_2 limits even stricter in future years. The second regulation (O. Reg. 419/05 Air Pollution-Local Air Quality) sets new air quality standards, in some cases for the first time, for many harmful pollutants; achieves a better picture of industrial emissions through updated technology; and introduces a faster, risk-based approach to implementing new air quality standards.

Currently, Ontario has in place regulations to reduce acidifying emissions (NO_X and SO_2) from the electricity sector (Ontario Emissions Trading Regulation, O. Reg. 397/01) which started December 31, 2001, and from 30 specified facilities in the following seven other industrial sectors: iron and steel, cement, petroleum refining, pulp and paper, non-ferrous smelting, carbon black, and glass (Industry Emissions – Nitrogen Oxides and Sulphur Dioxide Regulation, O. Reg. 194/05) starting January 1, 2006.

The Ontario Emissions Trading Regulation (O. Reg. 397/01) is designed to reduce annual emission limits from Ontario Power Generation's (OPG's) six fossil-fired generating stations (GSs) by over 50% for NO_X and 25% for SO_2 by 2007. OPG's six large fossil-fired GSs are: Atikokan (coal), Lakeview (coal), Lambton (coal), Lennox (oil and/or natural gas), Nanticoke (coal), and Thunder Bay (coal). On January 1, 2004, independent power producers' facilities (24 in total) fell under this same regulation.

On April 30, 2005, the Lakeview GS ceased operations (O. Reg. 396/01). In June 2005, Ontario announced its coal replacement plan that will require three (Thunder Bay, Atikokan and Lambton) of the four remaining coal-fired GSs to close by the end of 2007, with the remaining station, the Nanticoke GS, to close in early 2009. To support the replacement of this coal-fired generation, Ontario is seeking to produce well-over 7,500 megawatts of cleaner, more diversified power.

Implementation of the Industry Emission Reduction Plan (IERP) regulation (O. Reg. 194/05) will lead to incremental emissions reductions of SO_2 and NO_X from the 30 specific facilities in seven industrial sectors. By 2015, the IERP regulation will result in a 46% SO_2 reduction from 1994 levels and a 21% NO_X reduction from 1990 levels from these facilities. This is the first time NO_X and SO_2 emission limits are being applied to six of these seven large industrial sectors in Ontario, namely; iron and steel, cement, petroleum refining, pulp and paper, glass and carbon black. The seventh large industrial sector, non-ferrous smelting (INCO and Falconbridge), is also covered by Provincial Orders which require both facilities to reduce their allowable SO_2 emissions by 34%, effective 2007.

Historically, sulphur in gasoline accounted for one to two per cent of the total sulphur emissions that go into Ontario's air. Through O. Reg. 212/02, manufacturers, importers and blenders of gasoline for sale or use in Ontario were required to submit quarterly reports on the sulphur content of their gasoline up to the end of 2004. Ontario reported this information via the ministry's web site http://www.ene.gov.on.ca/envision/air/sig/index.htm enabling the public to make informed choices. As of December 31, 2004 (the sunset date for O. Reg. 212/02), all 14 refineries supplying Ontario's gasoline reported annual pooled average sulphur content levels below 150 parts per million (ppm) and nine reported pooled fourth-quarter average sulphur content levels below 30 ppm; the federally-regulated sulphur limit that became effective January 1, 2005.

2. Canada – United States Action on Acidification

Canada and the United States (U.S.) completed a cooperative science assessment in 2004 focussed on transboundary particulate matter (http://www.msc-smc.ec.gc.ca/saib/smog/transboundary/index_e.html) which provided important evidence to the two countries on the benefits of further emission reductions to levels of sulphur and nitrogen deposition. This evidence was the basis for a recommendation by the Canada-U.S. Air Quality Committee to the Canadian Minister of the Environment and the U.S. Environmental Protection Agency (EPA) Administrator which they endorsed in August 2004 to consider expanding the *Air Quality Agreement* to address transboundary PM and the related issues of acid rain, visibility and regional haze.

In the last year, new science on acidification has been completed in both Canada and the U.S. The 2004 Canadian Acid Deposition Science Assessment was presented to the U.S. EPA in October 2005 to outline for the U.S. the Canadian evidence on ecosystem response and the new critical load exceedance estimates and recovery constraints. At the same time, the U.S. EPA presented similar conclusions from the most recent U.S. National Acid Precipitation Assessment Program (NAPAP) where the need for further SO_2 reductions in the U.S. in the order of 40%-

80% beyond full implementation of the Title IV Acid Rain Program was highlighted as a precondition to broad recovery in the ecosystem from acid deposition.

Under the Canada-U.S. *Air Quality Agreement*, both countries committed to significant reductions in acid rain-causing emissions (NO_X and SO_2). As of 2001, eastern Canadian SO_2 emissions were more than 50 per cent below 1980 levels; the U.S. will achieve a comparable reduction as of 2010. These reductions were a good first step towards improving damaged ecosystems on both sides of the Canada-U.S. border. Under the *Air Quality Agreement's* Ozone Annex, signed in 2000, Canada has committed to reduce emissions of ozone-forming substances. Actions taken under this Annex are expected to reduce acidifying and smog-causing NO_X emissions and volatile organic compounds in the transboundary ozone area of Ontario and Quebec by 39 and 35 per cent, respectively, as of 2010 (when compared with 1990 levels), and reduce the flow of pollution into Canada from the U.S.

On June 23, 2003, Canada and the U.S. announced three major pilot projects to explore barriers to reducing air pollution in transboundary areas. These initiatives, taking place under part of the new Border Air Quality Strategy between our two countries, will help pave the way for developing new strategies to improve air quality and address transboundary air pollution of concern to Canadians and Americans.

The three projects reported to the public in 2005:

- Maintaining Air Quality in a Transboundary Air Basin: Georgia Basin-Puget Sound, available on Environment Canada's Greenlane at http://www.ec.gc.ca/cleanair-airpur/Georgia_Basin-Puget_Sound_Pilot_Project_Report-WS0469BE23-1_En.htm.
- Canada-United States Emissions Cap and Trading Feasibility Study, available on Environment Canada's Greenlane at http://www.ec.gc.ca/cleanair-airpur/Can-US_Emission_Trading_Feasibility_Study-WS105E2511-1_En.htm.
- Great Lakes Basin Airshed Management Framework, available on Environment Canada's Greenlane at http://www.ec.gc.ca/cleanair-airpur/CAOL/canus/great_lakes/toc_e.cfm.

The U.S. EPA announced the Clean Air Interstate Rule (CAIR) on March 10, 2005. CAIR will reduce and permanently cap emissions of SO_2 and NO_X in the eastern U.S. The focus of the reductions is emissions of SO_2 and NO_X from power plants. At full implementation, CAIR will reduce power plant SO_2 emissions in affected states to 2.5 million tons, which is 73% below 2003 emissions levels and in 2015, CAIR will reduce power plant NO_X emissions by 2 million tons, to 1.3 million tons in the affected states which is 61% below 2003 levels. SO_2 and NO_X emissions actively contribute to the formation of PM and acid rain while NO_X contributes to the formation of ground-level ozone.

3. "Keeping Clean Areas Clean" and Pollution Prevention

Provincial/territorial initiatives to reduce SO_2 & NO_X

In the Atlantic Region, many jurisdictions are taking a multi-pollutant approach, recognizing that it is more efficient to deal with a suite of pollutants and several air quality issues simultaneously rather than one at a time or issue-by-issue. In New Brunswick and Nova Scotia, for example, KCAC and pollution prevention (P2) actions and programs in support of *The Strategy* are being identified through their implementation planning under the PM and ozone Canada-Wide Standards (CWS) process.

Nova Scotia

A number of planned air quality management activities relating to acidifying emissions will be included in Nova Scotia's Implementation Plan for the CWS for PM and ozone. Initial work will focus on developing an airshed-based approach to emissions management, enhanced public information and outreach activities.

Nova Scotia is also participating in national initiatives to reduce emissions (including acidifying emissions) from several industrial sectors. For example, under the National Framework for Petroleum Refinery Emission Reductions, the Dartmouth Refinery will be developing measures to reduce NO_X and SO_2 emissions in a prioritized and phased manner over a 10-year time period.

New Brunswick

Emissions from major sources in New Brunswick continue to be regulated through the issuance of operating approvals. The approvals stipulate emissions limits for the facility and conditions under which they have to report. Reduction initiatives such as the *Canada-Wide Acid Rain Strategy for Post-2000* and CWS for PM and ozone are applied to facilities through these approvals. For existing major sources, emissions are reduced through the introduction of emissions caps and stack emissions limits. For new facilities, and when an existing major source adds new equipment or upgrades old equipment, the facility is required to install appropriate pollution control equipment.

New Brunswick is in the process of developing policies aimed at increasing the amount of energy consumed from renewable sources. Through the promotion of biomass fuels, wind power and energy conservation and efficiency measures, the province hopes to further reduce its reliance on fossil fuel power generation in future years.

Ontario

Ontario set a target of reducing provincial energy consumption by five percent by 2007 as part of the governments' plan to create a culture of conservation. The conservation plan includes launching a public education and outreach campaign, including town hall meetings, to encourage conservation, and setting aggressive targets to put smart meters into every home by 2010, with an interim target of 800,000 meters in place by 2007. The latter program will allow Ontarians to save money if they run appliances in off-peak hours. Incentives for local distribution companies and Hydro One to reduce expensive, wasteful "system loss" that can occur when transmitting electricity to customers is also part of the program.

In the last year, Ontario launched many initiatives that could increase electricity production from non-coal sources. In September 2004, the government initiated a request for proposals to identify interested proponents for the generation of 2,500 megawatts of new, clean electricity or conservation measures. In December 2004, Ontario signed a contract for the provision of an additional 300 megawatts (MWs) of new, renewable electricity capacity. These two initiatives will help the government meet its targets of generating 5 per cent (1,350 MW) of Ontario's total energy capacity from renewable sources by 2007, and 10 per cent (2,700 MW) by 2010. In addition, refurbishment and return to service of the Pickering Unit 1 will have a direct impact on Ontario's ability to phase-out some of its coal-fired units.

Manitoba

With respect to the management of acid rain in the province, Manitoba subscribes to the policy of "keeping clean areas clean". Manitoba's SO_2 emissions arise primarily from base metal smelting activities with emissions fluctuating on a yearly basis due to variations in operating schedules and shutdowns. Manitoba's NO_X emissions are mainly from the transportation sector.

Examples of actions taken by Manitoba Conservation which are likely either to expand knowledge of the potential impacts of acid deposition in the province or to reduce provincial emissions of SO_2 and NO_X include:

- Facilitating the sharing of information with government, industry and other stakeholders in order to better understand the potential impacts resulting from sulphur dioxide emissions from provincial sources;
- Continuing efforts towards investigating potential options to reduce SO_2 from the northern smelters;
- Working with and encouraging provincial sources to reduce emissions of all pollutants, including nitrogen oxides and sulphur dioxide, as part of the regulatory process under the Manitoba Environment Act. For example, the CCME NO_X emission limit for industrial boilers was included in the Environment Act licence for Husky's new 130 million litre ethanol plant to be constructed in south-western Manitoba.;
- Continuing to pursue pollution prevention opportunities for existing facilities although no major reductions in acidifying emissions have been realized in recent years; and
- Continuing to work cooperatively with other provincial and federal departments in addressing acid rain in Canada.

In addition, many of the current and proposed programs in Manitoba's Climate Change Action Plan[1] have the potential to concurrently reduce emissions of acid gases from various sectors, in most cases by reducing the need for the combustion of fossil fuels. Examples of just a couple of the programs include: the Wuskwatim Hydro Generation Project in Northern Manitoba (reducing the need for fossil fuel-fired thermal power generation); and Manitoba Hydro's Power Smart energy conservation programs.

[1] Province of Manitoba, "Kyoto and Beyond: A plan of action to meet and exceed Manitoba's Kyoto targets", October 2002.

Saskatchewan

Saskatchewan Environment recognizes that polluting "up to a limit" is not acceptable and that the best strategy to address this challenge is continuous improvement and keeping clean areas clean (CI/KCAC). Saskatchewan Environment has decided the most efficient mechanism to promote this concept is through the development of an Air Quality Strategy that includes the preparation of an implementation plan for CI/KCAC that encourages the development of airshed management associations throughout the province.

Saskatchewan has initiated its first airshed management association as a pilot project in the southeast corner of the province. Emissions from electricity generation, oil and gas activities and agricultural practices are all present in this area.

Saskatchewan Environment is attempting, through membership in the Wood Buffalo Environmental Association and Cumulative Environmental Management Association, to have the significant emissions from oil sands activity evaluated in the sensitive northern shield area of Saskatchewan to ensure these areas are kept clean.

In 2003 SaskPower established a testing and upgrade program to optimize the LIFAC system at Shand Power Station. The program involves a review of potential sorbents for SO_2 reduction, development of a sorbent transfer system and injection system, modification to the burner system of the boiler, equipment upgrades, and performance testing. The end goal of the project is to operate LIFAC at its original design specifications.

SaskPower also operates an Emissions Control Research Facility (ECRF) where they are currently testing sorbent injection into a baghouse for mercury control. SaskPower will be utilizing this facility to look at a number of multi-pollutant control systems in the future.

SaskPower is using waste heat from the Shand Power Station in Estevan Saskatchewan in the operation of a greenhouse in which over 500,000 tree, grass and shrub seedlings are grown each year for use in native prairie conservation and restoration planting projects throughout Saskatchewan.

SaskPower is a founding member of the Canadian Clean Power Coalition seeking innovative ways to burn coal cleanly and the Zero Emission Coal Alliance (ZECA) that is developing a hydrogen-based technology to eliminate emissions from coal fired electricity generation.

Consumers' Cooperative Refineries Limited (CCRL) and NewGrade Energy Inc. (NEI) report annually to Sakatchewan Environment on their SO_2 and NO_X emissions. The Refinery Expansion Project came on-line in August of 2003, increasing the Complex's processing capacity. The Complex's crude processing capacity increased from 9,284 cubic meters (m^3) per stream day in 2000 to 13,814 m^3 per stream day in 2004. The average crude feedstock sulphur concentration increased from 2.93 wt % in 2000 to 3.09 wt % in 2004. The Gasoline Desulphurization (GDS) Unit came on-line in September 2004 to allow the plant to meet federal regulations that reduced the average sulphur concentration in gasoline from 500 ppm to below 30 ppm. These plant additions have increased the amount of sulphur produced and subsequently the SO_2 emissions from the plant.

Although the SO_2 emissions increased between 2000 and 2004, the SO_2 emissions produced per m^3 throughput have decreased. This reduction in kilograms of SO_2 emissions per m^3 throughput is due to significant equipment enhancements and modifications to the Sulphur Plant in 2002 and 2003 to accommodate the increase in sulphur produced by the new processing units. The combined modifications of oxygen enrichment, the Sulfreen Reactors enlargement, and other equipment changes resulted in a higher recovery efficiency from the Sulphur Plant. The following table indicates the significant improvement in recovery per throughput.

Table 1 Changes in SO_2 emissions at a refining and upgrading complex in Saskatchewan

Year	Average SO_2 emissions (tonnes/day)	SO_2 emissions per m^3 crude (kg)	Sulphur Plant recovery efficiency (%)
2000	6.95	0.75	99.1
2004	7.47	0.57	99.7

All additional facilities for the Refinery Expansion Project and the GDS unit have had high efficiency/low NO_X burners installed. Any additions to the facility follow the CCME "National Emission Guidelines for Commercial/Industrial Boilers and Heaters, March 1998".

Alberta

Alberta approved Syncrude's Sulphur Emissions Reduction Project (SER, Approval 26-01-17) in 2004. The project was initiated to reduce the release of SO_2 and particulates from the main stack at the Mildred Lake site near Fort McMurray, Alberta. This project will result in an anticipated reduction of Syncrude's total SO_2 emissions from 245 tonnes per day (t/d) to 100 t/d and is scheduled to commence operation in 2009.

The Wabamum power plant in central Alberta is an old coal-fired power plant reaching its expected-life of operation and has four generation units. Unit 3 was shut down in 2002 and Units 1 and 2 were shut down in 2004, which resulted in a total reduction of about 8,500 tonnes of SO_2 and 4,500 tonnes of NO_X annually. The plant is scheduled for a complete shut down in 2010.

Federal initiatives to reduce SO_2 & NO_X

While the federal government has reduced emissions such as SO_2, and further reductions in NO_X from vehicles are expected, projections indicate that population and economic growth as well as international transport will offset these improvements. An increased use of emerging renewable energy like wind and solar power, along with other climate friendly technologies and increased energy conservation, will play a significant role as Canada moves forward to meet the challenge of helping preserve Canada's sensitive ecosystems, and improving air quality.

The following are initiatives undertaken by the Canadian government in 2004 and 2005 to reduce nitrogen and sulphur emissions from vehicles, engines and fuels; details on Environment

Canada's regulatory and other initiatives regarding transportation can be found at http://www.ec.gc.ca/cleanair-airpur/Transportation_emissions-WS9D1A65D7-1_En.htm.

- In November 2005, proposed *Regulations Amending the On-Road Vehicle and Engine Emission Regulations* were published in the *Canada Gazette, Part I.*
- In February 2005, the *Off-Road Compression-Ignition Engine Emission Regulations* were published in the *Canada Gazette, Part II*.
- In July 2004, a discussion document outlining the planned *Marine Spark-Ignition Engine and Off-Road Recreational Vehicle Emission Regulations* was posted on the CEPA Environmental Registry™. (http://www.ec.gc.ca/ceparegistry/documents/part/mar_ssi/toc.cfm) for public consultation;
- In October 2005, *Regulations Amending the Sulphur in Diesel Fuel Regulations* were published in the *Canada Gazette Part II*.

Negotiations to renew the 1995 MOU with Railway Association of Canada to align emission standards for locomotives in Canada with those of the U.S. EPA are underway. The original MOU, which set a cap for NO_X emissions from locomotives to 115 kilotonnes/year, expires at the end of 2005.

Environment Canada and the U.S. EPA have started to work together to reduce emissions from large shipping vessels. The goal of this collaboration is to develop an application to have the coasts of North America declared as a zone where marine bunker fuel with reduced sulphur content must be used. Reducing emissions for large marine vessels on the west coast is a priority. For example, in B.C.'s Lower Fraser Valley, marine emissions account for 33 per cent of total SO_2 emissions and 22 per cent of NO_X emissions. The relative contribution of marine emissions is projected to increase significantly in the next decade as measures to reduce air pollution from other sources take effect.

Environment Canada continues to address releases from the base metal smelting sector. Releases from primary and secondary copper smelters and refineries and releases from zinc plants were assessed to be toxic under the Canadian Environmental Protection Act (CEPA) in Sept 2002. In September 2004, a CEPA notice requiring the preparation and implementation of P2 plans was proposed in Part 1 of the *Canada Gazette*. The P2 notice proposes the achievement of facility-specific emission targets and schedules for SO_2 and PM by 2008 and 2015. A draft Environmental Code of Practise for the sector was made available at the same time for review and comment by stakeholders. The code of practice includes recommendations for environmental management, and multi-media standards as goals for continual improvements in performance.

4. Federal/Provincial/Territorial Acid Deposition Science and Monitoring Activities

Continuing science

2004 Canadian Acid Deposition Science Assessment

The *2004 Canadian Acid Deposition Science Assessment* is a review of the current science and monitoring information on the extent of acid deposition and its effects in Canada. The purpose of the *Assessment*, conducted by experts from federal and provincial governments and academia, is to synthesize the knowledge of acid deposition in the context of key policy questions put forth by the acid deposition policy and science communities. *A Summary of Key Results* was officially released in February 2004 at a stakeholder outreach workshop, and the full Assessment was released in the fall of 2005. Both documents are available in English and French in CDROM format as well as from the Environment Canada website (http://www.msc-smc.ec.gc.ca/saib/acid/acid_e.html).

The results of the *Assessment* confirm that acid deposition is still affecting our environment; in fact new research indicates that the problem is bigger than we anticipated. Approximately 21 – 75% (0.5 – 1.8 million km^2) of sampled areas in eastern Canada, including ~550,000 lakes, continue to receive levels of acid deposition (sulphur and nitrogen) in excess of critical loads. This exceedance range represents an optimistic and pessimistic scenario stemming from the fact that nitrogen is being absorbed by the ecosystem as a fertilizer but in the long-term it may act like an acid if the ecosystem becomes nitrogen saturated. The continued problem is despite the considerable decline in levels of acid deposition in eastern Canada over the last several decades as a result of significant reductions in sulphur emissions.

As a result of Canada's significant progress in reducing acid rain-causing emissions, there was an expectation that ecosystems would recover, including the repopulation of lakes and streams with aquatic life. However, as our understanding of the pathway to recovery of damaged ecosystems improves, it becomes increasingly clear that highly impacted aquatic ecosystems do not necessarily return to their "pre-acidification condition" when levels of acid deposition decline. Furthermore, some ecosystems may require management actions such as liming to recover from long-term exposure to acid deposition.

The *Assessment* reveals that lakes and rivers in eastern Canada are generally remaining too acidic or have not recovered to the point where they could support sensitive fish and other aquatic biota. There are, however, encouraging signs of improvements. Lakes in eastern Canada located near smelters that have dramatically reduced their emissions (Sudbury, Rouyn Noranda) provide the most definitive evidence of recovery, measured as an increase in lake pH and/or alkalinity.

One of the emerging areas of acid deposition research is the impact to soils, the subsequent depletion of nutrients, the resulting impacts on the health and productivity of forests, and the implications of both of these on associated lake ecosystems. The latest information suggests that acid deposition is negatively affecting forest growth and productivity, and that effects are likely occurring over ~50% of Canada's eastern boreal forests. As our understanding of the ecosystem

effects from exposure to acid deposition improves, it becomes increasingly clear that further reductions in acid-causing emissions are necessary to protect sensitive Canadian ecosystems from damage.

The *Assessment* describes both the direct and indirect economic impacts of acid deposition. Acid deposition has direct negative impacts on lakes, rivers, soils, forests, wildlife, biodiversity, buildings, and human health. The socio-economic benefits of decreasing or avoiding these negative impacts could be significant. For example, acid deposition can negatively affect tree growth. Preliminary estimates of the market value of lost wood production resulting from acid rain are in the hundreds of millions of dollars in Nova Scotia and New Brunswick alone. The loss of fish in lakes and rivers of eastern Canada due to acid rain has significant impacts on the recreational fishing industry, particularly for Atlantic salmon. In 1996, the recreational fishing industry was estimated to be worth $1.9 billion. The corrosive impacts of acid deposition can be significant, particularly for electrical transmission towers. Acid deposition can reduce the life expectancy of transmission towers by 50% and greatly increase repair frequency with an annual cost of thousands of dollars per tower.

The *Assessment* mentions the linkages between the pollutants that are responsible for acid rain and those that contribute to other air quality issues such as smog. Consequently, actions to reduce emissions of acid rain-causing pollutants will also reduce levels of smog. Since smog is known to adversely affect human health (for example, PM and ozone are responsible for the premature deaths of thousands of Canadians, tens of thousands of hospital admissions and millions of minor illness or asthma symptom days each year), reducing levels of acid deposition will reduce costs to the Canadian health care system.

Additional information presented in the *Assessment* includes:

- Response of the atmosphere to past, present, and future changes in emissions.
- New critical load calculations for aquatic and terrestrial ecosystems.
- Gaps in our understanding of the issue.

The Five-Year Review of The Canada-Wide Acid Rain Strategy for Post-2000 and Progress Implementing the Recommendations from the 1999 Review of Acid Rain Science Programs in Canada

In 1999, governments fulfilled a commitment under *The Strategy* to review the country's acid rain science and monitoring programs in order to ensure that Canada has "the capability to assess both the degree of environmental improvement achieved and the adequacy of control programs". In 2004, the Acid Rain Task Group conducted a five year review *The Strategy* which included an update on where jurisdictions are at with respect to implementing the recommendations from the *1999 Review of Acid Rain Science Programs in Canada.* The five-year review report reveals that federal/provincial/territorial governments continue to work together to fill the identified gaps in science and monitoring programs. The report was published in 2005 and is available electronically on the CCME website, at
http://www.ccme.ca/assets/pdf/5_year_review_acid_rain_strategy_e1.0_web.pdf

Recommendations for science and monitoring from the "Taking Stock and Next Steps on Acid Rain" Workshop

In February 2005, the Acid Rain Task Group hosted a workshop to present the major conclusions of the *2004 Canadian Acid Deposition Science Assessment*, discuss and identify the implications of the latest science to *The Strategy* and obtain input on next steps to address acid rain. The workshop, "Taking Stock and Next Steps on Acid Rain", was attended by 90 participants representing industry, NGOs and provincial and federal scientists and policy-makers. Participants spent the first day learning about the current status of the acid rain issue in Canada and the second day giving insightful comments on what the new science tells us about what needs to be done to address acid rain and providing their perspectives on opportunities for improving *The Strategy*.

The outcome of the workshop, a series of recommendations on where to take *The Strategy* next, was captured in the report "Acid Rain Task Group Workshop – Discussion Highlights". The workshop proceedings can be found at http://www.ccme.ca/ourwork/air.html?category_id=31. Some of the key recommendations include: moving to biennial rather than annual reporting, greater and continuing need to support monitoring (effects and deposition), improving communication amongst scientists and between governments; making information more accessible to the public, increasing recognition and linkages with other air pollution issues (smog, climate change); beginning now to establish new emission reduction targets for SO_2 post-2010 and NO_X post-2005; and expanding efforts to western Canada.

Assessing the role of nitrogen

In 2004, the Acid Rain Task Group identified the need to increase our knowledge on nitrogen cycling and nitrogen saturation processes in forested watershed that are being impacted by acid deposition. To this extent, the Task Group funded a science project that would measure nitrogen and carbon cycling ratios in soils from forested watersheds impacted by acid rain. Nitrogen (N) ratios provide insight into N levels and cycling in forest soils, while carbon ratios provide insights on the organic matter turnover which is strongly linked to N cycling. The results of the study are yet to be interpreted, but they will provide some insight into the biological and environmental factors that control soil microbial processes that affect N retention. Understanding the N saturation phenomenon will perhaps allow us to better assess the likelihood of it occurring in sensitive ecosystems.

In 2005, the Task Group hired academic experts to assess and map critical loads and exceedances for sulphur and nitrogen for upland forest soils in Manitoba and Saskatchewan. The maps will be produced following the protocol and guidelines established by the New England Governors – Eastern Canadian Premiers (NEG-ECP) Working Group on Forest Mapping so they will be directly comparable to maps produced for the eastern provinces. An interim report describing the data sources, strengths and limitations, approach being used, and recommendations, was submitted and presented at a workshop on critical loads for sulphur and nitrogen on Nov 7th, 2005 in Calgary (see below). A final report is due in the spring of 2006.

Workshop on the development of critical loads for sulphur and nitrogen

The Acid Rain Task Group hosted a second acid rain workshop focusing on the development of critical loads to protect Canadian ecosystems from atmospheric deposition of sulphur and nitrogen. The workshop was held on November 6-7, 2005 in Calgary, Alberta. Participants included experts involved in the development or application of critical loads from federal and provincial governments and academia, as well as Task Group members and other stakeholders.

The purpose of the workshop was to share the latest scientific information on critical loads of acidity, to identify and discuss the existing science knowledge gaps and to provide recommendations to the Task Group to fill the science gaps. Some of the key recommendations that were made include: establishing a Technical Working Group to develop an action plan for addressing gaps and recommendations; enhancing the monitoring and modeling of total deposition across Canada; obtaining more spatially representative soil and lake sensitivity data, particularly in western Canada; applying a consistent approach to critical load development across Canada; and engaging other government and non-government organizations involved in monitoring activities. This information will be useful to the Task Group when developing a long term science and monitoring plan as part of an improved Strategy. The workshop report, titled "Final report: Workshop on development of critical loads for sulphur and nitrogen" is available at http://www.ccme.ca/ourwork/air.html?category_id=31#249.

5. SO_2 and NO_X Emissions

Compliance with international commitments

As indicated in Table 2, Canada is meeting or exceeding its international emission reduction obligations for SO_2 and NO_X emissions.

Table 2 International commitments and compliance for SO_2 and NO_X in 2003

Commitment	Compliance status in 2003
1991 Canada–U.S. Air Quality Agreement national cap on SO_2 emissions of 3.2 million tonnes by 2000 onward reduce national NO_X emissions from stationary sources by 100 kilotonnes below the forecast level of 970 kilotonnes[a] by 2000	national SO_2 emissions were approximately 2.4 million tonnes (25% below the cap) national NO_X emissions from stationary sources have been reduced by over 100 kilotonnes from forecast levels
1985 UN ECE Sulphur Protocol permanent national cap of 3.2 million tonnes of SO_2 by 1993	national SO_2 emissions were approximately 2.4 million tonnes (25% below the cap)
1994 UN ECE Sulphur Protocol regional cap of 1.75 million tonnes of SO_2 by 2000 in the Sulphur Oxide Management Area (SOMA), plus the permanent national cap	SO_2 emissions in the SOMA were 1.1 million tonnes, or 38% below the SOMA cap
1988 UN ECE NO_X Protocol stabilise NO_X emissions at 1987 levels (2.5 million tonnes) by 1994	national NO_X emissions were 2.4 million tonnes, or 4% below 1987 levels
[a] The NO_X/VOC Emission Forecast 90-B from the 1990 NO_X/VOC Management Plan forecasts national NO_X emissions to be 970,000 tonnes in 2005	

Emission levels in Canada

Tables 3 and 4 on the following pages provide current, historical and an outlook of the emissions of SO_2 and NO_X.

The 1990, 1995 and 2000 national, provincial and territorial emissions inventories were developed collaboratively by Environment Canada and the different jurisdictions using information and statistics compiled through voluntary and mandatory surveys, permits, and models.

The implementation of mandatory Criteria Air Contaminant (CAC) emissions reporting under the National Pollutant Release Inventory (NPRI), commencing in the year 2002, led to the reporting of air emissions data for these pollutants by selected industrial facilities meeting the respective reporting criteria. Emissions from non-reporting facilities, non-industrial activities and transportation sources were developed collaboratively by Environment Canada and the jurisdictions to ensure the comprehensiveness of the sector emissions and the national, provincial, and territorial emission summaries. Environment Canada and the different jurisdictions are continuously collaborating to improve and update the emission estimates from all sources to reflect the latest emissions estimation methods available, and to ensure the comparability of the emissions trends and projections with the latest emission estimates.

Forecast emissions (years 2005 and onwards) have been projected based on the year 2000 emissions inventory in conjunction with available energy outlook information (i.e., energy and economic projections), and federal, provincial, territorial, and industrial expertise.

Table 3 Total SO_2 Emissions by Province and Sector (kilotonnes)

	Caps							Outlook [4]		
	1994-99	2005	2010/15 [3]	1990	1995	2000	2002	2005	2010	2015
British Columbia										
Upstream oil and gas						31	29	33	33	34
Non-ferrous mining and smelting						3	4	4	4	5
Pulp & Paper						16	16	16	15	15
Transportation						20	20	20	19	20
Other						14	13	16	18	20
Total	**N/A**	**N/A**	**N/A**	**90**	**111**	**85**	**82**	**87**	**90**	**94**
Alberta										
Upstream oil and gas						226	238	238	230	226
Oil sands						92	104	117	162	164
Electric power generation						125	132	129	131	131
Other						27	28	31	30	31
Total	**N/A**	**N/A**	**N/A**	**488**	**521**	**470**	**502**	**514**	**553**	**553**
Saskatchewan										
Electric power generation						95	98	95	96	100
Upstream oil and gas						7	8	8	8	8
Other						12	18	11	9	10
Total	**N/A**	**N/A**	**N/A**	**90**	**131**	**115**	**123**	**113**	**114**	**118**
Manitoba										
Non-ferrous mining and smelting						353	374	432	432	432
Other						9	7	6	5	5
Total	**550** [2]	**N/A**	**N/A**	**510**	**365**	**362**	**381**	**438**	**437**	**437**
Ontario										
Non-ferrous mining and smelting						255	288	319	252	103
Petroleum Refining						60	57	56	38	38
Other industrial sources						66	90	72	74	70
Electric power generation						166	149	159	131	131
Other						32	30	26	18	19
Total	**885**	**N/A**	**442.5**	**1152**	**613**	**579**	**614**	**631**	**513**	**361**
Quebec										
Non-ferrous mining and smelting						143	88	68 [5]	68	70
Aluminium industry						43	53	52	52	52
Petroleum Refining						15	12	13	13	13
Pulp and paper						22	23	24	23	23
Other						68	60	88	76	78
Total	**500**	**300**	**250**	**402**	**365**	**290**	**237**	**245**	**233**	**236**
New Brunswick										
Non-ferrous mining and smelting						12	8	9	12	12
Pulp and paper						12	12	11	11	11
Electric power generation						97	83	68	43	43
Other						19	13	16	16	17
Total	**175**	**122.5**	**87.5**	**189**	**115**	**141**	**117**	**104**	**82**	**82**
Nova Scotia										
Electric power generation						140	132	115	73	73
Other						27	23	21	21	21
Total	**189**	**142**	**142**	**179**	**166**	**166**	**154**	**136**	**94**[6]	**94**[6]
Prince Edward Island										
Electric power generation						<0.5	<0.5	<0.5	<0.5	0
Other						2	2	2	2	2
Total	**5** [2]	**N/A**	**N/A**	**4**	**2**	**3**	**2**	**2**	**2**	**2**

	Caps							Outlook [4]		
	1994-99	2005	2010/15 [3]	1990	1995	2000	2002	2005	2010	2015
Newfoundland and Labrador										
Petroleum refining						25	15	14	12	12
Iron ore mining						8	6	9	10	11
Electric power generation						11	25	14	9	9
Other						7	10	7	6	6
Total	**45**	**60[7]**	**60[7]**	**71**	**65**	**52**	**55**	**43**	**37**	**38**
Yukon										
Total	**N/A**	**N/A**	**N/A**	**N/A**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**
Northwest Territories										
Mining and rock quarrying						<0.5	<0.5	<0.5	<0.5	<0.5
Upstream oil and gas						0	<0.5	0	0	0
Other						<0.5	<0.5			
Total	**N/A**	**N/A**	**N/A**	**15**	**16**	**0.5**	**0.5**	**1**	**1**	**1**
Nunavut [1]										
Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**<0.5**	**<0.5**	**N/A**	**N/A**	**N/A**
SOMA										
Total	**1750**	**1750**	**1750**	**1872**	**1227**	**1147**	**1068**	**1106**	**917**	**829**
Canada										
Total	**3200**	**3200**	**3200**	**3184**	**2469**	**2263**	**2267**	**2315**	**2155**	**2015**

[1] Unless otherwise indicated, the emission summaries for Nunavut are included with the emissions for the Northwest Territories.
[2] Cap applied to 1994 only.
[3] Caps for Quebec and New Brunswick are for 2010; the cap for Ontario is for 2015.
[4] The 1990, 1995 and 2000 emissions inventories were developed using information and statistics compiled through voluntary and mandatory surveys, permits and models. Commencing in the year 2002, mandatory reported National Pollutant Release Inventory (NPRI) data by stationary point sources were used. Forecast emissions (years 2005 and onwards) have been projected based on year 2000 emissions. Work is underway to ensure comparability between historical and projected emissions to account for methodological variations and information reported under federal and provincial mandatory reporting programs.
[5] As of 2005, emissions from the zinc smelter at Valleyfield will be subtracted from the line "Other" and accounted for under "non-ferrous mining and smelting".
[6] Nova Scotia has a reduction target for existing sources of 94.5 kt by 2010 (not meant to be a cap).
[7] Newfoundland and Labrador's cap of 60 kt per year is provincially regulated through the Air Pollution Control Regulations 2004 and has been in effect since January 1, 2005.

Note: Numbers may not add due to rounding.
N/A = Not applicable
The emission summaries exclude emissions from forest fires, prescribed burning and landfill sites.

Source: The emission summaries and the emissions outlook were compiled by the Pollution Data Division of Environment Canada in collaboration with the emissions inventory experts from the provincial, territorial, and regional ministries of the environment and energy using the latest technical and statistical information available as of July 2006.

Table 4 Total Anthropogenic NO_X Emissions by Province and Sector (kilotonnes)

	cap for 1994 and beyond	1995	2000	2002	Outlook [3] 2005	2010	2015
British Columbia							
Stationary sources			83	93	90	95	99
Transportation			218	209	199	188	170
Total	**N/A**	**331**	**301**	**302**	**289**	**282**	**269**
Alberta							
Stationary sources			525	532	590	696	761
Transportation			231	226	209	172	130
Total	**N/A**	**681**	**756**	**758**	**799**	**868**	**890**
Saskatchewan							
Stationary sources			72	73	80	83	81
Transportation			120	118	110	98	80
Total	**N/A**	**205**	**191**	**191**	**190**	**180**	**161**
Manitoba							
Stationary sources			9	10	8	8	8
Transportation			72	71	65	57	46
Total	**N/A**	**92**	**80**	**81**	**73**	**65**	**53**
Ontario [1]							
Stationary sources			208	230	178	168	170
Transportation			412	389	344	291	228
Total	**N/A**	**630**	**619**	**619**	**523**	**459**	**398**
Quebec							
Stationary sources			62	69	71	78	79
Transportation			246	247	224	201	165
Total	**N/A**	**332**	**307**	**316**	**295**	**280**	**244**
New Brunswick							
Stationary sources			37	35	27	28	29
Transportation			38	34	31	26	21
Total	**N/A**	**70**	**76**	**69**	**58**	**55**	**50**
Nova Scotia							
Stationary sources			38	43	42	32	32
Transportation			33	31	28	24	19
Total	**N/A**	**78**	**71**	**74**	**71**	**55**	**51**
Prince Edward Island							
Stationary sources			1	1	1	1	1
Transportation			7	6	6	5	4
Total	**N/A**	**10**	**8**	**7**	**7**	**7**	**5**
Newfoundland and Labrador							
Stationary sources			14	16	20	23	24
Transportation			20	20	19	17	14
Total	**N/A**	**46**	**34**	**36**	**40**	**40**	**38**
Yukon							
Stationary sources			1	1	1	1	1
Transportation			1	1	1	1	1
Total	**N/A**	**4**	**2**	**2**	**2**	**2**	**1**
Northwest Territories							
Stationary sources			4	7	14	17	18
Transportation			3	4	5	4	3
Total	**N/A**	**12**	**7**	**11**	**18**	**21**	**21**
Nunavut [2]							
Stationary sources			1	2			
Transportation			1	1			
Total	**N/A**	**N/A**	**2**	**3**	**N/A**	**N/A**	**N/A**
Canada Total	**2514**	**2489**	**2456**	**2469**	**2364**	**2314**	**2182**

[1] Ontario's NO_X emissions reduction commitment is referenced to its 1990 baseline of 696 kilotonnes.
[2] Unless otherwise indicated the emission summaries for Nunavut are included with the emissions for the Northwest Territories
[3] The 1990, 1995 and 2000 emissions inventories were developed using information and statistics compiled through voluntary and mandatory surveys, permits and models. Commencing in the year 2002, mandatory reported National Pollutant Release Inventory (NPRI) data by stationary point sources were used. Forecast emissions (years 2005 and onwards) have been projected based on year 2000 emissions. Work is underway to ensure comparability between historical and projected emissions to account for methodological variations and information reported under federal and provincial mandatory reporting programs.

Note: Stationary sources include both point and area sources
Numbers may not add due to rounding
N/A = Not applicable
The emission summaries exclude the emissions from forest fires, prescribed burning, and landfill sites.

Source: The emission summaries and the emissions outlook were compiled by the Pollution Data Division of Environment Canada in collaboration with the emissions inventory experts from the provincial, territorial, and regional ministries of the environment and energy using the latest technical and statistical information available as of July 2006.

Next Steps

In 2004 and 2005, the Acid Rain Task Group either conducted or contributed to a number of workshops and published reports on acid rain policy, science and monitoring. In November 2005, the Task Group met face-to-face to begin compiling this information, and prioritising it as part of their continued work towards reducing acid rain in eastern Canada and preventing acidification in western and northern Canada.

As a first step, the Task Group intends to set up an informal scientific network to facilitate the continuation of discussions from the November 2005 critical loads workshop, particularly as they relate to achieving the long term goal of *The Strategy*.

In 2006, the Task Group will continue supporting the development of a national, multi-year science and monitoring program. As part of their 2006 workplan, Task Group members will discuss the *2004 Canadian Acid Deposition Science Assessment* and the recommendations from the February and November workshops, and determine what further work needs to be done to ensure successful implementation of *The Strategy*. The Task Group is also beginning to evaluate what further work needs to be done on the policy side i.e., predicting the magnitude and extent of further emissions reductions and the need for management actions to stimulate aquatic recovery and forest sustainability.

Altogether over the next several years, the Task Group intends to identify short-term and long-term actions that governments, industry, stakeholders and the scientific community can take together and separately to both implement *The Strategy* and move beyond to ensure that all of Canada is meeting critical loads and that ecosystems are recovering from acidification.