Cleaner Air through Cooperation

UNITED STATES • CANADA

Progress under the Air Quality Agreement 2003















About this Brochure

This brochure features recent progress made by Canada and the United States under the 1991 Air Quality Agreement and highlights key issues from the *2002 Canada–United States Air Quality Agreement Progress Report.* The Agreement's focus is to address the problem of transboundary air pollution, whereby pollutants released at one location can travel long distances, affecting air quality at their sources as well as many miles away. This brochure provides an overview of the 1991 Agreement, followed by key commitments and progress, including air quality programs and scientific cooperation between the two nations. A more complete presentation and discussion of all these areas can be found in the *2002 Progress Report* at <www.ec.gc.ca/pdb/can_us/canus_links_e.cfm> or <www.epa.gov/airmarkets/usca/2002report.html>.

Note: U.S. spelling is used throughout.

Working Together for Cleaner Air

Multiple environmental and health problems (including acid rain, impaired visibility, damaged ecosystems, and respiratory illness) are caused or worsened by air pollution from mobile and stationary emission sources in Canada and the United States. Both nations have an interest in reducing transboundary air pollution.

After more than a decade of scientific research and discussions, Canada and the United States signed a historic Air Quality Agreement in Ottawa, Canada, on March 13, 1991. The Agreement established a formal and flexible method of addressing transboundary air pollution and paved the way for cooperation on a variety of air quality issues. While the initial focus of the Agreement was on acid rain, the two nations recently expanded cooperative efforts to control transboundary ground-level ozone and to conduct joint analyses on transboundary particulate matter (PM).

The main body of the Agreement lays out overall air quality objectives and specific requirements for both countries, including regular communication, exchange of information, and consultation and settlement of issues of concern.

Canada/U.S. Percentage of Key Emissions by Sector (1999)

Sector	SO_2		NO_x		VOCs	
	U.S.	Canada	U.S.	Canada	U.S.	Canada
Electrical Utilities	67	25	23	12	-	-
Fuel Combustion	18	18	17	19	5	14
Industrial Sources	8	53	4	11	44	46
Transportation	7	4	55	56	47	23
Other	< 1	< 1	1	2	4	17

Shared Benefits of the Agreement

- Cleaner Air and Improved Health
- Increased Cooperation between Nations
- Healthier Ecosystems
- Improved Visibility
- Preservation of Monuments and Landmarks
- Information and Data Sharing

A bilateral Air Quality Committee is responsible for coordinating the overall implementation of the Agreement. Two subcommittees—Program Monitoring and Reporting, and Scientific Cooperation—meet annually with the Air Quality Committee and carry out yearly activities. The two nations prepare a joint progress report every two years and conduct a regular five-year review and assessment of the Agreement.

The Air Quality Agreement was signed in 1991 and included two annexes. Annex 1, the Acid Rain Annex, focuses on the commitments of both nations to reduce sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions, the primary precursors of acid rain. Under Annex 1, both Canada and the United States have committed to monitoring utility emissions. Continuous emission monitors (CEMs) are widely utilized in the United States; Canada uses CEMs along with other alternative methods. Under Annex 2, the Scientific and Technical Activities and Economic Research Annex, Canada and the United States agree to coordinate their air pollution monitoring networks; use compatible formats and methods for monitoring and reporting; and cooperate and exchange information about the causes and effects of air pollution and the use of market-based programs, such as the U.S. Acid Rain Program, to address air pollution issues.

In December 2000, Canada and the United States added Annex 3, the Ozone Annex, to the Agreement. This Annex commits the two nations to reducing emissions of NO_x and volatile organic compounds (VOCs)—the precursor pollutants to ground-level ozone, which is the major component of smog.

Pollutants and their Effects

Acid Rain: Acid deposition, more commonly known as acid rain, occurs when emissions of SO_2 and NO_x from power plants, vehicles, and other sources react in the atmosphere (with water, oxygen, and oxidants) to form various acidic compounds. These acidic compounds then fall to earth in either a wet form (rain, snow, or fog) or a dry form (gases and particles) and can harm aquatic and terrestrial ecosystems (particularly forests); affect human health; impair visibility; and damage automotive finishes, buildings, bridges, monuments, and statues.

Ground-Level Ozone: Ground-level ozone is a gas that forms when emissions of NO_x and VOCs react with other chemicals in the air in the presence of strong sunlight. NO_x and VOCs are emitted by combustion sources (such as vehicles and power plants). VOCs are also given off by solvents, cleaners, and paints. Ground-level ozone can cause or exacerbate respiratory illnesses, and is especially harmful to young children, the elderly, and those suffering from chronic asthma and/or bronchitis. Ground-level ozone can affect leaves and roots of plants, especially trees. This can make them more susceptible to attack from insects and diseases and can reduce their ability to withstand droughts, windstorms, and manmade stresses such as acid rain.

Particulate Matter: PM includes both solid particles and liquid droplets found in the air. Many manmade and natural sources emit PM directly or emit other pollutants that react in the atmosphere to form PM. PM comes in a range of sizes and is associated with numerous health effects. Particles less than 10 micrometers in diameter (PM_{10})—especially those less than 2.5 micrometers in diameter ($PM_{2.5}$)—pose the greatest health risk because they can be inhaled and accumulate in the respiratory system. Sulfates (SO_4) and nitrates (NO_3) formed from SO_2 and NO_x are significant components of $PM_{2.5}$. PM is also a major contributor to regional haze, which reduces visibility.

The Acid Rain Challenge

Achieving Progress through Committed Action

Key Commitments of the Acid Rain Annex

SO_2 Emission Reduction Requirements

Canada

- SO_2 emission reductions in the seven eastern-most provinces to 2.3 million tonnes[1] by 1994.
- Maintenance of 2.3 million-tonne annual cap for eastern Canada through December 1999.
- Permanent national cap for SO_2 emissions of 3.2 million tonnes by 2000.

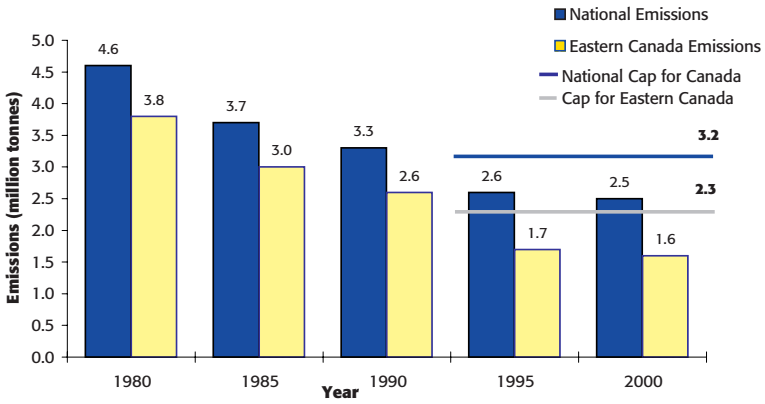
United States

- SO_2 emission reductions of 10 million tons[2] from 1980 levels by 2000, taking into account credits ("allowances") earned for reductions from 1995 to 1999.
- Permanent national cap of 8.95 million tons of SO_2 per year for electric utilities by the year 2010.
- National SO_2 emission cap of 5.6 million tons for industrial sources beginning in 1995.

[1] One tonne is equal to 1.1 short tons.
[2] One (short) ton is equal to 0.907 tonnes.

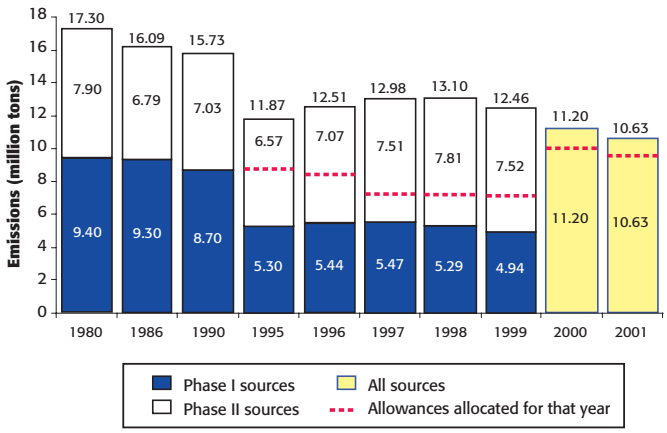
Canada and the United States have been successful in reducing SO_2 emissions under their respective Acid Rain Programs. In 2000, Canada's total SO_2 emissions of approximately 2.5 million tonnes were 20 percent below the national emission cap commitment of 3.2 million tonnes. New emission reduction targets have been set for SO_2 under the Canada-Wide Acid Rain Strategy for Post-2000. SO_2 emissions in the United States have been reduced by 6.7 million tons (39 percent) when compared with 1980 levels. Full implementation of the program in 2010 will result in SO_2 emission reductions of about 50 percent from 1980 levels.

Figure 1. Canada SO_2 Emissions Contributing to Acid Rain, 1980-2000



[Source: *2001 Annual Progress Report on the Canada-Wide Acid Rain Strategy for Post-2000*, December 2002]

Figure 2. U.S. SO_2 Emissions for Phase I and Phase II Units



This figure includes electric generating and industrial sources that have voluntarily joined the Acid Rain Program.

NO_x Emission Reduction Requirements

Canada

- By 2000, reduce stationary source emissions 100,000 tonnes below the forecast level of 970,000 tonnes.[3]
- By 1995, develop further annual emission reduction requirements from stationary sources to be achieved by 2000 and/or 2005.
- Implement a NO_x control program for mobile sources.

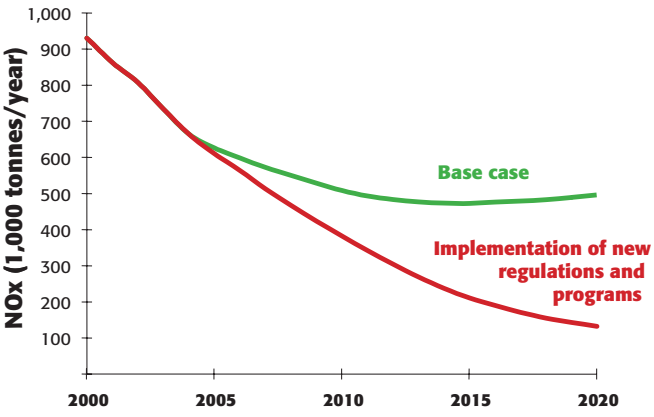
United States

- By 2000, reduce total annual emissions of NO_x by 2 million tons.
- Implement stationary source control program for electric utility boilers.
- Implement mobile source control program.

[3] The 970,000 tonnes is forecast for 2005 in the NOx/VOC Emission Forecast 90-B from the 1990 NOx/VOC Management Plan. Historical emissions and projections are subject to change as methodologies improve for estimating and forecasting emissions.

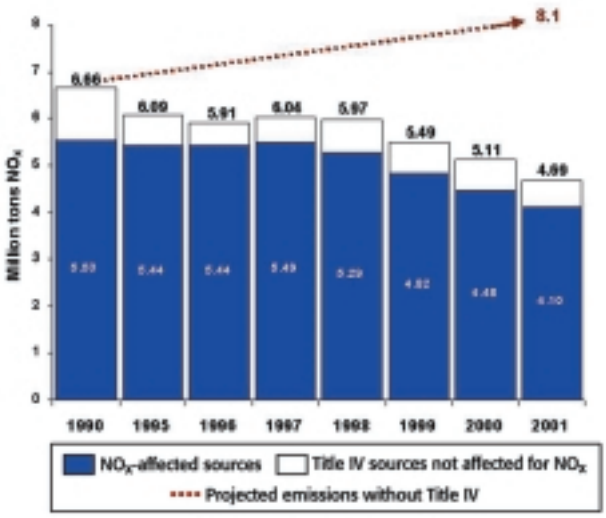
Canada and the United States have surpassed NO_x reduction targets and will gain further reductions from mobile source, ground-level ozone, and regional haze programs. In the United States, all sources affected by the Acid Rain Program's NO_x requirements reduced their combined NO_x emissions by 25 percent from 1990 levels in 2001; emissions from those sources were more than 40 percent below projected 2000 emissions without the Acid Rain Program. Canada projects further NO_x reductions relative to the "base case" level as a result of the new On-Road Vehicle and Engine Emission Regulations and Sulphur in Diesel Fuel Regulations.

Figure 3. Canada Forecast of NO_x Emissions from On-Road Vehicles



New regulations and programs aimed at reducing vehicle emissions as of July 2001 ("base case" level) are projected to result in a considerable reduction of NOx emissions during the 2000 to 2020 timeframe. [Source: SENES & AIR Inc., October 2002]

Figure 4. U.S. NO_x Emissions for Phase I and Phase II Electric Generating Sources



This figure includes electric generating and industrial sources that have voluntarily joined the Acid Rain Program.

Preserving Air Quality for Today and Tomorrow

Under Annex 1, Canada and the United States have committed to prevent air quality deterioration and to protect visibility from sources that could cause significant transboundary air pollution.

Canada is addressing this commitment through the Canada-Wide Acid Rain Strategy for Post-2000 and through the implementation of Canada-Wide Standards for Particulate Matter and Ozone. These programs include principles such as pollution prevention, continuous improvement (CI), and keeping clean areas clean (KCAC). The KCAC principle recognizes that polluting "up to a limit" is not acceptable and that the best strategy to avoid future problems is to keep clean areas clean. Jurisdictions are cooperatively developing a national guidance document on CI/KCAC as part of the Standards.

In the United States, the Prevention of Significant Air Quality Deterioration (PSD) Program, in place since the 1977 Clean Air Act Amendments, is aimed at limiting future air pollution from new major sources. Through case-by-case determination of best available control technology (BACT), air quality modeling, and limited increases in air pollution to levels below current standards, the PSD program protects public health from the negative effects of air pollution. It also preserves, protects, and enhances air quality and visibility in Class I areas (national parks and wilderness areas).

Notifying Neighbors—The Importance of Communication

Canada and the United States regularly notify each other concerning any proposed action, activity, or project that would be likely to cause significant transboundary air pollution within 100 kilometers (km), or 62 miles, of the border. Since notification began in 1994, Canada has notified the United States of 26 new sources of potential transboundary air pollution, and the United States has notified Canada of 23. Transboundary notification information is available on the Internet sites of the two governments at:

Canada: www.ec.gc.ca/pdb/can_us/canus_trans_e.cfm **United States:** www.epa.gov/ttn/gei/uscadata.html

Over the years, the two nations developed a system of ongoing, successful informal consultations regarding sources they believe are already causing pollution problems. The consultation process has resulted in cooperative air quality monitoring in Saskatchewan (Boundary Dam Power Plant) and North Dakota, and in Ontario (Algoma Steel Mill) and Michigan. An informal consultation on the Conners Creek power plant in Detroit was successfully concluded when the plant's fuel was changed from coal to natural gas. This high level of cooperation has enabled the two nations to more effectively manage air quality in shared airsheds.

Air pollution can significantly impair visibility in national parks and wilderness areas. These photos show a good-to-bad visibility day at the same location in Glacier National Park.

Key Commitments of the Ozone Annex

Emission Reduction Requirements

Canada

Canada estimates that by 2010, annual NO_x emissions in the Canadian transboundary region will be reduced by 44 percent from 1990 levels.

- Aggressive annual caps by 2007 of 39 kilotonnes (kt) of nitrogen dioxide (NO_2) emissions from fossil-fuel power plants in central and southern Ontario and 5 kt of NO_2 in southern Quebec, aligned with U.S. standards year round.
- New stringent emission reduction standards regulated to align with the United States to reduce NO_x and VOCs from vehicles and fuels, including cars, vans, light-duty trucks, off-road vehicles, small engines, diesel engines, and fuel.
- Measures required to attain the Canada-Wide Standard for Ozone to address NO_x emissions from industrial boilers and to address VOC emissions from solvents, paints, and consumer products.

United States

The United States estimates that by 2010, NO_x emissions in the U.S. transboundary region will be reduced by 36 percent from 1990 levels year round, and by 43 percent from 1990 levels during the ozone season (May - September).

- The NO_x emission reduction program, known as the NO_x SIP Call, is expected to reduce summertime NO_x emissions in the U.S. transboundary region by about 35 percent in 2007. EPA expects that this will be achieved by a more than 70 percent reduction in summertime emissions from power plants and major industrial sources.
- NO_x and VOC reductions are associated with existing U.S. vehicle and fuel quality rules and standards for new and modified stationary sources. VOC reductions are associated with standards for stationary sources of hazardous air pollutants, consumer and commercial products, architectural coatings, and automobile repair coatings.

Reporting Requirements

- Report ambient air quality within 500 km (310 miles) of the border beginning in 2002.
- Report annual emissions from major source categories beginning in 2004.
- Improve public access to information on emissions and air quality.
- Develop joint analyses on ground-level ozone and precursors.

Progress on Ground-Level Ozone

Canada and the United States signed the Ozone Annex to the Air Quality Agreement in December 2000 in Washington, DC. The Annex is expected to result in significant reductions of ozone precursor emissions of NO_x and VOCs. These reductions will help both nations attain their respective air quality goals to protect human health and the environment. The Ozone Annex established a transboundary region, known as the Pollutant Emission Management Area (PEMA), which includes central and southern Ontario, southern Quebec, 18 U.S. states, and the District of Columbia. The provinces and states within the PEMA region are the areas of primary concern for the impact of transboundary ozone.

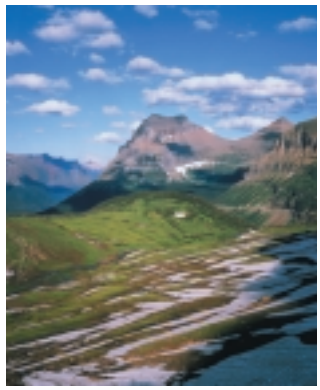
In 2002, Canada and the United States met the first reporting requirement: ambient air concentration data for ozone, VOCs, and NO_x were collected from monitoring stations within 500 km (310 miles) of the Canadian/U.S. border. These data were then analyzed to determine ozone conditions in the eastern and western regions of Canada and the United States.

Figure 5. Ozone Annex Pollutant Emission Management Area (PEMA)

Domestic Programs

To support its committed measures in the Ozone Annex, Canada will expand the National Pollutant Release Inventory (NPRI) to include annual public reporting of ground-level ozone precursors and components of smog. Other domestic measures in Canada include the Sulphur in Diesel Fuel Regulations and the On-Road Vehicle and Engine Emission Regulations. In addition, the Canadian provinces of Quebec and Ontario have made progress in meeting their commitments under the Ozone Annex.

To further protect against adverse health effects, the United States revised the National Ambient Air Quality Standards (NAAQS) for ozone in 1997. In addition, the United States is planning to designate new nonattainment areas for ozone. The United States is also continuing to implement regulations under the ozone transport reduction rule (known as the NO_x SIP Call), which focus on the regional transport of ground-level ozone.



Each U.S. state containing a nonattainment area for ozone is required to submit a demonstration plan to meet the NAAQS for ozone. In addition, northeastern and mid-Atlantic states and the District of Columbia in the Ozone Transport Region (OTR) are implementing various strategies to reduce regional air pollution. As of 2002, NO_x emissions from power plants and industrial sources in the OTR have been successfully reduced by more than 60 percent from 1990 levels.

Ozone Concentrations in Canada and the United States
(Based on ozone monitoring data from the period 1990-2001)

Figure 6. Eastern Regions

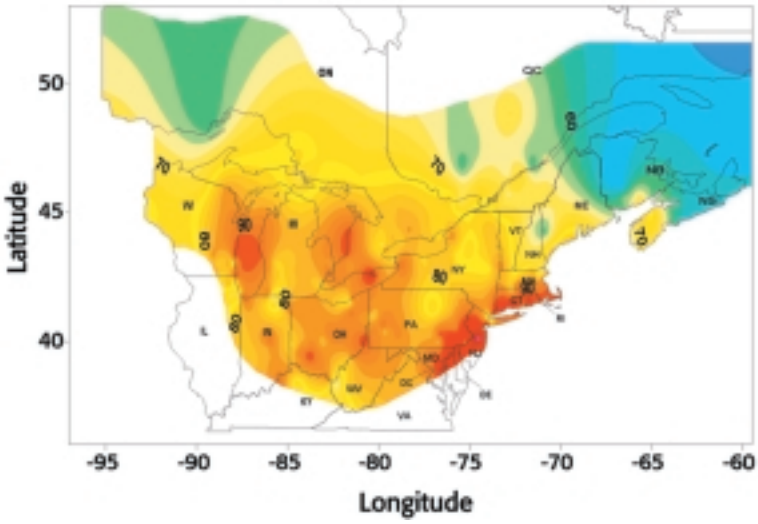
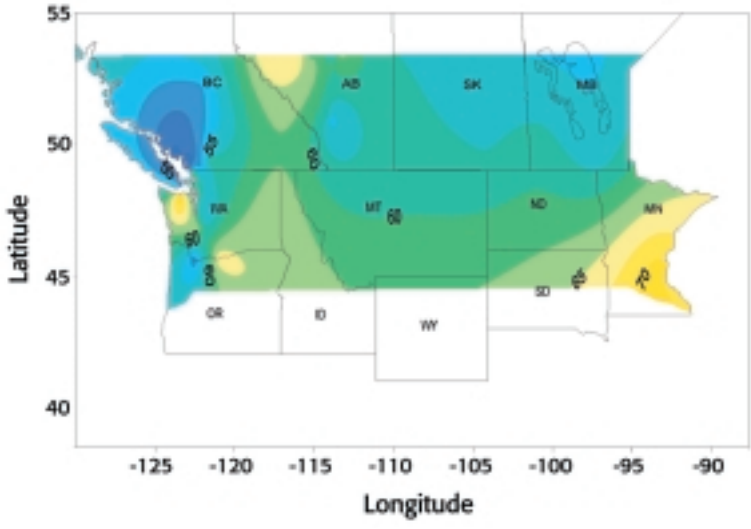
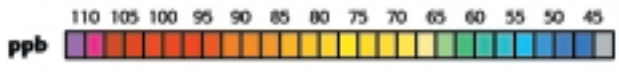


Figure 7. Western Regions





These ozone concentrations are based on data from ozone monitoring sites located within approximately 500 km (310 miles) of the Canadian/U.S. border.

Other Air Quality Programs

Particulate Matter—The Next Challenge

Canada and the United States are cooperating to achieve progress on other air quality issues, including PM. The two nations are developing a plan to identify transboundary contributions of PM and to issue a report based on their findings. This information will allow the nations to decide if a PM Annex should be added to the Air Quality Agreement.

Canada and the United States are also undertaking domestic programs to address PM. Canada's Clean Air Agenda aims to improve Canada's air quality and reduce negative impacts on human health and the environment. Under the Canadian Environmental Protection Act, 1999, the federal government added PM_{10} to its list of toxic substances and is undertaking efforts to deal with the precursors of PM and ozone. All provinces and territories are undertaking additional air quality initiatives.

The United States is currently working to address health concerns and visibility problems associated with PM. In 1997, EPA revised the NAAQS for PM to provide adequate protection from fine particles. EPA is currently conducting a subsequent review of these standards, which is targeted for completion in 2005.

Legislation has been proposed in the United States to address multiple pollutant (SO_2, NO_x, and mercury) emissions from power plants. EPA believes this legislation will efficiently and reliably address interstate transport of PM. If this legislation does not pass, a regulation on interstate transport of PM and its precursors is also under consideration.

Since PM is one of the primary sources of regional haze (and the resulting problem of reduced visibility), the United States has strengthened its visibility protection requirements for Class I areas by establishing regional haze regulations. These regulations require states and tribes to establish visibility improvement goals and develop regional haze plans. Regional planning organizations are also working with states and tribes to reduce emissions of PM and other pollutants that cause regional haze.

Cooperation among the States and Provinces

In a spirit of bilateral cooperation, some Canadian provinces and U.S. states have established partnerships and developed initiatives that focus on transboundary air quality issues.

NEG/ECP

To increase its outreach efforts and better inform the public about transboundary air pollution, the Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP) is developing a communications plan aimed at gauging public understanding and attitudes toward acid rain and mercury. The NEG/ECP is conducting the Forest Mapping Project to identify forest regions most sensitive to acid deposition by mapping sulfur and nitrogen deposition data. NEG/ECP is undertaking ozone and PM mapping and conducting public health outreach.

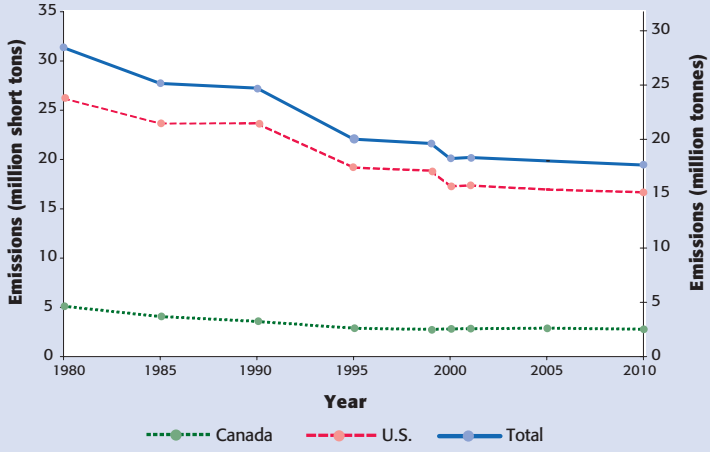
Georgia Basin/Puget Sound

More than six million people live in the Georgia Basin region of southwestern British Columbia and the Puget Sound region of northwestern Washington state. Due to concerns of continuing rapid growth in these regions, Environment Canada and EPA initiated a collaborative process to develop a Georgia Basin/Puget Sound International Airshed Strategy, which will combine early action, airshed characterization, and strategic planning to address high-priority air quality issues and challenges in these regions.

Cooperation on Emission Inventories, Trends, and Mapping

Accurate emission inventories and public availability of data are integral to the success of both nations' emission reduction goals and air quality management programs. Emission inventories help identify the major sources of pollution, track the progress of control strategies, and provide important data for use in air quality models. Figures 8, 9, and 10 present emission trends estimates for total SO_2, NO_x, and VOCs for both Canada and the United States, reflecting data measured at many large sources as well as new methodologies for developing estimates.

Figure 8. Canada/U.S. Total SO_2 Emissions, 1980-2010



Wet Sulfate and Nitrate Deposition in 1990-1994 and 1996-2000

Wet Sulfate Deposition

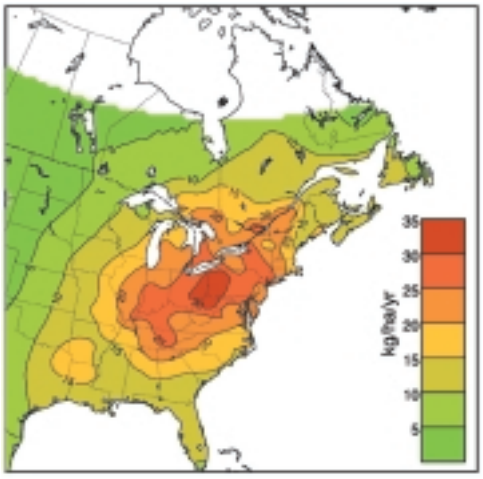


Figure 11. 1990-1994

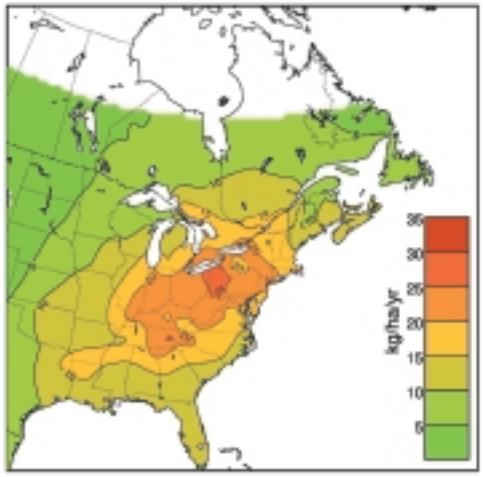


Figure 12. 1996-2000

Wet Nitrate Deposition

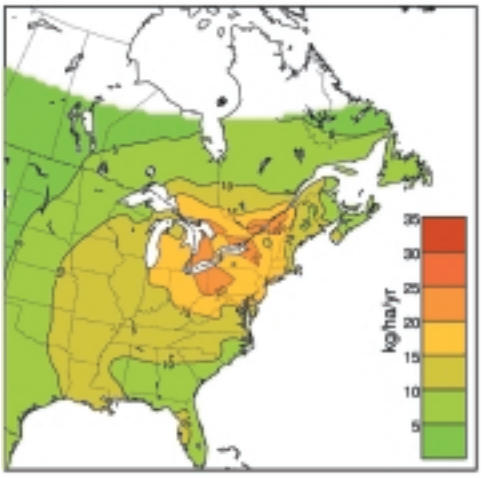


Figure 13. 1990-1994

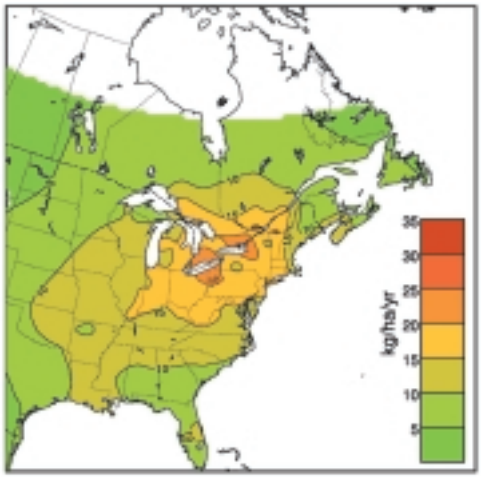


Figure 14. 1996-2000

Long-term environmental monitoring in Canada and the United States through well-established networks continues to play an essential role in evaluating the efficacy of air pollution control programs. Canada and the United States jointly developed these maps, which illustrate sulfate and nitrate wet deposition across eastern North America over two different five-year periods (1990-1994 and 1996-2000). As illustrated in Figures 11 and 12, SO_2 emission reductions resulted in a significant decrease in wet sulfate deposition over a large section of eastern North America. During these same time periods, however, wet nitrate deposition remained relatively unchanged, as illustrated in Figures 13 and 14.

Figure 9. Canada/U.S. Total NO_x Emissions, 1990-2010

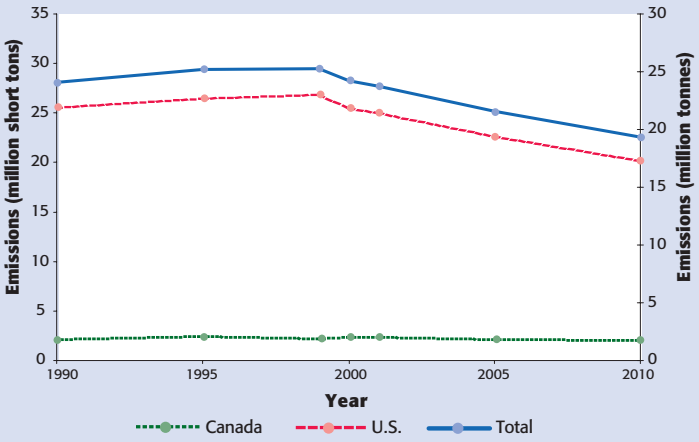
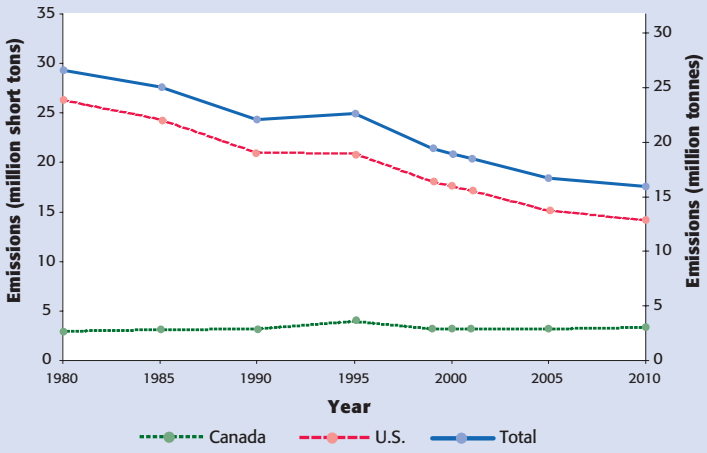


Figure 10. Canada/U.S. Total VOC Emissions, 1980-2010



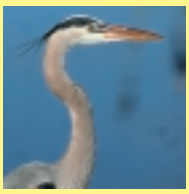
AIRNOW Mapping

EPA's AIR*NOW*, a real-time air quality information and mapping system for the United States, has been expanded to include data and air quality maps from seven Canadian provinces: British Columbia, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, and Quebec. AIR*NOW* provides hourly information on pollution levels via the Internet to public officials, health professionals, the media, and citizens to enable them to take proper steps to protect public health. The AIR*NOW* Web site is <www.epa.gov/airnow>.

Research Efforts on Effects of Air Pollution

Health Effects

In addition to joint research efforts to study the relationship between air pollution and human mortality, independent research efforts in Canada and the United States are also examining the links between PM and a variety of health risks, including lung cancer, heart attacks, and thickening of the blood.



Aquatic Effects

Joint Canadian/U.S. studies, including trends observed from 1989-1999 at sites in the International Cooperative Program on Assessment and Monitoring of Acidification of Rivers and Lakes, have found improvements in water quality from decreased acid deposition amid the complexity of ecosystem responses to multiple stressors.

Forest Effects

The NEG/ECP is undertaking a Forest Mapping Project to determine sustainable levels of acid deposition for forest soils in the northeastern United States and eastern Canada. Joint cooperation through the North American Forestry Commission is also assessing the effects of air pollution on forest ecosystems of North America.

Effects on Buildings and Monuments

The U.S. National Center for the Preservation of Technology and Training (NCPTT) and the Canadian Conservation Institute are continuing research on innovative conservation methods for historical structures and cultural materials.

A History of Cooperation

1980

Memorandum of Intent Concerning Transboundary Air Pollution signed by the governments of Canada and the United States.

1986

Publication of report, *Joint Report of the Special Envoys on Acid Rain*.

1989

Canadian and U.S. Heads of State commit to negotiate an Air Quality Agreement.

1991

Canadian and U.S. Heads of State sign Air Quality Agreement in Ottawa, Canada.

1992

First Air Quality Agreement Progress Report.

1996

First Five-Year Review and Assessment of Air Quality Agreement.

1997

Agreement to develop Joint Plan of Action for Addressing Transboundary Air Pollution focusing on ozone and PM signed by Canada and the United States.

1999

Publication of report, *Ground-Level Ozone: Occurrence and Transport in Eastern North America*, developed by the Air Quality Committee.

2000

Initiation of formal negotiations on Ozone Annex to address trans-boundary pollution of ground-level ozone precursors.

Canada and the United States sign the Air Quality Agreement's Ozone Annex.

Future Plans

Completion of report characterizing transboundary contributions of PM.

Meeting of Parties to assess progress on Ozone Annex.

For More Information

In Canada

Transboundary Air Issues Branch
Environment Canada
351 St. Joseph Boulevard
11th Floor, Place Vincent Massey
Hull, Quebec K1A 0H3

On the Web:

- Clean Air Page: www.ec.gc.ca/air/introduction_e.html
- Canada/United States Air Links and Canada-United States Air Quality Agreement Page: www.ec.gc.ca/pdb/can_us/canus_links_e.cfm
- Canada/United States Clean Air Related Page: www.ec.gc.ca/air/related_sites_e.html

In the United States

Clean Air Markets Division
U.S. Environmental Protection Agency
Mail Code 6204N
1200 Pennsylvania Avenue, NW.
Washington, DC 20460

On the Web:

- Clean Air Markets Division and Acid Rain Information: www.epa.gov/airmarkets/index.html
- Office of Air Quality Planning and Standards: www.epa.gov/oar/oaqps/
- Air Data: www.epa.gov/air/data/

Office of Air and Radiation
EPA430-F-03-010
1200 Pennsylvania Avenue, NW.
(6204N)
Washington, DC 20460
www.epa.gov/airmarkets
August 2003