
New England Governors/Eastern Canadian Premiers

Acid Rain Action Plan
1998

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Prepared by

The Committee on the Environment of
The Conference of New England Governors and Eastern Canadian Premiers

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Fredericton
Province of New Brunswick

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Summary of Goals and Basis for Action

Summary

In June 1997, the Conference of the New England Governors and Eastern Canadian Premiers (NEG/ECP) recognized the acid deposition is “a joint concern for which a regional approach on research and strategic action is required” and that “state and provincial monitoring efforts and analysis remain a high priority within their respective programs”. The Conference charged its Committee on the Environment to present specific policy recommendations at their next meeting, June 1998. A draft framework for the Acid Rain Action Plan was subsequently developed by representatives of the New England states and Eastern Canadian provinces. This draft was refined following the NEG/ECP Workshop on Acid Rain and Mercury in February 1997 in Portland, Maine.

The New England/Eastern Canadian Acid Rain Action Plan identifies steps to address those aspects of the acid rain problem in the Northeast that are within the region’s control to influence. Specifically, the action plan includes:

- a comprehensive and coordinated plan for further reducing emissions of sulfur dioxide and oxides of nitrogen which contribute to the problem of long range transport of air pollutants, acid deposition, and nutrient enrichment of marine waters in the region;
- a research and monitoring agenda targeted at both improving the state-of-the-science for this environmental problem, and increasing regional cooperative efforts in sharing research and data in order to better understand the impact of acid deposition on the region and analyze the effectiveness of current control programs on sensitive ecosystems;
- a public education and outreach agenda to ensure the public continues to be educated and mobilized towards the overall goal of protecting the natural environment.

The action plan contains 22 recommendations for specific actions that the provinces and states can undertake to ensure significant progress is realized in reducing the effects of acid deposition on ecosystems.

The NEG/ECP Committee on the Environment will appoint a steering committee to coordinate and prioritize the implementation of the action items. This steering committee will report back to the Committee on the Environment with milestones for achieving the reduction requirements no later than the year 2010.

Basis for Action

Acid rain is largely due to sulfates and nitrates formed from sulfur dioxide (SO₂) and nitrogen oxides (NO_x) emitted into the atmosphere during the burning of fossil fuels. The smelting of sulfide ores can also be a significant source of SO₂. Watersheds and forests, particularly high elevation forests, in the northeastern United States and Eastern Canada are especially sensitive to the effects of acid deposition due to the predominance of thin and poorly buffered soils throughout the region. While significant reduction of sulfur emissions have taken place in the region and across North America, resulting in significant reductions in wet sulfate deposition levels, remaining emissions of both sulfur

and nitrogen compounds, particularly those generated in the midwestern U.S. and central Canada, continue to negatively impact the resources of this region.

The combination of sensitive ecosystems and high rates of deposition have resulted in aquatic and terrestrial resources in the northeastern U.S. and eastern Canada suffering more damage from acid deposition than other regions of the continent. Aquatic resources of concern include fish and other species, phytoplankton that form the basis of aquatic food chains, and water quality. Terrestrial concerns include adverse effects on trees and the soils which support productive forests for recreational and economic activities. Further, studies of Chesapeake Bay, the Long Island Sound, and other marine waters off the eastern United States have documented that atmospheric deposition of nitrogen contributes to low dissolved oxygen in these marine systems.

Damage to these ecosystems can occur as a result of both chronic long-term deposition and short-duration episodes which produce “acidic pulses”. While most of the attention and concern to date has been focused on chronic acidification, short-term episodic acidification resulting from snow melt or heavy rain events, pose a similar level of threat to sensitive ecosystems and resources. For example, rapid snow melts can dramatically lower pH levels during times when aquatic life is most sensitive to such disturbances (e.g., during fish spawning and reproduction). Recent research of non-point source pollution suggests the acidic nature of storm water run-off contributes to pulses of toxic pollution in streams. In addition to their impacts on lakes and streams, acidic pulses can damage forest soils, with the potential of reducing or halting forest growth. We have traditionally relied on the long-term pH levels of lakes and streams as the primary indicator of acid deposition, and the frequency, duration and effects of episodic acidification are not well documented.

Although the emission targets associated with current initiatives in both countries have already been met or exceeded, the success in reducing the impacts of acid rain and related environmental effects are mixed. While wet sulfate deposition has significantly decreased in the region, nitrate levels have not. These findings are consistent with the fact that SO₂ emissions have decreased as a result of these current programs, while programs to reduce nitrogen emissions have not yet taken any effect. While the need for further action is clear, many questions remain about the myriad effects of acidic deposition in the region and the relationship between changes in emissions and the response of sensitive ecosystems. Moreover, the presence of mercury has been linked to the acidification of lakes and higher levels of mercury are found in fish tissue in low alkaline lakes.

With the decrease in wet sulfate deposition, these are some signs of ecological recovery. However, the U.S. EPA has concluded that an additional 40% to 50% reduction in sulfur and nitrogen deposition, beyond levels achieved by the Clean Air Act requirements, may be needed just to prevent further acidification of lakes in the Adirondacks.

In 1997, the Canadian Acidifying Emission Task Group concluded that even after full implementation of the Canadian and U.S. programs, most of southeastern Canada will

continue to be subject to levels of acid deposition above the critical load limits for sensitive aquatic systems. As a result, 95,000 lakes in southeastern Canada will continue to suffer damage from acid deposition. They found that further emissions reductions, of up to 75% in some source areas, are required to protect these lakes from further acidification. The interim target load of 20kg/ha/yr for wet sulfate deposition set in the 1980's was not intended to adequately protect the region's sensitive lakes, watersheds and forests and new target loads need to be established.

The acid rain action plan was not developed in isolation. It is understood that the acid precipitation phenomenon is closely linked to other airborne pollutant issues. Typically these issues are cross-media issues that can involve air, water, land, biota and human health and in many instances the effects of airborne pollutants on the environment and human health are the result of multiple stresses. Often it is very difficult to attribute measured responses to a single pollutant. Many airborne pollutants do, however, originate from similar industrial sectors. Measures taken to address a particular pollutant source or source category have the potential to simultaneously address a variety of airborne pollutant issues and to reduce the cumulative impact of pollutants on the environment and human health.

Guiding Principles

The New England Governors and Eastern Canadian Premiers recognize the following principles as the guidelines for action on acid rain in the region.

- Further reductions in the discharge of sulfur and nitrogen into the environment are required to ensure that serious or irreversible damage is not inflicted on the environment.
- Coordination of the efforts of the New England states and Eastern Canadian provinces is necessary for effective response strategies in dealing with acid rain issues.
- Environmental goals and objectives, in keeping with sustainable development, shall be formulated and implemented in ways that achieve high levels of ecological and human health and economic benefit.
- While acid rain is a regional problem that requires regional solutions, out-of-region sources contribute significantly to this environmental threat; the New England states and Eastern Canadian provinces stress the need for appropriate controls on sources outside the region.

In keeping with these guidelines, the following objectives and recommendations shall be pursued.

Action Item 1: Coordinated Data Collection/Management

Basis for Action

For pollutants subject to long-range transport, there is long-standing need for better mechanisms to exchange environmental data and data analysis between the New England states and Eastern Canadian provinces, and for more efficient data management partnerships among the states, provinces and their respective federal environmental agencies.

Goal

To develop a shared perspective on environmental effects and appropriate management strategies for long-range transport contaminants, to meet common data collection management and reporting needs within the region, and between the region and the respective federal environmental agencies (Environment Canada and U.S. EPA).

To develop a pilot program to facilitate the cross-border electronic exchange of data characterizing emissions, deposition, air quality, meteorology, water quality, and environmental effects. The pilot program will initially focus on a small number of comparable data sets, and will serve as a “model approach” for the future sharing of all data determined to be of regional significance.

Recommendations

1. Review currently available state, provincial and national data sets and report to the Environment Committee by December 31, 1998, with recommendations on:
 - a) specific data sets which would be;
 - i) most useful in regional assessments of acid deposition and related issues, and;
 - ii) collected by sufficiently comparable methods and with sufficient quality documentation to allow merging across states and provinces
 - b) electronic (software) mechanisms to distribute data sets among states/provinces;
2. Request collaborative assistance from Environment Canada and U.S. EPA to develop and analyze (with regional deposition models) the necessary US/Canadian data sets to evaluate “Regional Ecosystem Sensitivity to Changes in Sulfur and Nitrogen Oxide Emissions”. It is envisioned that between the federal, state and provincial environmental agencies, sufficient expertise exists to develop international data sets which include:
 - a) spatial pattern in New England/Eastern Canadian region of ecosystems sensitivity to sulfur and nitrogen deposition effects;
 - b) current patterns of measured wet(and dry) deposition rates of sulfur and nitrogen in New England and Eastern Canada
 - c) current and projected sulfur and nitrogen emissions inventories in eastern U.S. and Canada - with sufficient space/time resolution to support regional deposition modeling

- d) mechanisms to distribute a rollback of projected future emissions in the most economically efficient, energy efficient and/or environmentally beneficial manner
3. Distribute regional and bi-national data sets as they are developed, to the New England states and Eastern Canadian provinces, and provide the following information:
 - a) ecosystem sensitivity maps for (at least) the New England/Eastern Canadian region (and other regions if feasible)
 - b) regional maps comparing ecosystem sensitivity to current sulfur and nitrogen deposition
 - c) regional maps comparing ecosystem sensitivity to projected future sulfur and nitrogen deposition after US Clean Air Act and Canadian emissions reduction commitments are achieved, including transfer matrices apportioning sulfur and nitrogen deposition to/from individual states and provinces
 - d) regional maps comparing ecosystem sensitivity to projected future sulfur and nitrogen deposition if projected future U.S. and Canadian emissions are reduced by an additional 50% for sulfur and an additional 30% for nitrogen (beyond current commitments)
 - e) National (or Eastern North American) maps depicting changes that would result from emissions reductions in sulfur and nitrogen deposition, and “ancillary benefits” on fine particle sulfates and nitrate, and visibility.
 4. Report to the Governors and Premiers, at their annual meeting in 1999, appropriate revisions to critical loads for sulfur and nitrogen deposition needed to protect sensitive ecosystems in New England and Eastern Canada.

Action Items 2 & 3: Surface Water Quality and Fine Particulate Monitoring Programs

Basis for Action

The Canada/United States Air Quality Agreement commits the federal governments, in Annex 2 of that Agreement, to develop seamless monitoring efforts across the border so both countries have the ability to share and jointly analyze data collected in order to assess the state of the environment, trends, and the effectiveness of various control initiatives.

The NEG/ECP will work with the federal levels of government in both countries to begin to fulfill the Annex 2 commitment by establishing regional networks to monitor the effects of acidic deposition on aquatic ecosystems, and to monitor the levels and distribution patterns of fine particles across the region. These two preliminary monitoring projects (water and fine particulate) have been identified to provide manageable first steps in regional/federal collaborative efforts on these important issues.

The surface water quality monitoring program will address major knowledge gaps and will provide performance indicators for existing or upcoming control programs. It is recognized that water quality indicators are an excellent source of data for detecting early signs of changes in surface waters and ecosystems. The fine particulate monitoring program will monitor ambient particulate concentration, and will also determine sulfate/nitrate loading.

Action Item 2: Regional Surface Water Quality Monitoring Program

Goal

To design, implement, and maintain a regional environmental monitoring network to i) assess the recovery of acidified lakes; ii) evaluate the role of nitrogen and nitrogen saturation in the acidification process; iii) define critical load maps for sulfate and nitrate in surface waters; iv) analyze the effect of current and future regulatory programs in reducing the concentration and deposition of acidifying pollutants; and v) help define a new target load for wet sulfate deposition.

Recommendations

5. Establish a work group to draft a detailed work plan for the establishment of a regional surface water quality monitoring network. The work group shall report to the Environment Committee, no later than December 31, 1998, its findings related to the implementation of a regional aquatic effects monitoring network, specifically addressing the following issues:
 - a) the commitment of federal agencies to support the program as it responds to Annex 2 of the Canada/US Air Quality Agreement;
 - b) detection of a change in surface water quality following emission reductions;
 - c) the establishment of an aquatic effects monitoring protocol which includes;
 - monitor performance criteria
 - quality control/quality assurance standards
 - monitoring frequency and schedule
 - laboratory analysis protocol
 - data compilation and reporting protocol
 - application of modeling methods and environmental indicators
 - d) the anticipated costs per monitoring site including;
 - capital costs
 - operating and personnel costs
 - sample analysis costs
 - data processing and transfer costs
 - e) the identification of opportunities to share or pool resources within the region.
6. Where feasible, commit to the identification and establishment of at least one lake monitoring site in each jurisdiction to be maintained and operated according to the agreed-upon protocols.
7. Establish and implement, by June 30, 1999, a regional lake water quality monitoring network, and report on the extent to which the surface water quality monitoring network fulfills the federal commitment to cooperate under Annex 2 of the Canada/U.S. Air Quality Agreement.

Action Item 3: Regional Fine Particulate Monitoring Program

Goal

To design, implement, and maintain a regional environmental monitoring network to i) identify and quantify the atmospheric deposition of acidifying compounds and other fine particle pollutants; and ii) analyze the effect of current and future regulatory programs in reducing the concentration and deposition of acidifying pollutants.

Recommendations

8. Establish a work group to draft a detailed work plan for the establishment of a regional fine particulate monitoring network. The work group shall report to the Environment Committee, no later than December 31, 1998, its findings related to the implementation of a regional fine particulate monitoring network, specifically addressing the following issues:
 - a) the commitment of federal agencies to support the program as it responds to Annex 2 of the Canada/U.S. Air Quality Agreement;
 - b) the linkages between fine particulates and acid deposition;
 - c) the establishment of a fine particulate monitoring protocol which includes;
 - citing criteria
 - monitor performance criteria
 - quality control/quality assurance standards
 - monitoring frequency and schedule
 - filter analysis protocol
 - data compilation and reporting protocol
 - d) the anticipated costs per monitoring site including;
 - capital costs
 - operating and personnel costs
 - filter analysis costs
 - data processing and transfer costs.
 - e) the identification of opportunities to share or pool resources within the region.
9. Where feasible, commit to the identification and establishment of at least one fine particulate monitoring site in each jurisdiction to be maintained and operated according to the agreed-upon protocols.
10. Establish and implement, by June 30, 1999, a regional pilot fine particle monitoring network and report on the extent to which the pilot regional fine particulate monitoring network fulfills the federal commitment to cooperate under Annex 2 of the Canada/U.S. Air Quality Agreement.

Action Item 4: Forest Mapping Research Project

Basis for Action

Acid Deposition is a concern for Northeastern forests for several reasons: i) this region is a major receptor of long-range transported air pollutants; ii) forest health is poor in large areas; iii) forest soil fertility is marginal in many parts of the region; iv) poor forest nutrition and health have been related to soil acidification; and v) long-term studies report that nutrient depletion in forest soils is associated, in part, with acid deposition in several forest catchments in northeastern America.

Goal

To determine the critical thresholds for forest soil acidification in northeastern Canada and United States using a calculation and mapping system recently developed and implemented in Europe. This project will also provide data for estimating current critical sulfate and nitrogen levels in the forests of north eastern North America.

Recommendations

11. Establish an environment committee task group, to develop a detailed work plan for the establishment of a regional forest mapping project. The work group shall report to the NEG/ECP Environment Committee, no later than December 31, 1998, its findings related to the implementation of a regional forest mapping project, specifically addressing the following issues:
 - a) the establishment of a forest mapping protocol including;
 - siting criteria
 - quality control/quality assurance standards
 - mapping schedule
 - data compilation and reporting protocol
 - b) the anticipated costs per mapping site including;
 - capital costs
 - operating and personnel costs
 - data processing costs
 - c) the identification of opportunities to share or pool resources within the region.
12. Where feasible, commit to the identification and establishment of at least one forest mapping site in each jurisdiction to be maintained and operated according to the agreed upon protocols.
13. Establish, and implement, by June 30, 1999, a regional forest mapping project.

Action Item 5: Further Sulfur and Nitrogen Control Strategies

Basis for Action

In the United States, EPA's recent *Acid Deposition Standard Feasibility Study* has determined that reducing both sulfur and nitrogen deposition by 50% or more below current U.S. Clean Air Act acid rain requirements may be needed to protect sensitive resources from additional chronic acidification. In Canada, the 1997 *Canada-Wide Acid Rain Strategy for Post-2000* set a goal of reducing sulfur emissions sufficient to reduce wet sulfate deposition levels to below critical loads in eastern Canada. SO₂ emission reductions of up to 75% in central Canada and the midwestern U.S. were determined to meet this objective.

Annual nitrogen oxide emissions have not been subject to significant reductions under national acid rain control programs in the U.S. or Canada, but have been identified as a contributing cause of chronic acidification and a predominant cause of episodic acidification of surface waters in northeastern North America.

Acid deposition of sulfur and nitrogen compounds have recently been linked to soil damage. Resulting reductions in forest growth jeopardize continued economic growth in this vital sector.

Restructuring of the electric power industry in the United States also poses a significant environmental threat to New England and Eastern Canada. While the economic benefits of deregulation are widely recognized, these are serious concerns regarding its environmental impacts. Deregulation will favor a production shift from higher cost facilities, to those with lower operating costs. Unfortunately, many of these low-cost facilities are also high-polluting coal-fired units in the Midwest and central Canada, and are already responsible for significant production and transport of pollutants. As these sources increase their generation in the absence of adequate environmental safeguards, both upwind emissions and downwind transport impacts of sulfur and nitrogen oxides will increase. Only through the application of comparable environmental standards throughout the United States and Canada can the environmental consequences of deregulation be mitigated.

Goal

To reduce sulfur and nitrogen emissions to the environment to levels below those required by existing legislation and regulation in the U.S. and Canada through the establishment of appropriate reduction targets and the adoption and implementation of cost-effective control strategies.

Recommendations

14. Call upon the parties to the Canada/U.S. Agreement on Air Quality to i) move to strengthen sulfur and nitrogen emissions reductions in Annex 1 of said Agreement, and to develop additional Annexes to jointly reduce the impacts of fine particulates and ground level ozone, directly related to these same pollutants; ii) reduce current economic and pollution control inequities among competitive

- industries in different regions of North America; and iii) ensure that utility deregulation is accomplished in a manner consistent with the principles of economic and environmental equity.
15. Urge the respective federal jurisdictions to ensure that, no later than the year 2010, annual sulfur dioxide emissions in each country are reduced by an amount 50% greater than current commitments.
 16. Reduce annual sulfur dioxide emissions in each member jurisdiction, by the year 2010, through the establishment of appropriate reduction targets and the implementation of control strategies consistent with national strategies designed to protect sensitive ecosystems.
 17. Urge the respective federal jurisdictions to ensure that, no later than the year 2007, from all appropriate sectors, annual nitrogen oxide emissions in each country are reduced by an amount 20 to 30% greater than current commitments.
 18. Reduce annual nitrogen oxide emissions in each member jurisdiction, by the year 2007, through the establishment of appropriate regional reduction targets and the implementation of control strategies consistent with the recommended national goals.
 19. Extend any seasonal limits on nitrogen oxide emissions for ozone control purposes to annual requirements in order to reduce acid deposition and eutrophication.
 20. Revisit the interim target load of 20/kg/ha/yr set in the 1980's for wet sulfate deposition, and propose more protective targets to the Governors and Premiers at their 1999 meeting.

Action Item 6: Public Awareness/Education

Basis for Action

The public, educated and mobilized to action in the 1980's, needs to know how far we have come since then and where we still need to go to achieve the overall goal of protecting the natural environment, especially our acid sensitive and compromised resources.

Goal

To revitalize and deliver education and outreach programs, in support of the commitment to reversing the serious acidification of vital aquatic and terrestrial resources by raising public awareness of:

- the continued relevancy and critical nature of acid rain;
- the results of scientific study of acid rain, its impacts on the environment, and the effectiveness of our respective national control programs; and
- the need for further scientific research, measurement, data analysis and reductions in the acid forming emissions from all sources contributing to the continued degradation of our compromised natural resources.

Recommendations

21. Establish a public outreach work group charged with drafting a detailed work plan for the preparation of a public information report describing the continued relevancy and critical nature of acid rain. The work group shall report to the Environment Committee, no later than December 31, 1998, its findings related to the production of the report specifically addressing the following:
 - a) the anticipated cost of producing the document including:
 - personnel costs
 - production, translation, and printing costs
 - b) the anticipated audience, format, message and content of the document, ensuring the message is presented in a compelling and user-friendly manner and takes advantage of the electronic age, especially the Internet;
 - c) the identification of opportunities to share or pool resources within the region;
 - d) articulation of a longer term outreach plan to support the dissemination of information from the on-going monitoring, data collection and research activities and the emission reduction programs.
22. Produce and distribute, by June 1999, a regional report on the need for further controls for acid rain deposition to protect and restore the natural environment, especially the acid sensitive and compromised resources.