Communicating Science at Environment Canada

A Brief Review of Lessons Learned from Communications on Acid Rain and the Depletion of the Stratospheric Ozone Layer

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Prepared for: **Environment Canada S&T Advisory Board**
Working Group on Science Communications

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Executive Summary

Science and technology (S&T) are an integral part of Environment Canada and serve as the basis for departmental policies, programs and services. Sharing and communicating scientific information with Canadians and with institutions both within Canada and abroad is a key activity at Environment Canada. The communication of information is vital to fulfilling the Department's mandate as a science-based organization. In 1998, Environment Canada's Science and Technology (S&T) Advisory Board targeted science communications as an area for attention and advice to the Deputy Minister. The Board requested that the Department undertake a lessons-learned analysis of science communications associated with key environmental issues faced by the Department in the past, and use this analysis to develop a science communications framework for use by the Department in the future.

In discussing the methodology for this analysis, the S&T Advisory Board identified acid rain and depletion of the ozone layer as examples of successful science communication efforts to be studied. The Board requested that the Department prepare short case studies based on document review and informal interviews, as well as conduct a brief literature review to determine the possible role and impacts of issue life cycle and public attention cycles on science communications. The goal of the case study and literature review analysis was to identify common elements, as well as differences, associated with the two case study issues, the key communication messages, strategies and tools used by the Department; successes and failures; the media's role in communication; and the effects of the public's issue attention cycle on science communications. The overall objective of the review was to provide a basis for the S&T Advisory Board to develop a science communications management framework for the Department.

The case study analysis found that as science-based environmental issues, acid rain and depletion of the ozone layer were quite different in the way they developed over time and in the way the Department's communications were handled. In each case, there was a strong scientific basis for both the policy and communications. Significant communication efforts were directed at fostering better understanding of scientific issues, both in the traditional scientific publications and with the public. A key strength in the Department's efforts to communicate science on acid rain and stratospheric ozone depletion has been the tripartite approach taken. This tripartite approach consists of: (1) communication in recognized scientific arenas (e.g. conferences, technical reports, peer-reviewed scientific literature) in order to establish scientific authority and credibility; (2) communication in popular formats (e.g. science assessments, semi-technical reports, trend assessments, monitoring reports, etc.) that could be utilized by policy makers and specialized media journalists; and (3)

communication in easy-to-understand and popular formats that could be picked up and utilized easily by the general public and the popular media.

In terms of similarities from a communications standpoint, the issues of acid rain and depletion of the ozone layer each, at different times, became "flagship" science and policy issues for Environment Canada and generated focused and substantial communications efforts by the Department. Communication efforts by Environment Canada on both issues emphasized presenting scientific information to different audiences through different formats. In both cases, innovative science communication tools and approaches were developed and used. Communications to the public emphasized the use of simple messages.

A key characteristic associated with both the acid rain and the stratospheric ozone depletion issues was that action on the issue could be achieved, not by sacrifices involving individual members of the Canadian public, but rather through sacrifices or changes in operating practice from large industry. This made it easier to convince Canadians to support the policy actions needed to tackle these environmental problems.

In both cases, the Canadian media (especially science journalists) played a key role in translating and transferring science information to the public. As part of its communications efforts on the two issues, Environment Canada emphasized the cultivation of relationships between departmental officials (including scientists) and the media. In addition, the Department developed strategic communication relationships with third parties to help marshal the court of public opinion.

These case study analyses also pointed out some clear differences in the ways that science and policy-related communications were handled by the Department for the acid rain and the stratospheric ozone depletion issues. In the case of acid rain, Environment Canada established a sizable communications budget and assigned a special group of staff to acid rain-related communications. This specialized and focused approach was not employed on communications associated with stratospheric ozone depletion. Rather, communications on the latter was largely integrated with communications on other environmental issues being handled within the Department.

A key difference in these issues, which was reflected in the communications strategies, concerned the source of the problem, and hence the political approach needed for resolution. These differences also affected the types of science and communications done by Environment Canada, the target audiences, and the key messages communicated by the Department. From a Canadian perspective, acid rain was a problem generated primarily by industry in the United States. As a result, considerable communications efforts were directed at both influencing political action in the United States and fostering Canadian awareness of the source of the problem. The depletion of

stratospheric ozone, on the other hand, was a global problem that required cooperation between countries around the world. Communications efforts, therefore, focused on raising Canadian public awareness, which was needed to develop and sustain significant Canadian government involvement in international policy making related to ozone-depleting substances.

As an issue in the public issue attention cycle, acid rain more or less declined in the media and public interest polls following the signature of the Canada-U.S. Air Quality Agreement in the early 1990s. On the other hand, public concern about depletion of the ozone layer was still relatively strong in 1998. A primary factor underlying this continued public interest in ozone layer depletion is the strong link between the issue and human health impacts (including the effects on future generations). The acid rain issue did not generate a similar level of associated human health concerns to sustain public interest once a policy response had been developed and implemented.

Lessons Learned

The examination of these case studies demonstrated that there is a difference between communicating about an environmental issue (such as acid rain or ozone depletion) and communicating the science associated with an environmental issue. In both cases, Environment Canada's communication efforts began with explaining the science of the issues, but then quickly moved into the communication of policy responses required to address the issues. As the Environment Canada communication effort on acid rain began to focus on the desired policy response with the United States, for example, communications increasingly focused on the political aspects of atmospheric transboundary pollution from the United States to Canada. It is important to note, however, that the Department's communication of science continued through other established and regular mechanisms such as publication of scientific literature, preparation of science assessment and monitoring reports, and publication of scientific trends in environmental indicators. Following policy action, moreover, science communications had to evolve to generate new types of reports: implementation progress reports showing the actual impacts, from a scientific perspective, of policy actions taken.

From an issue attention or issue life cycle perspective, both acid rain and ozone depletion can be classified, compared to other environmental issues, as "celebrity issues." Some of Environment Canada's success with communications on acid rain was the result of favourable conditions regarding the source and effects of the problem combined with the politics of Canada-U.S. transborder air pollution and unique events occurring in the United States. Stratospheric ozone depletion became a celebrity issue in Canada in part because of the global attention it generated, but also because of other factors such as Canada's northern geography (e.g. Canada's possession of an Arctic ozone hole) and the

strong international science and policy presence of Environment Canada on this issue.

Lessons learned from these case studies do point out some important factors to consider in the communication of science for environmental issues. Science communications directed towards the public on environmental issues must make use of simple and consistent messages that can easily be understood by the public. The generation of various science communication approaches and material outputs for various audiences on a single issue helps to target the appropriate level and complexity of information to different groups. Perhaps one of the most fundamental lessons that can be learned from these case studies is the importance of department-wide commitment to strategic planning, resourcing and implementation of science communication efforts for priority issues. Such strategic science communication approaches may be more difficult to sustain on a diverse and wide range of issues. Innovation in terms of the types of science communication approaches used, tools developed and audiences reached can also generate unexpected successes. Identifying potential solutions to the problem, highlighting the populations and/or generations affected by the problem, and noting personal connections associated with the problem or issue are also useful strategies that can be linked to communication of science.

Introduction and Methodology

Science and technology (S&T) are an integral part of Environment Canada and serve as the basis for departmental policies, programs and services. Sharing and communicating scientific information with Canadians and with institutions both in Canada and abroad is a key activity at Environment Canada.

Canadians continue to identify Environment Canada as a leading source of credible scientific information and place great confidence in the authority of Environment Canada's scientists. As a result, communication of science continues to be vital to Environment Canada's mandate, which is to help Canadians live and prosper in an environment that is properly protected and conserved.

In 1998, Environment Canada's Science and Technology (S&T) Advisory Board targeted science communications as an area for attention and advice to the Deputy Minister. The Board requested that the Department undertake a lessons-learned analysis of science communications associated with key environmental issues faced by the Department in the past, and use this analysis to develop a science communications framework for use in the future.

The S&T Advisory Board identified acid rain and depletion of the ozone layer as examples of successful science communication efforts to be studied. The Board requested that the Department prepare short case studies based on document review and informal interviews, as well as conduct a brief literature review to determine the role and impact of issue life cycles and public attention cycles on science communications. The purpose of the case study and literature review analysis is to identify common elements, as well as differences, associated with the two case study issues with respect to the key communication messages, strategies and tools used by the Department; successes and failures; the media's role in communication; and the effects of the public's issue attention cycle on science communications.

The information contained in this report is based on personal interviews, conducted by a summer student, as well as document searches and reviews. Interviews were conducted either in person or over the telephone in July 1998. Interviewees were chosen because of their involvement in the communications of one or both of the issues as members of science, policy or communication teams. In addition, selected environmental journalists who wrote extensively on these issues were interviewed for the report. Appendices to the report set out brief life cycle time lines for both acid rain and stratospheric ozone depletion as issues, and include information on various public opinion polls conducted on environmental issues during these life cycles.

Life Cycle Theories and Their Application to Acid Rain and Stratospheric Ozone Depletion

This section briefly summarizes the literature associated with the life cycle of issues and examines how the issues of acid rain and ozone depletion relate to ideas discussed in the literature. While the theories concerning the life cycle of public attention may not fully explain developments related to the environmental issues being examined in this report, understanding of life cycle analysis can be a strategic tool in guiding the development of science communication approaches on emerging issues.

At any point in time there are many problems vying for public attention. However, not all of these issues can become significant in the public arena. A number of scholars have looked at questions such as:

- How do issues become important to the public?
- What kind of issues attract the attention of the public or the media?
- What factors determine how long issues retain public or media interest?
- Why do issues fade from public interest? and
- Once they fade, can important issues ever return to prominence?

There are several theories, and a substantial literature base, that address these questions. Most agree that the actual status of a problem does not always relate to its popularity (i.e. the severity of a problem does not necessarily determine the amount of public attention it gets). Another point of agreement is that most issues take time to become important to people — public interest is usually sparked by some event that has a personal impact. Most agree that all issues reach a period of peak public interest and then subsequently drop in popularity.

The Issue Attention Cycle (Downs 1972)

Downs (1972) described the life cycle of issues as a slow rise, a peak and a decline. He attributed the decline of public interest in issues to boredom, rather than to actual resolution of the problem. In fact, he argued that the public perception of most "crises" does not reflect changes in real conditions as much as the cycle of heightening public interest and then increasing boredom.

Downs identified five stages in his issue attention cycle theory:

1. **pre-problem:** some highly undesirable condition exists but has not yet captured much attention, even though experts or interest groups may be alarmed already — usually, conditions are worse during the pre-problem stage than by the time the public is interested.

2. **alarmed discovery and euphoric optimism:** usually the result of dramatic events, the public suddenly becomes aware of, and alarmed about, the problem — this is often accompanied by euphoric optimism about society's ability to solve it within a short period of time.

3. **realizing the cost of significant progress:** a gradually spreading realization that the cost of "solving" the problem is very high — requiring not only money, but also major sacrifices by large groups of the population. The public realizes that part of the problem results from arrangements that benefit some people or often many people.

4. **gradual decline of public interest:** as more and more people realize that solving the problem will be difficult and costly to themselves, three reactions set in: they get discouraged, feel threatened or get bored (most people feel a combination all three). Consequently, public desire to keep attention focused on the issue fades — and by this time, some other issue is usually entering stage two.

5. **post-problem:** the issue moves into prolonged limbo, with perhaps less attention or only spasmodic recurrence of interest. However, the issue now has a different relation to public attention than in the pre-problem stage — during the time that interest was on the issue, new programs, institutions and policies may have been set up to solve it. Any problem that once had public interest may sporadically recapture it, or important aspects may get attached to some other problem that becomes dominant. Therefore, problems that go through the full cycle almost always receive a higher average level of attention, public effort and general concern than those still in the pre-discovery stage.

Downs suggested that problems following the issue attention cycle exhibit three key characteristics:

1. The majority of persons in society are not suffering from the problem as much as some (numerical) minority. This means most people initially have to be told of the problem because they will not continually be reminded of it by their own suffering.

2. Suffering caused by the problem is usually generated by social arrangements that benefit a majority or powerful minority of the population. This means that solving the problem takes sustained attention and effort, plus fundamental changes in social institutions or behaviour (i.e. attempts to solve the problem may threaten important groups).

3. The problem has to exhibit exciting qualities (i.e. the problem must be dramatic and exciting or it will not maintain public interest). News is increasingly consumed as entertainment and thus competes with other news and also with non-news entertainment. Sustained focus by the media soon bores the majority of the public (and as soon as the media realize this effect, they shift focus).

The Public Arenas Model (Hilgartner and Bosk, 1988)

Hilgartner and Bosk (1988) addressed the competition and selection of problems in the public arena. These authors argued that social problems are not simple mirrors of objective conditions in society. This explains why some conditions or situations are defined as problems while others, although equally dangerous, are not. The public arenas model holds that public problems do rise and fall, but are not independent of other problems. In other words, issues compete for attention (which is a scarce resource) in the public arena. There are six main elements to the public arenas model:

1. there is a dynamic process of competition between issues;

2. institutional arenas serve as environments where problems compete (in mass media, government, research community, etc.);

3. arenas have carrying capacities, which limit the number of problems that can gain widespread public attention at one time;

4. principles of selection (or institutional, political and cultural factors) influence the probability of survival of competing problems in the public arena;

5. there are patterns of interaction among arenas, such as feedback and synergy; and

6. networks of operatives (e.g. information officers) try to promote and control problems.

According to this model, the total population of problems is stratified. A few become "celebrity" issues with high profiles. Some evolve to become minor issues, with small communities of professionals, activists and interest groups working on them. But the vast majority of problems remain outside public consciousness because of limited carrying capacity in the public arena.

Carrying capacity limits the number of problems that can gain recognition with the public. Different media and public institutions also have different carrying capacities. For example, a radio news program may broadcast only 10 stories a night, while that day's newspaper can carry many more. Government

departments and ministers have specific carrying capacities with regard to the time and resources they can devote to various issues. Individuals also have a carrying capacity, as they are limited by the amounts of time, money and "surplus compassion" they can direct to public issues after taking care of their own lives.

Hilgartner and Bosk noted that as one problem ascends in public attention, one or more others have to decline in interest. They found that the length of time that issues stay at the height of public attention varies. Some remain a focus of public attention for years, while others increase and decline rapidly or continue to fluctuate in and out of public interest. In other words, the fate of a problem in the public arena is a result of the nature of the problem as well as the selective process in which it competes.

Hilgartner and Bosk found that the decline of a problem does not necessarily mean it has been solved. Instead, they suggest that the public could lose interest because a more exciting issue has emerged. Moreover, they discovered that negative or positive feedback can result from relationships between arenas. For example, positive feedback can occur when news stories spawn other stories (often by competitors), either in the same medium or in others. Conversely, negative feedback can occur when growth is constrained by the finite carrying capacities of public arenas, by competition among problems for attention, or by the need for novelty.

The Agenda-Setting Model (Neuman, 1990; Rogers et al., 1991; Ader, 1995)

The agenda-setting model addresses the relationship between the relative emphasis given to various topics by the media and how important these topics are to the general public (Ader, 1995). Agenda setting focuses on the early stage of public awareness and the need for a "critical mass" to move matters from a private concern to a public issue. The media's role in building public support is of central importance to this hypothesis. Neuman (1990) has proposed that issues that develop increasing prominence with the public follow a logistic curve in which the beginning of an information campaign is characterized by little recognition by very few members of the public. As more media stories appear, however, more people begin to recognize and understand the issue. Often a critical point will be reached after which the media will compete to deliver additional stories on the issue. Ultimately, a saturation point is reached whereby another unit increase in media attention no longer corresponds to an equivalent increase in public response.

In his study, Neuman (1990) also found evidence that the media and the public respond differently to real-world cues. There also appears to be a temporal threshold that media and public opinion levels have to pass before they can

escalate to reach saturation. Neuman's research on issues of public and media concern identified four types of issues:

1. **crises** (e.g. the Vietnam war) are issues that have a fairly clear-cut beginning, middle and end. These issues do not closely follow the issue attention cycle as described by Downs because they do have a real-world life cycle and are not simply enduring social problems.

2. **symbolic crises** (e.g. poverty, pollution) are issues that do follow the issue attention cycle as described by Downs because they are problems that emerge and cannot be resolved in a short time frame. In each case of symbolic crisis, a combination of events and responses from government, the public and the media leads to public definition of the issue as a "crisis" for a limited period of time. Occasionally the symbolic crisis is caused by a defining event (e.g. the publication of *Silent Spring*) or the crystallization of naturally growing grassroots concerns (e.g. Earth Day).

3. **problems** (e.g. inflation and unemployment) are issues that have both periodic and occasional crises caused by dramatic or sudden change. However, these issues are often referred to as "stories without a story line." The media and the public often have different responses to these issues.

4. **non-problems** are issues in which there is no correlation (over time) between media coverage and public concern.

Environmental issues such as acid rain and ozone depletion are usually described as symbolic crises. In Neuman's 1990 study of crises and symbolic crises, each unit of increased news coverage was accompanied by an increase in points on a public opinion measure. However, it was also found that the public is less responsive to symbolic crises than actual crises. Neuman (1990) found that, on average, at least twice as many *symbolic* crisis media stories as *actual* crisis media stories are needed to produce equivalent levels of public concern. From an empirical perspective, the logistic relationship between media and public attention is not dramatic, but it is consistent with the threshold and saturation effects predicted.

Application of the Life Cycle Models to Acid Rain and Stratospheric Ozone Depletion

In the cases of acid rain and stratospheric ozone depletion in Canada, public interest built slowly but was sparked by certain events, after which public interest increased. For example, Brydges (1987) argued that acid rain rose to prominence in Canada after a 1978 *Toronto Star* article described damage to lakes in Ontario cottage country. The issue of ozone depletion rose in public

importance after media coverage reported the discovery of the ozone hole over Antarctica in 1986.

Stage three of Downs' model did not really apply to the cases of acid rain or stratospheric ozone depletion. While there were significant costs associated with the solution of these problems, the public recognized that in both cases this cost would not be borne by ordinary Canadians. Rather, the costs of solving the problem would be borne by large companies, especially in the United States. To a certain extent, popular thinking about sustainable development, environment-economy linkages and eco-efficiency also helped to produce a positive industrial response to the need to shift production strategies or optimize emission reductions through plant modernization. In the case of ozone-depleting substances, for example, policy actions helped to create new markets for substitute refrigerants. In the case of acid rain, smelter modernization helped to improve a firm's competitive position by lowering long-term production costs (e.g. energy costs).

The applicability of Downs' fourth and fifth stages to the acid rain issue in Canada is also questionable. It appeared that acid rain lost public attention not because people were concerned about costs and individuals felt threatened by potential sacrifices. Acid rain likely waned in public attention because Canadians came to understand (through communications messages and media reports) that the Canada-U.S. Air Quality Agreement had solved the problem, not because they got bored with hearing about the issue.

Interviews with Environment Canada staff involved in acid rain communications indicate that the Department's message to Canadians, following the signature of the Canada-U.S. Air Quality Agreement in 1991, was that the acid rain problem was solved. The message to Canadians concerning closure on the acid rain issue holds some important lessons, as this was a policy communications message, not a science communications message (it would take some time before a science message could be formulated to determine whether the policy action was having desired results). Once a problem is perceived as resolved, science communications on the issue become even more challenging: as new information emerges, it is occasionally necessary to begin moving through the issue attention cycle again.

Acid rain currently appears to be in the post-problem stage of Downs' model, despite the fact that environmental damage is still occurring in Canada and occasional news stories report the results of scientific studies on the continuing problem. As Downs predicted, certain institutions and groups set up to deal with the Canadian acid rain problem still exist and function (although some, such as the Canadian Coalition for Acid Rain, have disbanded).

Canadian public interest in the issue of stratospheric ozone depletion rose steadily in the late 1980s, dropped in the early-1990s, but has since risen again. The issue is now one of the top-ranked environmental problems in Canada, according to recent public opinion polls. Again, Downs' prediction regarding the threat of sacrifices needed to solve the problem did not hold, and the threat did not affect Canadian interest in the issue. The stratospheric ozone depletion issue in Canada also defied stage four of Downs' model since it rebounded after decline. The initial decline in public interest may have been due to the development of international agreements to combat ozone depletion, thereby creating a public perception that the problem was under control. Indeed, the communications message from Environment Canada following the signature of the Montreal Protocol in 1987 was that the ozone depletion problem was being addressed. However, the rebound of public interest in ozone depletion indicates the possibility that this issue has not even reached Downs' stage four yet.

Environment Canada interviewees indicated that stratospheric ozone depletion has regained and retained public interest because of constant public health-related reminders. These reminders include daily forecasts of local levels of ultraviolet (UV) radiation as part of weather reports. (A decline in protection from UV radiation is a direct result of stratospheric ozone depletion.) Daily UV ratings warn people to take care in the sun and are a constant public reminder that stratospheric ozone depletion is an issue of concern. In addition, the results of studies examining the status of the ozone hole over Antarctica (the relative size and trends in changing size) are routinely released to the public. There is no equivalent recurring release of scientific information on the effects of many other environmental issues, including acid rain.

Another important factor that interviewees agreed has sustained public interest in depletion of the ozone layer is the fact that all Canadians are affected by the problem of exposure to UV. Most Canadians do not experience the direct effects of acid rain, unless they own a cottage or have access to a lake in specific regions of the country.

In line with the public arenas model, acid rain did not have to compete with other major environmental issues, at least initially, and Environment Canada had the flexibility to devote substantial resources to influencing the profile of this issue within the public arena. Depletion of the stratospheric ozone layer was Canada's second "big" environmental issue. As an emerging issue, however, it had to compete with acid rain (and hence compete for attention and resources both within Environment Canada and with the media) in the public arena.

Many of the interviewees for this study agreed that the media played an important role in delivering the stories of acid rain and ozone depletion to the Canadian public, and hence influenced public interest in these issues. In other words, the media played a key role in agenda setting for these issues.

What Kind of Issues Become Prominent?

Hilgartner and Bosk (1988) argued that competition among issues for public attention results in a situation whereby only simple or dramatic issues gain prominence with the public. Both acid rain and ozone depletion are relatively easy to understand environmental problems, with relatively clear cause and effect relationships and explainable remedies. Studies have shown that an agenda-setting effect exists for unobtrusive issues, such as environmental pollution, with which the public often has had little personal contact and for which they rely heavily on the media for information (Ader, 1995). In these cases, the life cycle path of an issue is dependent on the media. Agenda setting does not occur for more obtrusive issues because the public can rely on their own observations of real-world conditions.

Acid rain, to a large extent, was an unobtrusive issue because most Canadians were not directly affected by the effects of acidification. The media did play a significant role in building and maintaining public interest in acid rain as a high-profile issue in Canada. On the other hand, stratospheric ozone depletion can be seen as a relatively obtrusive issue that affects all Canadians.

There are several similarities among the issue life cycle models and theories reviewed. They all suggest that issues start out as low-key stories that attract little attention from the public. Often, a dramatic or significant event increases public interest past a threshold. Media coverage also increases until it hits a peak when either there is a lack of new information or the public is led to believe that the problem has been solved. Either way, the public begins to lose interest. However, it has also been noted that new information on an issue that appears to be in decline may help to resurrect public interest, even if only for a brief period. Alternatively, an issue can repeatedly increase and decrease in prominence as it is reinterpreted in light of new information or perspectives.

Early communications on both the acid rain and stratospheric ozone depletion issues began as science communication efforts and reflected the state of scientific evidence. In Canada, the acid rain issue crystallized public interest when Canadians realized that cottage properties, as well as central and eastern wilderness areas, were being destroyed by acid precipitation. The stratospheric ozone depletion issue began to resonate with the public following the scientific discovery of the ozone hole over Antarctica and the links between stratospheric ozone depletion and effects of human exposure to UV radiation.

Many interviewees for this study indicated that they felt the acid rain issue disappeared quickly from Canadian public interest because the implicit communications message after the signing of the Canada-U.S. Air Quality Agreement was that the issue had been solved. As the issue progressed through

its life cycle, the communications emphasis shifted from science to policy, and the communications message became primarily a policy message, rather than a scientific one.

In contrast to acid rain, the stratospheric ozone issue has not disappeared from public interest, despite messages concerning the signature of international protocol agreements that could be interpreted by the public as a signal that the issue has been solved. New information concerning the size of ozone holes or the effects of UV exposure has helped maintain public interest in stratospheric ozone depletion.

Other environmental issues, such as global climate change, are not as far along in their life cycles as acid rain and ozone depletion. Climate change is a problem that, in contrast to the two case issues, will require sacrifices by individual Canadians and people across the globe (not just industry) in order to be solved. This issue is now entering the second stage of its life cycle, in that people are aware of the problem and public concern is growing. However, at this point, opinion polls show that climate change has not yet become a major issue in Canada, despite regular media coverage.

Environment Canada Approaches to Science Communications: Cases of Acid Rain and Stratospheric Ozone Layer Depletion

To a certain extent, acid rain and stratospheric ozone depletion have been treated quite differently by Environment Canada from a communications perspective. On the other hand, many of the approaches and tools the Department used to communicate scientific information associated with these issues were similar, consistent, and remain in place today. In both cases, a strong scientific information base was used to strengthen policy actions and the associated public communications strategies.

Science Communications on Acid Rain

Acid rain is often identified as Environment Canada's greatest success from a scientific, policy and communications perspective. Environment Canada was actively involved in the acid rain issue from the Department's formation in1971 until the signing of the Canada-U.S. Air Quality Agreement in 1991. Science and policy activities related to acid rain continue within the Department; however, the issue is no longer a flagship or even a high priority within the Department.

The key characteristics associated with Environment Canada's science communications on acid rain can be summarized as follows:

- The basis for acid rain communications was formulated as a result of substantial scientific efforts and results generated by Environment Canada and published in peer-reviewed literature.
- Environment Canada developed a variety of science communication approaches and tools, targeted to very different yet mutually reinforcing audiences.
- Environment Canada strategically timed the hosting of important science conferences and publication of acid rain science assessments to maintain public and political interest in acid rain.
- Acid rain had very little media competition from other Canadian environmental issues.
- Canadian interest in acid rain peaked at a time when environmental concerns were high (late 1980s).
- Environment Canada identified acid rain as a strategic priority and dedicated significant resources (financial and human) to scientific efforts and to communications.
- A series of successive environment ministers were interested in acid rain and made it a top priority for science, policy action and communications.
- Acid rain was a relatively simple environmental problem, with relatively clear cause and effect relationships and an understandable solution.

- The source of the acid rain problem was relatively specific, and the solution to the problem was easily identified and communicated.
- The Department used consistent science and policy communication messages.
- The Canadian public was interested in the message that acid rain was the result of transborder air pollution from the United States.
- Canada was willing to demonstrate action to rectify acid rain emissions in Canada in order to convince the United States to take similar action.
- The Canadian media played a key role in informing the public about acid rain and in communicating scientific information to the public.
- Communications help came from unexpected places.
- Environment Canada cultivated strategic communications relationships with third parties, which helped increase public and political interest in acid rain.
- Environment Canada directed significant effort into communicating scientific information on acid rain to U.S.-based audiences (including scientific audiences, political actors and the U.S. public).

Early History

Environment Canada was established as a federal department in 1971. Initially, the Department was slow to take an interest in acid rain from a communications or policy perspective. Environment Canada scientists, on the other hand, have been studying the environmental effects of acid rain since the establishment of the Department. The Department's research and monitoring interest in acid rain intensified after 1972. Environment Canada established a lake acidity monitoring program, the results of which were published in 1976, providing evidence of long-range transport of pollutants from the United States to Canada.

Communications by some of the early ministers of the environment also emphasized acid rain. In 1977, Environment Minister Roméo LeBlanc launched a speech with a review of scientific information on the acid rain problem in Canada, a problem he referred to as an "environmental time bomb." Acid rain was in the headlines of major Canadian newspapers in the mid-1970s, but according to staff interviewees, the issue did not firmly enter the public's mind until June 1978, when an article in the *Toronto Star* described acid rain damage in the Muskoka cottage area of Ontario. In 1979, Environment Canada established the Long Range Transport of Airborne Pollutants (LRTAP) program to collect further evidence of acid rain effects in Canada. By the late 1970s, the Department had begun complementing its science communication efforts with media-oriented communications designed to support policy options to address the issue.

Key Science Communication Events and Report

Environment Canada has traditionally used, and continues to use, the mainstream scientific literature and professional science conferences as

communication vehicles for scientific information. One of the strengths of the Department, from a scientific communications perspective, has been the professional reputation its scientists carry. This reputation has translated into strong credibility with the Canadian public and is a core aspect of all departmental science communications.

Throughout the 1970s the Department published findings extensively in the scientific literature. As public, departmental and political interest in the acid rain issue grew, the Department's scientists and science managers increasingly became involved in international or intergovernmental working groups, committees and associations. These mechanisms provided new opportunities to communicate scientific information associated with acid rain, and led to innovative science communication tools, such as state of science reports or science assessments, which could be targeted at learned audiences such as scientific journalists.

One of the early initiatives of the Federal-Provincial LRTAP Science Committee, established at the same time as the LRTAP program by Environment Canada, was to plan and host a 1981 conference in Montreal, "Acid Deposition, Known and Unknowns: The Canadian Perspective." The proceedings of this conference helped synthesize the results of acid rain research conducted in the 1970s and set a new research agenda for the 1980s that would strengthen the case for political action to resolve the issue. In 1985, the federal and provincial governments, under the leadership of Environment Canada, organized and held a major conference, the International Symposium on Acidic Precipitation, in Muskoka, Ontario. The results of the conference were edited by a senior scientist from Environment Canada and in 1986 were published in a special two-volume edition of the journal *Water, Air and Soil Pollution.* The Muskoka Conference involved over 200 scientific presentations and papers from around the world and covered a wide range of issues associated with acid rain. Major news networks and newspapers covered the conference, interviewed participants, and reported key findings to audiences around the globe. The federal LRTAP Office, run by Environment Canada, also produced annual synopsis documents that outlined Canadian acid rain research findings throughout the 1980s.

Acid Rain Communication Messages

Initial communications from Environment Canada concerning acid rain were purely scientific and technical in nature. These communications were used by the media to create popular stories and thus indirectly helped build public interest in the acid rain problem. However, by the early 1980s, the Department began to devote greater effort to acid rain communications directed towards the public and political actors. The Department repeatedly communicated a simple, fundamental message: "What goes up is SOx and NOx; what comes down is

acid rain, which affects our lakes and forests. Here are the sources of the problem...."

As the Canadian public became more interested in the issue of acid rain, new scientific information was built into existing communication messages to address sub-issues such as the effects of acid rain on biota and buildings. These communication messages were specifically designed to get reactions from Canadians and prompt calls for political action. While communication messages concerning acid rain were often based on science, the substantive points frequently had to be communicated in other terms, such as the economic impacts of the problem (how it is affecting tourism and vacation property values, etc.). For the most part, the scientific information that Environment Canada was generating on acid rain was not particularly controversial. No other institutions challenged the science, and Environment Canada was seen as a world-leading generator of scientific data on the problem.

In addition, the Department identified and targeted specific audiences. These included the Canadian and U.S. public, and policy makers or politicians in both countries. Science communications by Environment Canada had a significant and early impact on Canadian politicians and political structures. For example, in 1980 a Sub-Committee on Acid Rain was formed by the Canadian House of Commons Standing Committee on Fisheries and Forestry. The Sub-Committee made extensive use of Environment Canada scientific information and published two key policy-oriented documents on acid rain that helped pave the way for high-level political action in the late 1980s. The Sub-Committee's first report, *Still Waters* (published in 1981) was a comprehensive summary of Environment Canada acid rain monitoring information, the state of public awareness, the economic and social effects of acid rain in Canada (also determined through study by Environment Canada), and the need for joint policy solutions with the United States. *Still Waters* presented 38 recommendations to the Government of Canada. As part of the policy solution and communications message targeted towards the U.S. public, Environment Canada wanted to promote the idea that Canada was making efforts to reduce domestic acid emissions, thereby establishing a "moral upper hand." Domestic communications by the Department made use of new economic and policy research showing that cutting emissions through plant modernization could actually improve economic efficiency and competitiveness in global markets.

Communication Tools and Approaches Used

Throughout the 1980s Environment Canada did not possess legislative instruments to help reduce acid rain emissions. As a result, the Department's objective was to influence and reach agreements with jurisdictions that did possess these powers (e.g. provincial governments, the U.S. government). As a result, communications became very important in order to marshal public opinion

in a way that could influence political actions outside Environment Canada's jurisdiction.

The acid rain communications campaign organized by Environment Canada in the early to mid-1980s was aggressive and made use of several novel strategies. The Department recruited spokespersons from the scientific ranks, who became well versed in the political aspects of the problem as well. Departmental spokespersons also included individuals who could speak about other important aspects of the acid rain issue, such as the economic, social and international political aspects. The Department undertook a conscious and coordinated effort to have these key spokespersons speak about the acid rain issue in many different fora and locations, including the United States and abroad. The purpose of these efforts was to reach different audiences (who could have different types of influence on the issue) with similar messages concerning the science and political resolution options available. Speeches and presentations took advantage of opportunities to present the effects of acid rain in a visual manner. Powerful images of sick fish, dying lakes and eroding statues or buildings in urban areas were used to capture media, public and political attention.

Many federal government departments worked together on acid rain communications. This collaboration resulted in excellent coordination across the federal government from a communications standpoint. An interdepartmental screening committee on acid rain communications was established and subsequently received several merit awards for its information materials on acid rain. The Department of Fisheries and Oceans produced an effective poster depicting a fish in an hourglass under the slogan "Every Drop Counts," which won an environmental award in the United States. A public information document entitled *Downwind: The Acid Rain Story* won a communications design award in 1981. Environment Canada produced another publicly targeted and popular booklet, *The Acid Rain Story*, in 1986. The federally produced film *Acid Rain: Requiem or Recovery?* won some 10 awards, including the top film prize from the U.S. Educational Film Library at the Chicago Film Festival.

Communications officials at Environment Canada maintained steady contact with scientists working on acid rain-related research or monitoring projects, and actively involved these scientists in the development and implementation of communication strategies. Weekly meetings were held at Environment Canada between science, policy and communications officials involved with the acid rain file to plot strategy, compare notes, report important science results, ensure that scientific information was explained to the policy and communication officials and ensure, in turn, that communication or media relations strategies were explained to the scientists.

Environment Canada also took the unique step of funding acid rain communications and advocacy projects undertaken by third parties such as the

Canadian Coalition on Acid Rain (CCAR). CCAR was important because it was a single-issue coalition that brought many groups together (at one point over one and a half million Canadians were members). Environment Canada also funded lobbying and advocacy activities in the United States by an individual who was able to use U.S. political lobbying connections and strong links to wildlife, fishing and hunting interests to advance Canadian acid rain concerns in U.S. political circles.

Environment Canada held regular media briefings on acid rain, and because of the high level of interest was able to secure frequent contact between the media and the Minister of Environment. The Department produced video footage that television stations used in their coverage on acid rain, which helped the Department communicate an accurate and strategic message to the public. The Department also used its connections with national and local weather networks to produce acid rain-related reports that were published in newspapers and shown on television.

The Stop Acid Rain Campaign

A unique aspect of Environment Canada's strategic communications on acid rain involved a campaign-style public communications effort that involved special promotional materials. These communication materials did not focus extensively on the science of the issue, but were important basic information tools used for raising public awareness. The Department found that "Stop Acid Rain" was a catchy phrase that was easy to remember and visualize from a communications standpoint. (Traditionally, a relatively unwieldy term — long-range transport of airborne particles, or LRTAP — had been used to refer to the acid rain problem.) The Department decided to reinforce public recognition of "acid rain" as a key environmental issue by creating a Stop Acid Rain motto and logo. The logo was composed of a red octagon (a stop sign) containing the words "Stop Acid Rain" followed by the recognizable Government of Canada trademark. Promotional materials using the logo and motto included stickers, buttons, toques, umbrellas, billboards targeted at U.S. tourists, fact sheets, technical reports, brochures, radio and magazine advertisements, and films. These materials proved popular; for example, the first (100,000 copies) and second (500,000 copies) printings of *Downwind: The Acid Rain Story* all ran out quickly.

Communications costs associated with the Stop Acid Rain campaign and related departmental communications on the acid rain issue alone were in the range of $700,000 to $1 million per year through the mid- to late 1980s. This level of expenditure far exceeded communication budgets that have since been allocated by the Department to single environmental issues. The film *Acid Rain: Requiem or Recovery?* was made and distributed at a total cost of approximately $1 million. This film could potentially have been just another communications tool produced by the federal government, but after its release it was banned as

propaganda by the U.S. State Department. Media hype resulting from the ban led to public interest in the United States and considerable exposure to American audiences.

Use of Tours as a Communications Tool

Political interest and support for the Canadian policy options being proposed for acid rain were slow to build, despite the public interest in the issue. The Canadian and U.S. governments did sign a Memorandum of Intent (MOI) on Transboundary Air Pollution in 1980. However, the MOI focused largely on the need to conduct further cooperative research on acid rain, and set up several intergovernmental working groups to conduct research and develop recommendations on future emission reduction strategies. Canadian think tanks, such as the C.D. Howe Institute, also began to tackle the intergovernmental aspects, and in 1982 C.D. Howe published a special report, *Acid Rain: An Issue in Canadian-American Relations*, which was written by an American professor at the University of New Hampshire. There were also important international political events such as the International Conference of Ministers on Acid Rain, which was convened in Ottawa and involved several European and Scandinavian countries, but not the United States or United Kingdom.

To build political support for joint Canada-U.S. action on acid rain in the United States, the federal Department of Foreign Affairs, Environment Canada and the Canadian Embassy in Washington arranged for acid rain-affected regions of Canada to be toured by U.S. political advisors, politicians and media. According to departmental staff working on the acid rain file, these Canadian tours were one of the government's biggest communication successes. They were well organized, well rehearsed and well executed, taking advantage of the fact that acid rain was a visible issue affecting key Canadian wilderness areas. Touring Americans cynically expecting Canadian propaganda often changed their minds about acid rain when they met local Canadians who appeared genuinely concerned about the problem. The U.S. media used the tours as a basis for writing about the issue at home, helping to build public support for action on acid rain by the U.S. government.

Canada-U.S. Relations

The unique relationship between the United States and Canada was a significant factor in the unfolding of political action on acid rain. Canadians seemed to take pride in raising political stakes with the United States over the problem of transborder pollution. The banning of the *Requiem or Recovery* film produced a kind of publicity that Canadians enjoy receiving below the border. Canadian federal action on acid rain was extremely popular, since Canada was seen to be standing up for itself internationally to protect its natural heritage.

By the mid-1980s Canadians were convinced of the acid rain problem and had already initiated actions to do something about it (the result of considerable federal-provincial and industry-government negotiations and the development of a federal Acid Rain Program to help fund research on smelter modernization). As a result, much of the federal government's communications effort was concentrated on influencing political opinion in the United States. The U.S. political approach to acid rain, for several years, focused on creating uncertainty from a scientific perspective and calling for more research, rather than costly emission reductions. As in other cases associated with the environment, the uncertainties exploited by the United States tended to fall outside the bounds of general scientific consensus.

In the mid-1980s the United States and Canada established special high-level political envoys on acid rain. These envoys did publish joint reports outlining recent findings concerning acid rain, but policy analysis generally indicates that this mechanism was a stalling tactic employed by the U.S. government to avoid action on emission reductions. However, following the 1991 signing of the Canada-U.S. Air Quality Agreement, which did contain commitments to reduce sulphur dioxide emissions, new monitoring and reporting programs were put in place and annual progress reports were generated. As a result, by the early 1990s a new type of science communications tool — the annual progress report — was born. Environment Canada communications on acid rain ostensibly focused on providing information concerning the implementation of emission reduction strategies as well as whether the desired effects were being observed. Annual reports were also generated for the federal-provincial agreements concerning acid rain reduction strategies.

The Media's Role

A core group of Canadian reporters stayed active on the acid rain story throughout much of its life cycle development. These journalists and writers developed an understanding of crucial scientific information, and were interested in the subject. Environment Canada scientists and other officials working on acid rain were proactive in their efforts to brief these journalists. The relationship between the media and Environment Canada communications staff also became relatively well developed over time. The prominence of the acid rain issue in the media was self-reinforcing. The number of articles on acid rain in *The Globe and Mail* increased steadily after 1978 (Table 1). By 1985, acid rain was also a significant media story in the United States (e.g. that year's International Symposium in Muskoka attracted more than 100 media organizations, including CNN and NBC).

As acid rain evolved from a science news story to a political news story (e.g. U.S.-Canada relations) it became a topic for political reporters, not just

environmental and science reporters. This helped move acid rain off the back pages of newspapers and into the front sections and headlines.

Table 1: Articles with the Words Acid Rain, Acidic Rain, Acid Rainfall, Acidic Rainfall, Acid Precipitation or Acidic Precipitation in *The Globe and Mail*

Year	Number of Articles
(Nov. 14 - Dec. 31) 1977	1
(Jan. - May) 1978	2
(June - Dec.) 1978	19
1979	97
1980	176
1981	261
1982	199
1983	229
1984	339
1985	419
1986	365
(Jan. 1 - Nov. 5) 1987	359

Source: Adapted from Brydges, 1987.

Some examples of how the media covered acid rain include:

1977

- "Acid in Snow and Rain Increasing Every Year; Eating at Houses, Cars." Feb. 28, 1977. L. Dotto, *The Globe and Mail.*

1978-1979

- "Rain of Pollution Killing Our Resort Lakes." June 1978. *Toronto Star.*
- "Science Probes Acid Rain Harm in U.S., Europe." Nov. 15, 1978. AP, *The Globe and Mail.*
- "The Acid Rain Falls." July 17, 1979. *Winnipeg Free Press.*

1980

- "New Environmental Battles Being Mapped Out for the 1980s." Jan. 18, 1980. R. Platiel, *The Globe and Mail.*
- "Border Environment Problems Need Attention, Action Now." April 8, 1980. *Leader-Post.*

Mid-1980s

- "Two New Environment Ministers Facing Crucial Acid Rain Talks." Sept. 6, 1983. M. Keating, *The Globe and Mail.*
- "You'd Pay to Stop Acid Rain, Poll Finds." May 10, 1984. P. McNealy, *Toronto Star.*
- "Canada Tougher on Acid Rain, U.S. Study Says." July 28, 1985. P. Goodspeed, *Toronto Star.*

Mid- to late 1990s

- "Acid Rain Success Story in Peril." Sept. 19, 1993. L. Sweet, *Toronto Star.*
- "Acid Rain: An Environmental Success Story that Isn't." May 24, 1997. A. Nikiforuk, *The Globe and Mail.*
- "Acid Rain Threat Far from Over." June 11, 1997. S. Strauss, *The Globe and Mail.*
- "Acid Rain Problems Refuse to Go Away." Oct. 7, 1997. CP, *Toronto Star.*
- "Acid-Rain Study Review Set: Researchers to Follow Up Link between Pollution, Illness in Leamington Kids." Dec. 4, 1997. D. Schmidt, *Windsor Star.*

Focus by Environment Canada

For many years during the late 1970s and early 1980s several different environment ministers were able to devote significant attention to the acid rain issue. Doern and Conway (1994) noted:

> Acid rain was the DOE's torch of progress in the environmental-policy process. Successive ministers held it high, did their best to advance the cause, and passed it on to the next political champion.

One of the first measures of the uniqueness of the acid rain issue was the appointment of a senior communications advisor for acid rain within Environment Canada. When acid rain research started in earnest in 1979, Environment Canada spent 10-15% of its research budget on communications, according to officials involved with the acid rain file. Said one interviewee, "People often do not realize these funds were as well spent as the science money." No other issue has had so many resources devoted to it, including money, time and people. According to an Environment Canada interviewee, "One reason people hooked onto this thing was that we set out to communicate it very deliberately — right at the very beginning of it." "The most fascinating part," according to another Environment Canada official, "is that the Department was able to keep acid rain on the political agenda without real political progress for over five years" (1980-1985). While political action on the issue may not have advanced, there were scientific and domestic events to cover (the Muskoka Conference, federal-provincial negotiations, etc.) that made Canada look committed. In addition, third parties, such as the Canadian Coalition on Acid Rain, continued to push for

international action. Finally, scientific and political reports concerning European activities on acid rain helped keep the story front and centre in Canada.

Decline of Public Interest in Acid Rain

By the late 1980s, departmental communication efforts on acid rain began to decline in scale and scope. By 1988, Environment Canada had disbanded its office for acid rain. A spurt of acid rain-related communications surrounded the election of George Bush as U.S. president, and the signing of the Air Quality Agreement with the United States in 1991. Following the signing of the Agreement, Environment Canada communications concerning acid rain emphasized policy strategies, such as the Canada-U.S. Air Quality Agreement and federal-provincial agreements, that had been put in place. After 10 years of considerable effort and expense, the Department had difficulty maintaining public interest in a story about an unsolved problem, even though science indicated that the problem continued to exist.

After the Air Quality Agreement with the United States, the communications message concentrated on policy benefits instead of outstanding scientific concerns. In the public's mind, enough progress had been made and, as a result, acid rain was quickly removed as a top-of-mind issue for Canadians. Public interest in acid rain relative to other environmental issues peaked in 1989 and then quickly fell, giving way to other environmental issues such as ozone depletion. Today, the acid rain issue is still around, but the emphasis is on the health effects of particulate matter in urban smog, rather than the long-range transport from U.S. sources. This new perspective has helped give the issue a new focus, albeit not at levels of public interest previously enjoyed.

Despite the decline in public and media interest in acid rain, institutional policy interest and scientific interest (in particular, monitoring of acid rain effects) was maintained throughout the 1990s. In 1990, Environment Canada published the *1990 Canadian Acid Rain Assessment*, the first major national review of acid deposition and its effects in Canada. This assessment provided a thorough summary of current scientific knowledge and gave policy makers a sound factual basis for planning future controls of acidifying emissions. Publications from institutional arrangements continued into the late 1990s, particularly from the Federal-Provincial-Territorial National Air Issues Coordinating Committee and the Acidifying Emissions Task Group (composed of representatives from Environment Canada, other federal and provincial government agencies, the private sector and environmental organizations). In October 1997, for example, the Acidifying Emissions Task Group produced a seminal report, *Towards a National Acid Rain Strategy*, which was submitted to the National Air Issues Coordinating Committee. This report provided input to a subsequent *National Acid Rain Strategy for Post 2000* and documented key scientific findings from recent years, including changes in atmospheric deposition, relationships

between emissions and deposition, changes in aquatic ecosystems and effects on freshwater biology. Also in 1997, Environment Canada coordinated the completion of the *1997 Canadian Acid Rain Assessment*, a second major review of acid deposition and its effects in Canada. The 1997 *Assessment* consisted of five volumes covering up-to-date scientific developments and results concerning atmospheric science, aquatic effects of acid rain, effects of acid rain on Canada's forests, and the effects of acid rain on human health.

Summary

There are several reasons for the Department's science, policy and communications success on the acid rain issue. Some of the success is the direct result of departmental actions and some can be attributed to the characteristics of the issue itself — characteristics such as timing, nationality and economics. Acid rain quickly became a unifying national environmental issue when Environment Canada was established in 1971 and, as a result, significant departmental resources were devoted to it. A core group of dedicated officials, covering communications, policy, science, and media relations, focused on this issue for several years, helping to increase public and political interest. Finally, the science and geography of the issue, as well as the necessary policy solution, were relatively easy (compared to other environmental problems) to explain to Canadians.

One Environment Canada interviewee indicated that acid rain moved quickly off the public attention agenda, not because people got bored with the issue but because the major sources of the acid rain problem were largely dealt with in the Canada-U.S. Air Quality Agreement. A key characteristic affecting Canadian public interest in acid rain, and the desire to see a political solution to the problem, was the source of the problem. Acid rain in Canada was generated primarily by large industrial plants such as Inco, Ontario Hydro and Noranda in Canada and by coal-fired electricity-generating plants in the United States. The issue attracted substantial media and public interest because, relative to Canadian sources, industrial plants in the United States were a far greater source of the acid rain pollution affecting Canada. Acid rain was the first important example of local environmental problems in Canada being caused by faraway sources.

The acid rain issue was also unique among current environmental issues because the Canadian government was the major source of credible scientific knowledge on the topic. As a result, Environment Canada could actively communicate scientific information without entering into lengthy scientific debates within Canada, or even with scientists in the United States. Most debates concerning acid rain, even between the United States and Canada, focused on policy and economic aspects rather than science.

Public interest in acid rain grew when Canadians began to feel personally affected by the problem, either because their cottage properties were threatened or because Canada's wilderness was being harmed by pollution sources from outside the country. While scientific information alone failed to generate substantial public interest in acid rain, communication of scientific information did spark media interest, which in turn led to the personal connections with acid rain.

In many ways, acid rain defined the life cycle approach that the Department has had to emulate in dealing with several other environmental issues. The life cycle begins with science; communications are used to explain the problem and build public support for policy action; controls or policy solutions are implemented; and science is again used to monitor the intended results. Despite the completion of this life cycle, however, an environmental issue such as acid rain can live on — even after policy action has been taken and public interest has declined.

Science Communications on Stratospheric Ozone Depletion

Environment Canada's science communication efforts on stratospheric ozone depletion (in terms of budget, staff or communication output) were less significant than the efforts directed at acid rain in the 1980s. Nevertheless, the Department's science communications on ozone depletion are considered to be a success, perhaps an even greater success than the acid rain communications. The issue has persistently remained in the public arena and is still at the top of environmental public opinion polls.

The key characteristics associated with Environment Canada's science communications on stratospheric ozone depletion can be summarized as follows:

- The basis for communications was formulated as a result of substantial scientific efforts and results generated by Environment Canada and published in peer-reviewed literature.
- Environment Canada developed a variety of science communication approaches and tools, targeted to very different yet mutually reinforcing audiences.
- Environment Canada strategically timed the release of key science assessments and other communication materials to coincide with international political activities associated with stratospheric ozone depletion in order to maintain public and domestic political interest.
- Stratospheric ozone depletion was a relatively simple problem that could be communicated using consistent scientific messages.
- A highly visible environmental phenomenon appeared every year to remind people of the impact of chlorofluorocarbons (CFCs).
- Ordinary Canadians did not have to pay for the solution, which was largely to be found in changing industrial practices and products.

- The media played a role in informing the public about the science of stratospheric ozone depletion.
- Environment Canada cultivated relationships with third parties.
- Environment Canada was able to mobilize concern for the environment through linkages to human health.

Communications of science and policy on stratospheric ozone depletion, like acid rain communications, focused on delivering a relatively simple message that was easy to understand. Communications began in the 1970s, with the scientific postulation of the destruction of the ozone layer and subsequent ban on aerosol CFCs. A different form of communications followed in the mid-1980s after the discovery of the ozone hole and the emergence of political will to eliminate ozone-damaging chemicals.

From a communications perspective, the emerging stratospheric ozone depletion issue had to compete against the more recognizable problem of acid rain for public, departmental and political attention. In the late 1980s a series of emerging global problems, such as transboundary shipments of toxic waste, airborne transport of toxic substances, climate change and deforestation, were also beginning to compete for attention within Environment Canada, as well as with the Canadian public. As a result, the Department could no longer devote the same level of attention to single issues as it did with acid rain.

The scientific determination of a cause-effect linkage between depletion of the ozone layer and the increased risk of developing skin cancer made Canadians personally interested in the issue. With the discovery of the ozone hole over Antarctica, Canadians became even more concerned about the threat of stratospheric ozone depletion to their health. The recurring nature of the ozone hole triggered annual coverage using strong visual imagery. The discovery of the ozone hole, and the subsequent communications monitoring its size and placement, considerably raised Canadian interest in the issue.

Although industry was still targeted as the main source of the ozone depletion problem, Canadians could not direct their efforts to fix the problem solely at the United States. Twenty-six countries produced the CFCs that were causing stratospheric ozone depletion, and all countries used CFCs directly or indirectly in common products such as refrigerators. Unlike the acid rain problem, which mainly involved Canada-U.S. relations, stratospheric ozone depletion was an international problem that could be remedied only by a global solution requiring cooperation rather than competition.

An important aspect of the ozone depletion issue was the action taken to ban aerosol CFCs in the 1970s, even before the science establishing the cause-effect relationship was absolutely solid. In 1987, Canada became the first country in the world to focus on the Arctic ozone layer, following the discovery of

the ozone hole over Antarctica. Ozone thinning in the Arctic is greatest during the winter months, when research must be carried out in 24-hour darkness and in temperatures that regularly dip to –40°C. To assist scientists working in these harsh northern conditions, Environment Canada built a scientific ozone laboratory at Eureka, on Ellesmere Island, a remote weather station less than 1,000 km from the North Pole. Opened in 1993, the observatory has enabled researchers to carry out intensive studies of the Arctic ozone layer and has now become a centre for international research.

Environment Canada also operates a network of cross-country monitoring stations that have kept continuous watch on Canada's ozone layer for more than three decades. The early records, which were taken before any major human influence on the ozone layer, are vital to understanding the changes that are occurring today. Continued scientific research is essential to gain a better understanding of the depletion of the Arctic ozone layer and how it may affect the rest of Canada. The ozone layer must also be closely tracked to determine the effectiveness of the actions taken to reduce ozone-depleting chemicals.

Early History

Stratospheric ozone levels have been monitored since the 1960s in international studies aimed at understanding the relationship between the stratosphere and weather phenomena on the ground. In 1974, two U.S. scientists published research on the effects of nitrogen oxides from high-flying supersonic aircraft on stratospheric ozone and postulated that CFCs could be destroying the protective ozone layer. The publication of this hypothesis and subsequent measurements to test its validity brought the issue of ozone depletion to the public's attention for the first time.

The stratospheric ozone question was the subject of considerable research involving a broad range of countries, including the United Kingdom, Germany, France, Japan, the United States and Canada. Canada's contributions to ozone science quickly became significant despite the relatively small degree of scientific resources available to address the issue. Canadian scientists were able to demonstrate substantial degradation of the ozone layer. The Brewer spectrophotometer, developed in Environment Canada's laboratories, became the standard ground-based instrument for measuring stratospheric ozone and UV-B radiation on the ground. After five years of measurements with this instrument, two Environment Canada scientists demonstrated that UV-B radiation had increased along with a depletion of the stratospheric ozone layer.

Considerable scientific activity in the 1970s led to Canada joining with the United States and Nordic countries to institute a precautionary ban of aerosol CFCs, despite the fact that the issue was still a theoretical problem. No other

environmental issue had ever been tackled in such a precautionary manner, where the solution was begun before the problem was thoroughly defined.

Environment Canada Communications on Ozone Layer Depletion

With the emergence of scientific concern, the communications message focused on the potential environmental problem, urging a precautionary approach to err on the side of safety. The related policy thrust was to recommend the prohibition of CFC-containing aerosols for which substitute propellants already existed. Later communications messages included more human health factors, such as the need to avoid overexposure to the sun (especially at peak hours of intensity). Today the message has been expanded to include information about the effects of UV exposure on terrestrial and marine ecosystems, and the related dangers to food webs.

The stratospheric ozone depletion issue was the first environmental problem that was widely touted as having intergenerational implications, since the children and grandchildren of current generations would be affected by ozone depletion problems being caused at present. According to Environment Canada interviewees, the intergenerational aspect of the issue gave it a certain gravity. It raised for the first time the issue of responsibility of current generations toward future generations. The idea of mortgaging our children's future captured the public's interest and attention.

Initial communications from Environment Canada concerning stratospheric ozone depletion were purely scientific and technical in nature. These communications contributed to international knowledge on ozone depletion (and the resulting international media attention). They were used by the Canadian media to create popular stories and thus they indirectly helped build public interest in the problem. Environment Canada adapted many of the strategies it had used for communicating about acid rain to the ozone depletion issue. Simple messages emphasized the chemical reaction between man-made chemicals and molecules making up the protective ozone layer. The related public health implications were also the focus of simple communication messages.

Environment Canada identified and targeted specific audiences for its science communications. These included the Canadian public and policy makers, but also the international scientific community and non-government environmental groups both in Canada and abroad. Throughout most of the 1980s, the Department's science communication efforts focused on providing technical input to science assessments conducted through international institutions such as the World Meteorological Organization and the United Nations Environment Program. These communications took the form of published papers, scientific presentations, and participation on scientific advisory or technical panels. The target audiences for these communications were the international and domestic

political actors who needed to take initial precautionary action on CFCs. Secondary but important audiences were the scientifically advanced non-government environmental and public health advocacy organizations that could make use of the scientific information to press for international political action. A third audience for the more technical science communication efforts were the industrial institutions producing ozone-destroying chemicals. Clear scientific communications could encourage major CFC-producing firms to recognize the problem and develop corporate strategies to develop substitute products that did not interfere with the ozone layer.

Following the signing of the Vienna Convention and the Montreal Protocol to control and reduce the emission of ozone-depleting substances, Environment Canada initiated significant communications efforts to further educate the public about the science and effects of ozone layer depletion. These efforts helped Canada to maintain political interest in enforcement of existing international agreements and to press for further international actions needed to address outstanding issues related to ozone layer depletion.

Communication Tools and Approaches

Environment Canada did not establish a specific office to handle communications and policy aspects associated with stratospheric ozone depletion. However, the Department did employ a concerted effort to coordinate science, policy and communications officials working on the ozone depletion file. Science and policy briefings were routinely held with journalists. To prepare for press conferences associated with the Montreal Protocol, for example, the Department organized detailed science question and answer sessions so that journalists developed a basic understanding of the science and cause and effect relationships associated with stratospheric ozone depletion.

Environment Canada staff working on stratospheric ozone depletion also briefed members of non-government organizations, such as Friends of the Earth, so that they could help inform the public and solicit political action. Some Environment Canada officials indicated that they often hand-delivered information to newspapers (e.g. the *Ottawa Citizen*), beginning in 1984. Since this material was prepared with the public in mind, it was often extensively used by the recipients. In 1989, the Department widely distributed a document entitled *Preserving the Ozone Layer: A Step Beyond,* which outlined options for meeting Canada's objectives to eliminate emissions of controlled ozone-depleting substances within 10 years. In the early 1990s, Environment Canada began producing an annual report, *Canada's Ozone Layer Protection Program*, which outlined scientific discoveries made and management actions taken over the previous year. As in the case of acid rain, the House of Commons examined the issue of ozone depletion through the Standing Committee on Environment. In 1992, the Standing Committee published *Ozone Depletion: Acting Responsibly*. The report

provided summaries of the scientific evidence of ozone depletion, the potential effects of ozone depletion and technical and policy advances to address the problem, as well as a list of further recommendations for the government.

Promotional materials like the acid rain toques and umbrellas were not developed as part of ozone depletion communications, and the Department did not employ political lobbyists or provide issue-specific funding to environmental groups as it did on the acid rain file. However, the Department did create stratospheric ozone fact sheets, primers, notes for schools, and articles for newspapers. The federal Green Plan helped to fund a series of brochures, radio messages and educational materials under the common theme "Guarding Our Earth — Ozone." One brochure depicted the earth sitting (under an umbrella and wearing sunglasses) on a blanket of clouds, and was titled rhetorically *The Ozone Layer: What's Going On Up There?* Another Green Plan document was entitled *The OZONE Paradox — What is It? Where is It? Too Much or Too Little?* The Department also contracted the development of an ozone logo for the Montreal Protocol that is now used around the world and is evidence of Canada's leadership role in the Protocol. Under the federal Green Plan, Environment Canada made ozone depletion a central plank in its State of the Environment Reports, and published special reports and fact sheets that showed scientific trends and indicators for the state of the ozone layer.

In 1997, Canada hosted the 10th anniversary meetings of the Montreal Protocol. In preparation for these meetings, Environment Canada initiated the development of a number of science communication materials concerning ozone depletion. The Department sponsored a cost-benefit survey of the Montreal Protocol, which demonstrated that avoided health care costs greatly exceeded costs to generate ozone-friendly substances and ban ozone-destroying chemicals. The Department also published *Ozone Science: A Canadian Perspective on the Changing Ozone Layer*, which provided a comprehensive, up-to-date scientific assessment of Canadian science results concerning ozone layer depletion and the effects of UV-B on the Canadian environment and public health. Finally, in 1998, a research and development impact study was conducted to determine the economic and social (public good) benefits of Environment Canada's investment in stratospheric ozone research since the 1970s.

UV Warnings and Ozone Watch

Two important and innovative science communications tools developed by the Department were UV forecasts and Ozone Watch. These tools were used to inform Canadians, raise and maintain Canadian interest in and awareness of the effects of stratospheric ozone depletion, and encourage changes in behaviour (e.g. reduced exposure to the sun). Both of these tools were successful science-based communication mechanisms.

UV warning forecasts were initiated in 1992. These were implemented after U.S. government scientists predicted low stratospheric ozone levels and Canadian Environment Minister Jean Charest made a public comment about keeping children out of the sun. The Minister's remarks caused a certain level of panic among the Canadian public, and hastened the Department's planned implementation of public UV forecasts and warnings. The UV forecasts and warnings were broadcast on television and included with weather forecasts in other media. The warnings complemented educational efforts by the Canadian Dermatology Association, the Canadian Cancer Association and other advocacy groups. The UV warnings are still used in Canadian weather forecasts today. Similar programs, based on the Canadian model, have since been established in other countries.

The Media's Role

As with the acid rain issue, the Canadian media played a large role in getting scientific information on stratospheric ozone depletion out to the public. This was partly because of the relationships and trust built by Environment Canada with key journalists such as Eve Savory and Michael Keating. According to departmental interviewees, the media's coverage of the ozone hole over the Antarctic was the main factor in convincing the Canadian public that stratospheric ozone depletion was a serious problem.

Many of the science journalists who covered the acid rain issue also covered stratospheric ozone depletion. However, over time, as more environmental issues developed, less media coverage could be devoted to each one. Media attention on stratospheric ozone helped to influence industry in two ways: by fostering consumer demand for "ozone friendly" substitute products and by applying public pressure for government involvement in the development of international agreements, as well as domestic actions such as banning the production or importation of certain ozone-destroying chemicals. Media attention also helped raise the profile of actions taken by industry to produce substitute products or change technological practices.

Some examples of how the Canadian media covered the stratospheric ozone depletion issue include:

1974-1975

- "Sprays under Pressure for Environment Damage." Feb. 6, 1974. Reuter: *Gazette.*
- "Ozone Layer May Be Threatened by Aerosol Cans, Chemists Warn." Aug. 21, 1974. L. Dotto, *The Globe and Mail.*
- "Study Verifies Fears of Scientists of Threats to Ozone from SSTs [Supersonic Transport Aircraft]." Mar. 10, 1975. L. Dotto, *The Globe and Mail.*

1976

- "Aerosol Ban? U.S. Ruling that Spray Can Gases a Hazard May Have Repercussions in Canadian Industry." Sept. 14, 1976. P. Cook, *Ottawa Citizen.*

1985

"20 Nations Sign Pact to Protect Earth's Ozone." Mar. 23, 1985. M. Keating, *The Globe and Mail.*

1986

- "Is Thinning Ozone World Threat? Scientists Venture to South Pole to Determine if Loss of Sky Shield Foreshadows Beginning of the End." Oct. 25, 1986. J. Miller, *Toronto Star.*

1987-1988

- "Negotiators Reach Pact to Protect Ozone Layer." Sept. 16, 1987. M. Keating, *The Globe and Mail.*
- "Business Seeks Way to Conform to Ozone-Protecting Regulations." Jan. 14, 1988. C. MacKenzie, *The Globe and Mail.*
- "Two Chains May Follow Provigo and Pull Ozone-Destroying Packaging." Feb. 20, 1988. R. Boychuk, *Gazette.*

1992

- "Keep Children out of the Sun, Charest Warns." Feb. 8, 1992. P. Poier and S. Strauss, *The Globe and Mail.*
- "First Weekly Ozone Warning Issued." Mar. 12, 1992. G. York, *The Globe and Mail.*
- "Skin Cancer Rate Soars." Mar. 25, 1992. S. Kirkey, *Ottawa Citizen.*
- "Ozone Outlook: Daily Forecast to Report Sun's Hazard." May 28, 1992. T. Spears, *Ottawa Citizen.*
- "'Last Chance' Talks Aim to Save Ozone." Nov. 18, 1992. *Toronto Star.*

1996

- "Meeting Addresses Ozone Damage." Nov. 23, 1996. J. Stackhouse, *The Globe and Mail.*

1997-1998

- "Journey to Repair the Ozone Layer Is Far from Over." Dec. 3, 1997. A. Lindgren, *Ottawa Citizen.*
- "Canadians 'Too Complacent' about Ozone Depletion. May 15, 1998. A. Duffy, *Ottawa Citizen.*
- "20 Years before World Knows whether Ozone Layer Will Recover: Study." June 22, 1998. *Agence France Presse.*

The ozone depletion issue is still covered in the media today. Many of these reports are updates on the status of the ozone layer. Despite the relative maturity of the issue, however, the scientific information associated with media reports can paint a confusing picture for the public. For example, recent examples of contradictory reports include:

- "Ozone Hole Growing." Nov. 28, 1996. *Gazette.*
- "Ozone Layer Shows Signs of Recovery." July 4, 1997. CP: *The Globe and Mail.*
- "Arctic Ozone Levels Way Down." Sept. 9, 1997. M. Abley, *Gazette.*

Summary

Despite a limited budget for communications on stratospheric ozone depletion compared to acid rain, several interviewees from the Department indicated that public interest was generated and maintained because of the "almost religious fervour" associated with the issue, as well as the dedication of the staff to an issue they felt a personal (as well as professional) commitment to help resolve. The public felt it had a personal stake in the stratospheric ozone depletion issue after learning about the links between ozone depletion, increased exposure to UV-B, and the skin cancer-causing effects of increased UV-B exposure. UV forecast warnings and the UV Index pioneered by the Department became important communications tools that maintained public interest in the issue. The intergenerational nature of the problem, and the relatively small size of the industrial sector required to change production practices, also helped generate political pressure to resolve the problem.

Life Cycle Analysis

The stratospheric ozone depletion issue initially gained attention in the 1970s when scientific study determined that aerosol CFCs held destructive potential for stratospheric ozone and should be banned. Following political action to ban these substances in Canada, the United States and Nordic countries, the issue rose to prominence in the mid-1980s after further scientific study determined that the atmospheric lifetime of ozone-destroying chemicals could be as long as 350 years. The serendipitous scientific demonstration of the ozone hole over Antarctica (and later over the Arctic), combined with reports of ozone layer thinning around the country, significantly mobilized public interest and concern.

During the mid-1980s, the stratospheric ozone depletion issue was able to garner enough public and scientific support to generate an initial, albeit incomplete, international agreement (the Montreal Protocol) to phase out ozone-depleting substances. Further scientific study and communication of research

and monitoring results following the Protocol led to ever-increasing levels of public support for additional international regulatory actions. As a result, by the early 1990s, the political will was found to upgrade the Protocol to include a full ban on CFCs and other ozone-depleting substances.

In 1992, with the implementation of UV warnings as part of weather forecasts, the ozone depletion issue was cemented in the public's consciousness. Growing concerns about the human health effects associated with environmental problems such as stratospheric ozone depletion have helped keep this issue high on the public agenda, despite policy responses that have been put in place. Public attention on the stratospheric ozone depletion issue faded somewhat during the early to mid-1990s, as did public interest in all environmental issues, but it has since risen again in the late 1990s. By 1997, stratospheric ozone depletion was the number one environmental issue identified by the Canadian public (Synergistics, 1997).

Conclusions: Lessons Learned from Environment Canada's Communications Experience with Acid Rain and Stratospheric Ozone Depletion

Since its founding in 1971, Environment Canada has had to steadily increase its scientific capacity and policy activities to handle a growing variety of environmental issues. The Department's successful experience with acid rain, from a policy perspective, was due in large part to the strong scientific efforts that could be directed towards the issue, as well as the substantial investment made to influence public opinion and political action. Depletion of the stratospheric ozone layer, like many environmental issues today, had to compete harder for attention within the Department and at a political level. Nevertheless, the Department developed some innovative communications approaches and was successful (without large budgets) in raising public interest and influencing political action on the problem.

Science Communication Strategies

Can the success of science communications on an environmental issue be predicted beforehand? Most interviewees and literature on the subject agree that prediction in this area is difficult, as success in communications (like success in science) often depends on serendipity. However, a few guidelines for successful science communications have been identified:

1. Keep science communication messages simple and as consistent as possible.

2. Avoid confusing science and policy messages if at all possible, but ensure that science and policy messages are clearly linked.

3. Try to establish a personal stake for individuals to identify with. Public health is an example of a growing concern that can be linked to environmental issues.

4. Build science communication relationships with the media.

5. Internal communications and strategic planning between policy, communications and science people are extremely helpful to science communications.

6. Maintain a constant scientific effort that can produce information to be communicated to key audiences.

7. Constantly search for innovative science communication tools and approaches, or look at other successful science communication strategies that can be applied to the issue.

In addition, many of the people interviewed for this report suggested communications lessons and strategies that can be drawn from the experiences with acid rain and ozone depletion:

1. Keep the message simple, even if the issue is complex from a scientific perspective. If there is a clear goal it is helpful to communicate the goal while communicating scientific aspects.

2. Craft the message in a way that the largest number of people can relate to it from a personal perspective.

3. Informative and frequent communications on key environmental issues are a prerequisite to the creation of the political will needed to keep the issue in the public eye and remedy the situation.

4. The communications message has to have a strong scientific basis (scientific consensus has been established) and scientists have to be involved in communicating this message.

5. The communications message should focus on cause rather than effects if possible; effects can often be due to many factors.

6. Communications should determine the weaknesses or knowledge gaps that exist in the scientific aspects.

7. The aim of communications should be to create public interest, a well-informed public, and the political will to change a situation or create policy responses.

8. Scientific information concerning environmental protection and public health protection should be cast in the context of risk management.

9. Science communications on environmental issues should be tailored to avoid or overcome the disillusionment of people who think environmental issues can be resolved more quickly.

Publication in the scientific literature and presentations at technical conferences generate the professional credibility needed to speak authoritatively as an institution about the issue in question. Often, published results or conference presentations are directly picked up by the media and turned into accessible stories that create public interest. Science assessments, monitoring reports,

trend analyses and other "synthesis" types of documents are useful for communicating complex information to specialized members of the media, policy makers, and groups of interested individuals (environmental groups, industry associations, community interest organizations, etc.). The production of simple and easy-to-understand science communication materials is also important. These can be directed at audiences that have no prior interest in an issue in order to generate curiosity and encourage media pick-up.

Life cycle analysis also yields important lessons. The message to Canadians concerning closure on the acid rain issue was a policy communications message, not a science communications message (it would take some time before a science message could be formulated to determine whether the policy action was having the desired results). Once an issue is perceived as resolved, science communications on the issue become even more challenging; as new information emerges it is occasionally necessary to begin moving through the issue attention cycle again.

Media Relations

Relationships between Environment Canada scientists, policy and communications staff, and journalists were, and continue to be, an important aspect of science communications. A journalist who had many years of experience covering air-related environmental issues indicated that he relied heavily on Environment Canada scientists for information. Not only did he go to the Department, but the Department also sought him out when there was important news. Journalists were occasionally critical of the Department in its handling of the acid rain and ozone depletion files, but more often the two groups worked together as allies in a mutually beneficial relationship.

Today, the number of science reporters at major media outlets is small, and many newspapers have only one science reporter or none at all. Beat reporters are becoming scarce because media outlets cannot afford to maintain specialists to cover environmental or science issues. Television and radio are even less likely than newspapers to have specialist reporters because their production costs are higher. Financial constraints can also lead to less space for subjects that aren't considered as newsworthy as others. This situation makes the development of relationships between Environment Canada, as a source of scientific information, and the various media even more important. The relationship has to be clarified, however, in order to avoid charges that the Department is issuing propaganda or misusing scientific information, and to ensure that providers of information are able to do so in a balanced manner consistent with official departmental policy and the position of the Minister.

New media may play a role in increasing science coverage in the future. For example, Discovery Channel Canada's newsmagazine show, *@discovery.ca,*

often features Canadian government science in its coverage of science news. The Internet is also taking on a more prominent role as a news medium. In the future, the Department will have to continue to be innovative in the ways it makes use of tools such as the Internet and television to communicate its science-based messages.

Current Communications Approaches and Challenges

Perhaps one of the most significant lessons that can be learned from the case studies is the importance of Department-wide commitment to strategic planning, resourcing and implementation of science communication efforts for priority issues. Strategic science communication approaches can be difficult to sustain on a diverse range of issues. Environment Canada continues to be innovative in the tools and approaches it uses to communicate scientific information to Canadians. The Department's Green Lane Internet site has become a major communications tool, and special subsites have been developed for specific issues such as stratospheric ozone depletion and acid rain. The Department has also integrated science communications on a wide variety of environmental issues with new tools such as the *Enviro-tipsheet,* Planet Update radio series, *Science and Environment Bulletin,* and Discovery Channel series of television vignettes. These tools, each targeted towards unique audiences, allow the Department to rotate scientific stories on different issues over time. As a result, the Department has become increasingly sophisticated in its efforts to communicate science, making use of diverse new approaches and technologies, cost-saving measures, and Department-wide (not issue-specific) publications.

Perhaps Environment Canada's greatest science communications strength lies in the credibility of its scientists as communicators. Building on this established credibility with the public should continue to be a priority effort. Providing opportunities for young scientists to learn suitable communication skills, gain media training, mentor with established science communicators, and acquire their own experience through interacting with journalists and communities in interviews or meetings should be a priority of the highest importance for Environment Canada.

Research studies conducted on behalf of the Department during the past few years demonstrate the high degree of interest Canadians have in science-related environmental issues. New science communication approaches need to be constantly proposed and tested in order to reach certain audiences, such as young people, interest groups, eco-communities and specific socio-economic classes. The entire spectrum of new information technologies could be put to greater use in the Department's science communication efforts.

The diversity of programs and interests among Environment Canada's audiences necessitates the use of credible, effective and decentralized — but not

necessarily costly — communication techniques. Although almost every Canadian listens to at least one meteorological bulletin a day, data from other sectors of Environment Canada change frequently and are much more difficult to grasp. To successfully pass on departmental objectives, such as reaffirming the government's commitment to the protection of the environment in order to ensure the health and well-being of current and future generations, the ongoing identification of target audiences is of prime importance.

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Appendix A: Brief Acid Rain Timeline

Early 1970s	Definition of problem: scientific studies
1975	Muskoka lakes study
1978	*Toronto Star* article on resort lakes dying
1979	Initial attempts to solve problem: LRTAP started
1980	Canada and U.S. sign Memorandum of Intent
1981	Formation of Canadian Coalition on Acid Rain
1985	Muskoka Acid Rain Symposium
1991	Signature of Canada-U.S. Air Quality Agreement, Acid Rain Coalition disbands
1990	First Canadian Acid Rain Science Assessment published
Mid-late 1990s	Scientific study suggests problem persists
1997	Publication of 1997 Canadian Acid Rain Science Assessment
1997	Development of Canada-Wide Acid Rain Strategy for Post-2000

Appendix B: Brief Ozone Layer Depletion Timeline

1974-1975	Definition of problem: research on CFCs depleting ozone layer — heavy media coverage
1975	First attempts to solve problem: Johnson (U.S. largest manufacturer of household aerosol products) announced it would end its use of CFCs immediately
1978	Continuing efforts: U.S. became the first nation to take precautionary action by banning use of CFCs as propellants in most aerosol products (Canada, Norway, Sweden followed)
Mid-1980s	Attention turned to foam food packaging, media headlines
1985	International cooperation: Vienna Convention for Protection of Ozone Layer
1986	Discovery of Antarctic ozone hole
1987	Montreal Protocol signed by 24 countries on Sept. 16
1990	London conference (June — to strengthen Montreal agreement)
1992	First weekly ozone warning issued on March 12th. First daily UV readings provided in May
1992	Copenhagen talks (Nov. — to strengthen Montreal agreement again)
1993	Low ozone values reported
1996	Ozone Summit in Costa Rica
1997	10th anniversary of Montreal Protocol. New agreements signed. Publication of Canadian Ozone Science Assessment
1998	Ozone layer depletion identified as number one environmental issue of public concern in Canada

Appendix C: Public Opinion Polling

Environment Canada Strategic Policy and Communications has tracked polling since 1989. Trends can be determined despite the fact that different pollsters with different questions were used.

Angus Reid polls show that acid rain was the top environmental concern in 1989, but fell to second place in 1990, and then to third in 1991 (Table 2). Meanwhile, ozone depletion rose from the late 1980s to take first place by 1992. Air pollution also rose as a top concern, taking over from acid rain. Global warming remained in fourth place.

Table 2: Angus Reid Polls — Percentage Saying "Top Environmental Concern"
(rank in parentheses)

	1989	1990	1991	1992	1993
Acid rain	(1) 28%	(2) 22%	(3) 10%	(3) 7%	(3) 5%
Ozone depletion	(2) 21%	(3) 20%	(2) 20%	(1) 33%	(1) 35%
Air pollution	(3) 21%	(1) 28%	(1) 30%	(2) 32%	(2) 29%
Global warming	(4) 4%	(4) 7%	(4) 7%	(4) 4%	(4) 4%

A 1994 Synergistics poll showed a continuation of this trend, with climate change taking over third spot from acid rain (Table 3). The 1995 numbers should be viewed cautiously, since the questions focused on the provinces and the total percentages listed add up to only 22% — it is probable that local environmental problems were listed over global ones.

As revealed in these polls, air pollution and ozone depletion have consistently been the top two environmental concerns of the Canadian public since 1991. The author suggests a health-environment link with these two issues. In contrast, acid rain and global warming do not appear to have this link. He points out, however, that acid rain rated high in the late 1980s, probably due to heavy media coverage. Its popularity sharply decreased after 1990, and today it is not a major issue at all.

Health concerns are definitely influencing the way Canadians look at the environment. Insight Canada Research noted in 1996 that "Focus group participants perceived the environment as a human health issue first and

foremost. In fact, it is the specific first-hand knowledge of and experience with health problems related to perceived air quality that lead to its precedence over water quality in the minds of many respondents."

Lack of a link to human health, along with decreased media coverage, could help explain why acid rain is not high on the public agenda today. In contrast, the ozone layer is still a key issue in people's minds. Air quality is the current top environmental concern for Canadians.

Table 3: Synergistics Polls
(rank in parentheses)

	1994 (% saying greatest atmospheric concern)	**1995** (% saying greatest environmental issue facing province — average for Canada)	**1996** (% very concerned)	**1997** (% saying greatest atmospheric concern)
Acid rain	(4) 4%	(3) 2%	not listed	(4) 3%
Ozone depletion	(1) 38%	(2) 3%	(2) 55%	(1) 34%
Air pollution	(2) 26%	(1) 17%	(1) 58%	(2) 26%
Climate change	(3) 8%	not listed	(3) 36%	(3) 13%

Note: The questions differed from year to year.

Canadians' Public Policy Issues Agenda — Angus Reid

The environment as an issue peaked in July 1989, when it was the number one issue on the minds of Canadians. Since then, however, levels have declined to those seen before 1989. In comparison, concern about the deficit and public debt inversely grew in relation to concern about the environment. In November 1997 the top issue on the Canadian public agenda was unemployment and jobs.

The Environmental Monitor

In 1998, when Canadians were asked (unprompted) to name the two most important problems facing Canada, environment tied for fourth place on the list (12% of mentions), after national unity/other national problems (18%), unemployment/jobs (38%) and economy/debt/taxes (44%). Environment tied with political problems/corrupt or bad government. Half of Canadians think ozone depletion is a bigger problem than climate change; this is a decrease from past years (ozone depletion peaked in 1992 at 69%). Meanwhile, concern about climate change is rising.

Canadians and the Environment 1997 — State of the Environment Citizenship: A Report to Environment Canada

According to this Environics-generated report, the economy and unemployment continue to dominate as top-of-mind issues, and environment has fallen off, with less than 1% naming it as the top problem. However, environmental concerns are still present. In 1997, 91% of Canadians said they feel either a "great deal" or "fair amount" of concern.

Environics expects a new wave of environmental concern within the next five years (i.e. by 2002). Rising health concerns, falling trust in commitments from industry and government organizations, and global atmospheric concerns indicate there may soon be another "breach of trust" between Canadians and their institutions, similar to the 1988-89 period.

When asked to name the two greatest threats to future generations, 86% of respondents chose "environmental pollution" and "depletion of natural resources" from a list of five possible threats.

Gallup Polls

Until 1980, "Environment" did not appear as a category in the indexes; when it did appear, it was a combined "Energy/Environment" category. Polls of the "most important issue" did not include the environment as a choice until 1987. Gallup polls indicate that the environment peaked as the most important issue in 1989.

The polls concerning the environment did not ask the same questions throughout the years, so patterns can only be hypothesized. Acid rain first appeared in a 1980 poll, and there was strong awareness of acid rain in the early 1980s. However, specific mentions of acid rain disappear after 1989. Ozone layer depletion appeared in 1989. Support for the issue declined in the early 1990s. There was high awareness of pollution all the way through.