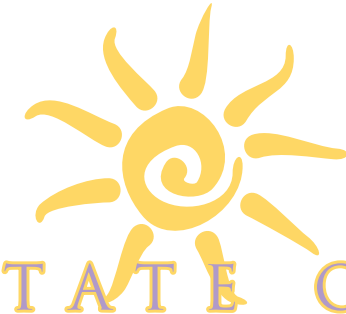
THE STATE OF THE
Nova Scotia Environment 1998



THE STATE OF THE Nova Scotia Environment 1998

Nova Scotia Department of the Environment
July 1998

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The production of the 1998 State of the Nova Scotia Environment Report was made possible through the collaboration of a number of government departments which served as a Steering Committee.

The Steering Committee

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The contribution of each member of the Committee is gratefully acknowledged.

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The Advisory Group

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The contributions of the members of the Advisory Group greatly enhanced the quality of the report. The time taken, and the investment made, by each member is gratefully acknowledged.

Editor: Joseph Szostak

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Message from the Minister

It is an honour for me to present to the people of Nova Scotia this first report on the state of the province's environment. It focuses on three aspects of our environment: air, water, and waste management. A series of additional reports produced in collaboration with other government departments, industry and community groups will be released in subsequent years to eventually cover all components of our natural environment.

Nova Scotia taxpayers have a need and right to know how well we are managing the environmental resources of this province. Their future, and the well being of future generations of Nova Scotians, will depend on how wisely we manage our land, air and water resources both for our use and enjoyment and for the health and maintenance of the myriad of plant and animal life that constitute our natural environment.

This report takes stock of where we are with respect to air and water quality and waste management. It points to progress and our numerous successes in restoring and maintaining environmental quality within this province, but as well, it provides an honest assessment of the concerns we still face. In this regard the state of the environment report provides a path forward in that it sets out those issues which still require action and resolution. This report just as importantly, defines our future monitoring effort and indicates what must be watched if we are to successfully track our progress in protecting our environment.

Government's responsibility for the protection of Nova Scotia's environment and the wise management of our natural resources is a task that cannot be ignored or taken lightly. It is my belief that state of the environment reporting is a means of documenting how well this task is being performed. Hopefully, it will also prompt a better understanding of how all Nova Scotians may share in this effort.

Honourable Donald R. Downe
Minister of the Environment
Province of Nova Scotia

INTRODUCTION

CHARTING A NEW COURSE: STATE OF THE ENVIRONMENT REPORTING

A Framework for Environmental Reporting

With the passage of the new Environment Act in 1995, the province committed itself to report to the people of Nova Scotia on the quality of the environment. This is part of a larger context of moving in the direction of sustainable development.

The province has initiated a program of State of the Environment Reporting (SOER). SOER provides a public reporting system that documents and evaluates the health of the environment and reports on how it is changing in response to human activities. SOER can serve several important goals:

- To assist Nova Scotians in judging whether our collective actions are having the desired environmental effect and to adjust our management practices and approaches accordingly;
- To act as an early warning system, identifying persistent or emerging environmental problems, and pointing to actions government, industry and communities must take to protect our environment for future generations;
- To identify knowledge gaps and provide criteria for what must be tracked;
- To provide a means for Nova Scotians to hold government departments accountable for meeting their stated environmental objectives.

SOER attempts to answer the following questions regarding the environment:

- What is happening in the environment?
- Why is it happening?
- Why is it significant?
- What are we doing about it?

For a detailed overview of the SOER program, the document “A Collaborative Framework for SOER in Nova Scotia” can be found at the Nova Scotia Department of the Environment web site on the internet.

One of the key features of the program is collaboration and partnership. The first SOE report was developed with the assistance of a Steering Committee comprised of provincial and federal government agencies. Advisory input was also provided through a committee of NGOs.

The 1998 State of the Environment Report

The 1998 State of the Environment Report deals with air, water and waste resource management. (Subsequent reports will cover land resources, biota, and coastal and marine ecosystems). While this is the initial step toward comprehensive SOE reporting, the report is not itself comprehensive. It is based on data currently available. The province has not traditionally conducted extensive environmental effects monitoring; this report identifies the data gaps, and initiates discussion on what key indicators must be monitored in the future, if government is to report on environmental trends.

Within the context of these limitations, the 1998 State of the Environment Report provides a brief look at the progress Nova Scotians have made in protecting the environment over the last 25 years, and attempts to give an accurate assessment of the concerns we still face. It provides Nova Scotians with a snapshot of the environment in several key areas and establishes a baseline against which we can measure future trends.

THE NATURE OF CHANGE

Natural landscapes are constantly changing, even in the absence of human activity. Landforms erode over time and materials can be transported long distances by air or water to form fertile soils, coastal beaches or other landform types. Only in this century, however, have we become globally aware of our capacity as human beings to accelerate change—to drastically alter in a relatively short space of time, what natural processes have taken centuries to create.

What is clear from the historical record, is that the pace and extent of change in Nova Scotia accelerated rapidly following the arrival of European settlers. It was first felt in coastal areas were the Acadians sought to reclaim salt marsh from the sea through dyking. Today, approximately 65% of the original salt marsh in the province has been dyked and converted to agricultural and other uses. As settlements moved inland, major change also took place in the forests. By the late 1800s, a booming lumber industry had extensively altered the forest with softwoods replacing hardwoods as the dominant forest cover type.

Dramatic population growth and technological developments that have enhanced our abilities to manipulate and exploit the world around us, have fueled much of the change that has taken place over the past two hundred years. Prior to European settlement, Nova Scotia was occupied by fewer than 40,000 inhabitants who had a limited capacity to impact their surrounding environment. Today, by contrast, the province is occupied by approximately 1 million individuals who have an enormous capacity to effect change.

Our ability to predict, monitor and control these impacts must be commensurate with our ever increasing capacity to alter our environment.

Growing Awareness of the Impacts of Human Activity on the Environment

The 1960s marked the first decade in which a truly global awareness of the impacts of human activity on the environment was evidenced. The unintended consequences of human activities were seen in the pollution of air and water resources throughout the world. Many governments of the day reacted by creating environment departments to monitor and regulate activities responsible for pollution. The government of Nova Scotia responded with its first Environmental Protection Act in 1973, which established the Nova Scotia Department of the Environment. The original focus, however, was on local pollution issues primarily relating to water courses. Furthermore, the approach taken to dealing with these issues was top down, with little opportunity for public participation.

Global concern for the environment jelled in the late 1980s with the release of the report of the Bruntland Commission, which coined the phrase sustainable development. In the aftermath of the report's release, many governments, including Nova Scotia, established Round Tables on the Environment and the Economy, to prepare strategic action plans to achieve sustainable development. Nova Scotia's Sustainable Development Strategy was released in 1993. The province, building on a number of the recommendations contained in the strategy, subsequently prepared and adopted a province wide Solid Waste Management Strategy in 1996. Today it is in the process of also releasing a Provincial Pollution Prevention Strategy. In addition, in recognizing inadequacies in the original environmental legislation, particularly with reference to changing environmental and economic conditions in the 1990s, the Government of Nova Scotia enacted a new Environment Act, which was proclaimed in 1995.

A distinctive development in environmental awareness throughout the 1980s, and continuing through the 1990s, is the marked increased in community-based environmental stewardship and resource management initiatives. Communities have clearly demonstrated that locally based, locally owned resource and environmental initiatives can often be more effective in dealing with local issues.

Recognizing the Missing Pieces

In spite of the progress outlined above, critical gaps in managing the impacts of human activity on the environment have continued. Missing in all of the initiatives discussed earlier are two important features:

1. Programs and procedures for systematically monitoring and reporting on the state of the environment in Nova Scotia, and
2. An indicator for measuring progress towards the achievement of sustainable development.

Both of these elements are necessary to ensure that economic development decisions take account of environmental impacts and provide some measure of progress in the pursuit of sustainable development. These missing pieces are now being put in place through State of the Environment Reporting and through recent research on an innovative index (the Genuine Progress Index [GPI]) that holds promise for integrating environmental and economic indicators into a common index of sustainability.

State of the Environment Reporting in Nova Scotia

The intention of SOE reporting is to provide an effective tool for monitoring the health of the environment, relative to economic decision making, and provide advance warning of action that may be required if we are to safeguard the environment from further deterioration.

Monitoring Sustainable Development: The Genuine Progress Index

Understanding the environmental consequences of our decisions requires the ability to integrate environmental factors into our economic accounting. The Genuine Progress Index attempts to do this by placing the human economic system within the framework of the larger ecosystem. The Provincial government is helping to fund a project to develop GPI into a tool for measuring sustainable development progress in Nova Scotia. In time, GPI may provide a means of reporting on trends in sustainability and become a regular component of SOE reporting. The basic concepts behind GPI are discussed in further detail in the concluding sections of this report.

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AIR QUALITY

AIR QUALITY

Overview

Overall, Nova Scotians enjoy good air quality. The combination of our maritime climate and relatively small population and industrial bases, means that local emissions rarely cause air quality problems. The province also has better controls over local sources of air pollution than it had in the past, and most Nova Scotia communities meet or exceed national air quality standards.

However, our air quality is influenced by long-range transport of air pollutants from central Canada and the U.S. The prevailing westerly winds carry air contaminants from industrial centres in the United States and central Canada to our doorstep. Two of these contaminants—ground level ozone and fine particulate—are emerging as health concerns in both the U.S. and Canada. Southwestern Nova Scotia is the area of the province most affected by ground level ozone.

These westerly wind currents also bring us acid rain, which has greatly affected our rivers and lakes. Sulphur dioxide (SO_2) emissions, a primary cause of acid rain, have been reduced in both the U.S. and Canada. While this has resulted in less acid deposition in Nova Scotia, many areas of the province are highly sensitive to acidification, and damage to our lakes and aquatic habitats continues. Consequently, new commitments for emission reductions are required in the U.S. and Canada to ensure recovery.

In addition, global air quality concerns, such as global warming, raise issues that the province must address. Meeting Canada's commitment to reduce green house gas emissions will require an aggressive effort within Nova Scotia.

Improvements in Local Air Quality

Since the first Nova Scotia Environmental Protection Act was passed 25 years ago, air quality in Nova Scotia has undergone a number of improvements *(Figure 1a, 1b, 1c, 1d)*.

figure 1a: LEAD LEVELS

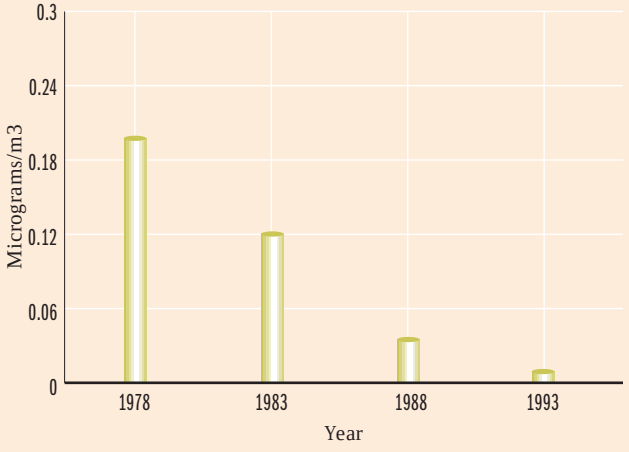


figure 1b: TOTAL SUSPENDED PARTICULATE

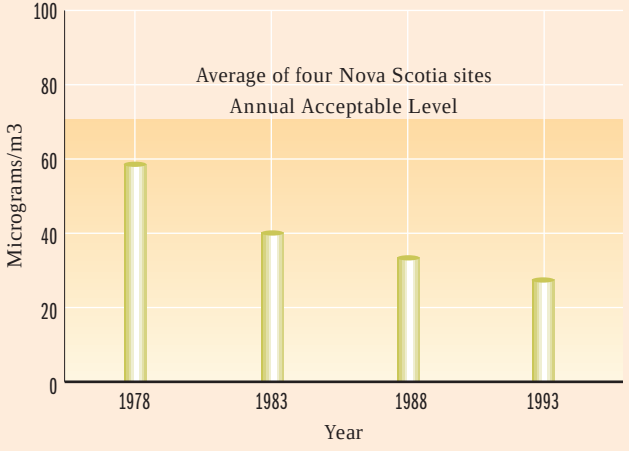
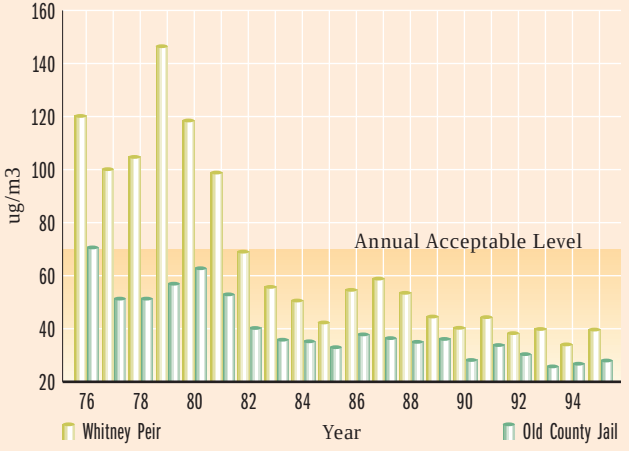


figure 1c: TOTAL SUSPENDED PARTICULATE

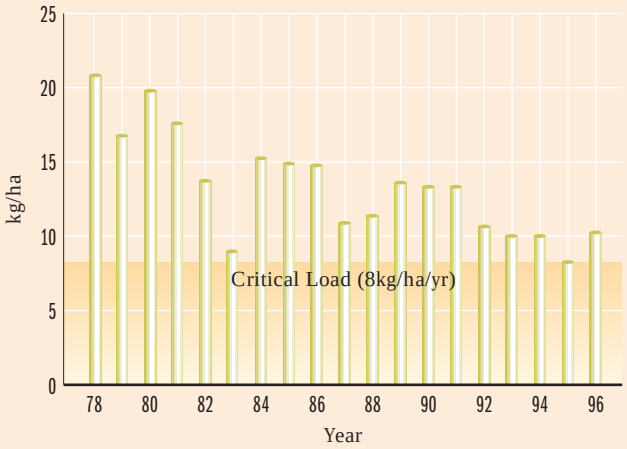


Figures 1a-1d: Over the last twenty years Nova Scotia has seen improvements in several areas of air quality. Ambient air levels for lead and particulate have decreased; sulphate deposition (acid rain) has also decreased.

- A dramatic decline in lead levels because of eliminating leaded gasoline; *(Figure 1a)*
- A reduction in emissions of toxic air pollutants and particulates, brought about in part by a provincial ban on the open burning of municipal waste;
- A major drop in particulate emissions in the Sydney area because of the modernization of the steel mill and closure of the coke ovens; *(Figure 1c)*
- A decrease in acid deposition in Nova Scotia as a result of emission controls throughout North America; *(Figure 1d)*

Air quality for common air pollutants has consistently been within the "Acceptable" range and frequently achieves the "Desirable" range in most regions of Nova

figure 1d: ANNUAL SULPHATE DEPOSITION



Monitoring Air Quality in Nova Scotia

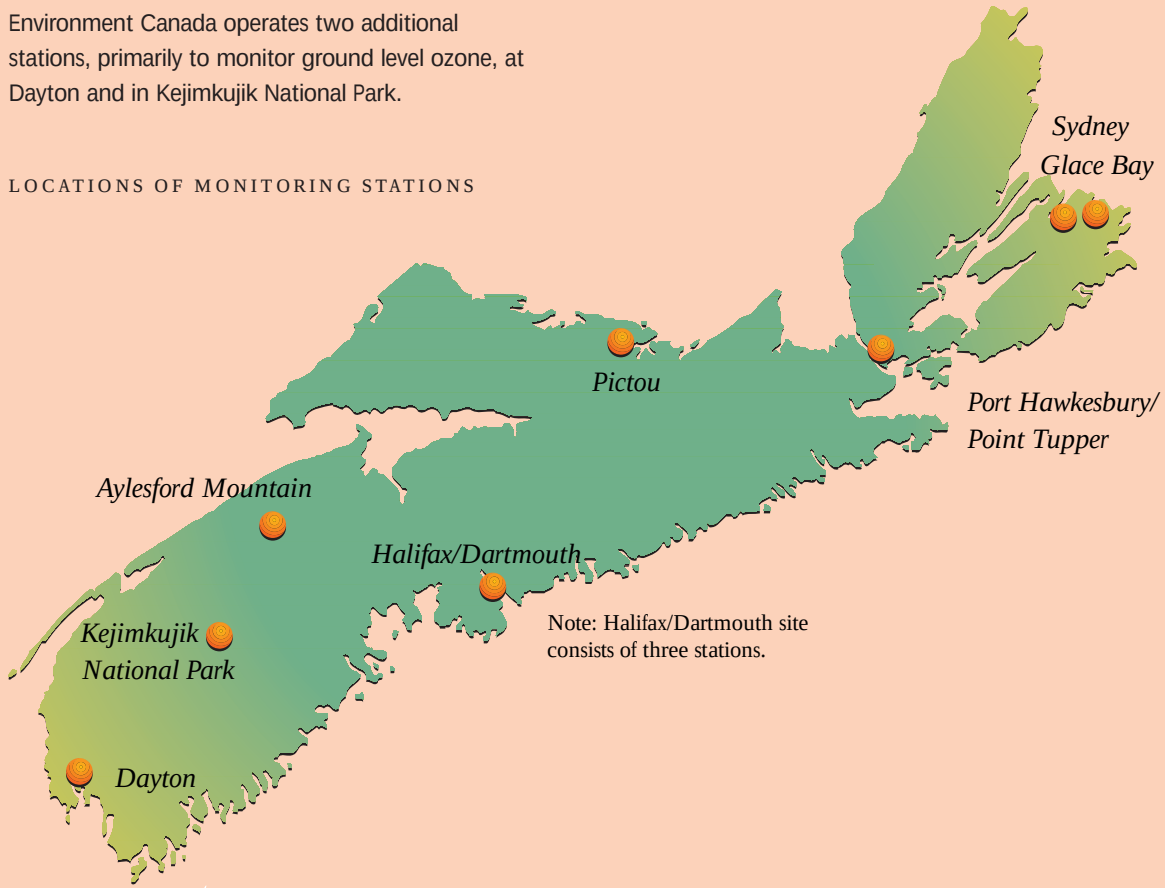
The Nova Scotia Department of the Environment monitors air quality at ten stations across the province susceptible to air quality problems. Monitoring stations are located at Point Tupper and Pictou, where industrial emissions can occur, Halifax/Dartmouth and Sydney where vehicle and urban related emissions are concentrated, and areas in southwestern Nova Scotia most likely to be affected by transboundary emissions.

Environment Canada operates two additional stations, primarily to monitor ground level ozone, at Dayton and in Kejimkujik National Park.

The common air quality pollutants monitored regularly in Nova Scotia are sulphur dioxide, suspended particulate, carbon monoxide, ground level ozone, nitrogen dioxide and hydrogen sulphide.

Objectives are established for five air contaminants to protect human health and the environment. When air pollution levels exceed the acceptable range we have ***exceedance***.

LOCATIONS OF MONITORING STATIONS



Note: Halifax/Dartmouth site consists of three stations.

Scotia.[1] In 1997, the province began continuous reporting of an air quality index for the Halifax/Dartmouth region, the largest urban centre in Atlantic Canada. Since reporting began, air quality has been predominantly in the GOOD category. *(Figure 2)*

The major local sources of air pollutants in the province are motor vehicles, electrical power generation, pulp and paper processing and oil refining *(Figure 3)*. The only area of the province where local emissions cause air quality exceedances periodically is Port Hawkesbury. There pulp and paper processing and electrical generation at Point Tupper occasionally contribute to levels above accepted standards for sulphur dioxide *(Figure 4)*. The pulp and paper operation also causes H_2S exceedances; however, recent process changes at the mill are expected to eliminate this problem.

Apart from Port Hawkesbury, all other air quality exceedances measured in Nova Scotia are caused by ground level ozone generated primarily by emissions from outside our region.

1 Common air pollutants are sulphur dioxide (SO_2), suspended particulate (TSP), carbon monoxide (CO), nitrogen oxides (NOx), hydrogen sulphide (H_2S) and ground level ozone. "Acceptable" provides adequate protection against adverse affects to soil, water, vegetation, animals, visibility, and human comfort and well being. "Desirable" is the level of protection for maintaining a pristine environment.

figure 2: 1997 HALIFAX/DARTMOUTH AIR QUALITY INDEX
The Air Quality Index for Halifax/Dartmouth was predominantly "good" with no days in the "poor" category.

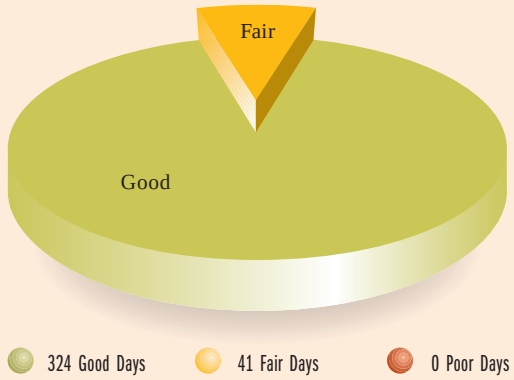


figure 3: PRINCIPLE EMISSION SOURCES
for four selected air contaminants

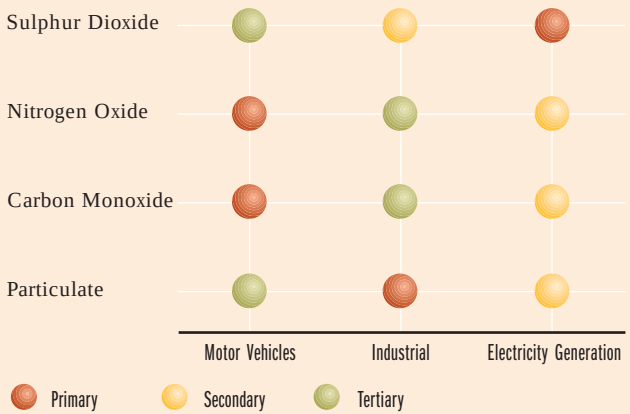
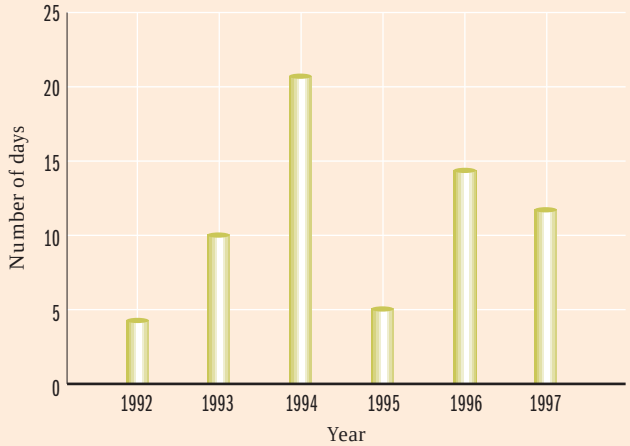


figure 4: POINT TUPPER SO_2 EXCEEDANCES
One hour or more above the air quality guideline creates an exceedance day.



How much Air Pollution comes from Outside our Borders?

Nova Scotia is located down wind from major urban and industrial centres in the U.S. and central Canada. Westerly and southwesterly air flows bring pollutants from the vehicles and industries of these centres into our region *(Figure 5)*. This contributes to our two major air quality concerns: smog and acid rain.

While smog is usually associated with large urban areas, ground level ozone, fine particulates and other constituents of smog are transported here and affect Nova Scotia's rural and urban areas.

Smog and Ground-Level Ozone

Most of the air quality exceedances in Nova Scotia are caused by ground level ozone, a major component of smog. Southwestern Nova Scotia is the area most affected.

While our exceedances are smaller and less frequent than those in industrial regions of Canada and the U.S., they are of concern *(See Ozone Data Sheet)*. Nova Scotians are experiencing increased problems with asthma and environmental illness. Poor outdoor air quality contributes to these problems.

figure 5: SURFACE WIND FLOW ACROSS CANADA AND THE UNITED STATES
Of Nova Scotia's ozone exceedances, 64% are estimated to originate from the northeastern U.S. and 36% from southern Ontario and Québec.

GROUND LEVEL OZONE DATA SHEET

Ozone: An invisible gas produced in the atmosphere when nitrogen reacts with volatile organic compounds. It is a component of smog.

Targets: A reading of over 82 ppb (parts per billion) constitutes an exceedance.

Sources: 64% of our ozone exceedances originate from the northeastern U.S. and 36% from southern Ontario and Quebec.

Exceedances: Concentrations above 82 ppb can have adverse respiratory affects. The highest levels measured in Nova Scotia have been up to 150ppb.

Bottom Line: International cooperation between the U.S. and Canada is required in the setting of standards and establishing effective controls.

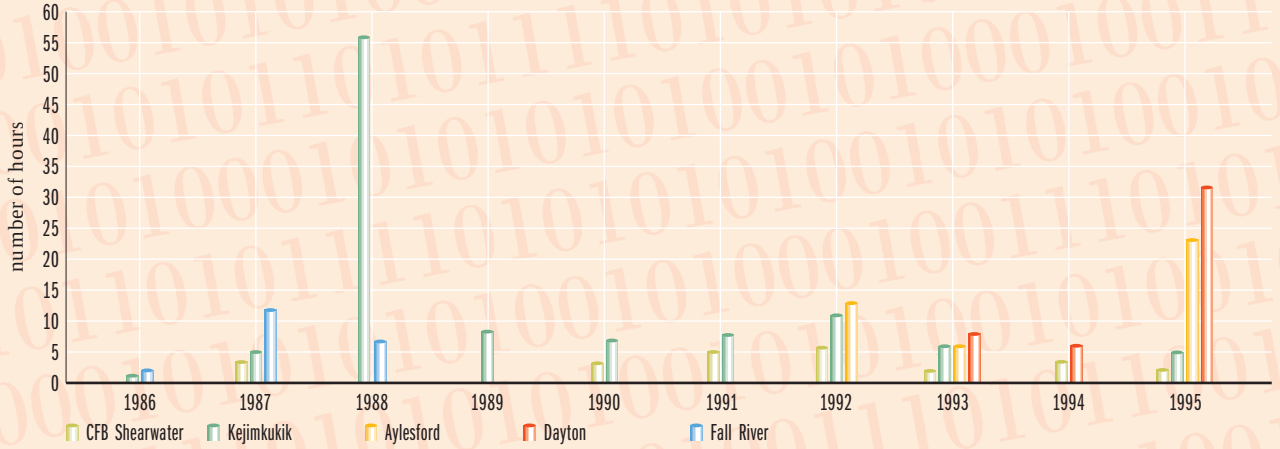
EFFECTS ON HEALTH

- linked to a range of adverse health impacts ranging from breathing discomfort, inflamation of the respiratory tract to hospitalization for respiratory ailments;
- Health affects heightened in individuals with heart or lung disease, including asthma;
- There is no established human health threshold for ground level ozone – even small amounts can affect human health.

EFFECTS ON THE ENVIRONMENT

- ground level ozone can damage sensitive plant species and result in lower crop yields.

OZONE TRENDS: Number of one-hour exceedances in southwestern Nova Scotia. Abnormally high levels were reported in 1998 in many areas of North America.



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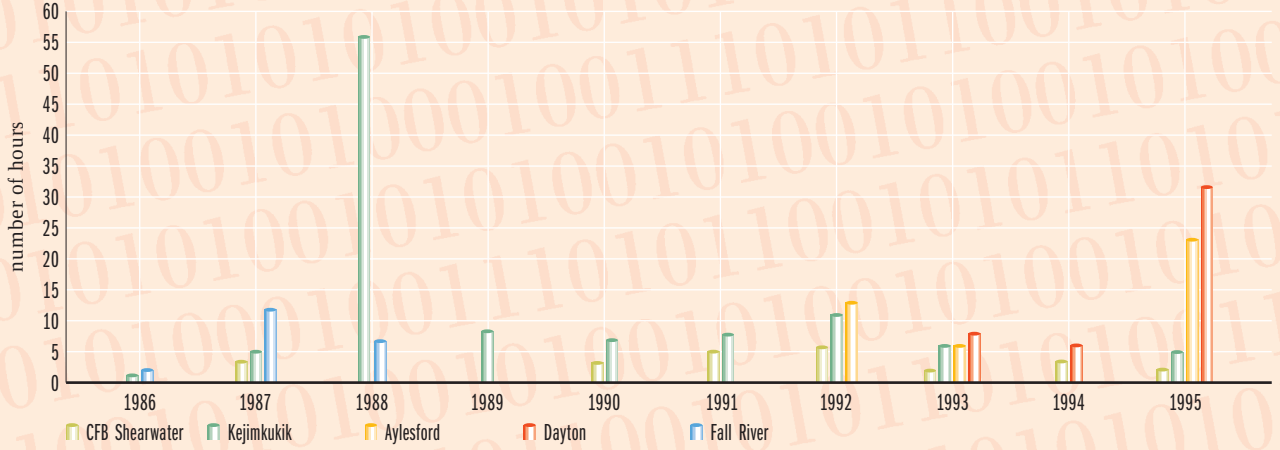


Ground-level ozone is linked to a range of adverse health impacts, ranging from breathing discomfort to hospitalization for respiratory ailments. Recent studies show that there is no human health "threshold" for ground-level ozone—even small amounts can affect human health.

Smog and Fine Particulate: New Recognition of the Health Risk

Within the last five years, fine particulate matter has emerged as another important health concern. Fine particulate matter includes very small particles emitted directly from fossil fuel combustion, or formed in secondary atmospheric chemical reactions from other pollutants. Because these particles are so small, they easily enter the lungs and the bloodstream. Like ground-level ozone, they contribute to respiratory problems, and have no clear health "threshold".

Fine particulate matter is also transported over long distances. Preliminary estimates suggest that more than 50% of fine particulate matter in Nova Scotia comes from the U.S. east coast.

Progress to Date

Because significant sources of these problems lie beyond our borders, controls on emissions in other parts of Canada and in the U.S. are required to reduce ground level ozone and fine particulate matter levels in Nova Scotia.

Under the 1991 Air Quality Agreement, Canada and the United States have reduced sulphur dioxide emissions that contribute to acid rain and fine particulate matter problems. Both countries are developing a joint plan of action that outlines cost-effective approaches to address transboundary air pollution. Key U.S. states have recently made commitments to further reductions of SO_2 and fine particulate of up to 60%. These reductions should provide significant benefits for air quality in Nova Scotia.

Looking Ahead

Controlling emissions that cause ground level ozone and fine particulate will take a renewed effort on both sides of the Canada/U.S. border. Two important actions are:

- Developing New Guidelines. Canada is developing new standards for ground-level ozone and fine particulate based on a better understanding of health and environmental risks. These are expected to take effect in 1999.
- Bringing US Standards to the Canadian Level. The U.S. standard for ozone is approximately 30% less stringent than Canada's. Achieving tougher objectives in the U.S. will require continued negotiation between the two countries.

Global Warming

What is Global Warming?

Greenhouse gases (GHG), created primarily from burning fossil fuels for energy and transportation *(figure 6)*, are having a discernable influence on the global climate. Most scientists believe the risk of climate change is significant enough to justify preventive measures now. Canada has agreed to reduce its greenhouse gas emissions by 6% from 1990 levels by the year 2010. Meeting this goal will require an aggressive emission reduction effort within Nova Scotia.

What are the Consequences of Global Warming for Nova Scotia?

Current models show that the doubling of atmospheric carbon dioxide (CO_2) likely to occur in the next century could cause sea levels to rise, create shifts in rainfall patterns, alter growing seasons, and lead to more frequent and severe weather disturbances. Canada's agriculture, forestry and fisheries would all be affected. For Nova Scotia, predictions include:

- Damages to the agricultural resources in Atlantic Canada from $20 to $88 million per year.
- Increases in forest productivity in Atlantic Canada, by 15-16%. (However, this is not a consensus position held in the industry. Too little research has been conducted to predict with certainty the effects of climatic change on our forests.)

- Shifts in the distribution of fish species, in migration patterns and growth rates that would affect both the commercial and recreational fisheries. Changes in water temperature would alter the ratio of groundfish to those found closer to the surface. The economic impacts of these changes are uncertain.

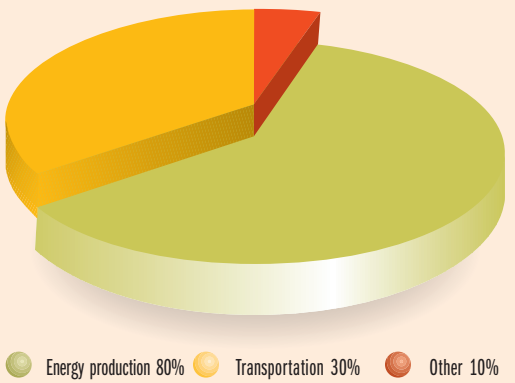
How much does Nova Scotia contribute to Global Warming?

Nova Scotia's current annual emissions are slightly below 1990 levels of 18.8 million tonnes. Given a moderate level of growth and no new efficiency measures, the province can expect to be 6% above its 1990 emission levels in 2010. Additional information is needed before the impact of the Sable Offshore Energy Project on the province's GHG emissions can be predicted with accuracy.

Looking Ahead

Meeting Canada's commitment to greenhouse gas reduction will require Nova Scotia to cut its projected GHG emissions by over 3 million tonnes from the projected 2010 level. The province plans to increase efforts to reduce GHG emissions in the short term and embark on developing a strategy for longer term reductions.

figure 6: GREENHOUSE GAS EMISSIONS
Energy production is the largest source of greenhouse gas emissions in Canada.



Air Quality Indicators

Note: The tables accompanying each section present the indicators used for this report as well as indicators that NSDOE is committed to monitoring for future reports.

INDICATOR	PERFORMANCE	TREND	COMMENT
Particulate levels	Total suspended particulates have declined in recent years and have now levelled off.	😐	A significant decline in suspended particulates accompanied the closure of the Sydney coke ovens. Since that closure the decline has levelled off. Future monitoring will be restricted to fine particulate.
Ground level ozone	Exceedances are most severe in southwestern Nova Scotia and are associated with long range transport of air pollutants.	😐	An air quality problem which can be compounded by local weather conditions. May be one of the contributing causes of increased asthma and respiratory illness.
Atmospheric mercury	Traceable to long range transport of contaminants, local fossil fuel burning, local automobile exhaust and volatilization of naturally occurring mercury into the atmosphere.	●	Expanded monitoring effort required under the recent New England Governors, Eastern Canadian Premiers Action Plan on Mercury.
Air quality index	Monitored continuously in the Halifax Dartmouth area since 1997. Thus far the index has indicated continuous GOOD quality air.	😐	The index is a compilation of monitoring results from sulphur dioxide, carbon monoxide, ground level ozone, and nitrogen dioxide.
Greenhouse gas emissions	Greenhouse gas emissions are increasing in Nova Scotia and could be 6% above 1990 levels by the year 2010.	☹	The target is 6% below 1990 levels. This indicator will track progress towards that target.

☺ Improving ☹ Worsening 😐 Static ● Don't Know

INDOOR AIR QUALITY

What is the Problem?

Indoor air quality is an emerging issue in many countries, including Canada, where individuals spend much of their time indoors. Air pollutants can become much more concentrated indoors than out of doors. Consequently, our biggest environmental health risks are sometimes encountered inside our homes, schools and workplace.

An Emerging Issue World Wide

Indoor air quality concerns emerged as an environmental issue more than twenty years ago. The World Health Organization estimates that 30% of newly constructed and renovated buildings have identifiable signs of "sick building syndrome". As many as 10-30% of the occupants of these buildings are affected, and may experience a variety of responses including allergic reactions, headaches, and nausea.

Indoor air quality problems seem especially acute in Atlantic Canada. Federal Government agencies that have received complaints about the indoor air quality report that almost one-third have come from Atlantic Canada.

The importance of indoor air quality was brought home to Nova Scotians in the early 1990's when over 600 workers at Halifax's Camp Hill medical Centre became seriously ill. Poor indoor air quality was thought to be an important part of the problem. A number of schools have also had air quality problems, resulting in short and long term closures.

These problems can be expensive. The Camp Hill Medical Centre in Halifax spent over $14 million to address its problems. The Nova Scotia Department of Education estimates that $340 million is required for renovation and new school construction in Nova Scotia. Air quality is one of the driving concerns.

Why is it happening here?

Our damp climate encourages the production of mould. Moulds can cause health problems when they grow in poorly ventilated homes, schools and offices. The age of our buildings may also contribute to mould and ventilation problems. The emphasis in the 1970's on energy conservation led to home and office building designs being more "air tight". This can also contribute to the build-up of indoor pollutants. Nova Scotians experience high incidents of asthma and environmental illness. Individuals with these aliments are especially sensitive to indoor air quality.

Looking Ahead

The province is taking a number of initiatives to address emerging concerns with indoor air quality:

- 40 schools are to be replaced or renovated;
- The Nova Scotia Occupational Health and Safety Advisory Council will adopt indoor air quality regulations, including procedures for dealing with complaints, investigations, information and education.

WOOD SMOKE

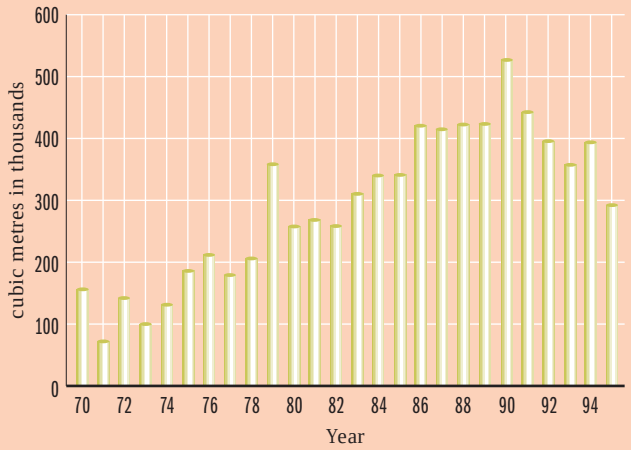
In some communities, especially those situated in depressions or valleys, pollutants from wood smoke can become concentrated at ground level. Government departments in Nova Scotia receive over 1000 complaints per year about wood smoke pollution and the number is growing. Individuals with respiratory problems and allergies are most affected.

Air quality studies performed in Truro and Lower Sackville in the mid-1980s found the levels of wood smoke pollution did not pose a health risk. However, the particulates released from wood stoves contribute to localized nuisance problems such as odours, reduced visibility and even respiratory discomfort for some residents.

The problem is *the way* we burn the wood. A "clean" fire – where the wood burns at high temperatures with enough air for complete combustion – produces almost no smoke and significantly less contaminants. But using inefficient stoves, burning green wood, choking off the air supply and similar practices result in dark, smelly wood smoke and air contamination.

Since wood burning is not regulated, it is up to individuals to be smart about how they burn wood. The Department of Natural Resources publishes pamphlets on best practices.

FUELWOOD AND FIREWOOD



Acid Rain in Nova Scotia

Acid rain is largely due to sulphates and nitrates formed from sulphur dioxide (SO_2) and nitrogen oxides (NO_x) emitted into the atmosphere during the burning of fossil fuels. Water bodies in Nova Scotia are particularly sensitive to the effects of acid deposition due to the predominance of thin and poorly buffered soils. Close to 80% of Nova Scotia's lakes greater than 1 ha of surface area are susceptible to acidification. *(Figure 7)* Consequently, acid deposition is a major threat to the biodiversity of freshwater aquatic life in the province, affecting many species of phytoplankton, zooplankton, benthic invertebrate and fish.

The best documented and most notable impact of acid rain has been on Atlantic salmon. By one estimate, a third of the available Atlantic Salmon habitat in Nova Scotia has been lost to acidification since 1950. This represents a loss to the salmon fishery of about 9,000 - 14,000 fish per year.

The effects of acid rain have been particularly severe in southwestern Nova Scotia, where many lakes were already naturally acidified. This region contains 63 rivers that supported salmon in the 1950s. Figure 8 shows the impact acid rain has had on these rivers.

figure 7: ACID SENSITIVITY IN NOVA SCOTIA
Sensitivity and Total Alkalinity (in microequivalents per litre)

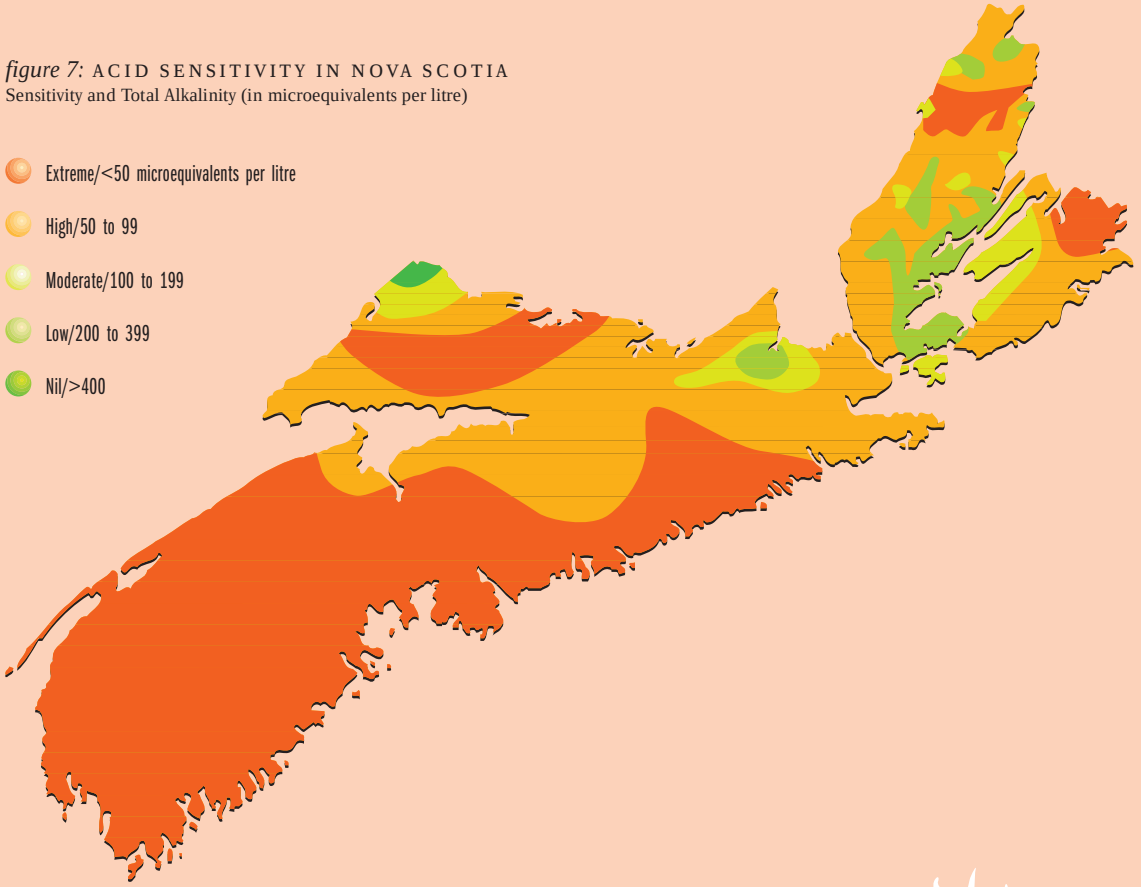
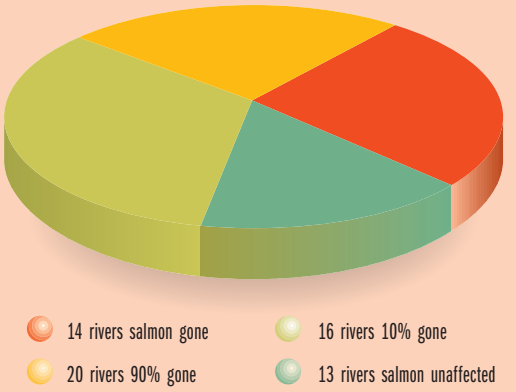


figure 8: ACID RAIN IMPACT ON ATLANTIC SALMON
In 63 Rivers in Southwestern Nova Scotia



Progress to Date

While local emissions have contributed to the problem, it is estimated that they contribute to less than 15% of the total sulphur deposition for the province. The rest originate from industrial sources in the United States midwest and central Canada.

Canada and the United States have reduced the amount of SO_2 emitted to the atmosphere. By 1996, annual SO_2 emissions in the seven eastern provinces had been reduced by 54% from 1980 levels. Similarly in the United States, emissions had dropped by about 30% from 1980 levels by the close of 1995. Sulphate deposition in the province has exhibited a gradual decline since the early 1980's. *(Figure 1d)*

More Work is Required

Although the emission reduction targets in Canada and the United States have been largely met or exceeded, this has not yet led to significant improvements in water quality in Nova Scotia, nor has there been a recovery of fish populations and other biota. Since the 1980s, only 18% of the lakes monitored in Nova Scotia have shown a reduction in acidity, and a measurable recovery of either salmon or brook trout in the rivers and streams of the affected areas has yet to be observed. It is likely that acid rain deposition in many parts of Nova Scotia remains above the "critical load threshold"; the amount of acid precipitation an ecosystem can tolerate before long term harmful effects occur.

To fully protect Nova Scotia's most sensitive ecosystems, recent modelling suggests that additional SO_2 emission reductions of up to 50% are required in targeted regions in eastern Canada, and the midwestern and northeastern United States. In order to bring about these required emissions reductions Nova Scotia, along with the other eastern Canadian provinces have recently agreed to develop a "Post 2000 Acid Rain Reduction Strategy".

Acid Rain Indicators

INDICATOR	PERFORMANCE	TREND	COMMENT
Sulphur Dioxide	Improving		1980 – 193 kilotonnes 1995 – 172 kilotonnes
Sulphate deposition	Improving		Over the past 20 years sulphate deposition has dropped from approximately 20 kg/ha/yr to 10 kg/ha/yr. Still largely above the critical load limits. Further controls needed to promote recovery.

Improving Worsening Static Don't Know

Mercury

What is Happening?

Mercury in the environment has become a concern in Nova Scotia. Recent studies have found that loons in Nova Scotia's Kejimikujik National Park have the highest blood mercury levels measured in loons anywhere in North America. As well, traces of mercury have been detected in certain species of freshwater sport fish and the province now issues consumption advisory notices for these fish.

Mercury in Fish

Mercury content in 17 of the 30 white perch sampled (57%) in Kejimkujik National Park in 1996 exceeded the safe consumption guideline of 0.5 ug/g wet wt., and 11 of these (37% of the entire sample) exceeded the 'no consumption' guideline of 1.0 ug/g wet wt. These figures indicate that mercury in wild sport fish populations is a concern in the area.

S. Beauchamp, N. Burgess, et. al., Environment Canada, 1996

Why is it Significant?

Mercury is a toxic substance. Once in the environment, it can accumulate in the food chain, working its way up through plants and animals until it reaches human beings. Mercury can damage the central nervous system in infants and adults. Prenatal exposure to even the lowest recorded concentrations of mercury has been shown to induce psychomotor retardation in infants.

Why is it Happening?

Mercury in the environment comes from many sources. While some of these are natural geological sources, sediment samples taken in eastern Canada show that mercury levels have increased by two to three times since the dawn of the industrial revolution.

Scientists do not have a clear understanding of how mercury moves in the environment. For example, it is unclear to what extent the high mercury levels in loons at Keji are attributable to manmade rather than to natural sources.

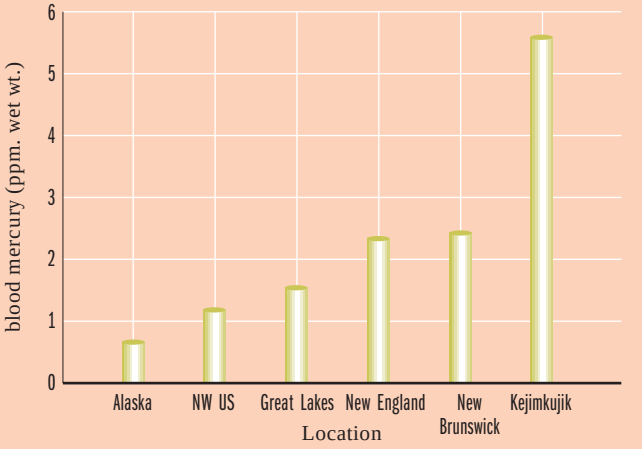
However, much of the mercury found in Nova Scotia is believed to be transported here by wind currents from emission sources in both eastern Canadian provinces and the eastern United States. Sources within the region produce an estimated 18,250 kg/yr. of mercury emissions. Municipal and biomedical waste and sludge incinerators are the largest sources for emissions coming from the northeast states. Non-ferrous metal production is the major source in eastern Canada. Mercury emissions in Nova Scotia are estimated to be 246 kg/yr, with coal fired utility boilers contributing the largest portion.

In addition to airborne sources, gold mining conducted in the late 19th and early 20th centuries resulted in tailings containing mercury contamination in many old gold mining districts in the province. While the gold districts and many of the tailing sites have been mapped, the extent of mercury contamination at these sites has yet to be determined.

What are we doing about it?

- The Provincial Solid Waste Management Strategy has banned all uncontrolled burning of municipal waste;
- The biomedical waste incinerator in Halifax has been shut down;
- State of the art pollution control equipment has been installed at the province's only solid waste combustion facility. As a result, mercury emissions from this source are less than 1 kg/yr;
- The province has signed a regional Mercury Action Plan drafted under the New England Governors/Eastern Canadian Premiers Conference. Initiatives set out in the plan include:
  - > An assessment of control options for coal fired utility boilers;
  - > Mercury reduction targets for the solid waste stream;
  - > Enhanced monitoring and research on a regional level.

MEAN MERCURY LEVELS
In Adult Common Loons



WATER RESOURCES

WATER RESOURCES

Overview

Nova Scotians can boast of some 6700 lakes, 100 rivers, 7400 km of shoreline and abundant supplies of ground water. These provide us with drinking water, and recreational and livelihood opportunities. They form the geographical backbone of our tourist trade. As well, they provide a rich and diverse habitat for a vast variety of fish, amphibians, mammals, birds and aquatic plants.

Over the past twenty-five years, we have seen a gradual improvement in the quality of our drinking water because of new municipal treatment facilities and better guidelines for well construction. Better on-site sewage treatment and more municipal sewage treatment plants have decreased the amount of raw sewage going into the environment in some areas. Better controls and treatment facilities at our pulp and paper mills are also helping to improve overall water quality.

However, we face a number of challenges, and they are outlined in the following pages. Acid rain has reduced our salmon stocks. Several municipal water supplies show high levels of trihalomethanes (THMs)—chemicals created when chlorine, used for disinfection, reacts with organic compounds. Cottage and urban development are having a negative impact on aquatic habitats.

Many of these impacts can be controlled, lessened, and even reversed with proper environmental stewardship. Numerous community groups have sprung up and are working to protect and improve water resources at the local level. Government agencies have developed better guidelines and planning strategies. Individuals living close to water bodies can also make a substantial difference. Commitment and action is needed from all sectors of our society if we are to protect our water resources.

Is the water safe to drink?

Our health depends on reliable supplies of good quality drinking water. Nova Scotia is fortunate to have an abundance of freshwater resources. While our water is generally safe to drink, problems can and do occur. Threats to drinking water quality include bacteria and viruses, chemical contamination, and dissolved minerals such as arsenic and uranium.

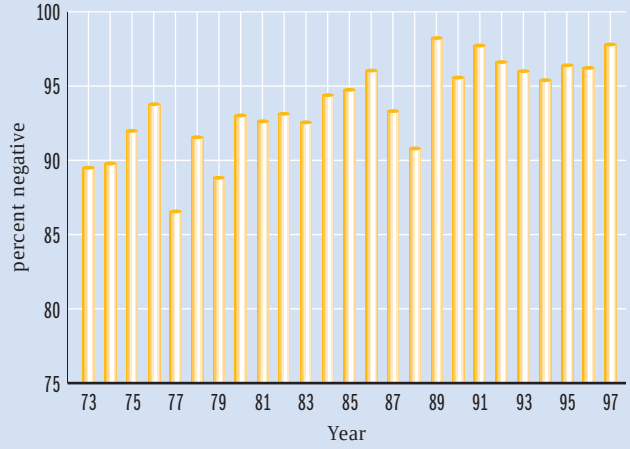
Municipal Water Supplies

Sixty percent of Nova Scotians receive their drinking water from municipal water supplies. Most of these supplies are disinfected with chlorine to kill harmful bacteria in the water. They are tested for microbiological and chemical contaminants to ensure compliance with the health-based standards established under the Guidelines for Canadian Drinking Water Quality.

Improved Treatment for Bacteria

Coliform bacteria, found in the feces of humans and animals, are important indicators of water quality and the integrity of the water treatment and distribution systems. Their presence indicates that other bacteria, more harmful to human health, may also be present. Over the past 25 years, the percentage of samples from municipal water supplies testing negative for total coliform bacteria has continually gone up. (Figure 9) This improving trend is the result of better treatment facilities, and better protection of water supply areas.

figure 9: COLIFORM BACTERIA AND WATER SUPPLY
Percentage of municipal water supply samples tesing negative for coliform bacteria



New Threats

An issue of growing concern is contamination of surface water supplies from viruses and protozoa, such as *giardia* and *cryptosporidium*. These are difficult to detect, resistant to disinfection procedures and have been linked to waterborne disease outbreaks. While no disease outbreaks associated with *giardia* and *cryptosporidium* have been reported in Nova Scotia, these and other contaminants remain a threat to public water supplies and underscore the need for high standards of system operation and continuous monitoring to minimize the risk of waterborne disease.

Getting Rid of THMs

THMs readily evaporate into the air and most are thought to be released as the water bubbles out of taps and when it sits in open containers for a few hours. THMs can be reduced or eliminated from drinking water in any one of several ways:

- Aerate tap water in a blender;
- Store water in the fridge for 24 hours;
- Use water treatment devices containing activated carbon.

The Threat from Chemicals

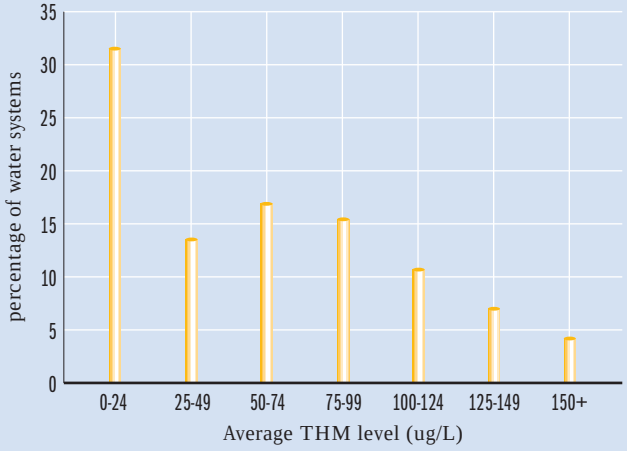
Between 1985 and 1988, a comprehensive study tested all the major municipal water supplies in Nova Scotia for more than 150 chemicals. The results showed that all water supplies met the health-based Canadian drinking water quality guidelines, with only one exception. One water supply was just over the trihalomethanes (THM) guideline.

In 1993, health risk studies led to the guideline for THMs being lowered to 100 micrograms per liter. Monitoring data collected between 1989 and 1995 for 72 Nova Scotia water systems indicates that 22% have average annual levels greater than the new THM guideline *(Figure 10)*.

THMs are a group of chlorination disinfection by-products formed when chlorine reacts with organic matter in the raw water. THMs are common in surface water supplies throughout Canada and are a concern because they have been linked to certain cancers and to adverse birth outcomes.

Despite the relatively high number of water supplies failing to meet the guideline, the risks associated with an improperly disinfected supply are much greater than those associated with the presence of chlorination by-products. Water treatment plants are being challenged to reduce THM concentrations without compromising the disinfection process. The Nova Scotia Department of the Environment, the Nova Scotia Department of Health and municipalities are actively looking at strategies to lower THM levels.

figure 10: TRIHALOMENTHANE VALUES
Average THM values for 72 Nova Scotia water systems

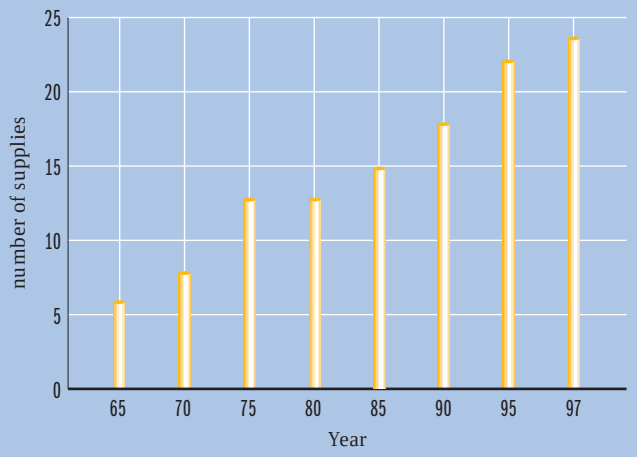


Protecting our Water Sources

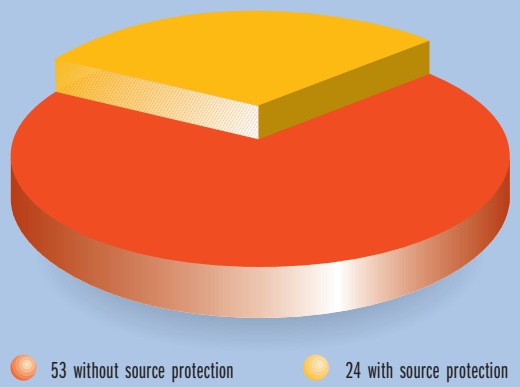
Poor natural water quality in some areas, and the ever-present threat of contamination from human activities, emphasizes the importance of water treatment in the provision of safe drinking water. But treatment isn't the complete answer. The best approach to ensuring safe drinking water is to protect the water supply area and prevent contaminants from getting into the source water in the first place. Highways, subdivisions, agriculture, forestry, industries and recreation can all affect water quality if located within a water supply area.

Of Nova Scotia's 77 municipal water supplies, 24 are designated as Protected Water Areas and/or have a comprehensive water supply protection strategy in place. However, nine of these were designated 30 years ago, and the designations need to be updated.

WATER SUPPLIES
Supplies with protection strategies or designated as Protected Water Areas



PROTECTED WATER AREA DESIGNATIONS



Contamination Threats to Private Wells

Approximately 40% of Nova Scotians obtain their drinking water from private wells. Between 2500 and 3000 new wells are constructed in the province each year. Until recently, groundwater was thought to be safe from many of the contamination problems that threaten surface water supplies. We now know that this is not so. Septic systems, fertilizers and pesticides, road salt, waste disposal, leaking underground storage tanks and accidental spills of chemicals can all cause groundwater contamination.

Contamination from Human Activities

A 1989 random survey of farm wells in the intensive agricultural areas of Kings County showed that all wells sampled for pesticides were within the Guidelines for Canadian Drinking Water Quality. However, detectable concentrations of one or more of nine pest control products were recorded in 41% of the wells tested *(Figure 11a)*.

The survey also found that 13% of the wells showed nitrate levels that exceeded the Guidelines for Canadian Drinking Water Quality *(Figure 11b)*, with

figure 11a: KINGS COUNTY FARM WELL STUDY
Results of the 1989 Kings County farm well survey for pesticides

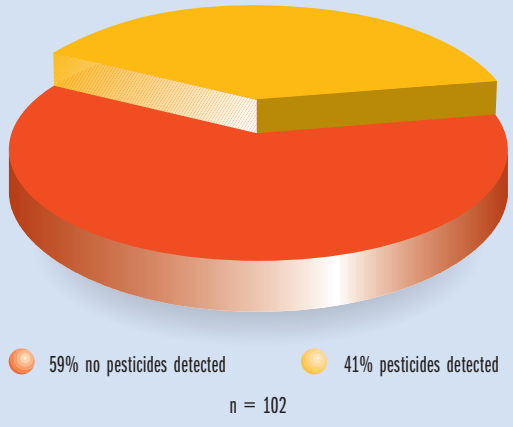
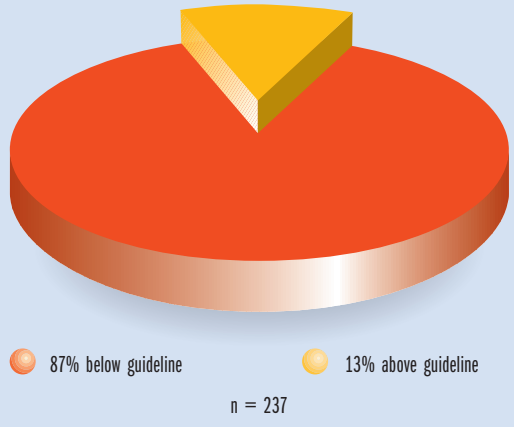


figure 11b: KINGS COUNTY FARM WELL STUDY
Results of the 1989 Kings County farm well survey for nitrates



nitrate levels three times higher than the average for wells not located in agricultural regions. Elevated nitrates in drinking water are linked to methaemoglobinaemia, or 'blue-baby syndrome', in infants less than three months old. While nitrates may occur naturally, elevated levels in agricultural areas are usually caused by animal wastes and nitrogen-based fertilizers.

The Department of Agriculture and Marketing has taken several actions. It has produced guidelines on the management of animal manure and produced kits to help farmers calculate safe fertilizer rates. It has also established three monitoring sites to provide data on nitrate runoff from crop lands.

Contamination from Natural Sources

Not all problems are caused by human activities. Arsenic and uranium are two naturally occurring contaminants that pose a health risk. Arsenic has been found in private wells in many parts of southern Nova Scotia, especially around gold mining districts where the

The Problem With Salt

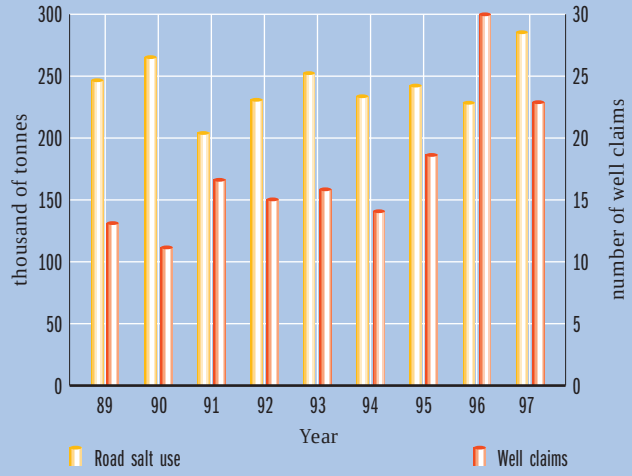
Because of our maritime climate, with its rapidly fluctuating temperatures and frequent winter storms, road salting is a standard road maintenance practice throughout the province. Each winter, the Nova Scotia Department of Transportation and Public Works (DTPW) applies nearly a quarter of a million tonnes of salt—about 230 tonnes of salt per road kilometre.

DTPW processes approximately 20 compensation claims a year for salt contaminated private wells. Studies in Ontario and Maine show that, along heavily salted highways, 20% of the road-side wells exhibit salt contamination.

Nova Scotia is applying two remedies:

- In area where road salt has contaminated wells, DTPW has switched from salt to sand;
- The province's well construction regulations now require new wells to be set back at least 20 feet from the road right-of-way.

ROAD SALT AND WELL WATER
Annual road salt use (Y1) and number of well claims handled by the Nova Scotia Department of Transportation and Public Works (Y2)



bedrock contains arsenic-bearing minerals *(Figure 12)*. High arsenic concentrations in drinking water have been linked with skin cancer and may result in acute or chronic arsenic poisoning.

Of all well water samples tested for arsenic at the Environmental Chemistry Laboratory in Halifax between 1991 and 1997, nine per cent exceeded the Guidelines for Canadian Drinking Water Quality *(Figure 13)*. However, in areas where the bedrock is known to contain arsenic, as many as one-fifth of wells could exceed the guideline. Elevated arsenic levels are more prevalent in drilled wells, but some dug wells constructed near or within mine tailings, can also be contaminated.

Uranium has been found in wells in areas where uranium-bearing minerals are present in the bedrock *(Figure 14)*. Elevated levels of uranium in drinking water can affect the kidneys. For private well samples tested at the Environmental Chemistry Laboratory, only one per cent exceeded the Guidelines for Canadian Drinking Water Quality. However, in communities where the bedrock contains uranium bearing minerals, as many as 3% of the wells exceed the guideline. Elevated uranium levels are confined almost entirely to drilled wells.

figure 12: NATURALLY OCCURING ARSENIC
Areas of Nova Scotia where naturally occuring arsenic is likely to occur in wells or has been found in groundwater

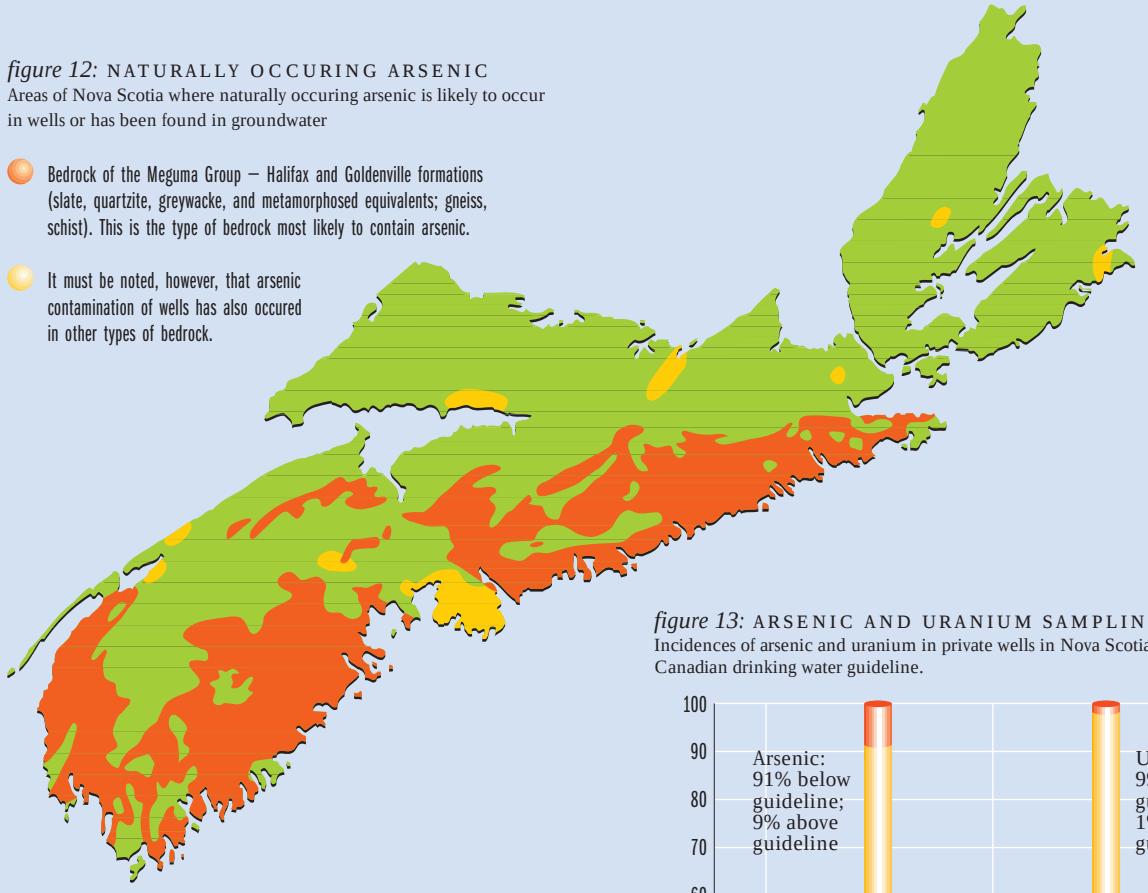


figure 13: ARSENIC AND URANIUM SAMPLING
Incidences of arsenic and uranium in private wells in Nova Scotia exceeding Canadian drinking water guideline.

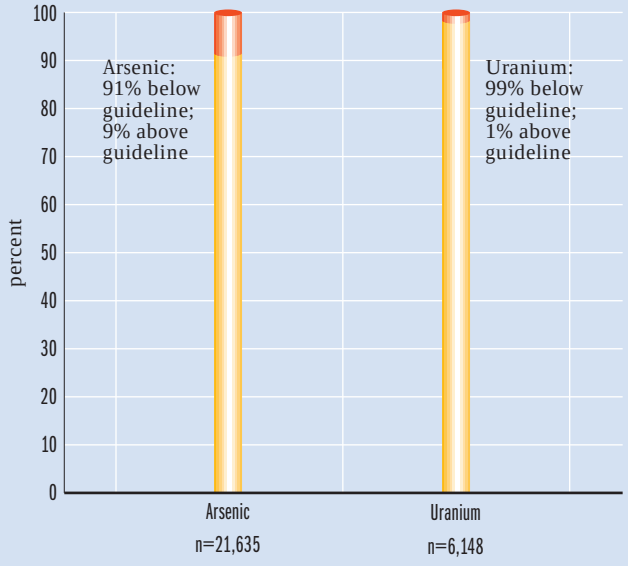
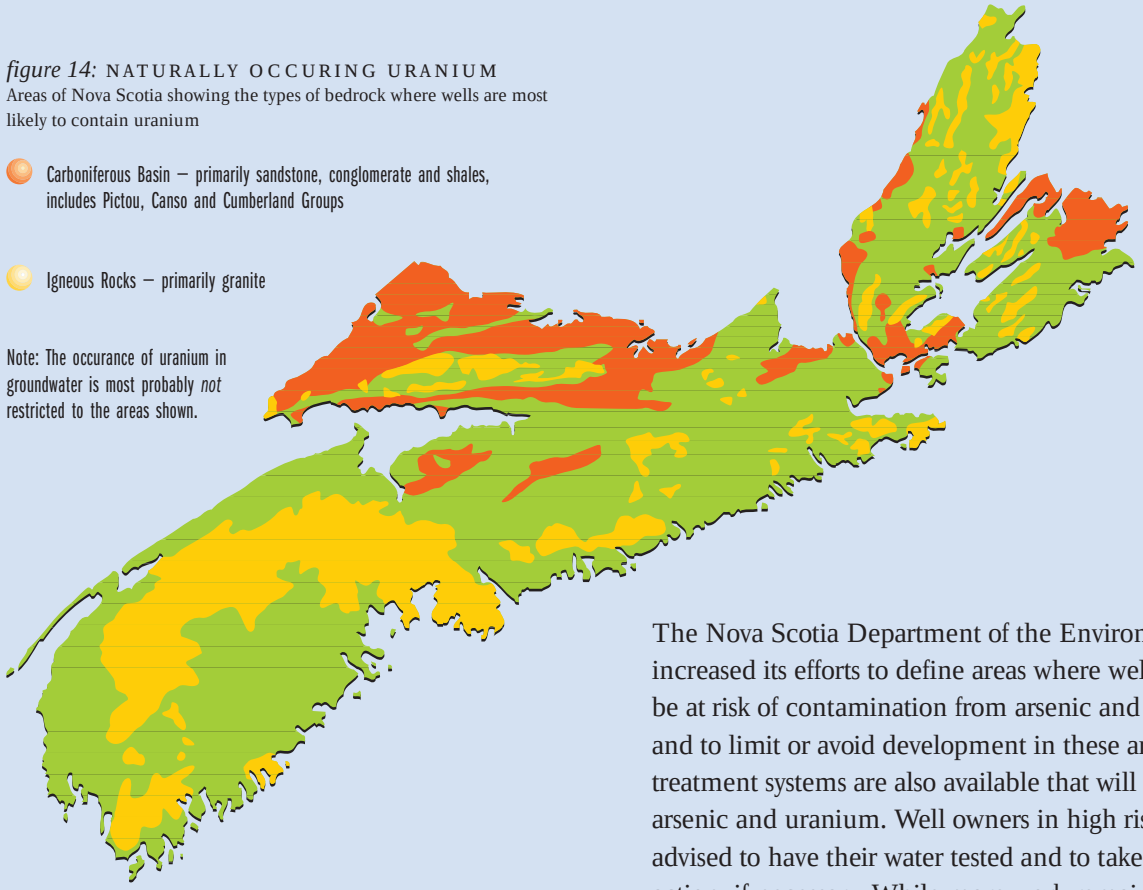


figure 14: NATURALLY OCCURING URANIUM
Areas of Nova Scotia showing the types of bedrock where wells are most likely to contain uranium



The Nova Scotia Department of the Environment has increased its efforts to define areas where wells would be at risk of contamination from arsenic and uranium, and to limit or avoid development in these areas. Water treatment systems are also available that will remove arsenic and uranium. Well owners in high risk areas are advised to have their water tested and to take corrective action, if necessary. While more work remains to be done, arsenic and uranium in private wells is basically a risk management problem.

Looking Ahead

- As Nova Scotians, we need to educate ourselves about where our drinking water comes from and how we can protect it. The Department of the Environment is encouraging increased involvement of individuals and communities in the management of municipal water supply watersheds.
- We have a long way to go before reaching our goal of all municipal water systems having a comprehensive water supply protection strategy in place. This is a priority in the 1998 provincial water strategy. The Government of Nova Scotia will continue to strongly encourage the development of municipal drinking water supply protection plans.
- NSDOE is reviewing the Provincial municipal water sampling program to identify opportunities for increasing efficiency and improving water quality, especially in reducing THMs.
- NSDOE is supporting a research project to develop a GIS database on uranium in well water. This will provide a more accurate map of uranium occurrence in groundwater.

Drinking Water Indicators

INDICATOR	PERFORMANCE	TREND	COMMENT
Number of municipal water supplies with Protected Water Area designation or comprehensive water supply protection strategy	Steadily increasing in number from 1965 to 1997 to 31% of supplies		Requires a cooperative effort between all levels of government and the local community. One of the objectives of the Provincial Water Strategy is improving water supply protection.
Municipal water supply samples testing negative for total coliform bacteria	Consistently over 95% in the past 8 years and showing increasing improvement over a 25 year period		More water utilities upgrading and improving treatment capacities and successful protection strategies in place
Number of municipal water supplies meeting the Guidelines for Canadian Drinking Water Quality (excluding aesthetic guidelines)	This will be more comprehensively reported in the future.		Data not readily accessible. Data collection and reporting system being constructed.
Water table levels			Data not readily accessible. Data collection and reporting system being constructed.
Number of boil orders issued for municipal water supplies	Boil orders are issued whenever coliform counts exceed the Guidelines for Canadian Drinking Water Quality.		Data not readily accessible. Data collection and reporting system being constructed.

 Improving  Worsening  Static  Don't Know

Protection of Aquatic Habitat

Nova Scotia's lakes, rivers and shorelines offer a rich and diverse habitat for a vast variety of fish, amphibians, mammals, birds and aquatic plants. These ecosystems are of intrinsic value in and of themselves and are essential to a healthy environment. They also provide aesthetic enjoyment and recreational activities to Nova Scotians and attract thousands of visitors and tourists each year. Freshwater commercial fishing, sports fishing and tourism all create jobs and contribute in a substantial way to the local economy. The recreational fishery alone is estimated to generate up to $82.5 million a year in direct and spinoff benefits to the Nova Scotia economy. The commercial freshwater fishery is much smaller consisting primarily of the eel and gaspereau fisheries. Together these species generated landed values in 1996 totalling approximately $2.1 million.

Human activities have had a significant impact on aquatic life in the province, both on the species themselves and on their habitat. Up to the early part of this century, loggers transporting logs in rivers straightened meandering streams radically altering the geometry of the river and seriously impairing fisheries habitat. Cutting, land clearing, tillage and pasturing to the edge of watercourses were standard practices, causing damage to stream banks and aquatic habitats.

Today aquatic species and habitats are still being affected by development pressures and by threats such as acid rain. These pressures come from agriculture, forestry, highway construction, residential development, cottage development, and industrial pollutants.

Throughout the 1980's however, the province initiated various policies, guidelines, and programs to reduce damage to lakes and rivers due to development. As well, community-based groups have become active in improving and protecting water bodies and shorelines. Yet in spite of government and private efforts, a gradual decline of fish habitats and the resulting losses of income and recreational opportunities continues. The loss of salmon habitats due to siltation and acid rain, and the closure of numerous shellfish areas because of sewage and agricultural runoff are examples.

While the damage in some areas has been severe, the trend in habitat loss is reversible. Protecting and restoring fish habitat is possible through coordinated action by government, industry, landowners and an informed public.

Land Development is Putting Pressure on our Aquatic Habitats

Land use and development affects aquatic habitats through siltation and eutrophication. Both are natural processes that can be seriously accelerated by human activities.

figure 15: LAND DEVELOPMENT AND SILTATION
This 1970s file photo shows the dramatic effect land development can have on an adjacent lake.

Community Groups can make a Difference

The Lake George Property Owners' Society (LGPOS)

Twenty five years ago, a few concerned cottage owners in Kings County met to discuss the state of lake water quality and future prospects for Lake George, the cottage owners and the watershed. Although the original concerns focused on sewage disposal, limits to development and boating safety, the group quickly expanded its scope of concerns to include a variety of lake management issues. Examples of community enhancement projects include a Lake Clean-Up Project in 1981 that removed 6-8 tons of garbage from around the perimeter of the lake. This had an important impact on the residents and a follow up survey in 1994 showed that the shoreline has continued "garbage free" since the 1981 clean-up. Other projects include improvements to the public beach and park; a Lake George Property Owners' Society water testing program; trout stocking; repairs to the main spillway and maintenance of water levels in the lake.

Lloyd Graham (a former Director of the LGPOS) states *"Armed with attainable goals, positive leadership, motivated stakeholders, and some common sense, most of our concerns have been handled through a process of education, cooperation, communication and legislation. The LGPOS is committed to supporting and maintaining the water quality and environment in this watershed."*

Effect of Eutrophication

Eutrophication spoils lakes for human uses such as drinking water supply, fishing, swimming, boating and aesthetic pleasure. It changes fish habitat, causing shifts in species from cold-water fish such as salmon and trout to warm-water species such as perch and bass. In extreme cases, eutrophication causes fish kills.

Siltation Destroys Habitat

Siltation is the deposition of eroded soil particles from the land into a watercourse. Any land use that removes the natural vegetative cover—grass, bushes, and trees—can cause siltation of nearby waters if precautions are not taken.

In certain areas of Nova Scotia, siltation of rivers is believed to be a key factor limiting the natural reproduction of trout and salmon and a cause of Atlantic salmon habitat loss. During the late 1980s, government departments in Nova Scotia adopted guidelines to help protect aquatic habitats. For example, the Forest/Wildlife Guidelines and Standards for Nova Scotia present ways to minimize the adverse environmental effects of forestry such as the use of buffer strips or greenbelts. The Guidelines have been adopted by the province's large forestry companies.

Eutrophication Ages Lakes

Eutrophication refers to the ageing of water bodies, especially lakes. A eutrophic lake is rich in nutrients that cause excessive plant growth. As they decompose, weeds and algae can kill animal life by depriving them of oxygen.

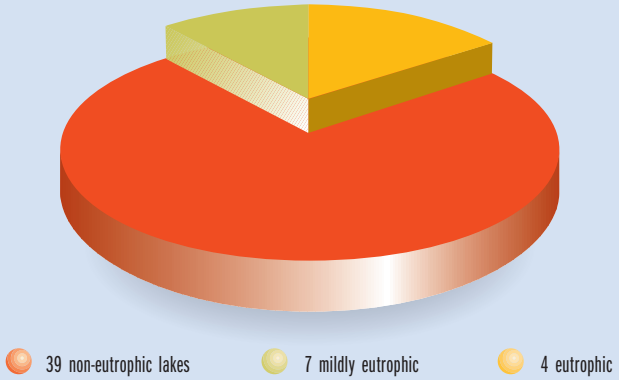
Although eutrophication is a natural process, human activity can greatly accelerate it by putting nutrients into the water. Nutrients include lawn and garden fertilizers, soaps and detergents, animal manures, and human sewage. Changes that occur naturally over thousands of years, take place within a decade in a nutrient rich lake.

Eutrophication has emerged as a major form of water pollution in many countries. While it is not a widespread problem in Nova Scotia, we do have specific problem areas.

For example, at Gaspereaux Lake in Antigonish County, agriculture and residential development caused highly eutrophic conditions in the 1980s. Residents reported blue-green algal blooms and fish kills. Attempts to restore the lake have been unsuccessful.

A study of 50 Halifax-Dartmouth area lakes suggests that residential development is causing eutrophication in four lakes *(Figure 17)*.

figure 16: HALIFAX/DARTMOUTH AREA LAKES
Results from a study on eutrophication of 50 lakes around Halifax/Dartmouth



In rare cases, eutrophication has been partially reversed. Russell Lake in Dartmouth was so eutrophic in the 1970s, a public advisory was issued warning residents of potential toxic algae. Monitoring activities by a community group and actions by NSDOE to eliminate the sources of nutrients being dumped into the lake have caused a dramatic change. Today, the lake is no longer eutrophic.

Some municipalities are taking a proactive approach to control the impact of development on lakes and aquatic habitats. The Municipality of Kings County, for example, has developed a model for predicting the impacts of development on lake water quality. The reliability of the model is being improved through a community monitoring program and will help planners predict how much development a lake can sustain.

Highway Construction and Maintenance Practices in Nova Scotia

Highways, bridges and other transportation infrastructure have often been constructed with little regard for negative impacts on land, water and biota. Soil erosion and compaction were routine events at many construction sites. Increased siltation in streams, chemical contamination of stream courses, and fish and wildlife habitat destruction, were common by-products of highway construction and maintenance.

In the early 1990s, the Nova Scotia Department of Transportation and Public Works (DTPW) began moving towards more responsible environmental practices. Perhaps one of the strongest indications of the change is that almost 10% of the cost of each construction project now goes to erosion control measures designed to minimize environmental impacts. The Department also requires contractors to limit the amount of exposed soil on a job and the length of time it is exposed. This is one of the most effective ways to reduce erosion.

The DTPW evaluates erosion control products, such as control blankets. Once rarely seen, some form of erosion control product is now standard procedure on most highway work.

Improvements have also been made in fish habitat protection. Fish baffles are installed in culverts through which fish travel, to ensure water remains inside the culvert during the summer low flow months. DTPW, in partnership with special interest groups and other government agencies, supports a variety of habitat restoration projects, such as restoring eroded stream banks.

The Department is also experimenting with using native vegetation that already grows along roadsides to replant disturbed areas. This results in more resilient vegetation and reduces herbicide and pesticide use.

Blankets for Erosion Control

Erosion control blankets are most often comprised of straw, wood fibre, jute or coconut fibre sewn together or bonded to a biodegradable or photodegradable netting. These mats are rolled out and staked to slopes and provide erosion protection by reducing the erosive forces of rainfall, runoff and wind, while enhancing seed germination and vegetative growth.

Community Based Environmental Management

Approximately 27 community groups across the province are working to improve and protect coastal and inland waters in Nova Scotia. Examples are:

- ACAP Cape Breton
- Bluenose ACAP
- Bras d'Or Stewardship Society
- Clean Annapolis River Project
- Clyde River Association
- Cumberland County River Enhancement Association
- East-Shelburne County Rivers Association
- Eskasoni Fish and Wildlife Commission
- Friends of the Cornwallis River
- Habitat Unlimited
- Halifax County Watershed Advisory Board
- LaHave River Watershed Enhancement Foundation
- Musquodoboit River Association
- New Waterford Fish and Game Association
- Pictou County Rivers Association
- Pictou Harbour Environmental Protection Project
- Sackville Rivers Association
- Shubenacadie Watershed Environmental Prot. Soc.
- St. Mary's River Association
- Tusket River Environmental Protection Association
- Woodens River Watershed Environment Organization

Looking Ahead

Much of the water quality information used for decision making in Nova Scotia has come in part from federal government monitoring programs. In recent years these programs have been scaled back. Nova Scotia requires a strengthened monitoring effort and a better understanding of long term trends if we are to make informed decisions on resource management and land use.

The provincial water resource management strategy is an action plan to address a number of issues. These actions include:

- Developing Provincial water quality guidelines and objectives for protecting aquatic life and other water uses;
- Developing surface and ground water monitoring networks and data bases to establish regional water quality baselines and determine long term trends;
- Promoting and encouraging community stewardship groups active in watershed protection;

Aquatic Habitat Indicators:

INDICATOR	PERFORMANCE	TREND	COMMENT
Number of community groups active in river or lake enhancement initiatives ***or*** percentage of bays, inlets and estuaries covered by community led initiatives	Significantly increasing over the past five to ten years		Attributable to education, awareness, community empowerment and concern
Toxins in shellfish	Too early to report trends. Data analysis incomplete.		Gulfwatch Program. This is a project of the Gulf of Maine Council on the Marine Environment.

Improving Worsening Static Don't Know

Wetlands, Salt Marsh and Shoreline Protection

Up to 90% of the wildlife in lakes, rivers and wetlands is found within a strip several metres wide on either side of shorelines. Nova Scotia also has some 8,000 km of saltwater coast and 11,000 ha of salt marsh. Our salt marshes are among the most productive ecosystems in the world, providing breeding grounds for water fowl, staging areas for migratory birds and wildlife habitats. Our freshwater wetlands are also highly productive biologically and also serve as water supply regulators and purifiers. Ours is an exceptionally rich heritage to manage and protect.

Salt Marsh

The remaining salt marsh in Nova Scotia is only a fraction of what existed prior to European settlement. As much as 65% or the original salt marsh in the province has been dyked or filled for agricultural purposes. Today, some dykeland is returning to natural salt marsh as some dykes deteriorate 6,100 acres of dykeland have been converted to salt water marsh.

Shorelines

Many of our freshwater shorelines have been affected by past resource management practices – particularly in forest harvesting and agriculture – that led to streambank destabalization and erosion. In other areas uncontrolled housing or cottage development exerts serious pressure on wildlife habitat, and on receiving waters. Uncontrolled development along shorelines also interferes with the public right of access to beaches and other coastal features that are held in trust, by the Crown, for the people of Nova Scotia.

The impacts of human activities on our shorelines include siltation and the run-off of chemicals (whether fertilizers or pesticides) into waterbodies. Eutrophication can cause extensive algal blooms, destruction of fish and waterfowl habitat and serious deterioration in water quality.

Individual Nova Scotians can take a number of actions to reducer negative impacts on our shorelines:

- Build at least 30 metres away from the shoreline
- Pump out septic tanks every three to five years
- Don't use fertilizer, herbicides or pesticides near water courses
- Avoid gas and oil spills
- Stop cutting grass or reduce the size of lawns near shorelines
- Use phosphate-free soaps and detergents
- Preserve and/or replant shoreline vegetation
- Keep lots well treed. Never clear-cut to the shoreline
- Avoid cultivation to the edge of stream banks
- Fence pastures bordering water courses to prevent animals trampling stream banks and drinking directly from streams.

Freshwater Wetlands

Nova Scotia has more than 35,000 freshwater wetlands constituting 15% of the province's total land area. According to the Canada Centre for Inland Waters, agricultural interests in freshwater wetlands in Atlantic Canada has not been as high as in other parts of the country. Estimated losses of freshwater wetland habitat in Atlantic Canada since settlement by Europeans range from 16 to 18 per cent – much lower that other regions of Canada.

Respect for wetlands is demonstrated by:

- Observing forest/wildlife guidelines when working near wetlands
- Minimizing disturbance to wetlands
- Building around wetlands as opposed to draining them and filling them in
- Travelling around wetlands rather than through them
- Planning in such a way as to respect the integrity of wetlands
- Keeping solid and chemical wastes out of wetlands
- Minimizing human activities in wetlands.

Wild Shellfish Harvesting

What is Happening?

The harvesting of shellfish[2] for human consumption is a practice that pre-dates European settlement in the Maritimes. In recent years, we have seen a major reduction in shellfish landings in all maritime provinces[3]. The deterioration of nearshore water quality is the primary reason for this decline.

2 For the purpose of this discussion, shellfish includes species such as oysters, clams and mussels. Lobsters and scallops are not included.

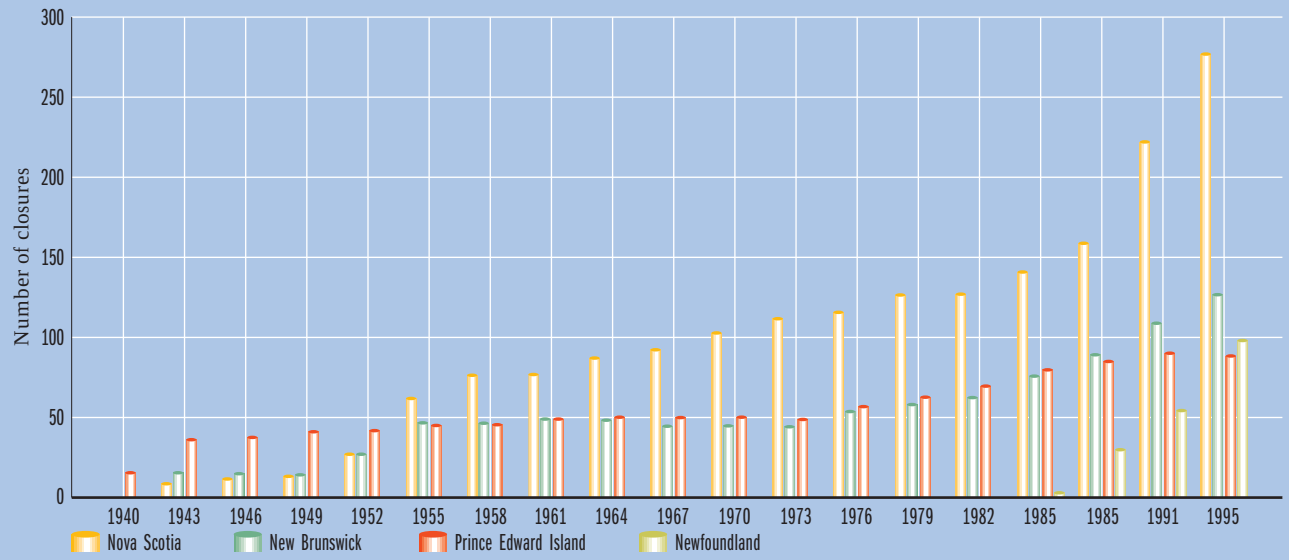
3 Shellfish Resources, Gulf of Maine Council on the Maine Environment, Fall 1996

Serious problems in the wild shellfish harvest surfaced in the 1920s. During the winter of 1924-25 an outbreak of typhoid fever, traceable to contaminated oysters, occurred in the U.S.. Authorities on both sides of the border reacted quickly to put regulations in place to control the industry and ensure the protection of consumers.

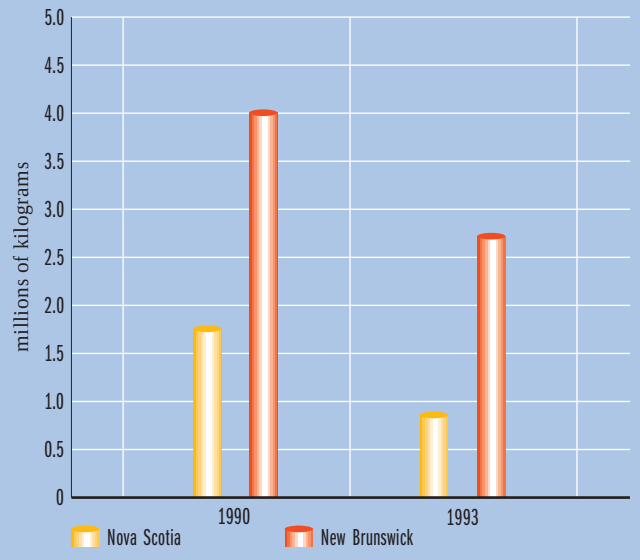
The Introduction of Shellfish Closures

Since the 1920s, the number of shellfish closures (areas closed to the harvesting of shellfish due either to chemical or bacteriological contamination) has grown in Nova Scotia. Today, approximately 270 areas are closed, covering more than 700 km2 of nearshore and estuarine waters. The number of closures appears to be growing at a greater rate in Nova Scotia than in any other Atlantic province. This trend has caused a large drop in incomes (estimated to have declined between 20% to 60%); it also means that harvesting pressures on the remaining areas have become unsustainable. As illustrated in the accompanying table, shellfish landings declined by 40% to 50% in New Brunswick and Nova Scotia between 1990 and 1993.

SHELLFISH CLOSURE TRENDS
In the Atlantic Provinces from 1940 to 1995



SHELLFISH LANDINGS
In Nova Scotia and New Brunswick for 1990 and 1993



Why is it Happening?

The principle sources of bacteriological contamination of coastal waters are untreated sewage and malfunctioning private septic systems. Others are non-point sources of coastal water contamination and increased sedimentation from agriculture and forest harvesting.

What are we Doing About it?

Proper sewage treatment is likely the only solution to cleaning up our coastal waters. Sewage treatment will eliminate bacteriological contamination from centralized collection systems. For example, a wastewater treatment plant built in 1991 on the harbour in Yarmouth allowed public officials to open sections of the harbour to shellfish harvesting that had been closed for years. In most circumstances, this success story could be replicated around the province wherever centralized collection systems are discharging untreated wastewater into the marine environment. Controls on forest harvesting and cultivation near water courses is also necessary to effectively control the sedimentation of estuaries and other coastal waters.

Water Quality and Recreation

NSDOE monitors recreational water quality in areas of high public use. For the most part, our small population places minimal recreational pressures on its lakes, waterways and coastal beaches. But there are exceptions. Several public beaches in Halifax and Colchester counties are closed for several days each summer, when bacteria counts exceed safe levels. This also occurs occasionally at other popular public swimming beaches in the province (*table at right).*

These beach closures are usually caused by high bacterial counts that occur in the summer months when water temperatures are high and water levels may be low. The cause is often poorly functioning septic or municipal sewage treatment systems or urban storm water drainage. In farming areas such as the Annapolis Valley, agricultural runoff containing manure or parasites can cause closures. Schistome, the organism that cause swimmers itch, is also responsible for some closures each year. This is a natural occurrence for which there are no preventive measures.

Beach closures have not been widespread and are not considered a serious deterrent to the recreational use of water in Nova Scotia. But because no government department maintains a data base on beach closures and their causes, it is not possible to establish a trend. Unofficially, the number of beach closures per year seems to remain relatively constant, with some improvement in recent years as Nova Scotians become more aware of the issue. New septic regulations passed in 1997 allow cottage owners more flexibility in choosing systems and it is anticipates this will lead to more and better treatment.

COUNTIES WITH AT LEAST ONE BEACH CLOSURE DURING THE 1995-96 SEASON

COUNTY	CLOSURES
Halifax/Hants	4 lakes
Colchester	4 rivers
Cape Breton	1 lake
Pictou	sections of 1 river
Annapolis	sections of 1 river
Lunenburg	sections of 1 river

Looking Ahead

- NSDOE will establish a data base on beach closures in order to monitor trends.

Recreational Water Indicators:

INDICATOR	PERFORMANCE	TREND	COMMENT
Number of beach closures annually	Unsure whether increasing, decreasing or staying the same annually		Data not readily accessible. Data Collection and reporting system being constructed.

Improving Worsening Static Don't Know

WASTE–RESOURCES MANAGEMENT

Overview

The dilemma of how to manage the by-products of human activity—what we commonly regard as "garbage, sewage and waste" is centuries old. As late as the early 1990s, Canadians were among the largest per capita producers of solid wastes in the world. However, environmental impacts such as shellfish closures, contaminated sites, and loss of aquatic habitat are making it clear that our land and water have only a limited capacity to receive our waste materials.

Over the last 25 years, Nova Scotia has made important advances in its management of waste materials.

We have made good progress in many areas, but there are also important issues to be resolved. These include cleanup of the Sydney Tar Ponds and curbing the discharge of raw sewage into the ocean. And while we have made important advances in managing our solid wastes, creating less waste in all segments of society is the most effective strategy, and one to which we can all contribute.

Better Controls over Industrial Discharges

Because of our small industrial base, industrial discharges have not been as large an environmental issue in Nova Scotia as they have been elsewhere in Canada. However, we do have major industries that discharge large amounts of liquid effluent. Many of these are located on shorelines and discharge into the ocean.

The major industries in Nova Scotia requiring approvals for liquid industrial discharges are:

- Pulp & Paper
- Textile Manufacturing
- Power Generation
- Oil Refining
- Tire Manufacturing
- Mining

The N.S. Environmental Protection Act of 1972 established a formal approval process governing industrial discharges of liquid effluent. These early approvals, however, were limited and tended to vary in their

Waste Resources Management

25 years ago

- Approximately 100 dump sites with open burning for disposal
- Municipalities dumped raw sewage into the ocean
- Poorly designed and inadequately maintained septic systems
- No standards for, or controls over, industrial discharges

Today

- Disposal sites reduced to 19 with no open burning, tight environmental controls
- Over 55 additional sewage treatment facilities, however too much raw sewage still going into our harbours
- Removal of over 1700 old petroleum storage tanks
- Better controls on industrial discharge

Approvals

Industrial activities create discharges in the form of liquid effluent, air emissions, or solid wastes. Because these can have an adverse effect on our water, air and land, industries need approvals before discharges into the environment are allowed. The Nova Scotia Department of the Environment reviews discharge locations and and mitigative measures for liquid discharges and requires these to meet certain quality standards. The Department issues between 70-100 approvals per year. Many of these (up to 75%) are for pits and quarries, which typically do not create toxic discharges. Some, however, may cause acid drainage problems.

requirements. Inadequacies were addressed in the 1995 Environment Act, which requires approvals of some 72 industrial activities that could affect the environment.

In recent years, major improvements have been made in the quality of liquid discharged from pulp and paper mills.

Dramatic Progress in the Pulp and Paper Industry

Nova Scotia's six pulp and paper mills represent one of the largest heavy industries in the province, accounting for 80% of the industrial liquid effluent discharged into the environment. In 1992, new federal regulations required all mills to upgrade their treatment systems. As a result, pollutants in pulp and paper effluent have been cut by as much as 90% from 1990 levels *(see Data Sheet)*.

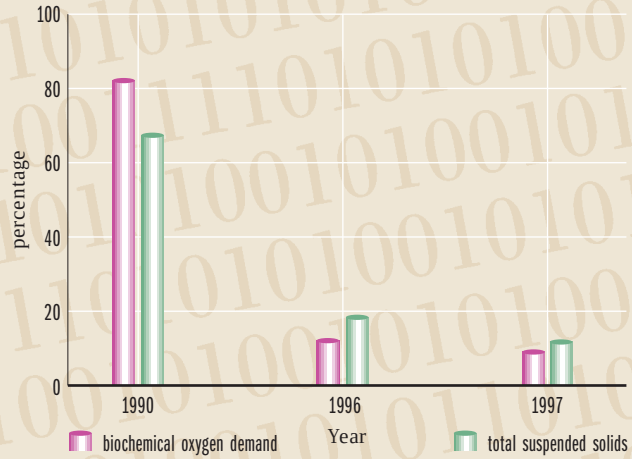
PULP AND PAPER INDUSTRIAL DISCHARGE DATA SHEET

Controlling industrial discharge from pulp and paper reduces the amount of biochemical oxygen demand (BOD) and total suspended solids (TSS) entering fresh water and marine environments.

Reason for Trend: New federal regulations have required the pulp and paper industry to install specialized treatment systems to improve the quality of the effluent discharged to the environment.

PULP AND PAPER DISCHARGE

Pollution in the effluent of Nova Scotia's six pulp and paper mills



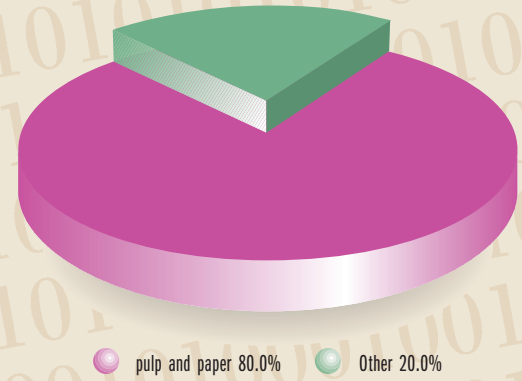
Bottom Line: Progress has been significant in improving the quality of effluent discharge from the pulp and paper industry.

EFFECTS ON THE ENVIRONMENT

- Reduced fish kills as a result of improved effluent treatment systems;
- Improved water quality for a wide variety of purposes including wildlife habitat, recreation.

SOURCES OF INDUSTRIAL DISCHARGE

Pulp and paper mills account for 80% of the liquid effluent discharges from industrial sources.



Looking Ahead

Further steps toward better control of industrial discharge include:

- Establish a self-reporting process, similar to that used in the pulp and paper industry, for major Nova Scotia industries producing industrial discharge;
- Promote pollution prevention as a practical way of moving towards zero discharge of effluent into the environment. Pollution prevention eliminates or reduces pollution at the source, rather than treating or containing it after it is released into the environment. It is achieved by using processes, practices and materials that minimize waste creation.

Industrial Discharge Indicators:

INDICATOR	PERFORMANCE	TREND	COMMENT
Quality of industrial discharges to the environment	Data not easily accessible for SOE reporting		Data not readily accessible. Data collection and reporting system being constructed.

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Cleaning Up Nova Scotia's Contaminated Sites

Nova Scotia began keeping an inventory of contaminated sites in 1991. To date, 715 sites have been registered.

Contaminated sites in Nova Scotia range in magnitude from a gas spill at a local service station to the Sydney Tar Ponds, the largest chemical waste site in Canada (see sidebar). However, the vast majority of Nova Scotia's contaminated sites are small and usually caused by petroleum leaks.

Petroleum Contaminated Sites

Petroleum contaminated sites include service stations and bulk fuel storage plants, commercial properties, and institutional and residential fuel oil spills that require remediation. Although usually small, they are important. Leaked petroleum spreads easily into surface and ground water and can quickly contaminate large areas.

The Beginning of Contaminated Site Assessment in Nova Scotia

In 1981, the chemical perchlorethylene was unexpectedly discovered in the water supply of Amherst, Nova Scotia. The chemical is a solvent used in dry cleaning. The source was a local dry cleaning operation.

After this discovery, the Nova Scotia Department of the Environment tested other public water supplies in the province. Water supplies for the town of Truro and the village of New Minas were also found to be contaminated by PCE.

Water supplies had to be abandoned, and new ones developed, at considerable cost. This was the beginning of contaminated site assessment in Nova Scotia.

Of the 647 petroleum related sites, 309 have been reported by the petroleum industry and 338 by commercial, residential and institutional users of oil. Since 1994, instances of contamination at bulk plants and service stations have steadily declined.

Since Nova Scotia enacted petroleum storage regulations in 1988, 2000 storage tanks have been upgraded or removed, significantly lessening the risk of petroleum leaks.

Industrial Properties

Industrial contaminated sites range from a small pile of incinerator ash containing heavy metals to extensive polychlorinated biphenyl (PCB) contamination at Five Island Lake (see sidebar). Industrial properties can have a wide range of chemical contaminants such as hydrocarbons, PCBs, polycyclic aromatic hydrocarbons (PAHs), metals, and pentachlorophenol (PCP). Since 1991, 43 industrial properties have been reported contaminated and required management or remediation.

Federal Properties

Twenty-five federal properties have also been reported contaminated and are being assessed and remediated by various federal government departments. These include: National Defense, Transport Canada, Fisheries and Oceans, RCMP and Parks Canada. Environment Canada is the lead regulatory agency responsible for environmental quality on federal properties.

Looking Ahead

- Contaminated sites have been handled through the Nova Scotia Department of the Environment's regional offices on a case by case basis. A centralized data base enabling a province-wide "snapshot" of the status of all sites is required for SOE reporting.

CONTAMINATED SITES DATA SHEET

A contaminated site is a property where contaminants have been released and pose a threat to human health and safety or to the environment. Restoring these sites to a useful purpose and eliminating or reducing the risks requires appropriate management or remediation.

Trend: The number of contaminated sites reported by the petroleum industry is beginning to level off. The initial flurry of sites in previous years reflected industry response to the new Petroleum Storage Regulations.

Bottom Line: Contamination from leaking underground petroleum storage tanks has produced the largest number of contaminated sites. Regulations establishing minimum criteria for installation of new tanks, and the removal of old tanks have significantly lessened the problem.

EFFECTS ON HEALTH

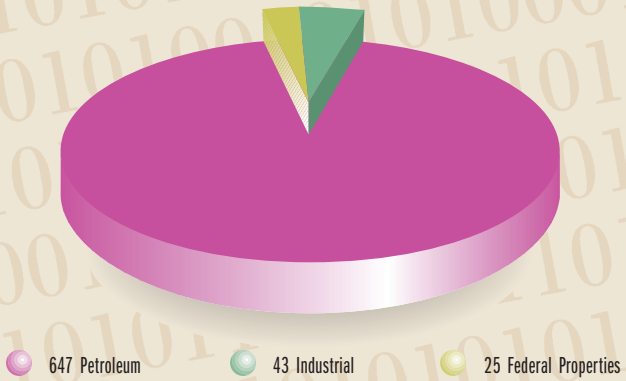
- Contaminants in soil can dissolve and affect ground water used for drinking or bathing or discharge to rivers or lakes and affect aquatic systems.
- Carcinogens in the environment carry the risks of cancer.

EFFECTS ON THE ENVIRONMENT

- Contaminants can be taken up by plants and animals resulting in impacts to the entire food chain.
- Contaminants can affect ecosystems in ways that can limit the overall ability of the environment to support a natural population.

CONTAMINATED SITES

As of 1998, Nova Scotia has 715 registered contaminated sites.



Five Island Lake: A New Model for Community Involvement

In 1988, acting on local complaints, the Nova Scotia Department of the Environment found PCB contamination at the site of a scrap yard in the community of Five Island Lake. The yard was ordered to close and government agencies took the lead role in the cleanup effort.

In 1994, researchers discovered that sediments in a northern section of Five Island Lake were contaminated. This posed a risk of affecting fish in the entire lake system. A consumption ban on fish was imposed by the Nova Scotia Department of Health and concern was expressed by the Canadian Wildlife Service about the impacts of PCB contaminated fish on surrounding wildlife. The complexity of the problem, and the large number of communities potentially affected, led to the creation of a citizens group: The Community Liason Committee (CLC). Since its inception, the CLC has been a model for how communities and government can work together to solve a difficult problem.

The CLC undertook to:

- Devise a remediation plan for the clean-up of contaminants that is environmentally sound and acceptable to the community.
- Ensure that the community gets accurate information from government departments involved in the remediation.
- Ensure that community concerns are heard by government.

In the CLC model, the community and the government have created a structure that allows them to exchange information and discuss concerns. The community, working with the appropriate government agencies, has taken a lead role in developing the remediation plan. Such a partnership can prevent many of the problems often associated with contaminated sites.

Sydney Tar Ponds

The Sydney Tar Ponds is the most toxic contaminated site in eastern Canada and the largest chemical waste site in the nation. It contains 700,000m^3 of sediment contaminated with polynuclear aromatic hydrocarbons (PAHs), and approximately 45,000 tonnes of sediment contaminated with polychlorinated biphenyls (PCBs). The Tar Ponds are also the site of numerous, untreated residential and industrial sewer outfalls.

Although the discharge of PAHs into the Tar Ponds was eliminated by the closure of the coke ovens, high rates of discharge from the Tar Ponds into Sydney Harbour continue. The commercial lobster fishery in the south arm of Sydney Harbour has been closed since the early 1980s. The Harbour is also closed to shellfish harvesting.

Because the Tar Ponds are located in an urban area, the environmental health effects are high on the list of concerns to the residents. Initial attempts to excavate the sediments and burn them in a revolving fluidized bed incinerator failed because of technological problems. A subsequent proposal to have the sediments contained by a slag cover has not received public support.

At this point, the three levels of government (federal, provincial and municipal) are working with the public in a participatory process that involves all members of the community in seeking to resolve the issue. The Joint Action Group (JAG) on the Environmental Clean Up of Muggah Creek is currently developing recommendations on the clean up of the Muggah Creek watershed which includes the Tar Ponds.

Industrial Discharge Indicators:

INDICATOR	PERFORMANCE	TREND	COMMENT
Number of contaminated sites identified by category, number assessed and number remediated	Lack of data or inaccessible data does not permit reporting on trend		Data not readily accessible. Data collection and reporting system being constructed.

Improving Worsening Static Don't Know

Treating our Sewage

Sewage in Nova Scotia is treated either "on-site" with septic tanks and disposal fields (45% of the population) or centrally by municipal treatment facilities. Over the last 25 years, we have made improvements in both areas, but we still have a long way to go. About 30% of our sewage continues to be dumped into our harbours with no treatment at all.

Better Treatment of our Municipal Sewage

Some of the improvements made over the past 25 years in treating municipal sewage are:

- Nova Scotia prohibited construction of new outfalls discharging raw sewage in the mid-1960s. As a result, 55 new sewage treatment facilities were built throughout the 1970s.

- Nova Scotia's sewage treatment facilities must now be managed by certified operators. More than 150 operators have been certified to-date and the number continues to grow.
- Chlorine, once used exclusively to disinfect effluent, is now recognized as potentially toxic in the environment. Dechlorination systems are used in many facilities. New treatment facilities are replacing chlorine treatment with ultraviolet light disinfection.

Better On-Site Systems

Nova Scotia had few regulatory controls over on-site sewage treatment systems until 1972 when new regulations, new guidelines and educational programs were introduced. Today, approximately 450,000 Nova Scotians are served by private on-site sewage disposal systems. More than 5000 approvals to install new on-site systems are issued each year.

In 1985, a new design for on-site waste water treatment

was developed in Nova Scotia, resulting in improved system efficiency and, in some cases, allowing lot size requirements to be cut in half. Guidelines for the new systems have been exported to other Canadian provinces and U.S. states.

Private on-site sewage disposal systems need to be properly managed to ensure safe, reliable, long term operation. Today's systems are less likely to malfunction than those of the past. However, inadequate maintenance can still lead to failures. In addition, many older systems no longer function adequately and need replacement.

Much Remains to be Done

Much remains to be done along three fronts:

- Eliminating raw sewage discharges;
- Improving efficiency of central treatment facilities;
- Improving efficiency of private on-site systems.

We have made some progress in eliminating the raw discharges of many communities. However, almost 300,000 Nova Scotians are still serviced by sewage collection systems with no treatment.

In Canada, 99 communities with populations

SEWAGE TREATMENT DATA SHEET

Reduces the amount of untreated sewage entering the environment and controls the quality of the effluent to reduce unintended negative impacts on aquatic habitats

Target: Elimination of non-treated sewage discharge

Reason for Trend: Data are insufficient to establish a clear trend although we know that more municipal collection systems provide treatment today than was the case 25 years ago.

Bottom Line: Discharge of untreated sewage into the environment continues at unacceptably high levels. The two major urban areas of the province (i.e., Halifax and Sydney) still discharge raw sewage into their harbours.

EFFECTS ON HEALTH

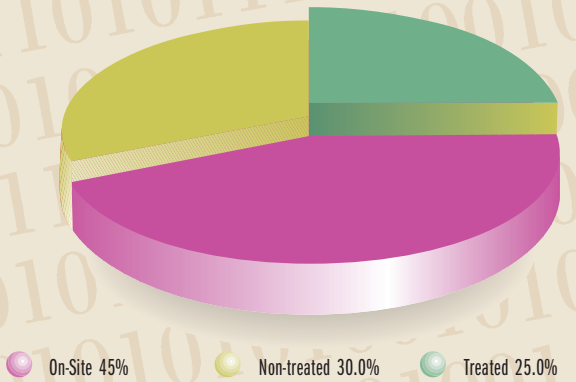
- Coastal areas closed periodically to swimming due to high coliform counts;

EFFECTS ON THE ENVIRONMENT

- Serious decline in marine environmental quality affecting wildlife habitat;
- 270 areas in the province closed to shellfish harvesting due to high coliform counts.

SEWAGE TREATMENT STATUS

Nova Scotia municipal sewage treatment status, 1997



The Solution is Expensive

The total costs associated with addressing Nova Scotia's wastewater treatment deficiencies are enormous, an estimated $683 million:

- $400 million of this is for Halifax Harbour clean-up;
- $86 million to rectify problems for communities with "on-site" disposal systems.

greater than 10,000 still discharge raw sewage. Of those, four are in Nova Scotia. The HRM is only one of six communities in the country with populations more than 50,000 that discharge raw sewage.

We have only limited information on the efficiency of Nova Scotia's central treatment facilities. However, a recent inspection of a limited number of plants has served to indicate that many of the more than 300 private and municipally owned facilities require improved operation and effluent monitoring programs.

Looking Ahead

- NSDOE will conduct an audit of municipal treatment systems in the summer of 1998.
- The Provincial government is developing a Nova Scotia wide Sewage Discharge Strategy to address the problems discussed above.
- The Halifax Regional Municipality has recently adopted a plan that will result in the complete treatment of municipal sewage.

Sewage Treatment Indicators:

INDICATOR	PERFORMANCE	TREND	COMMENT
Number of certified operators	Increasing	☺	Provincial regulations and approvals responsible for trend
Number of Nova Scotians on municipal sewage systems with treatment	A slight increase has occured with the communities of Bear River, Yarmouth, Mahone Bay and several others acquiring treatment facilities	☺	Implementation of the HRM plan to treat HRM sewage will reduce the percentage of population with untreated sewage to 10%.
Number of municipal sewage treatment facilities operating properly	Performance problems at some treatment plants	●	Data not readily accessible. Data collection and reporting system being constructed.
Number of private central sewage treatment facilities	No data available to determine trends	●	Monitoring not in place. Monitoring system being constructed.

☺ Improving ☹ Worsening 😐 Static ● Don't Know

Managing our Solid Waste Resources

For much of the last 25 years, the province exercised little control over the way in which garbage was disposed. In the early 1970s, Nova Scotia had more than 100 active dumps. Most had open burning with no pollution control and released carbon monoxide, hydrocarbons and particulate matter into the air. As well, since they did not have proper containment, leachate could seep into the ground, finding its way into ground or surface waters.

Today, the province has effective regulations and design standards in place. For example, Nova Scotia no longer permits the open burning of wastes. In addition, all new landfills are required to install plastic or soil liner containment systems. These systems act like giant bathtubs, ensuring that leachate does not pollute ground water. The leachate is drained away through collection systems and then treated. All existing landfills will be required to meet these standards by the year 2005.

We also have fewer disposal sites, nineteen for all of Nova Scotia (a decrease in number from 44 in 1995 to 19 in 1998). Although, in and of itself, fewer landfills do not automatically mean improved waste-resources management, improved regulations and design standards have produced improvements. Recycling and waste diversion is reducing the materials going to landfills and eliminating many materials that caused problems in the past. By the year 2005, the number of disposal sites will be further reduced to between seven and ten.

Less Garbage in our Landfills

In 1989, Nova Scotia, along with other provinces across Canada, agreed to divert from disposal sites 50% of its solid waste by the year 2000 (based on 1989 levels). Nova Scotia's *Solid Waste Resource Management Strategy* has laid out the framework for achieving this goal.

Besides enacting stricter disposal standards, the province is working with municipalities and nonprofit groups on an infrastructure to divert waste through reducing, reusing, recycling and composting. Each region of the province is developing a plan to carry out programs to achieve 50% diversion. Once that target is reached, an evaluation will be carried out to determine the feasibility of making even further reductions in the volume of waste going into landfills.

The province has also banned the disposal of beverage containers, newsprint, corrugated cardboard, used tires, lead acid batteries, waste paint, and automotive antifreeze. The Resource Recovery Fund Board (The RRFB), a nonprofit non-government organization, is responsible for dealing with many of these materials. More than 40 of Nova Scotia's municipalities have now set up curbside recycling programs; approximately 77% of the population has access to this service. The curbside programs and the Enviro Depot system diverted more than 140 million beverage containers and 20 million milk containers in fiscal year 1996.

In 1996-97, Nova Scotians sent 26% less garbage to landfills and incinerators than they did in 1989. Per person, that's a drop of 187 kg a year. (From 712 kg. per person to 525 kg.) How much of this reduction is due to consuming less, and how much to recycling is difficult to say. Consuming less is ultimately the most efficient and effective way to reduce solid waste.

Looking Ahead

In recent years, Nova Scotia has greatly advanced in its management of solid waste. Notwithstanding the improvements, opportunities for further progress remain.

- Almost 30% of our waste stream is compostable organic material. Currently four central composting facilities serve the province. More will be created so that we can achieve the 50% target.
- Regional solid waste-resources management plans have been developed. The next step is for municipalities to act on these plans.

Solid Waste Resource Management Strategy Goals

1. 50% diversion
2. Improved environmental standards
3. Regional cooperation to reduce costs
4. Development of economic opportunities

RRFB Establishes Enviro-Depot System

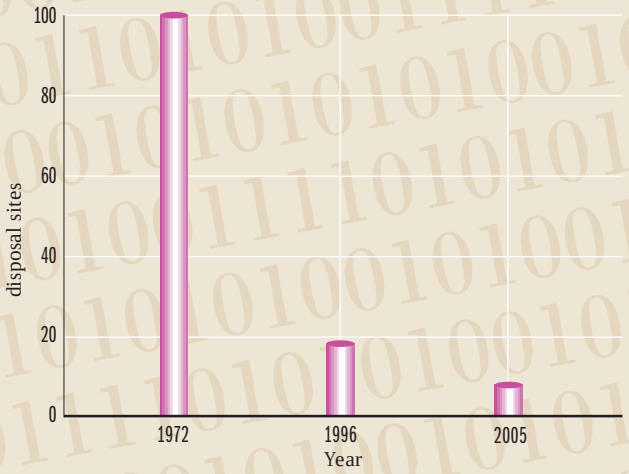
In 1996, the Resource Recovery Fund Board (RRFB) established an Enviro-Depot system to collect materials banned from landfill sites. Since that time, the RRFB has set up almost 100 Enviro-Depots and implemented a deposit-refund system for beverage containers, giving all Nova Scotians access to recycling services.

SOLID WASTE-RESOURCE DIVERSION DATA SHEET

Reduces the amount of solid waste entering disposal sites and contributes to resource conservation through recycling.

DISPOSAL SITES

Number of disposal sites in Nova Scotia for 1972, 1996 and proposed for 2005



Target: 50% diversion of solid waste (from 1989 levels) by the year 2000.

Reason for Trend: The Nova Scotia Solid Waste Resource Management Strategy released in 1995. This led to increased recycling of reusable wastes and regulatory controls on substances entering landfill sites.

Bottom Line: Nova Scotia is on track for achieving the reduction target within the specified time period.

EFFECTS ON HEALTH

- Improved air quality
- Increased protection of potable water supplies

EFFECTS ON THE ENVIRONMENT

- Reduced demand on land resources to accomodate waste disposal
- Extends the life of existing landfill sites
- Reduces demands on new raw resources through recycling and reuse
- Reduces threat to water quality through regulation of materials entering landfill sites
- Reduces quantities of greenhouse gases and other airborne contaminants due to elimination of uncontrolled burning, and reduction of methane gas released from landfills.

Solid Waste-Resource Management Indicators

INDICATOR	PERFORMANCE	TREND	COMMENT
Number of disposal sites	Improving significantly. Number has dramatically declined.	Improving	This indicator tracks progress towards the target of 7 sites by 2005. Attributable to the provincial solid waste-resource management strategy.
Diversion of solid waste from disposal sites	Improving dramatically	Improving	Attributable to the provincial solid waste-resource management strategy. This indicator tracks progress towards a 50% diversion target.
Number of kg waste produced per capita	Improving	Improving	Attributable to the provincial solid waste-resource management strategy and recycling initiatives.
Per cent organic waste being composted	Nova Scotia will soon ban compostable waste entering landfills and incinerators.	Improving	Since the target is zero organic material entering the disposal sites, this indicator will track progress towards that target.

Improving Worsening Static Don't Know

CONCLUSION

Re-thinking our Approach to Environmental Protection

Governments have been in the "environmental business" for 25 years and have accomplished many things, however, enacting environmental legislation and adopting environmental regulations does not directly facilitate reporting on the state of the environment. Commitment to monitoring (i.e., taking the pulse of) critical indicators that will tell us about the health of the natural world around us, is an essential component of the SOER program.

SOE partners must now turn their attention to prioritizing monitoring requirements; filling data and information gaps and, assembling existing data and information into a more readily accessible form. The challenges are greater than any single government, or government department can meet. Collaboration and partnerships between governments, with the private sector and, with community groups and other NGOs, will be critical to meeting many of the data and information shortcomings identified in this report.

Pillars of a New Approach to Environmental Stewardship

Environmental stewardship will finally mature when a number of changes are firmly established:

- The transition is made from reacting to the effects of human activity in the environment to pro-actively managing those activities in order to control effects.
- The delivery of environmental stewardship initiatives is focused at the local or community level and adequate resources are provided in support of those initiatives.
- Appropriate stakeholder partnerships are negotiated to ensure that the necessary indicators to report on environmental health are being consistently and accurately monitored.

Some evidence exists that changes of the nature described above are taking place. The new *Pollution Prevention Strategy* is an example of adopting a more proactive approach to managing human activity in the environment.

An Example from the Pollution Prevention Initiative

When NSDOE was first created twenty-five years ago, it began implementing a regulatory system aimed at controlling pollution at the point of discharge. This was done to protect the environment and human health from pollutants being released directly to the environment. It required operators to obtain from government multiple, legally enforceable, "end of pipe" permits based on discharges to the air, land and water.

"In the long term, these initiatives contribute to reduced environmental liabilities, and improved community and employee environmental health. They also improved our efficiencies and costs."

Giles Morel, Environmental Health and Safety Supervisor
Imperial Oil

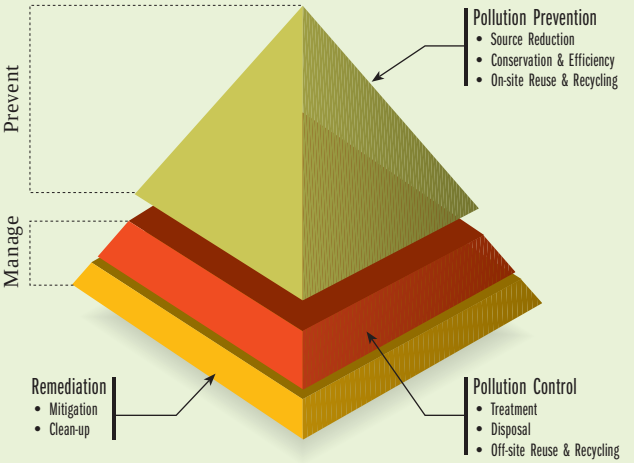
While we must continue to make progress in cleaning up and treating existing sources of contamination, it is often more effective and efficient to prevent problems before they occur. Today government, industry and the public recognize that it is necessary to "move up the pipe" to avoid, eliminate and reduce pollution at the source. While not new, pollution prevention is gaining prominence because it is the most efficient and cost effective way to minimize damage to the environment. It can also provide value-added benefits by linking protecting the environment with increasing efficiency, reducing costs, improving flexibility and gaining a competitive advantage

The Nova Scotia Department of Environment has adopted pollution prevention as the preferred method of environmental protection and improvement.

Pollution prevention means avoiding, eliminating and reducing pollution at the source rather than treating or containing it after it has been created. This is achieved by using processes, practices, materials, products, and energy sources that avoid or minimize the creation of waste.

Many Nova Scotians are using the pollution prevention approach and proving that it works. Our goals are to further promote the integration of pollution prevention into industry's long range business plans; to see pollution prevention planning become prominent in the activities, policies and programs of government; and to see pollution prevention become a way of life for Nova Scotians.

ENVIRONMENTAL MANAGEMENT HIERARCHY



Pollution Prevention in Nova Scotia

In 1998, two Nova Scotia enterprises won Pollution Prevention Awards from the Canadian Council of Ministers of the Environment (CCME):

- The Municipality of Annapolis County received an award for its wastewater treatment facility in Bear River. The world-famous facility uses an indoor marsh with plants, trees and snails to treat the community's sewage.
- Bebbington Industries of Dartmouth were recognized for adopting pollution prevention policies and procedures in all phases of their operations including the products that they market.

Many other industries in Nova Scotia are incorporating pollution prevention into their operations. An example is Imperial Oil Limited's Dartmouth refinery, which has integrated environmental and economic priorities in many aspects of their business. Over the past four years, Imperial Oil achieved the following results through pollution prevention initiatives:

- 58% reduction in National Pollution Release Inventory emissions through leak detection and repair programs.
- 20%-40% reduction in most waste water effluent parameters through improved process controls and operational practices.
- 50% reduction in solid waste through emphasis on recycling.

Environmental Stewardship at the Local Level

One of the most striking developments in resource and environmental management in the 1990s has been the increase in the number of community-based groups assuming responsibility for environmental stewardship. Even more striking are the success stories in areas of water quality enhancement, habitat recovery and landscape rehabilitation. What governments alone have appeared incapable of doing, community groups, with the assistance of government, have demonstrated considerable success.

The next report on the State of the Environment in Nova Scotia will include a module created by community groups highlighting many of the successful initiatives undertaken all across Nova Scotia. While stakeholders at many different levels are required to protect the environment, tangible change is most often achieved at the local level when communities take ownership and assume leadership of initiatives.

Monitoring

The capability to measure environmental response to human activity, and to store, analyse and retrieve the associated data lies at the heart of state of the environment reporting. The first SOE report for Nova Scotia has identified important gaps in data as well as weaknesses in our data management systems. These gaps and weaknesses must be remedied if our ability to monitor environmental change is to improve in the years ahead. This report contains tables of indicators that the Nova Scotia Department of the Environment is committed to monitoring in the coming years. This is not a comprehensive or "ultimate" lists of indicators. They represent the best indicators that we can report on at present, and others that NSDOE has committed to reporting on in the future. There are other indicators that could be monitored but departmental resources are limited. The tables below show a number of "desirable indicators" that the Department could include in future reports on air, water and waste management, if other partners can be found to collect and maintain the necessary data.

In addition to monitoring selected indicators, the Nova Scotia Department of the Environment is also committed to improving data management systems that will facilitate rapid storage, analysis and retrieval of information critical to reporting on the state of the environment. This new system will be in place by the spring of 1999 for the capture of new data.

Desirable Indicators: Requiring the Commitment of Other Partners

DRINKING WATER

INDICATOR	PERFORMANCE	TREND	COMMENT
Nitrates in private wells	Studies have shown elevated levels of nitrate in wells in agricultural areas (1967, 1974, 1989) but they indicate the levels have remained static		Need to undertake periodic assessment of wells

AQUATIC HABITAT

Number of waterbodies which do not meet Canadian Water Quality Guidelines for Protection of Aquatic Life related to total suspended solids	A problem primarily associated with inadequate maintenance of buffer zones along streams and lake shores and resource development activities in proximity to lakes and streams		Water quality objectives for aquatic life have not yet been adopted. Once they are in place, monitoring programs need to be established.
Number of hectares of freshwater wetlands	Across Atlantic Canada 15% of our freshwater wetlands have been lost. We don't know what the status of Nova Scotia wetlands are specifically.		Monitoring program under development. Too early to report.
Mercury levels in water	Insufficient long term data to report on trends.		Need to maintain long term monitoring program

INDUSTRIAL DISCHARGE

Quality of pulp and paper discharge	Effluent quality increasing dramatically in recent years		Attributable to federal regulations of the pulp and paper industry

Improving Worsening Static Don't Know

Developing An Index Of Sustainability

NSDOE is supporting research on the development of the Genuine Progress Index (GPI) for application in the province. One of the primary purposes of the Genuine Progress Index is the integration of environmental variables into the economic accounting system thus providing a means of measuring progress towards sustainable development.

It is now common ground that "sustainable development" must include social, economic and environmental considerations. The long standing impediment to measuring progress in the achievement of sustainable development has been the lack of a single index incorporating these diverse interests. The GPI holds promise that such an index may finally be in reach. If the current research substantiates this promise, the GPI will become a regularly reported indicator in all SOE reports, providing a fundamental measure of progress towards sustainability.

GLOSSARY

Acid Rain - The result of emissions, principally from fossil fuel burning, of sulphur dioxide and nitrogen oxides, that significantly lower the pH of the rain.

Baseline - A starting point for measuring trends in a particular aspect of the environment.

Beach Closure - Closure of a beach to public swimming due to high bacterial levels in water.

Biota - Living plants and animals.

BOD - Biochemical oxygen demand is a measure of how much oxygen is needed to break down organic matter such as found in sewage; high BOD indicates that oxygen levels available to fish and other aquatic life may be low.

Coliform - A bacteria whose presence in water can be indicative of the presence of other harmful contaminants.

Disposal ban - means that a material can no longer be disposed in a landfill or incinerator in Nova Scotia. The material must be diverted. Implementing the disposal bans will help achieve the province's goal of 50% waste diversion in 2000.

Diversion of solid waste - Reducing, reusing, recycling or composting of solid waste so that it no longer is disposed in landfills or incinerators.

Diversion rate - the reduction of solid waste disposed in landfills and incinerators per person relative to the 1989 baseline.

Ecosystem - A system of interacting organisms in a particular habitat.

Effluent - A liquid waste material that is a by-product of human activity (e.g., liquid industrial discharge or sewage) which may be discharged into the environment.

Eutrophication - The natural ageing of a lake that may be exacerbated by human activity.

Exceedance - A level beyond which an air contaminant is considered to be in concentrations which are undesirable for human and environmental health.

Fine Particulate - Particles less than 10 microns in diameter generated primarily through fossil fuel burning.

Global Warming - Increase in global temperature due to the increasing concentration of carbon dioxide acting like a greenhouse in the atmosphere.

Indicator - A device that points to an environmental concern and provides information on the current status of that concern.

Leachate - leachate is formed when organic materials break down in landfills and mix with rain water. Leachate is very acidic and picks up contaminants like heavy metals from the other garbage in the landfill.

Long Range Transport - The process by which air contaminants are carried to Nova Scotia on winds from industrial areas to the west and south.

Natural attenuation - a "leaking" landfill that is designed to control leachate by allowing it to seep into the surrounding soil.

Ozone - An invisible gas produced in the atmosphere by the interaction of nitrogen with volatile organic compounds.

PAHs - Polycyclic aromatic hydrocarbons.

PCBs - Polychlorinated biphenyls.

PCPs - Pentachlorophenol.

Protected Water Area - A watershed around a public water supply system that is the subject of special land use regulations and controls to protect the integrity of the water supply.

Raw Sewage - Sewage discharged to the environment without any treatment.

Shellfish Closure - An area of coastal water closed to shell fish harvesting due to bacterial contamination usually associated with inadequate sewage treatment or malfunctioning septic systems.

Siltation - The entry of sediments eroded from land into a water body.

Smog - A combination of ground level ozone, fine particulate and other constituents.

Sustainable Development - Improving the quality of human living with the carrying capacity of supporting ecosystems.

THMs - Trihalomethanes, a known carcinogen, that forms in some surface water supplies by the interaction of the chlorine disinfection process with organic matter in the water.

TSS - is the amount of total suspended solid matter present in effluent.

References

Beauchamp, S., P. Waugh and R. Tordon, 1992. *Ozone Exceedances Atlantic Region 1980-1991.*

Beauchamp, S., 1996. *The Status of Mercury in Eastern Canada,* Environment Canada

Bryson and Hare, 1974, quoted in the United States-Canada Memorandum of Intent on Transboundary Air Pollution, MCARLO Interim Model Profile, July 1981.

Burgess, N., 1996. *High Mercury Levels in Common Loons Breeding in the Maritimes*. Paper presented at the EMAN 2nd National Meeting.

Environment Act, S.N.S., c.5, 1995

Environmental Protection Act, S.N.S., c.1, 1973

Federal Provincial Advisory Committee on Air Quality. Review of National Ambient Air Quality Objectives. Reports on various pollutants and their effects are published annually.

Kosteltz, A., and M. DesLauriers, 1990. *Canadian Emission Inventory of Canada*. Conservation and Protection, Ottawa. Report EPS/AP/3.

Nova Scotia Department of the Environment. *Canadian/Nova Scotia Agreement Respecting an Acid Rain Reduction Program. Nova Scotia 1995 Annual Report.*

Linton, Jamie, 1997. *Beneath the Surface of the Water: The State of Water in Canada.* Published by the Canadian Wildlife Federation.

Eaton, P.B., A.G. Gray, P.W. Johnson and E. Hundert, 1994. *State of the Environment in the Atlantic Region*, published by authority of the Minister of the Environment, Minister of Supply and Services, 1994.

P.D. Keizer, et al., 1993. Synoptic Water Quality Survey of Halifax/Dartmouth Metro Area Lakes on April 16, 1991. *Canadian Data Report of Fisheries and Aquatic Sciences 914,* Fisheries and Oceans Canada.

Menon, Amar, 1995. *Canadian Shellfish Sanitation Program (CSSP)*, Environment Canada, Atlantic Region, Dartmouth, Nova Scotia. www.na.ec.gc.ca/epb/sfish/cssp/html

Moerman, D., and D. Briggins, 1994. *Nova Scotia Farm Well Water Quality Assurance Study*, published jointly by the Nova Scotia Departments of Agriculture and Marketing, and the Environment.

Watt, W.D., 1987. *A Summary of the Impact of Acid Rain on Atlantic Salmon (Salmo salar) in Canada.* Wate, Air and Soil Pollution, Vol. 35: 27-35.

_____, 1997. Phase 2 Federal Smog Management. *Smog and Ambient Air Quality in Canada*, Environment Canada

_____, 1997. *Pollution Prevention Strategy: a discussion paper,* Nova Scotia Department of the Environment

_____, 1995. *Solid Waste-Resource Management Strategy,* Nova Scotia Department of the Environment

_____, 1992. *Sustainable Development Strategy for Nova Scotia*. Nova Scotia Round Table on Environment and Economy

_____, 1988. *Acid Rain and Watershed Sensitivity.* prepared by the Committee on the Environment, Conference of the New England Governors and Easter Canadian Premiers.

_____, 1996. *Ecology of the Gulf's Shellfish Resources*. Shellfish Resource in the Gulf of Maine, Gulf of Maine Council on the Marine Environment, Fall 1996.

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