News Release

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Ambient Air Quality Accounts for Nova Scotia
Full report available at: http://www.gpiatlantic.org/pdf/airquality/airquality.pdf

NS contributor as well as victim of transborder pollution

Nova Scotians give as good as they get when it comes to transborder air pollution, GPI Atlantic said yesterday in a 250-page report on the state of the province's atmosphere.

Anne Monette, GPI Atlantic senior researcher and the report's lead author, today confirmed the widespread belief that problems in the province's air quality stem largely from pollution in central Canada and the Northeastern U.S.

"But that doesn't let Nova Scotians off the hook," said Monette, an environmental scientist. "We are major polluters. We're perpetrators as much as we're victims."

Nova Scotia's per capita sulphur oxide emissions, which contribute to acid rain, are twice the Canadian level; 2.6 times the levels of the U.S.A. (the next highest emitter); and much higher than any other reporting OECD country.

Sulphur oxides (SOx) are a by-product of burning coal for electric power generation. Despite having a relatively small population, Nova Scotia emits more SOx from electric power generation by utilities than any other Canadian province (135 kilotonnes). The province alone accounts for 25% of Canada's SOx emissions attributable to electric power generation (534kt).

Nova Scotia electric power generation emissions of SOx are 145kg/capita, more than 8 times the Canadian average and 1.35 times the per capita electric power generation SOx emissions of the next-closest province (Saskatchewan, 107kg/capita).

GPI Atlantic is a non-profit research institute based in Nova Scotia that is developing new measures of wellbeing – the Genuine Progress Index.

Ground-level ozone levels high

Other highlights from the report:

• In the summer of 2001, Nova Scotians seeking refuge from ground-level ozone pollution were better off in downtown Halifax than in Kejimkujik National Park, where ozone levels have been as high as 2.33 times the maximum acceptable concentration. In 2001, the highest ozone concentration in Canada occurred in Kings County, NS.

• Also in 2001, downtown Halifax had the highest annual average sulphur dioxide concentration of any commercial site in Canada – between two and 12 times the levels detected in commercial areas of other Canadian cities.

• Air pollutants emitted by Nova Scotians on a per capita basis were higher than all reporting OECD countries and produced damaging effects in excess of half a billion dollars a year. Sulphur oxides account for 40-50% of these damages.

• NS lakes have been slower to recover from acid rain than those in Ontario, Quebec and Newfoundland.

• The frequency of public reporting on air quality in the province has declined sharply. The GPI report is the first assessment of Nova Scotia's air quality to be released at the provincial level in nearly six years - since the provincial government abandoned its State of the Environment reporting.

Significant improvements

There have been significant improvements in the quality of both Nova Scotia's and Canada's outdoor air since the 1970s. In Halifax, carbon monoxide (CO) levels are 63% lower than 25 years ago, particulate matter (PM) concentrations are down about 50%, sulphur dioxide (SO_2) levels have dropped by 90%, and nitrogen dioxide (NO_2) levels by 20%. The most dramatic improvements have been in Sydney, where the closing of the Sydney Steel coke ovens in the 1980s saw PM concentrations in Whitney Pier drop by 79%, from levels that had been far in excess of the maximum acceptable concentration to levels below the maximum desirable concentration today.

Some of these improvements are due to improved emissions controls, including catalytic converters, in cars and trucks. Joint Canada-U.S. initiatives have also sharply reduced the sulphur and nitrogen oxide emissions that contribute to acid rain.

A key air quality concern today is ground-level ozone - a pollutant formed when sunlight interacts with other pollutants. There have been no improvements in ozone concentrations in the province in more than 15 years, and ozone levels at all Nova Scotia monitoring stations are higher than the Canadian government's "maximum acceptable concentration." This means that Nova Scotians are exposed to ozone pollution at levels that can cause harmful health effects.

Ozone has been linked to respiratory illnesses like bronchitis, asthma, pneumonia, and emphysema, lung damage, and cardiovascular illnesses. High ozone levels are associated with increased hospital admissions, emergency room visits, and premature mortality due to cardiovascular and respiratory illness.

Monitoring stations in Kings County, Yarmouth, and Kejimkujik - far from local pollution sources - regularly register ozone levels at twice the maximum acceptable concentration, indicating that high ozone levels in the province are largely the result of pollutants being transported by wind from the U.S. and central Canada.

Nova Scotia's per capita ***emissions*** of carbon monoxide, particulate matter, sulphur oxides, and volatile organic compounds are higher than those of all industrialized countries. Its per capita emissions of nitrogen oxides are the third-highest in the world.

Some 40% of the half-billion dollars annually in damages from these emissions are attributable to electric power generation, nearly 60% of which relies on coal. Another 8% is due to light-duty cars and trucks.

The biggest industrial polluter in the province is the pulp and paper industry, which produces about 3% of total pollution damage costs.

Air pollution damages include the effects of acid rain on rivers, lakes, fish populations, and forests; human health impacts; damages to materials; reduced agricultural yields and forest productivity; and diminished visibility.

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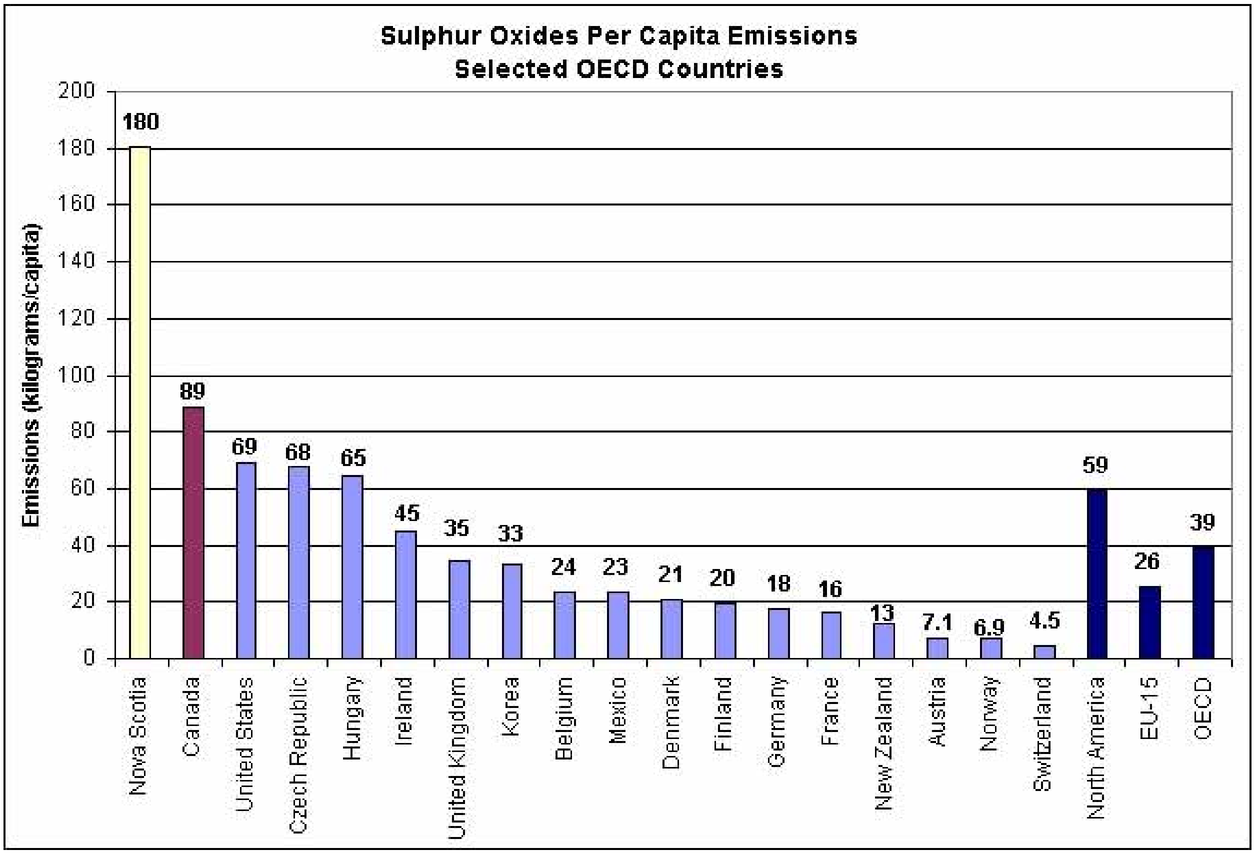
Per Capita Emissions of Sulphur Oxides (kg/capita), Selected OECD Countries (1997 and comparable years)



Note: Comparative results should be interpreted with caution since the details of estimation methods differ greatly between OECD countries. For example, Nova Scotia, Canada, United States, Czech Republic, Hungary, Korea, France, New Zealand, Austria, Mexico, and United Kingdom estimates are for sulphur dioxide only. All other emissions are for sulphur oxides, which include sulphur dioxide. Also, all estimates are for anthropogenic emissions with the exception of France, which includes natural sources. In addition, Mexico estimate is for 1994; Nova Scotia emissions estimate is for 1995; Austria, Belgium, France, Korea, and United Kingdom data are for 1996; and all other figures are for 1997.

Source: Nova Scotia emissions: Environment Canada, 2000; International and Canadian emissions: OECD, 1999.

Selected Ambient Air Quality Trends in Nova Scotia. See full report for more sites.

Pollutant	Monitoring Site	Time Period	Change	Canada 1979-1996
Carbon monoxide	Halifax (Downtown)	1977-2001	-63%	-63%
Total particulate matter	Technical University of Nova Scotia, Halifax	1974-2001	-53%	-40%
	Dalhousie University, Halifax	1974-1998	-27%	
	CFB Shearwater, Dartmouth	1974-1998	-63%	
	Whitney Pier Fire Station, Sydney	1974-2001	-79%	
	South Street, Glace Bay	1978-1995	-34%	
Sulphur dioxide	Halifax (Downtown)	1975-2001	-74%	-50%
	Bedford	1991-2002	-90%	
	CFB Shearwater, Dartmouth	1975-1998	-68%	
	Imperial Oil Ltd. Dartmouth refinery	1977-1998	-21%	
	Whitney Pier Fire Station, Sydney	1974-1986	-52%	
	County Jail, Sydney	1974-2001	-96%	
	Point Tupper	1977-1995	-54%	
Nitrogen dioxide	Halifax (Downtown)	1976-2001	-20%	-31%
	CFB Shearwater, Dartmouth	1976-1993	+14%	
	Millville, Cape Breton	1996-2002	+100%	
Ground-level ozone	Halifax (Downtown)	1977-2001	-43%	+34%
	Dayton, Yarmouth	1994-2000	-13%	
	Kejimkujik National Park	1986-1988	+8%	
		1992-2001	+21%	

Technical Notes for Media

Ambient Air Quality Accounts

January 21, 2004

National Ambient Air Quality Objectives

In the 1970s, the Canadian federal government set national ambient air quality objectives (NAAQOs). As "objectives," they are not legally binding. NAAQOs have been established as a three-tiered system: desirable, acceptable, and tolerable objectives (see table below).

- The *maximum desirable concentration (MDC)* is the long-term goal for air quality and also provides a basis for an anti-degradation policy for unpolluted parts of the country (of not allowing the quality of unpolluted air to deteriorate even though there might be apparent leeway to do so without demonstrable effect). It also provides a guideline for the continuing development of control technology.
- The *maximum acceptable concentration (MAC)* is intended to provide adequate protection against the potential effects of air pollution on soil, water, vegetation, materials, animals, visibility, and personal comfort and wellbeing.
- The *maximum tolerable concentration (MTC)* denotes time-based concentrations of air contaminants beyond which, due to a diminishing margin of safety, appropriate and immediate action is required to protect the health of the general population.

NAAQOs are based on the assumption that a threshold level (an exposure below which health effects do not occur) exists for pollutants. However, there is considerable uncertainty about whether safe thresholds for pollutants exist.

Canada's National Ambient Air Quality Objectives

Pollutant	Averaging Time	Maximum desirable concentration	Maximum acceptable concentration	Maximum tolerable concentration
Carbon monoxide (ppm)	8-hour	5	13	17
	1-hour	13	31	
Suspended particulates ($\mu g/m^3$)	annual	60	70	
	24-hour		120	400
Sulphur dioxide (ppb)	annual	11	23	
	24-hour	57	115	306
	1-hour	172	344	
Nitrogen dioxide (ppb)	annual	32	53	
	24-hour		106	160
	1-hour		213	532
Ozone (ppb)	annual		15	
	1-hour	50	82	150

Note: Blank cells indicate that there is no established objective.

Carbon Monoxide

(For more detail please see Page 17 of the full report)

Description

Carbon monoxide (CO) is a colourless, odourless, and tasteless gas toxic to humans in sufficient concentrations. CO is a product of incomplete combustion of fossil fuels (i.e., any combustion process where carbon-containing organic material is burned without sufficient oxygen).

Sources of Carbon Monoxide Emissions

The major sources of CO are primarily natural: volcanic, marsh and natural gases, oceans, fires, and electrical storms. The major human sources of CO in Canada are industrial, including fossil fuel-based electricity generation; residential (e.g., fires, wood or gas stoves, etc.); and waste disposal.

Total Particulate Matter

(For more detail please see Page 20 of the full report)

Description

Airborne particulate matter (PM) is any aerosol that is released to the atmosphere in either solid or liquid form and that can be inhaled. This includes particles such as dust, soot, ash, fibre, and pollen. Airborne particulate matter has an upper size limit generally considered to be approximately 75 micrometres, or microns (one millionth of a metre), in diameter. The terms suspended particulate, total suspended particulate (TSP), suspended particulate matter (SPM), PM, total particulate matter (TPM), aerosols, and airborne particles are generally used interchangeably.

Airborne particles or particulate matter with diameters larger than about 10 microns are large enough to settle soon after being emitted from a source. Smaller particles can remain suspended in air for long periods of time. PM with diameters less than or equal to 10 microns are referred to as PM10. PM10 are also called "thoracic particles," since they can be inhaled into the thoracic (tracheobronchial and alveolar) regions of the respiratory system. PM_{10} is also sometimes referred to as "respirable" or "inhalable" particles, although these terms are generally applied to particles less than or equal to 15 microns in diameter.

PM_{10} can be sub-divided into two fractions: a fine fraction of particles with diameters less than or equal to 2.5μm (called $PM_{2.5}$), and a coarse fraction of particles with diameters >2.5μm but <10μm ($PM_{10-2.5}$). PM_{10} and $PM_{2.5}$ are considered to be "toxic" under the 1999 Canadian Environmental Protection Act (CEPA) PM_{10} exposure has been associated with cardiovascular and respiratory disease mortality, and $PM_{2.5}$ with cardiopulmonary and lung cancer mortality.

Sources of Particulate Matter Emissions

Particles originate from both natural and human sources. The main natural sources of PM include volcanoes, wind erosion of soil and rock, forest fires, and plants. The principal sources of PM emitted as a result of human activity are industrial processes, fuel combustion, transportation, and solid wastes.

Sulphur Oxides

(For more detail please see Page 23 of the full report)

Description

Sulphur dioxide (SO_2) is a colourless gas with a pungent odour that combines easily with water vapour to form sulphurous acid (H_2SO_3). It will unite with oxygen in air to form the more corrosive sulphuric acid (H_2SO_4). Sulphur forms a number of oxides but only SO_2 and sulphur trioxide (SO_3) are important as gaseous air pollutants. Usually, only a small amount of SO_3 accompanies SO_2, and together the two are designated sulphur oxides (SOx).

Two common air pollutants acidify precipitation: SO_2 and nitrogen oxides (NOx; See below). Acid rain is a generic term used for precipitation that contains a high concentration of sulphuric and nitric acids (H_2SO_4 and HNO_3). These acids form in the atmosphere when SOx and NOx emissions combine with water in air. Rain measuring between 0 and 5 on the “pH scale” is acidic and is therefore called “acid rain.” Clean rain has a pH value of about 5.6. By comparison, vinegar has a pH of 3.

Sources of Sulphur Oxides Emissions

SO_2 is generally a by-product of industrial processes and the burning of fossil fuels. Ore smelting, coal-fired electricity generation, petroleum refining, pulp and paper mills, incineration, and natural gas processing are the main contributors (Health Canada, 1998; Environment Canada, 2002a).

Nitrogen Oxides

(For more detail please see Page 29 of the full report)

Description

Nitrogen oxides (NOx) is a generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colourless and odourless. The most important of these compounds with respect to air pollution are nitric oxide (NO) and nitrogen dioxide (NO_2). NO_2 is a reddish brown gas with a characteristic pungent odour. In the presence of sunlight these substances can transform into acidic air pollutants such as nitrate (NO_3^-) and nitric acid (HNO_3) particles. NOx also play a key role in the formation of smog (see “Ground Level Ozone & Smog” below).

Sources of Nitrogen Oxides Emissions

Most of the NOx in the environment come from natural sources such as lightning, and biological and non-biological processes in soil. The main human source of NOx emissions is the combustion of fuels in motor vehicles, residential and commercial furnaces, industrial and electrical-utility boilers and engines, and other equipment. Various industrial processes and solid waste disposal also contribute to NOx emissions.

Ground Level Ozone & Smog

(For more detail please see Page 35 of the full report)

Description

Ozone is a molecule consisting of three atoms of oxygen that are bound together. Tropospheric ozone (or ground-level ozone) is not emitted as a pollutant but is formed through a complex series of reactions involving oxides of nitrogen and VOCs (above). It is important to note the difference between tropospheric and stratospheric ozone. Even though both types of ozone are exactly the same molecule, their presence in different parts of the atmosphere has entirely different consequences. Stratospheric ozone (the "ozone layer") blocks harmful solar radiation. Ground-level ozone, on the other hand, is a pollutant that can have negative impacts on human health, agricultural crops, forests, etc.

In the absence of pollution, ozone is produced and consumed in a cyclical reaction involving natural NOx, resulting in fairly constant ozone concentrations throughout the troposphere. In polluted air, which contains increased concentrations of NOx and VOCs, the natural equilibrium between NOx and ozone is upset.

Smog is the term given to a noxious mixture of air pollutants, including gases and fine particles, that can often be seen as a brownish-yellow or greyish-white haze. The mixture is produced by photochemical reactions between NOx and VOCs. Because both these compounds are produced by motor vehicles, transportation is a major contributor to smog. The main components of smog in eastern North America are elevated concentrations of ground-level ozone, a photochemical oxidant, and particulates. Ninety per cent of all smog found in urban areas is made up of ground-level ozone.

About GPI Atlantic

"We measure what we value."

GPI Atlantic is a non-profit research organization committed to the development of the Genuine Progress Index (GPI) – a new measure of sustainability, wellbeing and quality of life.

The Genuine Progress Index is an alternative to the practice of equating progress with economic growth alone. The GPI links the economy with social and environmental variables to create a more comprehensive and accurate measurement tool.

The GPI, for example, treats pollution and crime as costs rather than gains to the economy. That might seem obvious, but pollution clean-up costs and the purchase of burglar alarms in response to crime waves actually contribute to "growth" in the Gross Domestic Product, our most common measure of progress. As well, the GPI assigns explicit value to health, education, volunteer work, environmental quality and other assets. By contrast, the GDP, for example, counts the depletion of natural resources as if it were economic gain, sending the misleading message that the more trees we cut down and the more fish we catch, the "better off" we are.

Our core mission is the development of a demonstration index consisting of 22 components – of which air quality is one – focusing on the province of Nova Scotia. This "full cost accounting" project will serve as a pilot project for Canada and other provinces.

Taken alone, each of the 22 GPI components addresses one vital aspect of our way of life. Taken together, the components provide a comprehensive management tool for use by politicians, policy makers, and community planners. The GPI can also provide the media and ordinary citizens with an easy-to-understand measure of the effectiveness of government in advancing our shared social values. This report recognizes that clean air is one of those values, and it counts improvements in air quality and reductions in pollutant emissions as signs of genuine progress.

GPI Atlantic is a pioneer and leader in quality of life research. Established in 1997 by Ronald Colman Ph D and supported by a distinguished group of academics and researchers, GPI Atlantic is not affiliated with any political party or interest group. To date, GPI Atlantic has completed 50 detailed reports covering 16 of the 22 components of the prototype GPI and many other related projects that apply full cost accounting methods to measuring progress. Compiling the separate components into an integrated index is scheduled to begin in 2005.

Dedicated to indicator research alone, GPI Atlantic works closely with Statistics Canada and other experts to assure the quality of its work and its usefulness for application at the national and provincial levels. Thus, this report was reviewed by key air quality experts at Environment Canada, Statistics Canada, and other agencies. GPI Atlantic is also the first research group in Canada to develop a comprehensive GPI at a community level.