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The State of Urban Air in Canada

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Executive summary

Misperceptions about the environment are rampant

Newspapers in Canada, like those in much of the developed world, give extensive coverage to alarming claims about poor air quality and its impact upon health. Claims linking increasing rates of asthma and death due to air pollution are carried uncritically. Through surveys of students, The Fraser Institute has found a strong disconnect between the perceptions of environmental trends (mostly negative) among Canadian students and the reality of environmental trends (mostly positive): 74% of the students attending Fraser Institute seminars believe that air quality has failed to improve over the past ten years.

But, the reality of the state of our air is quite different from the portrayals of alarmists or the understanding of the public. Things are, in fact, improving dramatically in the developed world as improvements in technology, higher incomes, and democratic systems have created an ever-increasing ability to protect the environment. There is every reason to believe that similar improvements will be seen globally as developing countries open to international trade and have access to advanced technologies. And, while many Canadians are unaware of it, the majority of environmental trends in Canada have been positive for decades.

If it matters, measure it

The Fraser Institute believes strongly in the idea of public policy debate informed by hard data and sound logic. We published our first *Environmental Indicators* report in 1997, going to the original data sources (primarily governmental) to compile evidence that might show us the real state of environmental progress. What we have found is a story of optimism that is not understood by a large section of the population. One of the most far-reaching environmental improvements is the increasing quality of the air Canadians breathe.

- Ambient levels of sulphur dioxide, a pollutant produced by burning coal and oil, which can cause breathing problems and aggravation of respiratory disease, decreased 72.2% from 1974 and 2001.
- Ambient levels of particulate matter, which can irritate lung tissue and reduce visibility in the air, decreased 50.7% from 1974 to 1999.
- Improvements in technology have resulted in an 82.6% decrease in ambient levels of carbon monoxide from 1974 to 2001 despite the fact that there has been a 30% increase in total vehicle registrations over the same period (Statistics Canada, 2000: 121).
- The decline in ambient levels of lead is the greatest success story in the efforts to reduce air pollution. Ambient lead levels fell 94% in Canada from 1974 to 1998, a concentration so low that it no longer needed measuring, and resources were diverted from lead measurement to other activities.
- Nitrogen dioxide, a highly reactive gas emitted by both natural and industrial activities, is a cause for concern because it combines with volatile organic compounds to produce ozone, considered to be a precursor to smog. Canadian ambient levels of nitrogen dioxide decreased 34.4% from 1974 to 2001.

This is not to say the news is all good—ground-level ozone, for reasons not fully understood, is increasing despite decreases in precursor chemicals—but clearly, the trends in air quality have been astonishingly good. While environmental alarmists publish a steady stream of scary reports based on dubious science, all it takes is a quick look at the data to show that the reality of environmental progress is overwhelmingly positive. As the Beatles used to sing, "Things are getting better all the time."

Measuring air quality

Citizens continue to be concerned about the quality of the air that they breathe. As public awareness about the environment has grown, so too has concern about issues such as urban smog and industrial emissions and how these issues affect the health of our population. The purpose of this section is to examine objectively the underlying pollutants that degrade air quality. An analysis of these pollutants will illustrate trends in air quality across Canada and North America, show how they compare to standards set by national and international health bodies, and tell us what to expect in the future.

Measuring air quality

What to measure?

The air that we breathe is incredibly complex. Pure air consists of 21% oxygen and 78% nitrogen by volume, plus traces of other substances and gases both natural and man-made. Regulations designed to improve air quality target six main pollutants: sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ground level ozone (O_3), carbon monoxide (CO), particulate matter (PM), and lead (Pb). These substances, either principle components or precursors to smog, which may have adverse effects on human health, are primarily produced by automobiles and industrial activity (Health Canada, 2001). It is important to recognize that many of these pollutants are also the result of natural biological and chemical processes not significantly influenced by human action; this report does not examine data for these sources.

How to measure?

Two techniques are commonly used to measure air quality: ambient concentrations and emissions estimates. Ambient concentrations are the actual measured amount of pollutant in the air, usually reported in parts per million (ppm), parts per billion (ppb), or micrograms per cubic metre (μg/m3). Emission estimates are calculations of the amount of a particular pollutant emitted by various sources over a given period. These calculations, based on many assumptions about human activity and industrial technology, attempt to model the amount of each pollutant emitted over a certain time period.

Ambient concentrations

The National Air Pollution Surveillance (NAPS) network was established in 1969 to trace common air contaminants in Canada. In 1970, 43 monitoring instruments were tracking pollutant levels in 14 urban centres (Furmanczyk, 1987: 2). As of 2001, the network consisted of 253 stations in 56 cities across the country.

Emission estimates

Emission estimates, the second technique used to determine concentrations of air pollutants, involves a set of calculations that estimate the amount of a particular pollutant emitted by various sources over a given period of time. These calculations are based upon a variety of assumptions, including the level of industrial activity, changes in technology, fuel-consumption rates, vehicle miles traveled, and other activities that are known to contribute to air pollution. Although these emission estimates provide useful information regarding trends in air quality, they are deemed less reliable as indicators than measurements of ambient concentrations due to their dependence on assumptions and the fact they are only estimates. Notably, these emissions estimates do not account for pollutants produced via natural sources.

Performance assessment

In order to make a meaningful assessment of the outcomes of air-quality measurements over time, results must be compared against the air-quality objectives set

by various national and international health and environmental organizations. Such comparisons determine not just whether air quality is improving or deteriorating but also whether, at present levels, the pollutants measured pose a risk to human or environmental health.

In the 1970s, the federal government implemented objectives to protect human health and the environment. These objectives identify acceptable thresholds over given time periods for each common pollutant. Until 1998, Canada used a three-tiered system of National Ambient Air Quality Objectives (NAAQO) that defines maximum desirable, acceptable, and tolerable levels of air pollution for periods of one year, 24 hours, eight hours, or one hour, depending on the pollutant, with standards becoming more stringent over longer time periods (table 1). In 1998, Canada adopted the maximum acceptable objective as the target to achieve through regulatory air-quality management actions and a maximum tolerable objective where immediate action is required (Health Canada, 2001). According to Environment Canada,

> [t]he maximum desirable objective, the strictest of the three objectives, defines a level of pollutant that acts as a long-term objective for air quality. The maximum acceptable objective is intended to provide adequate protection against adverse effects on human health, animals, vegetation, soil, water, materials, and visibility. Finally, the maximum tolerable objective defines concentrations of air contaminants where action is required to protect human health and the environment. When air pollutants reach this level of concentration appropriate action is required without delay to protect the health of the general population. (Environment Canada, 1999)

Table 1: National Ambient Air Quality Objectives (NAAQO)

Air Contaminant	Acceptable	Desirable
Sulphur Dioxide (ppb)		
1 hour	334	172
24 hour	115	57
Annual	23	11
Nitrogen Dioxide (ppb)		
1 hour	213	n/a
24 hour	106	n/a
Annual	53	32
Ground Level Ozone (ppb)		
1 hour	82	51
8 hour	n/a	n/a
24 hour	25	15
Annual	15	n/a
Suspended Particulates (µg/m^3)		
24 hour	120	n/a
Annual	70	60
Carbon Monoxide (ppm)		
1 hour	30.6	13.1
8 hour	13.1	5.2

Source: Health Canada (2001), *National Ambient Air Quality Objectives*, <http://www.hc-sc.gc.ca/hecs-sesc/air_quality/naaqo.htm>.

Performance analysis

In order to make a systematic assessment of air quality in Canada, this report will examine the status of each pollutant based upon the following criteria, where applicable.

1 National trends

Ambient concentrations are assessed in order to identify quantifiable changes in pollutants over time. Both annual averages and mean readings from individual stations are examined. National averages for each pollutant are derived via the mean of all station means measured through the NAPS network. The objective is to determine whether air quality is improving or deteriorating over time at the national level. Comparatively, ambient concentrations for select stations are analyzed to determine if localized areas are experiencing chronically poor results not evident in the national average. The strictest NAAQO objective for each pollutant has been illustrated in all graphs of ambient pollutants to provide a benchmark for good air quality.

2 Conformance with standards

The purpose of this analysis is to make a quantitative comparison of air quality in selected Canadian cities against the strictest air-quality objectives. Both annual and short-term objectives are examined to determine how levels of conformance have changed over time. Additional analysis will include the percentage of stations with readings exceeding the NAAQO standards.

These figures are calculated by dividing the number of stations with at least one reading above the NAAQO by the total number of stations that recorded a reading. The average number of reading in the given municipality are also indicated.

When interpreting this data, it is important to understand that one reading above the standard may not be critical, considering that many stations have several thousand readings a year. Moreover, measurements can be influenced by meteorological factors, including temperature, sunlight, air pressure, humidity, wind, and rain. Despite these limitations, the data provides a good complement to the annual data, illustrating changes in the number of stations meeting short-term concentration objectives.

3 Pollutant by source

This analysis uses emission estimates to examine the sources of each pollutant over time. This helps to determine which sources are primarily responsible for each pollutant and how technology is improving the emissions from various sources over time. Trend graphs have been developed where data permit.

Limitations of analysis

Although this report uses the best data available, some limitations should be recognized.

- Monitoring stations are primarily located in urban centres; therefore, any national results are not necessarily representative of general air quality. Given that stations are typically located in areas of higher pollution (urban centres), sampling is skewed, producing artificially higher national pollutant levels than would be achieved through a sampling program across the country.

- The number of stations within the monitoring network is always changing. Stations are regularly added at new locations while old stations may be decommissioned. As a result, data may be derived from different locations each year, a procedure that can introduce small sampling errors when trends are analyzed over time.

- Stations are often unable to collect enough data to provide a mean value for every year. As a result, some stations are not represented in each year, thus introducing a small sampling error.

Sulphur dioxide

Sulphur dioxide (SO_2) is a colourless gas that, in sufficient concentrations, has a pungent odour similar to burning matches. The largest contributing source of atmospheric SO_2 is fuel that contains sulphur, usually coal and oil (EPA, 2001). Burning such fuel is most prevalent in manufacturing and industrial processes, often the generation of electricity. Other common industrial sources of SO_2 include steel mills, petroleum refineries, and pulp and paper mills (MOE, 2003). Environmental factors such as thermal inversion, wind speed, and wind concentration also affect measured levels.

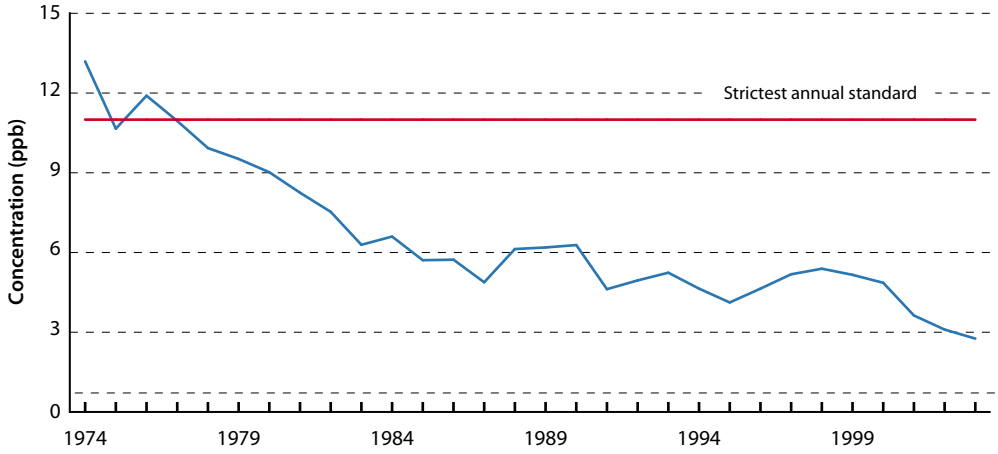
SO_2 is known to have an impact on both human health and the environment. Health effects associated with high levels of SO_2 include breathing problems, respiratory illness, and aggravation of respiratory disease. People with asthma or chronic lung conditions are particularly sensitive to high concentrations of SO_2 (OMOE, 2003). SO_2 is also known as a precursor to acid rain. Following emission into the atmosphere, SO_2 is chemically converted into forms of sulphuric and nitric acid, which subsequently fall back to earth as precipitation. Concentrations of acid rain that are high enough can cause the acidification of lakes and streams, accelerated corrosion of buildings and monuments, and impaired visibility.

Trend for sulphur dioxide

Ambient SO_2 levels in Canada have improved dramatically over the past three decades. The ambient annual national mean for SO_2 decreased by 72.2% between 1974 and 2001 (figure 1). These improvements are marked by two distinct periods: rapid improvement during the first 10 years followed by a second phase of slower improvements. This is likely the result of addressing the most serious sources of pollutant first, leaving less significant sources to be addressed in more recent years.

During the period from 1977 to 2001, there was a significant reduction in the number of monitoring stations

Figure 1: Ambient levels of suphur dioxide, 1974–2003



Source: Environment Canada, National Air Pollution Surveillance Network 2002 Annual Data (2004).

that recorded readings in excess of Canada's NAAQO quality standards (non-conforming stations). The percentage of stations exceeding the one-hour objective fell for both the Desirable and Acceptable standards, falling from 42.2% to 14.7%, and 19.3% to 5.3%, respectively (table 2). Moreover, there was a similar trend for the 24-hour objective where the percentage of non-conforming stations also fell for both the Desirable and Acceptable standards, from 53% to 10.5% and 22.9% to 6.3%, respectively, over the same period. Given that a station counts as non-conforming after registering one reading above the standard over the entire year, these levels may be artificially high; since there are 8,760 hours in a year, one reading may in fact be insignificant.

Table 2: Average number of 1-hour and 24-hour periods exceeding objectives for sulphur dioxide.

	1-hour objectives		24-hour objectives		Number of Stations
	> Acceptable	> Desirable	> Acceptable	> Desirable	
1977	19.30	42.20	22.90	53.00	83
1982	8.60	35.80	6.20	40.70	81
1987	6.90	23.60	2.80	18.10	72
1991	9.33	20.00	5.33	18.67	75
1992	10.39	22.08	3.90	18.18	77
1993	11.94	25.37	1.49	19.40	67
1994	7.89	21.05	5.26	23.68	38
1995	7.27	20.00	0.00	10.91	55
1996	10.17	20.34	1.70	16.95	59
1997	10.34	20.69	3.45	17.24	58
1998	14.93	29.85	5.97	23.88	67
1999	12.90	25.81	3.23	14.52	62
2000	11.11	23.81	3.17	11.11	63
2001	5.26	14.74	5.26	10.53	95
2002	6.82	18.18	4.55	7.95	88
2003	3.09	11.34	4.12	7.22	97

Source: Environment Canada, National Air Pollution Surveillance Network 2002 Annual Data (2003); Website: http://www.etc-cte.ec.gc.ca/publications/naps/naps_lib_e.html#2002; Access Database: Canada Air Means.

Estimates of sulphur dioxide emissions reaffirm the decreasing trend: emissions fell 42% from 1980 to 1997 (figure 2). The increased use of technology and control devices by industry, such as widely used sulphur-dioxide scrubbers, has contributed to this substantial decline. Improvements in the processes used, closure of smelters, the use of low-sulphur coal, the adoption of coal blending and washing procedures, and the conversion to cleaner burning fuels (e.g., natural gas and light oil) have also contributed to this decline (EPA, 1996: 29).

Industrial processes and power generation are responsible for the majority of SO_2 production in Canada, together accounting for 81% of total emissions (OECD, 2002). Although total emissions have fallen significantly, the combined share of these two sources has remained relatively stable, falling only 3% since 1980. Improvements in industrial processes that resulted in a decreased proportion (–5.3%) of pollutant share over the period were offset by increases in power generation, for which the share rose 2.1%. Over the same period, mobile emissions grew 58%, rising from 2.95% to 4.68% of total emissions.

Nitrogen dioxide

Nitrogen dioxide (NO_2) is a highly reactive gas that is formed through the combination of nitric oxide (NO) with oxygen. This reaction is typically the result of lightning, volcanic activity, bacterial action in soil, and forest fires. Most of the compounds of nitric oxide needed for this reaction, however, originate from human activities. Nitrogen oxides (NO_x) are the sum total of NO, NO_2, and other oxides of nitrogen. The combustion of fossil fuels in automobiles, power plants, industry, and household activities all contribute to their concentrations in the environment.

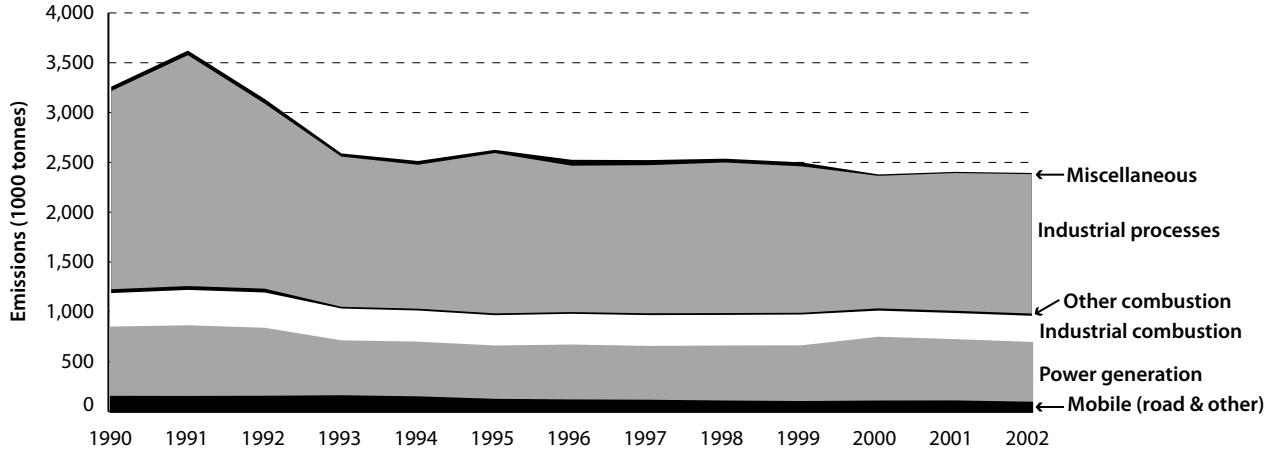
Levels of NO_x in the environment are of concern because they actively combine with volatile organic compounds (VOCs) in the presence of sunlight to form ground-level ozone, which is a primary component of urban smog. Nitrogen oxides also play a major role in atmospheric photochemical reactions that contribute to acid rain. However, because NO is so readily converted to NO_2 in the environment, environmental agencies generally track only NO_2. Nitrogen dioxide is also the easiest of the nitrogen oxides to detect because of its presence in higher concentrations.

Trend for nitrogen dioxide

From 1974 to 2001, ambient levels of nitrogen dioxide in Canada decreased by 34.4% (figure 3). Annualized concentrations of NO_2 have steadily declined in Canada, remaining well below NAAQO standards over the period. With the annual average falling from 21.0 to 13.8 ppb, NO_2 levels have remained well below the desirable standard of 32 ppb. On a non-aggregate basis, data indicates that since 1990, over 99% of all stations have recorded annual means either at, or below, the desirable standard, while 100% of the stations met the acceptable standard.

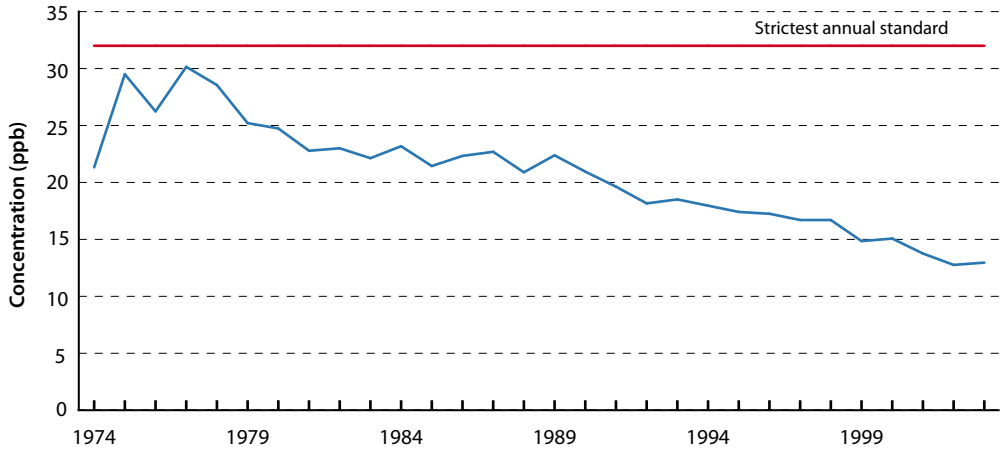
Short-term levels of ambient nitrogen dioxide also improved significantly, with far fewer stations recording

Figure 2: Suphur dioxide emissions by source, 1990–2002



Source: OECD, *Environmental Data Compendium 2004* (2005).

Figure 3: Ambient levels of nitrogen dioxide, 1974–2003



Source: Environment Canada, National Air Pollution Surveillance Network 2002 Annual Data (2004).

readings in excess of the 1-hour and 24-hour standards (table 3). In 1977, 13.6% of monitoring stations reported at least one reading in excess of the 1-hour maximum acceptable level, and 15.9% had a reading that exceeded the 24-hour acceptable level. In contrast, 2001 showed less than 1% of stations exceed the 1-hour and 24-hour acceptable levels (which are the strictest standards as there are no 1-hour or 24-hour desirable standards set for NO_2).

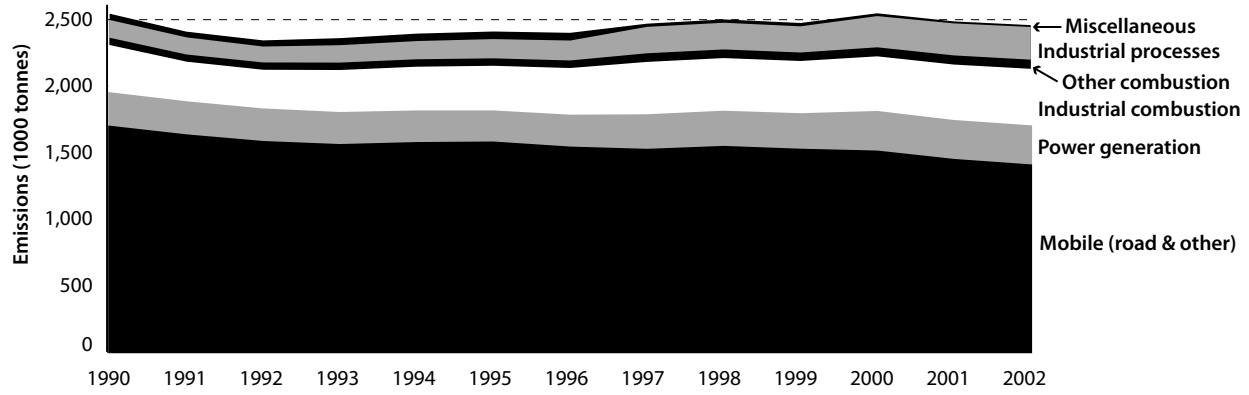
The sources of NO_2 emissions remained relatively unchanged from 1980 to 1996 (figure 4). In 1980, the largest three contributing sources, mobile, power generation, and industrial combustion, accounted for approximately 96% of total emissions. In 1996, these same sources still accounted for 89% of emissions, with small decreases being shown in mobile sources and increases in industrial processes.

Table 3: Average number of 1-hour and 24-hour periods exceeding objectives for nitrogen dioxide

	1-hour objectives		24-hour objectives		Number of Stations
	> Acceptable	> Tolerable	> Acceptable	> Tolerable	
1977	13.60	0.00	15.90	0.00	44
1982	16.30	0.00	8.20	0.00	49
1987	0.00	0.00	2.00	2.00	49
1991	2.41	0.00	3.61	0.00	83
1992	0.00	0.00	1.15	0.00	87
1993	3.57	0.00	1.19	0.00	84
1994	3.75	0.00	1.25	0.00	80
1995	1.27	0.00	1.27	0.00	79
1996	1.27	0.00	0.00	0.00	79
1998	1.02	0.00	2.04	1.02	98
1999	0.94	0.00	0.00	0.00	106
2001	0.90	0.00	0.00	0.00	111
2002	0.00	0.00	0.00	0.00	110
2003	0.00	0.00	0.00	0.00	110

Source: Environment Canada, National Air Pollution Surveillance Network 2002 Annual Data (2003); Website: http://www.etc-cte.ec.gc.ca/publications/naps/naps_lib_e.html#2002; Access Database: Canada Air Means.

Figure 4: Nitrogen dioxide emissions by source, 1990–2002



Source: OECD, *Environmental Data Compendium 2004* (2005).

Ground-level ozone

Ground-level ozone (O_3) is a colourless, odorless gas known to aggravate a variety of respiratory conditions. It is formed just above the earth's surface through the reaction of NO_x and volatile organic compounds (VOCs). Since this reaction is facilitated by the presence of heat and sunlight, ozone is typically a greater concern during summer months.

Because ozone is the primary contributor to urban smog, regulators target emissions of both NO_x and VOCs to combat the problem. VOCs, a subgroup of hydrocarbons (HCs), enter the atmosphere through evaporation of automotive fuel (from the fuel tanks of automobiles and spills), paints, coatings, solvents, and consumer products such as lighter fluid and perfume. VOCs also occur naturally as a result of photosynthesis.

Increasing levels of ozone have led regulators to develop more stringent standards. In 1998, 12 Canadian Ministers of the Environment endorsed the Canada-wide Accord on Environmental Harmonization. This agreement included the development of Canada-wide standards for both ozone and particulate matter. The recommended standard for ozone was stipulated at 65 ppb averaged over eight hours, to be achieved by 2010.

Much of the concern over ozone levels stems from a Canadian study examining NO_x and VOCs that claims that the current 1-hour maximum acceptable level for ozone does not fully protect human health. It also reports that there is "no discernible human health threshold for ground-level ozone," meaning that any improvement in ambient ozone levels is expected to have public health benefits (Environment Canada, 1997a: 3).

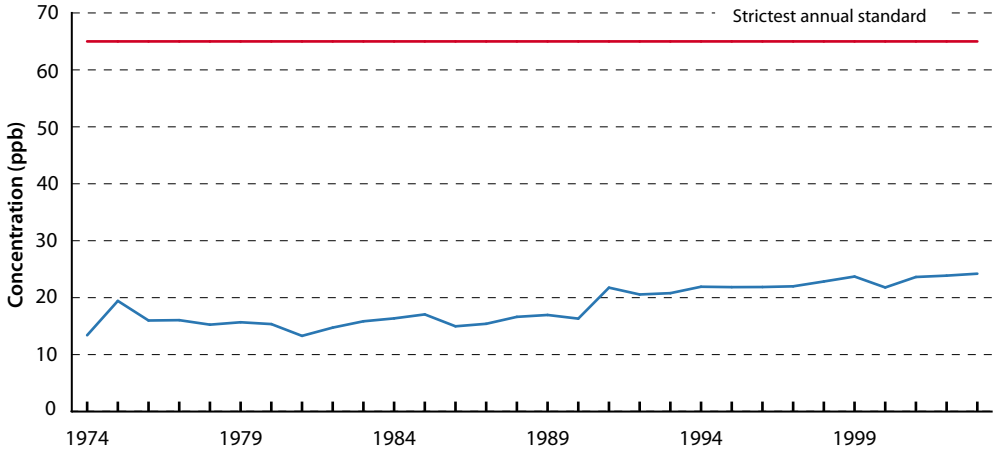
Trend for ground-level ozone

Ambient levels of ground-level ozone (O_3) increased by 32.7% between 1974 and 2001 (figure 5). Annualized ozone levels have become of increasing concern because they consistently measure above NAAQO objectives. Because no maximum desirable objective is set for an annual period, the acceptable value of 15 ppb acts as the strictest standard for performance assessment. Annual concentrations surpassed this objective in 1975 and have risen steadily since, now registering 19.5 ppb or 30% above the acceptable standard. In 2001, less than 10% of individual stations recorded means below this level.

Data on the percentage of stations with readings exceeding short-term concentration objectives also indicate that ozone levels are increasing (table 4). The percentage of stations reporting at least one reading above the desirable 1-hour standard increased from 95.1% in 1977 to 97.6% in 2001. However, the percentage of stations exceeding the acceptable standard fell from 78% to 47%, while the percentage exceeding the tolerable standard fell from 14.6% to zero.

VOC emissions, which contribute to the formation of ground level ozone, increased 27.2% between 1980 and 1997 (OECD, 2002) (figure 6). Mobile and industrial sources, which accounted for approximately 76% of the total emissions in 1980, accounted for only 69.9% of production in 1997. Reductions over this period were reported in the mobile sources (reduced by approximately 19%) while increases were reported by industrial sources.

Figure 5: Ambient levels of ozone, 1974–2003



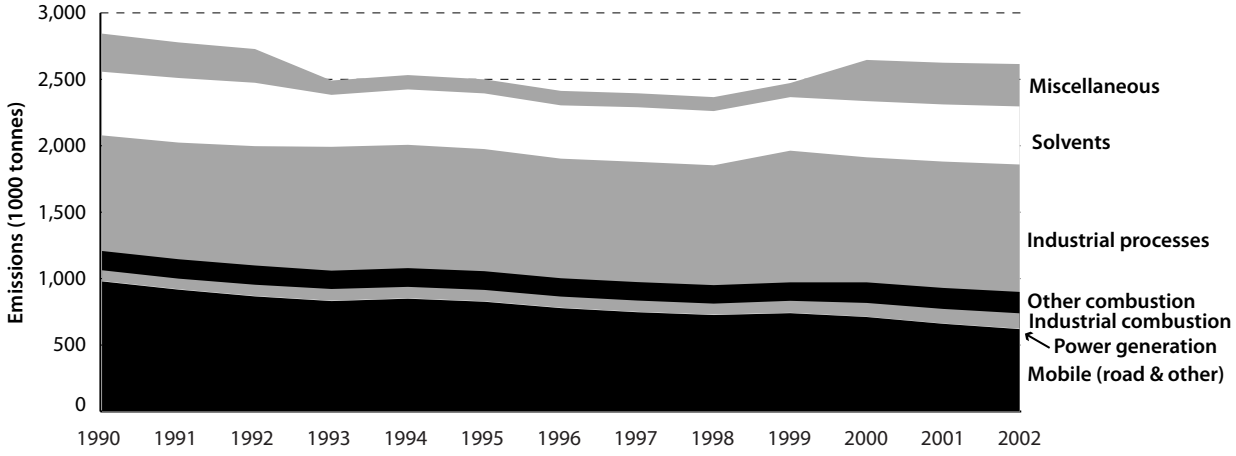
Source: Environment Canada, National Air Pollution Surveillance Network 2002 Annual Data (2004).

Table 4: Average number of 1-hour periods exceeding objective for ozone

	1-hour objective		Number of Stations		1-hour objective		Number of Stations
	> Acceptable	> Desirable			> Acceptable	> Desirable	
1977	78.00	95.10	41	**1996**	57.14	99.32	147
1982	78.00	96.00	50	**1997**	57.24	97.93	145
1987	54.10	93.40	61	**1998**	64.71	95.42	153
1991	55.81	98.45	129	**1999**	59.09	98.70	154
1992	56.12	95.68	139	**2000**	29.88	95.73	164
1993	47.55	95.80	143	**2001**	54.22	97.59	166
1994	55.94	99.30	143	**2002**	57.14	97.02	168
1995	60.00	98.00	150	**2003**	56.80	98.22	169

Source: Environment Canada, National Air Pollution Surveillance Network 2002 Annual Data (2003); Website: http://www.etc-cte.ec.gc.ca/publications/naps/naps_lib_e.html#2002; Access Database: Canada Air Means.

Figure 6: Volatile organic compounds emissions by source, 1990–2002



Source: OECD, *Environmental Data Compendium 2004* (2005).

Total suspended particulates

Suspended particulates are small pieces of dust, soot, dirt, ash, smoke, liquid vapour, or other matter in the atmosphere. Sources may include forest fires and volcanic ash as well as emissions from power plants, motor vehicles, waste incineration, and dust from mining.

Particulates are an irritant to lung tissue and may aggravate existing respiratory problems and cardiovascular diseases. Once lodged in the lungs, certain particulates may contribute to the development of lung cancer. The smallest particulates pose the greatest threat to human health because they are able to reach the tiniest passages of the lungs. Canada's National Ambient Air Quality Objectives (NAAQOs) exist only for total suspended particulates although they are being changed to reflect the importance of measuring the smallest particulates. The Canada-wide Accord on Environmental Harmonization in 1998 led to the development of Canada-wide standards for particulate matter. The new standard focuses on particulates smaller than 2.5 microns, known as $PM_{2.5}$. The recommended standard is 30 µg/m³ averaged over 24 hours, to be achieved by 2010. Some provinces have already developed provincial standards for PM_{10} and $PM_{2.5}$ (Environment Canada, 2002).

Trend for total suspended particulates

Ambient levels of total suspended particulates (TSP) decreased by 54.2% from 1974 to 2001 (figure 7). Efforts to reduce suspended particulates have resulted in annualized concentrations that are well below NAAQO standards. In fact, TSP levels have remained well below the desirable standard of 60 µg/m³ since 1981. The data indicates that, since 1990, over 87% of all stations have recorded annual means either at, or below, the desirable standard, while 100% of the stations met the acceptable standard.

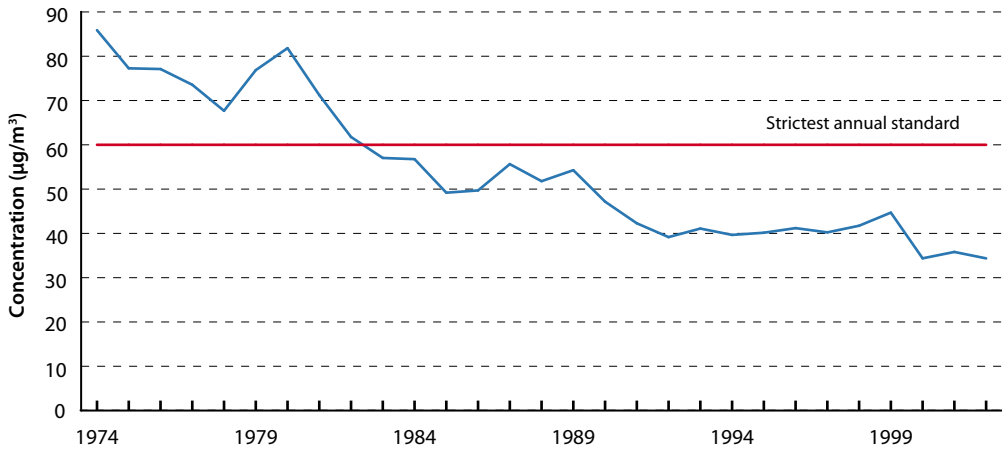
Short-term concentrations also improved dramatically. In 1977, 81.7% of monitoring stations reported at least one reading in excess of the 1-hour maximum acceptable level and 9.6% exceeded the 24-hour acceptable level. In contrast, 2001 showed 2.9% percent of stations to exceed the acceptable 1-hour objective while none of the stations exceeded the tolerable 24-hour levels (table 5).

Following a sharp reduction between 1980 and 1985, emissions estimates for TSPs have since been steadily on the rise. Emissions have increased by 20% since 1985. Industrial processes accounted for 70% of total emissions in 1980 but only 47.0% in 1996 (figure 8). Categories such as non-industrial combustion activities and miscellaneous sources, however, have reported increases during this time.

Carbon monoxide

When fuel and other substances containing carbon burn without sufficient oxygen, carbon monoxide (CO), a highly toxic, colourless, odourless gas is produced. Trace amounts of CO occur naturally in the atmosphere but most emissions come from automobiles. Levels of CO are of particular concern to monitoring organizations

Figure 7: Ambient levels of total suspended particulates, 1974–2002



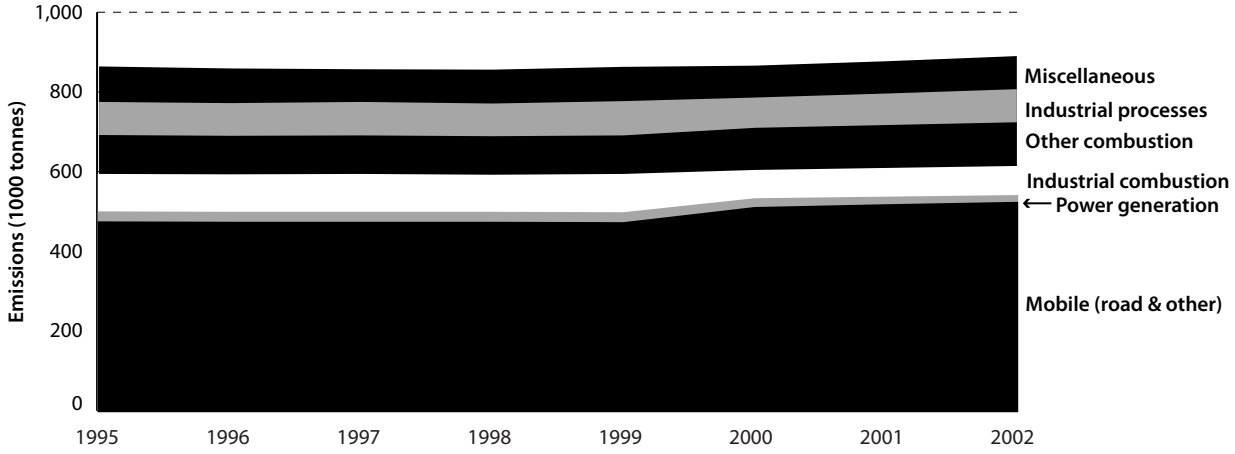
Source: Environment Canada, National Air Pollution Surveillance Network 2002 Annual Data (2004).

Table 5: Average number of 24-hour periods exceeding objective for total suspended particulates)

	24-hour objectives > Acceptable	Number of Stations		24-hour objectives > Acceptable	Number of Stations
1977	81.70	104	**1996**	34.62	78
1982	66.10	109	**1997**	37.84	74
1987	58.00	100	**1998**	59.49	79
1991	39.56	91	**1999**	51.85	54
1992	46.07	89	**2000**	35.71	28
1993	46.74	92	**2001**	26.47	34
1994	31.82	88	**2002**	25.00	32
1995	36.59	82			

Source: Environment Canada, National Air Pollution Surveillance Network 2002 Annual Data (2003); Website: http://www.etc-cte.ec.gc.ca/publications/naps/naps_lib_e.html#2002; Access Database: Canada Air Means.

Figure 8: Total suspended particulates emissions by source, 1995–2002



Source: OECD, *Environmental Data Compendium 2004* (2005).

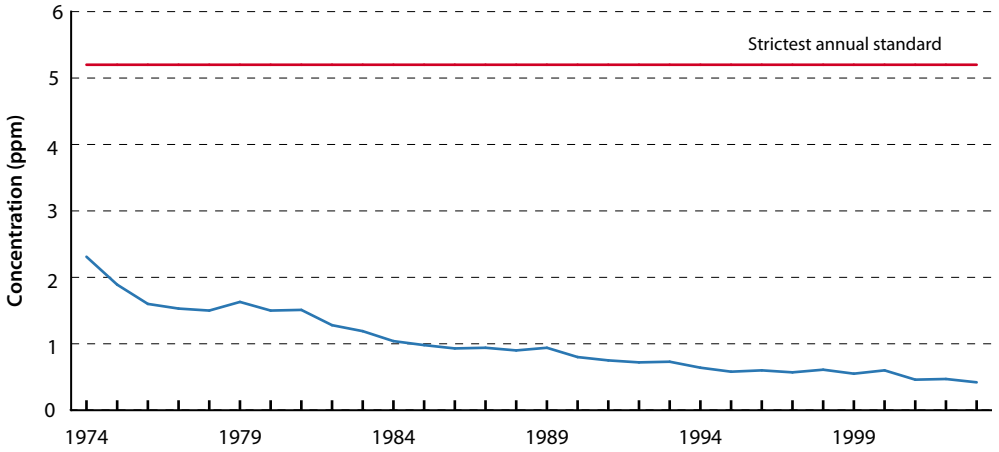
because of their effect upon human health: CO reduces the capacity of red blood cells to carry oxygen to body tissues. Since CO poisoning occurs as a result of short-term exposure, health guidelines do not include annual recommendations for ambient CO levels. However, 8-hour and 1-hour guidelines are available.

Trend for carbon monoxide

Ambient levels of carbon monoxide have been dramatically reduced over the past three decades. From 1974 to 2001, ambient levels of CO registered a decrease of 82.6% (figure 9). These reductions have occurred despite an increase in total vehicle registrations greater than 30% over the same period (Statistics Canada, 2000: 121). The decreases in ambient CO represent Canada's second most effective campaign at eliminating pollutants, second only to decreases in lead.

The percentage of stations with readings exceeding short-term NAAQO levels has also decreased over the past two decades (table 6). Whereas 68.8% of stations had at least one reading exceeding the 1-hour desirable level in 1977, in 2001 zero stations recorded exceedences. Similarly, the percentage of stations exceeding the 8-hour desirable objective fell from 85.4% to zero over the same period. There have been no readings above the 1-hour and 8-hour objectives since 1992.

Figure 9: Ambient levels of carbon monoxide, 1974–2003



Source: Environment Canada, National Air Pollution Surveillance Network 2002 Annual Data (2004).

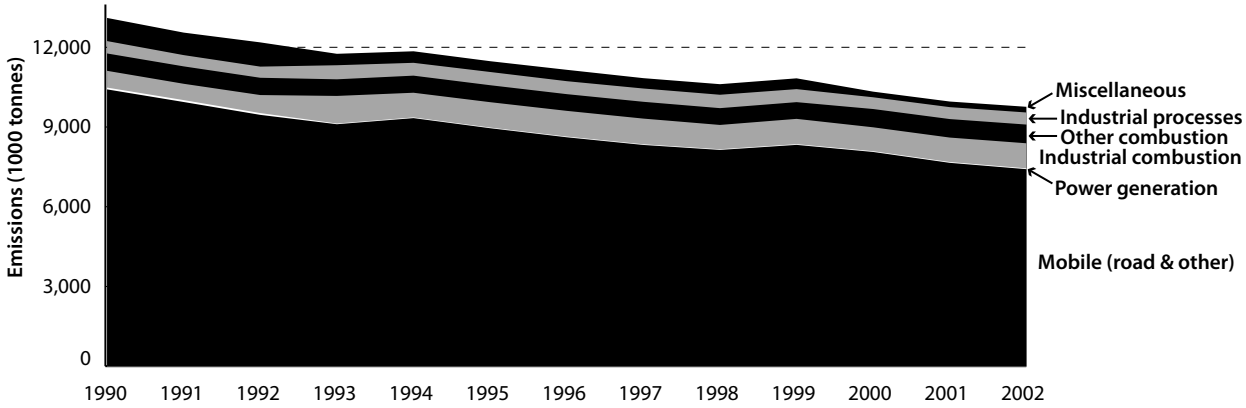
Table 6: Average number of 1-hour and 8-hour periods exceeding objective for carbon monoxide

	1-hour objectives		8-hour objectives		Number of stations
	> Acceptable	> Desirable	> Acceptable	> Desirable	
1977	4.20	68.80	12.50	85.40	48
1982	7.70	50.00	11.50	88.50	52
1987	0.00	22.60	5.70	54.70	53
1991	0.00	11.11	3.70	33.33	54
1992	0.00	7.14	0.00	35.71	56
1993	0.00	7.69	0.00	34.62	52
1994	0.00	10.00	4.00	32.00	50
1995	0.00	8.33	0.00	18.75	48
1996	0.00	4.00	0.00	18.00	50
1997	0.00	4.35	0.00	17.39	46
1998	0.00	3.77	0.00	11.32	53
1999	0.00	0.00	0.00	1.96	51
2000	0.00	0.00	0.00	3.92	51
2001	0.00	0.00	0.00	4.05	74
2002	0.00	0.00	0.00	1.35	74
2003	0.00	0.00	0.00	0.00	72

Source: Environment Canada, National air Pollution Surveillance Network 2002 Annual Data (2003); Website: http://www.etc-cte.ec.gc.ca/publications/naps/naps_lib_e.html#2002; Access Database: Canada Air Means.

Carbon monoxide emission estimates decreased 12.4% between 1970 and 1997 (figure 10). These reductions can partially be attributed to cleaner automobiles and more fuel-efficient industrial processes. To meet American motor-vehicle regulations adopted in the early 1970s, exhaust-gas recycling systems (EGRS) were installed and some older vehicles were retired. This led to vastly reduced emissions per vehicle. For example, North American cars built in 1993 emitted 90% less NO_x, 97% less hydrocarbon, and 96% less CO than cars built two decades earlier (Bast, Hill and Rue, 1994: 111). There has also been an 87.5% reduction in CO emissions from incinerators between 1980 and 1995. In 1995, the two main sources of CO emissions were transportation (39.2%) and open sources (primarily forest fires) (figure 10).

Figure 10: Carbon monoxide emissions by source, 1990–2002



Source: OECD, *Environmental Data Compendium 2004* (2005).

Lead

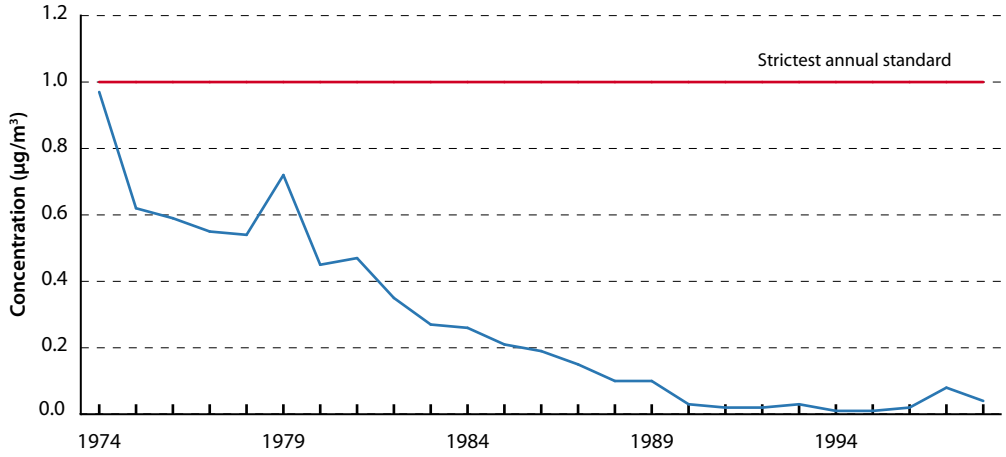
Lead is a soft, dense, bluish-grey metal. Its high density, softness, low melting point, and resistance to corrosion make it useful in piping, batteries, weights, gunshot, and crystal. Until recently, automobiles were the source of most lead emissions although small quantities of lead are naturally present in the environment. Lead is the most toxic of the main air pollutants. When it is inhaled, it accumulates in the body's tissues. In high concentrations, it can cause damage to the nervous system and the brain, seizures, and behavioural disorders. In addition, recent evidence suggests that exposure to lead may be associated with hypertension and heart disease (USEPA, 1995: 2–6).

Because of lead's toxicity, environmental and health guidelines for lead are stricter than those for other air pollutants. Canada is committed to reducing levels as low as technologically feasible although no explicit objectives have been set. The maximum set by the World Health Organization (WHO) for the protection of human health is 1.0 μg/m³.

Trend for lead

The decline in ambient lead concentration is the greatest success story in Canada's efforts to reduce air pollution. Ambient lead concentrations fell 94% in Canada between 1974 and 1998 (figure 11). Although the Canadian average has been below the WHO's standard throughout this period, it was not until 1982 that means below the health standard were reported by all stations except one located near a lead mine (annual mean, 1997: 1.51 μg/m³, 1999: 0.77 μg/m³). Levels in Canada are currently so low that most stations have discontinued monitoring them.

Figure 11: Ambient levels of lead, 1974–1998



Source: Environment Canada, National Air Pollution Surveillance Network 2002 Annual Data (2004).

Urban Air Quality in Canadian Cities

Trends by Census Metropolitan Area

The second section of this paper reports the performance of the 28 Canadian Census Metropolitan Areas (CMAs). A CMA is a Canadian census division comprising a large urban area (known as the urban core) and adjacent areas (known as urban and rural fringes) that have a high degree of social and economic integration with the urban core. The charts and tables in this section depict the trend of each of the six most important pollutants over the past three decades (where data is available). These graphs allow readers to compare the performance of their municipality to that of comparable municipalities.

The CMAs examined include:

Abbotsford, BC	p. 18	Montréal, QC	p. 51	St. John's, NF	p. 84
Calgary, AB	p. 21	Oshawa, ON	p. 56	Sudbury, ON	p. 88
Edmonton, AB	p. 25	Ottawa, ON	p. 60	Thunder Bay, ON	p. 91
Halifax, NS	p. 29	Quebec City, QC	p. 64	Toronto, ON	p. 95
Hamilton, ON	p. 21	Regina, SK	p. 68	Trois Rivières, QC	p. 99
Hull, QC	p. 36	Saint John, NB	p. 72	Vancouver, BC	p. 102
Jonquière, QC	p. 40	Saskatoon, SK	p. 76	Victoria, BC	p. 106
Kingston, ON	p. 42	Sherbrooke, QC	p. 79	Windsor, ON	p. 110
Kitchener, ON	p. 44	St. Catharines, ON	p. 80	Winnipeg, MB	p. 114
London, ON	p. 47				

Additionally, tables have been provided to document the percentage of readings from each city that exceed the standards each year. This is helpful as annual averages are often well below NAAQQ standards although there have been a few observations throughout the year that were above the standard.

Objectives and Standards in Canada

There are currently two sets of air quality standards being applied in Canada: The National Ambient Air Quality Objectives, and Canada-wide Standards. Each graph (except those for lead) has a straight, solid line showing one of these standards so that the magnitude of pollutant concentrations can be compared to generally accepted health standards.

National Ambient Air Quality Objectives

Canada's *National Ambient Air Quality Objectives* (NAAQOs) prescribe targets for air quality. These targets reflect health protection and long-term risk reduction while recognizing technological and economical limits. Consequently, the resulting objectives may be set above a level at which no effects are observed. The objectives are established to provide background information, a uniform scale for assessing the quality of air in all parts of Canada, and guidance to governments for making risk-management decisions, such as planning control strategies and setting local standards.

Two ranges of air quality are prescribed: "desirable" and "acceptable." The numerical values for the highest levels of contaminant in each range are based on the following qualitative definitions:

- The *maximum desirable level* is the long-term goal for air quality and provides a basis for an antidegradation policy for unpolluted parts of the country and for the continuing development of pollution control technology.

- The *maximum acceptable level* is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, and personal comfort and well-being.

The graphs of sulphur dioxide, nitrogen dioxide, total suspended particulates, and carbon monoxide depict the most stringent national ambient air quality objective, the maximum desirable level.

Canada-wide Standards

The Canada-wide Standards (CWSs) are intergovernmental agreements developed by the Canadian Council of Ministers of the Environment. Standards have been developed for particulate matter ($PM_{2.5}$) and ozone. Canada-wide Standards have the approval of federal and provincial governments and involve the development of jurisdictional risk-management plans to attain the agreed-upon Standard. Stakeholder consultation is a fundamental aspect of the CWS process and is conducted on all aspects of the Standard and associated management plans both at the provincial and federal level (Environment Canada, 2005). CWSs can include qualitative or quantitative standards, guidelines, objectives, and criteria for protecting the environment and reducing risks to human health. The levels or concentrations contained in the standards are generally those that provide protection for the environment and human health and are technologically and economically achievable.

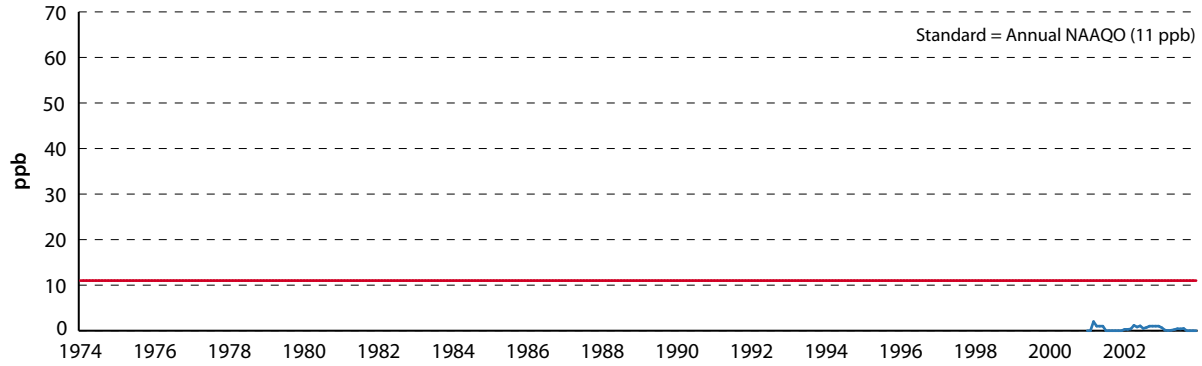
The graphs of fine particulate ($PM_{2.5}$) and ozone show the applicable Canada-wide Standard. Unlike the NAAQOs, the Canada-wide Standards use three-year averaging periods to determine achievement of the standard. The Canada-wide Standard for PM is focused on the fine fraction of particulate matter, smaller than 2.5 microns, known as $PM_{2.5}$. The recommended Standard for $PM_{2.5}$ is 30 $\mu g/m^3$, averaged over 24 hour periods, to be achieved by 2010. Achievement is to be based on the 98th percentile ambient measurement annually, averaged over three consecutive years. The recommended Canada-wide Standard for Ozone is 65 ppb, averaged over eight-hour periods, to be achieved by 2010. Achievement is to be based on the fourth-highest measurement annually, averaged over three consecutive years.

Particulate Matter: TSP and $PM_{2.5}$

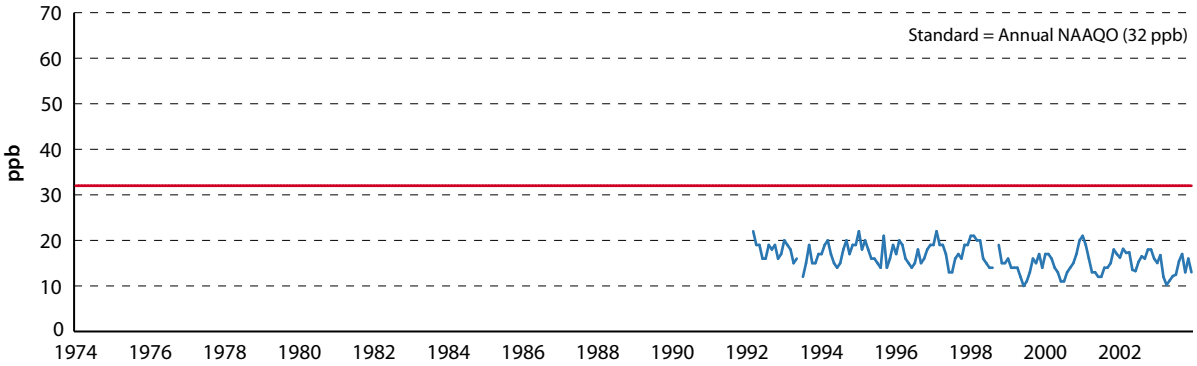
Data for particulate matter data have traditionally been reported as what is called "Total Suspended Particulate" or "TSP." Total Suspended Particulate included both $PM_{2.5}$ and PM_{10} (particles with aerodynamic diameters of less than 2.5 and 10 micrometers, respectively). Data for Total Suspended Particulate are no longer being reported by Environment Canada's National Air Pollution Surveillance (NAPS) Network. The most recent reports (2003) give data only for $PM_{2.5}$, also known as "fine particulate matter."

Abbotsford, British Columbia

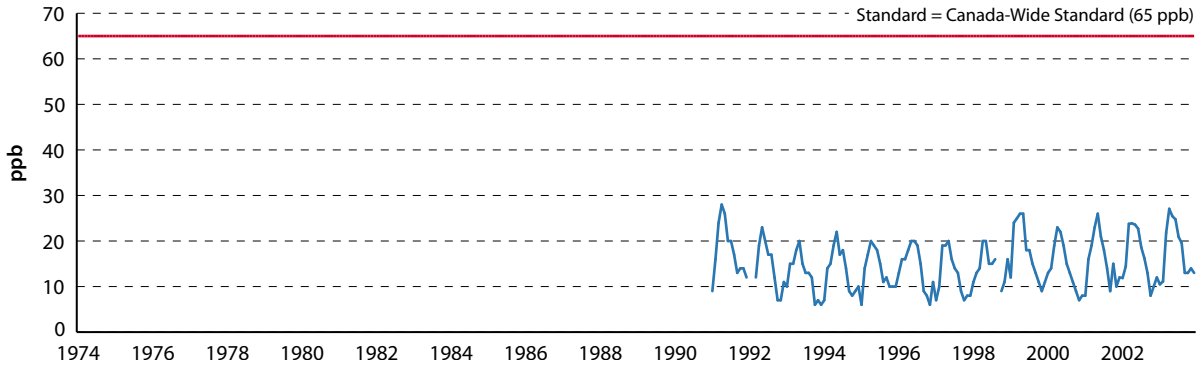
Abbotsford—ambient levels of sulphur dioxide, 2001–2003



Abbotsford—ambient levels of nitrogen dioxide, 1992–2003



Abbotsford—ambient levels of ozone, 1991–2003



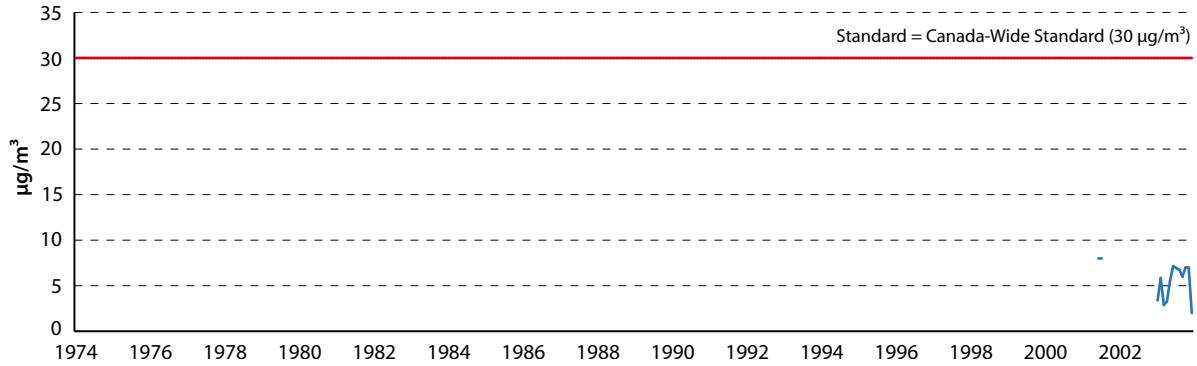
Abbotsford—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.00%	0.00	1.26%	110.62
1992	0.01%	1.23	1.57%	137.84
1993	0.00%	0.00	0.76%	66.69
1994	0.02%	2.14	0.53%	46.03
1995	0.01%	1.05	0.54%	47.32
1996	0.00%	0.00	0.88%	76.72
1997	0.00%	0.00	0.48%	42.00
1998	0.00%	0.00	1.12%	98.44
1999	0.00%	0.00	0.85%	74.66
2000	0.00%	0.00	0.32%	27.70
2001	0.00%	0.00	0.59%	52.03
2002	0.00%	0.00	0.89%	77.71
2003	0.00%	0.00	1.20%	105.03

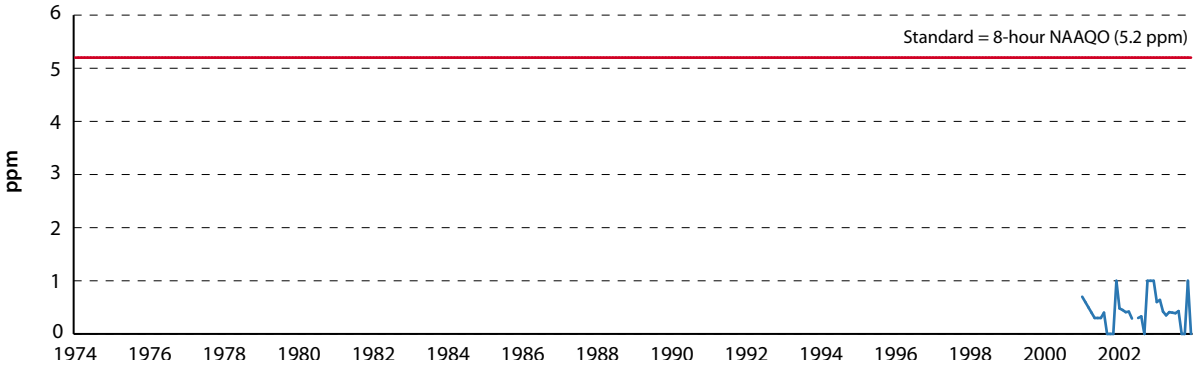
Abbotsford—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	58.67	65
1994	59.00	65
1995	56.00	65
1996	56.67	65
1997	54.33	65
1998	55.33	65
1999	54.67	65
2000	53.33	65
2001	52.67	65
2002	54.33	65
2003	57.00	65

Abbotsford—ambient levels of $PM_{2.5}$, 2001–2003

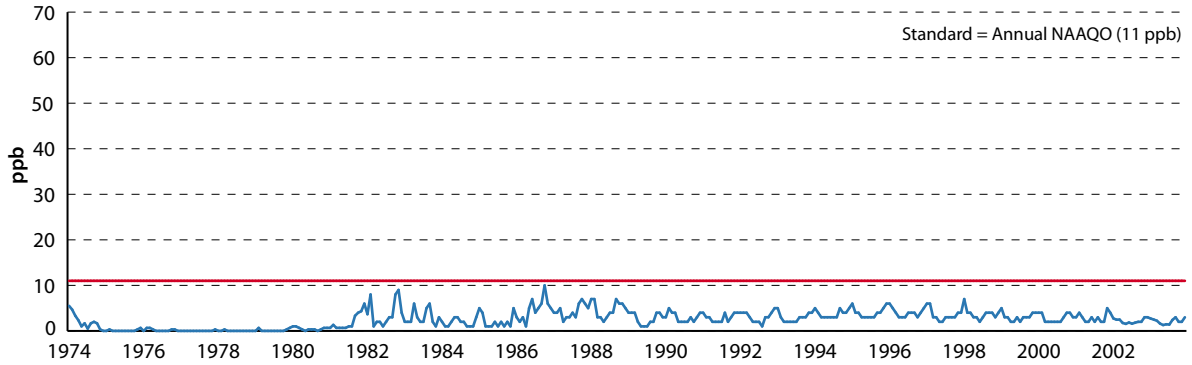


Abbotsford—ambient levels of carbon monoxide, 2001–2003

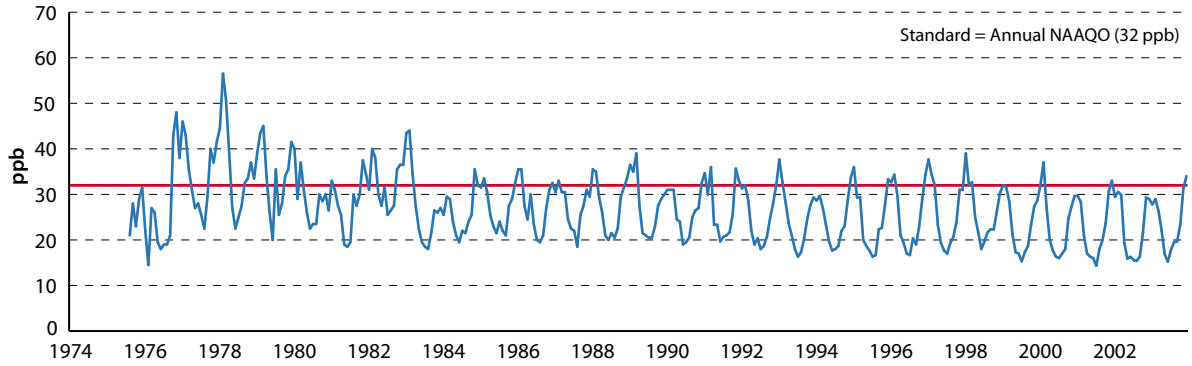


Calgary, Alberta

Calgary—ambient levels of sulphur dioxide, 1974–2003



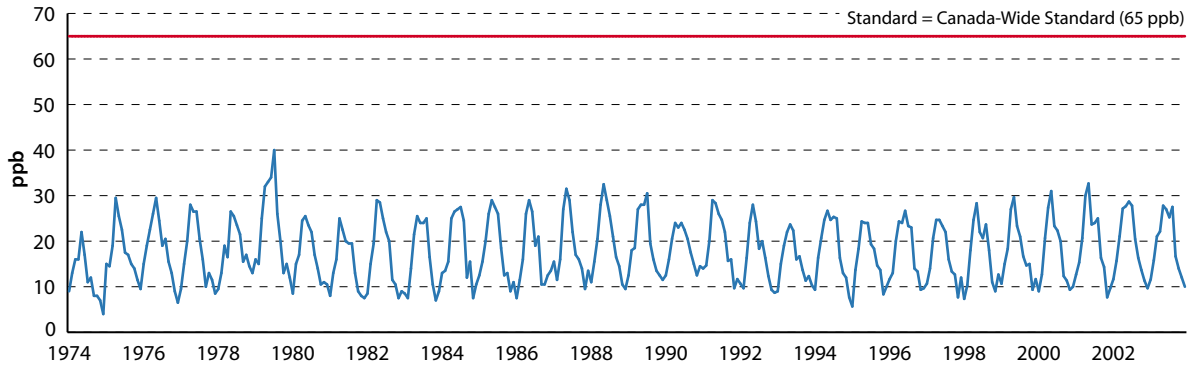
Calgary—ambient levels of nitrogen dioxide, 1975–2003



Calgary—average number of 1-hour and 24-hour periods exceeding standards for nitrogen dioxide

	1-hour objective > Acceptable		24-hour objective > Acceptable	
	percent	number of hours	percent	number of days
1991	0.01%	1.01	0.11%	0.39

Calgary—ambient levels of ozone, 1974–2003



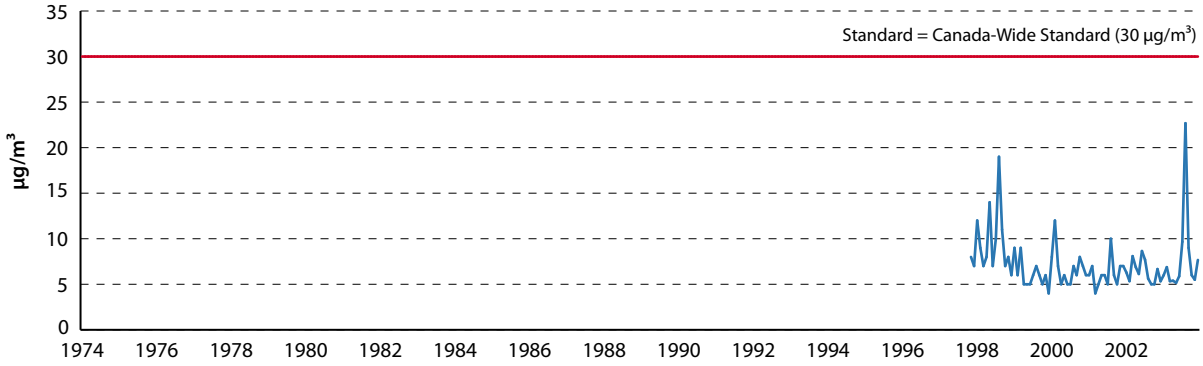
Calgary—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.00%	0.00	2.07%	181.08
1992	0.00%	0.00	0.72%	62.77
1993	0.00%	0.00	0.46%	40.17
1994	0.02%	2.01	1.83%	160.66
1995	0.00%	0.00	1.10%	96.16
1996	0.00%	0.00	0.98%	85.92
1997	0.00%	0.00	0.80%	70.04
1998	0.01%	1.00	1.74%	152.62
1999	0.00%	0.00	1.18%	103.02
2000	0.00%	0.00	1.27%	111.02
2001	0.00%	0.00	1.87%	163.94
2002	0.02%	2.02	1.94%	169.84
2003	0.01%	1.01	1.84%	160.86

Calgary—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	52.44	65
1994	53.22	65
1995	51.78	65
1996	52.33	65
1997	50.67	65
1998	52.33	65
1999	53.33	65
2000	54.22	65
2001	54.56	65
2002	55.89	65
2003	56.56	65

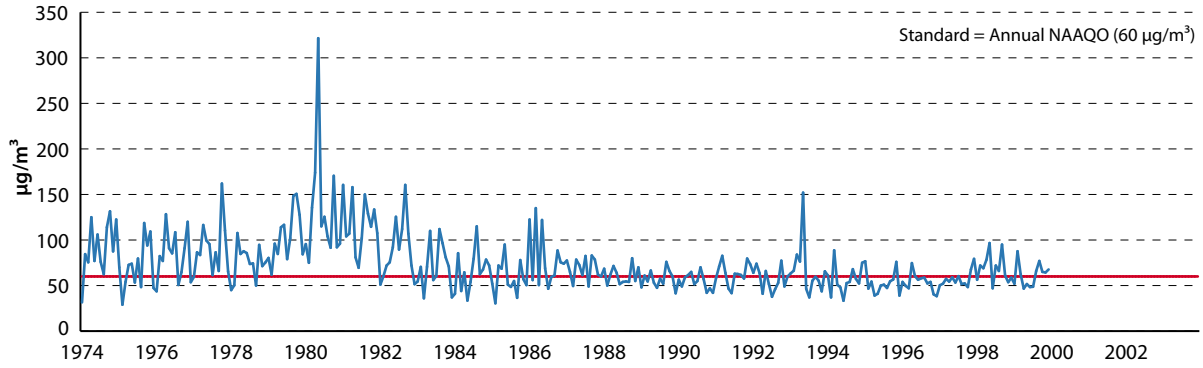
Calgary—ambient levels of $PM_{2.5}$, 1997–2003



Calgary—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2000	20.33	30
2001	16.33	30
2002	18.00	30
2003	23.33	30

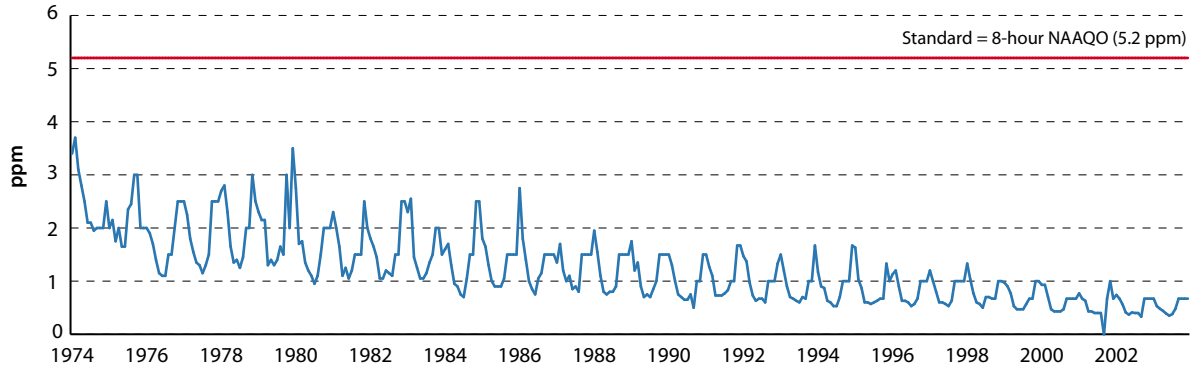
Calgary—ambient levels of total suspended particulates, 1974–1999



Calgary—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective			
	> Acceptable		> Tolerable	
	percent	number of days	percent	number of days
1991	9.49%	34.64	0.00%	0.00
1992	4.99%	18.22	0.00%	0.00
1993	18.03%	65.82	3.28%	11.97
1994	9.06%	33.06	0.00%	0.00
1995	9.02%	32.91	0.00%	0.00
1996	9.17%	33.46	0.00%	0.00
1997	10.66%	38.89	0.00%	0.00
1998	13.51%	49.32	0.00%	0.00
1999	25.00%	91.25	0.00%	0.00

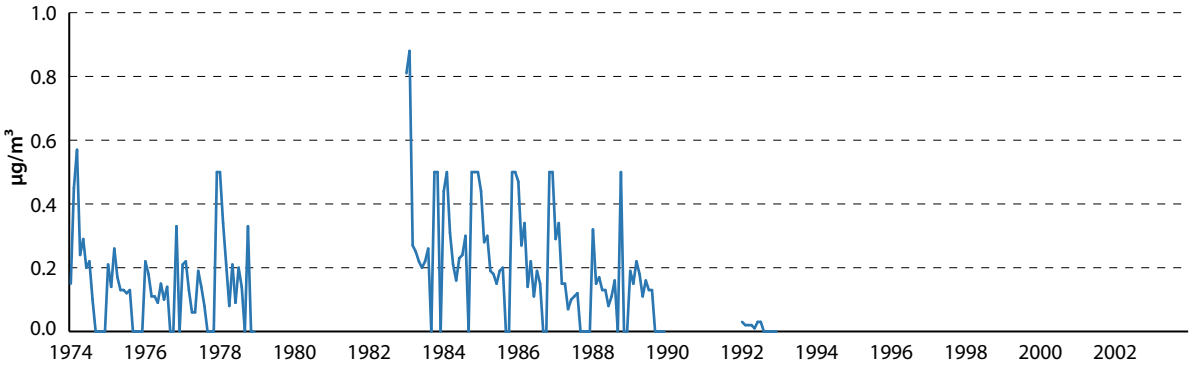
Calgary—ambient levels of carbon monoxide, 1974–2003



Calgary—average number of 1-hour and 8-hour periods exceeding standards for carbon monoxide

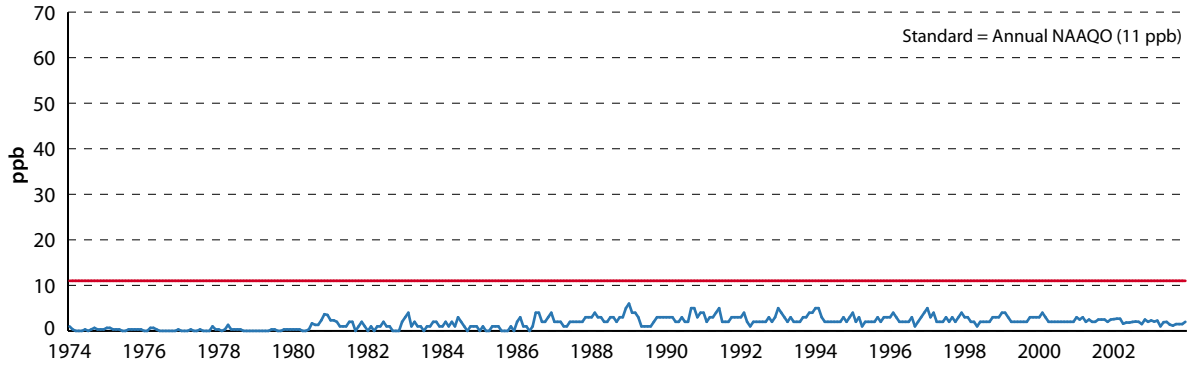
	1-hour objective		8-hour objective			
	> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of 8-hour periods	percent	number of 8-hour periods
1991	0.12%	10.10	0.05%	0.50	0.97%	10.68
1992	0.03%	3.01	0.00%	0.00	0.29%	3.16
1993	0.03%	3.01	0.00%	0.00	0.48%	5.29
1994	0.11%	9.59	0.06%	0.63	0.60%	6.54
1995	0.04%	3.52	0.00%	0.00	0.21%	2.27
1996	0.02%	2.02	0.00%	0.00	0.35%	3.84
1997	0.00%	0.00	0.00%	0.00	0.23%	2.48
1998	0.01%	1.01	0.00%	0.00	0.12%	1.26
1999	0.00%	0.00	0.00%	0.00	0.01%	0.13
2001	0.00%	0.00	0.00%	0.00	0.04%	0.44

Calgary—ambient levels of lead, 1974–1992



Edmonton, Alberta

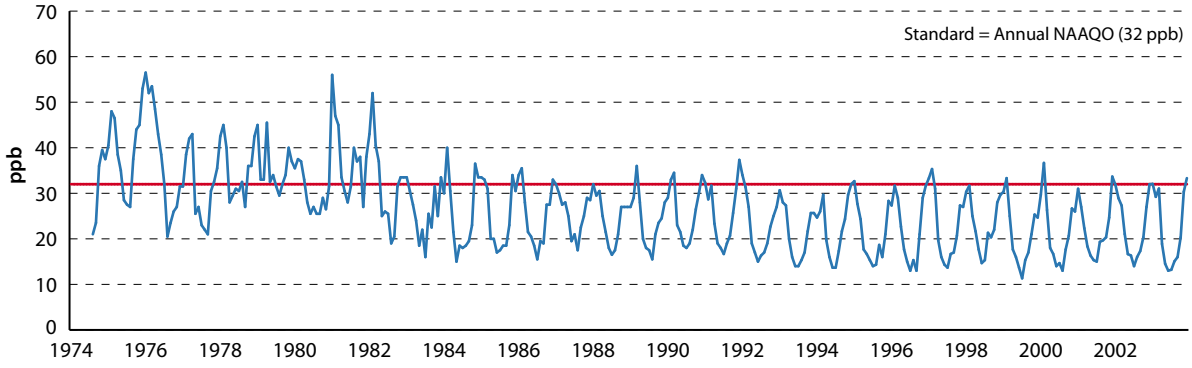
Edmonton—ambient levels of sulphur dioxide, 1974–2003



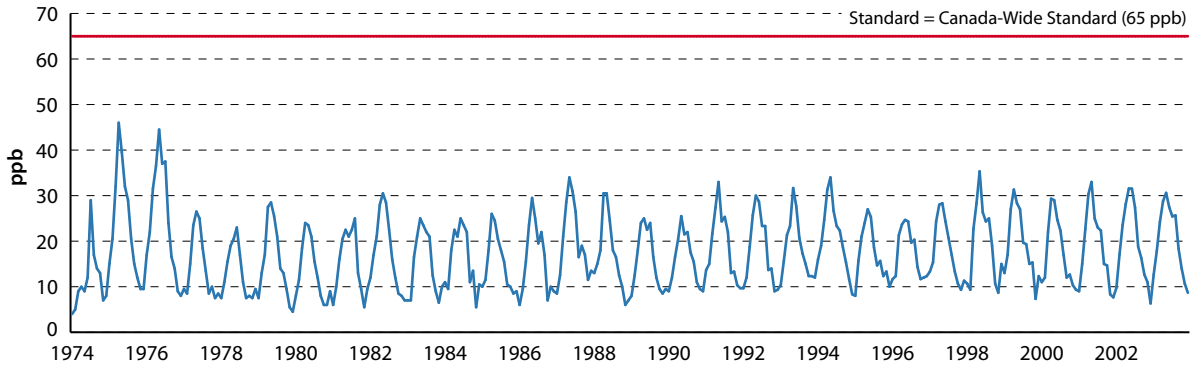
Edmonton—average number of 1-hour and 24-hour periods exceeding standards for sulphur dioxide

	1-hour objective				24-hour objective			
	> Acceptable		> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours	percent	number of days	percent	number of days
1993	0.00%	0	0.01%	1.010614	0.00%	0	0.00%	0

Edmonton—ambient levels of nitrogen dioxide, 1974–2003



Edmonton—ambient level of ozone, 1974–2003



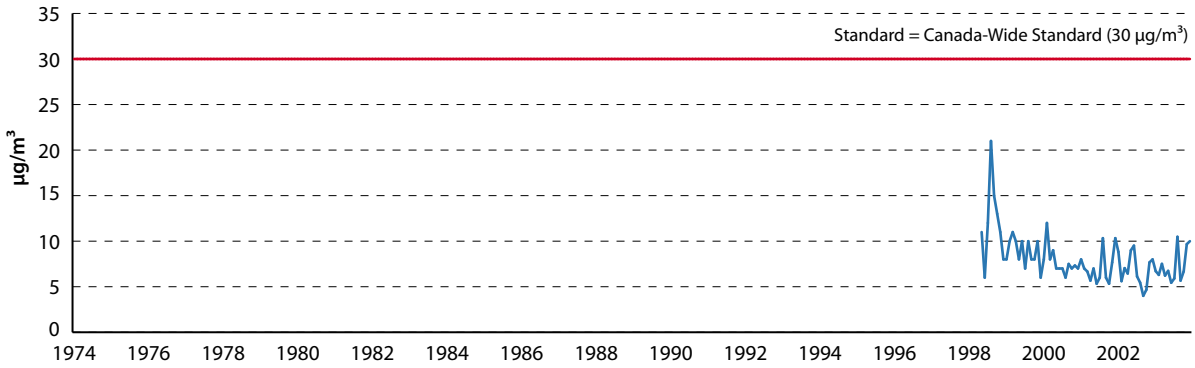
Edmonton—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.03%	3.03	2.53%	221.25
1992	0.01%	1.04	1.53%	134.06
1993	0.02%	2.02	1.43%	124.84
1994	0.02%	1.35	3.38%	296.19
1995	0.03%	2.55	1.05%	92.32
1996	0.02%	2.00	0.53%	46.22
1997	0.00%	0.00	1.47%	128.80
1998	0.02%	1.52	3.22%	281.86
1999	0.01%	1.00	1.88%	165.07
2000	0.00%	0.00	1.61%	141.38
2001	0.01%	1.01	1.83%	159.89
2002	0.04%	3.68	2.54%	222.19
2003	0.03%	2.52	2.27%	198.60

Edmonton—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	58.56	65
1994	60.11	65
1995	58.56	65
1996	56.22	65
1997	54.00	65
1998	56.67	65
1999	58.89	65
2000	59.44	65
2001	57.78	65
2002	60.78	65
2003	61.78	65

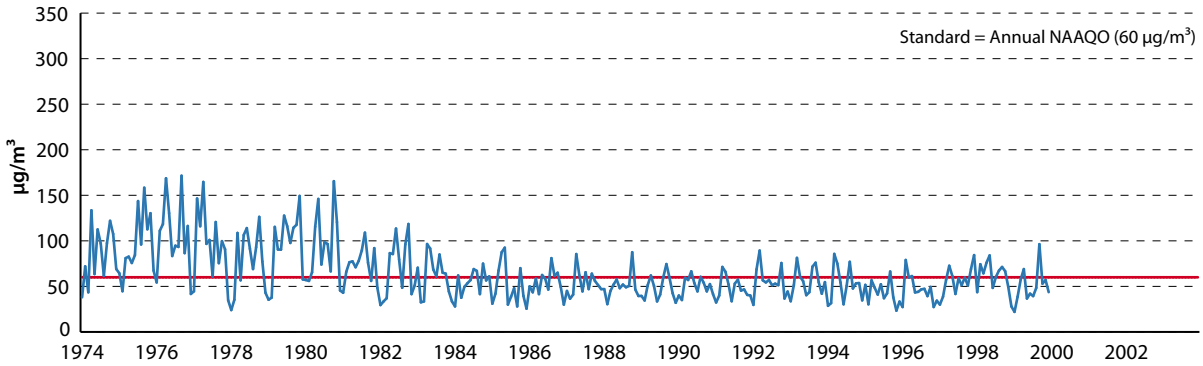
Edmonton—ambient levels of $PM_{2.5}$, 1998–2003



Edmonton—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2000	25.33	30
2001	20.67	30
2002	21.44	30
2003	22.44	30

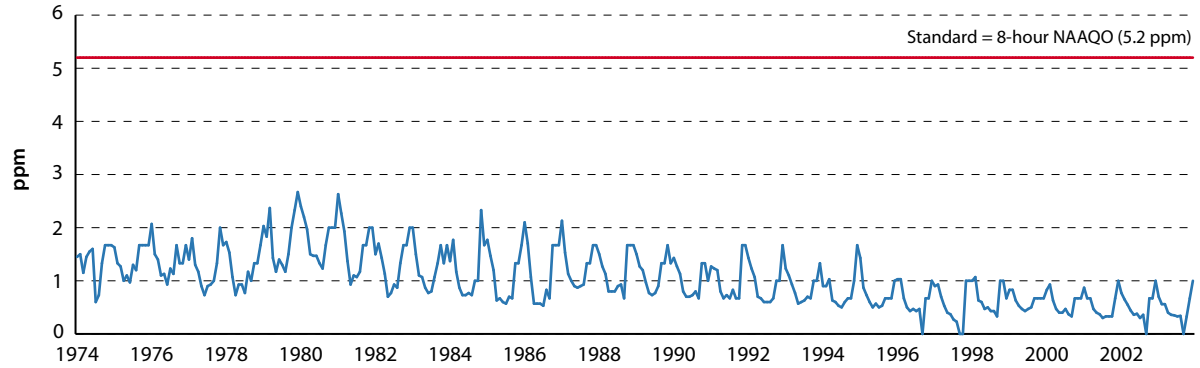
Edmonton—ambient levels of total suspended particulates, 1974–1999



Edmonton—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1991	5.11%	18.67
1992	3.99%	14.58
1993	3.37%	12.31
1994	4.51%	16.47
1995	3.44%	12.56
1996	3.84%	14.03
1997	9.96%	36.35
1998	7.10%	25.93
1999	5.74%	20.95

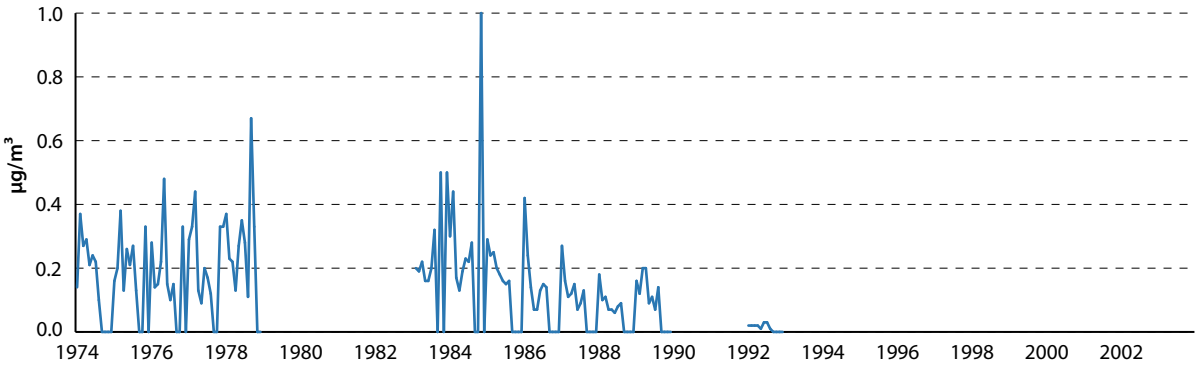
Edmonton—ambient levels of carbon monoxide, 1974–2003



Edmonton—average number of 1-hour and 8-hour periods exceeding standards for carbon monoxide

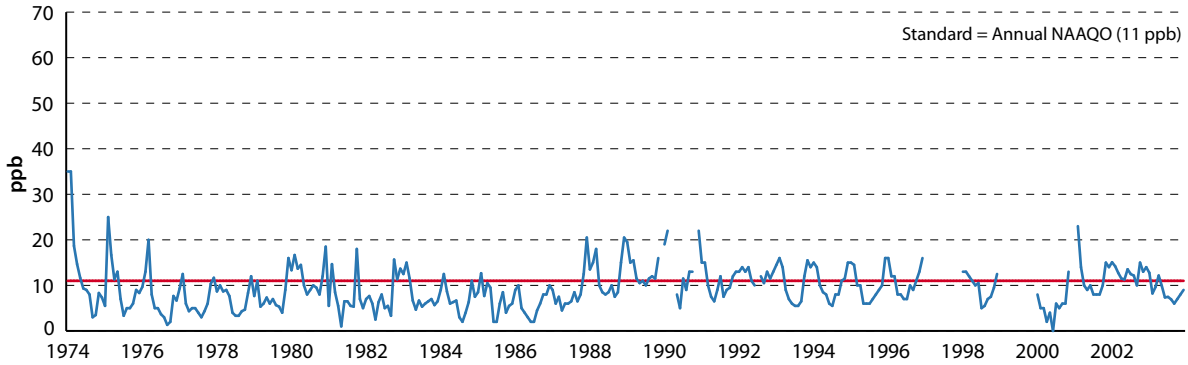
	1-hour objective		8-hour objective			
	> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of 8-hour periods	percent	number of 8-hour periods
1991	0.06%	5.06	0.00%	0.00	0.71%	7.82
1992	0.06%	5.00	0.00%	0.00	0.66%	7.27
1993	0.03%	3.02	0.00%	0.00	0.19%	2.03
1994	0.03%	2.51	0.02%	0.25	0.36%	3.90
1995	0.01%	1.00	0.00%	0.00	0.30%	3.29
1996	0.00%	0.00	0.00%	0.00	0.09%	1.01
1997	0.01%	1.01	0.00%	0.00	0.06%	0.64
1998	0.01%	1.02	0.00%	0.00	0.12%	1.34
2001	0.00%	0.00	0.00%	0.00	0.09%	1.02
2002	0.00%	0.00	0.00%	0.00	0.08%	0.88

Edmonton—ambient levels of lead, 1974–1992



Halifax, Nova Scotia

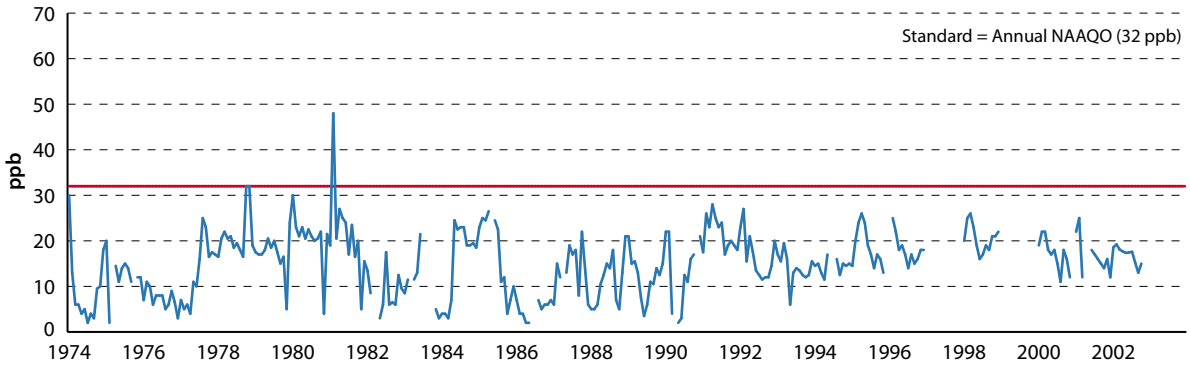
Halifax—ambient levels of sulphur dioxide, 1974–2003



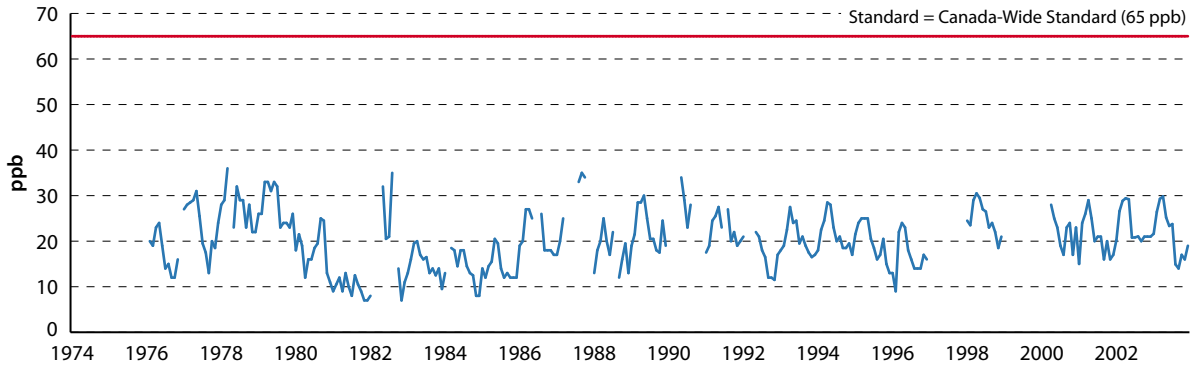
Halifax—average number of 1-hour and 24-hour periods exceeding standards for sulphur dioxide

	1-hour objective				24-hour objective			
	> Acceptable		> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours	percent	number of days	percent	number of days
1991	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.21%	0.75
1992	0.00%	0.00	0.14%	12.08	0.00%	0.00	0.47%	1.70
1993	0.03%	2.26	0.06%	5.65	0.00%	0.00	0.61%	2.21
1994	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.16%	0.59
1998	0.00%	0.00	0.01%	1.09	0.00%	0.00	0.12%	0.42
2002	0.00%	0.00	0.01%	1.07	0.00%	0.00	0.00%	0.00

Halifax—ambient levels of nitrogen dioxide, 1974–2002



Halifax—ambient levels of ozone, 1976–2003



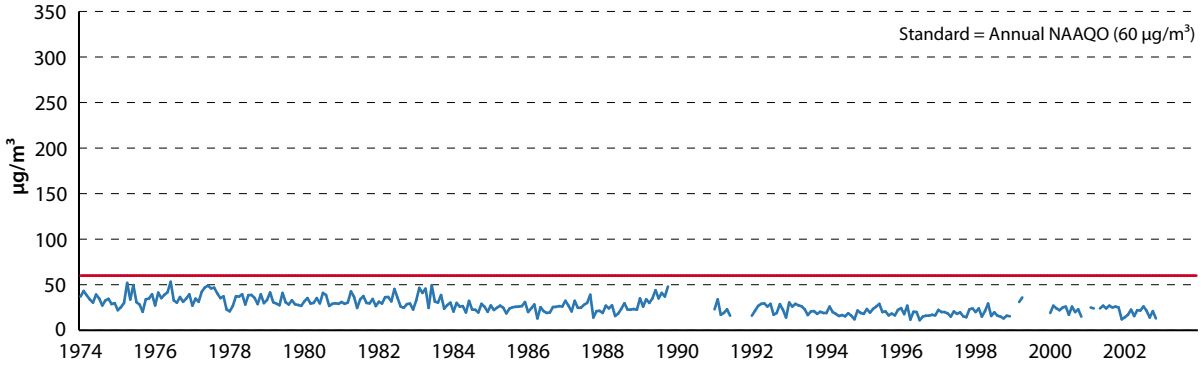
Halifax—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.07%	6.24	1.41%	123.16
1992	0.09%	8.13	0.56%	48.80
1993	0.03%	2.68	0.60%	52.63
1994	0.03%	2.77	0.99%	86.67
1995	0.03%	2.28	0.88%	76.73
1996	0.00%	0.00	0.29%	25.32
1998	0.00%	0.00	1.82%	159.65
2000	0.05%	4.22	1.85%	161.75
2001	0.00%	0.00	0.87%	75.86
2002	0.01%	1.01	0.84%	73.72
2003	0.00%	0.00	0.38%	33.54

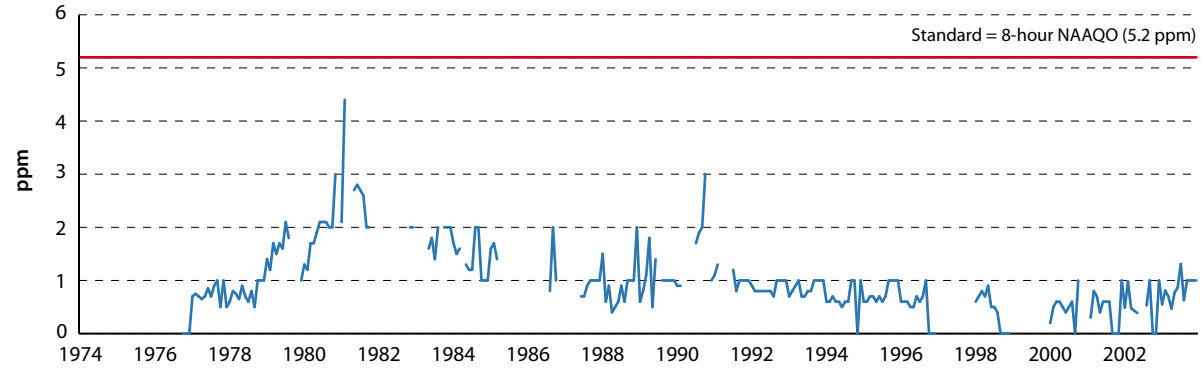
Halifax—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	59.50	65
1994	54.17	65
1995	53.83	65
1996	54.00	65
1998	57.17	65
2000	59.50	65
2001	60.50	65
2002	56.67	65
2003	53.33	65

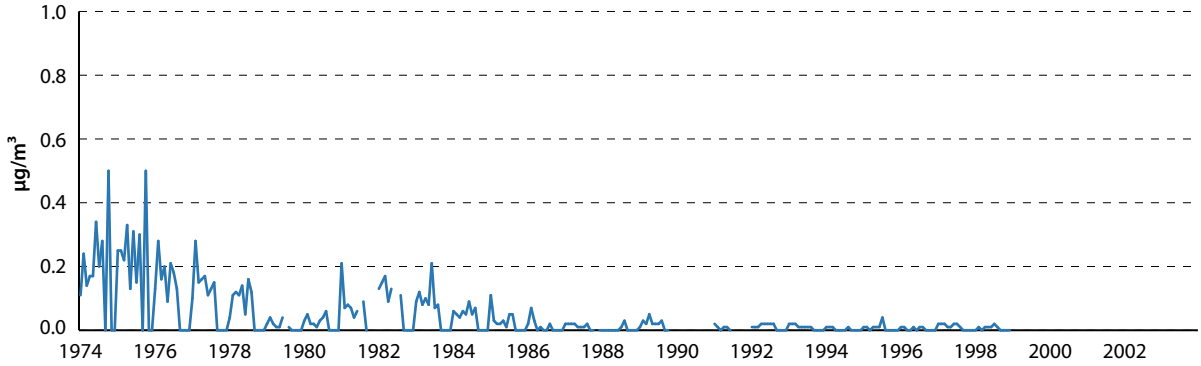
Halifax—ambient levels of total suspended particulates, 1974–2002



Halifax—ambient levels of carbon monoxide, 1976–2003

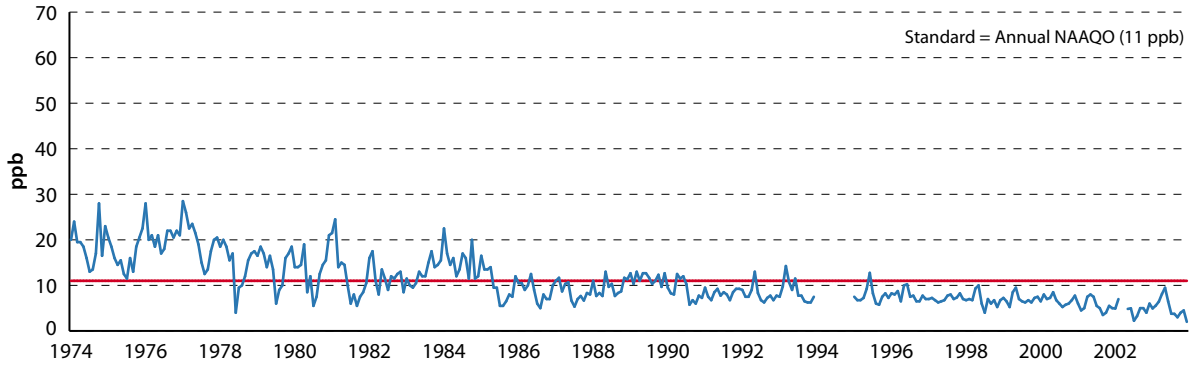


Halifax—ambient levels of lead, 1974–1998



Hamilton, Ontario

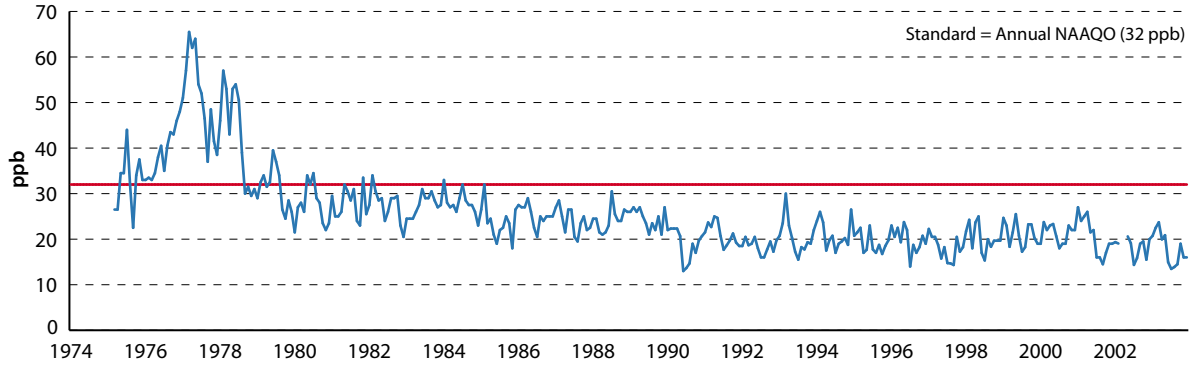
Hamilton—ambient levels of sulphur dioxide, 1974–2003



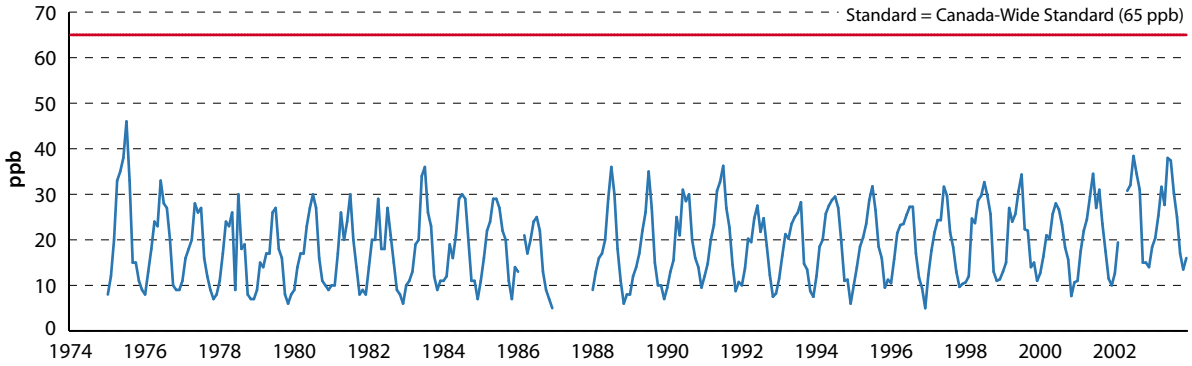
Hamilton—average number of 1-hour and 24-hour periods exceeding standards for sulphur dioxide

	1-hour objective				24-hour objective			
	> Acceptable		> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours	percent	number of days	percent	number of days
1991			0.00%	0			0.47%	40.8
1996			0.01%	1.04			0.00%	0
1997			0.00%	0			0.28%	24.25
1998			0.00%	0			0.31%	27.01

Hamilton—ambient levels of nitrogen dioxide, 1975–2003



Hamilton—ambient levels of ozone, 1975–2003



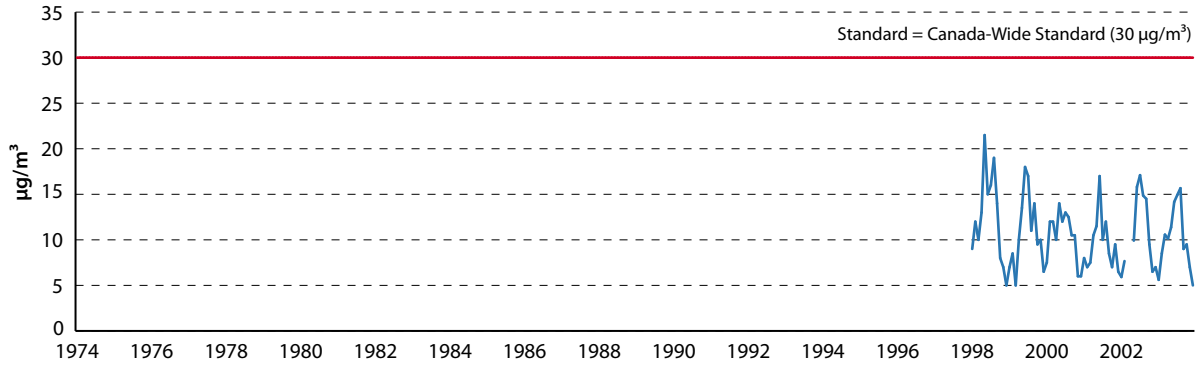
Hamilton—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.94%	82.60	7.63%	668.18
1992	0.11%	9.36	2.89%	253.09
1993	0.05%	4.16	3.76%	329.48
1994	0.25%	21.79	5.27%	461.63
1995	0.35%	30.69	4.69%	411.04
1996	0.09%	7.48	4.20%	367.49
1997	0.19%	16.91	4.26%	373.00
1998	0.45%	39.01	6.81%	596.36
1999	0.26%	22.73	5.65%	495.10
2000	0.14%	12.02	3.22%	282.15
2001	0.63%	55.36	6.47%	567.12
2002	1.19%	104.00	8.93%	782.33
2003	0.63%	54.95	6.74%	590.31

Hamilton—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	75.00	65
1994	71.67	65
1995	74.83	65
1996	75.75	65
1997	75.25	65
1998	74.31	65
1999	76.89	65
2000	76.67	65
2001	79.61	65
2002	83.78	65
2003	88.17	65

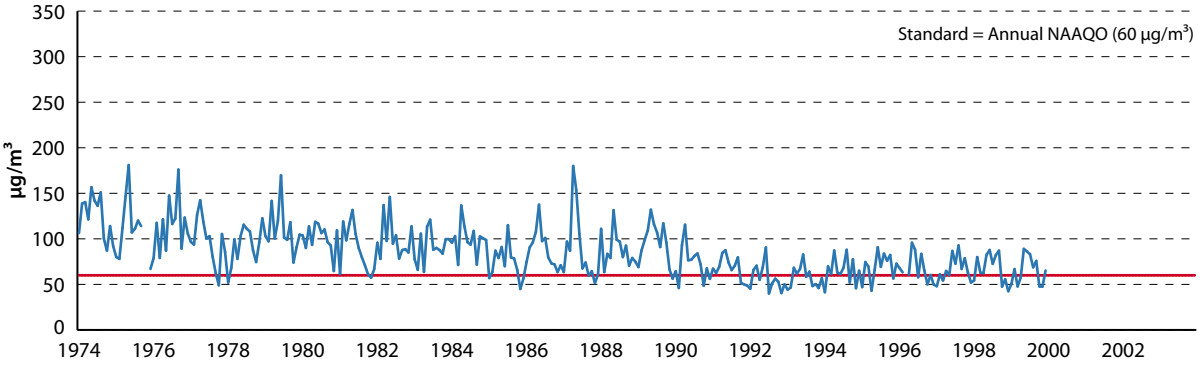
Hamilton—ambient levels of $PM_{2.5}$, 1998–2003



Hamilton—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2000	32.50	30
2001	30.00	30
2002	30.00	30
2003	31.67	30

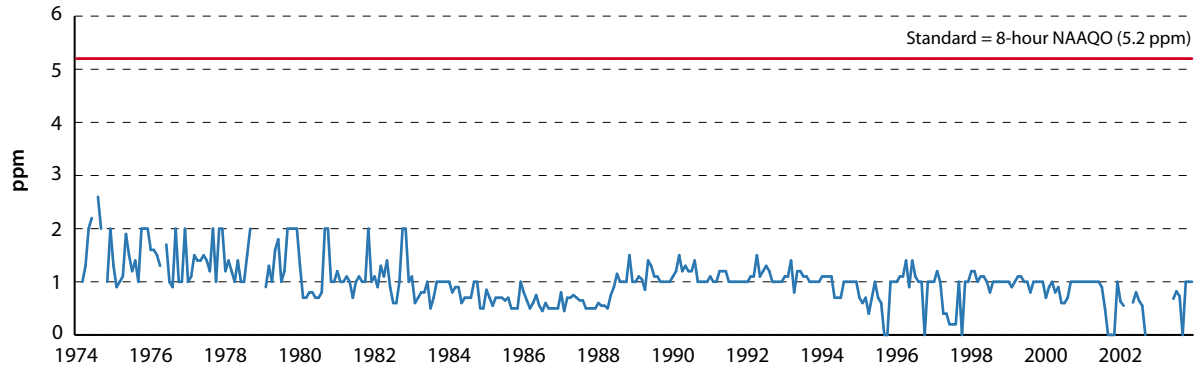
Hamilton—ambient levels of total suspended particulates, 1974–1999



Hamilton—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1991	7.68%	28.05
1992	4.17%	15.23
1993	4.17%	15.21
1994	9.23%	33.70
1995	11.94%	43.59
1996	10.20%	37.22
1997	9.32%	34.00
1998	9.57%	34.95
1999	8.68%	31.69

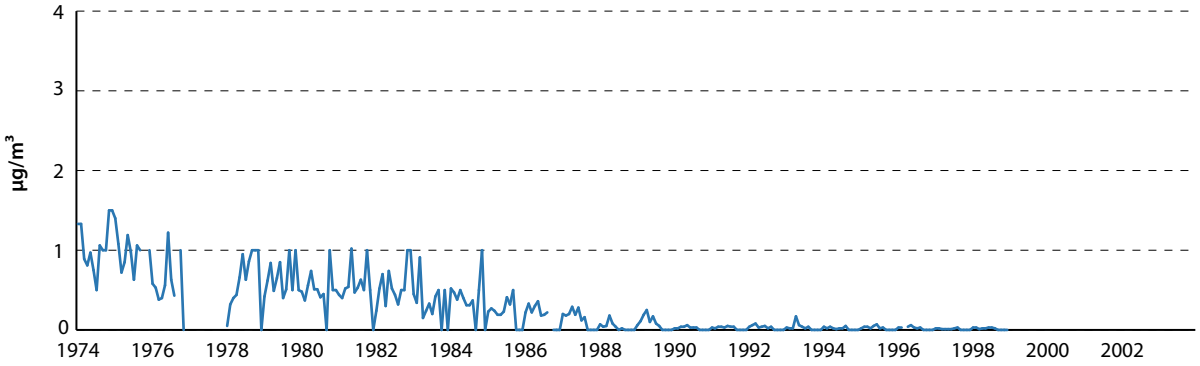
Hamilton—ambient levels of carbon monoxide, 1974–2003



Hamilton—average number of 1-hour and 8-hour periods exceeding standards for carbon monoxide

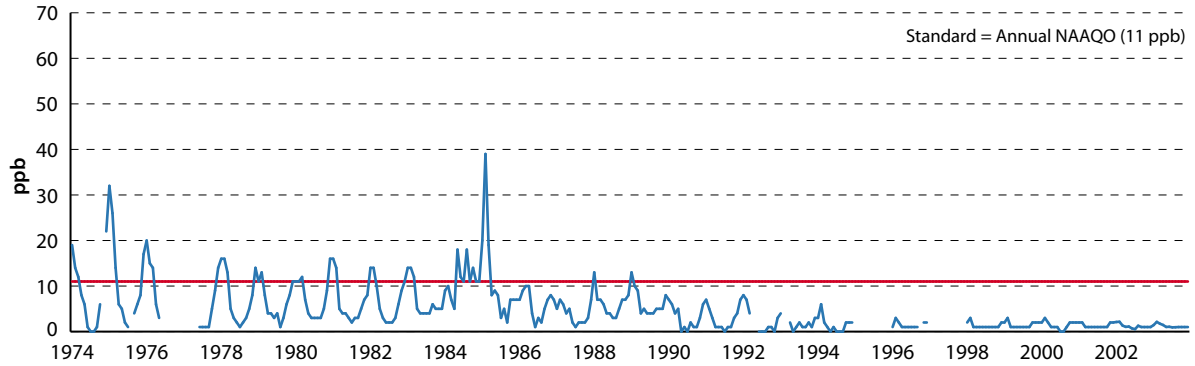
	1-hour objective		8-hour objective	
	> Desirable		> Desirable	
	percent	number of hours	percent	number of 8-hour periods
1996	0.18%	15.66	0.66%	7.19

Hamilton—ambient levels of lead, 1974–1998

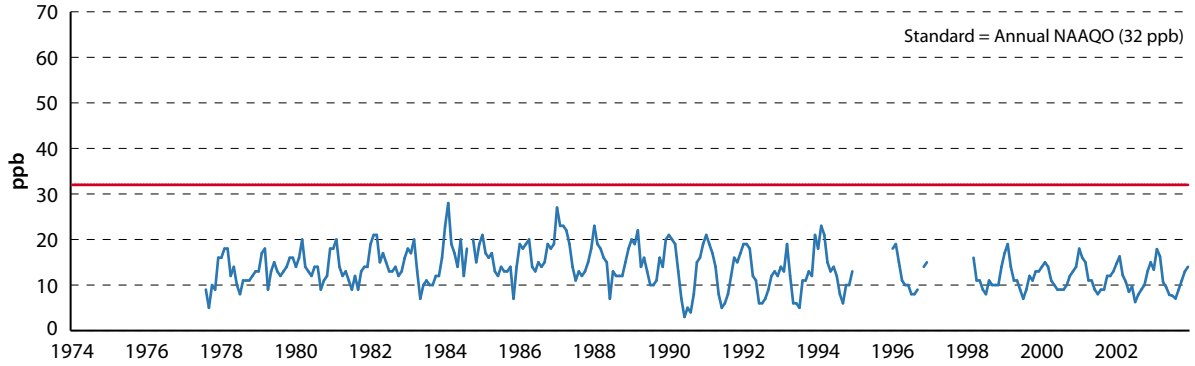


Hull, Québec

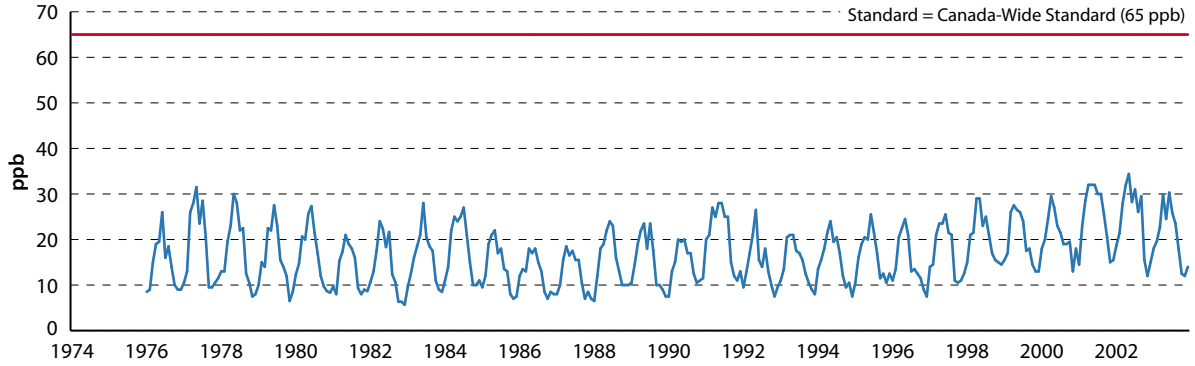
Hull—ambient levels of sulphur dioxide, 1974–2003



Hull—ambient levels of nitrogen dioxide, 1977–2003



Hull—ambient levels of ozone, 1976–2003



Hull—number of readings exceeding standards for ozone

		1-hour objectives		8-hour objectives		24-hour objectives		Canada-wide standards	
	Station ID	> Desirable	> Acceptable	> Desirable	> Acceptable	> Desirable	> Acceptable	Current average	Days
1992	50203	179	10					76	358
1993	50203	72	3					65	279
1994	50203	143	2					73	360
1995	50203	29	0						133
1996	50203	77	0					57	307
1997	50204	235	7					71	328
1998	50204	296	25					85	363
1999	50204	444	33					84	365
2000	50204	139	0					63	347
2001	50204	455	17					76	365
2002	50204	373	13						
2003	50204	308	12						

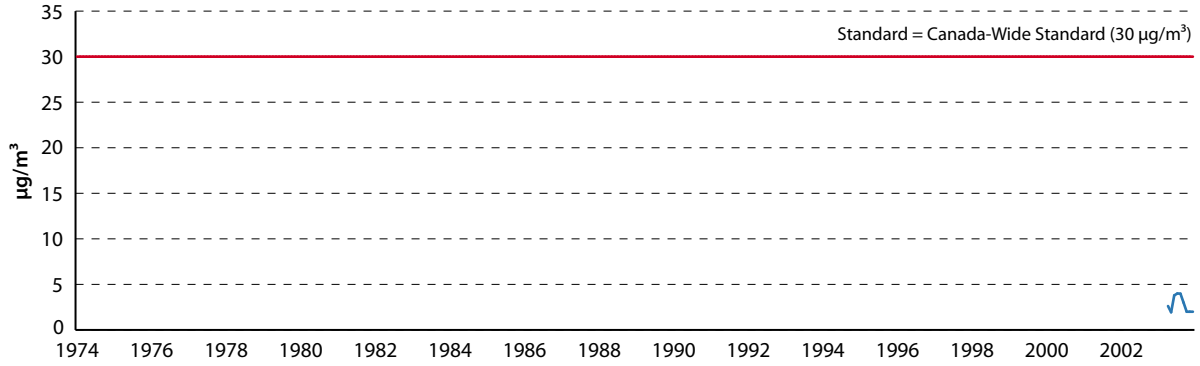
Hull—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1992	0.12%	10.94	2.23%	195.78
1993	0.05%	4.32	1.18%	103.72
1994	0.02%	2.17	1.77%	154.80
1995	0.00%	0.00	0.92%	80.34
1996	0.00%	0.00	1.09%	95.06
1997	0.09%	8.23	3.15%	276.21
1998	0.31%	26.86	3.63%	318.00
1999	0.40%	34.70	5.33%	466.81
2000	0.00%	0.00	1.77%	154.76
2001	0.20%	17.87	5.46%	478.26
2002	0.16%	13.69	4.49%	392.91
2003	0.15%	13.26	3.89%	340.37

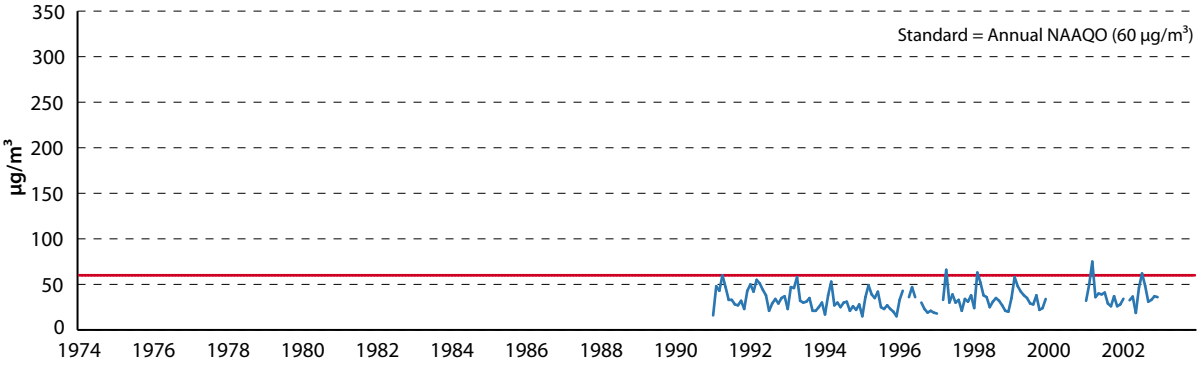
Hull— 3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1994	71.33	65
1995		65
1996		65
1997		65
1998	71.00	65
1999	80.00	65
2000	77.33	65
2001	74.33	65
2002	71.33	65
2003	76.67	65

Hull—ambient levels of $PM_{2.5}$, 2003



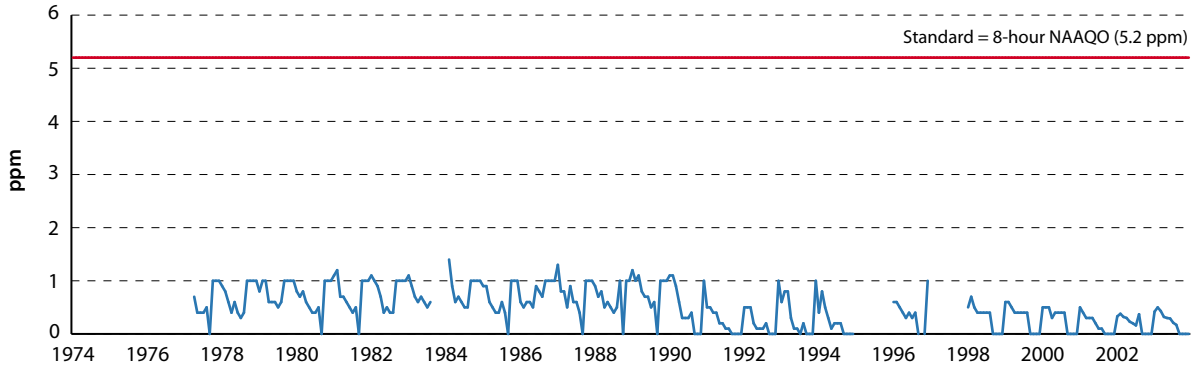
Hull—ambient levels of total suspended particulates, 1991–2002



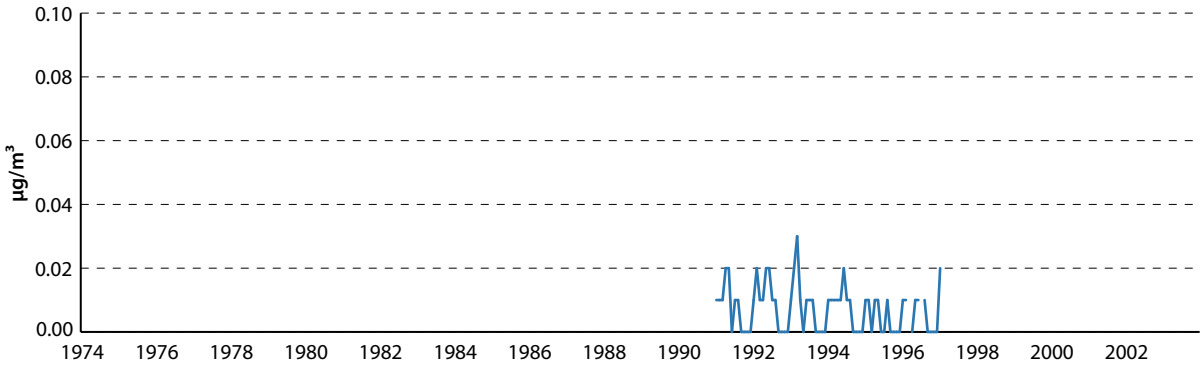
Hull—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1992	1.72%	151.03
1993	1.67%	146.00
2001	1.72%	151.03

Hull—ambient levels of carbon monoxide, 1977–2003

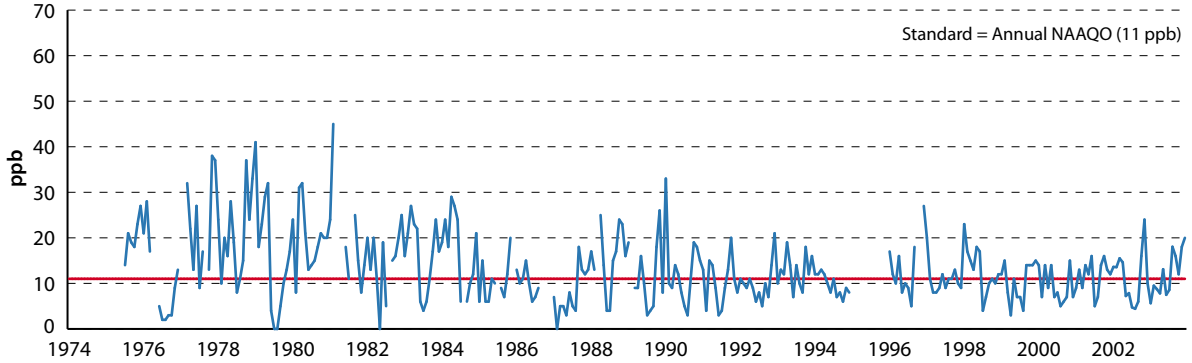


Hull—ambient levels of lead, 1991–1997



Jonquière, Québec

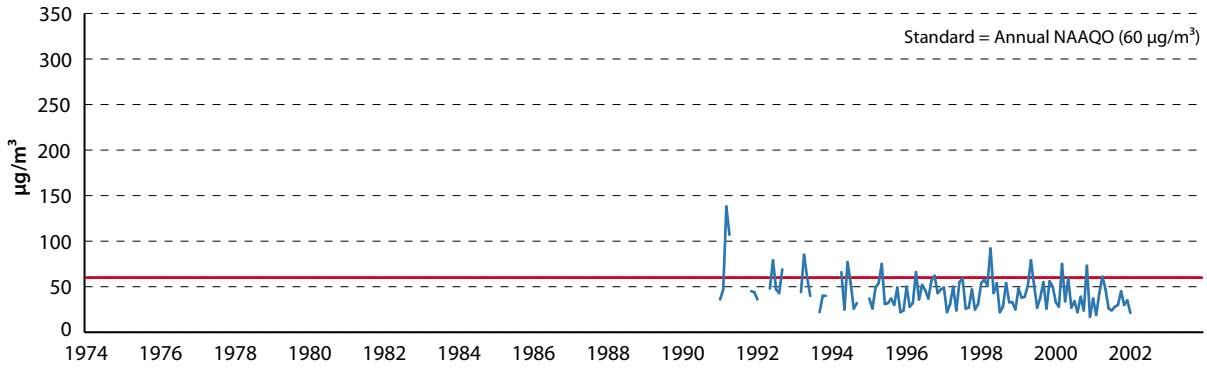
Jonquière—ambient levels of sulphur dioxide, 1975–2003



Jonquière—average number of 1-hour and 24-hour periods exceeding standards for sulphur dioxide

	1-hour objectives				24-hour objectives			
	> Acceptable		> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours	percent	number of days	percent	number of days
1991			0.03%	2.20	0.00%	0.00	2.36%	8.61
1992			0.13%	10.96	0.00%	0.00	4.22%	15.41
1993			0.11%	9.82	0.00%	0.00	4.02%	14.65
1994			0.08%	6.57	0.00%	0.00	2.57%	9.39
1995								
1996			0.06%	5.02	0.00%	0.00	5.55%	20.27
1997			0.00%	0.00	0.00%	0.00	2.34%	8.54
1998			0.05%	4.37	0.00%	0.00	3.85%	14.06
1999			0.06%	5.32	0.00%	0.00	2.88%	10.52
2000			0.02%	2.10	0.00%	0.00	1.04%	3.79
2001			0.19%	16.73	0.00%	0.00	4.40%	16.08
2002			0.04%	3.20	0.05%	0.17	3.19%	11.65
2003			0.04%	3.24	0.11%	0.39	4.69%	17.14

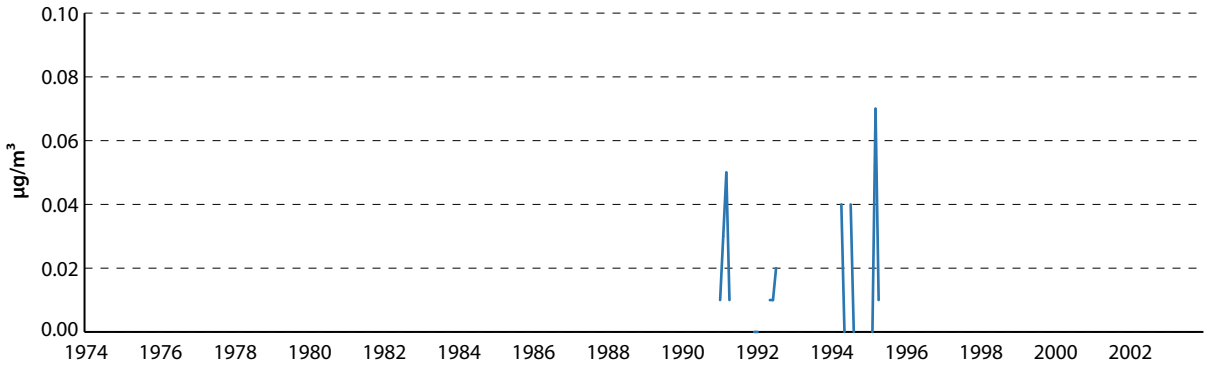
Jonquière—ambient levels of total suspended particulates, 1991–2002



Jonquière—average number of 24-hour periods exceeding standards for total suspended particulates

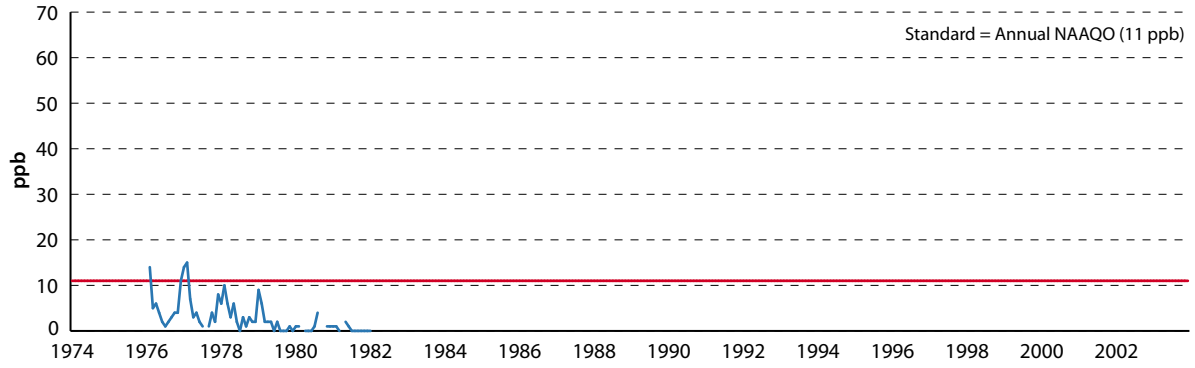
	24-hour objective > Acceptable	
	percent	number of days
1991	21.74%	79.35
1992	5.13%	18.72
1993	2.56%	9.36
1994	8.33%	30.42
1995	3.45%	12.59
1996	3.45%	12.59
1997	1.69%	6.19
1998	3.51%	12.81
1999	5.17%	18.88
2000	1.64%	5.98

Jonquière—ambient levels of lead, 1991–1995

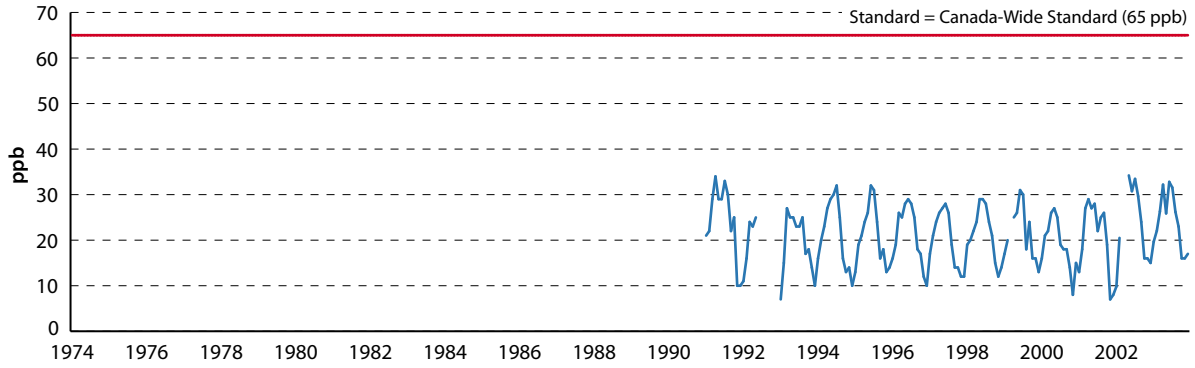


Kingston, Ontario

Kingston—ambient levels of sulphur dioxide, 1976–1982



Kingston—ambient levels of ozone, 1991–2003



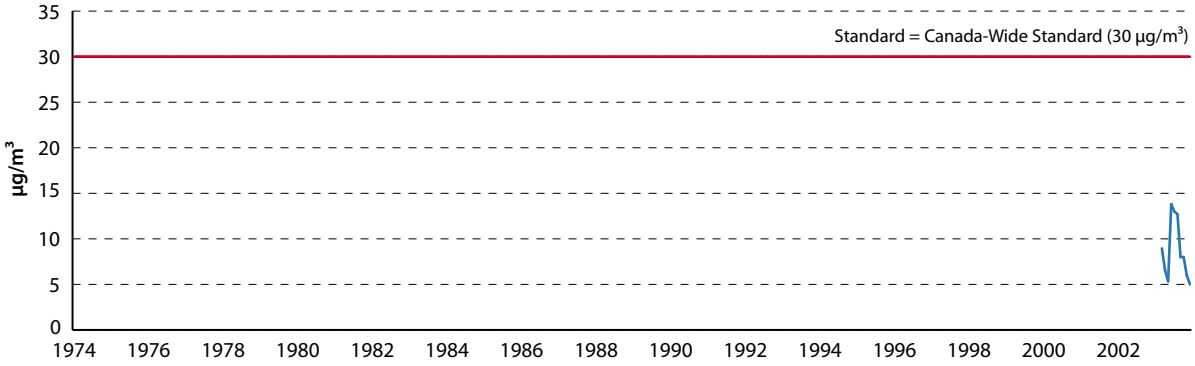
Kingston—average number of 1-hour periods exceeding standards for ozone

	1-hour objectives			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.80%	70.10	6.47%	566.44
1992	0.11%	9.57	2.29%	200.88
1993	0.14%	12.65	4.33%	379.45
1994	0.16%	14.35	5.29%	463.32
1995	0.49%	42.72	4.71%	412.63
1996	0.06%	5.08	4.11%	359.71
1997	0.32%	28.07	3.62%	316.76
1998	0.37%	32.12	6.01%	526.33
1999	0.45%	39.79	5.96%	521.67
2000	0.09%	8.06	2.21%	193.46
2001	0.44%	38.78	4.76%	417.39
2002	0.90%	79.27	6.52%	571.46
2003	0.40%	35.25	5.00%	438.10

Kingston—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

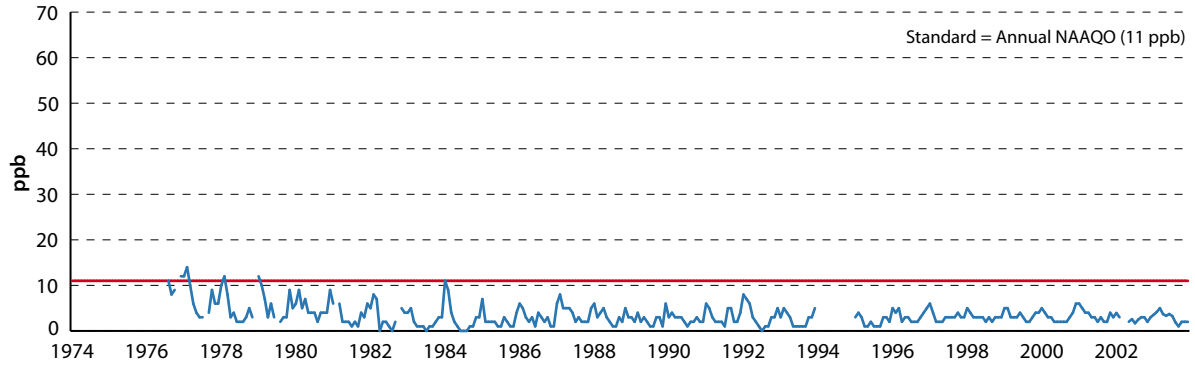
	3-year average	Canada-wide standard
1995	80.33	65
1996	78.00	65
1997	79.33	65
1998	78.00	65
1999	82.00	65
2000	78.00	65
2001	77.67	65
2002	79.67	65
2003	86.67	65

Kingston—ambient levels of $PM_{2.5}$, 2003

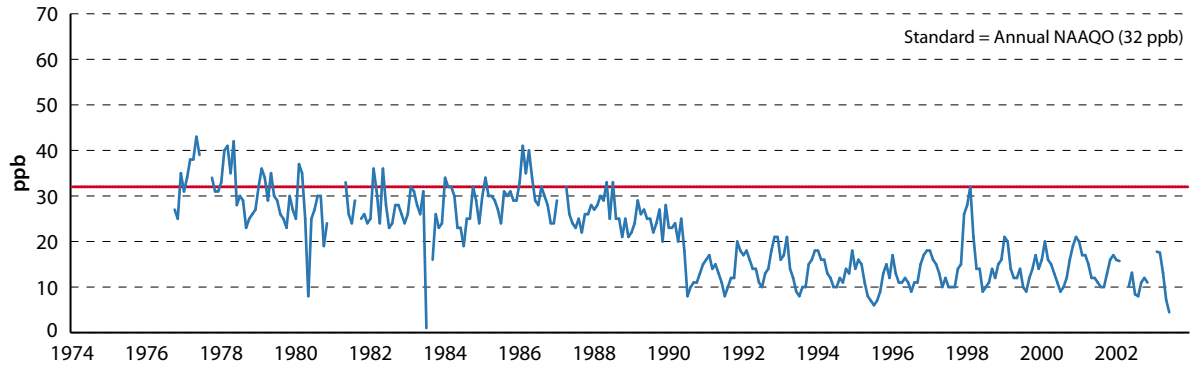


Kitchener, Ontario

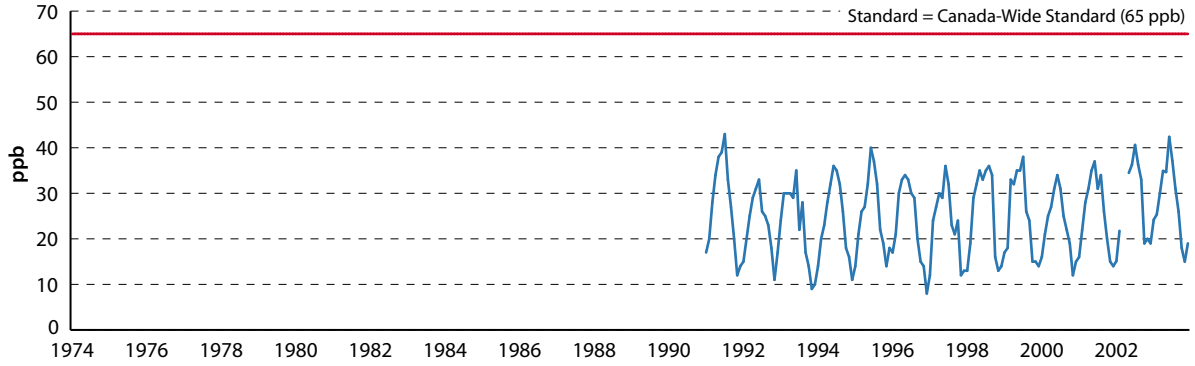
Kitchener—ambient levels of sulphur dioxide, 1976–2003



Kitchener—ambient levels of nitrogen dioxide, 1976–2003



Kitchener—ambient levels of ozone, 1991–2003



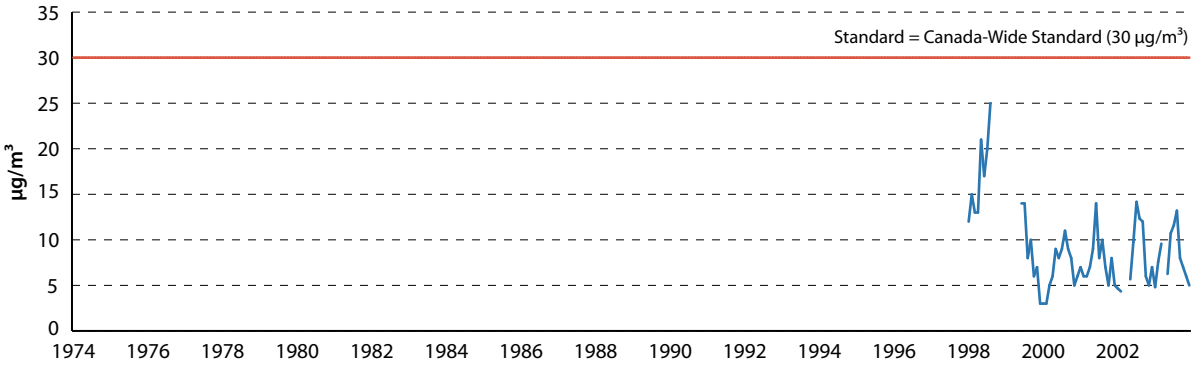
Kitchener—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.86%	75.14	9.81%	859.79
1992	0.19%	16.23	3.58%	313.78
1993	0.16%	14.13	5.00%	438.16
1994	0.36%	31.34	7.11%	622.75
1995	0.50%	43.38	7.46%	653.67
1996	0.17%	14.46	5.51%	482.42
1997	0.18%	15.33	4.97%	435.39
1998	0.97%	85.35	9.01%	788.98
1999	0.83%	72.48	7.95%	696.61
2000	0.22%	19.05	4.30%	376.99
2001	0.61%	53.45	7.71%	675.71
2002	1.32%	115.29	9.86%	864.11
2003	0.67%	58.58	8.20%	718.05

Kitchener—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	81.67	65
1994	77.33	65
1995	80.00	65
1996	80.67	65
1997	80.67	65
1998	85.00	65
1999	90.67	65
2000	89.67	65
2001	84.33	65
2002	82.00	65
2003	87.67	65

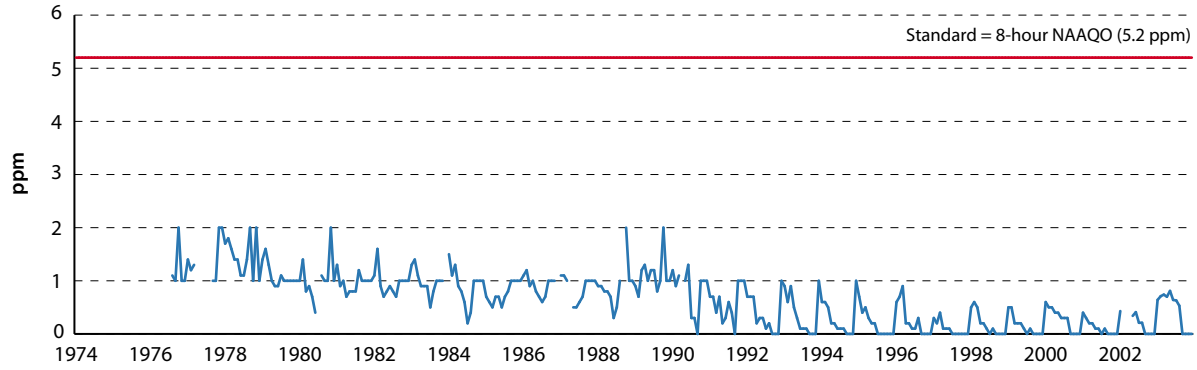
Kitchener—ambient levels of $PM_{2.5}$, 1998–2003



Kitchener—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2000	32.00	30
2001	27.33	30
2002	26.00	30
2003	28.33	30

Kitchener—ambient levels of carbon monoxide, 1976–2003

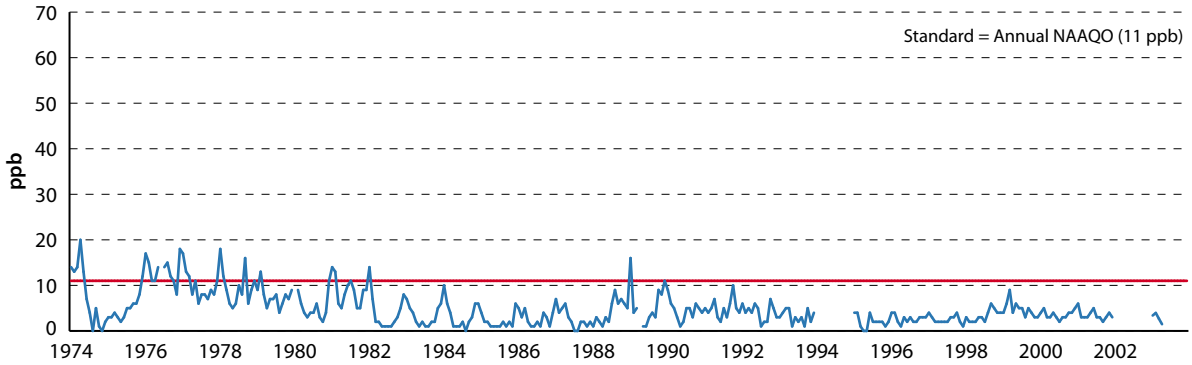


Kitchener—average number of 8-hour periods exceeding standards for carbon monoxide

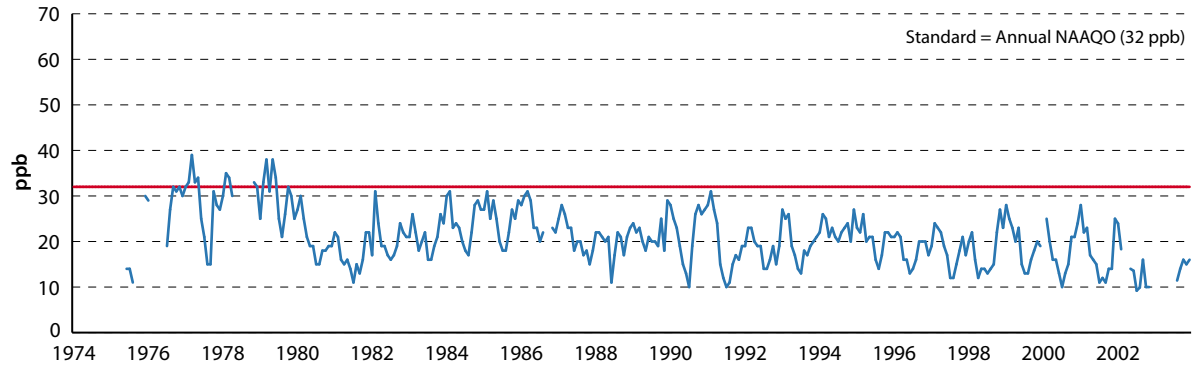
	8-hour objective > Desirable	
	percent	number of 8-hour periods
1991	0.01%	0.13
1993	0.04%	0.39
1994	0.05%	0.51

London, Ontario

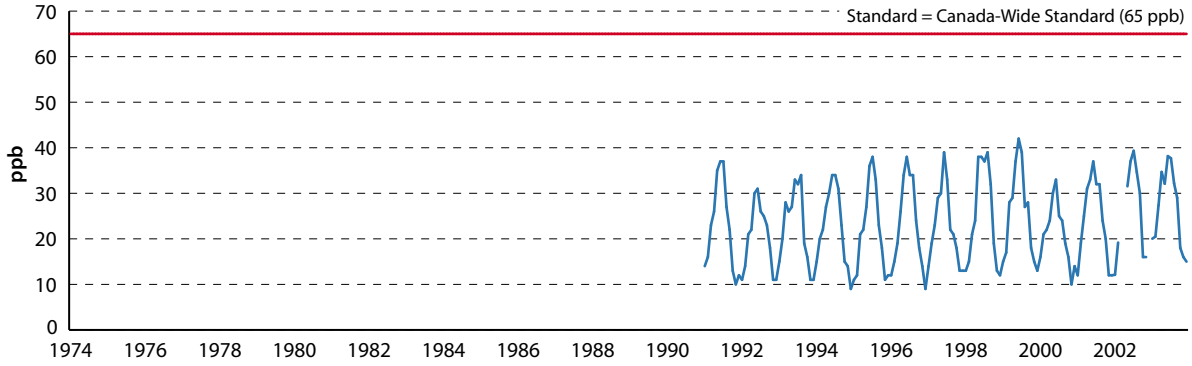
London—ambient levels of sulphur dioxide, 1974–2003



London—ambient levels of nitrogen dioxide, 1975–2003



London—ambient levels of ozone, 1991–2003



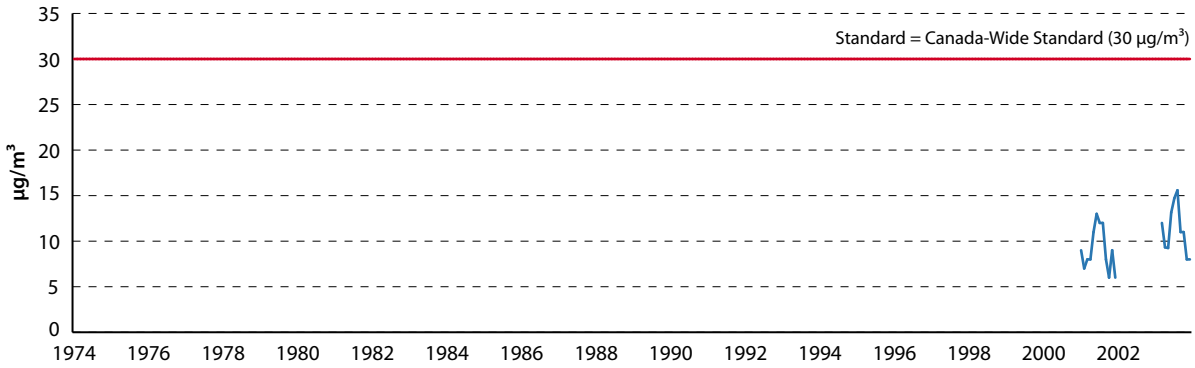
London—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.57%	49.69	7.84%	686.56
1992	0.16%	14.13	3.74%	328.00
1993	0.16%	14.26	5.91%	517.45
1994	0.28%	24.81	6.60%	577.93
1995	0.55%	48.53	6.32%	553.46
1996	0.76%	66.67	6.99%	612.31
1997	0.52%	45.22	6.10%	534.40
1998	1.19%	104.45	10.03%	878.81
1999	1.17%	102.85	9.25%	810.66
2000	0.24%	20.67	3.23%	283.18
2001	0.67%	58.83	7.20%	630.93
2002	1.67%	146.11	9.79%	857.25
2003	0.43%	37.77	7.82%	685.15

London—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	78.67	65
1994	77.00	65
1995	77.50	65
1996	80.83	65
1997	83.50	65
1998	89.00	65
1999	92.67	65
2000	90.67	65
2001	88.00	65
2002	86.67	65
2003	87.00	65

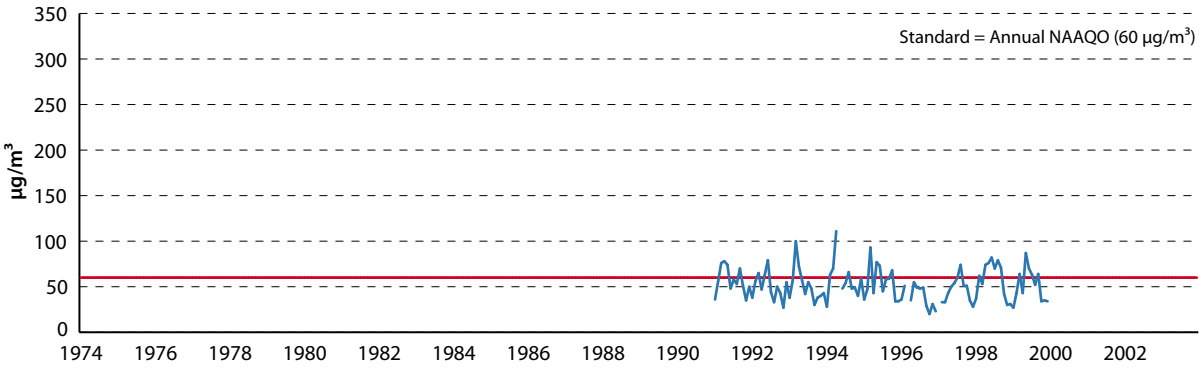
London—ambient levels of $PM_{2.5}$, 2001–2003



London—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2003	31	30

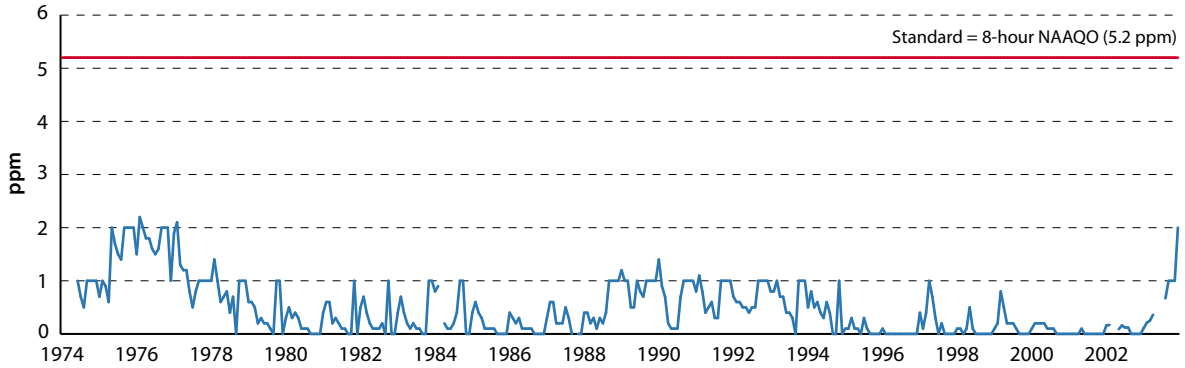
London—ambient levels of total suspended particulates, 1991–1999



London—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1991	3.77%	330.57
1992	3.39%	296.95
1993	5.36%	469.29
1994	5.77%	505.38
1995	3.70%	324.44
1998	1.75%	153.68
1999	3.85%	336.92

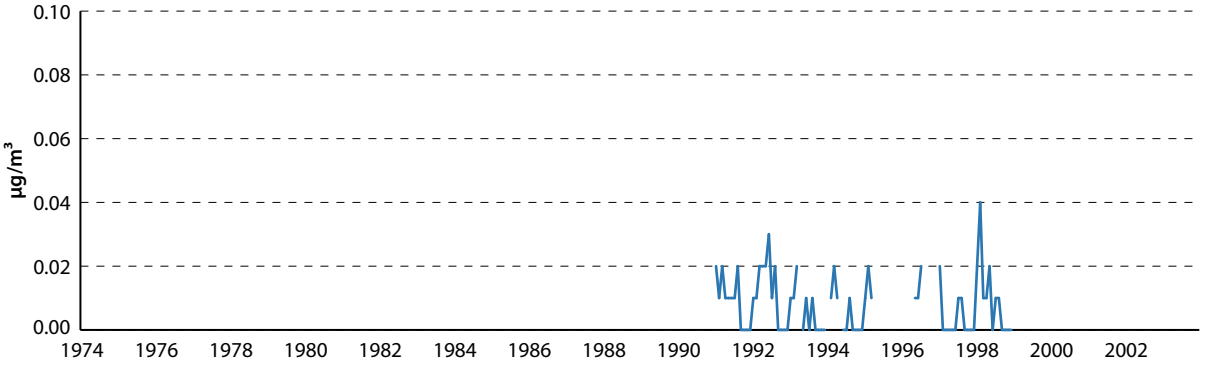
London—ambient levels of carbon monoxide, 1974–2003



London—average number of 8-hour periods exceeding standards for carbon monoxide

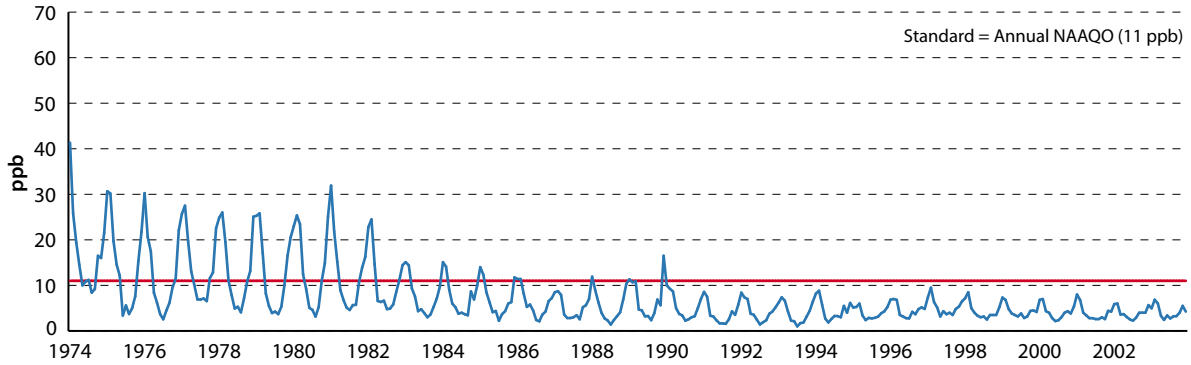
	8-hour objective > Desirable	
	percent	number of 8-hour periods
1991	0.10%	1.13
1995	0.07%	0.81

London—ambient levels of lead, 1991–1998



Montréal, Québec

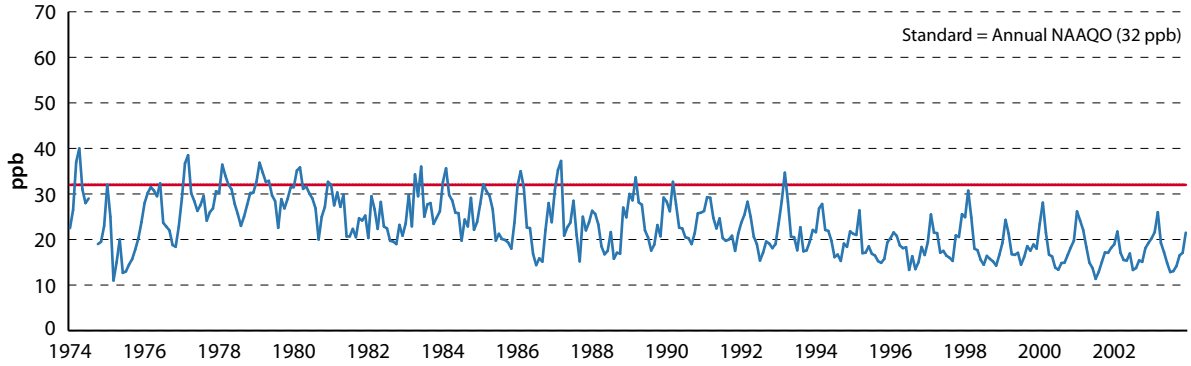
Montréal—ambient levels of sulphur dioxide, 1974–2003



Montréal—average number of 1-hour and 24-hour periods exceeding standards for sulphur dioxide

	1-hour objectives		24-hour objectives	
	> Desirable		> Desirable	
	percent	number of hours	percent	number of days
1991	0.01%	1.29	0.02%	0.06
1992	0.04%	3.29	0.30%	1.10
1993	0.02%	2.08	0.00%	0.00
1994	0.05%	4.38	0.00%	0.00
1995	0.02%	2.13	0.08%	0.31

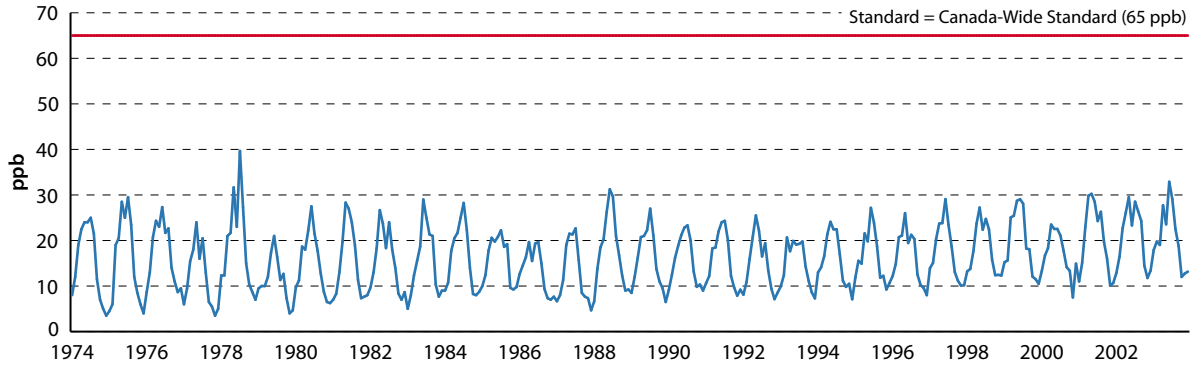
Montréal—ambient levels of nitrogen dioxide, 1974–2003



Montréal—average number of 1-hour and 24-hour periods exceeding standards for nitrogen dioxide

	1-hour objectives		24-hour objectives			
	> Acceptable		> Acceptable		> Tolerable	
	percent	number of hours	percent	number of days	percent	number of days
1992	0.00%	0.00	0.12%	0.44	0.00%	0.00
1993						
1994						
1995						
1996						
1997						
1998	0.10%	8.52	0.30%	1.08	0.17%	0.62

Montréal—ambient levels of ozone, 1974–2003



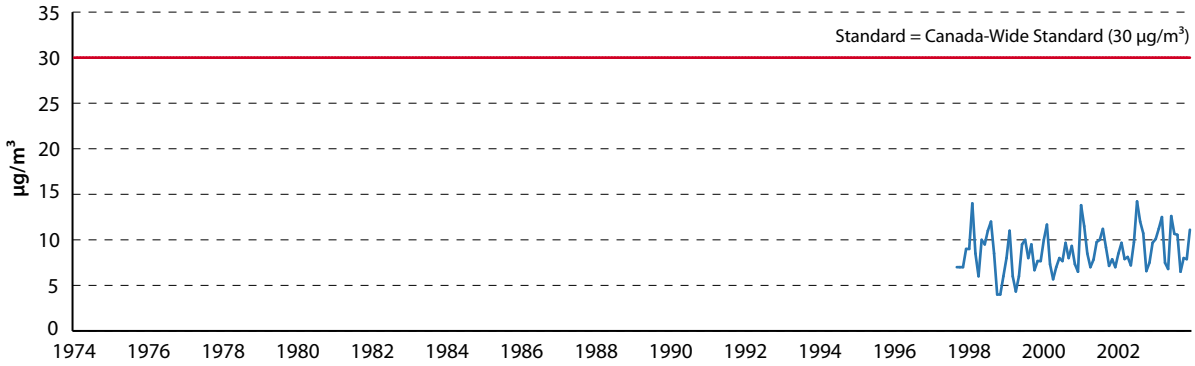
Montréal—average number of 1-hour periods exceeding standards for ozone

	1-hour objectives					
	> Acceptable		> Desirable		> Tolerable	
	percent	number of hours	percent	number of hours	percent	number of hours
1991	0.13%	10.99	2.29%	200.61	0.00%	0.00
1992	0.18%	15.57	1.55%	135.76	0.00%	0.00
1993	0.04%	3.68	1.17%	102.54	0.00%	0.00
1994	0.05%	4.62	1.16%	101.98	0.02%	2.12
1995	0.16%	14.31	2.46%	215.09	0.00%	0.00
1996	0.06%	5.64	1.35%	118.18	0.00%	0.00
1997	0.18%	15.60	2.12%	186.13	0.00%	0.00
1998	0.14%	11.91	2.68%	234.43	0.00%	0.00
1999	0.28%	24.48	4.18%	366.09	0.00%	0.00
2000	0.01%	1.02	0.90%	78.94	0.00%	0.00
2001	0.27%	23.53	4.23%	370.55	0.00%	0.00
2002	0.19%	16.69	3.72%	325.68	0.00%	0.00
2003	0.15%	13.23	3.66%	320.79	0.00%	0.00

Montréal—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	65.16	65
1994	61.00	65
1995	61.88	65
1996	61.89	65
1997	65.98	65
1998	66.64	65
1999	72.37	65
2000	67.23	65
2001	68.98	65
2002	68.21	65
2003	73.69	65

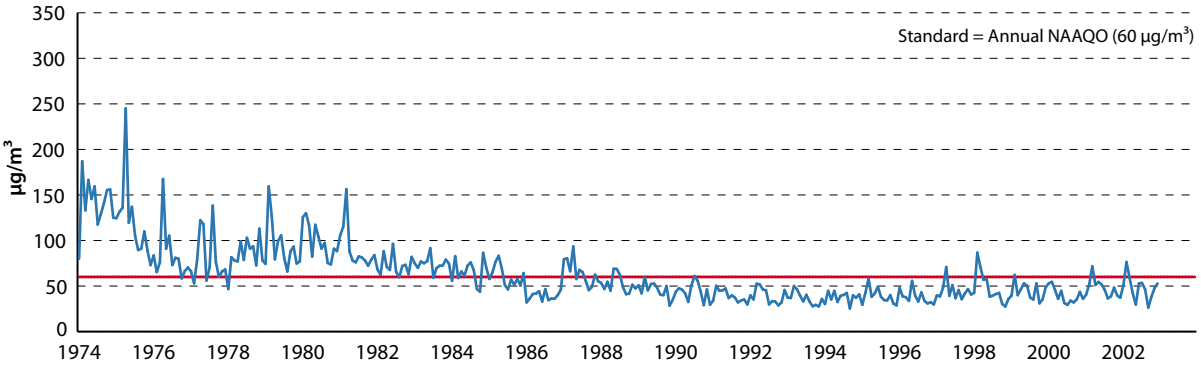
Montréal—ambient levels of $PM_{2.5}$, 1997–2003



Montréal—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2000	26.78	30
2001	27.04	30
2002	30.54	30
2003	34.06	30

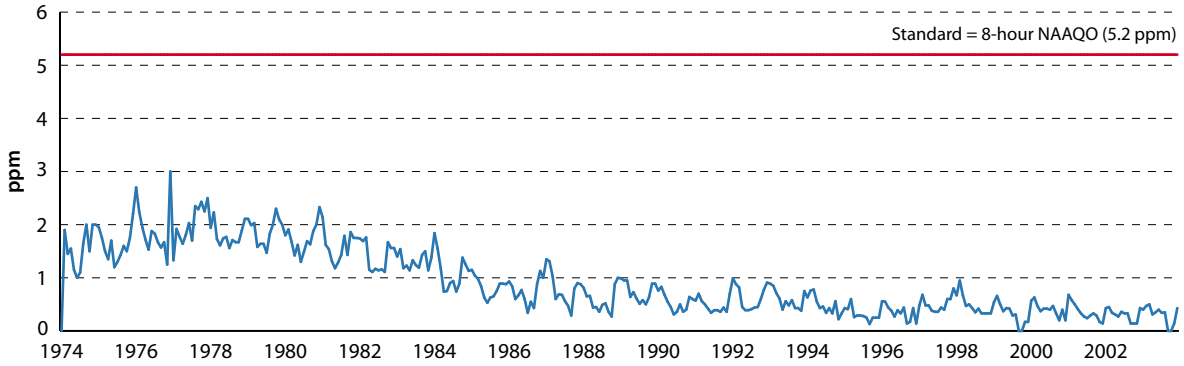
Montréal—ambient levels of total suspended particulates, 1974–2002



Montréal—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1991	3.58%	13.07
1992	2.51%	9.15
1993	2.17%	7.92
1994	4.26%	15.53
1995	2.26%	8.24
1996	1.82%	6.66
1997	4.16%	15.19
1998	4.02%	14.68
1999	3.66%	13.34
2001	2.85%	10.40
2002	6.59%	24.06

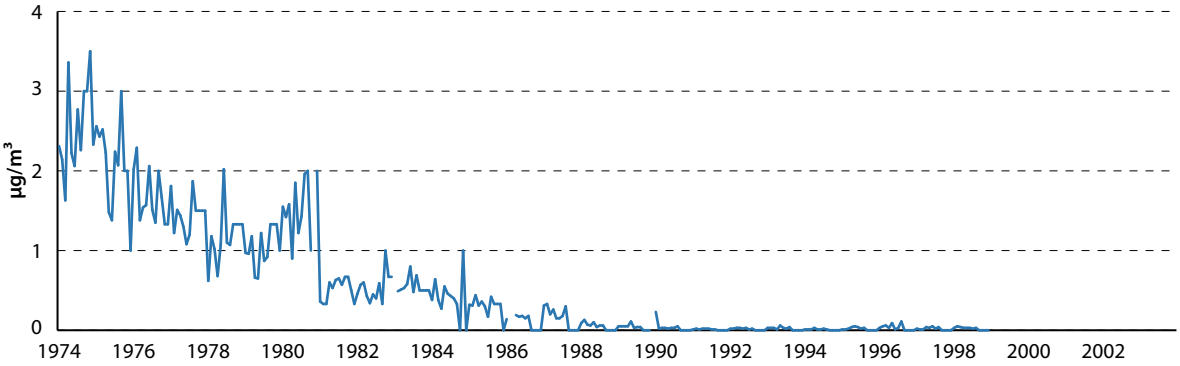
Montréal—ambient levels of carbon monoxide, 1974–2003



Montréal—average number of 1-hour and 8-hour periods exceeding standards for carbon monoxide

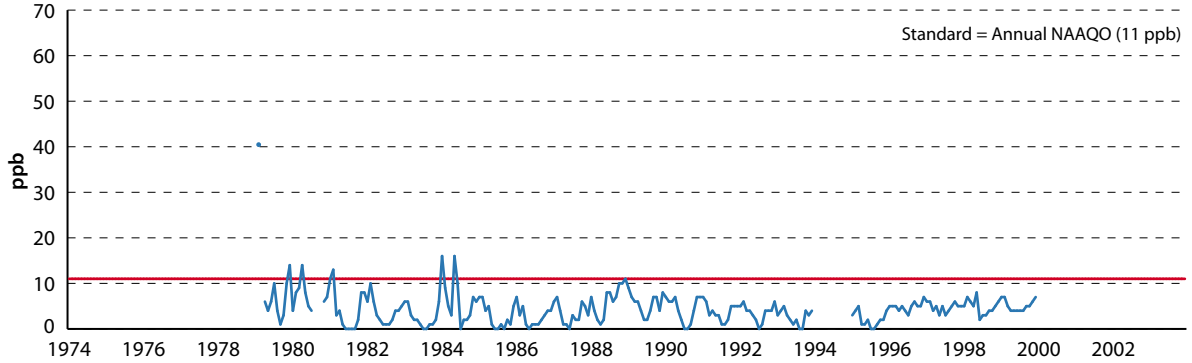
	1-hour objectives > Desirable		8-hour objectives > Desirable	
	percent	number of hours	percent	number of 8-hour periods
1991	0.00%	0.00	0.13%	1.40
1992	0.01%	1.09	0.11%	1.23
1993	0.00%	0.00	0.12%	1.33
1994	0.00%	0.00	0.07%	0.81
1995				
1996	0.00%	0.00	0.11%	1.23
1997	0.01%	1.02	0.06%	0.64
1998	0.00%	0.00	0.19%	2.09

Montréal—ambient levels of lead, 1974–1998

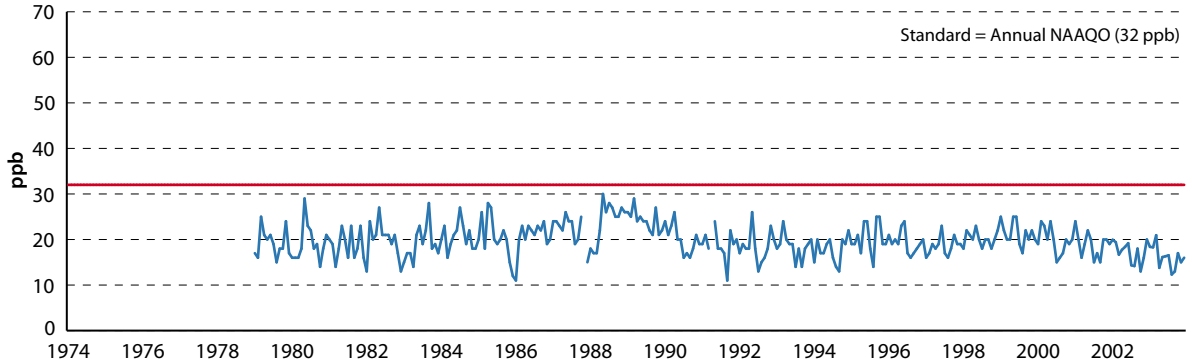


Oshawa, Ontario

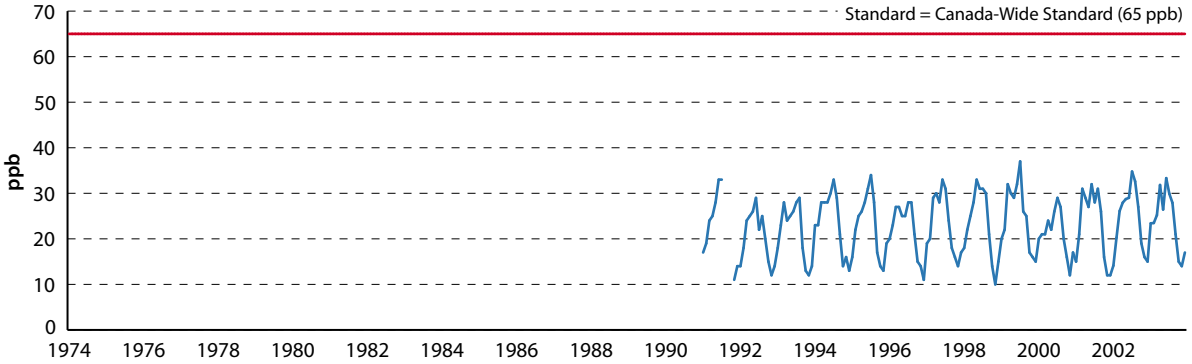
Oshawa—ambient levels of sulphur dioxide, 1979–1999



Oshawa—ambient levels of nitrogen dioxide, 1979–2003



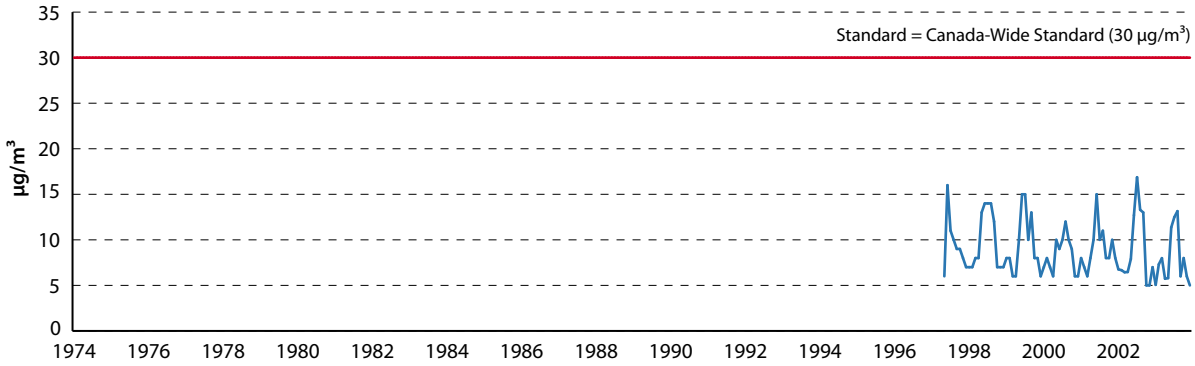
Oshawa—ambient levels of ozone, 1991–2003



Oshawa—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	76.33	65
1994	73.67	65
1995	79.00	65
1996	77.33	65
1997	77.67	65
1998	74.67	65
1999	80.67	65
2000	75.67	65
2001	79.00	65
2002	78.67	65
2003	84.00	65

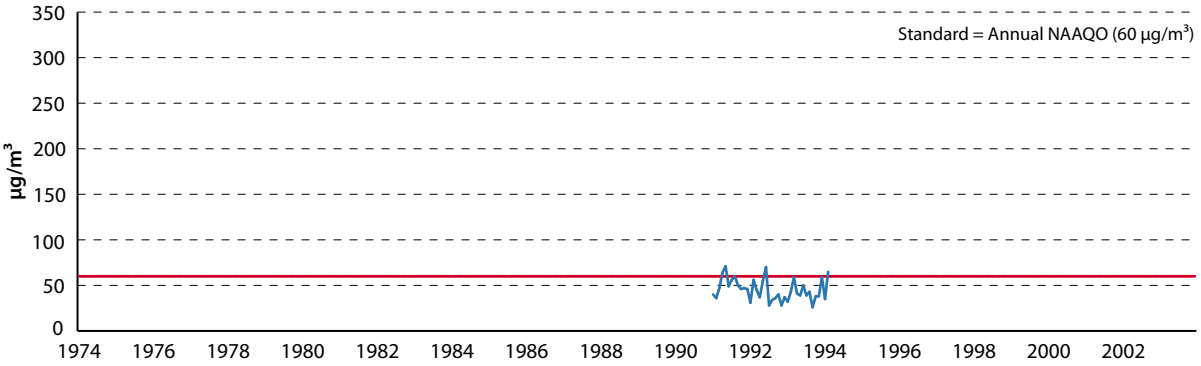
Oshawa—ambient levels of $PM_{2.5}$, 1997–2003



Oshawa—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
1999	31.67	30
2000	29.33	30
2001	28.00	30
2002	29.67	30
2003	29.67	30

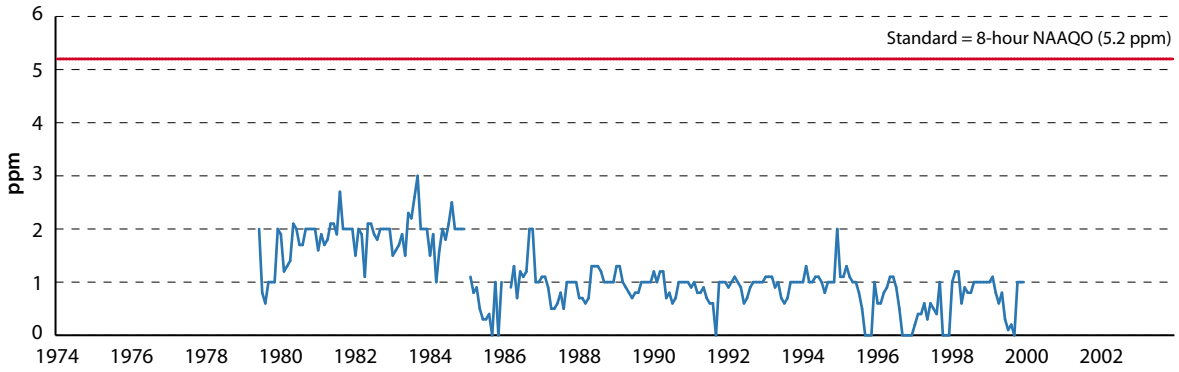
Oshawa—ambient levels of total suspended particulates, 1991–1994



Oshawa—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1991	5.26%	19.2
1992	1.72%	6.29

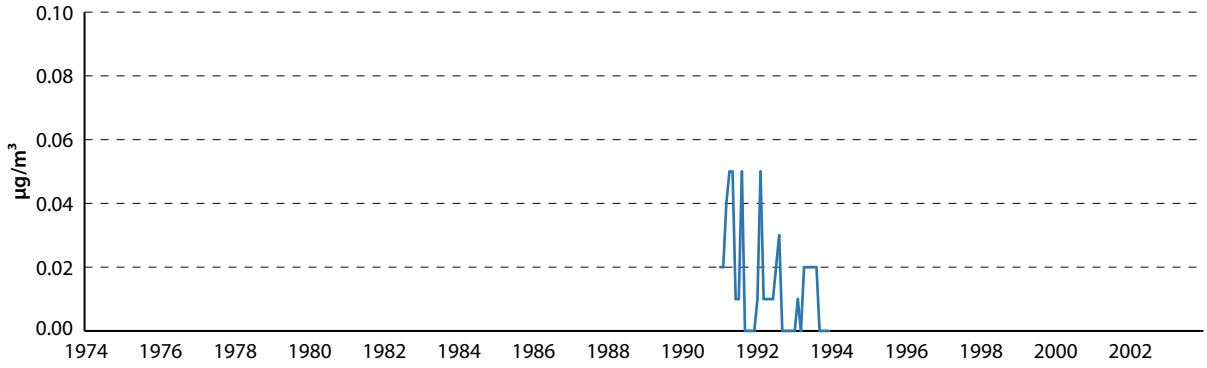
Oshawa—ambient levels of carbon monoxide, 1970–1999



Oshawa—average number of 8-hour periods exceeding standards for carbon monoxide

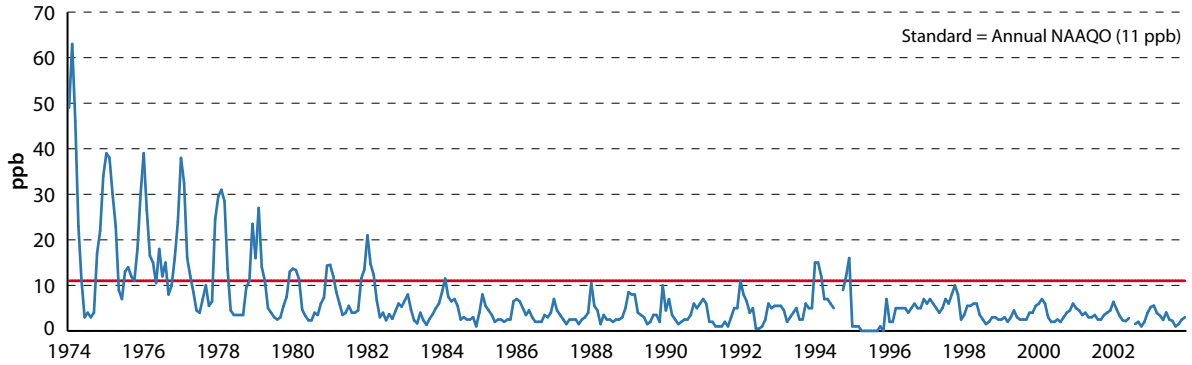
	8-hour objective > Desirable	
	percent	number of 8-hour periods
1994	0.18%	2.01
1997	0.07%	0.80

Oshawa—ambient levels of lead, 1991–1994

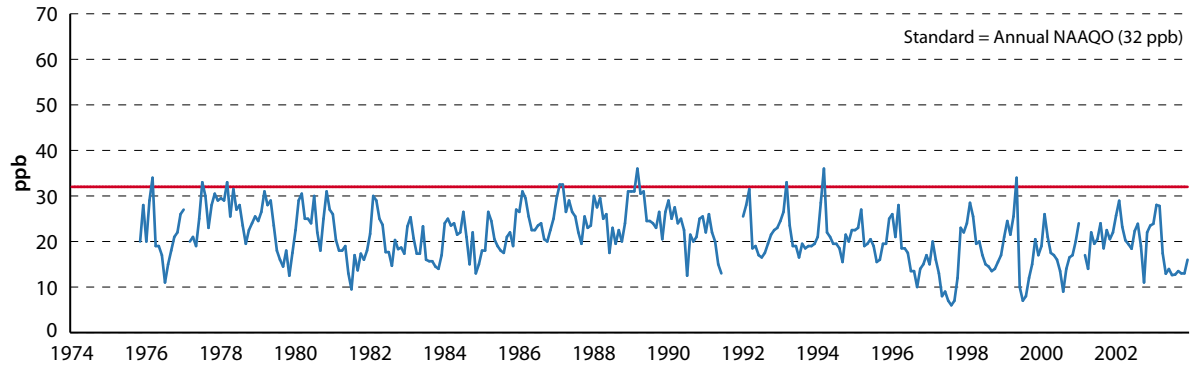


Ottawa, Ontario

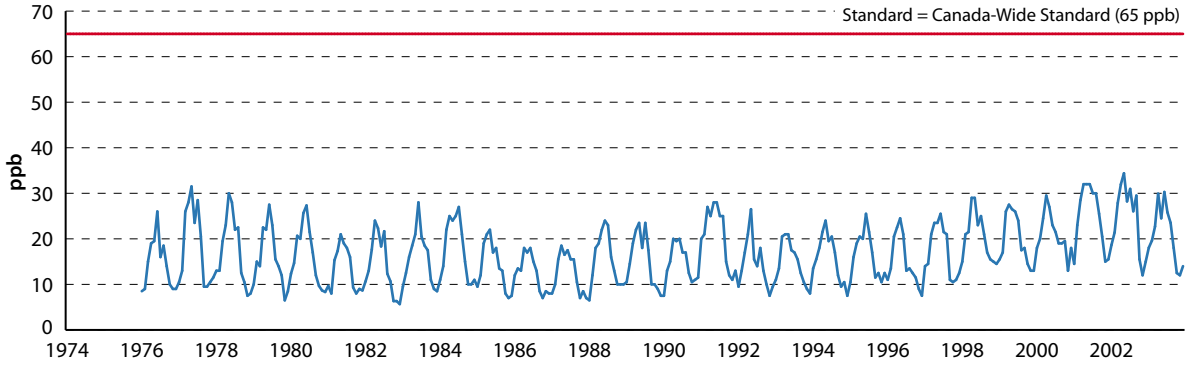
Ottawa—ambient levels of sulphur dioxide, 1974–2003



Ottawa—ambient levels of nitrogen dioxide, 1975–2003



Ottawa—ambient levels of ozone, 1976–2003



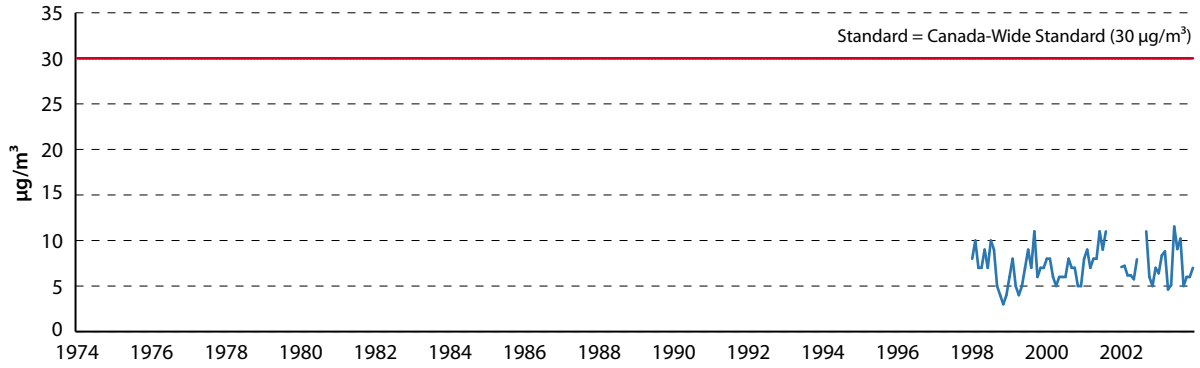
Ottawa—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.24%	21.26	3.42%	299.83
1992	0.07%	6.14	1.09%	95.85
1993	0.00%	0.00	0.92%	80.22
1994	0.00%	0.00	1.17%	102.35
1995	0.23%	20.44	1.40%	122.55
1996	0.03%	2.22	0.73%	63.51
1997	0.06%	5.06	1.30%	114.04
1998	0.02%	1.64	1.65%	144.90
1999	0.07%	6.12	1.95%	170.89
2000	0.00%	0.00	0.48%	42.39
2001	0.30%	26.65	4.39%	384.53
2002	0.10%	8.50	3.57%	312.67
2003	0.17%	15.14	2.42%	211.97

Ottawa—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	63.33	65
1994	55.67	65
1995	56.83	65
1996	55.67	65
1997	56.17	65
1998	57.33	65
1999	61.67	65
2000	59.50	65
2001	62.17	65
2002	66.33	65
2003	71.33	65

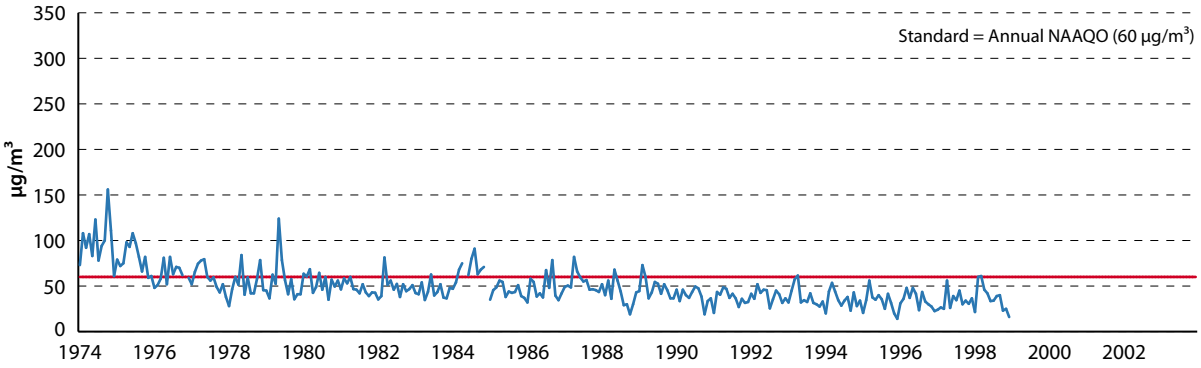
Ottawa—ambient levels of $PM_{2.5}$, 1998–2003



Ottawa—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2000	21.67	30
2001	22.33	30
2002	24.33	30
2003	26.33	30

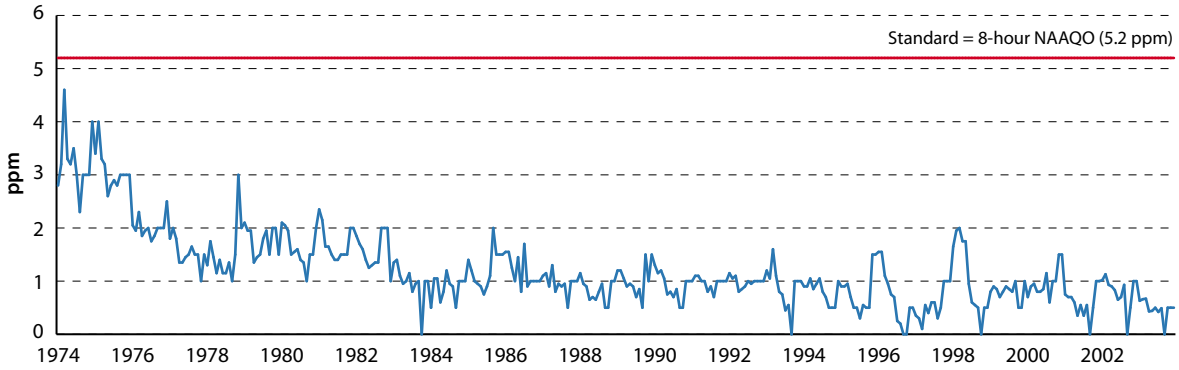
Ottawa—ambient levels of total suspended particulates, 1974–1998



Ottawa—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1992	1.67%	6.08
1993	2.53%	9.23
1994	1.67%	6.08
1995		
1996		
1997	1.67%	6.08

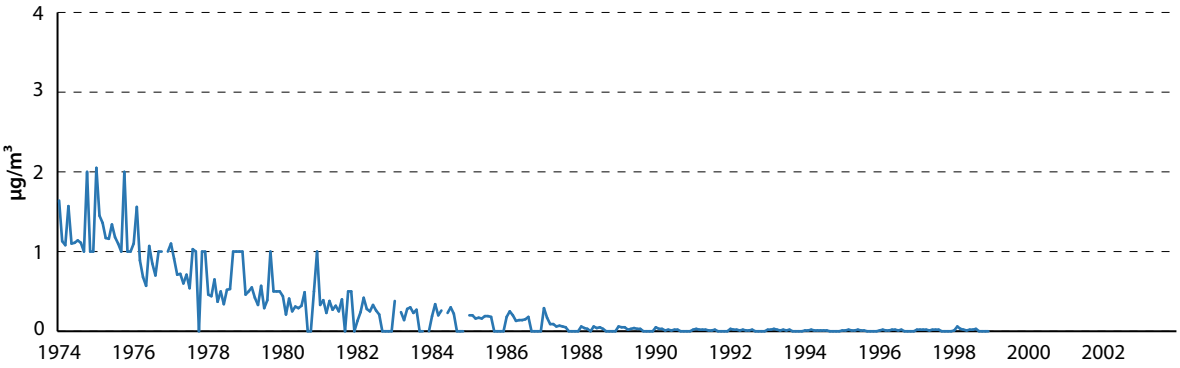
Ottawa—ambient levels of carbon monoxide, 1974–2003



Ottawa—average number of 8-hour periods exceeding standards for carbon monoxide

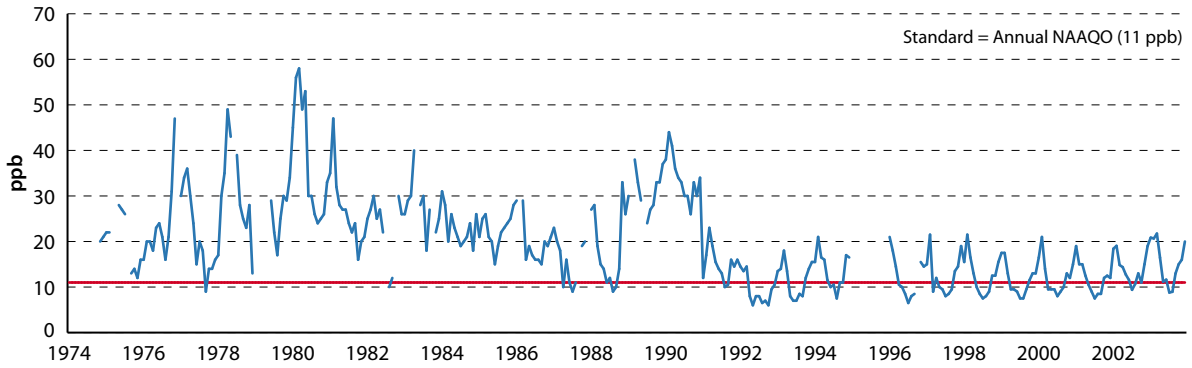
	8-hour objective > Desirable	
	percent	number of 8-hour periods
1992	0.08%	0.89
1993		
1994		
1995		
1996		
1997		
1998	0.07%	0.80

Ottawa—ambient levels of lead, 1974–1998



Québec City, Québec

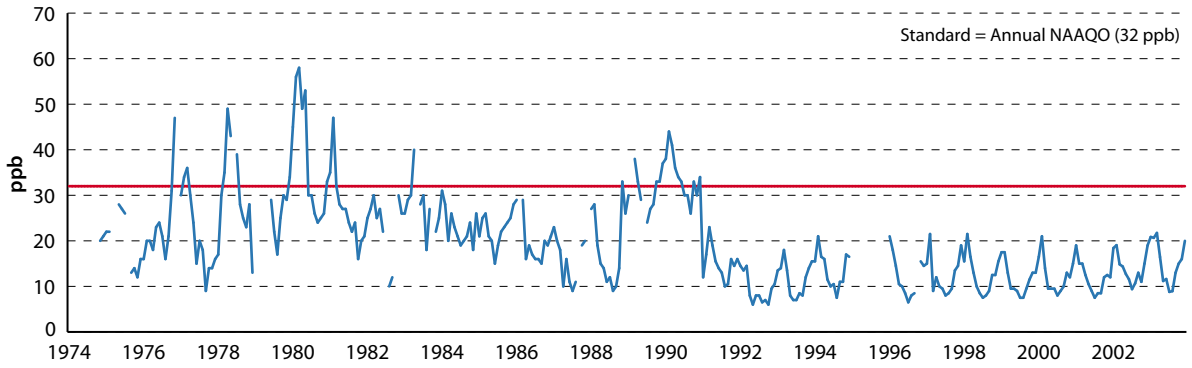
Québec—ambient levels of sulphur dioxide, 1974–2003



Québec—average number of 1-hour and 24-hour periods exceeding standards for sulphur dioxide

	1-hour objectives				24-hour objectives			
	> Acceptable		> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours	percent	number of days	percent	number of days
1991	0.48%	41.71	0.67%	58.40	1.59%	5.81	4.31%	15.72

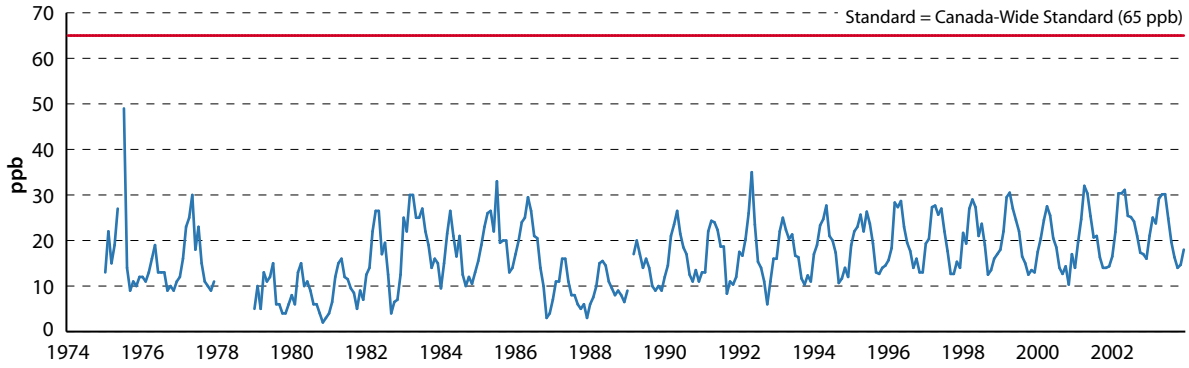
Québec—ambient levels of nitrogen dioxide, 1974–2003



Québec—average number of 1-hour and 24-hour periods exceeding standards for nitrogen dioxide

	1-hour objectives	
	> Acceptable	
	percent	number of hours
1994	0.05%	4.57

Québec—ambient levels of ozone, 1975–2003



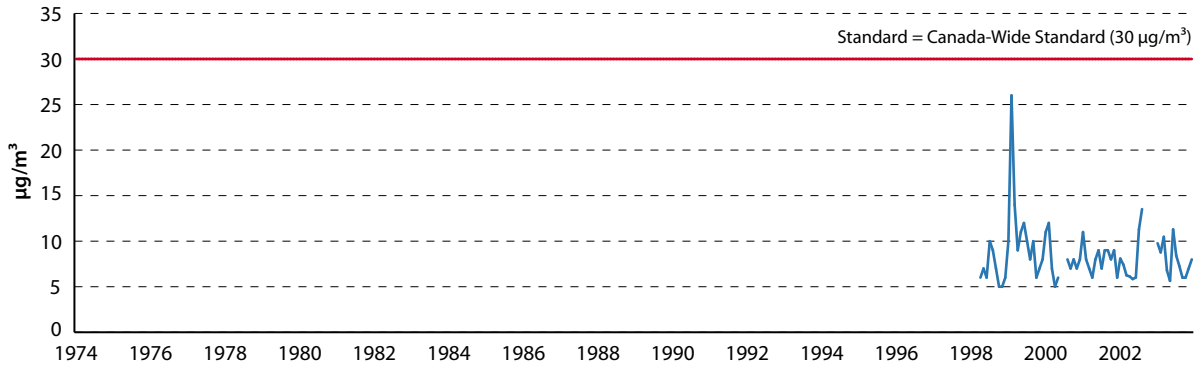
Québec—average number of 1-hour periods exceeding standards for ozone

	1-hour objectives			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.00%	0.00	0.53%	46.70
1992	0.11%	10.03	1.02%	89.67
1993	0.01%	1.07	0.91%	80.07
1994	0.00%	0.00	0.40%	34.87
1995	0.02%	1.82	1.62%	142.08
1996	0.01%	1.17	1.07%	93.40
1997	0.07%	6.49	1.22%	106.91
1998	0.04%	3.39	2.07%	181.60
1999	0.00%	0.00	2.35%	205.67
2000	0.00%	0.00	0.29%	24.98
2001	0.07%	5.77	2.44%	214.00
2002	0.12%	10.36	2.72%	238.58
2003	0.02%	1.58	1.89%	165.71

Québec—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	58.89	65
1994	59.44	65
1995	61.00	65
1996	59.78	65
1997	63.33	65
1998	63.11	65
1999	66.50	65
2000	60.72	65
2001	61.83	65
2002	64.11	65
2003	71.56	65

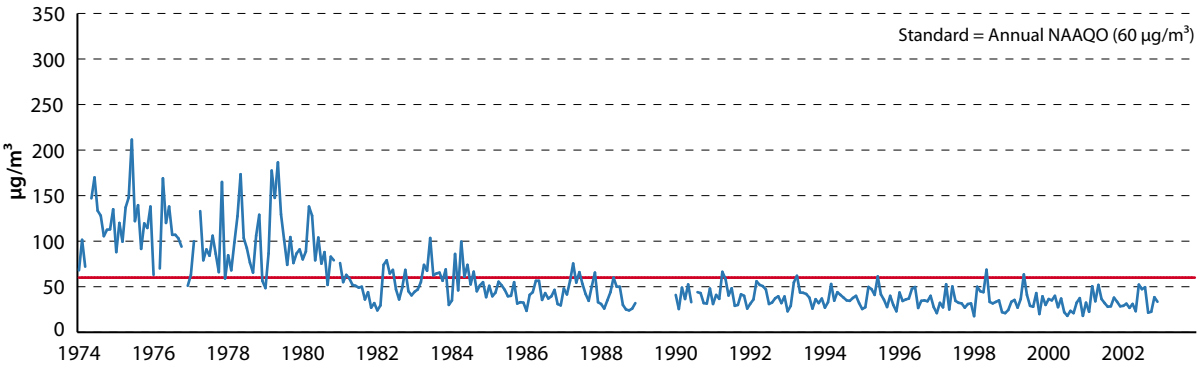
Québec—ambient levels of $PM_{2.5}$, 1998–2003



Québec—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2001	29.00	30
2002	28.67	30
2003	29.00	30

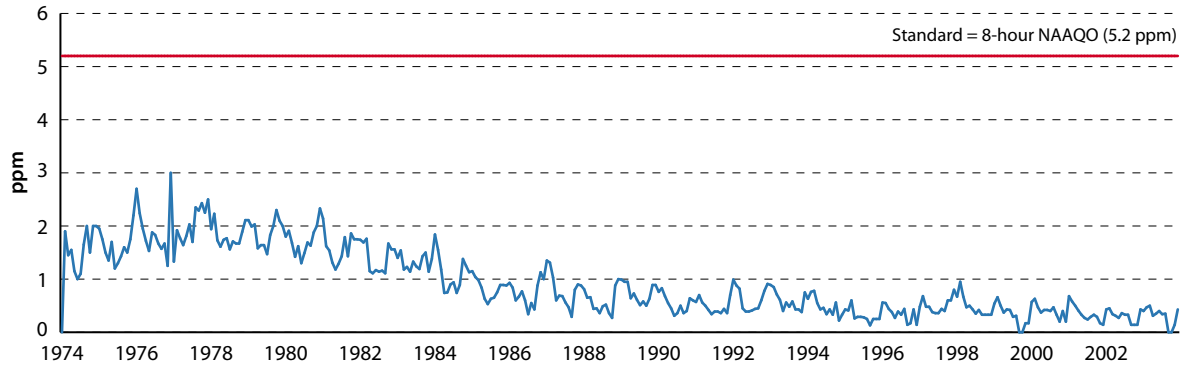
Québec—ambient levels of total suspended particulates, 1974–2002



Québec—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objectives > Acceptable	
	percent	number of days
1992	2.00%	7.30
1993	2.44%	8.90
1994	1.96%	7.16
1995	4.10%	14.96
1996		
1997		
1998	2.12%	7.72
1999	1.79%	6.52
2000	2.00%	7.30
2001		
2002	1.67%	6.08

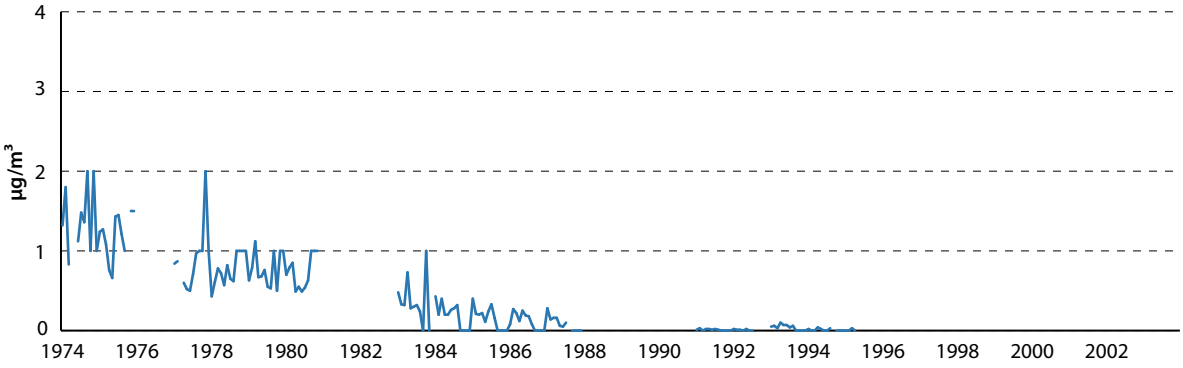
Québec—ambient levels of carbon monoxide, 1974–2003



Québec—average number of 8-hour periods exceeding standards for carbon monoxide

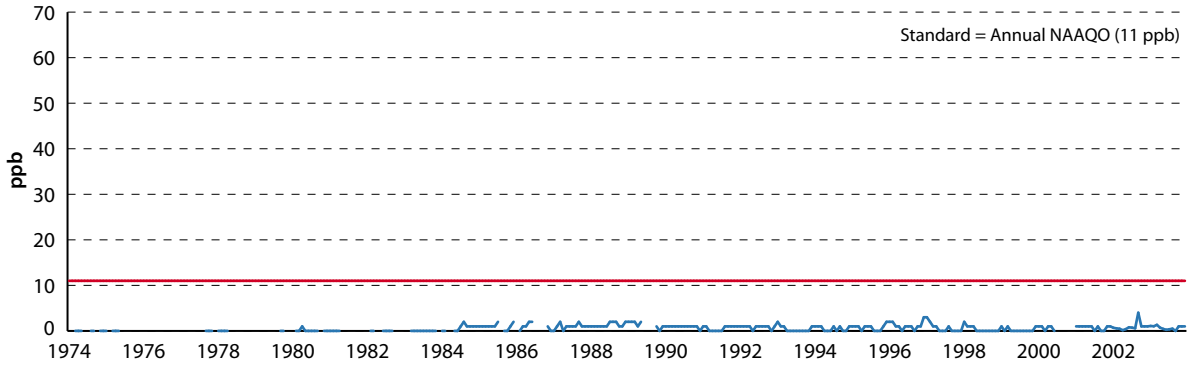
	8-hour objective > Desirable	
	percent	number of 8-hour periods
1991	0.09%	0.93
1992	0.05%	0.52
1993	0.01%	0.13
1994		
1995		
1996	0.07%	0.73

Québec—ambient levels of lead, 1974–1995

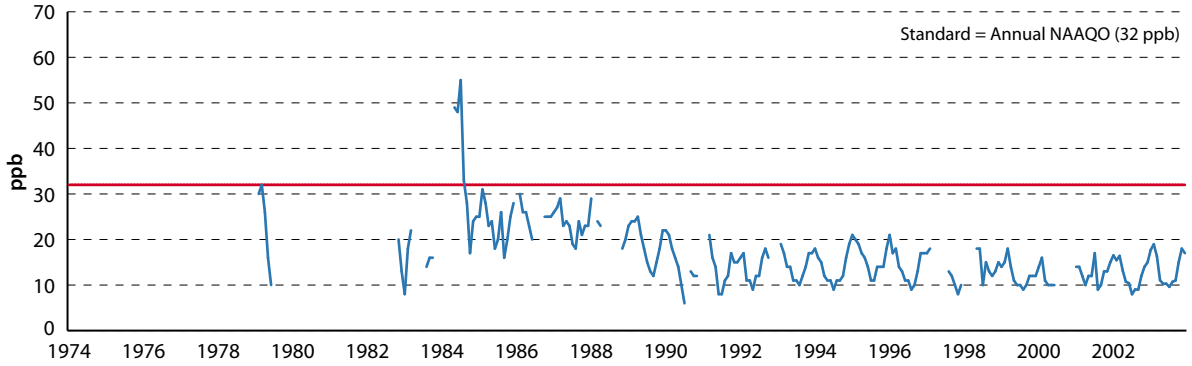


Regina, Saskatchewan

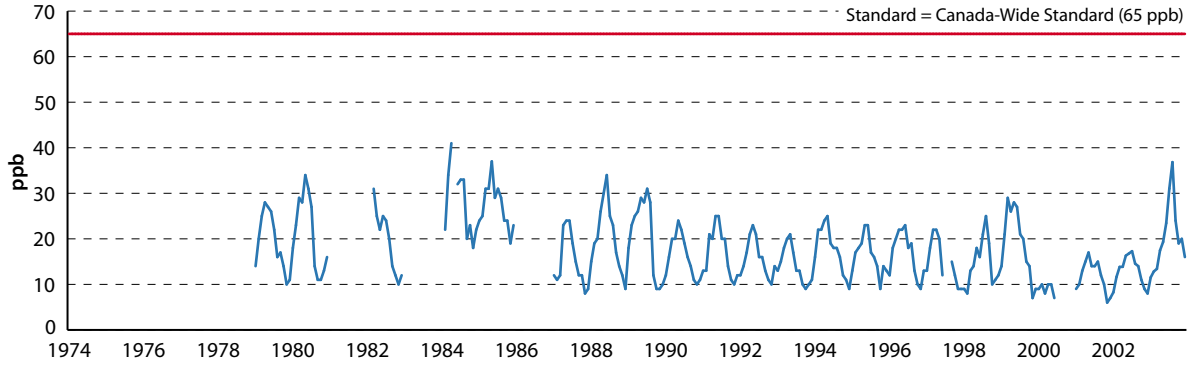
Regina—ambient levels of sulphur dioxide, 1974–2003



Regina—ambient levels of nitrogen dioxide, 1979–2003



Regina—ambient levels of ozone, 1979–2003



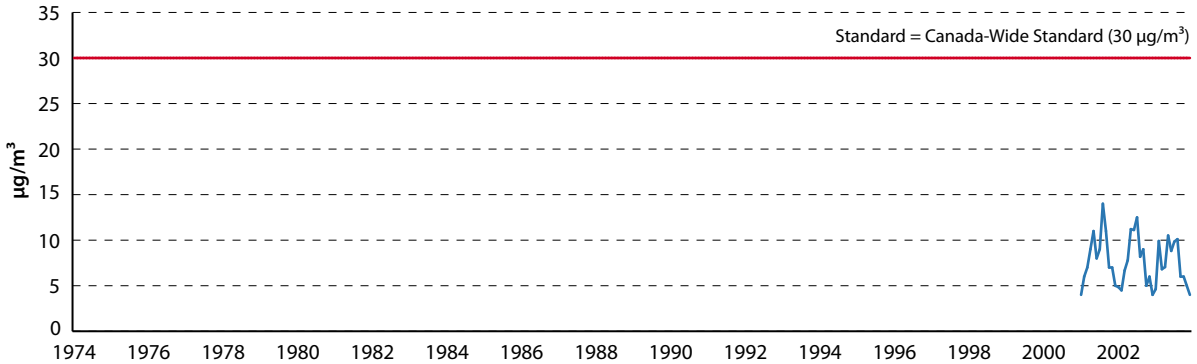
Regina—average number of 1-hour periods exceeding standards for ozone

	1-hour objectives			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.00%	0.00	0.09%	8.16
1992	0.01%	1.03	0.01%	1.03
1993	0.00%	0.00	0.06%	5.15
1994	0.00%	0.00	0.09%	8.17
1995	0.00%	0.00	0.13%	11.25
1996	0.00%	0.00	0.01%	1.01
1997				
1998	0.00%	0.00	0.22%	19.10
1999	0.00%	0.00	0.47%	41.27
2000				
2001				
2002				
2003	0.08%	7.06	3.06%	268.39

Regina—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	42.67	65
1994	42.00	65
1995	42.33	65
1996	44.00	65
1997	42.00	65
1998	43.67	65
1999	46.33	65
2000		65
2001		65
2002		65
2003	42.33	65

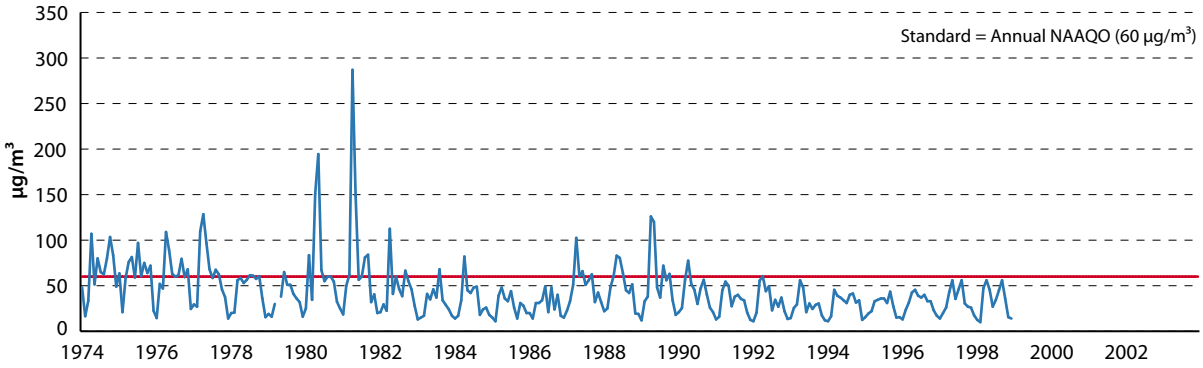
Regina—ambient levels of $PM_{2.5}$, 2001–2003



Regina—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2003	19	30

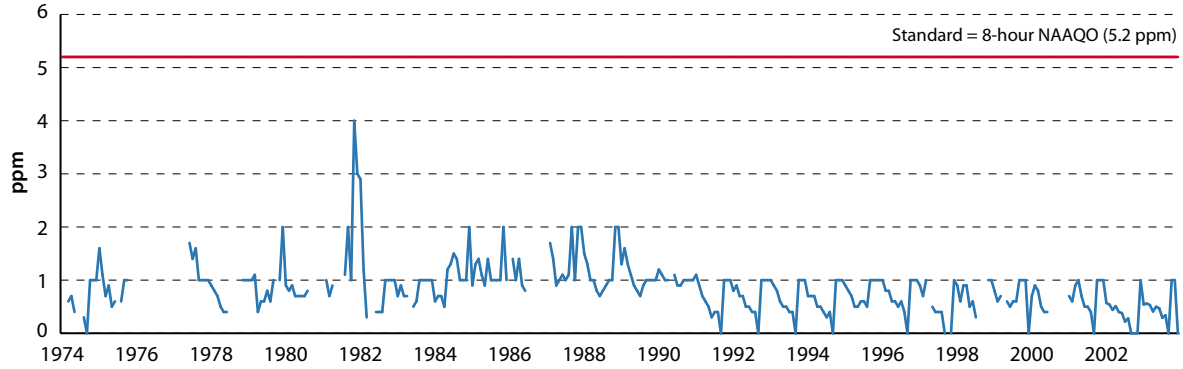
Regina—ambient levels of total suspended particulates, 1974–1998



Regina—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1992	4.92%	17.95
1993	1.72%	6.29
1994		
1995		
1996	1.75%	6.40
1997		
1998	3.28%	11.97

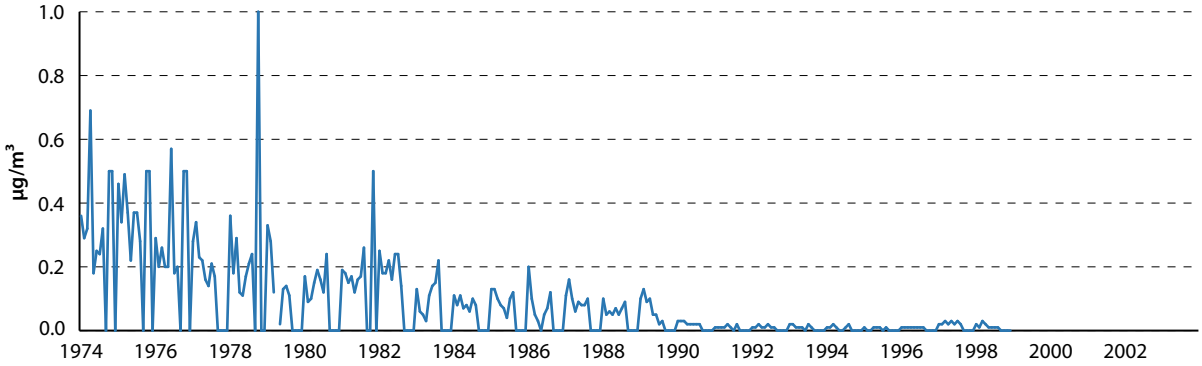
Regina—ambient levels of carbon monoxide, 1974–2003



Regina—average number of 8-hour periods exceeding standards for carbon monoxide

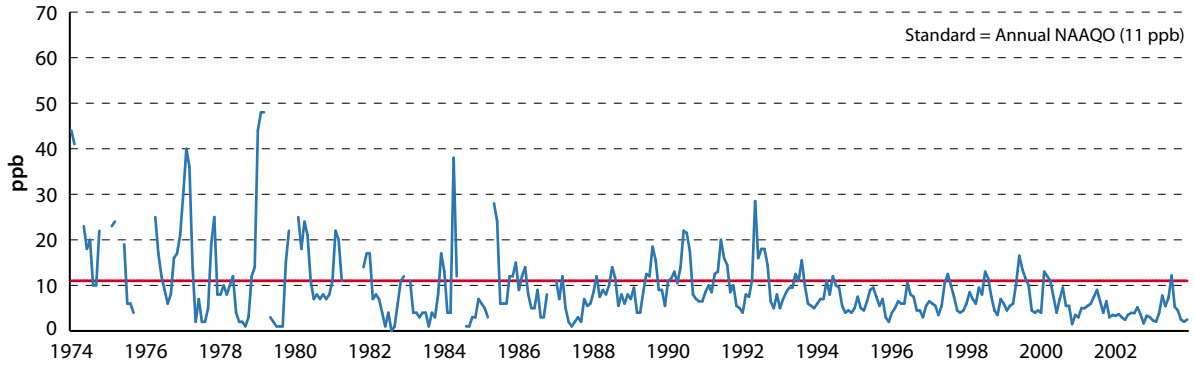
	8-hour objective	
	> Desirable	
	percent	number of 8-hour periods
1994	0.08%	0.88

Regina—ambient levels of lead, 1974–1998



Saint John, New Brunswick

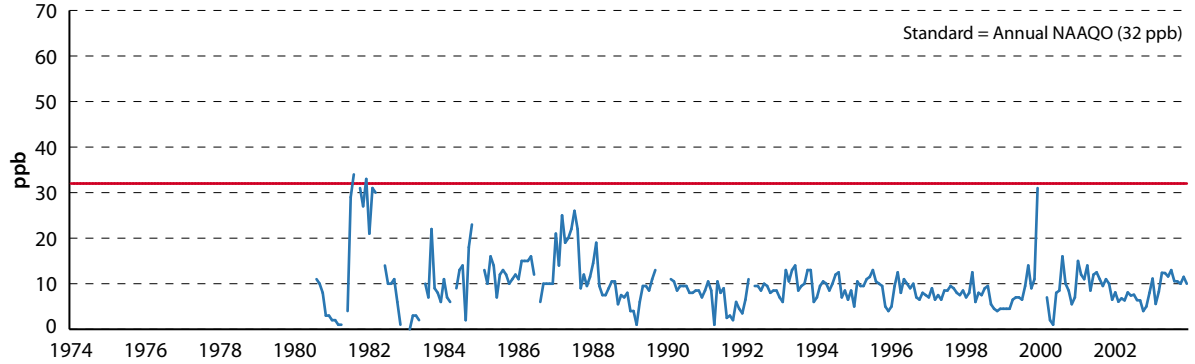
Saint John—ambient levels of sulphur dioxide, 1974–2003



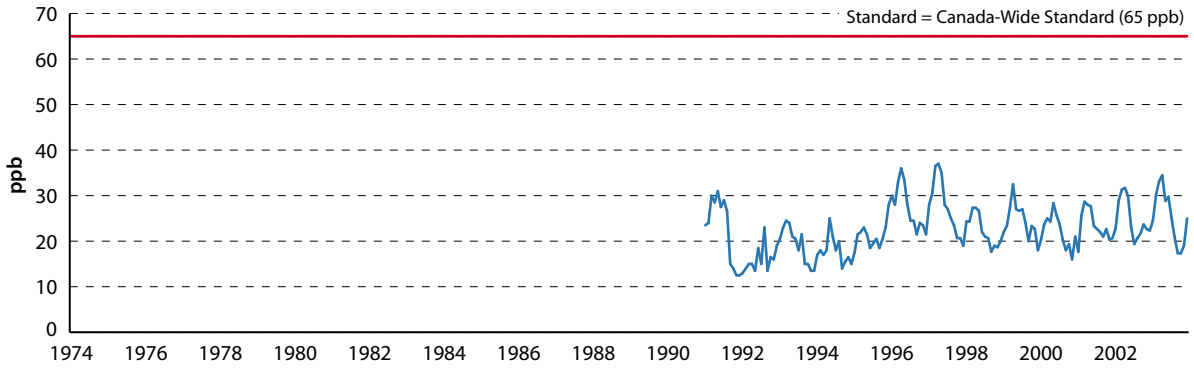
Saint John—average number of 1-hour and 24-hour periods exceeding standards for sulphur dioxide

	1-hour objective				24-hour objective			
	> Acceptable		> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours	percent	number of days	percent	number of days
1991	0.01%	1.07	0.23%	20.30	0.00%	0.00	3.26%	11.91
1992	0.04%	3.41	0.33%	28.55	0.29%	1.05	3.34%	12.21
1993	0.00%	0.00	0.09%	7.55	0.00%	0.00	0.69%	2.52
1994	0.00%	0.00	0.05%	4.27	0.00%	0.00	0.28%	1.02
1995	0.00%	0.00	0.04%	3.16	0.00%	0.00	0.22%	0.80
1996	0.00%	0.00	0.03%	2.38	0.00%	0.00	0.01%	0.05
1997	0.00%	0.00	0.04%	3.28	0.00%	0.00	0.11%	0.40
1998	0.01%	1.00	0.03%	3.05	0.00%	0.00	0.18%	0.67
1999	0.00%	0.00	0.02%	2.09	0.00%	0.00	0.43%	1.56
2000	0.00%	0.00	0.03%	2.20	0.00%	0.00	0.00%	0.00
2003	0.00%	0.00	0.01%	1.06	0.00%	0.00	0.26%	0.96

Saint John—ambient levels of nitrogen dioxide, 1980–2003



Saint John—ambient levels of ozone, 1991–2003



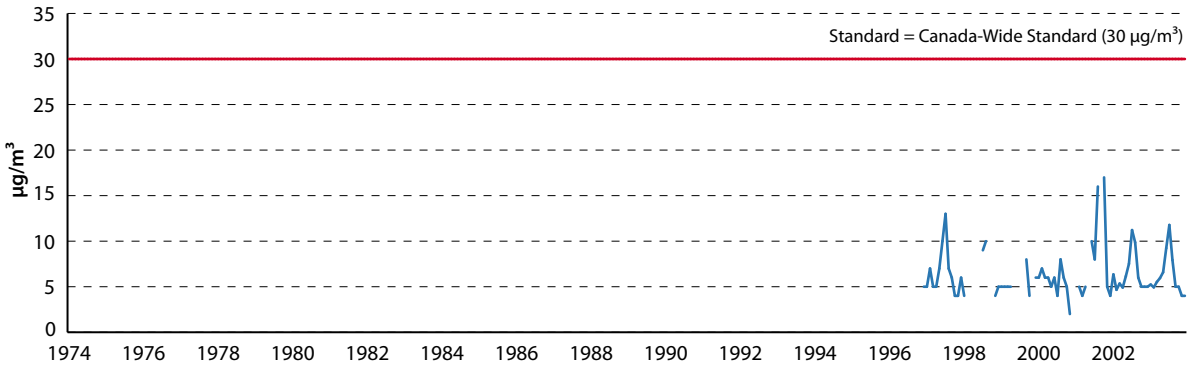
Saint John—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.36%	31.26	3.26%	285.25
1992	0.01%	1.19	0.47%	41.34
1993	0.01%	1.01	0.36%	31.89
1994	0.02%	2.09	0.44%	38.47
1995	0.00%	0.00	0.93%	81.69
1996	0.00%	0.00	1.11%	97.17
1997	0.05%	4.07	2.04%	178.39
1998	0.05%	4.56	1.23%	107.72
1999	0.08%	7.21	1.63%	142.48
2000	0.00%	0.00	0.88%	77.33
2001	0.05%	4.58	1.78%	155.55
2002	0.00%	0.00	0.81%	70.85
2003	0.00%	0.00	1.36%	118.74

Saint John—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	63.50	65
1994	52.33	65
1995	51.50	65
1996	55.33	65
1997	58.33	65
1998	56.72	65
1999	57.17	65
2000	54.67	65
2001	59.33	65
2002	57.67	65
2003	58.78	65

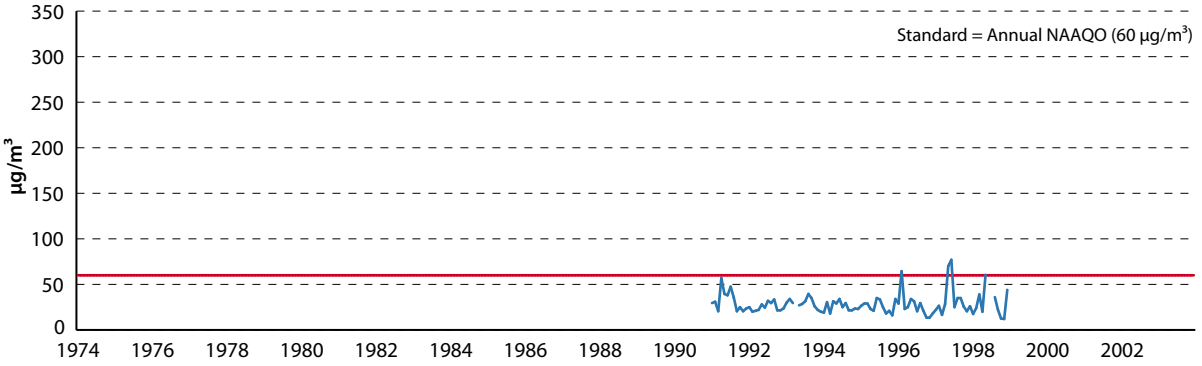
Saint John—ambient levels of $PM_{2.5}$, 1996–2003



Saint John—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
1999	18.33	30
2000	16.00	30
2001	20.00	30
2002	25.00	30
2003	26.33	30

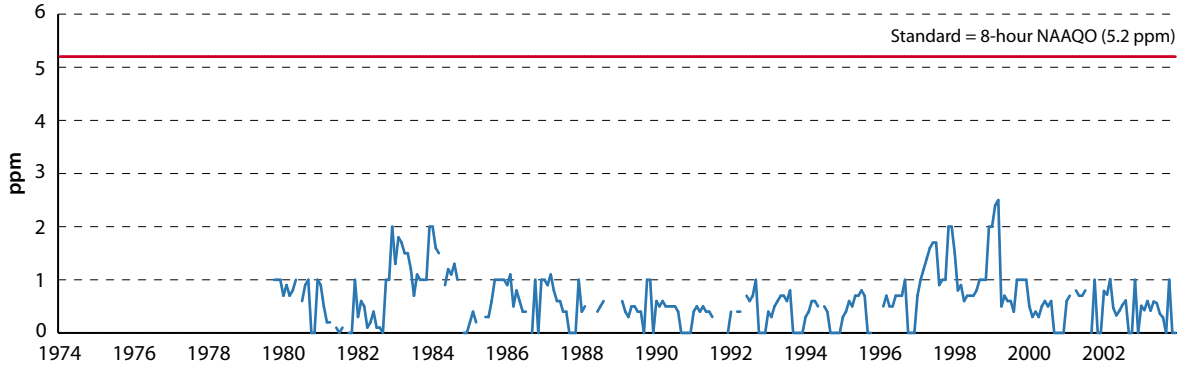
Saint John—ambient levels of total suspended particulates, 1991–1998



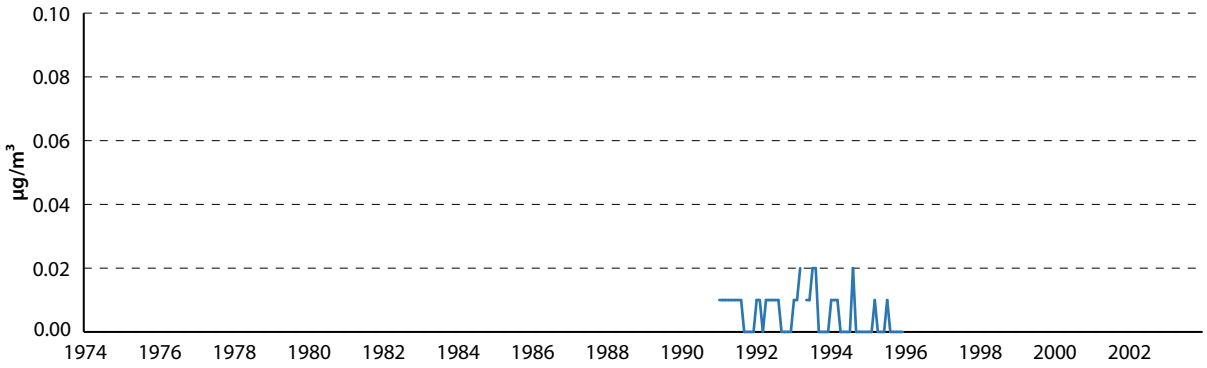
Saint John—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1991	1.89%	6.89
1992	1.92%	7.02
1996	4.00%	14.60

Saint John—ambient levels of carbon monoxide, 1979–2003

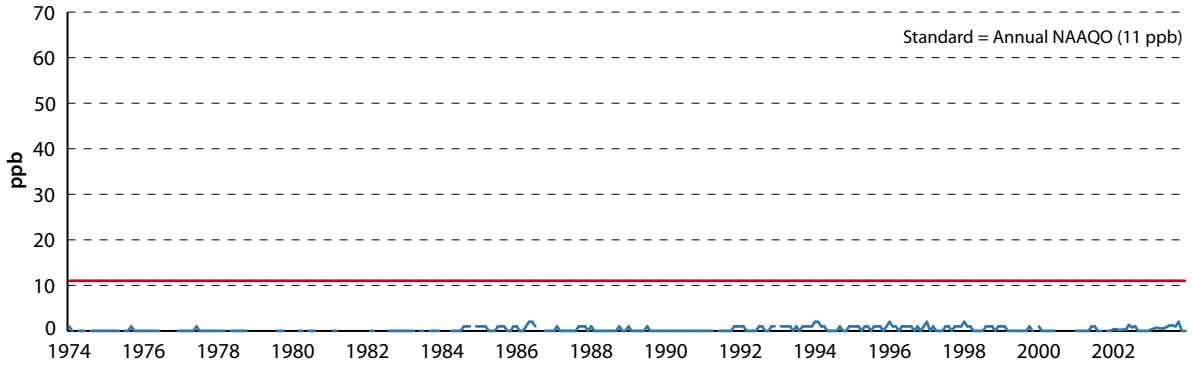


Saint John—ambient levels of lead, 1991–1995

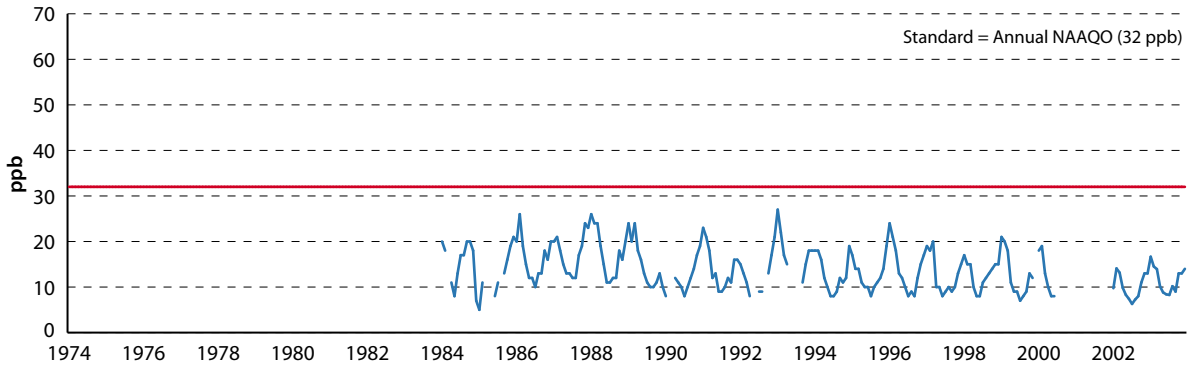


Saskatoon, Saskatchewan

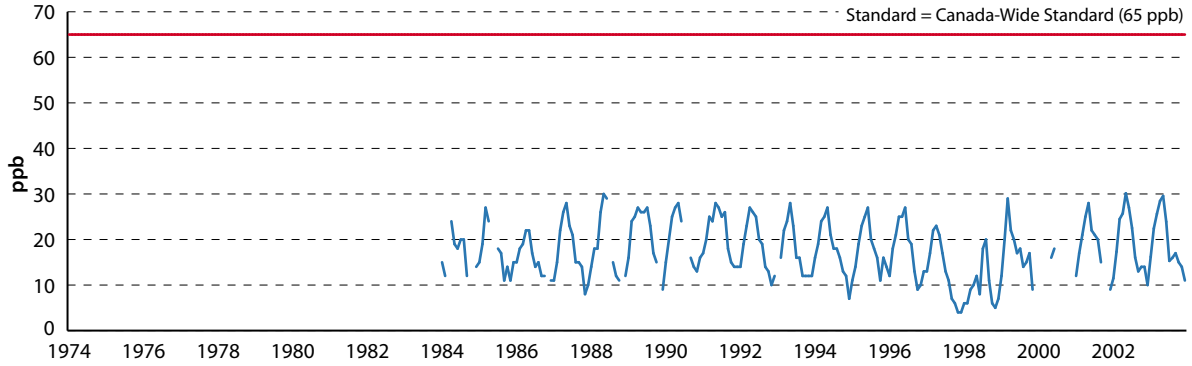
Saskatoon—ambient levels of sulphur dioxide, 1974–2003



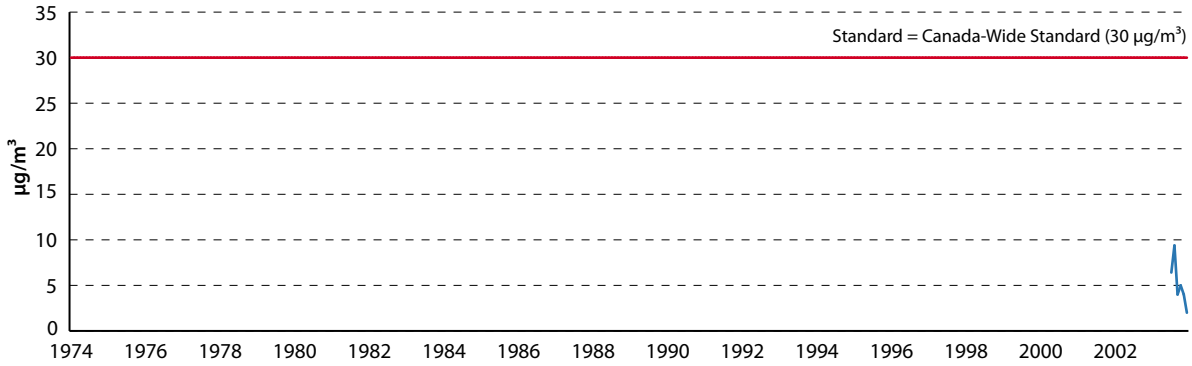
Saskatoon—ambient levels of nitrogen dioxide, 1984–2003



Saskatoon—ambient levels of ozone, 1984–2003



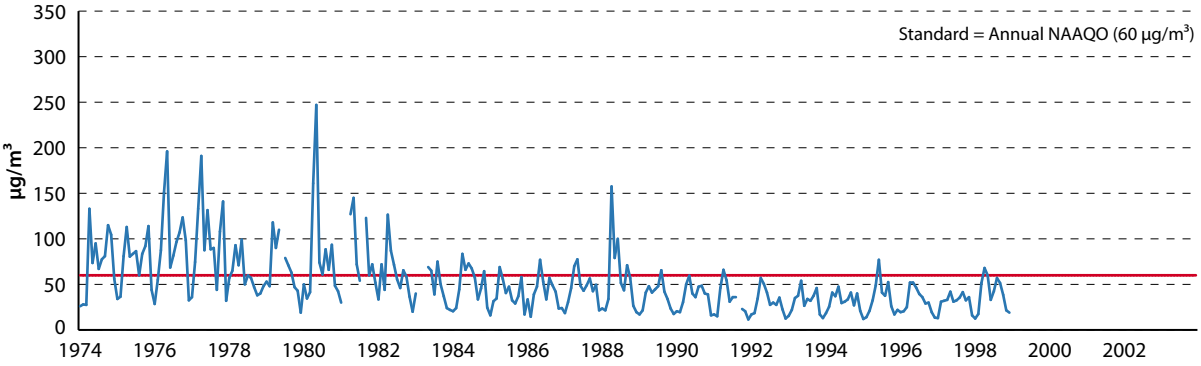
Saskatoon—ambient levels of $PM_{2.5}$, 2003



Saskatoon—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	50.67	65
1994	48.33	65
1995	49.33	65
1996	50.00	65
1997	47.67	65
1998	43.67	65
1999	42.00	65
2000		65
2001		65
2002		65
2003	47.67	65

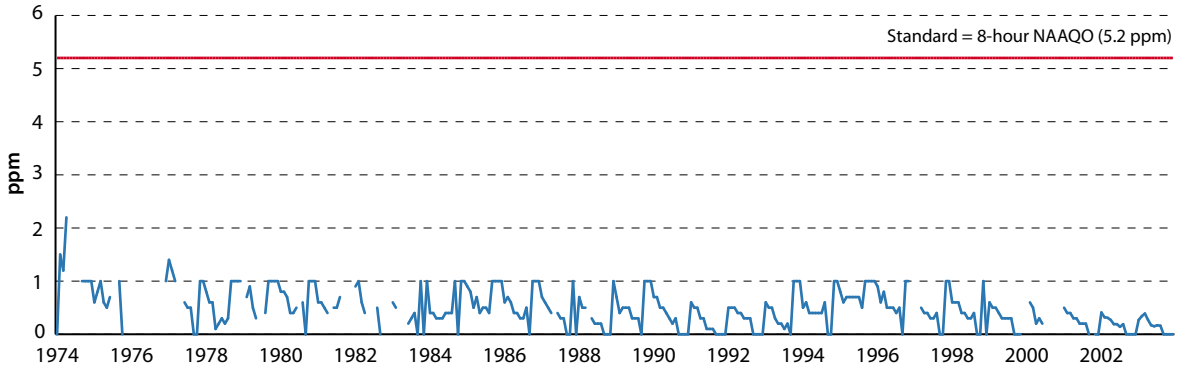
Saskatoon—ambient levels of total suspended particulates, 1974–1998



Saskatoon—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Accessible	
	percent	number of hours
1991	4.35%	380.87
1992	1.69%	148.47
1993		
1994		
1995		
1996	1.79%	156.43
1997		
1998	3.33%	292.00

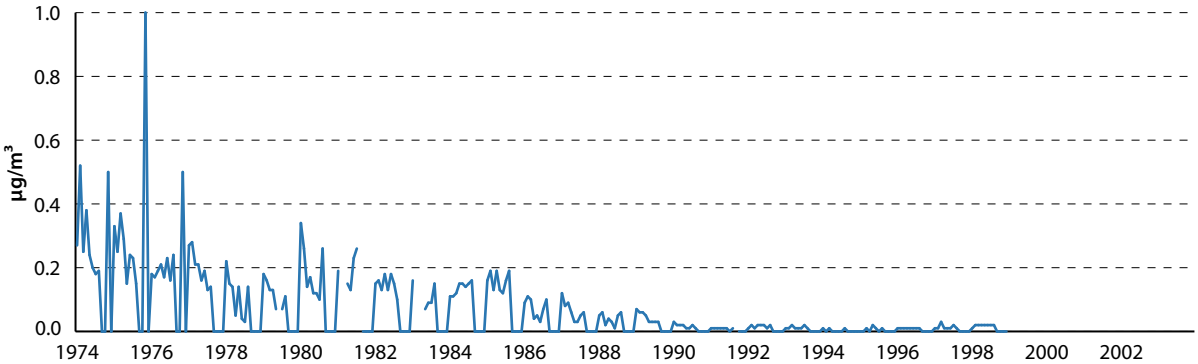
Saskatoon—ambient levels of carbon monoxide, 1974–2003



Saskatoon—average number of 8-hour periods exceeding standards for carbon monoxide

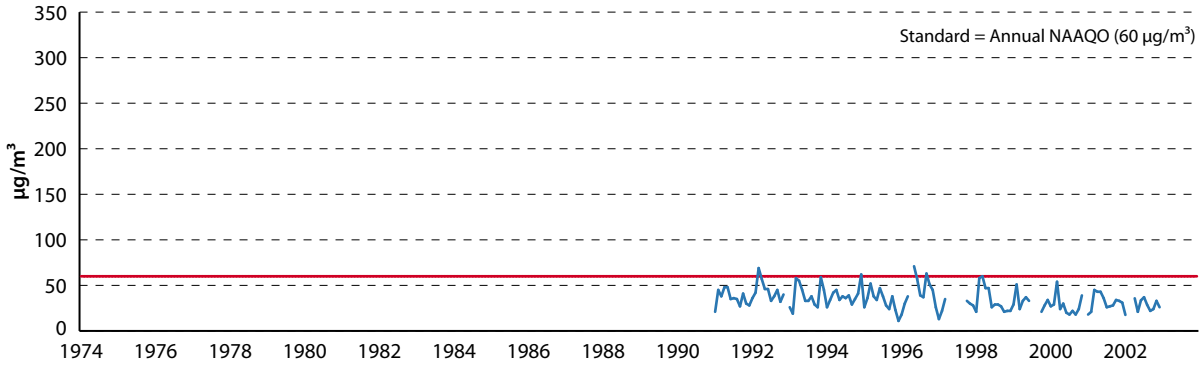
	8-hour objective > Desirable	
	percent	number of 8-hour periods
1997	0.03%	0.29

Saskatoon—ambient levels of lead, 1974–1998



Sherbrooke, Québec

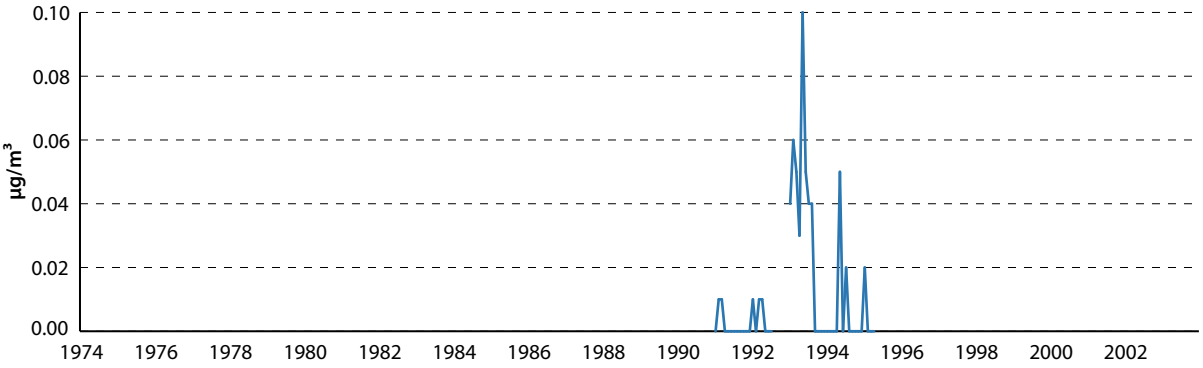
Sherbrooke—ambient levels of total suspended particulates, 1991–2002



Sherbrooke—average number of 24-hour periods exceeding standards for total suspended particulates

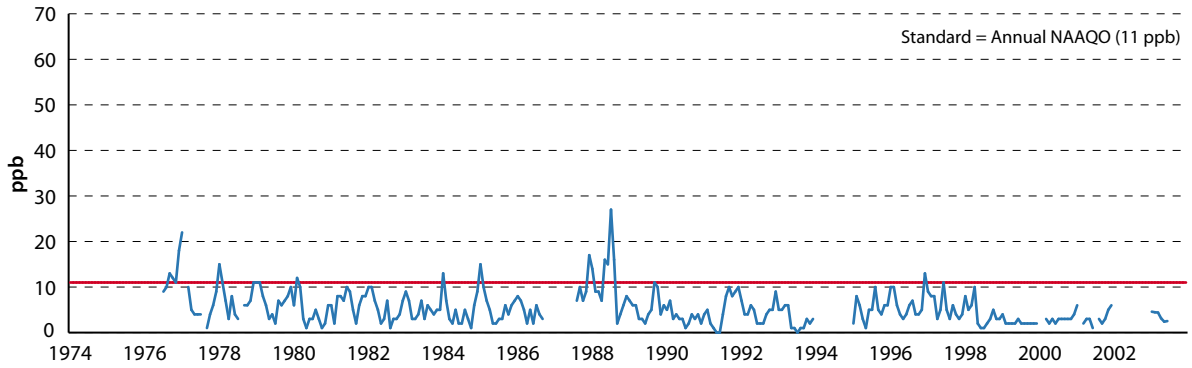
	24-hour objective > Acceptable	
	percent	number of days
1992	1.85%	6.76
1993	1.75%	6.40

Sherbrooke—ambient levels of lead, 1991–1995

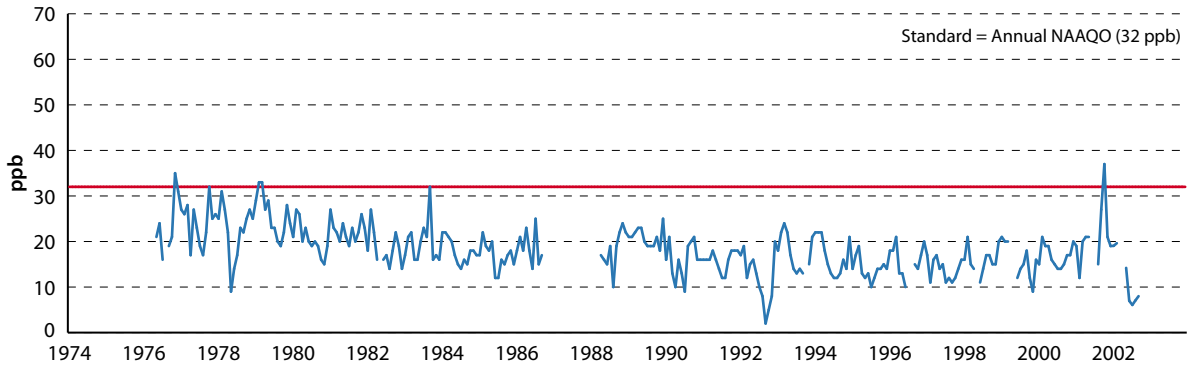


St. Catharines, Ontario

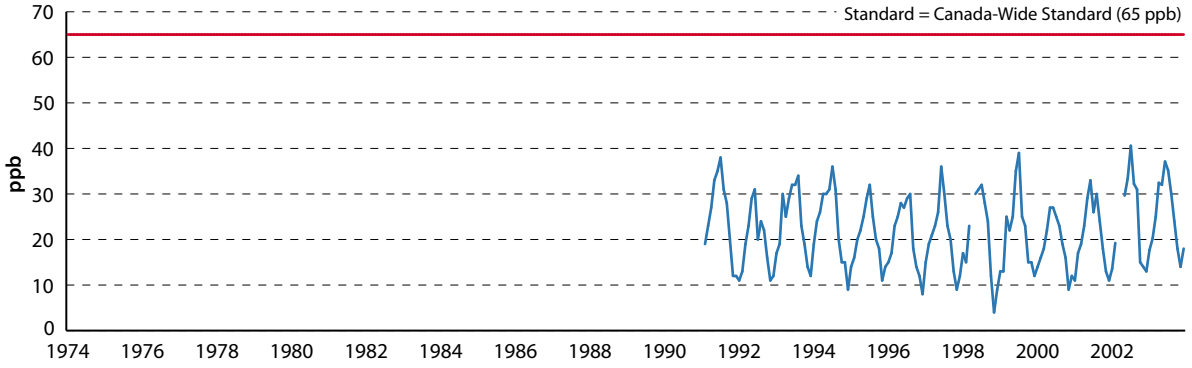
St Catharines—ambient levels of sulphur dioxide, 1976–2003



St Catharines—ambient levels of nitrogen dioxide, 1976–2002



St Catharines—ambient levels of ozone, 1991–2003



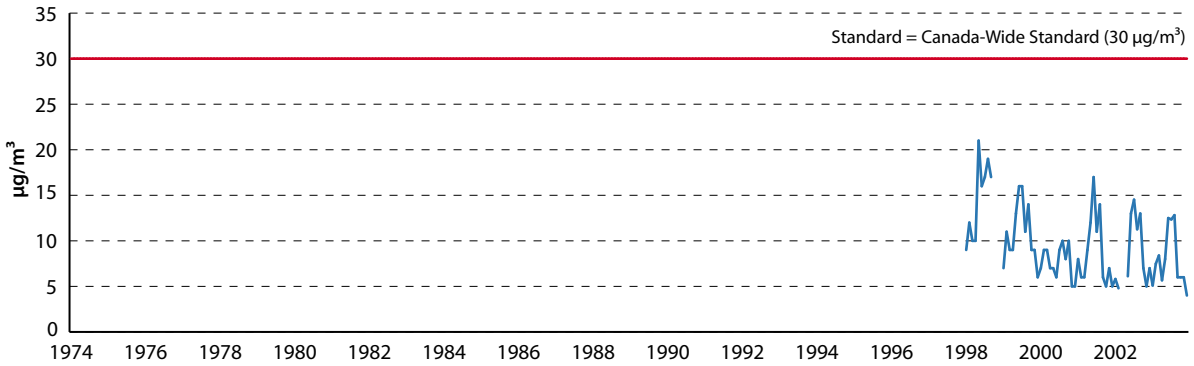
St Catharines—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.44%	38.19	9.37%	821.05
1992	0.24%	20.72	3.41%	298.32
1993	0.31%	27.52	7.57%	663.50
1994	0.13%	11.62	6.83%	598.09
1995	0.12%	10.11	4.29%	376.21
1996	0.20%	17.48	4.45%	389.72
1997	0.16%	13.74	5.12%	448.20
1998	0.39%	33.81	6.74%	590.54
1999	0.42%	36.72	7.01%	613.99
2000	0.16%	14.24	2.90%	254.24
2001	0.37%	32.40	6.24%	546.68
2002	1.22%	106.83	9.42%	824.96
2003	0.60%	52.14	7.20%	630.83

St Catharines—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	78.33	65
1994	76.33	65
1995	75.67	65
1996	74.67	65
1997	75.67	65
1998	77.33	65
1999	79.00	65
2000	78.00	65
2001	78.00	65
2002	81.67	65
2003	87.67	65

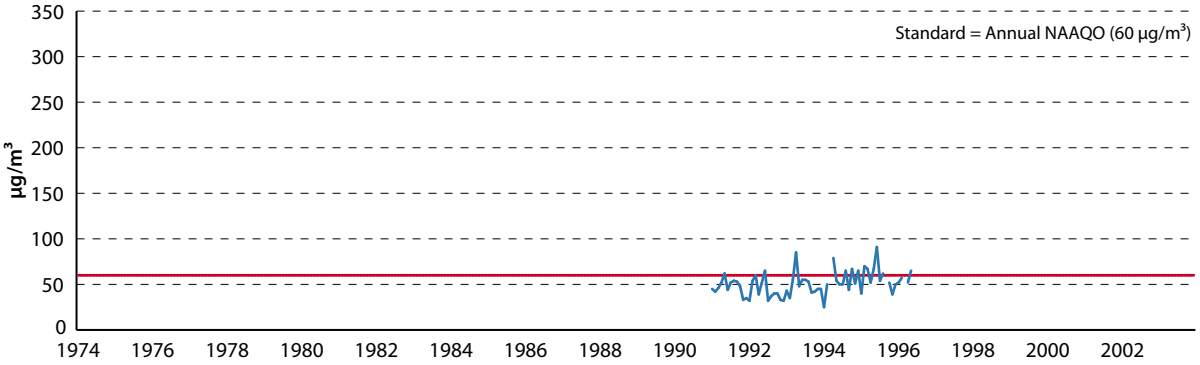
St Catharines—ambient levels of $PM_{2.5}$, 1998–2003



St Catharines—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2000	30.67	30
2001	29.67	30
2002	30.00	30
2003	30.67	30

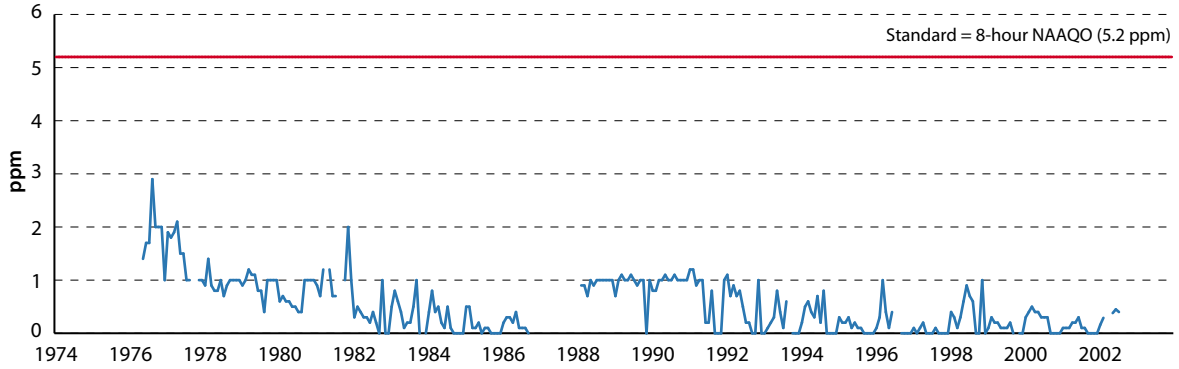
St Catharines—ambient levels of total suspended particulates, 1991–1996



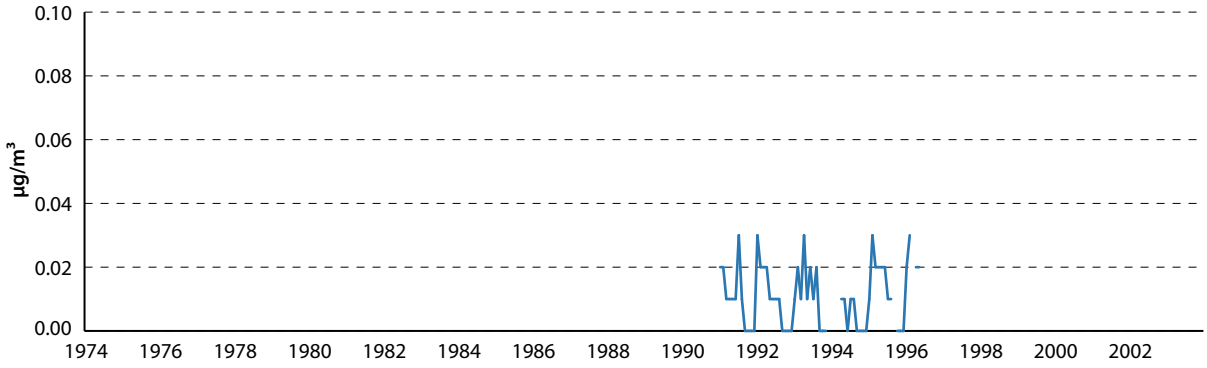
St Catharines—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1993	3.51%	12.81
1994		
1995	1.85%	6.76

St Catharines—ambient levels of carbon monoxide, 1976–2002

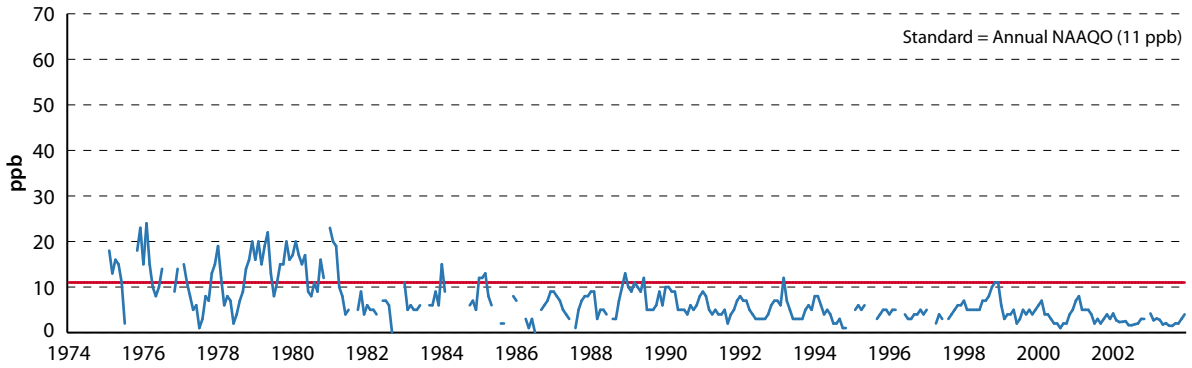


St Catharines—ambient levels of lead, 1991–1996

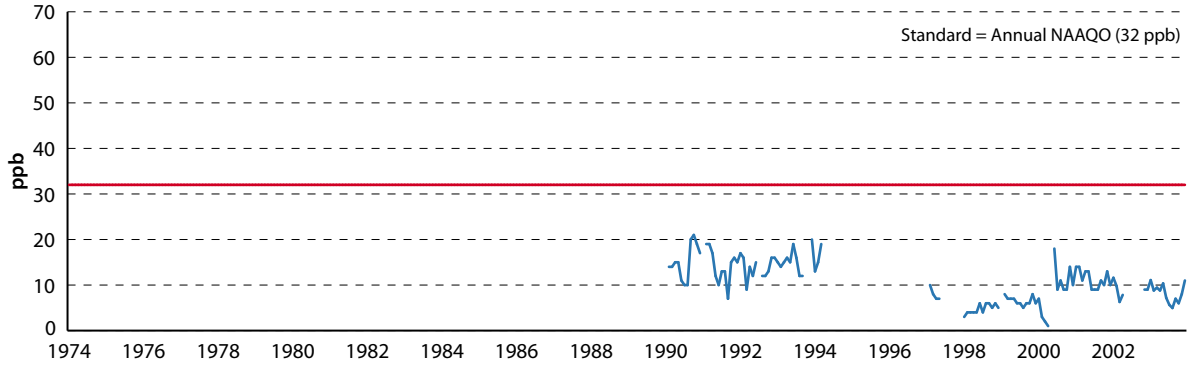


St. John's, Newfoundland

St John's—ambient levels of sulphur dioxide, 1975–2003



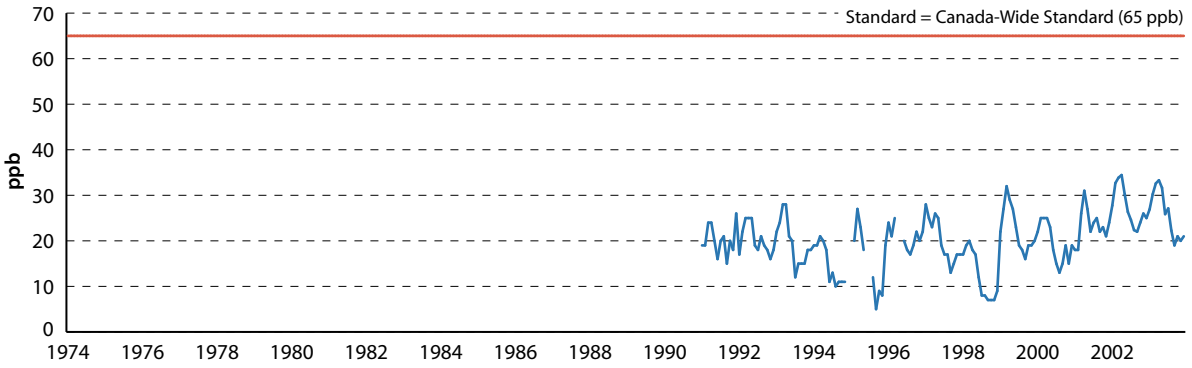
St John's—ambient levels of nitrogen dioxide, 1990–2003



St John's—average number of 1-hour periods exceeding standards for nitrogen dioxide

	1-hour objective > Acceptable	
	percent	number of days
2001	0.01%	1.01

St John's—ambient levels of ozone, 1991–2003



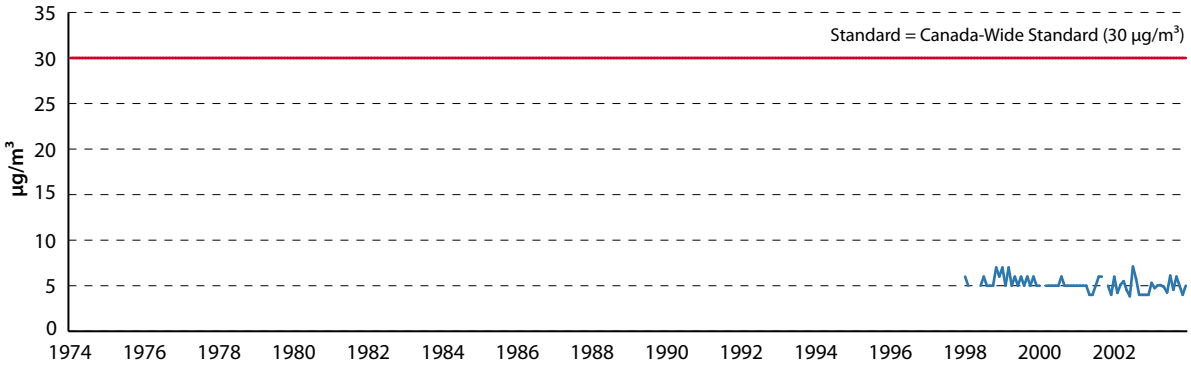
St John's—average number of 1hr periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.00%	0.00	0.51%	44.74
1992	0.00%	0.00	0.26%	23.15
1993	0.00%	0.00	0.01%	1.07
1994	0.04%	3.46	0.05%	4.61
1995	0.00%	0.00	0.29%	25.27
1996	0.00%	0.00	0.33%	29.20
1997	0.00%	0.00	0.04%	3.20
1999	0.00%	0.00	0.39%	34.12
1998	0.00%	0.00	0.00%	0.00
2000	0.00%	0.00	0.07%	6.36
2001	0.00%	0.00	0.66%	57.48
2002	0.00%	0.00	0.40%	35.43
2003	0.00%	0.00	0.16%	14.19

St John's—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	47.33	65
1994	41.67	65
1995	40.67	65
1996	42.00	65
1997	44.67	65
1999	38.67	65
1998	41.67	65
2000	41.67	65
2001	51.67	65
2002	51.00	65
2003	53.00	65

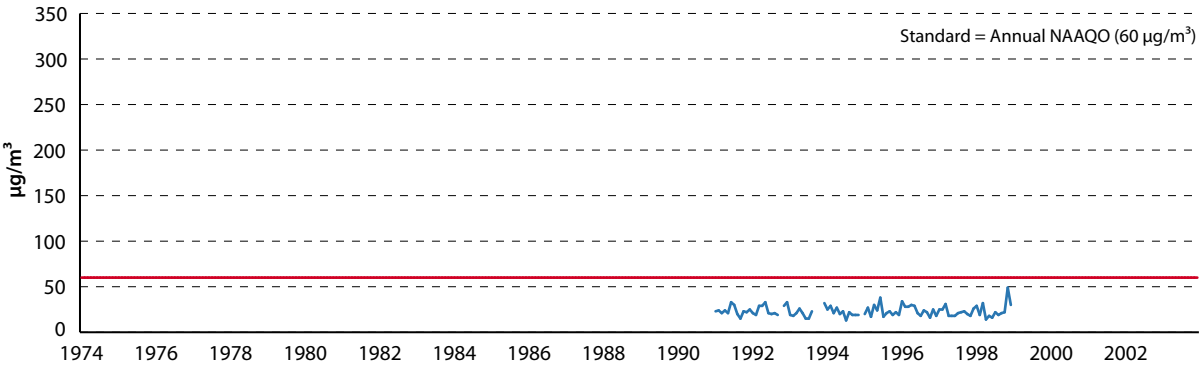
St John's—ambient levels of $PM_{2.5}$, 1998–2003



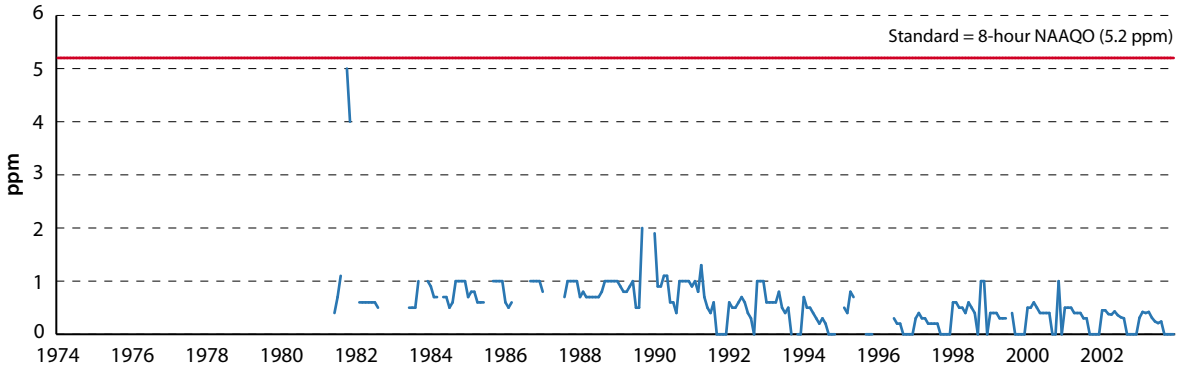
St John's—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2000	12.33	30
2001	13.00	30
2002	12.67	30
2003	13.00	30

St John's—ambient levels of total suspended particulates, 1991–1998



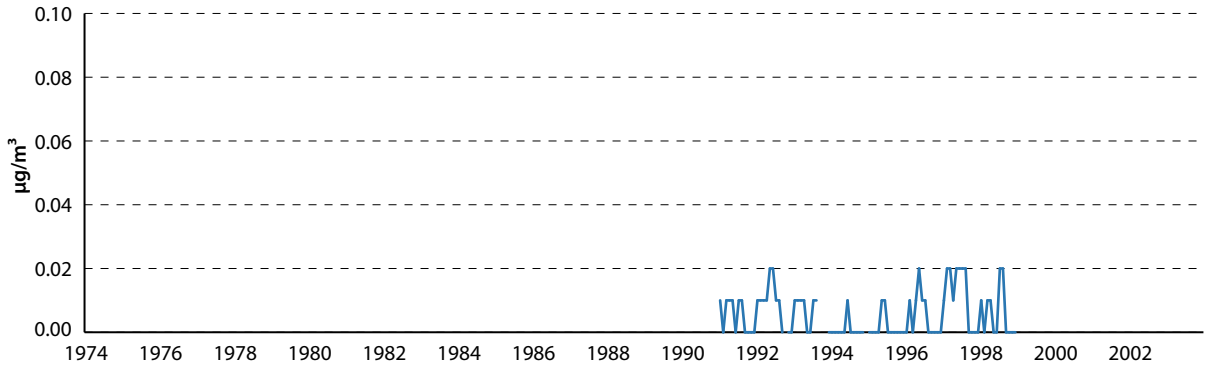
St John's—ambient levels of carbon monoxide, 1981–2003



St John's—average number of 8-hour periods exceeding standards for carbon monoxide

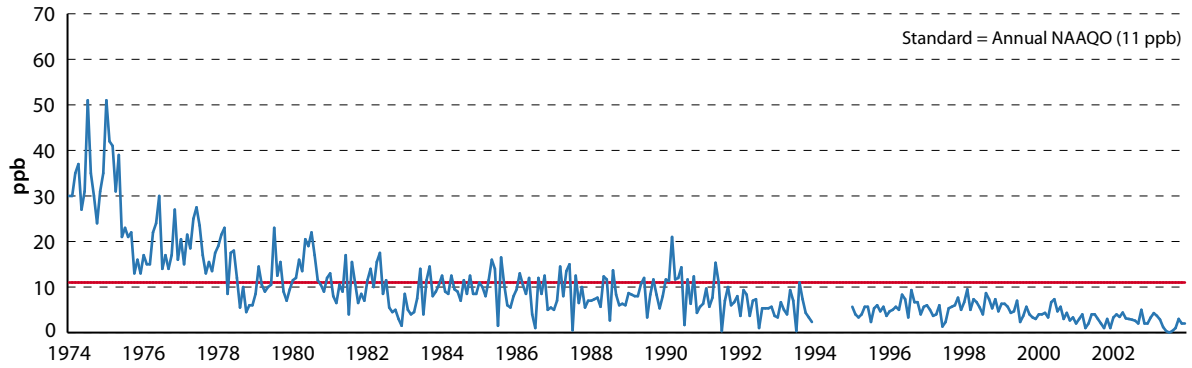
	8-hour objective > Desirable	
	percent	number of 8-hour periods
1991	0.01%	0.13

St John's—ambient levels of lead, 1991–1998



Sudbury, Ontario

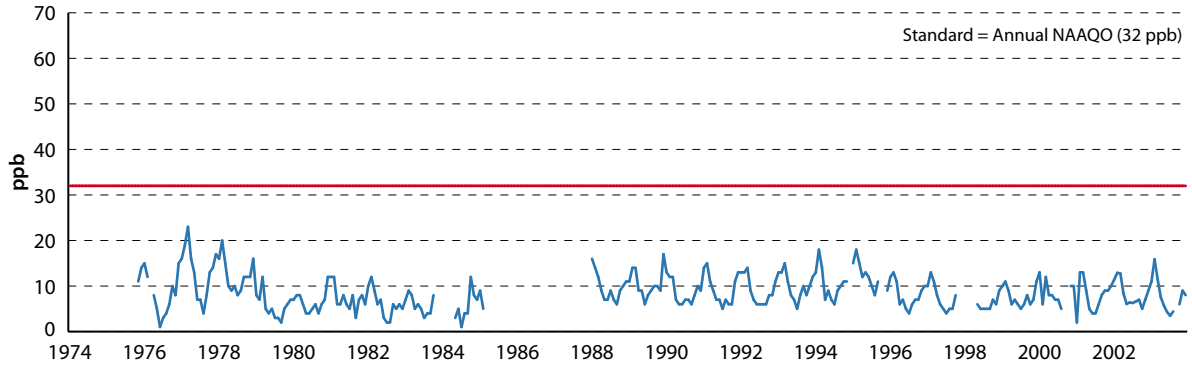
Sudbury—ambient levels of sulphur dioxide, 1974–2003



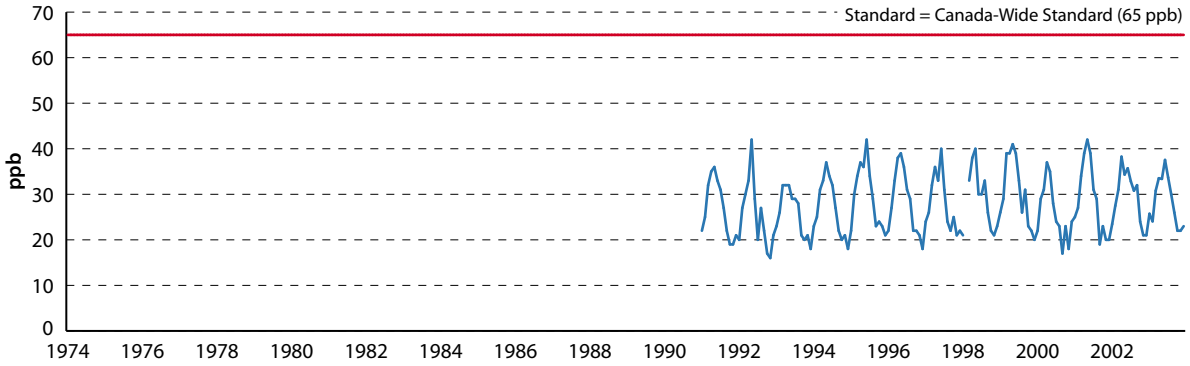
Sudbury—average number of 1-hour and 24-hour periods exceeding standards for sulphur dioxide

	1-hour objective				24-hour objective			
	> Acceptable		> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours	percent	number of days	percent	number of days
1991	0.12%	10.44	0.57%	49.85	0.01%	0.04	1.08%	3.93
1992	0.01%	1.00	0.30%	26.42	0.00%	0.00	0.44%	1.59
1993	0.09%	8.18	0.42%	37.08	0.00%	0.00	0.82%	2.99
1995	0.03%	3.04	0.23%	19.94	0.00%	0.00	0.51%	1.85
1996	0.09%	7.52	0.31%	27.08	0.00%	0.00	0.55%	2.01
1997	0.03%	3.00	0.19%	16.48	0.00%	0.00	0.13%	0.47
1998	0.05%	4.59	0.37%	32.36	0.00%	0.00	0.36%	1.33
1999	0.02%	1.51	0.17%	14.78	0.00%	0.00	0.00%	0.00
2000	0.02%	1.69	0.12%	10.40	0.00%	0.00	0.00%	0.00
2001	0.00%	0.00	0.09%	8.02	0.00%	0.00	0.00%	0.00
2002	0.00%	0.00	0.08%	7.19	0.00%	0.00	0.00%	0.00
2003	0.00%	0.00	0.02%	2.02	0.00%	0.00	0.00%	0.00

Sudbury—ambient levels of nitrogen dioxide, 1975–2003



Sudbury—ambient levels of ozone, 1991–2003



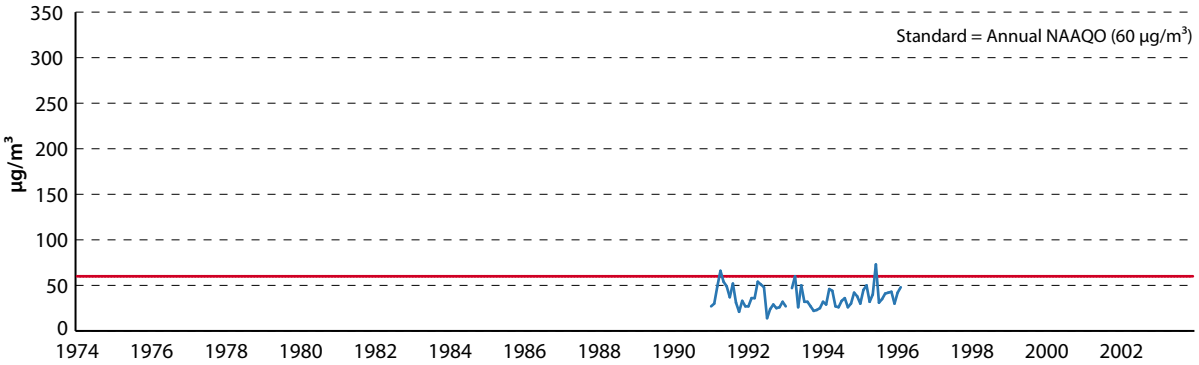
Sudbury—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.19%	16.30	3.89%	341.19
1992	0.21%	18.33	3.38%	296.28
1993	0.00%	0.00	2.49%	218.24
1994	0.04%	3.17	3.84%	336.15
1995	0.31%	27.56	6.13%	536.91
1996	0.06%	5.09	4.21%	368.61
1997	0.33%	29.27	4.40%	385.61
1998	0.31%	26.92	6.77%	593.36
1999	0.54%	47.18	8.65%	757.85
2000	0.01%	1.03	2.15%	188.23
2001	0.21%	18.13	6.83%	598.23
2002	0.12%	10.24	4.43%	388.13
2003	0.19%	16.25	4.72%	413.27

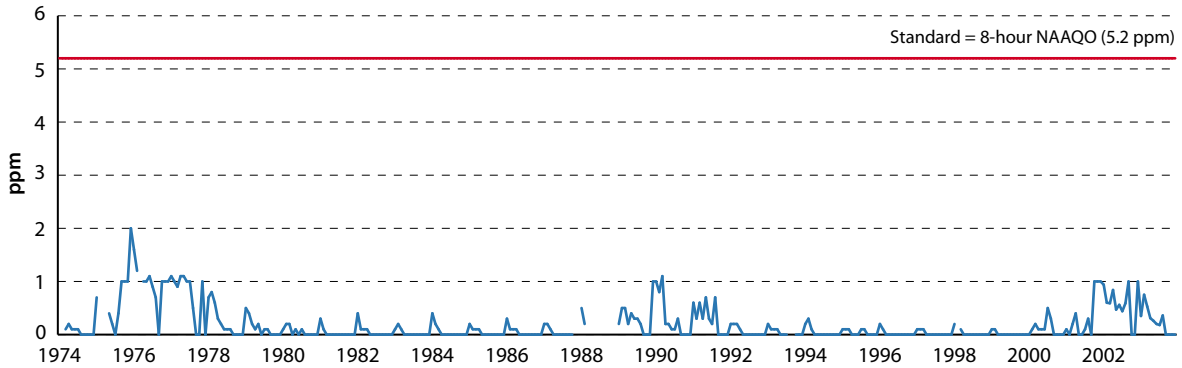
Sudbury—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	74.67	65
1994	72.67	65
1995	72.00	65
1996	72.33	65
1997	77.00	65
1998	78.00	65
1999	82.00	65
2000	74.67	65
2001	74.33	65
2002	73.67	65
2003	79.00	65

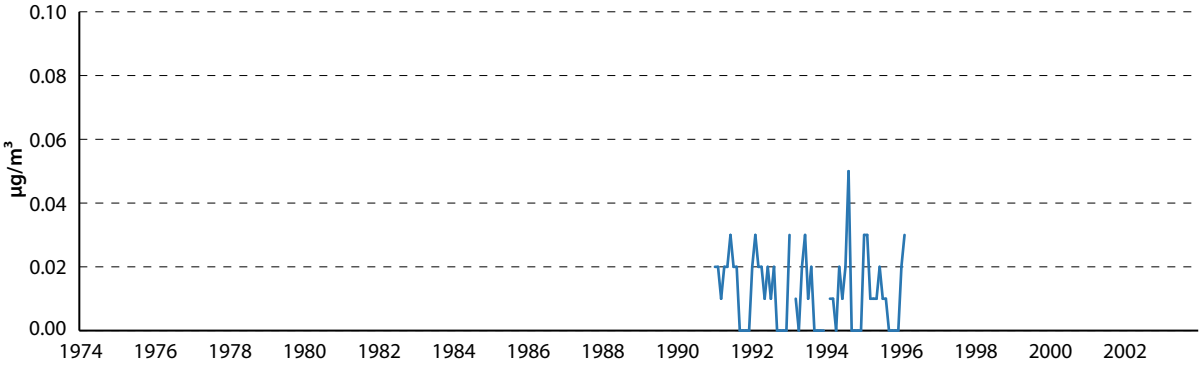
Sudbury—ambient levels of total suspended particulates, 1991–1996



Sudbury—ambient levels of carbon monoxide, 1974–2003

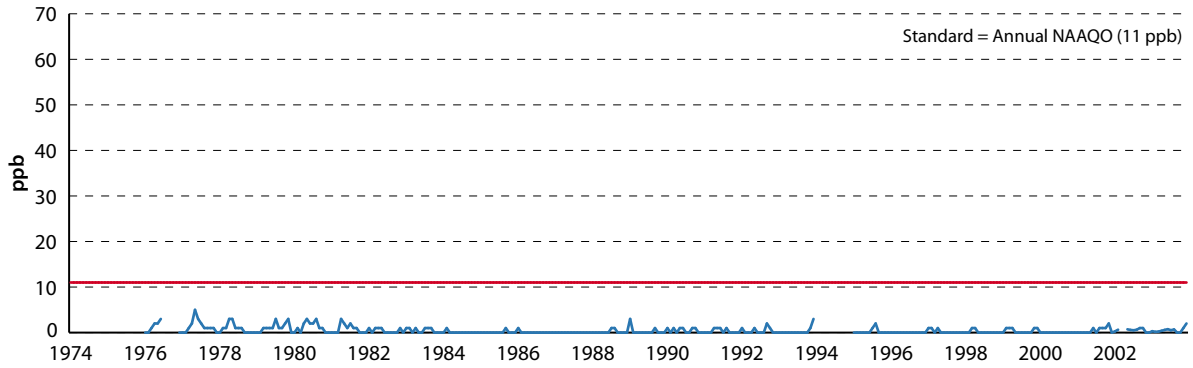


Sudbury—ambient levels of lead, 1991–1996

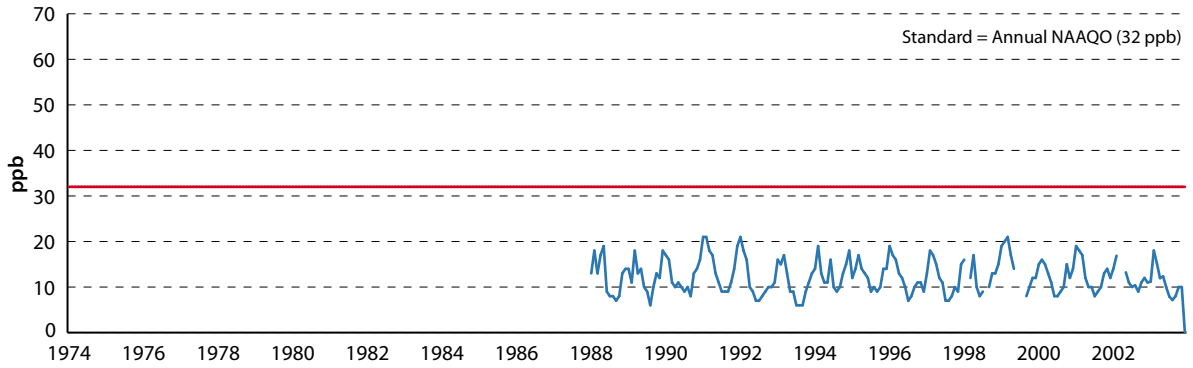


Thunder Bay, Ontario

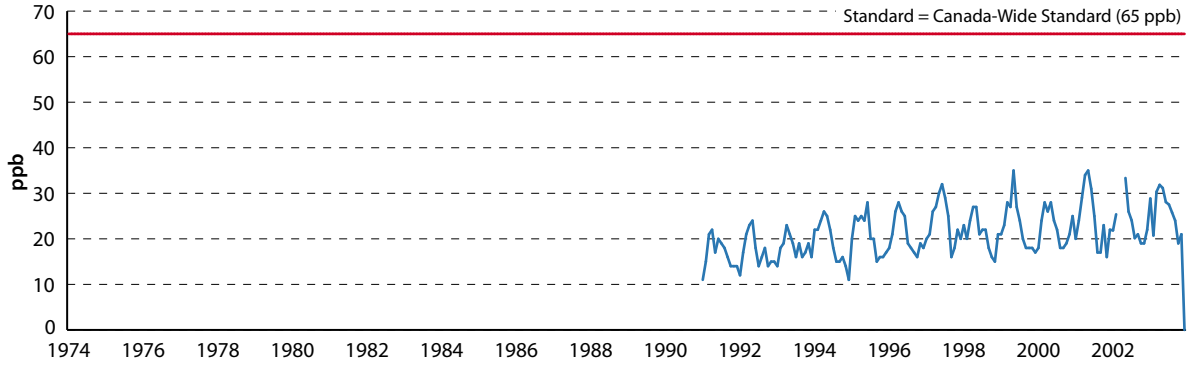
Thunder Bay—ambient levels of sulphur dioxide, 1976–2003



Thunder Bay—ambient levels of nitrogen dioxide, 1988–2003



Thunder Bay—ambient levels of ozone, 1991–2003



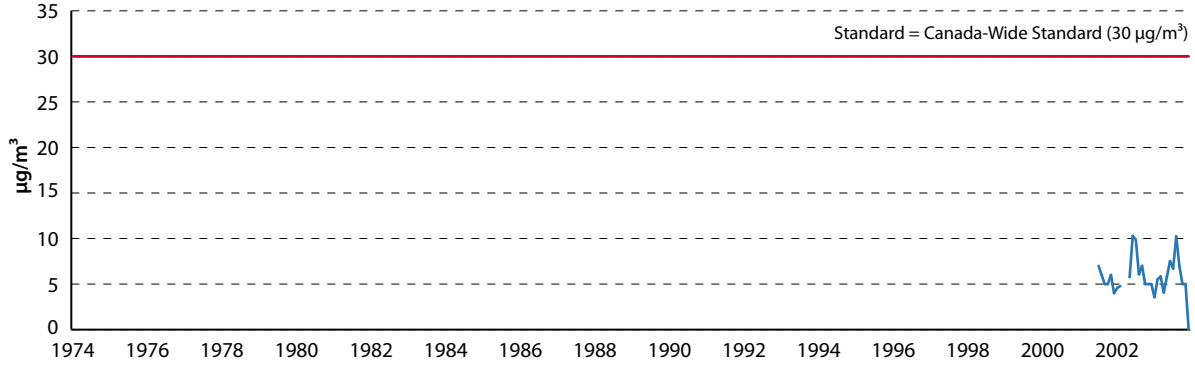
Thunder Bay—average number of 1-hour periods exceeding standards for ozone

	1-hour objective > Desirable	
	percent	number of hours
1991	0.31%	27.11
1992	0.33%	29.10
1993	0.30%	26.22
1994	0.44%	38.46
1995	1.23%	107.86
1996	0.38%	32.99
1997	2.00%	174.88
1998	1.10%	96.41
1999	1.83%	160.41
2000	0.74%	65.07
2001	2.03%	177.41
2002	1.72%	150.31
2003	2.78%	243.69

Thunder Bay—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	50.00	65
1994	50.67	65
1995	54.33	65
1996	55.00	65
1997	58.67	65
1998	58.00	65
1999	61.00	65
2000	60.00	65
2001	60.33	65
2002		65
2003		65

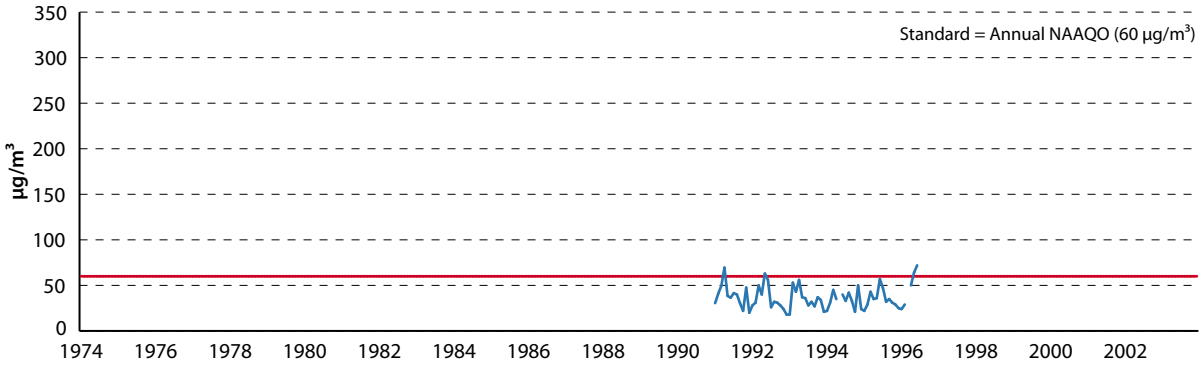
Thunder Bay—ambient levels of $PM_{2.5}$, 2001–2003



Thunder Bay—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2003	21	30

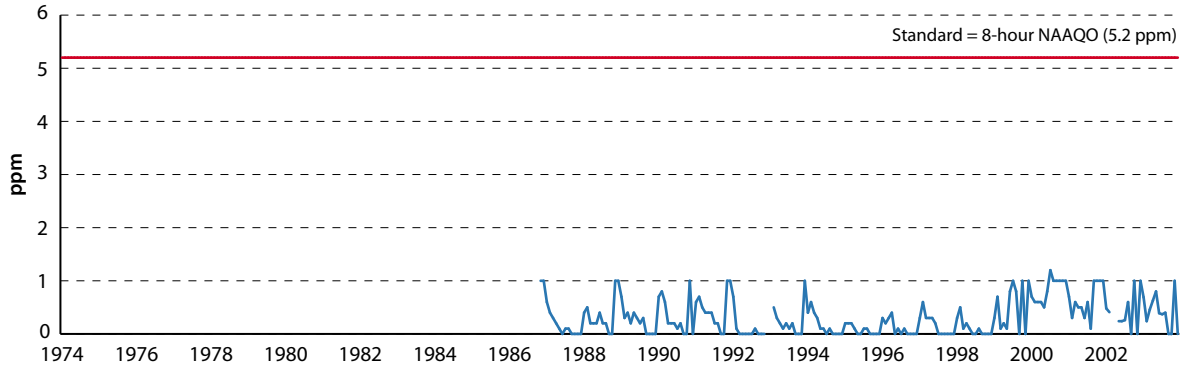
Thunder Bay—ambient levels of total suspended particulates, 1991–1996



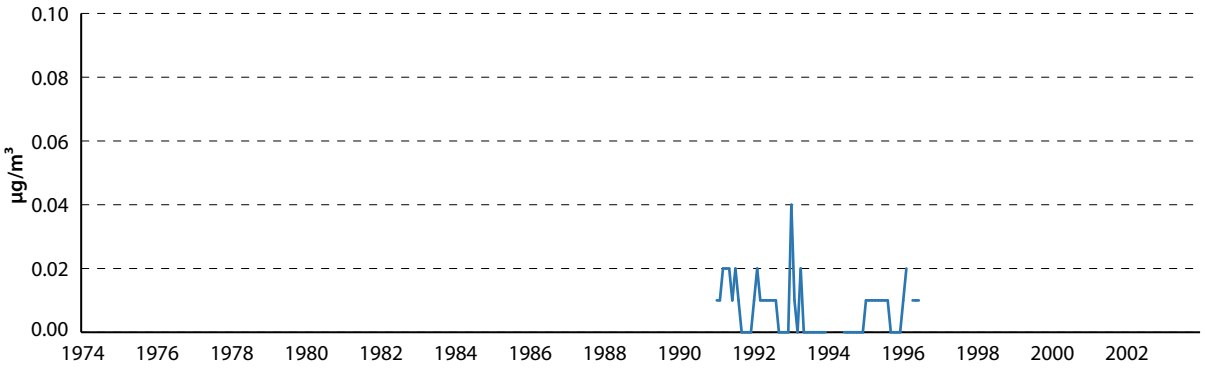
Thunder Bay—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1992	3.45%	12.59
1993		
1994		
1995		
1996	4.55%	16.59

Thunder Bay—ambient levels of carbon monoxide, 1986–2003

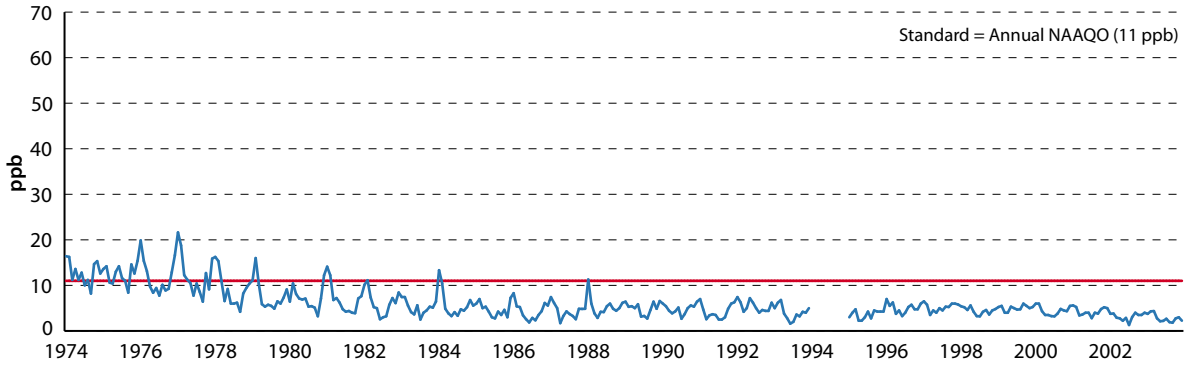


Thunder Bay—ambient levels of lead, 1991–1996



Toronto, Ontario

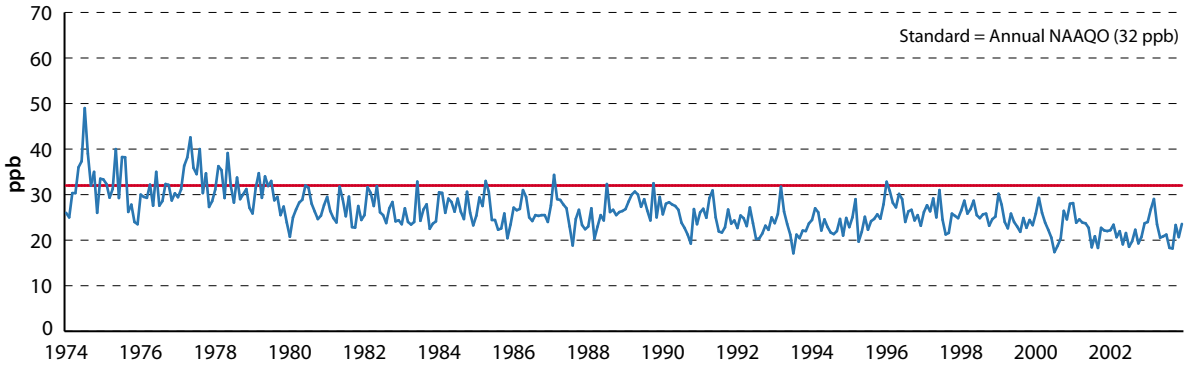
Toronto—ambient levels of sulphur dioxide, 1974–2003



Toronto—average number of 1-hour periods exceeding standards for sulphur dioxide

	1-hour objective > Desirable	
	percent	number of hours
1991	0.02%	2.03
1992	0.01%	1.00
1995	0.01%	1.02
1998	0.01%	1.12
1999	0.02%	1.54
2000	0.03%	3.01
2001	0.01%	1.00
2002	0.02%	2.02

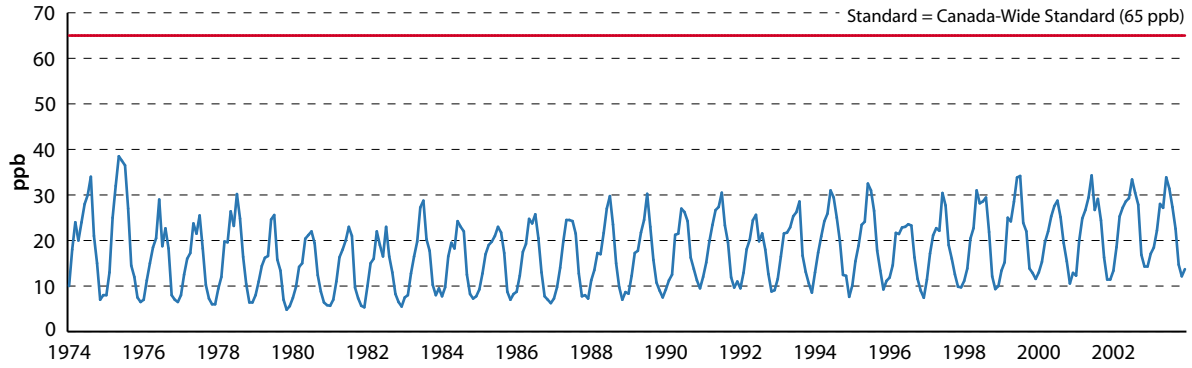
Toronto—ambient levels of nitrogen dioxide, 1974–2003



Toronto—average number of 1-hour and 24-hour periods exceeding standards for nitrogen dioxide

	1-hour objective > Acceptable		24-hour objective > Acceptable	
	percent	number of hours	percent	number of days
1991	0.00%	0.00	0.07%	0.27
1993	0.01%	1.06	0.00%	0.00
1995	0.00%	0.00	0.15%	0.53

Toronto—ambient levels of ozone, 1974–2003



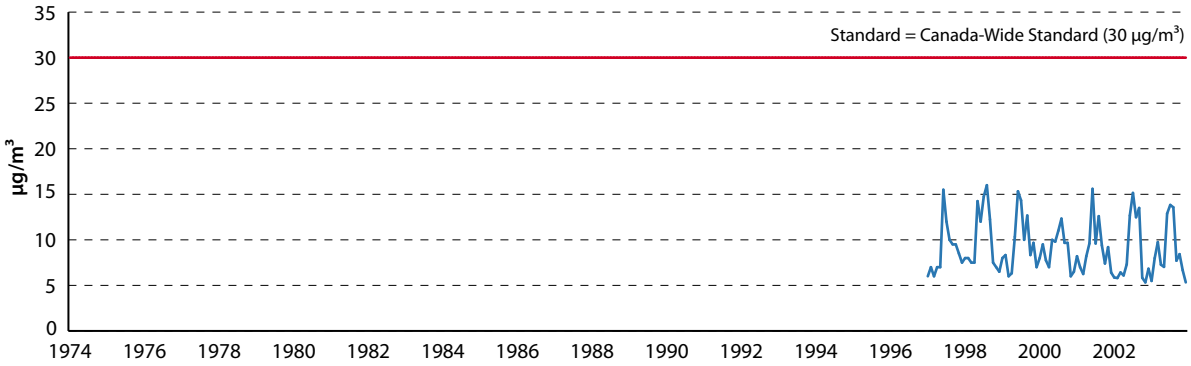
Toronto— Average number of 1-hour periods exceeding standards for ozone

	1-hour objective					
	> Acceptable		> Desirable		> Tolerable	
	percent	number of hours	percent	number of hours	percent	number of hours
1991	0.75%	65.32	5.02%	440.01	0.00%	0.00
1992	0.32%	27.67	2.87%	251.60	0.00%	0.00
1993	0.37%	32.04	3.38%	295.83	0.00%	0.00
1994	0.67%	58.90	5.36%	469.93	0.32%	28.01
1995	0.68%	59.97	5.32%	465.68	0.00%	0.00
1996	0.21%	18.50	2.95%	258.82	0.00%	0.00
1997	0.29%	25.21	3.08%	270.10	0.00%	0.00
1998	0.47%	40.83	6.15%	538.56	0.00%	0.00
1999	0.69%	60.53	6.36%	557.47	0.00%	0.00
2000	0.15%	13.55	3.23%	283.27	0.00%	0.00
2001	0.64%	55.98	5.93%	519.26	0.00%	0.00
2002	0.68%	59.82	6.17%	540.22	0.00%	0.00
2003	0.50%	44.03	4.73%	414.25	0.00%	0.00

Toronto— 3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	73.95	65
1994	73.03	65
1995	76.73	65
1996	76.66	65
1997	75.54	65
1998	76.10	65
1999	81.71	65
2000	80.76	65
2001	81.57	65
2002	81.10	65
2003	84.19	65

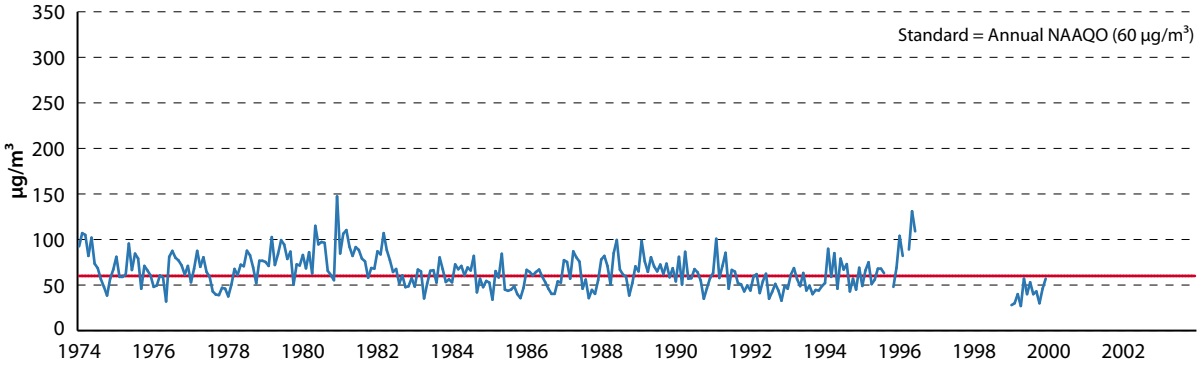
Toronto—ambient levels of $PM_{2.5}$, 1997–2003



Toronto—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
1999	30.47	30
2000	29.47	30
2001	28.79	30
2002	29.51	30
2003	31.34	30

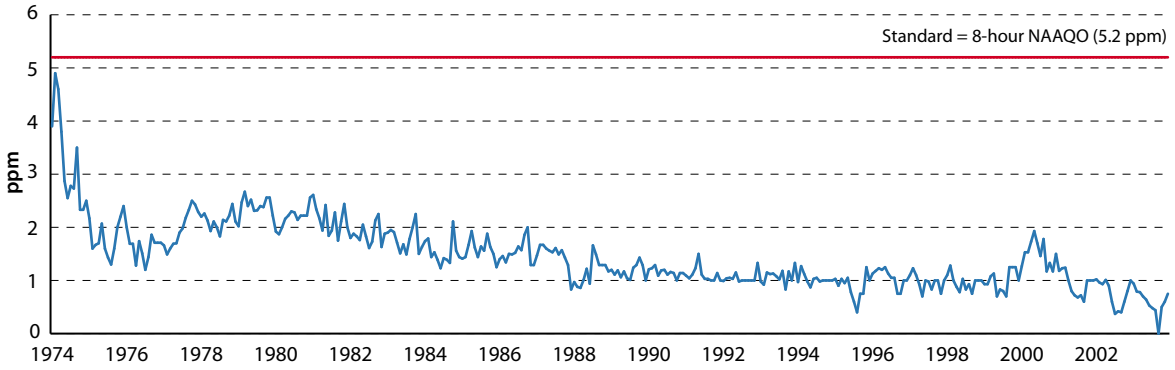
Toronto—ambient levels of total suspended particulates, 1974–1999



Toronto—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1991	5.02%	18.31
1992	4.58%	16.72
1993	4.69%	17.13
1994	11.46%	41.82
1996	30.43%	111.09
1999	3.64%	13.27

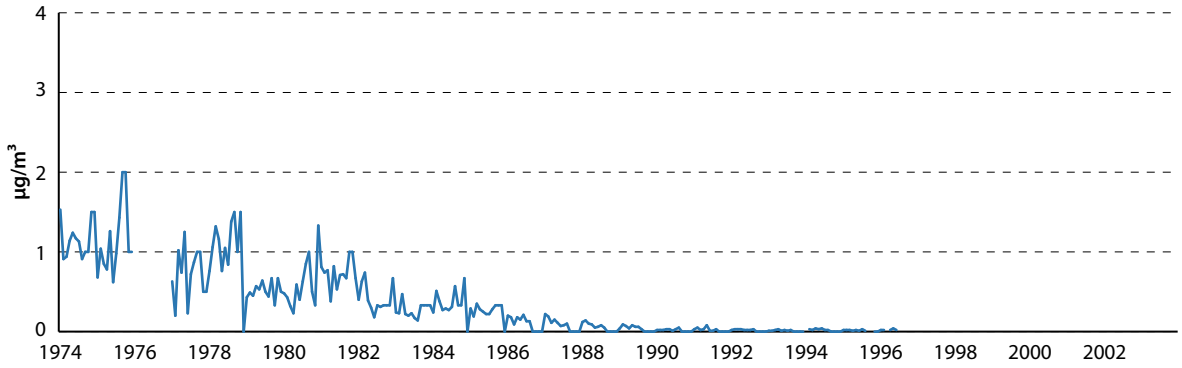
Toronto—ambient levels of carbon monoxide, 1974–2003



Toronto—average number of 1-hour and 8-hour periods exceeding standards for carbon monoxide

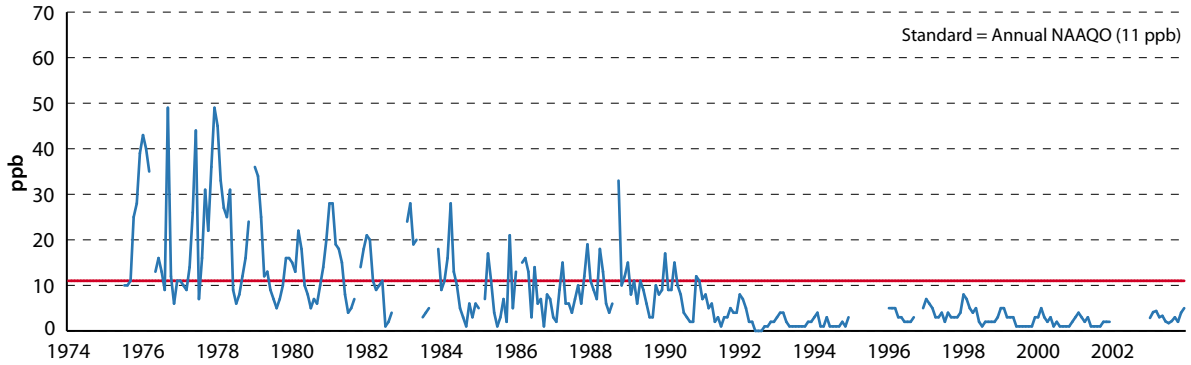
	1-hour objective		8-hour objective			
	> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of 8-hour periods	percent	number of 8-hour periods
1991	0.16%	14.14	0.08%	0.91	5.68%	62.16
1992	0.00%	0.00	0.00%	0.00	0.66%	7.23
1993	0.01%	1.03	0.00%	0.00	0.55%	5.99
1994	0.01%	1.06	0.00%	0.00	0.37%	4.03
1995	0.00%	0.00	0.00%	0.00	0.07%	0.72
1996	0.00%	0.00	0.00%	0.00	0.01%	0.13
2000	0.00%	0.00	0.00%	0.00	0.05%	0.50

Toronto—ambient levels of lead, 1974–1996



Trois Rivières, Québec

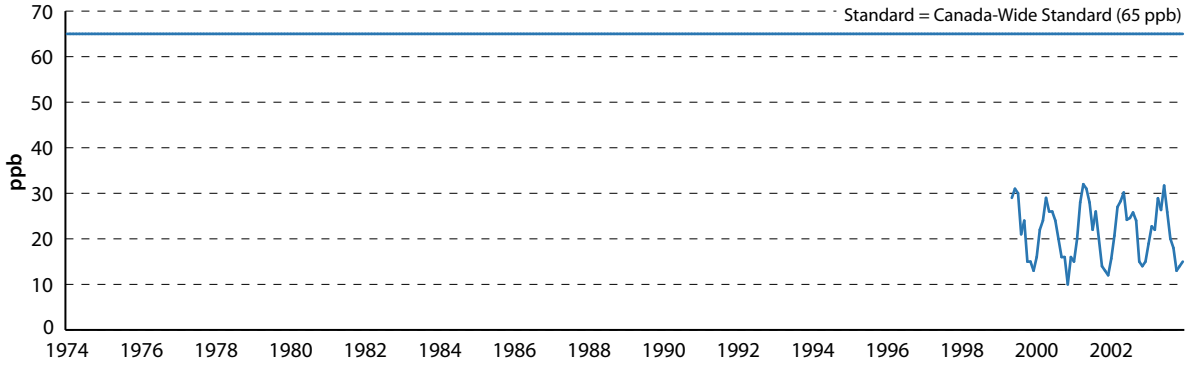
Trois Rivières—ambient levels of sulphur dioxide, 1975–2003



Trois Rivières—average number of 1-hour periods exceeding standards for sulphur dioxide

	1-hour objectives > Desirable	
	percent	number of hours
1991	0.01%	1.05
1992	0.06%	5.28
1993		
1994		
1995		
1996		
1997	0.01%	1.07

Trois Rivières—ambient levels of ozone, 1999–2003



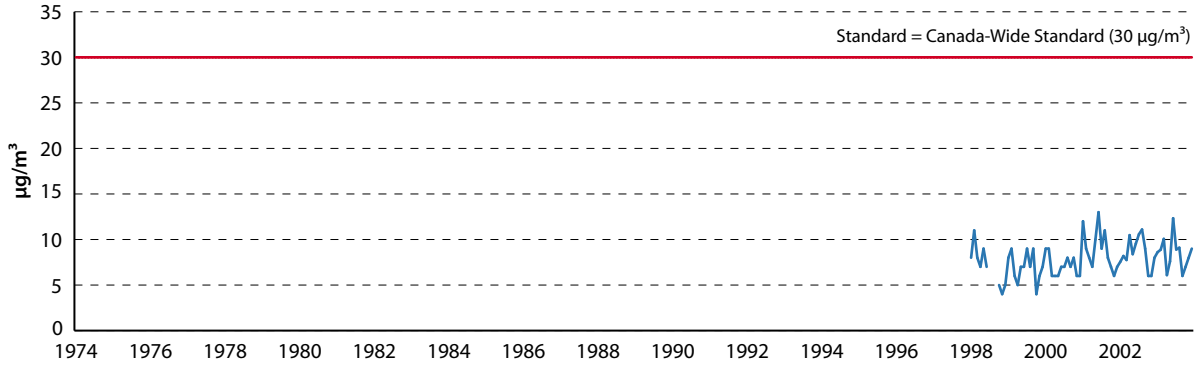
Trois Rivières— Average number of 1-hour periods exceeding standards for ozone

	1 hour objectives			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1999	0.58%	50.58	5.68%	497.34
2000	0.00%	0.00	1.08%	94.27
2001	0.17%	14.63	3.28%	287.40
2002	0.16%	14.14	2.23%	195.75
2003	0.16%	13.59	1.93%	169.39

Trois Rivières—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
2001	70.67	65
2002	67.00	65
2003	73.00	65

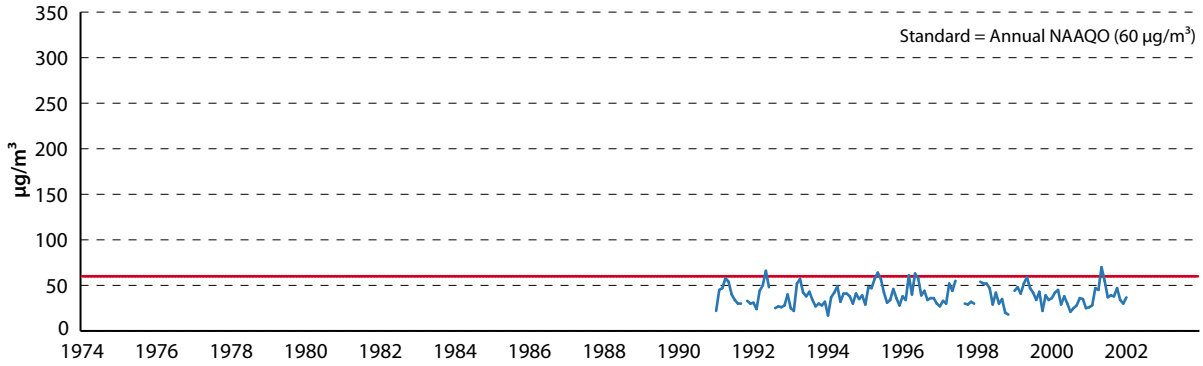
Trois Rivières—ambient levels of $PM_{2.5}$, 1998–2003



Trois Rivières—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2001	22.67	30
2002	24.33	30
2003	27.67	30

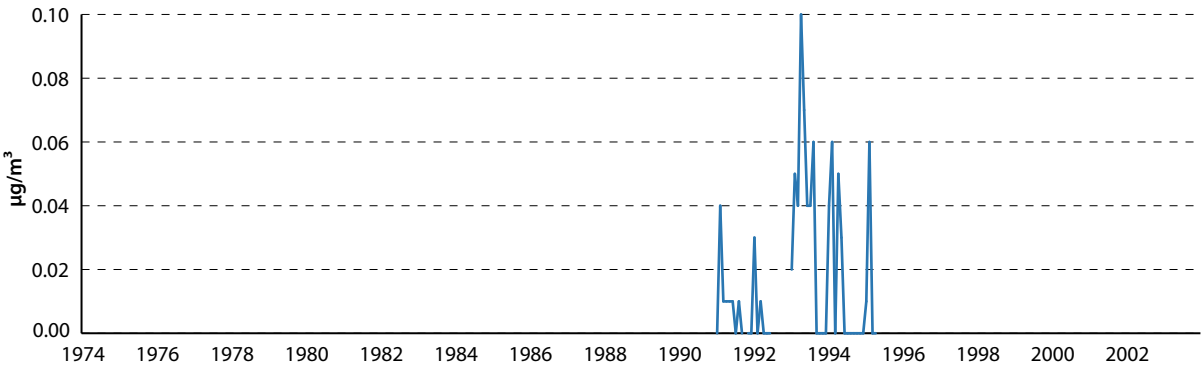
Trois Rivières—ambient levels of total suspended particulates, 1991–2002



Trois Rivières—average number of 24-hour periods exceeding standards for total suspended particulates

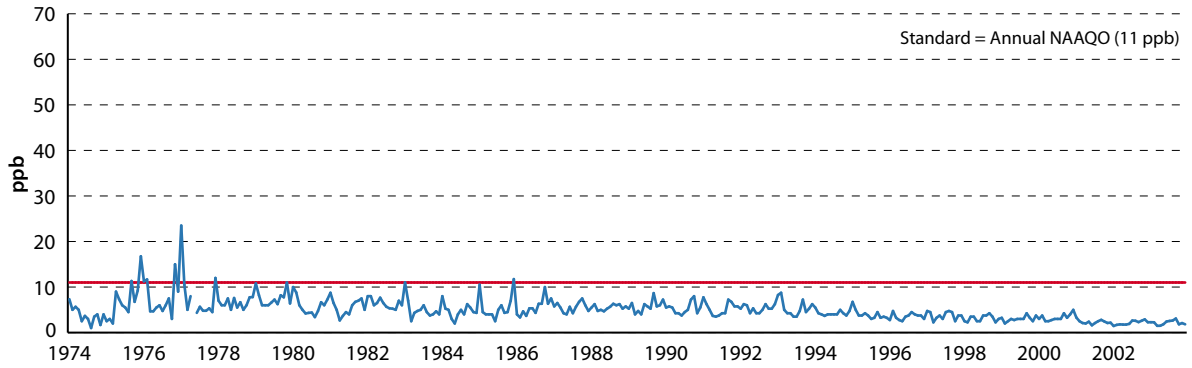
	24-hour objective > Acceptable	
	percent	number of days
1992	1.92%	7.02
1993	1.67%	6.08
1995	1.69%	6.19

Trois Rivières—ambient levels of lead, 1991–1995



Vancouver, British Columbia

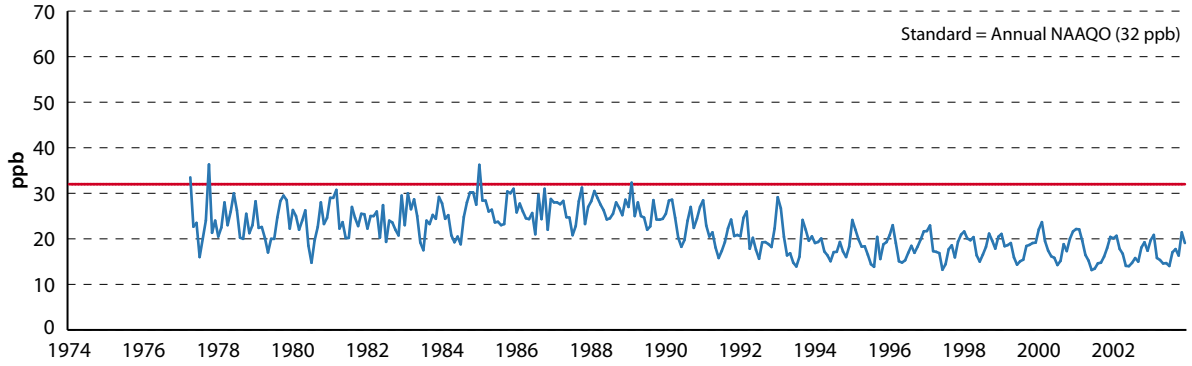
Vancouver—ambient levels of sulphur dioxide, 1974–2003



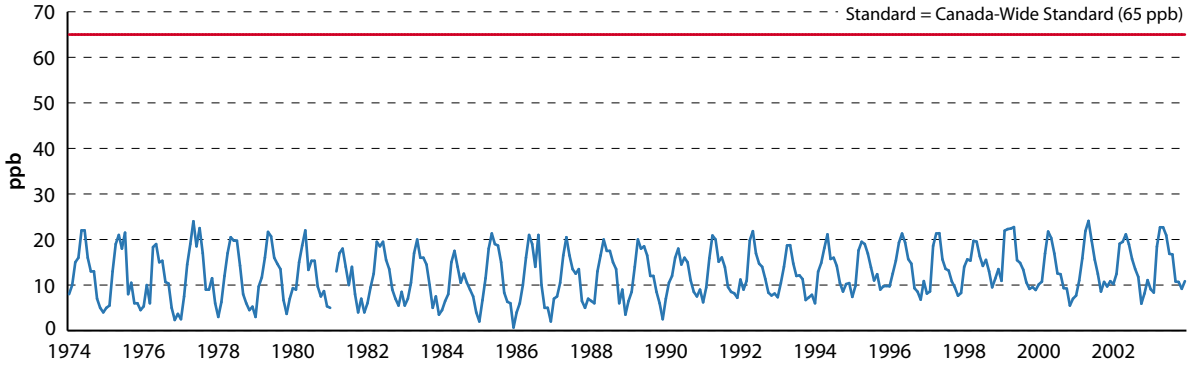
Vancouver—average number of 1-hour periods exceeding standards for sulphur dioxide

	1-hour objective > Desirable	
	percent	number of hours
2002	0.04%	3.08

Vancouver—ambient levels of nitrogen dioxide, 1977–2003



Vancouver—ambient levels of ozone, 1974–2003



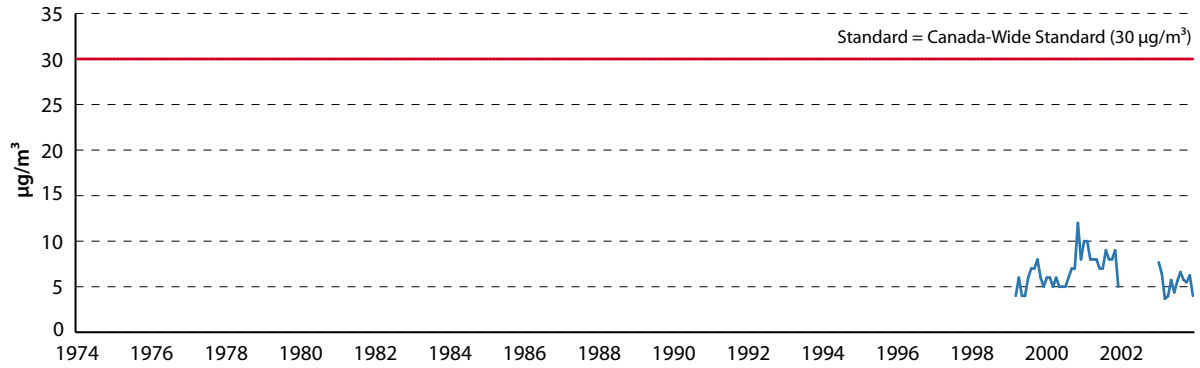
Vancouver—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.02%	1.50	0.53%	46.13
1992	0.04%	3.09	0.61%	53.64
1993	0.00%	0.00	0.42%	36.58
1994	0.05%	4.63	0.39%	34.13
1995	0.01%	1.02	0.33%	28.57
1996	0.03%	2.38	0.30%	26.57
1997	0.02%	2.05	0.29%	25.08
1998	0.04%	3.14	0.50%	43.71
1999	0.69%	60.49	0.47%	41.16
2000	0.00%	0.00	0.14%	12.60
2001	0.01%	1.02	0.21%	18.73
2002	0.00%	0.00	0.15%	13.40
2003	0.00%	0.00	0.23%	20.54

Vancouver—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	48.43	65
1994	49.21	65
1995	47.65	65
1996	47.79	65
1997	46.31	65
1998	48.34	65
1999	47.66	65
2000	46.63	65
2001	44.21	65
2002	43.90	65
2003	45.04	65

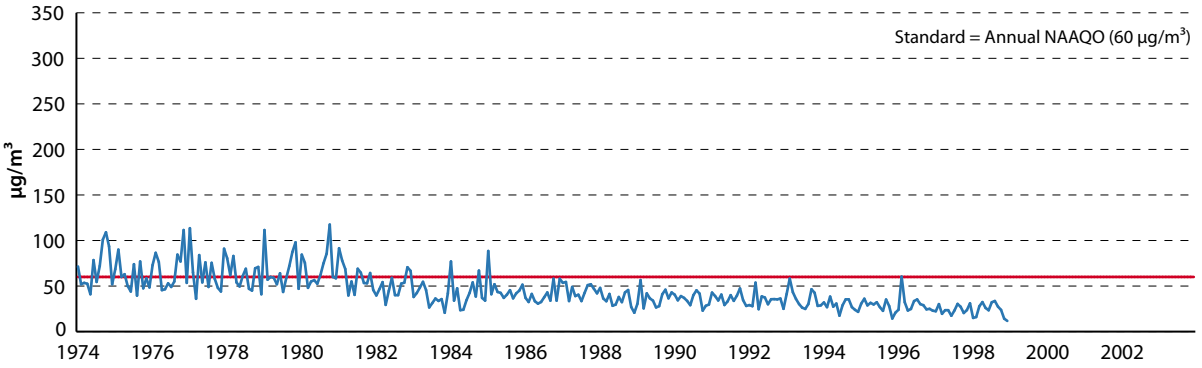
Vancouver—ambient levels of $PM_{2.5}$, 1999–2003



Vancouver—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2001	16.33	30

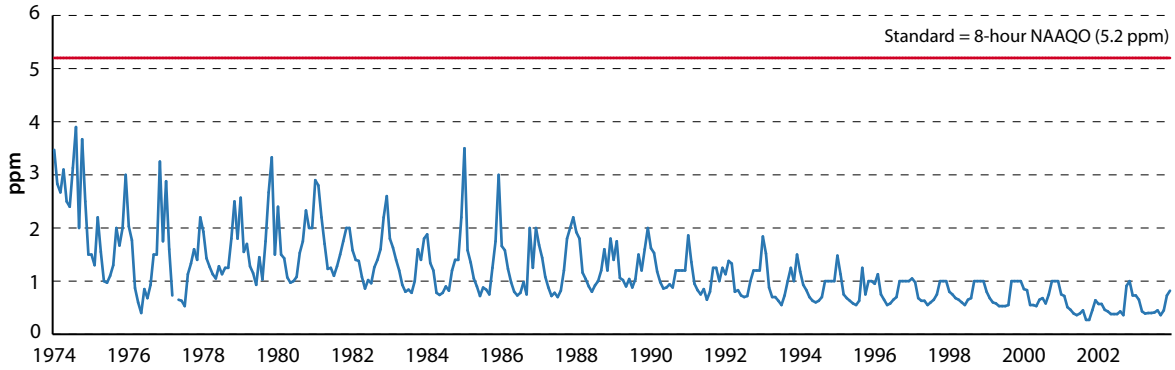
Vancouver—ambient levels of total suspended particulates, 1974–1998



Vancouver—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective			
	> Acceptable		> Tolerable	
	percent	number of days	percent	number of days
1991	3.73%	13.62	0.00%	0.00
1992	5.66%	20.66	0.00%	0.00
1993	2.80%	10.22	0.00%	0.00
1995	1.75%	6.40	0.00%	0.00
1996	7.14%	26.07	1.79%	6.52
1998	1.72%	6.29	0.00%	0.00

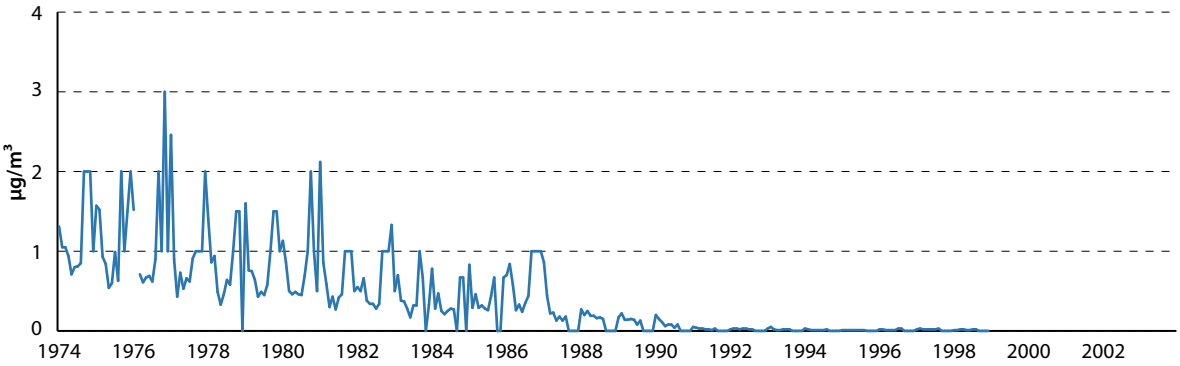
Vancouver—ambient levels of carbon monoxide, 1974–2003



Vancouver—average number of 1-hour and 8-hour periods exceeding standards for carbon monoxide

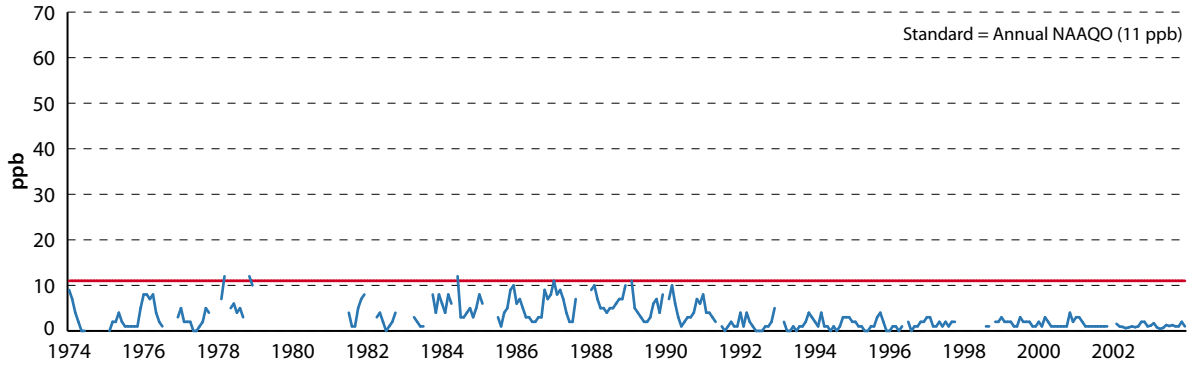
	1-hour objective > Desirable		8-hour objective > Desirable	
	percent	number of hours	percent	number of 8-hour periods
1991	0.00%	0.00	0.27%	2.99
1992	0.00%	0.00	0.13%	1.41
1993	0.00%	0.00	0.34%	3.67
1995	0.01%	1.06	0.67%	7.30

Vancouver—ambient levels of lead, 1974–1998

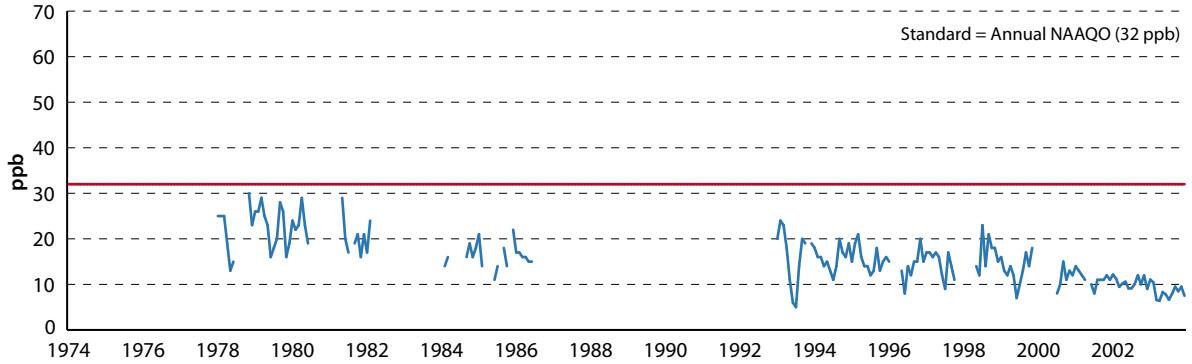


Victoria, British Columbia

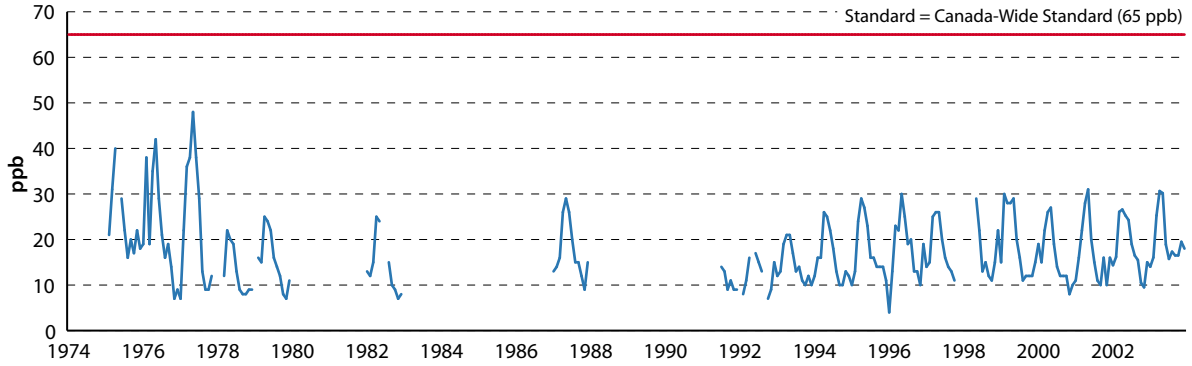
Victoria—ambient levels of sulphur dioxide, 1974–2003



Victoria—ambient levels of nitrogen dioxide, 1977–2003



Victoria—ambient levels of ozone, 1975–2003



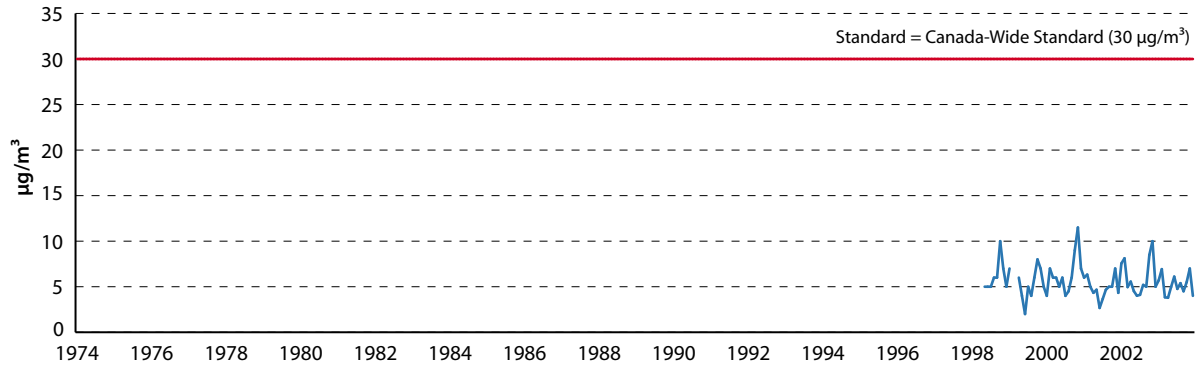
Victoria—average number of 1-hour periods exceeding standards for ozone

	1-hour objective >Desirable	
	percent	number of hours
1991	0.08%	9.36
1992	0.09%	10.85
1993	0.02%	3.05
1994	0.09%	10.90
1995	0.05%	6.01
1996	0.13%	16.36
1997	0.07%	9.28
1998	0.29%	36.12
1999	0.07%	9.01
2000	0.13%	16.22
2001	1.84%	228.85
2002	0.30%	36.99
2003	0.36%	45.12

Victoria—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1994	40.67	65
1995	42.67	65
1996	44.67	65
1997	45.33	65
1998	45.67	65
1999	45.67	65
2000	47.00	65
2001	47.00	65
2002	46.83	65
2003	46.83	65

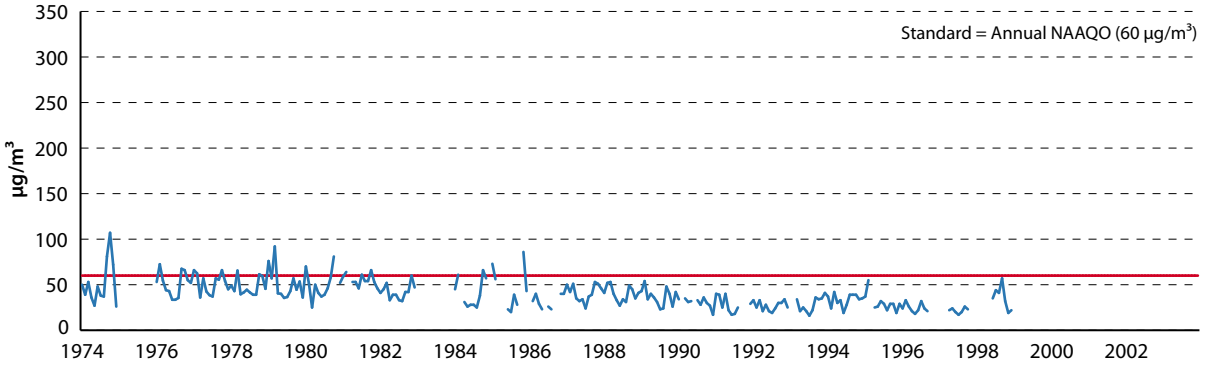
Victoria—ambient levels of $PM_{2.5}$, 1998–2003



Victoria—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2001	14.61	30
2002	15.44	30
2003	13.61	30

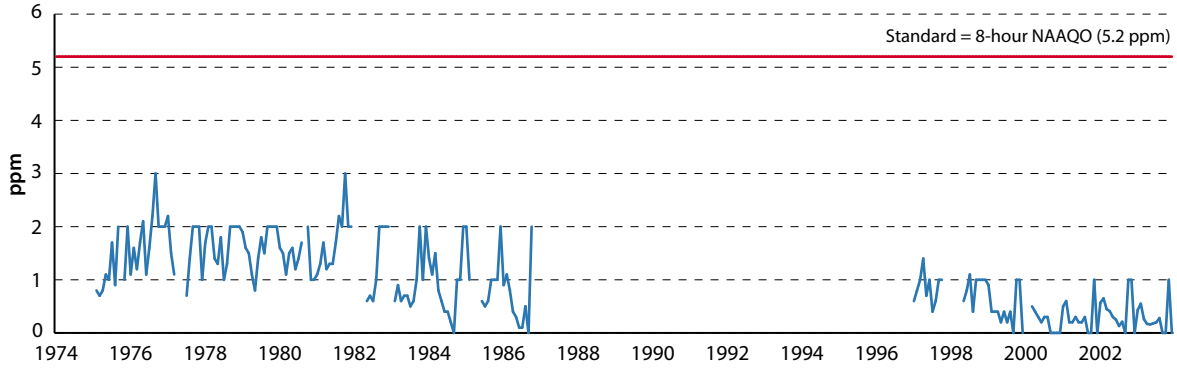
Victoria—ambient levels of total suspended particulates, 1974–1998



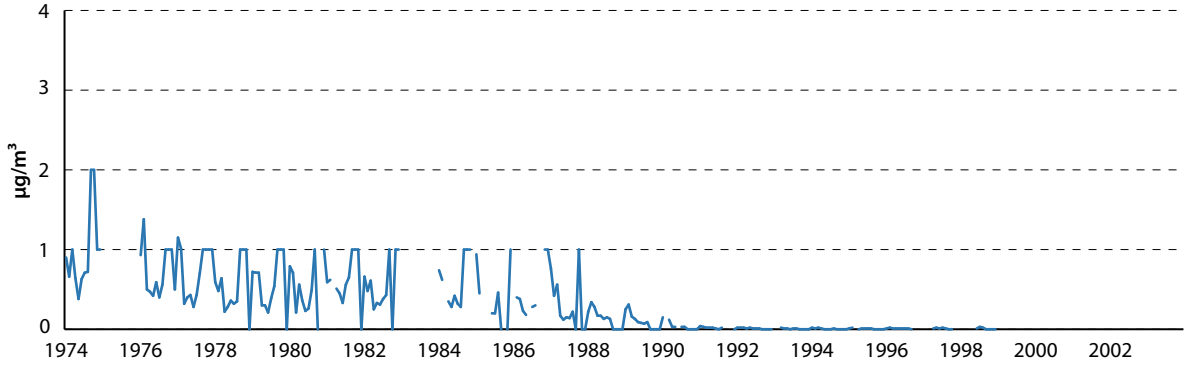
Victoria—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1998	2.94%	10.74

Victoria—ambient levels of carbon monoxide, 1975–2003

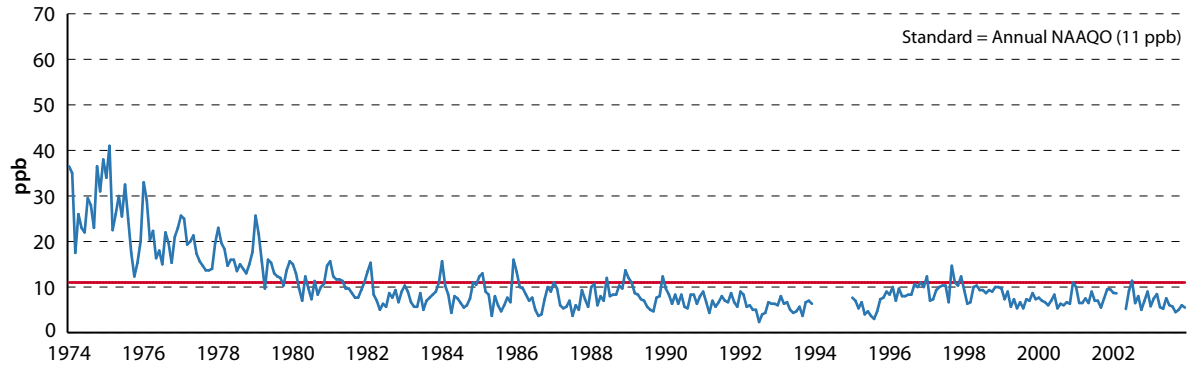


Victoria—ambient levels of lead, 1974–1998



Windsor, Ontario

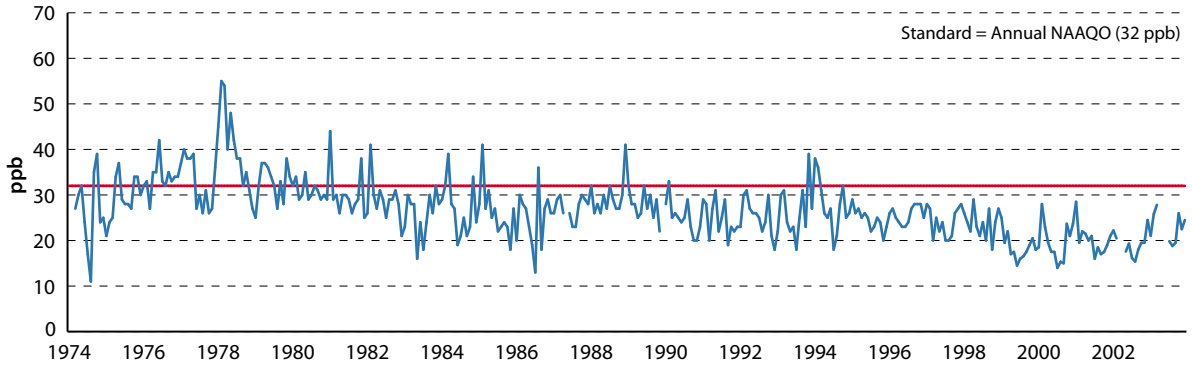
Windsor—ambient levels of sulphur dioxide, 1974–2003



Windsor—average number of 1-hour and 24-hour periods exceeding standards for sulphur dioxide

	1-hour objective				24-hour objective			
	> Acceptable		> Desirable		> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours	percent	number of days	percent	number of days
1997	0.13%	11.4	0.30%	26.3	0.52%	1.9	1.00%	3.6
1998	0.00%	0	0.01%	1.0	0.00%	0	0.00%	0.0
2000	0.00%	0	0.01%	1.0	0.00%	0	0.00%	0.0

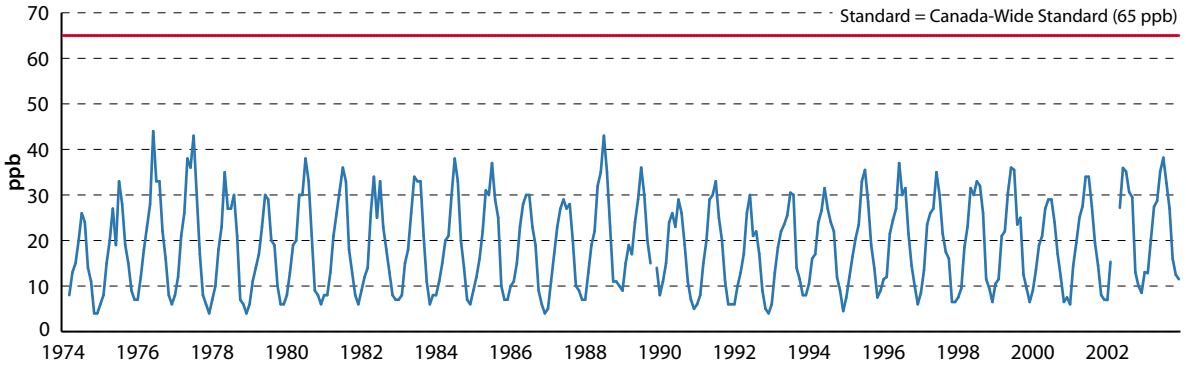
Windsor—ambient levels of nitrogen dioxide, 1974–2003



Windsor—average number of 1-hour and 24-hour periods exceeding standards for nitrogen dioxide

	1-hour objective		24-hour objective	
	> Acceptable		> Acceptable	
	percent	number of hours	percent	number of days
1993	0.05%	4.1	0.25%	0.93
1994	0.00%	0	0.02%	0.08

Windsor—ambient levels of ozone, 1974–2003



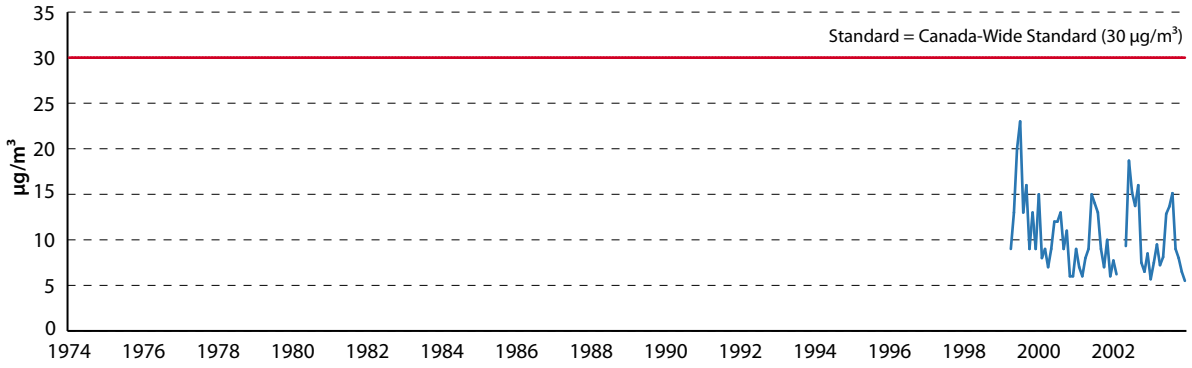
Windsor—average number of 1-hour periods exceeding standards for ozone

	1-hour objective			
	> Acceptable		> Desirable	
	percent	number of hours	percent	number of hours
1991	0.76%	67.0	5.91%	517.6
1992	0.25%	22.3	3.28%	286.9
1993	0.35%	31.0	4.00%	350.1
1994	0.57%	50.0	5.38%	471.7
1995	0.71%	61.8	5.97%	522.7
1996	0.99%	86.3	7.15%	626.1
1997	0.46%	40.2	5.29%	463.2
1998	0.75%	65.9	7.71%	675.5
1999	0.96%	84.2	7.09%	621.4
2000	0.15%	13.1	4.07%	356.3
2001	0.62%	54.1	6.55%	573.4
2002	2.06%	180.3	9.02%	790.5
2003	0.79%	68.9	7.19%	629.9

Windsor—3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	79.17	65
1994	80.00	65
1995	84.33	65
1996	88.33	65
1997	86.50	65
1998	86.83	65
1999	86.00	65
2000	82.50	65
2001	82.50	65
2002	84.67	65
2003	91.67	65

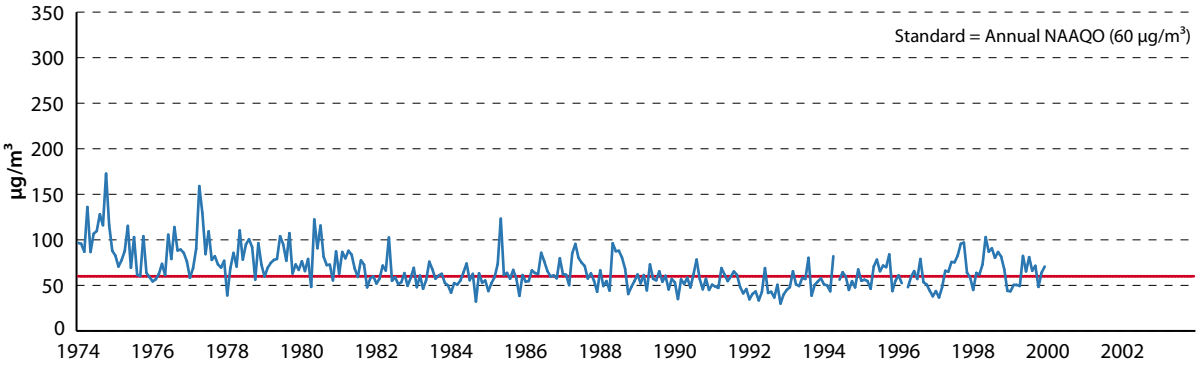
Windsor—ambient levels of $PM_{2.5}$, 1999–2003



Windsor—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2001	33.67	30
2002	30.67	30
2003	31.83	30

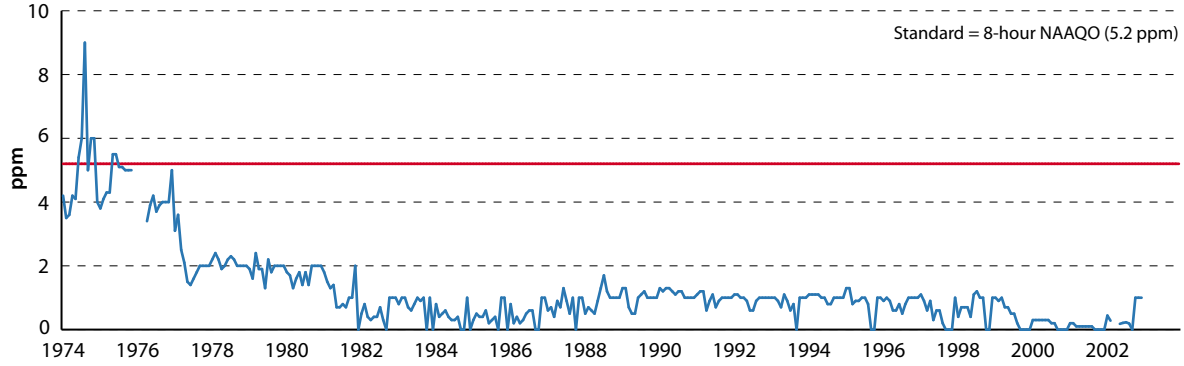
Windsor—ambient levels of total suspended particulates, 1974–1999



Windsor—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective			
	> Acceptable		> Tolerable	
	percent	number of days	percent	number of days
1991	2.71%	9.91	0.00%	0.00
1992	1.85%	6.76	0.00%	0.00
1993	3.64%	13.27	1.82%	6.64
1994	4.10%	14.96	0.00%	0.00
1995	5.10%	18.61	0.00%	0.00
1996	4.35%	15.87	0.00%	0.00
1997	4.73%	17.27	0.00%	0.00
1998	9.40%	34.32	0.00%	0.00
1999	4.94%	18.02	0.00%	0.00

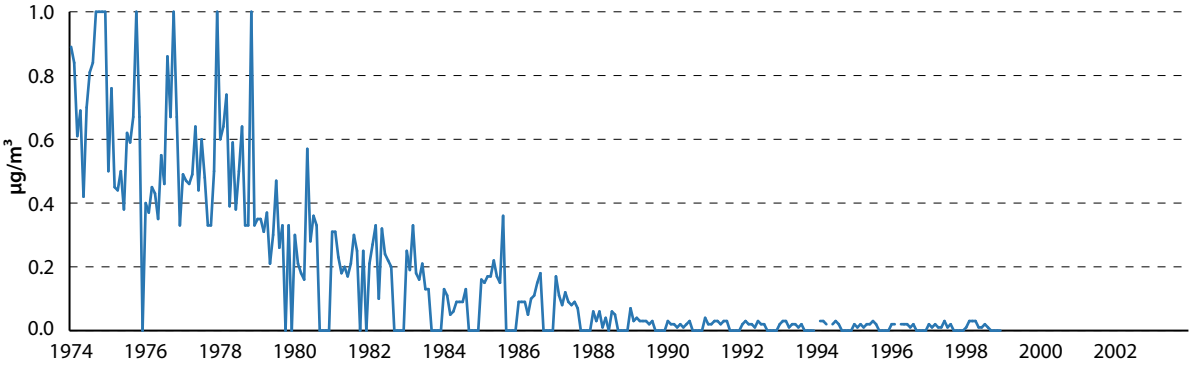
Windsor—ambient levels of carbon monoxide, 1974–2002



Windsor—average number of 8-hour periods exceeding standards for carbon monoxide

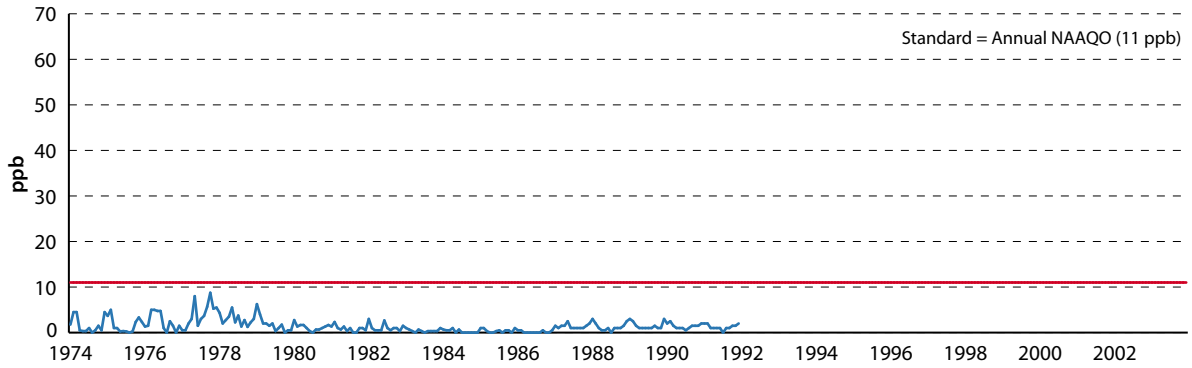
	8-hour objective > Desirable	
	percent	number of 8-hour periods
1993	0.05%	0.51
1994	0.09%	1.00

Windsor—ambient levels of lead, 1974–1998

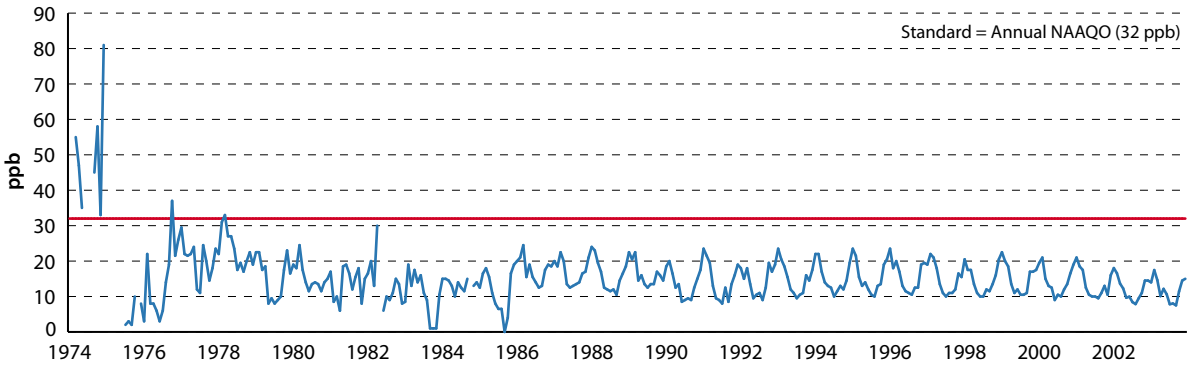


Winnipeg, Manitoba

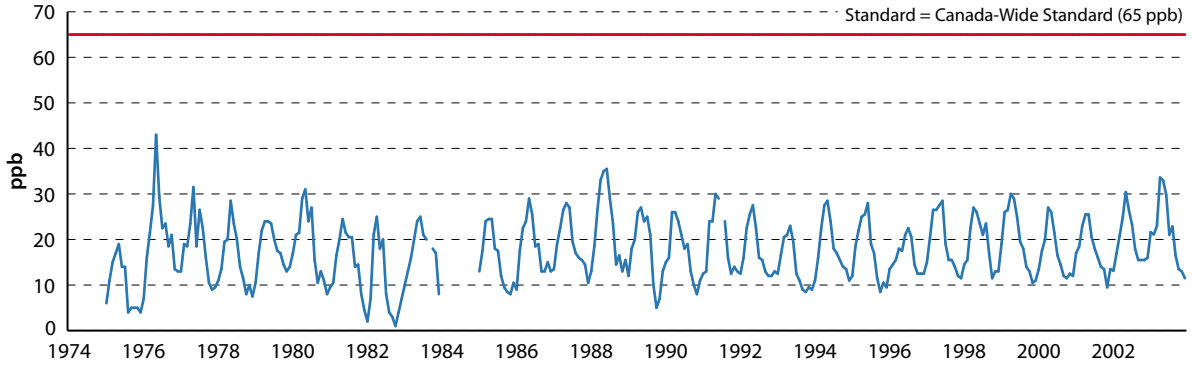
Winnipeg—ambient levels of sulphur dioxide, 1974–1991



Winnipeg—ambient levels of nitrogen dioxide, 1974–2003



Winnipeg—ambient levels of ozone, 1975–2003



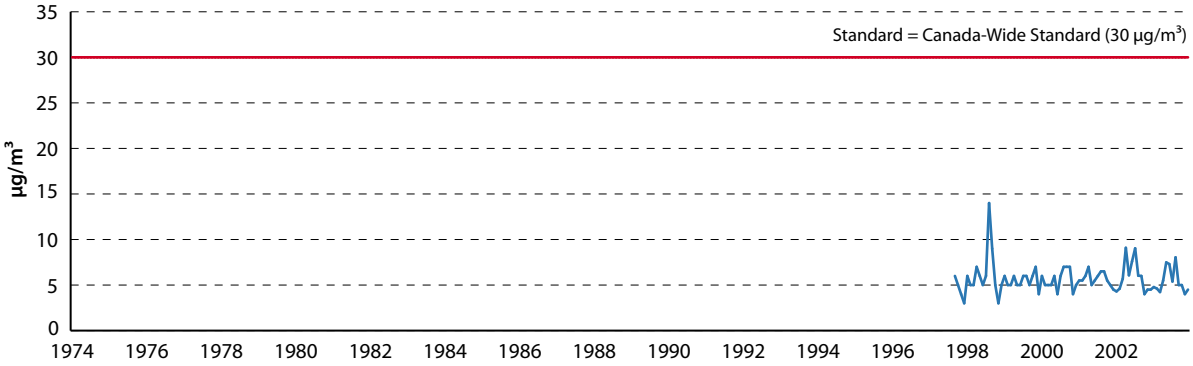
Winnipeg—average number of 1-hour periods exceeding standards for ozone

	1-hour objective > Desirable	
	percent	number of hours
1991	1.00%	87
1992	0.84%	74
1993	0.13%	11
1994	1.17%	102
1995	1.36%	119
1996	0.13%	12
1997	1.27%	111
1998	1.08%	94
1999	1.32%	116
2000	0.26%	23
2001	0.35%	31
2002	0.47%	41
2003	1.82%	159

Winnipeg— 3-year average of the 4th-highest annual measurement (in ppb) of ozone reported over 8-hour averaging periods

	3-year average	Canada-wide standard
1993	52.0	65
1994	53.3	65
1995	53.8	65
1996	53.7	65
1997	55.7	65
1998	53.2	65
1999	56.8	65
2000	52.0	65
2001	51.7	65
2002	50.0	65
2003	54.0	65

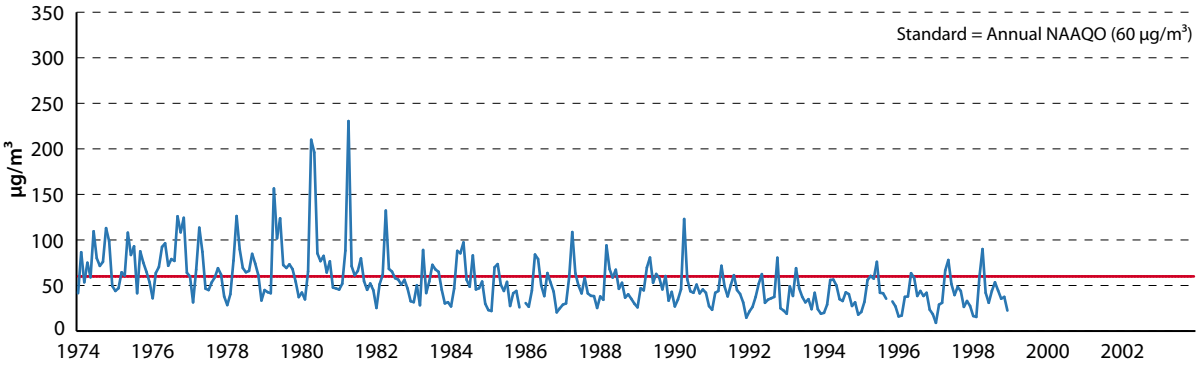
Winnipeg—ambient levels of $PM_{2.5}$, 1997–2003



Winnipeg—3-year average of the 98th percentile of the 24-hour mean for $PM_{2.5}$ (in µg/m³)

	3-year average	Canada-wide standard
2000	16.3	30
2001	14.2	30
2002	15.7	30
2003	15.7	30

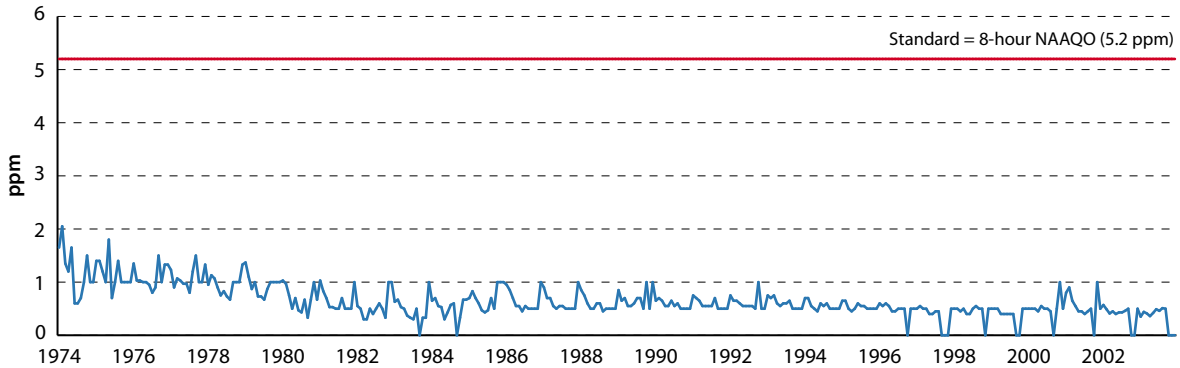
Winnipeg—ambient level of total suspended particulates, 1974–1998



Winnipeg—average number of 24-hour periods exceeding standards for total suspended particulates

	24-hour objective > Acceptable	
	percent	number of days
1991	5.22%	19.1
1992	3.40%	12.4
1993	1.67%	6.1
1995	3.92%	14.3
1996	1.75%	6.4
1997	3.39%	12.4
1998	3.39%	12.4

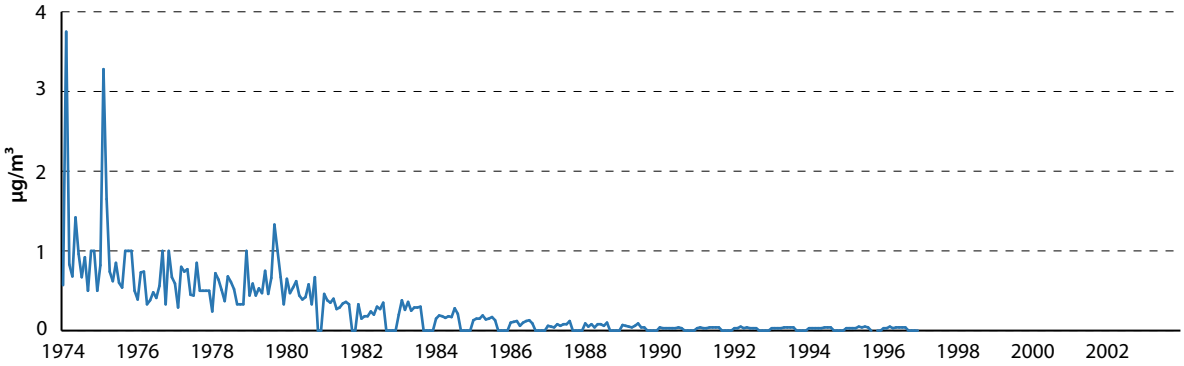
Winnipeg—ambient levels of carbon monoxide, 1974–2003



Winnipeg—average number of 8-hour periods exceeding standards for carbon monoxide

	8-hour objective > Desirable	
	percent	number of 8-hour periods
1992	0.08%	0.9
1993	0.05%	0.5

Winnipeg—ambient levels of lead, 1974–1996



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