Air Quality in Ontario 2013 Report

MINISTRY OF THE ENVIRONMENT AND CLIMATE CHANGE

Ontario

2013 Air Quality Report Highlights

- The 2013 air quality report marks 43 years of long-term reporting on the state of air quality in Ontario. This report summarizes province-wide trends for key airborne pollutants affecting Ontario's air quality.
- Overall, air quality has improved significantly over the past 10 years, especially for nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and carbon monoxide (CO) – pollutants emitted by vehicles and industry, as well as fine particulate matter ($PM_{2.5}$) which may be emitted directly into the atmosphere as a by-product of fuel combustion or it may be formed indirectly in the atmosphere through a series of complex chemical reactions.
- $PM_{2.5}$ trends continue to show improvement in air quality. Ontario is continuously improving its air monitoring network. In 2013 we adopted new, upgraded technology that allows us to measure fine particulate matter more accurately. The increase in $PM_{2.5}$ annual means reported in 2013 reflects the greater accuracy of the new technology which better protects Ontarians.
- Ozone is a secondary pollutant formed when nitrogen oxides (NO_X) and volatile organic compounds (VOCs) react in the presence of sunlight. Ozone annual means have increased by 8 per cent from 2004 to 2013; however, ozone summer means have remained constant over the same period.
- Emissions of nitrogen oxides (NO_X), CO and SO_2 continue to decrease due in part to Ontario's air quality initiatives such as the phase-out of coal-fired generating stations, emissions trading regulations (O. Reg. 397/01 and O. Reg. 194/05), emissions controls at Ontario smelters, and Drive Clean emissions testing, which supports the federal vehicle emission standards and lower sulphur content in transportation fuels.

Decreasing Provincial Ambient Concentrations (2004 – 2013)	
NO_2	↓ 40%
SO_2	↓ 46%
CO	↓ 42%
$PM_{2.5}$	↓ 30%

Decreasing Provincial Emissions (2003 – 2012)	
NO_X	↓ 39%
SO_2	↓ 51%
CO	↓ 19%
$PM_{2.5}$	↓ 27%

Reduce smog, reduce the risk, breathe easy.

For more information on Ontario's air quality, visit www.airqualityontario.com

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1.0 Introduction

This annual report, the 43rd in a series, summarizes the state of ambient air quality in Ontario during 2013 and examines 10-year trends.

It reports on the measured levels of six common air pollutants: ground-level ozone (O_3), fine particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2) and total reduced sulphur (TRS) compounds, and how Ontario is performing compared to the Ambient Air Quality Criteria (AAQC). This report also provides an overview of the Air Quality Index (AQI) and Smog Alert programs in addition to the federal Air Quality Health Index (AQHI). Annual statistics, as well as 10 and 20-year trends of ambient air quality data are in the attached Appendix.

FACT: An AAQC is a desirable concentration of a contaminant in air, based on protection against adverse effects on health or the environment. The term "ambient" is used to reflect general air quality independent of location or source of a contaminant. AAQCs are most commonly used in environmental assessments, special studies using ambient air monitoring data, assessment of general air quality in a community and annual reporting on air quality across the province. AAQCs are set with different averaging times appropriate for the effect they are intended to protect against.

Contaminant	1-hour AAQC	8-hour AAQC	24-hour AAQC	Annual AAQC
O_3	80 ppb	-	-	-
$PM_{2.5}$	-	-	28 µg/m^3[(1)]	-
NO_2	200 ppb	-	100 ppb	-
SO_2	250 ppb	-	100 ppb	20 ppb
CO	30 ppm	13 ppm	-	-

[(1)] Reference level based on Canadian Ambient Air Quality Standard (CAAQS).

Ontario continues to benefit from one of the most comprehensive air monitoring systems in North America, comprised of 40 monitoring sites across the province that undergo regularly scheduled maintenance and strict data quality assurance and quality control (QA/QC) procedures to ensure a high standard of data quality and data completeness. The data, which are collected continuously at these sites, are used to determine the current state of ambient air quality and are reported every hour on the ministry's web site, www.airqualityontario.com.

2.0 Ground-Level Ozone (O_3)

Ground-level ozone is a gas formed when nitrogen oxides (NO_X) and volatile organic compounds (VOCs) react in the presence of sunlight. While ozone at ground level is a significant environmental and health concern, the naturally occurring ozone in the stratosphere, 10 to 40 kilometres above the earth's surface, is beneficial as it shields the earth from harmful ultraviolet radiation.

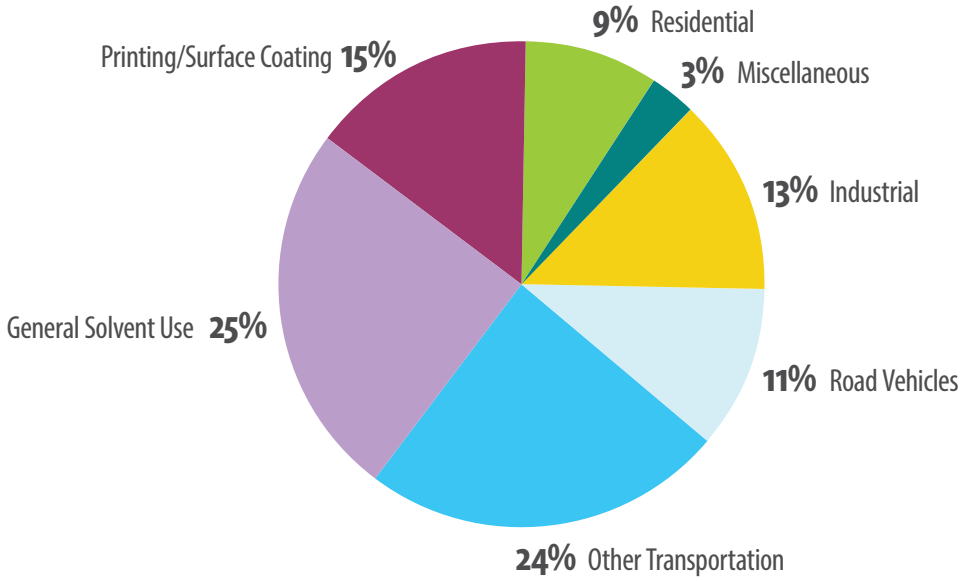
Ozone is a colourless, odourless gas at typical ambient concentrations, and is a major component of smog. Ozone is not generally emitted directly into the atmosphere; the formation and transport of ozone is strongly dependent on meteorological conditions and emissions of chemical precursors, particularly NO_X and VOCs. Changing weather patterns contribute to differences in ozone concentrations hour-to-hour, day-to-day, season-to-season, and year-to-year. In Ontario, the highest concentrations of ground-level ozone are typically recorded on hot and sunny days from mainly May to September, between noon and early evening.

Ozone irritates the respiratory tract and eyes. Exposure to ozone in sensitive people can result in chest tightness, coughing and wheezing. Children who are active outdoors during the summer, when ozone levels are highest, are particularly at risk. Individuals with pre-existing respiratory disorders, such as asthma and chronic obstructive pulmonary disease (COPD), are also at risk. Ozone is associated with increased hospital admissions and premature deaths. Ozone also causes many losses in agricultural crops each year in Ontario, with visible leaf damage in many crops, garden plants and trees, especially during the summer months.

Figure 1 shows the estimates of Ontario's VOCs emissions from point, area and transportation sources. Transportation sectors accounted for approximately 35 per cent of VOCs emissions and the second largest source was general solvent use accounting for approximately 25 per cent. **Figure 2** shows the estimates for Ontario's NO_X emissions from point, area and transportation sources. The transportation sectors accounted for approximately 69 per cent of NO_X emissions (NPRI, 2014).

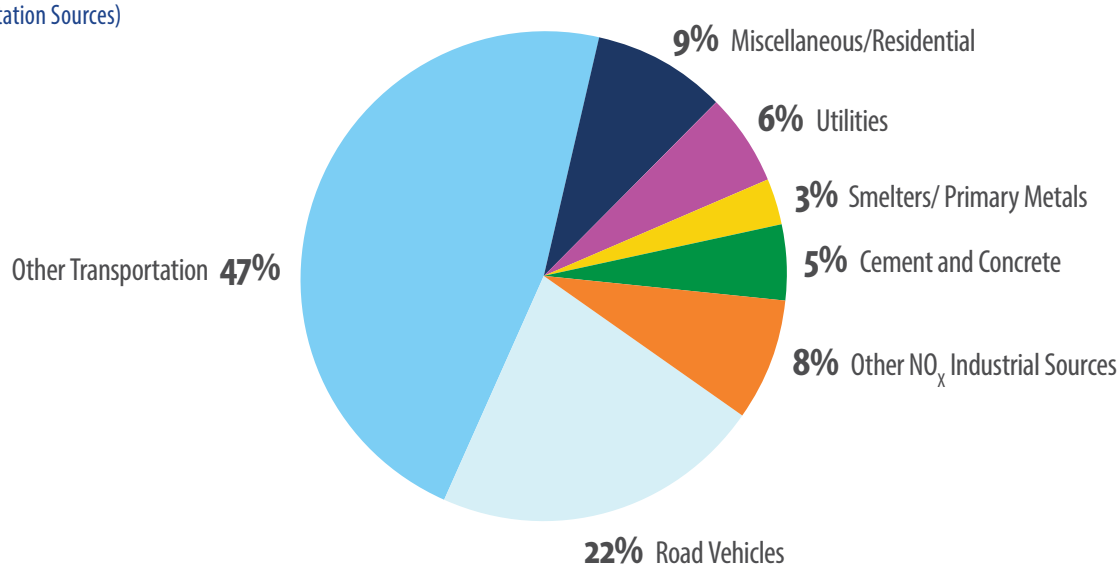
In 2013, ozone was monitored at the ministry's 40 AQI sites. The highest annual mean was 33.9 parts per billion (ppb), measured at Port Stanley, a transboundary-influenced site on the northern shore of Lake Erie. The lowest annual mean, 21.5 ppb, was measured at Toronto West, an urban site located near a major transportation corridor, Highway 401, and directly impacted by local nitric oxide (NO) emissions from vehicles. Generally, ozone concentrations are lower in urban areas because ozone is depleted by reacting with NO emitted by vehicles and other local combustion sources.

Figure 1:
Ontario VOCs Emissions by Sector
(2012 Estimates for Point/Area/
Transportation Sources)



Note: Excludes emissions from open and natural sources.

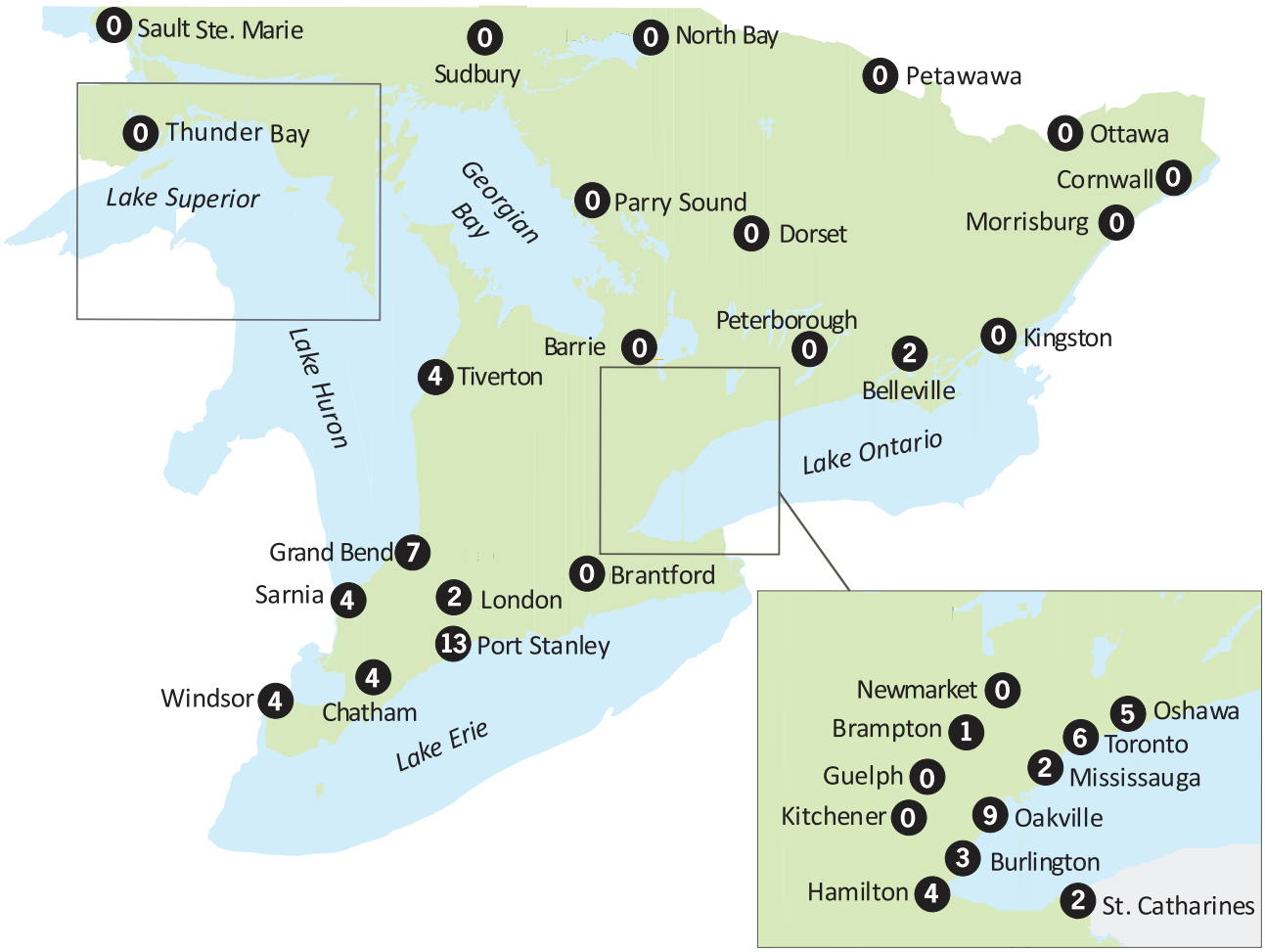
Figure 2:
Ontario NO_X Emissions by Sector
(2012 Estimates for Point/Area/
Transportation Sources)



Note: Excludes emissions from open and natural sources.

Ground-level ozone concentrations continued to exceed the provincial one-hour Ambient Air Quality Criterion (AAQC) of 80 ppb at 21 sites in 2013. These 21 sites measured ozone levels above 80 ppb for at least one hour in 2013. The maximum one-hour ozone concentrations ranged from 63 ppb recorded in Thunder Bay, to 101 ppb recorded in Oakville. Ontario's one-hour AAQC for ozone was exceeded the most often at Port Stanley on 13 occasions. The geographical distribution of one-hour ozone exceedances across the province is shown in **Figure 3.**

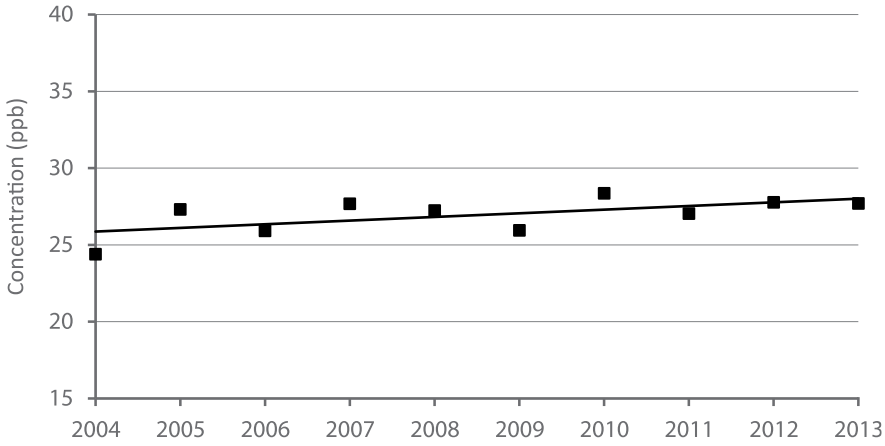
Figure 3:
Geographical Distribution of the Number of Hours Above the One-Hour Ozone AAQC Across Ontario in 2013



The ozone exceedances reported in southwestern Ontario, on the eastern shore of Lake Huron and on the northern shore of Lake Erie are typically resulting from transboundary flow of pollutants. As stated in the *Transboundary Air Pollution in Ontario* report, elevated ozone levels in southwestern Ontario are generally attributed to the long-range transport of pollutants from the United States (Yap et al, 2005).

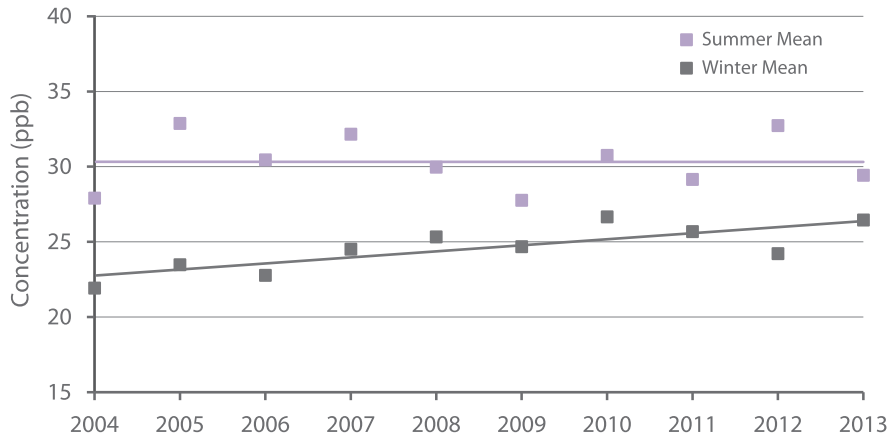
The ozone annual means in **Figure 4** display an increasing trend of 8 per cent for the 10-year period from 2004 to 2013. The trend of ozone summer means and ozone winter means are shown in **Figure 5.** The ozone summer means trend remained constant from 2004 to 2013, whereas the ozone winter means have increased by 16 per cent over the same 10-year period. The increase in the ozone winter means are mainly attributed to the rising global background concentrations which in turn drives the increasing trend of ozone annual means (Reid et al, 2008).

Figure 4:
Trend of Ozone Annual Means Across Ontario (2004-2013)



Note: 10-year trend is a composite annual mean based on data from 37 monitoring sites.

Figure 5:
Trend of Ozone Summer and Winter Means Across Ontario (2004-2013)



Note: 10-year trends are composite means for the summer and winter months based on data from 37 monitoring sites.
Summer: May - September; Winter: January - April, October - December.

3.0 Fine Particulate Matter ($PM_{2.5}$)

Airborne particulate matter is the general term used to describe a mixture of microscopic solid particles and liquid droplets suspended in air. Particulate matter is classified according to its aerodynamic size, mainly due to the different health effects associated with particles of different diameters. Fine particulate matter, denoted as $PM_{2.5}$, refers to respirable particles that are less than 2.5 micrometres in diameter, approximately 30 times smaller than the average diameter of a human hair. Due to their small size, they can penetrate deep into the lungs.

Particulate matter includes aerosols, smoke, fumes, dust, fly ash and pollen. Its composition is complex and varies with origin, residence time in the atmosphere, time of year and environmental conditions. Major components of $PM_{2.5}$ in Ontario are typically nitrates, sulphates, organic matter and particle-bound water. Higher nitrate levels are common in the cooler months whereas sulphates are more elevated during warm temperatures. Fine particulate matter may be emitted directly into the atmosphere as a by-product of fuel combustion or it may be formed indirectly in the atmosphere through a series of complex chemical reactions. Major sources of $PM_{2.5}$ include motor vehicles, smelters, power plants, industrial facilities, residential fireplaces and wood stoves, agricultural burning and forest fires.

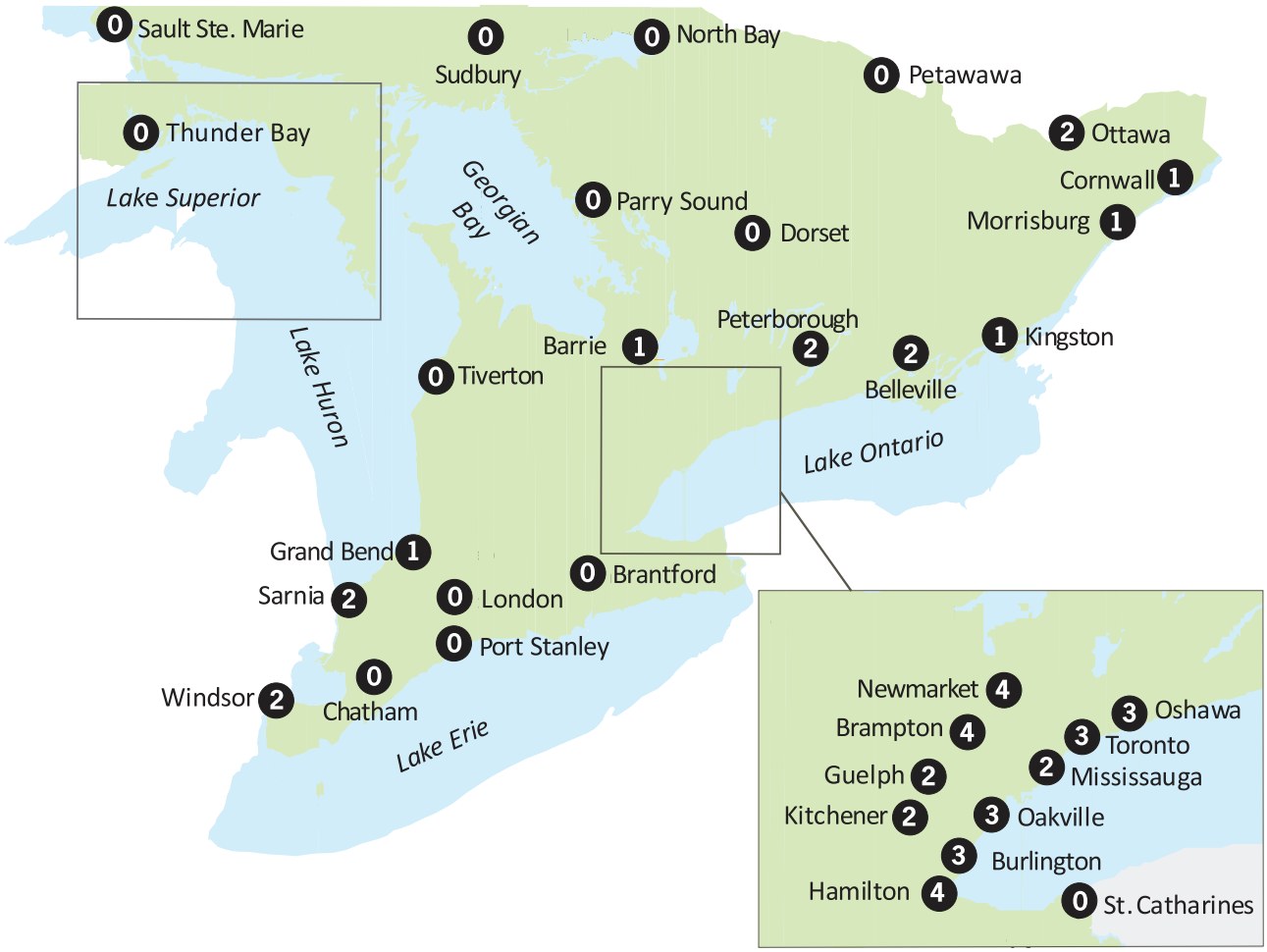
The 2012 estimates for Ontario's $PM_{2.5}$ emissions from point, area and transportation sources (excluding emissions from open and natural sources) indicate residential fuel combustion accounted for 39 per cent. The major contributor to residential emissions is fuel wood combustion in fireplaces and wood stoves. Industrial processes and transportation sectors accounted for 31 per cent and 22 per cent, respectively (NPRI, 2014).

As part of a national initiative funded by Environment Canada, Ontario upgraded all $PM_{2.5}$ monitors across the ambient air monitoring network and started reporting with this new technology as of January 2013. While annual means and maximums are reported for 2013, 10-year trends for the entire ambient air monitoring network cannot be determined since the 2013 $PM_{2.5}$ data set is not directly comparable to data collected prior to the change in monitoring technology. Ontario's new $PM_{2.5}$ measurement technology and 10-year trends are discussed further in **Section 3.1**: Technical Discussion – New $PM_{2.5}$ Measurement Technology in Ontario.

In 2013, 27 of the 40 AQI sites exceeded Ontario's 24-hour $PM_{2.5}$ reference level of 28 $\mu g/m^3$ on at least one occasion. The 2013 $PM_{2.5}$ annual mean concentrations ranged from 4.8 $\mu g/m^3$ in Petawawa to 10.1 $\mu g/m^3$ in downtown Hamilton. The $PM_{2.5}$ 24-hour maximum concentrations ranged from 16 $\mu g/m^3$ in North Bay to 55 $\mu g/m^3$ recorded in both Morrisburg and Cornwall. The $PM_{2.5}$ 24-hour maximum concentrations recorded in Morrisburg and

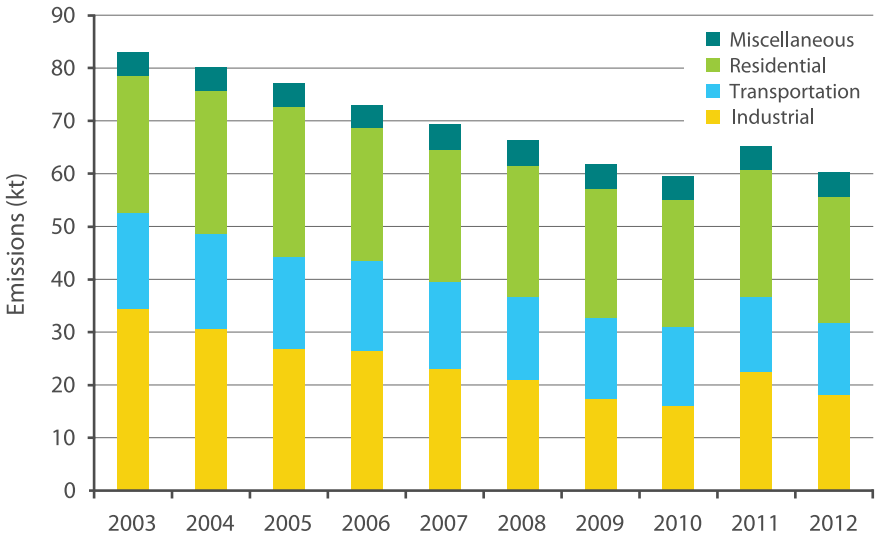
Cornwall were both recorded on July 2, 2013 due to forest fire smoke that originated in northwestern Quebec, east of James Bay (Sofowote and Dempsey, 2015). During periods of elevated concentrations of $PM_{2.5}$ in Ontario, notwithstanding forest fires, it is estimated that there are significant contributions from the U.S., specifically affecting border communities (Yap et al, 2005). The geographical distribution of 24-hour $PM_{2.5}$ exceedances above the 28 µg/m³ reference level across the province is shown in **Figure 6.**

Figure 6:
Geographical Distribution of the Number of Days Above the 24-Hour $PM_{2.5}$ Reference Level Across Ontario in 2013



Provincial $PM_{2.5}$ emissions have decreased approximately 27 per cent from 2003 to 2012 as shown in **Figure 7.** Fine particulate matter emissions from electric utilities and industrial processes have been reduced approximately 48 per cent during this period. Emissions from the transportation sector decreased 24 per cent with the phase-in of new vehicles/engines having more stringent emission standards over the same period.

Figure 7:
Ontario $PM_{2.5}$ Emissions Trends (2003-2012)



Note: Excludes emissions from open and natural sources.

3.1 Technical Discussion

New $PM_{2.5}$ Measurement Technology in Ontario

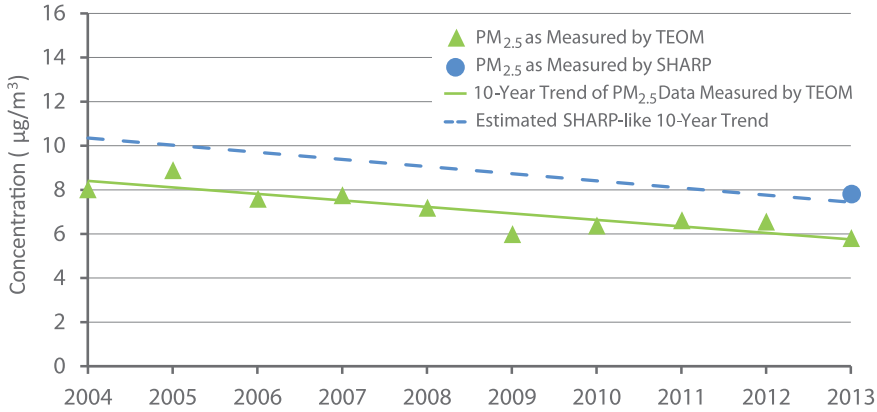
In 2002 Ontario became the first province in Canada to report hourly $PM_{2.5}$ concentrations to the public under the AQI program utilizing Tapered Element Oscillating Microbalance (TEOM) instruments that provided continuous particulate matter (PM) monitoring. Continuous PM monitoring is essential for reporting hourly ambient concentrations. The TEOM was the most innovative method at the time for continuous real-time $PM_{2.5}$ monitoring (Patashnick and Rupprecht, 1991), and continues to be used by many jurisdictions across North America.

Over the last decade, continuous $PM_{2.5}$ monitoring technologies have evolved dramatically to address the technical issues associated with cold weather $PM_{2.5}$ measurements. After extensive evaluation of four new $PM_{2.5}$ monitors, it was determined that Ontario's TEOM instruments did not perform as well as these new $PM_{2.5}$ monitors, particularly during the winter. Ontario selected the Synchronized Hybrid Ambient Real-time Particulate (SHARP) 5030 to replace the aging TEOM monitors deployed in the AQI network. As part of a national initiative funded by Environment Canada, Ontario deployed the SHARP

5030 monitors in 2012 across the ambient air monitoring network for testing. In January 2013, Ontario commenced public reporting with the new SHARP 5030 instruments. The SHARP 5030 reports higher $PM_{2.5}$ concentrations than TEOM during cold weather due to the improved performance of the SHARP 5030 (Sofowote et al, 2014). This has resulted in an increase in Ontario's $PM_{2.5}$ annual mean in 2013, however this is not an indication that the air quality has changed; only that the measurement is more accurate.

A network-wide trend using historical TEOM and 2013 SHARP data cannot be determined as the two datasets are not directly comparable. In anticipation of this, TEOM and SHARP monitors were collocated at a sub-set of the air monitoring network to continue reporting annual trends and work towards making the new $PM_{2.5}$ measurements comparable to historical data. Seven sites including Sarnia, Port Stanley, Hamilton Downtown, Toronto West, Ottawa Downtown, Cornwall and North Bay, were selected to be representative of Ontario's $PM_{2.5}$ network, taking into consideration the differences in air quality across the province. The 10-year $PM_{2.5}$ trend for these sites, using TEOM technology, continues to show a decrease of $PM_{2.5}$ levels. For the period of 2004 to 2013 a decrease of 30 per cent was observed (**Figure 8**). Additionally Ontario developed corrections for historical TEOM measurements, for the fall and winter seasons, for the purpose of making them more agreeable to SHARP measurements through a multiple linear regression analysis. This analysis, using collocated TEOM and SHARP instruments, showed that on average annual SHARP measurements were 25 per cent higher than TEOM measurements (Sofowote et al, 2014). Using this as an approximate correction factor, **Figure 8** displays an estimated SHARP-like 10-year trend that parallels the TEOM trend, and illustrates that Ontario's air quality is still improving based on the new technology.

Figure 8:
Trend of $PM_{2.5}$ Annual Means at Selected Sites Across Ontario (2004-2013)



Note: The trend is a composite mean based on data from Sarnia, Port Stanley, Hamilton Downtown, Toronto West, Ottawa Downtown, Cornwall and North Bay.
$PM_{2.5}$ concentrations as measured by TEOM operated at 30˚C with SES (2004-2013) and by SHARP 5030 (2013).

With more accurate but higher reported $PM_{2.5}$ values that come with the implementation of SHARP instruments, achievement of $PM_{2.5}$ reference levels and standards is more challenging. Nonetheless the maximum number of days any station in the province recorded daily mean concentrations above the 28 µg/m³ $PM_{2.5}$ reference level was four (observed at Hamilton Downtown, Brampton and Newmarket). Many of these days recorded above the 28 µg/m³ reference level can be attributed to forest fire smoke that originated in northwestern Quebec, east of James Bay; these include July 1, 2 and 3, 2013 for Hamilton and July 2 and 3, 2013 for both Brampton and Newmarket.

4.0 Other Air Pollutants

Nitrogen Dioxide (NO_2)

Nitrogen dioxide is a reddish-brown gas with a pungent odour, which transforms in the atmosphere to form gaseous nitric acid and nitrates. It plays a major role in atmospheric reactions that produce ground-level ozone, a major component of smog. Nitrogen dioxide also reacts in the air and contributes to the formation of $PM_{2.5}$ (Seinfeld & Pandis, 2006). All combustion in air produces NO_X, of which NO_2 is a component. Major sources of NO_X emissions include the transportation sector, industrial processes and utilities.

Nitrogen dioxide can irritate the lungs and lower their resistance to respiratory infection. People with asthma and bronchitis have increased sensitivity to NO_2. Nitrogen dioxide chemically transforms into nitric acid in the atmosphere and, when deposited, contributes to the acidification of lakes and soils in Ontario. Nitric acid can also corrode metals, fade fabrics, degrade rubber, and damage trees and crops.

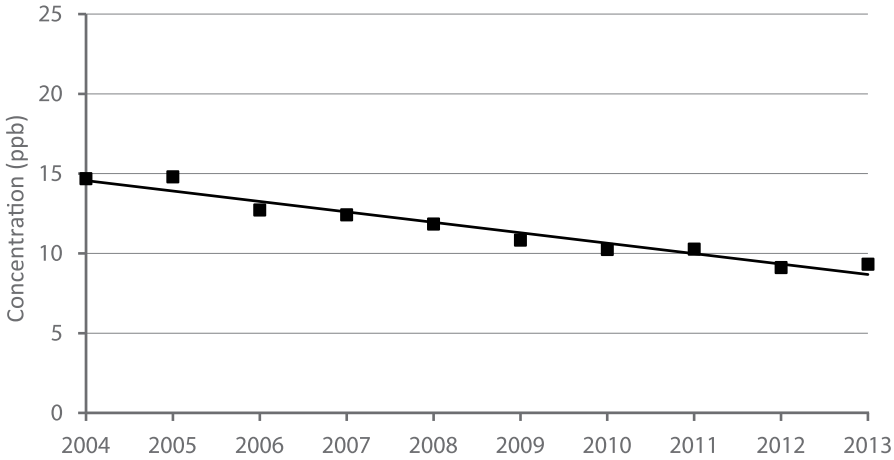
There were no exceedances of the provincial one-hour and 24-hour AAQC for NO_2, 200 ppb and 100 ppb, respectively, at any of the monitoring locations in Ontario during 2013. The Toronto West air monitoring station, located in an area of Toronto influenced by significant vehicular traffic, recorded the highest NO_2 annual mean (16.1 ppb) during 2013; whereas Tiverton, a rural site, recorded the lowest NO_2 annual mean (1.9 ppb). The highest NO_2 means were recorded in large urbanized areas, such as the Greater Toronto Area of southern Ontario. The Toronto East station recorded the highest one-hour NO_2 concentration (79 ppb), and Toronto West recorded the highest 24-hour NO_2 concentration (38 ppb).

The NO_2 annual mean concentrations across Ontario have decreased 40 per cent from 2004 to 2013, as displayed in **Figure 9.** The NO_X emission trend from 2003 to 2012 indicates a decrease of approximately 39 per cent as shown in **Figure 10** (NPRI, 2014). Ontario's emissions trading regulations on sulphur

dioxide and nitrogen oxides (O. Reg. 397/01 and O. Reg. 194/05) have contributed to the reduction in nitrogen oxides emissions in recent years. Nitrogen oxides emissions from on-road vehicles have also decreased due to the phase-in of new vehicles having more stringent emission standards. The implementation of the Ontario Drive Clean program in southern Ontario in 1999 has also helped further reduce the NO_X emissions from light duty gasoline vehicles.

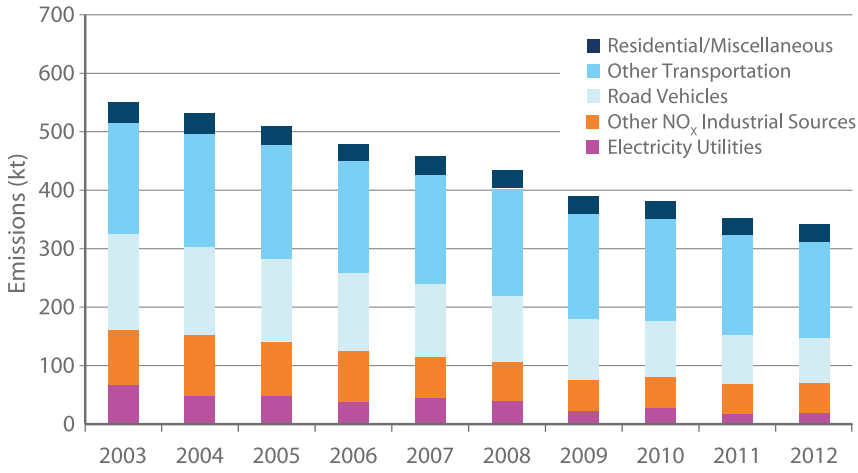
FACT: Drive Clean continues to play an important role in protecting the quality of the air we breathe by ensuring that vehicles run as cleanly as they were designed to. The program significantly contributes to the reduction of emissions that cause smog and poor air quality. Since 1999, Drive Clean has prevented 397,636 tonnes of smog-causing pollutants (hydrocarbons and nitrogen oxides) from being released into the air. In addition to these benefits, Drive Clean has also prevented the following emissions: 3.8 million tonnes of carbon monoxide (a poisonous gas), 327,000 tonnes of carbon dioxide (a greenhouse gas), and 3,340 tonnes of particulate matter (a pollutant linked to cardiac and respiratory diseases). With the introduction of the new on-board diagnostic test, a faster and more accurate way of finding emissions problems, Drive Clean will continue to ensure air quality is improved across Ontario for years to come.

Figure 9:
Trend of NO_2 Annual Means Across Ontario (2004-2013)



Note: 10-year trend is a composite mean based on data from 22 monitoring sites.

Figure 10:
Ontario NO_X Emissions Trends (2003-2012)



Note: Excludes emissions from open and natural sources.

Sulphur Dioxide (SO_2)

Sulphur dioxide is a colourless gas that smells like burnt matches. It can also be oxidized in the atmosphere to form sulphuric acid aerosols. In addition, sulphur dioxide is a precursor to sulphates, one of the main components of airborne secondary $PM_{2.5}$. Major sources of SO_2 include smelters, industrial processes and electric utilities.

Health effects caused by exposure to high levels of SO_2 include breathing problems, respiratory illness, and the exacerbation of respiratory and cardio-vascular disease. People with asthma, chronic lung disease or heart disease are the most sensitive to SO_2. Sulphur dioxide damages trees and crops. Similar to NO_2, SO_2 leads to the formation of $PM_{2.5}$ and is also a precursor to acid rain, which contributes to the acidification of soils, lakes and streams, accelerated corrosion of buildings, and reduced visibility.

Smelters in central Ontario are the major sources of SO_2 emissions in Ontario, accounting for approximately 62 per cent of the provincial SO_2 emissions according to 2012 estimates for point, area and transportation sources (excluding emissions from open and natural sources). Electric utilities and other industrial processes (e.g. petroleum refining, cement and concrete manufacturing) accounted for an additional 30 per cent. The transportation sector and miscellaneous sources accounted for the remaining 8 per cent of all SO_2 emissions in the province (NPRI, 2014).

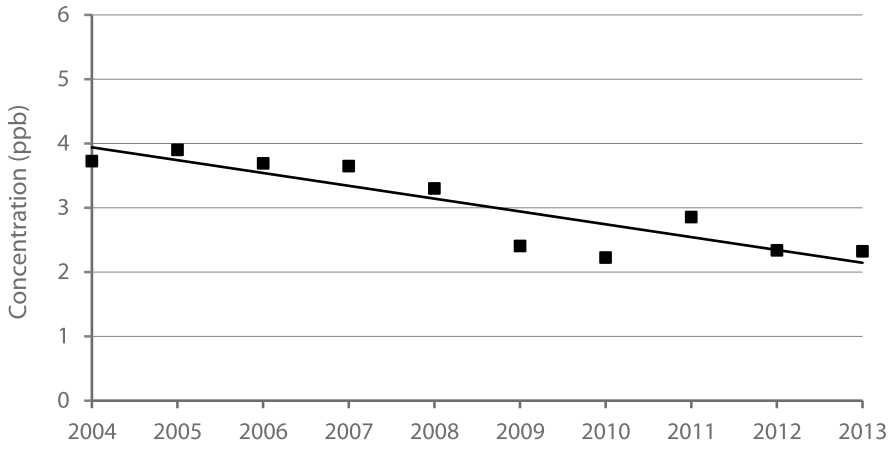
There were no exceedances of the provincial one-hour, 24-hour and annual AAQC for SO_2 of 250 ppb, 100 ppb and 20 ppb, respectively, at any of the monitoring locations in Ontario during 2013. Hamilton Downtown recorded the highest SO_2 annual mean (4.8 ppb) and 24-hour maximum concentration (43 ppb) during 2013, whereas Sudbury recorded the highest one-hour maximum concentration (198 ppb).

The SO_2 annual mean concentrations from 2004 to 2013 show a decreasing trend of 46 per cent across Ontario in **Figure 11.** Overall, provincial SO_2 emissions have decreased by approximately 51 per cent from 2003 to 2012 as shown in **Figure 12** (NPRI, 2014). The reduction of SO_2 emissions over the years is the result of various initiatives, which include, but are not limited to,

i. Control orders for Ontario smelters;
ii. Countdown Acid Rain program and Canada-wide Acid Rain Strategy;
iii. Ontario emissions trading regulations on sulphur dioxide and nitrogen oxides (O. Reg. 397/01 and O. Reg. 194/05);
iv. Phase-out of coal-fired generating stations (GS), with Lakeview GS shut down in 2005. Atikokan GS stopped using coal as fuel in September 2012 and is being converted to use biomass pellets as fuel. Two units at Lambton GS and four units at Nanticoke GS remained in a safe shutdown state in 2012. Remaining units in the two generating stations stopped using coal as fuel in 2013. Thunder Bay GS is being converted from coal to use advanced biomass as fuel in 2014; and
v. Low sulphur content in transportation fuels.

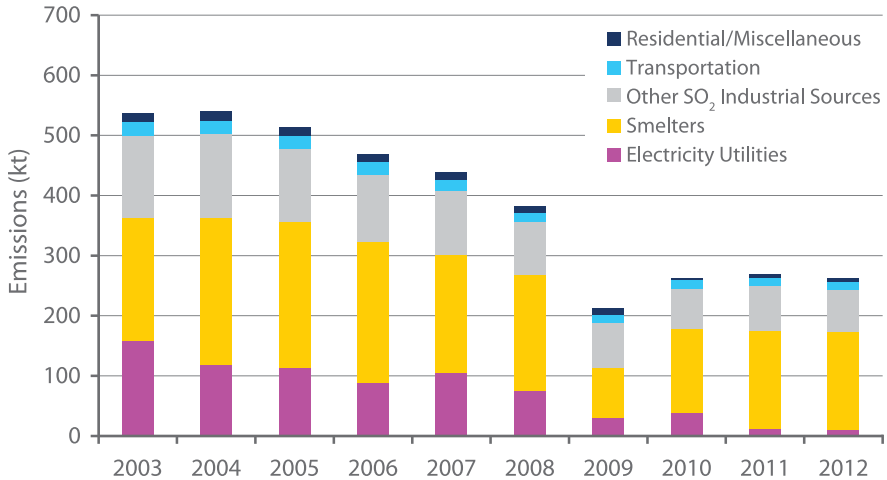
FACT: NO_X and SO_2 electricity sector emissions trading regulation (O. Reg. 397/01) placed limits on Ontario Power Generation's (OPG) fossil fuel-fired generating stations starting 2002. Effective January 1, 2004 the program also applied to independent power producers (IPPs). The trading program was expanded in 2006 to include thirty facilities from seven industrial sectors. NO_X and SO_2 for electricity generators covered under the trading program have fallen by approximately 66% and 90% respectively between 2004 and 2013, largely because of coal closure. NO_X and SO_2 emissions for the industrial facilities regulated under the program have fallen by approximately 31.8% and 26.7% between 2006 and 2013. This decline is the result of a combination of factors including emissions reduction initiatives undertaken by facilities covered by the program and industry restructuring.

Figure 11:
Trend of SO_2 Annual Means Across Ontario (2004-2013)



Note: 10-year trend is a composite mean based on 9 sites.

Figure 12:
Ontario SO_2 Emissions Trends (2003-2012)



Note: Excludes emissions from open and natural sources.

Carbon Monoxide (CO)

Carbon monoxide is a colourless, odourless, tasteless and, at high concentrations, poisonous gas. This gas can enter the bloodstream and reduce oxygen delivery to the organs and tissues. People with heart disease are particularly sensitive to CO. Exposure to high CO levels is associated with the impairment of vision, work capacity, learning ability and performance of complex tasks. Carbon monoxide is produced primarily by the incomplete combustion of fossil fuels. The 2012 estimates for point, area and transportation sources (excluding emissions from open and natural sources) indicate that the transportation sector accounted for 87 per cent of all CO emissions (NPRI, 2014).

In 2013 there were no exceedances of the provincial one-hour and eight-hour AAQC of 30 ppm and 13 ppm, respectively, at any of the monitoring locations in Ontario. Hamilton Downtown recorded the highest one-hour CO maximum of 1.95 parts per million (ppm) and Toronto West recorded the highest eight-hour maximum (1.21 ppm). Typically, higher CO concentrations are recorded in urban centres attributable to vehicle emissions.

The annual means of the one-hour and eight-hour CO maximums have decreased 42 per cent and 44 per cent, respectively, across the province from 2004 to 2013. Carbon monoxide emissions have been reduced by approximately 19 per cent from 2003 to 2012 (NPRI, 2014).

5.0 Canadian Ambient Air Quality Standards

In May of 2013 the federal government published the Canadian Ambient Air Quality Standards (CAAQS) as non-binding objectives under the Canadian Environmental Protection Act. The CAAQS were developed under the auspices of the Canadian Council of Ministers of the Environment as outdoor air quality targets that "set the bar" for air quality actions across the country.

The CAAQS replaced the existing Canada-wide Standards (CWS) for ozone and $PM_{2.5}$ in 2013 by setting stricter targets, and introducing an annual standard for $PM_{2.5}$. An annual standard helps protect human health from long-term or chronic exposure to fine particles. The purpose of the CAAQS is to drive continuous improvement in air quality. Ambient air quality will be measured against these new standards for the first time in 2015 to determine management levels for air zones. **Table 5.1** shows the standards for the 2015 target date for achieving the CAAQS.

Table 5.1:
CCME Standards

Type	Ozone 8h	$PM_{2.5}$ 24h	$PM_{2.5}$ Annual
CAAQS	63 ppb[1]	28 µg/m^3 [2]	10 µg/m^3 [3]
CWS[4]	65 ppb[1]	30 µg/m^3 [2]	no standard

[1] based on the annual 4th highest daily maximum eight-hour running average, averaged over three consecutive years.

[2] based on the 98th percentile measurement annually, averaged over three consecutive years.

[3] based on the annual mean averaged over three consecutive years.

[4] replaced in 2013 by the CAAQS.

Table 5.2 displays the ozone and $PM_{2.5}$ CAAQS metric values for designated Ontario sites for 2013 (based on a three-year average, 2011-2013). The 2013 ozone CAAQS metric values ranged from 55 ppb reported for Thunder Bay to 77 ppb reported for Windsor Downtown. Only two of the 21 designated sites, Ottawa and Thunder Bay, met the CAAQS of 63 ppb for ozone in 2013. The 2013 24-hour $PM_{2.5}$ CAAQS metric values ranged from 13.6 µg/m^3 reported for Sudbury to 24.1 µg/m^3 reported for Hamilton Downtown. The 2013 annual $PM_{2.5}$ CAAQS metric concentrations ranged from 4.5 µg/m^3 reported for Sudbury to 8.8 µg/m^3 reported for Hamilton Downtown. There were no exceedances of either $PM_{2.5}$ CAAQS in 2013 at any of the 21 designated sites.

Table 5.2:
Ozone and $PM_{2.5}$ CAAQS Metric Values for Designated Sites Across Ontario (2013)

City/Town	8h Ozone (ppb)	24h $PM_{2.5}$ µg/m^3	Annual $PM_{2.5}$ µg/m^3
Windsor Downtown	77	20	8.1
Chatham	74	18	6.9
London	71	19	7.2
Brantford	72	19	7.1
Kitchener	68	19	6.9
Guelph	70	18	6.6
St. Catharines	69	18	7.0
Hamilton Downtown	66	24	8.8
Hamilton Mountain	71	21	7.4
Burlington	68	20	7.1
Oakville	69	18	6.8
Mississauga	67	18	6.6
Brampton	70	18	6.7
Toronto	70	19	7.3
Oshawa	67	18	6.1
Barrie	65	18	6.3
Peterborough	69	17	5.9
Kingston	71	21	6.7
Ottawa Downtown	59	16	5.5
Sudbury	65	14	4.5
Thunder Bay	55	14	5.0

Note:

Designated sites include communities with populations greater than 100,000.

The CAAQS for ozone is based on the consecutive three year average of the annual 4th highest daily maximum eight-hour running average.

The CAAQS for 24h $PM_{2.5}$ is based on the 98th percentile measurement annually, averaged over three consecutive years.

The CAAQS for annual $PM_{2.5}$ is based on the annual mean averaged over three consecutive years.

Toronto reporting is based on Toronto Downtown, Toronto North, Toronto East and Toronto West stations.

Red font indicates an exceedance of the CAAQS.

Outdoor concentrations of ozone and $PM_{2.5}$ can be influenced by emission sources that are outside the control of provinces and territories, such as transboundary flows and exceptional events including forest fires. The *Guidance Document on Achievement Determination for the Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone (2012)* guides provinces and territories in the consideration of transboundary flows and exceptional events when implementing management actions, and in conveying to the public that a standard was not achieved as a result of these influences.

To demonstrate the influence of transboundary flows, a preliminary weight of evidence (WOE) analysis was conducted for selected sites, Windsor Downtown, Toronto, Sudbury and Kitchener, where the ozone CAAQS was exceeded in 2013. A comprehensive network review for transboundary influence will be completed for 2015, the first year that achievement will be assessed relative to the CAAQS. The WOE approach consists of performing, evaluating and documenting a series of technical analyses that collectively support the conclusion that exceedances of the standard on a given day were influenced by, in this case, transboundary flows. **Table 5.3a** shows the 2013 ozone CAAQS metric values including and excluding transboundary flow days for Windsor Downtown, Toronto, Sudbury and Kitchener. The WOE approach confirms that these four Ontario cities listed in **Table 5.3a** would have met the ozone CAAQS if they had not been influenced by days with transboundary flow. **Table 5.3b** displays the number of transboundary flow days that were removed for each of the four sites.

Table 5.3a:
Ozone CAAQS Metric Values Using the Weight of Evidence Approach (2013)

City	Transboundary Flow Days	4th Highest Daily Max 8h Running Average			3y CAAQS Metric Value
		2011	2012	2013	
Windsor Downtown	included	80.3	82.9	68.0	77
	excluded	55.8	62.3	57.4	58
Toronto	included	65.5	76.3	67.2	70
	excluded	52.9	53.8	62.0	56
Sudbury	included	60.5	72.8	60.8	65
	excluded	60.5	52.3	60.8	58
Kitchener	included	65.6	73.5	65.6	68
	excluded	54.6	58.5	54.6	56

Note:
Ozone concentrations reported in ppb.
Red font indicates an exceedance of the CAAQS.

Table 5.3b:
Number of Transboundary Flow Days Removed by Year

City/Town	2011	2012	2013
Windsor Downtown	52	40	17
Toronto	27	43	4
Sudbury	0	27	0
Kitchener	20	30	19

Transboundary influences, mainly from the U.S., account for approximately half of Ontario's smog on high concentration days. Emission reductions in Ontario and the U.S. have contributed to decreases in $PM_{2.5}$ and ozone precursors. However, while ambient concentrations have improved, the province continues to experience high levels of ozone due to transboundary air pollution which can result in exceedances of the ozone standard. It is therefore important to consider the influence of transboundary flows using WOE for each designated monitoring station when reporting on achievement of the CAAQS.

6.0 Air Quality Index and Smog Advisories

Ontario Air Quality Index (AQI)

The Air Quality Office of the Environmental Monitoring and Reporting Branch continuously obtains near real-time data for criteria pollutants from 40 AQI sites as displayed in **Map A1** of the Appendix. The AQI, based on pollutants that have adverse effects on human health and the environment, includes O_3, $PM_{2.5}$, NO_2, SO_2, CO and TRS compounds. At the end of each hour, the concentration of each pollutant measured at each site is converted into a number ranging from zero upwards using a common scale or index. The calculated number for each pollutant is a sub-index value. At a given air monitoring site, the highest sub-index value for any given hour becomes the reporting AQI for that hour. The index is a relative scale, in that the lower the index, the better the air quality. Index values between 0 and 15 are very good, 16-31 good, 32-49 moderate, 50-99 poor, and 100+ are very poor. The ministry web site, www.airqualityontario.com, provides index values, corresponding categories, and potential health and environmental effects.

The AQI network provides the public with hourly air quality information (24 hours per day, 7 days a week) from across the province. The public can access AQI readings via the ministry's web site or via the Interactive Voice Response (IVR) system. (To access an English recording, call 1.800.387. 7768, or in Toronto, call 416.246.0411. For a French recording, call 1.800.221.8852). The ministry's web site and IVR system also provide daily air quality forecasts, based on regional meteorological conditions and current pollution levels in Ontario and bordering U.S. states.

Based on the AQI categories, in 2013, Ontario reported very good to good air quality 94 per cent of the time, and moderate to poor air quality 6 per cent of the time. **Table A19** of the Appendix provides the percentage distribution of hourly AQI readings for each of the 40 monitoring sites by AQI category and the number of poor air quality days.

Smog Advisories

Smog advisories are issued to the public in advance when AQI values are expected to be in the poor category due to elevated, widespread and persistent levels, generally 3 or more hours in duration. Smog advisories are typically issued for elevated levels of O_3 and/or $PM_{2.5}$ but can be issued for other pollutants. Smog advisories are usually issued 24 hours in advance; however, if elevated smog conditions occur suddenly, and weather conditions conducive to elevated smog levels are expected to continue for several hours, a smog advisory is issued effective immediately. Note that a smog advisory is a forecast and does not necessarily mean elevated smog is a certainty since it is based on weather forecasts.

Smog advisories are issued via the ministry's web site and the ministry's IVR system (refer to Ontario's Air Quality Index section above for details), and through email notification as per the Smog Alert Network. (To receive a direct email notification of a smog advisory, visit the ministry web site and subscribe to the Smog Alert Network).

The ministry issued one smog advisory in 2013, which covered 2 days (July 2-3, 2013) due to forest fire smoke that originated in northwestern Quebec, east of James Bay. In Ontario, potential impacts of forest fires are forecasted by determining prevalent meteorological conditions and observing air pollutants at AQI monitoring stations (Sofowote and Dempsey, 2015). **Table A20** of the Appendix summarizes the number of smog advisories issued for Ontario from 2004 to 2013.

Federal Air Quality Health Index (AQHI)

In September 2006, Health Canada proposed the AQHI, an index that derives a value based on the cumulative effects of three pollutants – O_3, $PM_{2.5}$ and NO_2. It is being developed and implemented by Health Canada with the assistance of Environment Canada and all provinces. The AQHI for Canada informs the public about health risks associated with air quality and encourages the public to make their own decisions or modify their behaviour depending on how they are individually affected by air quality. As the ministry continues to collaborate with the Ministry of Health and Long-Term Care (MOHLTC) and the federal government to determine a path forward for reporting air quality in the province, Ontario is participating in the development of the national AQHI by providing Environment Canada with air quality data for a pilot program taking place in selected urban communities in Ontario including Windsor, London, Hamilton, St. Catharines, Burlington, Oakville, Mississauga, Brampton, Newmarket, Toronto, Oshawa, Peterborough, Kingston, Ottawa, Barrie, Dorset and Sault Ste. Marie. For more information on the federal AQHI and reported AQHI values for cities in the Ontario pilot program, please visit www.airhealth.ca.

Glossary

Air Quality Index - real-time information system that provides the public with an indication of air quality in cities, towns and in rural areas across Ontario.

AQI station - continuous monitoring station used to inform the public of general ambient air quality levels over an entire region (not a localized area) on a real-time basis; station reports on criteria pollutant levels that are not unduly influenced by a single emission source, but rather are the result of emissions from multiple sources, including those in neighbouring provinces and states.

Ambient air - outdoor or open air.

Annual mean - the average value of hourly data for a given year.

Carbon monoxide - a colourless, odourless, tasteless, and at high concentrations, poisonous gas.

Continuous pollutants - pollutants for which a continuous record exists; effectively, pollutants that have hourly data (maximum 8,760 values per year except leap year – e.g. 2004 where maximum values for the year are 8,784).

Continuous station - where pollutants are measured on a real-time basis and data determined hourly (for example ozone, sulphur dioxide).

Criterion - maximum concentration or level (based on potential effects) of pollutant that is desirable or considered acceptable in ambient air.

Exceedance - violation of the air pollutant concentration levels established by environmental protection criteria or other environmental standards.

Fine Particulate Matter - particles smaller than 2.5 micrometres in aerodynamic diameter, which arise mainly from fuel combustion, condensation of hot vapours and chemically-driven gas-to-particle conversion processes; also referred to as $PM_{2.5}$ or respirable particles. These are fine enough to penetrate deep into the lungs.

Fossil fuels - natural gas, petroleum, coal and any form of solid, liquid or gaseous fuel derived from organic materials for the purpose of generating heat.

Ground-level ozone - colourless gas formed from chemical reactions between nitrogen oxides and volatile organic compounds (VOCs) in the presence of sunlight near the earth's surface.

Micrometre - a millionth of a metre.

Nitrogen dioxide - a reddish-brown gas with a pungent and irritating odour.

Glossary

Oxidation - a chemical reaction where a substance gains oxygen; for example, in the atmosphere, sulphur dioxide is oxidized by hydroxyl radicals to form sulphate.

Particulate matter - the general term used to describe a mixture of microscopic solid particles and liquid droplets suspended in air.

Percentile value - percentage of the data set that is equal to or lies below the stated value; if the 70 percentile value is 0.10 ppm, then 70 per cent of the data are equal to or below 0.10 ppm.

Primary pollutant - pollutant emitted directly to the atmosphere.

Secondary pollutant - pollutant formed from other pollutants in the atmosphere.

Smog - a contraction of smoke and fog; colloquial term used for photochemical smog, which includes ozone, and may include fine particulate matter, and other contaminants; tends to be a brownish haze.

Smog advisory - smog advisories are issued to the public when there is a strong likelihood that widespread, elevated and persistent smog levels are expected.

Stratosphere - atmosphere 10 to 40 kilometres above the earth's surface.

Stratospheric ozone - ozone formed in the stratosphere from the conversion of oxygen molecules by solar radiation; ozone found there absorbs some of the sun's ultraviolet radiation and prevents it from reaching the earth.

Sulphur dioxide - a colourless gas that smells like burnt matches.

Troposphere - atmospheric layer extending from the surface up to about 10 kilometres above the earth's surface.

Acronyms

AAQC	Ambient Air Quality Criteria (Ontario)
AQI	Air Quality Index
CO	carbon monoxide
CAAQS	Canadian Ambient Air Quality Standard
IVR	Interactive Voice Response
NO	nitric oxide
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
O_3	ozone
$PM_{2.5}$	fine particulate matter
SES (TEOM)	Sample Equilibration System
SHARP	Synchronized Hybrid Ambient Real-time Particulate
SO_2	sulphur dioxide
TEOM	Tapered Element Oscillating Microbalance
TRS	total reduced sulphur
VOCs	volatile organic compounds
WOE	weight of evidence
kt	kilotonnes
$\mu g/m^3$	micrograms (of contaminant) per cubic metre (of air) – by weight
ppb	parts (of contaminant) per billion (parts of air) – by volume
ppm	parts (of contaminant) per million (parts of air) – by volume

References

1. Canadian Council of Ministers of the Environment, 2012. *Guidance Document on Achievement Determination: Canadian Ambient Air Quality Standards for Particulate Matter and Ozone.*

2. Federal Register. 2006. 40 CFR Parts 53 and 58: *Revisions to Ambient Air Monitoring Regulations; Final Rule.* 71 (200), 61236-61328. October 17, 2006.

3. NPRI, 2014. National Pollutant Release Inventory (NPRI) Downloadable Datasets. Environment Canada.

4. Ontario Ministry of the Environment. 2014. *Air Quality in Ontario 2012 Report.*

5. Patashnick, H. and E.G. Rupprecht. 1991. *Continuous PM-10 Measurements Using the Tapered Element Oscillating Microbalance.* Journal of the Air & Waste Management Association, Vol. 41, pp. 1079-1083.

6. Seinfeld, J.H. and S.N. Pandis. 2006. *Atmospheric chemistry and physics: From air pollution to climate change.* (2nd ed.) New Jersey: John Wiley & Sons Inc.

7. Sofowote, U. and F. Dempsey. 2015. *Impacts of Forest Fires on Ambient near Real-Time $PM_{2.5}$ in Ontario, Canada: Meteorological Analyses and Source Apportionment of the July 2011-2013 Episodes.* Atmospheric Pollution Research, doi: 10.5094/APR.2015.001.

8. Sofowote, U., Su, Y., Bitzos, M.M., and Munoz, A. 2014. *Improving the Correlations of Ambient TEOM $PM_{2.5}$ Data and SHARP 5030 FEM in Ontario: a Multiple Linear Regression Analysis*. Journal of the Air & Waste Management Association, 64:1, 104-114.

9. United States Environmental Protection Agency (USEPA). 2011. *List of Designated Reference and Equivalent Methods.* Issue Date: October 12, 2011.

10. Yap, D., Reid, N., De Brou, G. and R. Bloxam. 2005. *Transboundary Air Pollution in Ontario.* Ontario Ministry of the Environment.

Resources

1. Brook, J.R., Dann, T. and R.T. Burnett. 1997. *The Relationship among TSP, PM_{10}, $PM_{2.5}$ and Inorganic Constituents of Atmospheric Particulate Matter at Multiple Canadian Locations.* Journal of Air and Waste Management Association, Vol 46, pp. 2-18.

2. Burnett, R.T., Dales, R.E., Krewski, D., Vincent, R., Dann, T., and J.R. Brook. 1995. *Associations between Ambient Particulate Sulphate and Admissions to Ontario Hospitals for Cardiac and Respiratory Diseases*. American Journal of Epidemiology, Vol 142, pp. 15-22.

3. Fraser, D., Yap, D., Kiely, P. and D. Mignacca. 1991. *Analysis of Persistent Ozone Episodes in Southern Ontario 1980-1991.* Technology Transfer Conference, Toronto, 1991. Proceedings AP14, pp. 222-227.

4. Geddes, J.A., Murphy, J.G., and D.K.Wang. 2009. *Long term changes in nitrogen oxides and volatile organic compounds in Toronto and the challenges facing local ozone control.* Atmospheric Environment, Vol. 43, pp. 3407-3415.

5. Itano, Y., Bandow, H., Takenaka, N., Saitoh, Y., Asayama, and A., J. Fukuyama. 2007. *Impact of NO_X reduction on long-term ozone trends in an urban atmosphere.* Science of the Total Environment, Vol. 379, pp. 46-55.

6. Lin, C.C.-Y., Jacob, D.J., Munger, J.W., and A.M. Fiore. 2000. *Increasing Background Ozone in Surface Air Over the United States.* Geophysical Research Letters, Vol. 27 (21), pp. 3465-3468.

7. Lioy, P. 1991. *Assessing Human Exposure to Airborne Pollutants.* Environmental Science and Technology, Vol. 25, pp. 1360.

8. Lipfert, F.W. and T. Hammerstrom. 1992. *Temporal Patterns in Air Pollution and Hospital Admissions.* Environmental Research, Vol. 59, pp. 374-399.

9. Lippmann, M. 1991. *Health Effects of Tropospheric Ozone.* Environmental Science and Technology, Vol. 25, No. 12, pp. 1954-1962.

10. Logan, J. A., Staehelin, J., Megretskaia, I. A., Cammas, J.-P., Thouret, V., Claude, H., Backer, H. D., Steinbacher, M., Scheel, H.-E., Stubi, R., Frohlich, M., and R. G. Derwent. 2012. *Changes in ozone over Europe: Analysis of ozone measurements from sondes, regular aircraft (MOZAIC) and alpine surface sites.* Journal of Geophysical Research, 117, D09301, doi:10.1029/2011JD016952.

Resources

11. Ontario Ministry of the Environment, 2011. Publications. Ontario Ministry of the Environment. http://www.airqualityontario.com/press/publications.php.

12. Pengelly, L.D., Silverman, F. and C.H. Goldsmith. 1992. *Health Effects of Air Pollution Assessed Using Ontario Health Survey Data.* Urban Air Group, McMaster University.

13. Reid, N., Yap, D., and R. Bloxam. 2008. *The potential role of background ozone on current and emerging air issues: An overview.* Air Quality, Atmosphere & Health, Vol. 1, pp. 19-29.

14. *Rethinking the Ozone Problem in Urban and Regional Air Pollution.* National Academy Press, Washington, D.C., 1991.

15. United States Environmental Protection Agency. 2003. *Latest Findings on National Air Quality, 2002 Status and Trends.*

16. United States Environmental Protection Agency. 2003. *National Air Quality and Emission Trends, 2003 Special Studies Edition.*

17. United States Environmental Protection Agency. 2004. *Particle Pollution Report, Current Understanding of Air Quality and Emissions through 2003.*

18. Vingarzan, R. 2004. *A review of surface ozone background levels and trends.* Atmospheric Environment, Vol. 38, pp. 3431-42.

19. Wolff, G.T., Kelley, N.A. and M.A. Ferman. 1982. *Source Regions of Summertime Ozone and Haze Episodes in the Eastern U.S.* Water, Air and Soil Pollution, 18: pp. 65-81.

20. Yap, D., Ning, D.T. and W. Dong. 1988. *An Assessment of Source Contribution to the Ozone Concentrations in Southern Ontario.* Atmospheric Environment, Vol. 22, No. 6, pp. 1161-1168.

Air Quality in Ontario

2013 Appendix

The **Appendix** is intended for use in conjunction with the *2013 Annual Air Quality in Ontario Report.* The Appendix briefly describes the provincial Air Quality Index (AQI) network, quality assurance and quality control procedures, and the Ministry of the Environment and Climate Change's air quality database. It also includes a series of tables displaying station locations and a listing of the summary statistics including means, maximums, percentile values and the number of exceedances of the Ontario Ambient Air Quality Criteria (AAQC) for each pollutant. In addition, trends for select pollutants are displayed for 10- and 20-year periods.

Monitoring Network Operations

Network Description

In 2013, the Environmental Monitoring and Reporting Branch (EMRB) operated 40 ambient air monitoring sites across Ontario as part of the AQI network. Monitoring site locations for the AQI network are illustrated in **Map A1.** The AQI network was comprised of 134 continuous monitoring instruments at 40 sites. These instruments have the capability of recording minute data (approximately 70 million data points per year) that are used to scan and validate the continuous hourly data.

Quality Assurance and Quality Control

Day-to-day maintenance and support of the instruments are administered by EMRB staff. Instrumentation precision is verified by daily automatic internal zero and span checks. Data analysts and station operators review span control charts to confirm instrument precision using a telemetry system. A quarterly quality assurance and quality control (QA/QC) review is performed on the ambient data set in order to highlight anomalies and administer corrective action in a timely manner.

The air monitoring station operators routinely inspect and maintain monitoring equipment and stations with mandatory bi-monthly on-site visits where secondary transfer standards are used to calibrate instrumentation. Station activity is recorded using FieldWorker Inc. software, an electronic documentation solution; this information is transferred directly to the ministry's database. The instrumentation used throughout the provincial air monitoring network has been standardized to Thermo Electron Corporation analyzers in an effort to streamline parts inventory and leverage common hardware used within each analyzer. The following is a summary of the instrumentation deployed within the network:

- Ozone – TE49C/I
- Fine Particulate Matter – SHARP 5030
- Nitrogen Oxides – TE42C/I
- Carbon Monoxide – TE48C/I
- Total Reduced Sulphur – TE43C/CDN 101
- Sulphur Dioxide – TE43C/I

EMRB operates a laboratory with gas reference standards that adhere to those of the U.S. National Institute of Standards and Technology (NIST) and the Air Quality Research Division of Environment Canada. The secondary transfer standards used by station operators are referenced and certified to EMRB's NIST primary standards on a quarterly basis.

The Ontario ambient air quality monitoring network undergoes constant maintenance to ensure a high standard of quality control. Continuous real-time data are consistently reviewed, assessed and validated by EMRB staff. Immediate actions are taken to correct any inconsistencies that may affect the validity of the data. These measures ensure ambient air monitoring data are valid, complete, comparable, representative and accurate. As a result, the 2013 ambient air quality monitoring network had greater than 98 per cent valid data from over one million hourly data points.

Data Base

The ambient air quality data used in this report are stored in the ministry's air quality information system (AQUIS). A statistical pattern test is used to identify data anomalies, such as unusual pollutant concentrations. Each pollutant has a predetermined concentration range based on historical data. Values outside this range are flagged for further investigation.

Data obtained from automated ambient air monitoring instruments that operate continuously to produce an average measurement for every hour for a possible total of 8,760 measurements in a given year. Hourly parameters measured include O_3, $PM_{2.5}$, $NO/NO_2/NO_X$, CO, SO_2 and TRS compounds. A valid annual mean requires at least 6,570 hourly readings. In addition, the 2nd and 3rd quarters of the year should have 75 per cent valid data for ozone, whereas for $PM_{2.5}$, each quarter of the year should have 75 per cent valid data.

Network Descriptive Table, Annual Statistics and Trends

The AQI network for 2013 is summarized in **Table A1.** The table displays the station name, numerical identifier and pollutants measured. The numerical identifier is the station (ID) number, the first digit of which identifies the geographic region in which the station is located.

Table A1 also identifies the type of air monitoring site: ambient, road-side, Canadian Ambient Air Quality Standard (CAAQS), and/or National Air Pollution Surveillance (NAPS). Ambient sites represent the general air quality of an area without any direct influence of local industrial sources. Road-side sites are within approximately 100 m of a major roadway with daily traffic volumes greater than 10,000 vehicles per day.

The 2013 statistical data and 10-year trends for various continuous pollutants are provided in **Tables A2-A9,** and **Tables A10-A18,** respectively. To be included in the 10-year trend analysis, a site must have valid annual means for a minimum of 8 years over the 10-year period from 2004-2013. The 20-year trends for ozone, NO_2 and SO_2 are provided in **Figures A1-A26, Figures A27-A40,** and **Figures A41-A48,** respectively. To be included in the 20-year trend analysis, a site must have valid annual means for a minimum of 15 years over the 20-year period from 1994-2013. A linear regression was applied to each of the 20-year trends presented to calculate the per cent change in concentrations over time.

Map A1: Air Quality Index (AQI) Monitoring Sites Across Ontario in 2013

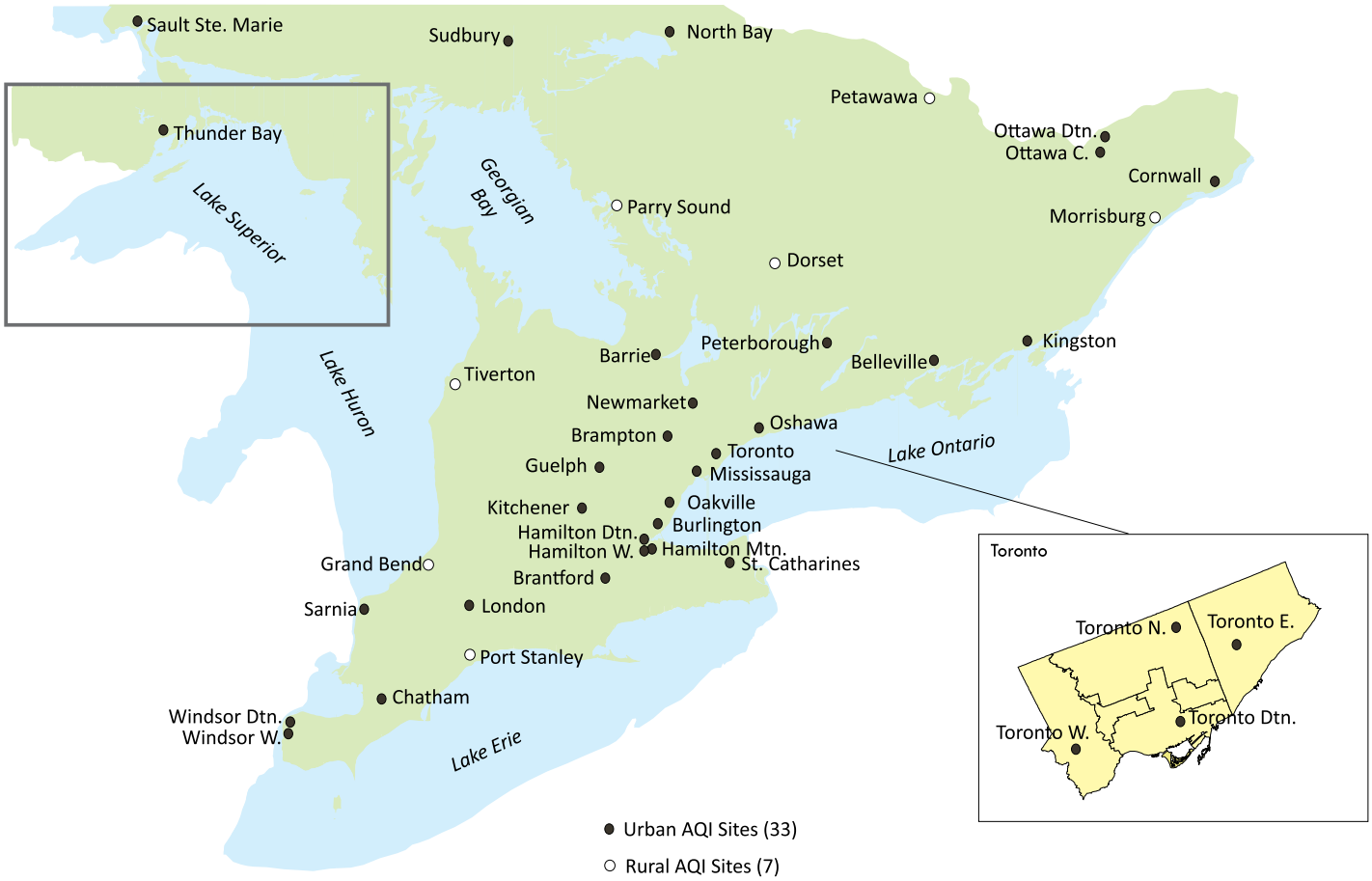


Table A1: 2013 Ontario Continuous Ambient Air Monitoring Network

ID	STATION NAME	STATION LOCATION	YEAR	LATITUDE (D:M:S)	LONGITUDE (D:M:S)	AIR INTAKE (AGL)	TYPE	AQI	O_3	$PM_{2.5}$	NO_2	SO_2	CO	TRS
12008	Windsor Downtown	467 University Ave. W.	1969	42°18'56.8"	-83°02'37.2"	8	A/RS/C/N	Y	T	T	T	T	T	.
12016	Windsor West	College Ave./South St.	1975	42°17'34.4"	-83°04'23.3"	4	A/N	Y	T	T	T	T	.	T
13001	Chatham	435 Grand Ave. W.	2005	42°24'13.3"	-82°12'29.9"	15	A/C/N	Y	T	T	T	.	.	.
14064	Sarnia	Front St. N./CN Tracks, Centennial Park	1978	42°58'56.2"	-82°24'18.3"	3	A/N	Y	T	T	T	T	.	T
15020	Grand Bend	Point Blake Conservation Area	1991	43°19'59.1"	-81°44'34.4"	5	A/N	Y	T	T	T	.	.	.
15026	London	42 St. Julien St.	2013	42°58'28.1"	-81°12'03.1"	5	A/C/N	Y	T	T	T	.	.	.
16015	Port Stanley	43665 Dexter Line, Elgin Water T. Plant	2002	42°40'19.5"	-81°09'46.4"	5	A/N	Y	T	T	.	.	.	.
18007	Tiverton	4th Concession/Bruce Rd. 23	1979	44°18'52.1"	-81°32'59.0"	4	A/N	Y	T	T	T	.	.	.
21005	Brantford	324 Grand River Ave.	2004	43°08'19.0"	-80°17'33.5"	5	A/C/N	Y	T	T	T	.	.	.
26060	Kitchener	West Ave./ Homewood Ave.	1990	43°26'37.8"	-80°30'13.7"	5	A/C/N	Y	T	T	T	.	.	.
27067	St. Catharines	Argyle Cres., Pump Stn.	1987	43°09'36.2"	-79°14'05.1"	4	A/C/N	Y	T	T	T	.	.	.
28028	Guelph	Exhibition St./Clark St. W.	2000	43°33'05.8"	-80°15'51.0"	4	A/C/N	Y	T	T	T	.	.	.
29000	Hamilton Downtown	Elgin St./Kelly St.	1987	43°15'28.0"	-79°51'42.0"	4	A/RS/C/N	Y	T	T	T	T	T	T
29114	Hamilton Mountain	Vickers Rd./E. 18th St.	1985	43°13'45.9"	-79°51'46.0"	3	A/C/N	Y	T	T	T	T	.	.
29118	Hamilton West	Main St. W./Hwy 403	1985	43°15'26.8"	-79°54'27.9"	3	A/RS	Y	T	T	T	.	.	.
31103	Toronto Downtown	Bay St./Wellesley St. W.	2000	43°39'46.7"	-79°23'17.2"	10	A/RS/C/N	Y	T	T	T	.	.	.
33003	Toronto East	Kennedy Rd./ Lawrence Ave. E.	1970	43°44'52.5"	-79°16'26.6"	4	A/RS/C/N	Y	T	T	T	.	.	.
34020	Toronto North	Hendon Ave./Yonge St.	1988	43°46'53.8"	-79°25'03.8"	5	A/RS/C/N	Y	T	T	T	.	.	.
35125	Toronto West	125 Resources Rd.	2003	43°42'34.0"	-79°32'36.6"	8	A/RS/C/N	Y	T	T	T	T	T	.
44008	Burlington	North Shore Blvd. E./ Lakeshore Rd.	1979	43°18'54.4"	-79°48'09.5"	5	A/C/N	Y	T	T	T	.	.	.
44017	Oakville	Eighth Line/Glenashton Dr., Halton Reservoir	2003	43°29'12.9"	-79°42'08.2"	12	A/C/N	Y	T	T	T	.	.	.
45026	Oshawa	2000 Simcoe St. N., Durham College	2005	43°56'45.4"	-78°53'41.7"	7	A/RS/C/N	Y	T	T	T	.	.	.
46089	Brampton	525 Main St. N., Peel Manor	2000	43°41'55.5"	-79°46'51.3"	5	A/C/N	Y	T	T	T	.	.	.
46108	Mississauga	3359 Mississauga Rd. N., U of T Mississauga	2007	43°32'49.1"	-79°39'31.3"	5	A/C/N	Y	T	T	T	T	.	.
47045	Barrie	83 Perry St.	2001	44°22'56.5"	-79°42'08.3"	5	A/C/N	Y	T	T	T	.	.	.

Table A1: 2013 Ontario Continuous Ambient Air Monitoring Network (continued)

ID	STATION NAME	STATION LOCATION	YEAR	LATITUDE (D:M:S)	LONGITUDE (D:M:S)	AIR INTAKE (AGL)	TYPE	AQI	O_3	$PM_{2.5}$	NO_2	SO_2	CO	TRS
48006	Newmarket	Eagle St. W./ McCaffrey Rd.	2001	44°02'39.5"	-79°28'59.7"	5	A/N	Y	T	T	T	.	.	.
49005	Parry Sound	7 Bay St.	2001	45°20'16.3"	-80°02'17.4"	5	A/N	Y	T	T	T	.	.	.
49010	Dorset	1026 Bellwood Acres Rd.	1981	45°13'27.4"	-78°55'58.6"	3	A/N	Y	T	T	.	.	.	.
51001	Ottawa Downtown	Rideau St./ Wurtemburg St.	1971	45°26'03.6"	-75°40'33.6"	4	A/C/N	Y	T	T	T	T	T	.
51002	Ottawa Central	960 Carling Ave.	2007	45°22'57.1"	-75°42'51.1"	5	A/N	Y	T	T	T	.	.	.
51010	Petawawa	Petawawa Research Forest Facility	2007	45°59'48.2"	-77°26'28.3"	6	A/N	Y	T	T	.	.	.	.
52022	Kingston	752 King St. W.	2006	44°12'58.5"	-76°31'41.9"	13	A/C/N	Y	T	T	T	.	.	.
54012	Belleville	2 Sidney St., Water Treatment Plant	2002	44°09'01.9"	-77°23'43.8"	10	A/N	Y	T	T	T	.	.	.
56010	Morrisburg	County Rd. 2, Morrisburg Water Tower	2005	44°53'59.1"	-75°11'23.8"	5	A/N	Y	T	T	.	.	.	.
56051	Cornwall	Bedford St./3rd St. W.	1970	45°01'04.7"	-74°44'06.8"	4	A/N	Y	T	T	T	.	.	.
59006	Peterborough	10 Hospital Dr.	1998	44°18'06.9"	-78°20'46.4"	10	A/C/N	Y	T	T	T	.	.	.
63203	Thunder Bay	421 James St. S.	2004	48°22'45.8"	-89°17'24.6"	15	A/RS/C/N	Y	T	T	T	.	.	.
71078	Sault Ste. Marie	Sault College	2004	46°31'59.5"	-84°18'35.7"	8	A/N	Y	T	T	T	T	.	T
75010	North Bay	Chippewa St. W., Dept. National Defence	1979	46°19'23.5"	-79°26'57.4"	4	A/RS/N	Y	T	T	T	.	.	.
77233	Sudbury	155 Elm St.	2013	46°29'31.0"	-81°00'11.2"	3	A/C/N	Y	T	T	T	T	.	.
TOTAL								**40**	**40**	**40**	**36**	**10**	**4**	**4**

Notes:
ID - station identfication number
Year - year station began monitoring
Air intake - height of air intake above ground (m)
Type - type of monitoring site: A = ambient, RS = road-side, C = CAAQS, N = NAPS
AQI - Air Quality Index site
T - telemetry
O_3 - ground-level ozone
$PM_{2.5}$ - fine particulate matter
NO_2 - nitrogen dioxide
CO - carbon monoxide
SO_2 - sulphur dioxide
TRS - total reduced sulphur

Table A2: 2013 Ozone (O_3) Annual Statistics

Unit: parts per billion (ppb)
O_3 1h AAQC: 80 ppb

ID	City	Location	PERCENTILES								Maximum		No. of Times Above Criterion
			Valid h	10%	30%	50%	70%	90%	99%	Mean	1h	24h	1h
12008	Windsor Downtown	467 University Ave. W.	8722	9	19	26	33	45	63	26.9	89	58	4
12016	Windsor West	College Ave./South St.	8539	8	19	26	34	45	61	26.7	87	57	3
13001	Chatham	435 Grand Ave. W.	8723	14	23	29	35	45	65	29.6	85	61	4
14064	Sarnia	Front St. N./CN Tracks, Centennial Park	8675	12	22	29	35	44	62	28.6	83	54	4
15020	Grand Bend	Point Blake Conservation Area	8717	17	26	32	38	46	66	32.3	86	60	7
15026	London	42 St. Julien St.	8639	10	22	29	35	45	63	28.7	82	55	2
16015	Port Stanley	43665 Dexter Line, Elgin Water T. Plant	8741	19	27	33	39	49	70	33.9	85	68	13
18007	Tiverton	4th Concession/Bruce Rd. 23	8666	19	27	32	37	45	63	32.4	92	61	4
21005	Brantford	324 Grand River Ave.	8727	10	22	29	36	46	63	29.0	74	57	0
26060	Kitchener	West Ave./Homewood Ave.	8723	11	22	28	35	44	59	28.0	72	54	0
27067	St. Catharines	Argyle Cres., Pump Stn.	8731	11	23	29	35	45	61	28.6	96	57	2
28028	Guelph	Exhibition St./Clark St. W.	8730	12	23	29	36	45	61	29.0	73	57	0
29000	Hamilton Downtown	Elgin St./Kelly St.	8720	9	19	24	30	41	59	25.0	86	58	3
29114	Hamilton Mountain	Vickers Rd./E. 18th St.	8608	13	23	29	36	45	62	29.5	86	58	4
29118	Hamilton West	Main St. W./Hwy 403	8679	5	18	25	32	40	57	24.4	78	54	0
31103	Toronto Downtown	Bay St./Wellesley St. W.	8743	10	19	25	32	43	60	26.2	90	54	3
33003	Toronto East	Kennedy Rd./Lawrence Ave. E.	8695	7	17	24	30	40	60	24.1	87	58	3
34020	Toronto North	Hendon Ave./Yonge St.	8723	9	19	25	31	40	60	25.3	87	56	6
35125	Toronto West	125 Resources Rd.	8670	3	13	20	28	39	60	21.5	83	53	3
44008	Burlington	North Shore Blvd. E./Lakeshore Rd.	8623	8	19	26	33	43	60	26.4	92	58	3
44017	Oakville	Eighth Line/Glenashton Dr., Halton Res.	8742	11	21	28	35	44	63	28.3	101	59	9
45026	Oshawa	2000 Simcoe St. N., Durham College	8737	12	21	28	33	41	59	27.2	96	53	5

Table A2: 2013 Ozone (O_3) Annual Statistics (continued)

Unit: parts per billion (ppb)
O_3 1h AAQC: 80 ppb

ID	City	Location	PERCENTILES								Maximum		No. of Times Above Criterion
			Valid h	10%	30%	50%	70%	90%	99%	Mean	1h	24h	1h
46089	Brampton	525 Main St. N., Peel Manor	8734	8	20	27	34	43	60	26.7	84	57	1
46108	Mississauga	3359 Mississauga Rd. N., U of T Campus	8733	6	19	26	32	41	59	25.2	83	57	2
47045	Barrie	83 Perry St.	8722	9	20	26	32	39	53	25.5	73	50	0
48006	Newmarket	Eagle St. W./McCaffrey Rd.	8671	13	23	29	35	43	59	28.7	72	56	0
49005	Parry Sound	7 Bay St.	8746	16	25	31	36	44	61	30.4	77	57	0
49010	Dorset	1026 Bellwood Acres Rd.	8721	11	22	29	35	43	57	28.1	69	50	0
51001	Ottawa Downtown	Rideau St./Wurtemburg St.	8560	10	19	26	32	40	54	25.6	67	49	0
51002	Ottawa Central	960 Carling Ave.	8647	10	21	27	33	42	55	26.6	70	50	0
51010	Petawawa	Petawawa Research Forest Facility	8722	12	21	28	34	43	56	27.6	69	55	0
52022	Kingston	752 King St. W.	8635	18	25	30	35	43	59	30.3	79	59	0
54012	Belleville	2 Sidney St., Water Treatment Plant	8633	13	23	29	34	44	63	29.2	92	58	2
56010	Morrisburg	County Rd. 2, Morrisburg Water Tower	8731	13	23	29	34	43	57	28.7	70	52	0
56051	Cornwall	Bedford St./3rd St. W.	8400	11	21	27	33	41	58	26.9	73	54	0
59006	Peterborough	10 Hospital Dr.	8725	14	23	29	34	43	60	28.6	74	53	0
63203	Thunder Bay	421 James St. S.	8690	10	20	26	34	42	51	26.3	63	47	0
71078	Sault Ste. Marie	Sault College	8730	15	24	29	34	42	57	28.9	66	56	0
75010	North Bay	Chippewa St. W., Dept. National Defence	8746	10	22	28	34	42	56	27.4	72	52	0
77233	Sudbury	155 Elm St.	8713	12	22	27	33	42	57	27.2	76	53	0

Table A3: 2013 Fine Particulate Matter ($PM_{2.5}$) Annual Statistics

Unit: micrograms per cubic metre (µg/m^3)
$PM_{2.5}$ 24h Reference Level: 28 µg/m^3

ID	City	Location	PERCENTILES								Maximum		No. of Times Above Reference Level
			Valid h	10%	30%	50%	70%	90%	99%	Mean	1h	24h	24h
12008	Windsor Downtown	467 University Ave. W.	8419	4	6	8	11	17	29	9.2	43	29	1
12016	Windsor West	College Ave./South St.	8322	3	6	9	12	18	31	10.0	58	32	2
13001	Chatham	435 Grand Ave. W.	8611	3	5	7	10	15	24	8.1	38	23	0
14064	Sarnia	Front St. N./CN Tracks, Centennial Park	8721	3	5	7	10	16	28	8.5	49	31	2
15020	Grand Bend	Point Blake Conservation Area	8531	2	4	6	9	15	28	7.3	44	30	1
15026	London	42 St. Julien St.	8528	2	5	8	11	18	30	9.1	48	28	0
16015	Port Stanley	43665 Dexter Line, Elgin Water T. Plant	8714	2	4	6	9	14	25	7.4	47	23	0
18007	Tiverton	4th Concession/Bruce Rd. 23	7368	2	3	4	7	13	24	5.8	34	22	0
21005	Brantford	324 Grand River Ave.	8444	3	5	7	10	16	31	8.5	60	27	0
26060	Kitchener	West Ave./Homewood Ave.	8561	2	4	7	10	17	32	8.7	61	37	2
27067	St. Catharines	Argyle Cres., Pump Stn.	8304	3	5	7	10	16	27	8.5	54	27	0
28028	Guelph	Exhibition St./Clark St. W.	8527	2	4	6	9	16	32	8.1	53	34	2
29000	Hamilton Downtown	Elgin St./Kelly St.	8580	3	5	8	12	20	39	10.1	74	43	4
29114	Hamilton Mountain	Vickers Rd./E. 18th St.	8305	2	5	7	11	18	37	9.2	83	42	3
29118	Hamilton West	Main St. W./Hwy 403	8477	3	5	7	12	19	37	9.6	82	40	3
31103	Toronto Downtown	Bay St./Wellesley St. W.	8500	2	4	7	10	16	30	8.3	75	33	2
33003	Toronto East	Kennedy Rd./Lawrence Ave. E.	8699	3	4	6	9	16	34	8.2	64	33	2
34020	Toronto North	Hendon Ave./Yonge St.	8703	2	5	7	10	16	33	8.3	54	32	3
35125	Toronto West	125 Resources Rd.	8442	3	5	7	10	18	33	8.8	75	34	3
44008	Burlington	North Shore Blvd. E./ Lakeshore Rd.	8676	2	5	7	10	17	33	8.7	63	36	3
44017	Oakville	Eighth Line/Glenashton Dr., Halton Res.	8631	2	4	6	10	16	30	8.0	59	34	3
45026	Oshawa	2000 Simcoe St. N., Durham College	8645	2	4	6	8	14	31	7.4	77	41	3

Table A3: 2013 Fine Particulate Matter ($PM_{2.5}$) Annual Statistics (continued)

Unit: micrograms per cubic metre (µg/m^3)
$PM_{2.5}$ 24h Reference Level: 28 µg/m^3

ID	City	Location	PERCENTILES								Maximum		No. of Times Above Reference Level
			Valid h	10%	30%	50%	70%	90%	99%	Mean	1h	24h	24h
46089	Brampton	525 Main St. N., Peel Manor	8597	2	4	7	10	17	34	8.5	152	32	4
46108	Mississauga	3359 Mississauga Rd. N., U of T Campus	8578	2	4	6	9	16	33	7.9	105	33	2
47045	Barrie	83 Perry St.	8546	2	4	6	9	15	31	7.5	88	29	1
48006	Newmarket	Eagle St. W./McCaffrey Rd.	8724	1	3	6	9	15	31	7.3	47	32	4
49005	Parry Sound	7 Bay St.	8486	2	3	4	6	12	24	5.8	52	22	0
49010	Dorset	1026 Bellwood Acres Rd.	8685	1	3	4	6	11	23	5.4	65	23	0
51001	Ottawa Downtown	Rideau St./Wurtemburg St.	8561	2	3	5	8	14	31	7.0	50	42	2
51002	Ottawa Central	960 Carling Ave.	8646	2	4	5	8	14	31	7.1	57	47	2
51010	Petawawa	Petawawa Research Forest Facility	8629	2	3	4	5	9	19	4.8	50	24	0
52022	Kingston	752 King St. W.	8401	2	4	5	7	12	26	6.5	75	50	1
54012	Belleville	2 Sidney St., Water Treatment Plant	8693	2	4	5	8	14	27	6.9	79	40	2
56010	Morrisburg	County Rd. 2, Morrisburg Water Tower	8565	2	4	5	7	13	26	6.7	91	55	1
56051	Cornwall	Bedford St./3rd St. W.	8580	2	4	6	9	15	28	7.7	70	55	1
59006	Peterborough	10 Hospital Dr.	8617	2	4	6	9	15	31	7.4	77	36	2
63203	Thunder Bay	421 James St. S.	8728	2	4	5	7	12	22	6.3	37	21	0
71078	Sault Ste. Marie	Sault College	8682	2	3	4	6	11	20	5.6	47	18	0
75010	North Bay	Chippewa St. W., Dept. National Defence	8536	2	3	4	6	10	19	5.2	38	16	0
77233	Sudbury	155 Elm St.	8665	2	3	4	6	12	23	5.7	50	24	0

Notes:
Measurements taken by Synchronized Hybrid Ambient Real-time Particulate (SHARP) 5030.

Table A4: 2013 Nitric Oxide (NO) Annual Statistics

Unit: parts per billion (ppb)

ID	City	Location		PERCENTILES							Maximum	
			Valid h	10%	30%	50%	70%	90%	99%	Mean	1h	24h
12008	Windsor Downtown	467 University Ave. W.	8706	0	1	2	3	8	38	3.7	232	41
12016	Windsor West	College Ave./South St.	8422	0	0	1	2	6	54	3.6	325	64
13001	Chatham	435 Grand Ave. W.	8721	0	0	1	2	4	15	1.6	65	12
14064	Sarnia	Front St. N./CN Tracks, Centennial Park	8424	0	1	1	1	4	15	1.7	91	13
15020	Grand Bend	Point Blake Conservation Area	8636	0	0	0	1	4	8	1.0	27	11
15026	London	42 St. Julien St.	8639	0	0	1	1	3	16	1.4	60	9
18007	Tiverton	4th Concession/Bruce Rd. 23	8255	0	0	0	0	1	2	0.1	28	2
21005	Brantford	324 Grand River Ave.	8732	0	0	1	1	2	14	1.2	99	25
26060	Kitchener	West Ave./Homewood Ave.	8459	0	0	0	1	2	29	1.6	105	28
27067	St. Catharines	Argyle Cres., Pump Stn.	8733	0	0	1	1	4	36	2.2	130	25
28028	Guelph	Exhibition St./Clark St. W.	8731	0	0	0	1	2	17	1.1	85	13
29000	Hamilton Downtown	Elgin St./Kelly St.	8730	0	1	1	3	10	48	4.3	148	32
29114	Hamilton Mountain	Vickers Rd./E. 18th St.	8613	0	0	1	1	4	27	2.0	146	24
29118	Hamilton West	Main St. W./Hwy 403	8651	0	1	2	3	13	61	5.4	149	42
31103	Toronto Downtown	Bay St./Wellesley St. W.	8744	0	0	1	2	7	27	2.7	85	17
33003	Toronto East	Kennedy Rd./Lawrence Ave. E.	8693	0	1	3	5	12	56	5.7	250	63
34020	Toronto North	Hendon Ave./Yonge St.	8722	0	1	2	3	10	42	4.1	121	36
35125	Toronto West	125 Resources Rd.	8658	0	1	3	8	21	78	8.6	249	74
44008	Burlington	North Shore Blvd. E./Lakeshore Rd.	8637	0	1	2	3	10	50	4.6	168	31
44017	Oakville	Eighth Line/Glenashton Dr., Halton Res.	8744	0	0	0	1	5	30	2.1	111	32
45026	Oshawa	2000 Simcoe St. N., Durham College	8735	0	0	1	1	3	14	1.5	61	12
46089	Brampton	525 Main St. N., Peel Manor	8680	0	1	1	3	10	56	4.6	260	40
46108	Mississauga	3359 Mississauga Rd. N., U of T Campus	8696	0	0	1	1	6	48	3.1	144	34
47045	Barrie	83 Perry St.	8710	0	1	2	2	5	42	3.2	154	35
48006	Newmarket	Eagle St. W./McCaffrey Rd.	8603	0	0	1	1	3	23	1.5	77	22
49005	Parry Sound	7 Bay St.	8745	0	0	0	0	1	6	0.5	32	5
51001	Ottawa Downtown	Rideau St./Wurtemburg St.	8559	0	1	1	2	4	24	2.1	81	21
51002	Ottawa Central	960 Carling Ave.	8651	0	0	0	1	5	51	2.8	129	38
52022	Kingston	752 King St. W.	8231	0	0	0	0	1	3	0.2	25	7
54012	Belleville	2 Sidney St., Water Treatment Plant	8698	0	1	1	1	3	16	1.7	99	11
56051	Cornwall	Bedford St./3rd St. W.	7889	0	0	1	1	3	26	1.9	129	27
59006	Peterborough	10 Hospital Dr.	8733	0	1	1	1	3	13	1.7	57	10
63203	Thunder Bay	421 James St. S.	8714	1	1	2	4	12	34	4.7	121	21
71078	Sault Ste. Marie	Sault College	8703	0	0	1	1	3	14	1.3	105	10
75010	North Bay	Chippewa St. W., Dept. National Defence	8747	1	1	1	2	4	22	2.5	74	16
77233	Sudbury	155 Elm St.	8662	1	1	1	2	5	34	2.9	154	31

Table A5: 2013 Nitrogen Dioxide (NO_2) Annual Statistics

Unit: parts per billion (ppb)
NO_2 1h AAQC: 200 ppb
NO_2 24h AAQC: 100 ppb

ID	City	Location	PERCENTILES								Maximum		No. of Times Above Criteria	
			Valid h	10%	30%	50%	70%	90%	99%	Mean	1h	24h	1h	24h
12008	Windsor Downtown	467 University Ave. W.	8706	5	7	10	15	23	39	12.4	60	36	0	0
12016	Windsor West	College Ave./South St.	8422	4	7	10	13	22	41	11.5	65	31	0	0
13001	Chatham	435 Grand Ave. W.	8721	2	3	5	7	11	24	6.0	41	20	0	0
14064	Sarnia	Front St. N./CN Tracks, Centennial Park	8424	2	4	6	10	17	29	8.1	46	23	0	0
15020	Grand Bend	Point Blake Conservation Area	8673	1	2	4	5	9	14	4.4	27	18	0	0
15026	London	42 St. Julien St.	8641	2	3	5	7	12	27	6.4	38	21	0	0
18007	Tiverton	4th Concession/Bruce Rd. 23	8255	0	1	1	2	4	8	1.9	16	8	0	0
21005	Brantford	324 Grand River Ave.	8732	1	2	3	5	11	23	4.8	37	28	0	0
26060	Kitchener	West Ave./Homewood Ave.	8459	2	3	5	7	13	33	6.7	57	27	0	0
27067	St. Catharines	Argyle Cres., Pump Stn.	8733	3	4	6	8	15	32	7.7	51	27	0	0
28028	Guelph	Exhibition St./Clark St. W.	8731	2	3	5	7	14	30	6.6	48	26	0	0
29000	Hamilton Downtown	Elgin St./Kelly St.	8730	3	6	10	15	25	40	12.4	57	33	0	0
29114	Hamilton Mountain	Vickers Rd./E. 18th St.	8612	2	4	6	10	20	38	9.0	54	28	0	0
29118	Hamilton West	Main St. W./Hwy 403	8651	4	7	10	15	25	40	12.7	55	36	0	0
31103	Toronto Downtown	Bay St./Wellesley St. W.	8744	5	8	12	16	24	40	13.5	60	33	0	0
33003	Toronto East	Kennedy Rd./Lawrence Ave. E.	8694	4	8	11	16	26	41	13.6	79	31	0	0
34020	Toronto North	Hendon Ave./Yonge St.	8722	4	7	11	16	25	40	12.9	56	34	0	0
35125	Toronto West	125 Resources Rd.	8658	5	10	14	20	30	46	16.1	76	38	0	0
44008	Burlington	North Shore Blvd. E./Lakeshore Rd.	8637	3	6	9	13	22	38	11.0	59	33	0	0
44017	Oakville	Eighth Line/Glenashton Dr., Halton Res.	8744	2	4	6	10	20	38	9.2	53	33	0	0
45026	Oshawa	2000 Simcoe St. N., Durham College	8735	2	3	4	7	12	24	5.9	38	22	0	0
46089	Brampton	525 Main St. N., Peel Manor	8680	2	4	6	11	21	38	9.1	55	32	0	0
46108	Mississauga	3359 Mississauga Rd. N., U of T Campus	8696	3	5	7	11	19	36	9.5	48	33	0	0
47045	Barrie	83 Perry St.	8710	2	4	6	8	17	33	7.8	51	26	0	0
48006	Newmarket	Eagle St. W./McCaffrey Rd.	8603	2	3	5	7	14	34	6.8	56	29	0	0
49005	Parry Sound	7 Bay St.	8745	1	1	2	3	6	16	2.9	30	10	0	0
51001	Ottawa Downtown	Rideau St./Wurtemburg St.	8501	2	3	5	9	18	33	7.9	45	29	0	0
51002	Ottawa Central	960 Carling Ave.	8649	1	3	4	7	15	36	6.6	46	31	0	0
52022	Kingston	752 King St. W.	8231	1	2	3	4	7	18	3.6	35	18	0	0
54012	Belleville	2 Sidney St., Water Treatment Plant	8698	1	2	3	5	10	24	4.7	37	14	0	0
56051	Cornwall	Bedford St./3rd St. W.	7889	2	3	4	6	14	31	6.2	46	27	0	0
59006	Peterborough	10 Hospital Dr.	8733	1	2	4	6	10	25	5.0	41	18	0	0
63203	Thunder Bay	421 James St. S.	8713	2	3	5	8	15	33	7.3	48	24	0	0
71078	Sault Ste. Marie	Sault College	8700	2	2	3	5	11	23	5.0	49	16	0	0
75010	North Bay	Chippewa St. W., Dept. National Defence	8747	1	2	3	6	13	32	5.8	49	21	0	0
77233	Sudbury	155 Elm St.	8661	2	3	5	7	16	38	7.2	63	32	0	0

Table A6: 2013 Nitrogen Oxides (NO_x) Annual Statistics

Unit: parts per billion (ppb)

ID	City	Location		PERCENTILES							Maximum	
			Valid h	10%	30%	50%	70%	90%	99%	Mean	1h	24h
12008	Windsor Downtown	467 University Ave. W.	8706	5	9	12	18	30	73	16.2	290	68
12016	Windsor West	College Ave./South St.	8422	4	8	11	16	27	86	15.2	356	93
13001	Chatham	435 Grand Ave. W.	8720	2	4	6	9	14	35	7.7	99	30
14064	Sarnia	Front St. N./CN Tracks, Centennial Park	8424	3	5	7	11	20	42	9.8	127	33
15020	Grand Bend	Point Blake Conservation Area	8636	1	3	4	7	11	19	5.4	40	21
15026	London	42 St. Julien St.	8639	3	4	6	8	15	37	7.8	85	29
18007	Tiverton	4th Concession/Bruce Rd. 23	8255	0	1	2	2	4	9	2.1	33	9
21005	Brantford	324 Grand River Ave.	8732	1	2	4	6	13	33	5.7	129	53
26060	Kitchener	West Ave./Homewood Ave.	8458	2	4	5	8	15	57	8.3	157	51
27067	St. Catharines	Argyle Cres., Pump Stn.	8732	3	4	6	10	20	59	9.9	157	52
28028	Guelph	Exhibition St./Clark St. W.	8731	2	4	5	8	16	43	7.8	106	33
29000	Hamilton Downtown	Elgin St./Kelly St.	8730	4	8	12	19	34	81	16.8	202	65
29114	Hamilton Mountain	Vickers Rd./E. 18th St.	8613	3	5	7	11	24	59	11.0	200	51
29118	Hamilton West	Main St. W./Hwy 403	8651	5	8	12	19	39	94	18.1	197	72
31103	Toronto Downtown	Bay St./Wellesley St. W.	8744	6	9	13	18	30	63	16.1	129	46
33003	Toronto East	Kennedy Rd./Lawrence Ave. E.	8693	5	10	15	21	37	91	19.4	329	92
34020	Toronto North	Hendon Ave./Yonge St.	8722	4	8	13	19	34	79	17.0	170	67
35125	Toronto West	125 Resources Rd.	8659	6	12	18	27	50	111	24.7	325	109
44008	Burlington	North Shore Blvd. E./Lakeshore Rd.	8637	4	7	11	16	31	86	15.6	209	60
44017	Oakville	Eighth Line/Glenashton Dr., Halton Res.	8744	2	4	7	12	25	63	11.2	161	66
45026	Oshawa	2000 Simcoe St. N., Durham College	8735	2	3	5	8	15	37	7.4	85	34
46089	Brampton	525 Main St. N., Peel Manor	8680	3	5	8	14	31	84	13.9	289	58
46108	Mississauga	3359 Mississauga Rd. N., U of T Campus	8696	4	5	8	12	26	76	12.6	176	67
47045	Barrie	83 Perry St.	8710	3	5	7	10	22	69	11.0	183	59
48006	Newmarket	Eagle St. W./McCaffrey Rd.	8603	2	3	5	8	17	53	8.4	117	51
49005	Parry Sound	7 Bay St.	8735	1	1	2	3	7	20	3.4	55	12
51001	Ottawa Downtown	Rideau St./Wurtemburg St.	8561	2	4	7	11	21	54	10.1	126	50
51002	Ottawa Central	960 Carling Ave.	8650	2	3	5	9	21	72	9.4	142	64
52022	Kingston	752 King St. W.	8231	1	2	3	4	7	19	3.8	49	25
54012	Belleville	2 Sidney St., Water Treatment Plant	8697	2	3	4	6	13	37	6.3	136	24
56051	Cornwall	Bedford St./3rd St. W.	7889	2	3	5	7	17	51	8.0	166	48
59006	Peterborough	10 Hospital Dr.	8733	2	3	5	7	13	36	6.6	93	28
63203	Thunder Bay	421 James St. S.	8713	3	5	8	12	26	62	12.0	159	42
71078	Sault Ste. Marie	Sault College	8703	2	3	4	6	14	33	6.3	152	21
75010	North Bay	Chippewa St. W., Dept. National Defence	8747	2	4	5	8	17	52	8.3	123	38
77233	Sudbury	155 Elm St.	8662	3	4	6	10	21	66	10.1	183	63

Table A7: 2013 Sulphur Dioxide (SO_2) Annual Statistics

Unit: parts per billion (ppb)
SO_2 1h AAQC: 250 ppb
SO_2 24h AAQC: 100 ppb
SO_2 1y AAQC: 20 ppb

ID	City	Location	PERCENTILES								Maximum		No. of Times Above Criteria		
			Valid h	10%	30%	50%	70%	90%	99%	Mean	1h	24h	1h	24h	1y
12008	Windsor Downtown	467 University Ave. W.	8724	0	0	1	2	7	22	2.4	48	13	0	0	0
12016	Windsor West	College Ave./South St.	8539	0	0	1	2	8	23	2.6	52	15	0	0	0
14064	Sarnia	Front St. N./CN Tracks, Centennial Park	8674	0	0	1	3	10	45	3.8	144	31	0	0	0
29000	Hamilton Downtown	Elgin St./Kelly St.	8721	0	0	1	2	17	50	4.8	100	43	0	0	0
29114	Hamilton Mountain	Vickers Rd./E. 18th St.	8566	0	1	1	2	7	27	2.8	78	26	0	0	0
35125	Toronto West	125 Resources Rd.	8670	0	0	0	1	1	5	0.6	15	5	0	0	0
46108	Mississauga	3359 Mississauga Rd. N., U of T Campus	8616	0	0	0	1	2	7	0.7	40	6	0	0	0
51001	Ottawa Downtown	Rideau St./Wurtemburg St.	8560	0	0	0	1	1	2	0.3	6	3	0	0	0
71078	Sault Ste. Marie	Sault College	8715	0	0	0	0	1	17	0.8	62	10	0	0	0
77233	Sudbury	155 Elm St.	8689	0	0	0	1	8	44	2.8	198	26	0	0	0

Table A8: 2013 Carbon Monoxide (CO) Annual Statistics

Unit: parts per million (ppm)
CO 1h AAQC: 30 ppm
CO 8h AAQC: 13 ppm

ID	City	Location	PERCENTILES								Maximum		No. of Times Above Criteria	
			Valid h	10%	30%	50%	70%	90%	99%	Mean	1h	8h	1h	8h
12008	Windsor Downtown	467 University Ave. W.	8708	0.16	0.20	0.22	0.27	0.39	0.72	0.26	1.93	0.88	0	0
29000	Hamilton Downtown	Elgin St./Kelly St.	8740	0.15	0.19	0.22	0.26	0.41	0.79	0.26	1.95	1.03	0	0
35125	Toronto West	125 Resources Rd.	8667	0.17	0.20	0.23	0.27	0.36	0.63	0.25	1.41	1.21	0	0
51001	Ottawa Downtown	Rideau St./Wurtemburg St.	8362	0.14	0.17	0.19	0.22	0.30	0.48	0.21	0.92	0.64	0	0

Table A9: 2013 Total Reduced Sulphur (TRS) Compounds Annual Statistics

Unit: parts per billion (ppb)

ID	City	Location	PERCENTILES								Maximum	
			Valid h	10%	30%	50%	70%	90%	99%	Mean	1h	24h
12016	Windsor West	College Ave./South St.	8317	0	0	0	0	1	3	0.3	16	2
14064	Sarnia	Front St. N./CN Tracks, Centennial Park	8623	0	0	0	0	1	1	0.1	15	1
29000	Hamilton Downtown	Elgin St./Kelly St.	8632	0	0	0	0	0	3	0.2	7	3
71078	Sault Ste. Marie	Sault College	8728	0	0	0	0	0	0	0.0	3	1

Table A10: 10y Trend for O_3 Annual Mean (ppb)

ID	City/Town	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change Over Time
12008	Windsor Downtown	20.2	25.3	24.6	27.0	26.9	24.8	28.0	27.2	28.0	26.9	↑ 22%
12016	Windsor West	22.6	25.6	24.3	25.3	25.9	24.9	26.7	26.4	28.0	26.7	↑ 15%
13001	Chatham	INS	31.0	28.7	30.9	30.9	28.8	31.9	29.7	29.5	29.6	↓ 2%
14064	Sarnia	23.8	27.4	26.7	28.6	28.7	26.6	30.7	29.7	29.7	28.6	↑ 17%
15020	Grand Bend	25.8	32.5	29.7	31.7	31.3	29.6	35.0	32.8	33.2	32.3	↑ 17%
15026	London	23.6	26.1	25.1	27.2	27.0	25.1	28.2	26.8	27.7	28.7	↑ 15%
16015	Port Stanley	32.2	34.6	32.4	34.3	34.3	30.9	34.6	32.8	33.1	33.9	↑ 1%
18007	Tiverton	28.1	31.8	29.0	34.3	32.6	31.4	33.8	32.1	32.0	32.4	↑ 10%
21005	Brantford	26.2	27.9	27.0	28.9	28.4	26.5	29.4	28.7	28.8	29.0	↑ 8%
26060	Kitchener	24.8	28.0	26.6	28.6	28.1	27.0	29.4	27.6	28.0	28.0	↑ 7%
27067	St. Catharines	23.6	26.3	26.2	28.1	27.5	25.6	28.3	28.0	28.7	28.6	↑ 15%
28028	Guelph	25.9	28.6	26.8	28.1	27.9	27.3	30.7	28.9	28.8	29.0	↑ 9%
29000	Hamilton Downtown	20.1	23.3	23.2	24.8	25.1	24.3	26.9	25.4	25.7	25.0	↑ 19%
29114	Hamilton Mountain	24.6	28.2	27.5	29.2	29.0	27.2	29.7	28.8	30.2	29.5	↑ 13%
29118	Hamilton West	19.2	21.2	20.9	23.0	23.3	21.8	24.5	24.2	24.2	24.4	↑ 23%
31103	Toronto Downtown	22.8	24.5	22.6	25.7	26.0	24.6	26.1	25.4	26.6	26.2	↑ 14%
33003	Toronto East	19.9	22.4	22.0	23.2	21.6	22.1	23.0	23.3	24.6	24.1	↑ 16%
34020	Toronto North	22.5	24.5	23.3	24.5	22.7	22.1	24.8	23.6	25.7	25.3	↑ 8%
35125	Toronto West	17.6	20.3	19.0	21.1	20.7	19.5	20.6	20.1	21.5	21.5	↑ 14%
44008	Burlington	21.0	23.9	23.5	24.6	24.9	24.1	26.6	25.9	26.7	26.4	↑ 21%
44017	Oakville	24.6	27.7	26.1	27.5	27.0	25.5	28.0	26.8	27.7	28.3	↑ 8%
45026	Oshawa	23.3	28.6	25.1	28.0	27.0	25.5	28.0	26.6	27.0	27.2	↑ 6%
46089	Brampton	25.1	26.8	25.5	26.8	26.6	25.2	27.5	26.1	26.6	26.7	↑ 3%
46108	Mississauga	20.6	23.1	22.4	23.3	24.6	24.0	25.9	24.1	25.6	25.2	↑ 19%
47045	Barrie	24.8	26.9	24.1	25.9	26.5	24.3	26.8	25.3	26.3	25.5	↑ 2%
48006	Newmarket	28.3	30.8	28.8	31.7	29.5	28.6	31.5	27.8	29.4	28.7	↓ 2%
49005	Parry Sound	31.1	33.8	30.7	31.8	32.1	29.7	31.3	29.7	30.1	30.4	↓ 7%
49010	Dorset	28.8	32.3	28.9	29.9	29.3	27.7	28.6	27.0	28.0	28.1	↓ 9%
51001	Ottawa Downtown	21.7	23.3	23.6	24.7	23.3	23.4	25.7	24.2	26.0	25.6	↑ 15%
54012	Belleville	28.1	29.4	29.2	32.0	29.8	28.5	30.0	27.9	28.0	29.2	↓ 3%
56010	Morrisburg	28.0	27.8	28.0	29.2	27.9	26.1	28.6	27.2	28.2	28.7	→ 0%
56051	Cornwall	23.8	27.7	27.5	28.3	26.6	25.5	27.9	26.1	27.1	26.9	↑ 3%
59006	Peterborough	27.1	31.2	24.9	27.6	28.2	27.7	30.5	27.9	29.1	28.6	↑ 4%
63203	Thunder Bay	22.0	22.3	23.5	24.2	23.0	24.2	25.7	25.2	25.0	26.3	↑ 18%
71078	Sault Ste. Marie	27.0	30.2	29.1	29.7	28.9	27.8	28.4	27.8	28.8	28.9	↓ 1%
75010	North Bay	25.2	28.0	26.7	27.1	27.7	26.1	28.0	26.7	26.1	27.4	↑ 2%
77233	Sudbury	27.8	31.0	28.4	28.1	27.9	25.9	28.7	28.7	28.5	27.2	↓ 4%

Notes:
INS indicates there was insufficient data in the 2nd and/or 3rd quarter to calculate a valid annual mean.
Station 15026 replaced station 15025 as the London site in 2013.
Station 45026 replaced station 45025 as the Oshawa site in 2005.
Station 46108 replaced station 46109 as the Mississauga site in 2009.
Station 46109 replaced station 46110 as the Mississauga site in 2004.
Station 77233 replaced station 77219 as the Sudbury site in 2013.

Table A11: 10y Trend for O_3 Summer Means (May - September) Summer Mean (ppb)

ID	City/Town	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change Over Time
12008	Windsor Downtown	26.3	35.6	32.6	36.3	34.1	30.4	34.6	33.8	36.8	32.5	↑ 10%
12016	Windsor West	29.6	35.8	31.9	33.5	32.1	29.5	31.8	31.9	35.7	30.9	↑ 1%
13001	Chatham	INS	39.5	35.5	38.2	36.7	32.6	36.5	34.4	36.6	34.2	↓ 9%
14064	Sarnia	26.6	34.1	32.0	34.2	33.0	28.6	34.3	32.9	36.6	32.0	↑ 12%
15020	Grand Bend	29.8	36.3	33.5	34.9	32.4	29.7	37.8	33.9	38.9	33.1	↑ 9%
15026	London	28.5	33.9	31.2	33.2	31.6	28.4	32.5	30.7	34.4	30.9	↑ 3%
16015	Port Stanley	35.7	42.3	38.5	40.4	38.8	33.2	38.9	35.5	38.4	36.9	↓ 6%
18007	Tiverton	29.8	33.3	30.4	38.3	34.0	30.3	33.3	31.7	36.0	32.5	↓ 5%
21005	Brantford	28.9	33.5	31.8	33.6	31.0	27.5	31.6	31.1	33.5	30.1	→ 0%
26060	Kitchener	29.8	34.3	32.0	34.2	31.0	28.8	31.6	30.2	33.5	29.8	↓ 4%
27067	St. Catharines	28.3	33.6	32.6	33.9	31.2	27.7	32.0	31.2	35.0	31.2	↑ 3%
28028	Guelph	29.5	34.0	31.5	33.1	30.4	28.7	32.5	31.3	34.5	30.4	↑ 1%
29000	Hamilton Downtown	24.9	30.4	29.2	30.8	29.8	28.2	31.6	28.7	32.4	28.4	↑ 8%
29114	Hamilton Mountain	29.7	36.7	33.7	36.1	33.6	31.0	34.4	32.3	37.4	32.5	↑ 3%
29118	Hamilton West	22.7	25.7	25.3	26.9	26.7	23.9	27.9	26.2	29.2	26.4	↑ 14%
31103	Toronto Downtown	28.3	31.9	28.7	33.2	30.9	27.9	31.1	29.5	33.3	30.1	↑ 4%
33003	Toronto East	24.5	30.6	27.2	28.3	24.9	25.2	26.7	27.4	30.6	27.1	↑ 4%
34020	Toronto North	26.3	30.2	28.6	29.9	26.4	25.6	28.0	27.5	32.7	29.4	↑ 6%
35125	Toronto West	21.4	26.5	24.3	25.9	24.8	22.5	24.3	23.6	27.5	24.4	↑ 5%
44008	Burlington	25.1	30.2	29.2	30.0	28.3	26.7	30.2	29.2	32.5	29.2	↑ 10%
44017	Oakville	28.6	34.4	31.7	32.8	30.8	28.2	31.5	29.9	34.2	30.6	→ 0%
45026	Oshawa	25.9	INS	28.0	31.5	28.3	26.4	29.5	28.5	31.1	28.3	↑ 8%
46089	Brampton	29.1	31.7	31.3	31.9	31.0	28.5	30.8	29.3	32.7	29.5	↓ 1%
46108	Mississauga	24.6	31.6	28.5	28.6	27.3	26.2	29.0	26.7	30.4	26.5	→ 0%
47045	Barrie	27.3	30.7	28.1	28.6	30.0	25.0	27.9	26.2	29.7	25.6	↓ 7%
48006	Newmarket	32.3	36.1	33.7	36.0	32.1	30.9	34.4	30.5	34.2	30.3	↓ 8%
49005	Parry Sound	33.2	36.9	33.3	33.6	32.2	28.6	30.4	28.7	32.8	30.1	↓ 15%
49010	Dorset	28.5	33.0	29.2	30.0	27.2	25.0	25.2	23.8	28.3	25.3	↓ 19%
51001	Ottawa Downtown	23.5	27.2	26.5	28.2	24.9	24.6	26.1	25.1	29.3	26.5	↑ 6%
54012	Belleville	33.0	35.6	34.1	37.0	32.3	30.6	34.2	29.9	32.7	30.6	↓ 11%
56010	Morrisburg	29.7	30.6	30.6	31.6	27.8	26.7	29.5	27.1	31.1	28.2	↓ 6%
56051	Cornwall	26.1	31.8	29.8	31.1	27.6	27.1	29.8	26.7	30.7	28.1	↓ 2%
59006	Peterborough	30.0	36.5	27.2	30.0	31.6	29.2	32.0	29.8	34.2	29.5	↓ 1%
63203	Thunder Bay	22.7	23.6	24.7	24.6	21.3	24.2	23.9	24.2	25.3	24.7	↑ 7%
71078	Sault Ste. Marie	27.3	32.0	31.4	31.5	28.4	27.5	27.2	26.4	30.3	28.2	↓ 8%
75010	North Bay	28.4	31.0	29.0	28.5	28.3	26.5	28.4	26.3	28.5	26.9	↓ 9%
77233	Sudbury	28.7	32.4	30.1	29.5	26.0	25.7	26.3	26.9	29.8	28.0	↓ 9%

Notes:
INS indicates there was insufficient data in the 2nd and/or 3rd quarter to calculate a valid annual mean.
Station 15026 replaced station 15025 as the London site in 2013.
Station 45026 replaced station 45025 as the Oshawa site in 2005.
Station 46108 replaced station 46109 as the Mississauga site in 2009.
Station 46109 replaced station 46110 as the Mississauga site in 2004.
Station 77233 replaced station 77219 as the Sudbury site in 2013.

Table A12: 10y Trend for O_3 Winter Means (January-April, October-December) Winter Mean (ppb)

ID	City/Town	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change Over Time
12008	Windsor Downtown	16.0	16.5	18.8	20.3	21.7	20.8	23.2	22.5	21.7	22.8	↑ 46%
12016	Windsor West	17.7	18.2	18.8	19.4	21.5	21.6	22.8	22.5	22.3	23.4	↑ 39%
13001	Chatham	INS	25.1	23.9	25.4	26.8	26.1	28.5	26.7	24.3	26.2	↑ 5%
14064	Sarnia	22.0	INS	23.0	24.7	25.5	25.2	28.1	27.4	24.7	26.2	↑ 22%
15020	Grand Bend	22.7	29.8	26.8	29.4	30.5	29.5	33.0	32.1	29.1	31.8	↑ 27%
15026	London	20.0	20.4	20.7	22.8	23.7	22.8	25.0	24.2	22.9	26.9	↑ 32%
16015	Port Stanley	29.9	29.2	28.0	30.0	31.0	29.4	31.5	31.0	29.3	31.8	↑ 7%
18007	Tiverton	INS	30.7	28.2	31.5	31.7	32.3	34.1	32.2	29.2	32.4	↑ 8%
21005	Brantford	24.1	23.9	23.6	25.5	26.6	25.8	27.8	27.1	25.4	28.3	↑ 16%
26060	Kitchener	21.1	23.4	22.7	24.6	26.0	25.9	27.8	25.7	24.0	26.7	↑ 21%
27067	St. Catharines	20.2	20.9	21.7	24.1	24.9	24.1	25.6	25.8	24.1	26.8	↑ 32%
28028	Guelph	23.4	24.8	23.4	24.8	26.1	26.4	29.3	27.2	24.8	28.0	↑ 19%
29000	Hamilton Downtown	16.6	18.2	18.9	20.5	21.7	21.5	23.5	23.1	20.9	22.5	↑ 36%
29114	Hamilton Mountain	21.1	22.1	23.0	24.2	25.7	24.5	26.3	26.3	25.0	27.3	↑ 28%
29118	Hamilton West	16.6	17.9	17.8	20.1	20.9	20.4	22.1	22.7	20.6	23.0	↑ 38%
31103	Toronto Downtown	18.7	19.1	18.2	20.4	22.2	22.4	22.4	22.6	21.8	23.5	↑ 30%
33003	Toronto East	16.6	17.5	18.2	19.5	19.3	19.9	20.4	20.4	20.3	22.0	↑ 30%
34020	Toronto North	19.7	20.4	19.4	20.7	20.1	19.5	22.5	20.8	20.7	22.3	↑ 11%
35125	Toronto West	14.9	15.8	15.1	17.7	17.7	17.4	18.0	17.7	17.2	19.5	↑ 27%
44008	Burlington	18.1	19.3	19.3	20.7	22.5	22.3	23.9	23.5	22.5	24.4	↑ 37%
44017	Oakville	21.7	22.8	22.0	23.7	24.4	23.6	25.5	24.7	23.1	26.6	↑ 18%
45026	Oshawa	21.4	24.1	23.0	25.6	25.7	24.9	26.9	25.2	24.1	26.4	↑ 16%
46089	Brampton	22.3	23.3	21.4	23.1	23.4	22.8	25.2	23.8	22.2	24.6	↑ 8%
46108	Mississauga	18.0	17.0	18.0	19.2	22.8	22.5	23.7	22.5	22.2	24.3	↑ 47%
47045	Barrie	22.9	24.2	21.3	24.0	24.2	23.8	26.0	24.7	23.9	25.5	↑ 12%
48006	Newmarket	25.4	27.0	25.3	28.6	27.6	27.1	29.4	25.8	26.0	27.5	↑ 4%
49005	Parry Sound	29.6	31.6	28.9	30.6	32.0	30.5	31.9	30.4	28.1	30.6	↓ 1%
49010	Dorset	29.0	31.8	28.6	30.1	30.7	29.6	31.0	29.5	27.7	30.1	↓ 2%
51001	Ottawa Downtown	20.4	20.7	21.4	22.0	22.2	22.6	25.5	23.6	23.5	24.9	↑ 25%
54012	Belleville	24.6	25.1	25.8	28.4	28.0	26.9	27.0	26.4	24.6	28.2	↑ 7%
56010	Morrisburg	26.6	25.7	26.2	27.5	27.9	25.7	28.0	27.5	26.0	29.1	↑ 6%
56051	Cornwall	22.2	24.8	25.9	26.3	26.0	24.5	26.5	25.7	24.2	25.7	↑ 6%
59006	Peterborough	25.0	27.3	23.3	25.9	26.0	26.7	29.5	26.6	25.5	28.0	↑ 10%
63203	Thunder Bay	21.9	21.7	22.6	23.9	24.3	24.2	27.1	26.1	24.7	27.4	↑ 28%
71078	Sault Ste. Marie	26.8	28.9	27.5	28.6	29.3	28.4	29.3	28.9	27.6	29.4	↑ 5%
75010	North Bay	23.0	25.9	25.0	26.2	27.2	25.8	27.7	27.0	24.4	27.8	↑ 11%
77233	Sudbury	27.2	30.0	27.2	27.2	29.3	26.0	30.5	30.0	27.6	26.6	→ 0%

Notes:
INS indicates there was insufficient data in the 2nd and/or 3rd quarter to calculate a valid annual mean.
Station 15026 replaced station 15025 as the London site in 2013.
Station 45026 replaced station 45025 as the Oshawa site in 2005.
Station 46108 replaced station 46109 as the Mississauga site in 2009.
Station 46109 replaced station 46110 as the Mississauga site in 2004.
Station 77233 replaced station 77219 as the Sudbury site in 2013.

Ontario's move to new measurement technology in 2013 has resulted in increased $PM_{2.5}$ annual means; the increases are not an indication that the air quality has changed, but that the measurements are more accurate. For more information see **Section 3.1:** Technical Discussion – New $PM_{2.5}$ Measurement Technology in Ontario.

Table A13: 10y Summary for $PM_{2.5}$ Annual Mean ($\mu g/m^3$)

ID	City/Town	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
12008	Windsor Downtown	8.6	10.4	8.2	9.5	8.3	7.2	7.7	7.6	7.4	**9.2**
12016	Windsor West	9.5	10.5	9.2	9.8	8.9	7.4	7.8	7.8	7.6	**10.0**
13001	Chatham	INS	9.1	7.4	7.9	7.3	6.3	6.5	6.6	6.0	**8.1**
14064	Sarnia	12.2	12.9	11.3	12.2	11.4	9.8	10.4	10.5	10.2	**8.5 (7.0*)**
15020	Grand Bend	7.0	7.4	6.5	6.7	6.8	5.8	6.1	6.1	5.8	**7.3**
15026	London	7.8	8.8	6.9	6.5	6.8	5.7	INS	6.2	6.5	**9.1**
16015	Port Stanley	7.5	8.6	7.3	7.2	6.7	5.6	5.9	6.0	5.9	**7.4 (5.3*)**
18007	Tiverton	5.8	6.6	5.6	5.6	5.0	4.0	4.5	4.7	INS	**5.8**
21005	Brantford	7.5	8.9	7.6	7.7	6.8	5.8	6.5	6.6	6.2	**8.5**
26060	Kitchener	8.1	9.5	7.7	8.0	7.1	5.8	6.3	6.2	6.0	**8.7**
27067	St. Catharines	7.3	8.6	7.9	8.2	7.4	6.0	6.5	6.3	6.3	**8.5**
28028	Guelph	7.8	8.8	7.0	7.5	6.5	5.6	5.7	5.9	5.8	**8.1**
29000	Hamilton Downtown	8.9	10.0	9.1	8.9	8.3	6.8	7.7	8.1	8.3	**10.1(7.8*)**
29114	Hamilton Mountain	9.3	9.8	8.1	7.8	7.3	6.3	6.2	6.7	6.5	**9.2**
29118	Hamilton West	8.4	9.6	8.2	8.3	7.6	6.1	6.8	7.1	7.3	**9.6**
31103	Toronto Downtown	7.1	8.5	7.3	7.3	6.6	5.6	6.0	6.2	6.4	**8.3**
33003	Toronto East	7.4	8.4	7.6	7.8	6.7	5.9	6.7	6.2	6.3	**8.2**
34020	Toronto North	7.7	9.4	7.6	7.8	7.3	5.9	6.2	7.7	7.3	**8.3**
35125	Toronto West	9.8	10.0	8.2	8.4	7.5	6.1	6.5	6.9	7.1	**8.8 (6.6*)**
44008	Burlington	7.9	9.1	7.6	7.3	6.9	5.9	6.2	6.2	6.4	**8.7**
44017	Oakville	8.1	8.9	7.4	7.6	6.7	5.3	5.7	6.4	6.1	**8.0**
45026	Oshawa	INS	8.1	6.8	6.8	6.3	5.2	5.6	5.5	5.5	**7.4**
46089	Brampton	7.7	8.9	7.2	7.4	6.8	5.6	5.8	6.0	5.7	**8.5**
46108	Mississauga	8.0	9.2	7.6	7.2	7.1	5.8	6.1	6.0	6.0	**7.9**
47045	Barrie	6.9	8.1	6.7	6.9	6.1	5.2	5.4	5.7	5.6	**7.5**
48006	Newmarket	6.4	7.7	6.4	6.6	6.0	5.1	5.6	5.5	5.6	**7.3**
49005	Parry Sound	5.3	6.1	5.3	5.5	4.7	3.9	4.4	4.7	4.8	**5.8**
49010	Dorset	4.7	5.8	4.5	5.0	4.5	3.6	4.0	4.1	4.1	**5.4**
51001	Ottawa Downtown	6.5	7.7	6.1	6.0	5.3	4.6	4.5	4.9	4.8	**7.0 (5.1*)**
54012	Belleville	6.4	7.0	6.2	6.2	6.1	4.9	INS	4.8	5.1	**6.9**
56010	Morrisburg	6.2	7.0	6.8	6.2	5.7	5.0	5.3	5.2	5.0	**6.7**
56051	Cornwall	6.8	7.6	6.5	6.4	6.1	5.4	5.7	5.7	5.4	**7.7 (5.2*)**
59006	Peterborough	5.9	7.5	6.3	6.4	6.0	4.9	5.1	5.5	4.9	**7.4**
63203	Thunder Bay	4.2	4.4	4.8	4.4	4.2	3.8	4.1	4.8	4.1	**6.3**
71078	Sault Ste. Marie	4.5	5.4	5.2	5.3	4.4	4.0	4.1	4.4	4.4	**5.6**
75010	North Bay	4.5	5.6	4.9	5.0	4.6	3.8	3.8	4.2	4.1	**5.2 (3.8*)**
77233	Sudbury	INS	5.1	4.6	4.9	4.1	3.4	3.6	4.0	4.0	**5.7**

Notes:
* For data comparison purposes, measurements were taken by Tapered Element Oscillating Microbalance (TEOM) sampler at selected sites.
From 2004-2012, measurements taken by TEOM sampler operated at 30°C with a Sample Equilibration System (SES).
As of 2013, measurements taken by Synchronized Hybrid Ambient Real-time Particulate (SHARP) 5030.
Due to change in the $PM_{2.5}$ monitoring method in 2013, it is inappropriate to calculate a change over time.
INS indicates there was insufficient data in any one quarter to calculate a valid annual mean.
Station 15026 replaced station 15025 as the London site in 2013.
Station 45026 replaced station 45025 as the Oshawa site in 2005.
Station 46108 replaced station 46109 as the Mississauga site in 2009.
Station 46109 replaced station 46110 as the Mississauga site in 2004.
Station 77233 replaced station 77219 as the Sudbury site in 2013.

Table A14: 10y Trend for NO

Annual Mean (ppb)

ID	City/Town	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change Over Time
12008	Windsor Downtown	10.5	7.8	7.2	6.4	5.9	5.6	4.7	4.5	4.7	3.7	↓ 63%
12016	Windsor West	11.3	8.3	7.2	6.5	5.1	5.4	6.1	3.8	4.6	3.6	↓ 66%
13001	Chatham	INS	2.5	2.6	2.4	3.1	3.5	2.6	1.9	1.8	1.6	↓ 34%
14064	Sarnia	3.7	3.8	3.7	3.2	3.2	2.8	2.2	3.1	2.1	1.7	↓ 50%
15026	London	6.0	5.5	4.4	3.6	3.1	2.8	2.9	3.3	4.2	1.4	↓ 60%
21005	Brantford	2.8	3.8	2.5	1.8	1.3	1.7	1.3	1.2	1.1	1.2	↓ 75%
26060	Kitchener	4.9	4.4	3.5	2.7	2.5	2.1	2.5	2.0	2.1	1.6	↓ 69%
29000	Hamilton Downtown	9.6	9.9	8.0	7.7	6.5	5.8	5.0	4.8	4.6	4.3	↓ 62%
31103	Toronto Downtown	7.6	7.2	7.0	5.9	5.0	5.1	4.1	3.4	2.8	2.7	↓ 69%
33003	Toronto East	16.0	14.4	12.5	10.8	9.2	7.8	7.8	7.6	6.6	5.7	↓ 67%
34020	Toronto North	10.5	10.8	10.0	8.3	7.7	7.1	5.7	6.2	5.0	4.1	↓ 63%
35125	Toronto West	26.6	26.1	20.1	17.5	16.2	13.5	13.4	12.4	11.3	8.6	↓ 69%
44008	Burlington	11.1	12.3	9.8	8.8	6.5	5.9	5.0	4.6	4.6	4.6	↓ 72%
44017	Oakville	5.3	5.2	4.3	3.9	4.0	3.5	3.6	2.7	3.4	2.1	↓ 53%
45026	Oshawa	8.2	INS	3.8	3.2	3.2	3.0	2.3	2.3	2.1	1.5	↓ 85%
46089	Brampton	8.7	8.9	9.1	6.0	5.8	6.5	3.7	4.6	4.4	4.6	↓ 59%
47045	Barrie	7.3	7.1	8.0	5.5	5.5	5.1	4.3	3.8	3.2	3.2	↓ 63%
48006	Newmarket	3.1	3.5	3.0	2.2	2.6	3.2	2.3	2.2	2.0	1.5	↓ 46%
51001	Ottawa Downtown	3.2	3.3	3.0	3.4	2.7	2.4	1.6	1.8	2.4	2.1	↓ 44%
54012	Belleville	5.6	4.5	3.0	3.2	3.0	1.9	2.3	2.3	1.6	1.7	↓ 74%
59006	Peterborough	n/a	n/a	2.5	2.3	3.0	1.9	1.7	2.2	1.8	1.7	↓ 36%
75010	North Bay	8.8	3.7	4.4	3.5	3.8	4.2	3.4	4.0	2.9	2.5	↓ 60%

Notes:
n/a indicates pollutant not monitored.
INS indicates there was insufficient data to calculate a valid annual mean.
Station 15026 replaced station 15025 as the London site in 2013.
Station 45026 replaced station 45025 as the Oshawa site in 2005.

Table A15: 10y Trend for NO_2 Annual Mean (ppb)

ID	City/Town	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change Over Time
12008	Windsor Downtown	18.3	16.9	17.2	17.2	15.2	14.4	15.6	14.5	13.2	12.4	↓ 30%
12016	Windsor West	17.6	17.1	15.7	16.1	16.2	13.2	14.5	12.9	11.4	11.5	↓ 35%
13001	Chatham	INS	11.0	9.5	8.6	7.0	7.5	6.4	6.6	5.7	6.0	↓ 48%
14064	Sarnia	11.7	12.7	11.0	11.3	10.8	8.2	8.0	8.6	8.6	8.1	↓ 38%
15026	London	13.7	14.1	12.3	11.7	10.8	9.0	8.8	8.3	6.3	6.4	↓ 58%
21005	Brantford	8.6	10.1	8.8	7.7	6.9	7.3	5.8	6.1	5.4	4.8	↓ 49%
26060	Kitchener	13.1	12.9	10.8	9.7	9.0	8.6	7.7	7.7	7.1	6.7	↓ 52%
29000	Hamilton Downtown	16.8	19.3	17.0	17.0	14.7	13.6	12.7	13.5	11.9	12.4	↓ 37%
31103	Toronto Downtown	20.1	20.7	19.2	18.2	17.0	16.5	16.1	14.9	13.4	13.5	↓ 36%
33003	Toronto East	19.8	20.1	17.4	17.2	16.5	14.9	14.8	15.2	14.0	13.6	↓ 33%
34020	Toronto North	17.3	19.2	17.4	16.7	16.5	15.8	14.3	15.4	13.4	12.9	↓ 29%
35125	Toronto West	24.8	26.6	22.3	22.1	20.8	19.0	20.1	19.1	16.3	16.1	↓ 37%
44008	Burlington	15.3	17.2	16.2	16.0	13.6	12.5	12.2	11.8	11.0	11.0	↓ 38%
44017	Oakville	13.5	14.5	12.5	13.0	12.0	11.1	9.2	10.3	9.1	9.2	↓ 38%
45026	Oshawa	14.2	INS	8.9	8.1	8.5	7.4	7.2	7.0	5.6	5.9	↓ 58%
46089	Brampton	16.2	16.9	15.2	13.9	13.1	13.3	10.7	11.3	10.4	9.1	↓ 45%
47045	Barrie	13.3	13.8	12.6	11.5	10.8	9.9	8.7	8.6	8.1	7.8	↓ 47%
48006	Newmarket	9.9	8.5	9.0	8.3	8.0	7.8	7.2	8.1	7.2	6.8	↓ 27%
51001	Ottawa Downtown	11.1	9.8	8.6	8.7	11.4	8.6	7.4	7.9	7.8	7.9	↓ 28%
54012	Belleville	9.4	8.2	4.5	6.4	7.3	6.0	5.5	6.3	4.7	4.7	↓ 42%
59006	Peterborough	n/a	n/a	6.3	6.4	7.0	5.6	5.0	4.3	3.7	5.0	↓ 38%
75010	North Bay	9.2	6.8	7.7	7.4	7.5	8.2	7.6	7.4	6.1	5.8	↓ 23%

Notes:
n/a indicates pollutant not monitored.
INS indicates there was insufficient data to calculate a valid annual mean.
Station 15026 replaced station 15025 as the London site in 2013.
Station 45026 replaced station 45025 as the Oshawa site in 2005.

Table A16: 10y Trend for NO_X Annual Mean (ppb)

ID	City/Town	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change Over Time
12008	Windsor Downtown	29.3	24.9	24.4	23.6	21.1	20.0	20.2	18.9	17.8	16.2	↓ 41%
12016	Windsor West	29.1	25.6	22.8	22.6	21.3	18.6	20.6	16.7	16.0	15.2	↓ 46%
13001	Chatham	INS	13.5	12.1	11.0	10.1	10.9	9.0	8.4	7.5	7.7	↓ 45%
14064	Sarnia	15.7	16.8	14.7	14.5	13.9	11.0	10.2	11.7	10.7	9.8	↓ 42%
15026	London	19.4	19.4	16.7	15.3	13.9	11.9	11.7	11.6	10.5	7.8	↓ 58%
21005	Brantford	11.6	13.7	11.3	9.5	8.2	9.1	7.2	7.3	6.7	5.7	↓ 56%
26060	Kitchener	18.2	17.4	14.3	12.4	11.5	10.8	10.3	9.6	9.2	8.3	↓ 57%
29000	Hamilton Downtown	27.7	30.1	24.9	24.7	21.2	19.5	17.8	18.3	16.6	16.8	↓ 48%
31103	Toronto Downtown	28.1	28.2	26.1	24.2	22.1	21.6	20.3	18.4	16.2	16.1	↓ 46%
33003	Toronto East	36.3	34.7	29.9	28.0	25.7	22.7	22.6	22.8	20.6	19.4	↓ 48%
34020	Toronto North	28.3	30.4	27.5	25.0	24.3	22.8	20.0	21.5	18.5	17.0	↓ 42%
35125	Toronto West	51.2	52.4	42.4	39.6	37.0	32.5	33.5	31.5	27.6	24.7	↓ 53%
44008	Burlington	26.1	29.3	26.0	24.8	20.0	18.4	17.2	16.4	15.6	15.6	↓ 51%
44017	Oakville	18.3	19.5	16.7	16.9	16.1	14.6	12.8	13.0	12.6	11.2	↓ 41%
45026	Oshawa	22.5	INS	12.7	11.3	11.7	10.4	9.5	9.2	7.8	7.4	↓ 67%
46089	Brampton	25.0	25.9	24.2	19.9	18.9	19.9	14.4	15.9	14.8	13.9	↓ 50%
47045	Barrie	20.8	21.0	20.6	17.0	16.3	15.1	13.1	12.4	11.3	11.0	↓ 53%
48006	Newmarket	13.0	12.2	11.8	10.4	10.4	11.0	9.5	10.3	9.2	8.4	↓ 32%
51001	Ottawa Downtown	14.7	13.7	11.5	12.0	14.0	11.0	9.0	9.7	10.2	10.1	↓ 34%
54012	Belleville	14.4	12.6	7.5	9.6	10.2	7.9	7.8	8.7	6.4	6.3	↓ 52%
59006	Peterborough	n/a	n/a	8.8	8.6	10.0	7.5	6.7	6.6	5.4	6.6	↓ 38%
75010	North Bay	19.0	11.2	12.1	10.9	11.3	12.4	11.0	11.5	9.1	8.3	↓ 42%

Notes:
n/a indicates pollutant not monitored.
INS indicates there was insufficient data to calculate a valid annual mean.
Station 15026 replaced station 15025 as the London site in 2013.
Station 45026 replaced station 45025 as the Oshawa site in 2005.

Table A17: 10y Trend for CO

1h Maximum (ppm)
CO 1h AAQC: 30 ppm

ID	City/Town	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change Over Time
12008	Windsor Downtown	2.3	1.3	2.9	5.0	1.3	1.4	2.5	3.8	2.1	1.9	↓ 3%
29000	Hamilton Downtown	4.0	2.6	2.8	6.0	3.3	5.0	2.2	1.8	1.7	2.0	↓ 50%
35125	Toronto West	2.9	2.7	3.0	1.4	1.7	1.6	1.8	1.4	1.4	1.4	↓ 59%
51001	Ottawa Downtown	2.2	2.0	1.4	1.5	1.3	1.4	1.5	1.5	0.9	0.9	↓ 50%

Table A18: 10y Trend for SO_2

Annual Mean (ppb)
SO_2 1y AAQC: 20 ppb

ID	City/Town	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change Over Time
12008	Windsor Downtown	4.8	4.9	5.0	5.5	4.5	3.5	3.5	3.5	2.8	2.4	↓ 51%
12016	Windsor West	4.6	5.1	4.9	5.2	4.7	3.6	3.2	3.4	2.8	2.6	↓ 50%
14064	Sarnia	8.2	7.8	8.3	8.0	7.7	4.5	3.9	5.3	4.1	3.8	↓ 60%
29000	Hamilton Downtown	4.0	5.3	4.8	4.2	4.3	3.3	3.3	5.2	4.8	4.8	↓ 3%
29114	Hamilton Mountain	n/a	n/a	3.3	3.5	3.0	3.0	2.9	4.1	3.7	2.8	↓ 1%
35125	Toronto West	2.7	2.3	2.0	1.5	1.4	1.2	0.9	1.5	0.6	0.6	↓ 79%
51001	Ottawa Downtown	1.0	1.5	1.1	0.9	1.0	0.9	0.2	0.4	0.3	0.3	↓ 85%
71078	Sault Ste. Marie	0.9	1.5	1.4	1.8	1.2	0.6	0.7	0.8	0.6	0.8	↓ 53%
77233	Sudbury	INS	2.8	2.4	2.3	2.0	1.1	1.3	1.5	1.3	2.8	↓ 34%

Notes:
n/a indicates pollutant not monitored.
Station 77233 replaced station 77219 as the Sudbury site in 2013.

Table A19: 2013 Air Quality Summary

City/Town	No. of Valid Hours	Percentage of Valid Hours AQI in Range					No. of Days
		Very Good 0-15	Good 16-31	Moderate 32-49	Poor 50-99	Very Poor 100+	At Least 1 Hour > 49
Windsor Downtown	8738	28.2	63.3	8.5	<0.1	0	2
Windsor West	8708	27.0	63.9	9.1	<0.1	0	1
Chatham	8753	24.6	68.1	7.2	<0.1	0	2
Sarnia	8753	23.6	69.1	7.2	<0.1	0	3
Grand Bend	8728	17.0	74.4	8.6	0.1	0	4
London	8746	21.1	69.5	9.4	<0.1	0	1
Port Stanley	8749	15.2	74.1	10.5	0.1	0	3
Tiverton	8686	17.2	76.2	6.5	<0.1	0	1
Brantford	8739	21.2	69.8	8.9	<0.1	0	1
Kitchener	8730	23.8	68.6	7.4	0.2	0	3
St. Catharines	8739	21.7	70.4	7.8	0.1	0	2
Guelph	8737	23.5	69.1	7.3	0.1	0	2
Hamilton Downtown	8750	29.5	60.5	9.5	0.4	0	9
Hamilton Mountain	8673	20.4	70.0	9.2	0.3	0	8
Hamilton West	8686	27.1	64.9	7.7	0.3	0	5
Toronto Downtown	8749	33.2	60.3	6.3	0.2	0	5
Toronto East	8752	37.5	55.9	6.4	0.1	0	4
Toronto North	8734	32.7	61.0	6.1	0.2	0	4
Toronto West	8740	43.4	49.1	7.3	0.2	0	7
Burlington	8724	28.8	63.8	7.2	0.2	0	7
Oakville	8753	25.6	66.9	7.3	0.2	0	5
Oshawa	8740	28.7	65.4	5.5	0.3	0	4
Brampton	8742	27.1	64.9	7.9	0.1	<0.01	6
Mississauga	8747	32.0	62.2	5.6	0.2	<0.01	4
Barrie	8751	31.1	64.5	4.3	0.1	0	2
Newmarket	8737	23.7	69.2	7.1	<0.1	0	1
Parry Sound	8752	22.0	72.6	5.3	0	0	0
Dorset	8728	30.8	65.5	3.7	<0.1	0	1
Ottawa Downtown	8630	33.5	62.0	4.3	0.1	0	3
Ottawa Central	8710	28.6	66.2	5.0	0.2	0	3
Petawawa	8731	33.1	64.1	2.7	0	0	0
Kingston	8729	21.1	74.6	4.1	0.2	0	3
Belleville	8752	24.0	69.2	6.5	0.2	0	6
Morrisburg	8736	25.5	69.7	4.6	0.2	0	1
Cornwall	8732	27.4	67.7	4.8	0.2	0	1
Peterborough	8739	25.9	68.8	5.1	0.1	0	3
Thunder Bay	8740	34.2	64.1	1.7	0	0	0
Sault Ste. Marie	8752	26.2	70.5	3.4	0	0	0
North Bay	8758	31.5	65.5	3.0	0	0	0
Sudbury	8756	32.4	63.5	4.1	0	0	0

Table A20: Summary of Smog Advisories (2004 - 2013)

Air Quality Forecast Region	2004		2005		2006		2007		2008		2009		2010		2011		2012		2013	
	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days	Adv.	Days
Algonquin	3	6	5	16	1	3	1	3	0	0	1	1	0	0	0	0	1	3	0	0
Bancroft-Bon Echo	6	12	7	21	1	3	4	13	2	3	2	4	1	5	0	0	2	5	1	2
Barrie-Orillia-Midland	5	12	13	39	5	11	8	21	3	7	2	4	1	4	1	1	7	15	0	0
Belleville-Quinte-Northumberland	5	10	13	42	5	12	9	24	4	8	2	4	2	8	1	1	6	13	1	2
Brockville-Leeds and Grenville	5	10	7	24	2	5	3	5	2	4	2	4	1	2	0	0	2	4	1	2
Burk's Falls-Bayfield Inlet	5	11	8	24	2	4	1	3	0	0	1	1	0	0	0	0	2	4	0	0
City of Hamilton	6	15	13	45	5	11	10	31	6	13	2	4	2	8	2	2	7	18	1	2
City of Ottawa	1	1	7	25	2	5	2	4	1	1	2	4	1	2	0	0	1	2	1	2
City of Toronto	6	14	14	48	5	11	11	29	6	13	2	4	2	8	1	1	8	16	1	2
Cornwall-Morrisburg	1	1	7	25	2	5	3	5	2	4	2	4	1	2	0	0	1	2	1	2
Dufferin-Innisfil	5	13	13	44	5	11	9	27	3	7	2	4	1	5	1	1	7	15	0	0
Dunnville-Caledonia-Haldimand	6	16	13	45	5	11	12	31	4	11	2	4	2	8	1	1	6	16	0	0
Elgin	6	16	12	45	4	13	13	37	6	15	2	4	2	10	2	4	7	18	0	0
Elliot Lake-Ranger Lake	0	0	4	12	1	3	1	3	0	0	0	0	0	0	0	0	2	4	0	0
Greater Sudbury and Vicinity	0	0	7	20	2	4	1	3	0	0	1	1	0	0	0	0	2	4	0	0
Grey-Bruce	4	10	10	32	4	10	9	22	1	2	2	4	2	8	1	1	6	14	0	0
Haliburton	6	12	10	30	4	10	6	17	1	2	2	4	1	4	0	0	3	6	0	0
Halton-Peel	6	14	14	48	5	11	11	31	6	13	2	4	2	8	1	1	8	17	1	2
Huron-Perth	6	16	12	44	4	11	12	27	3	7	2	4	2	10	1	1	7	18	0	0
Kingston-Prince Edward	5	10	10	32	5	12	9	23	4	8	2	4	2	8	1	1	5	11	1	2
London-Middlesex	6	16	12	45	4	12	12	27	5	11	2	4	2	9	1	1	7	18	0	0
Manitoulin-Northshore-Killarney	0	0	6	18	2	4	1	3	0	0	1	1	0	0	0	0	2	4	0	0
Niagara	5	13	13	45	5	11	10	29	4	11	2	4	2	8	1	1	6	16	0	0
North Bay-West Nipissing	2	4	7	20	2	4	1	3	0	0	1	1	0	0	0	0	2	4	0	0
Oxford-Brant	6	16	13	46	5	11	12	31	4	11	2	4	2	8	1	1	6	16	0	0
Parry Sound-Muskoka-Huntsville	5	11	10	30	4	10	8	21	2	5	2	4	1	4	0	0	5	10	0	0
Peterborough-Kawartha Lakes	6	12	12	38	4	10	8	21	3	6	2	4	2	8	0	0	6	13	1	2
Prescott and Russell	1	1	7	25	2	5	2	4	1	1	2	4	1	2	0	0	1	2	1	2
Renfrew-Pembroke-Barry's Bay	3	6	5	17	1	3	2	5	0	0	2	4	1	2	0	0	1	2	1	2
Sarnia-Lambton	6	16	13	46	4	12	13	29	4	10	2	4	2	10	2	4	7	18	0	0
Sault Ste. Marie-Superior East	0	0	4	10	1	3	1	3	0	0	0	0	0	0	0	0	1	3	0	0
Simcoe-Delhi-Norfolk	6	16	13	46	5	11	12	31	4	11	2	4	2	10	1	1	6	16	0	0
Smiths Falls-Lanark-Sharbot Lake	4	8	6	19	2	5	2	4	1	1	2	4	1	2	0	0	1	2	1	2
Stirling-Tweed-South Frontenac	5	10	8	25	2	5	5	13	2	3	2	4	2	8	0	0	3	6	1	2
Waterloo-Wellington	5	13	13	45	5	11	11	29	3	7	2	4	2	8	1	1	6	15	0	0
Windsor-Essex-Chatham-Kent	6	16	13	46	4	14	13	38	5	12	3	5	2	10	4	8	8	24	0	0
York-Durham	6	14	14	48	5	11	11	29	5	9	2	4	2	8	1	1	8	16	1	2
ONTARIO	**8**	**20**	**15**	**53**	**6**	**17**	**13**	**39**	**8**	**17**	**3**	**5**	**3**	**12**	**5**	**9**	**12**	**30**	**1**	**2**

Note:
A smog advisory day refers to a calendar day when a smog advisory is in effect.

Figure A1: 20y Trend of Ozone Annual Mean at Windsor Downtown

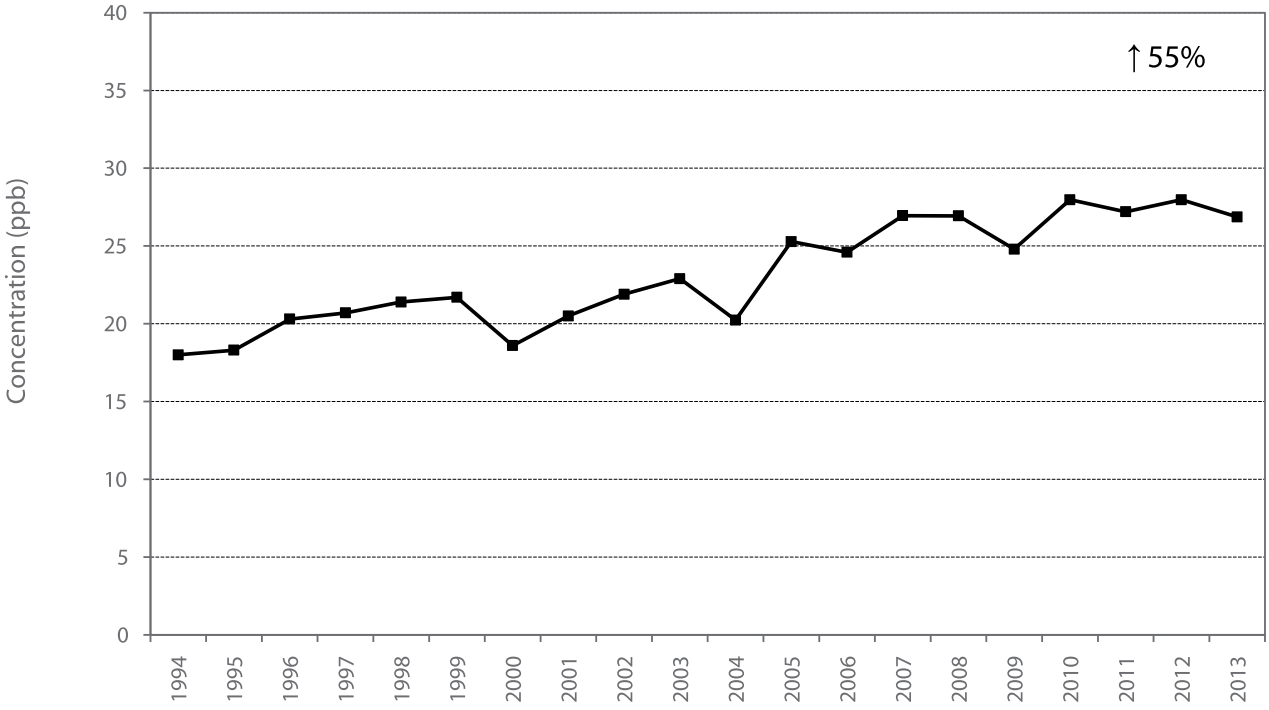


Figure A2: 20y Trend of Ozone Annual Mean at Windsor West

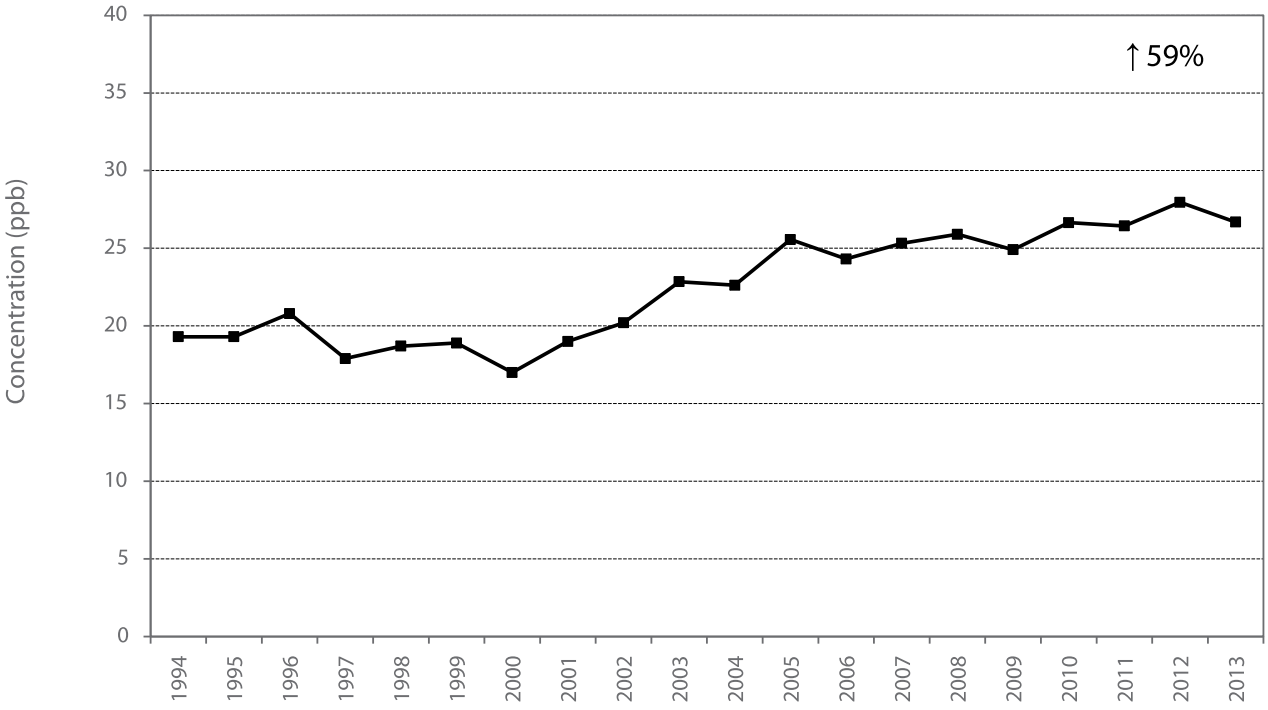


Figure A3: 20y Trend of Ozone Annual Mean at Sarnia

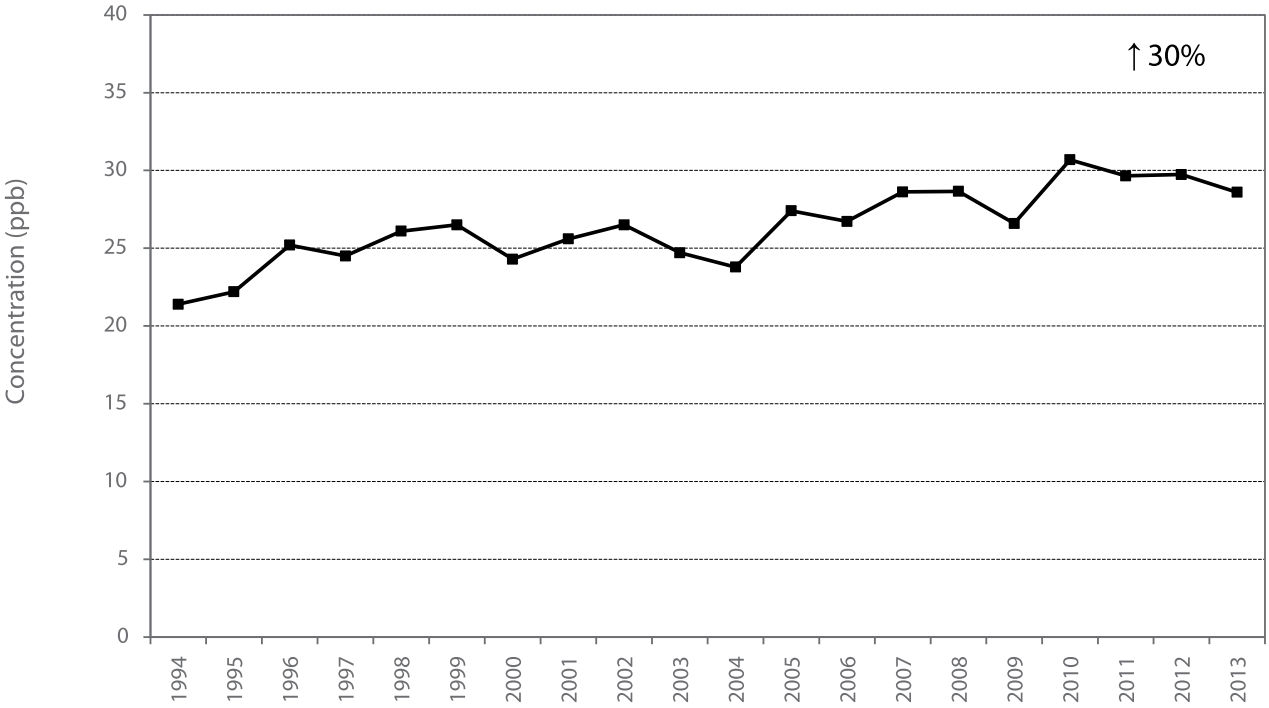


Figure A4: 20y Trend of Ozone Annual Mean at Grand Bend

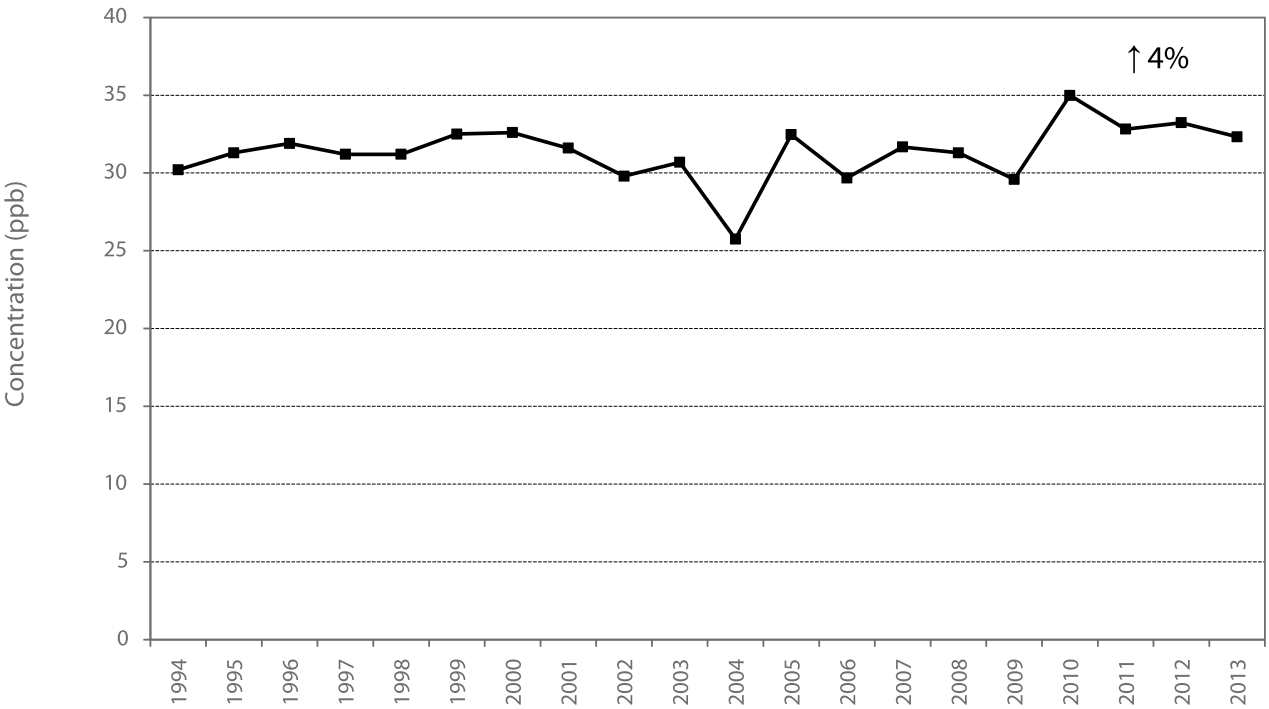


Figure A5: 20y Trend of Ozone Annual Mean at London

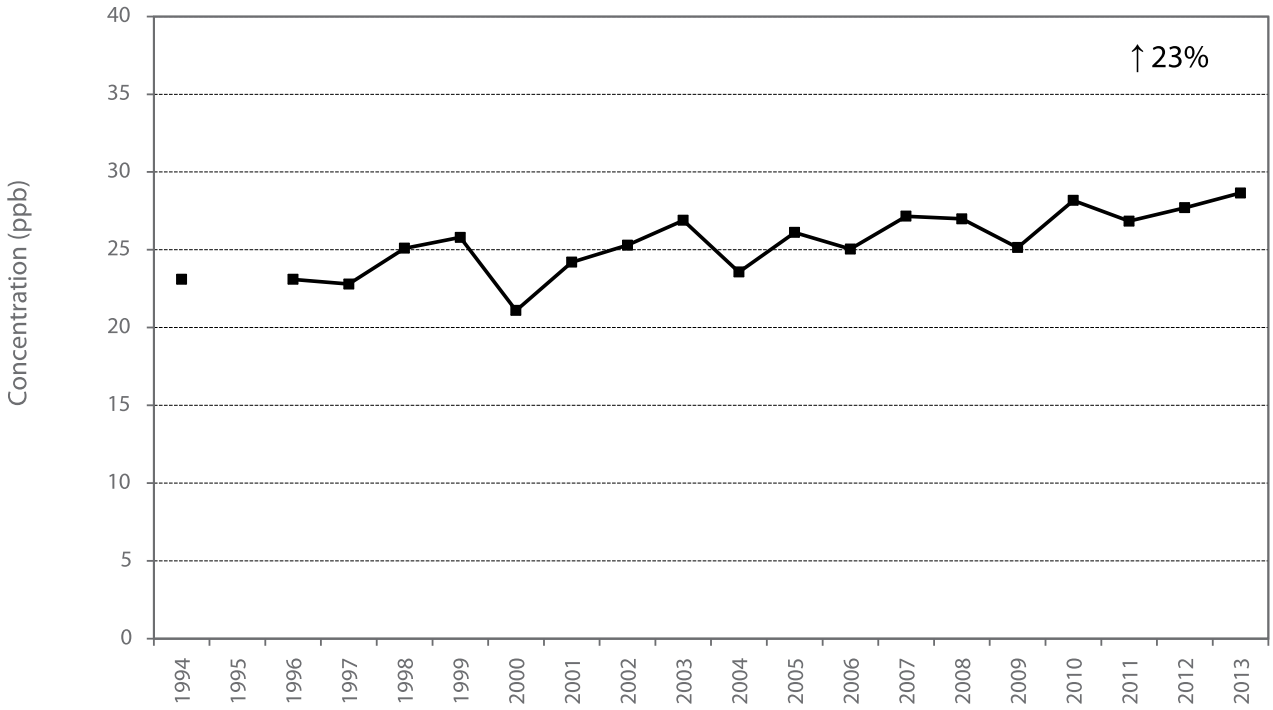


Figure A6: 20y Trend of Ozone Annual Mean at Tiverton

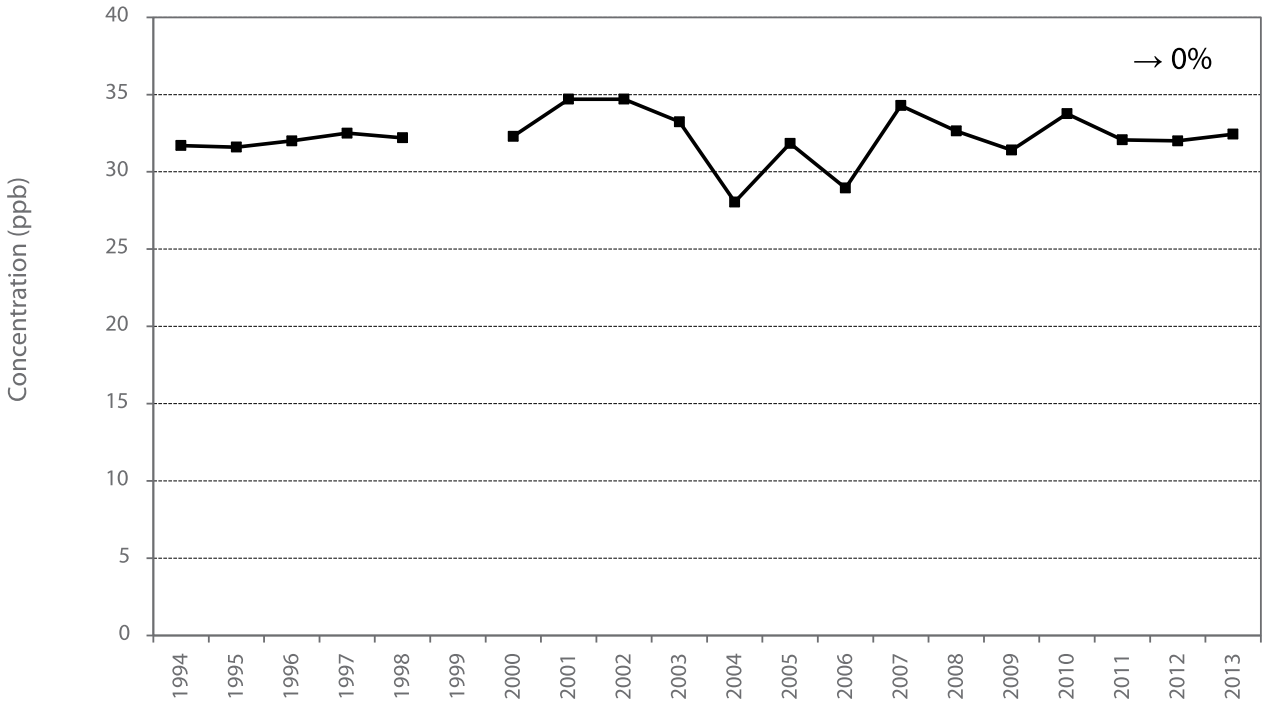


Figure A7: 20y Trend of Ozone Annual Mean at Kitchener

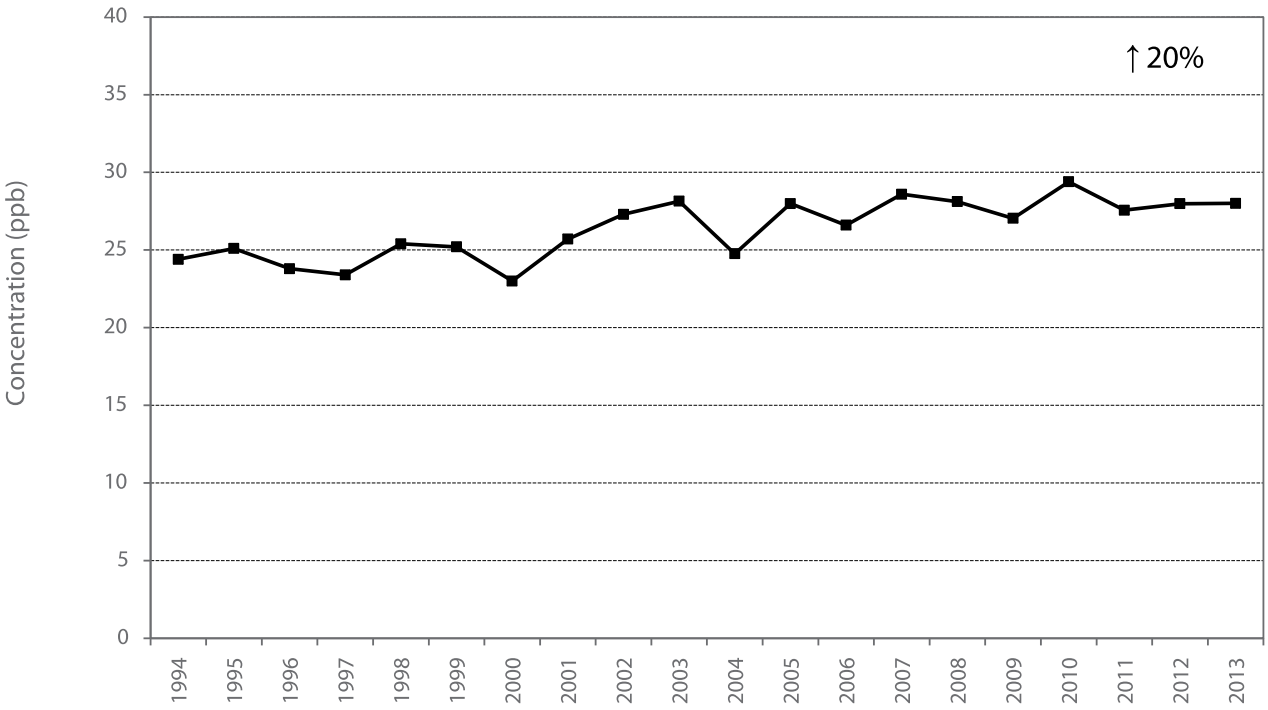


Figure A8: 20y Trend of Ozone Annual Mean at St. Catharines

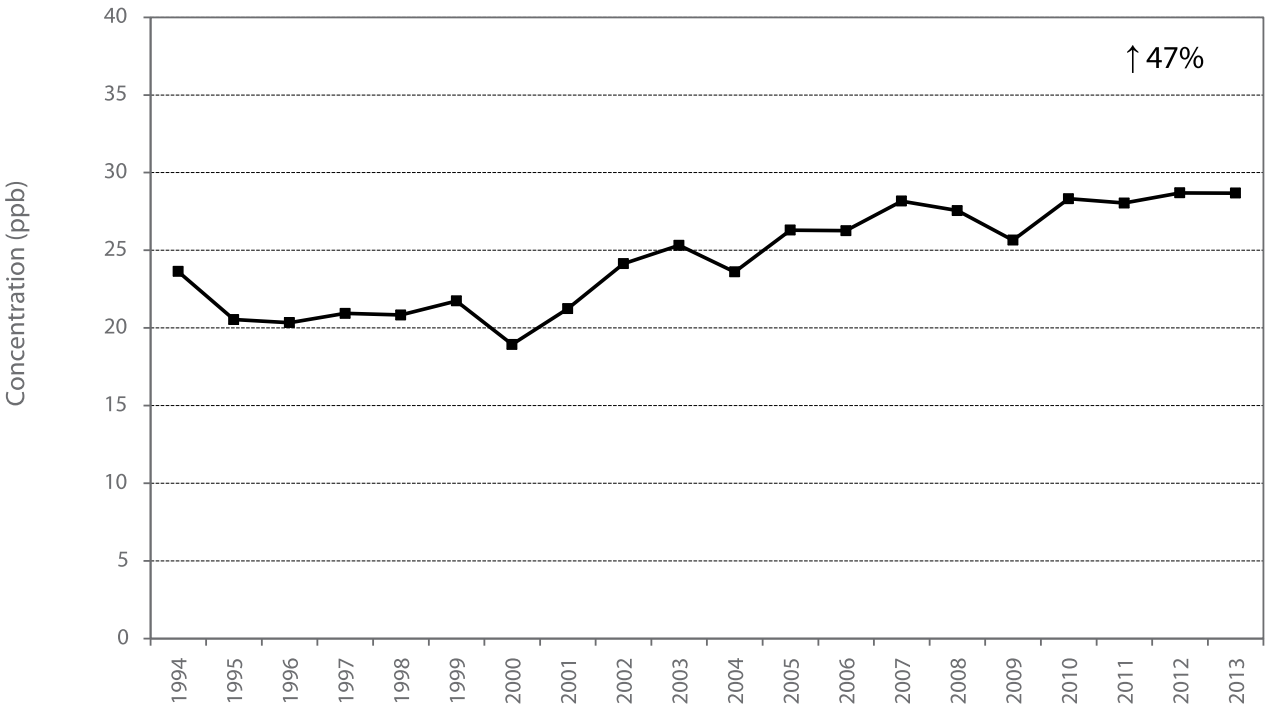


Figure A9: 20y Trend of Ozone Annual Mean at Guelph

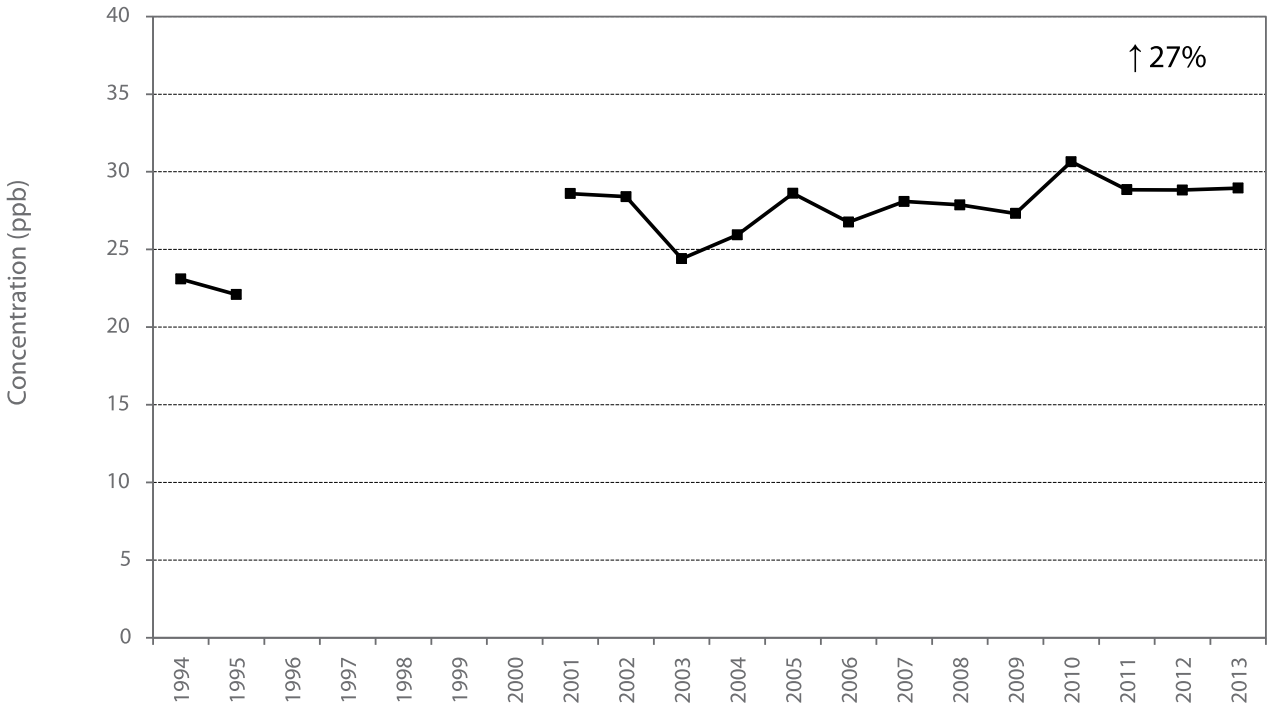


Figure A10: 20y Trend of Ozone Annual Mean at Hamilton Downtown

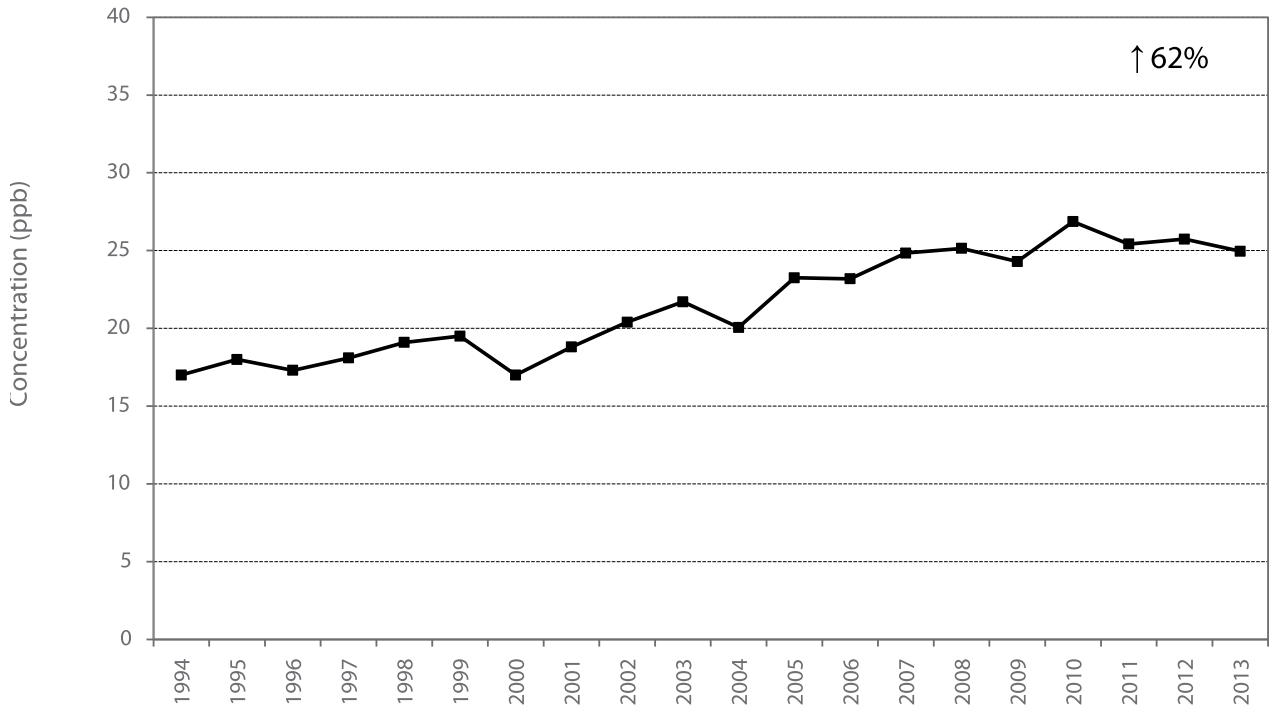


Figure A11: 20y Trend of Ozone Annual Mean at Hamilton Mountain

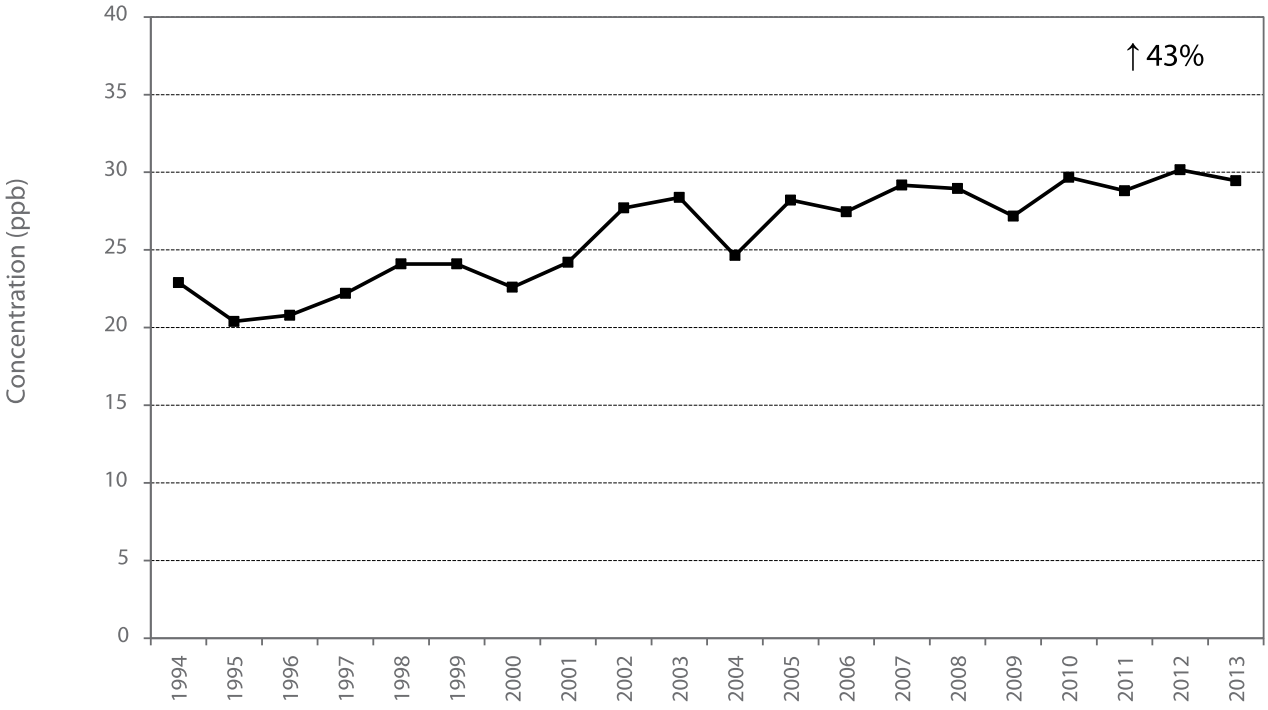


Figure A12: 20y Trend of Ozone Annual Mean at Hamilton West

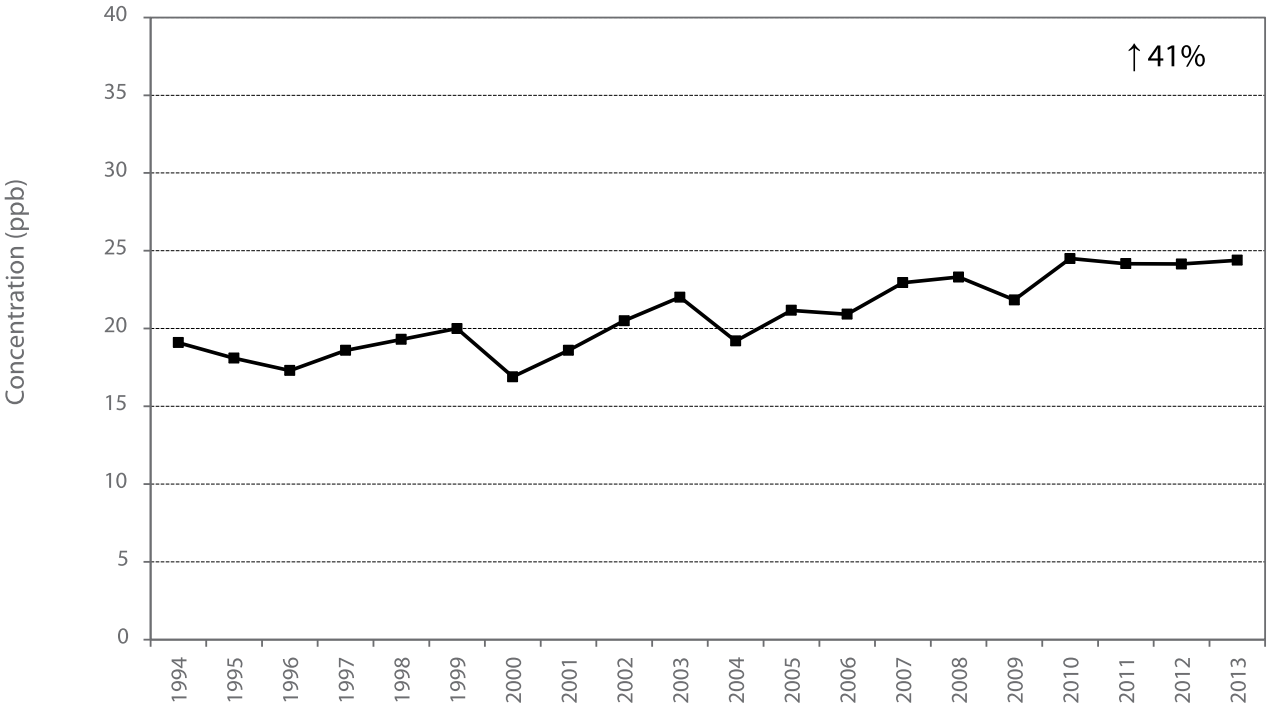


Figure A13: 20y Trend of Ozone Annual Mean at Toronto Downtown

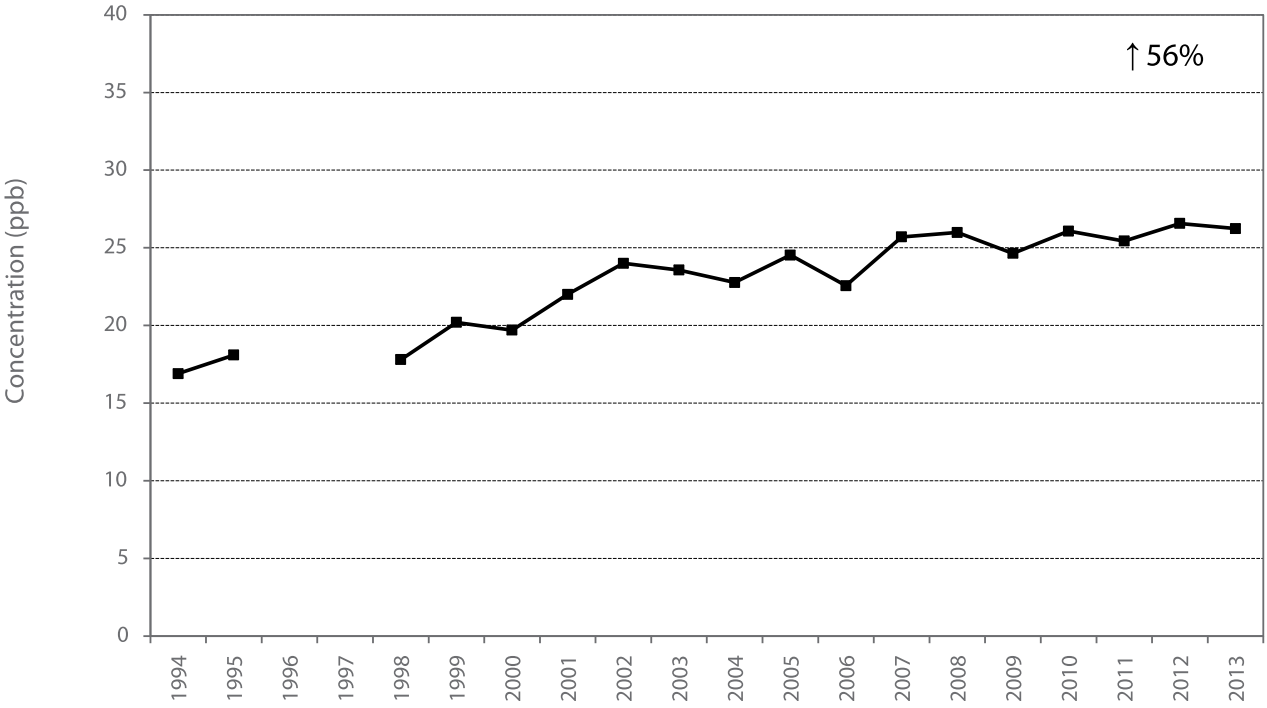


Figure A14: 20y Trend of Ozone Annual Mean at Toronto East

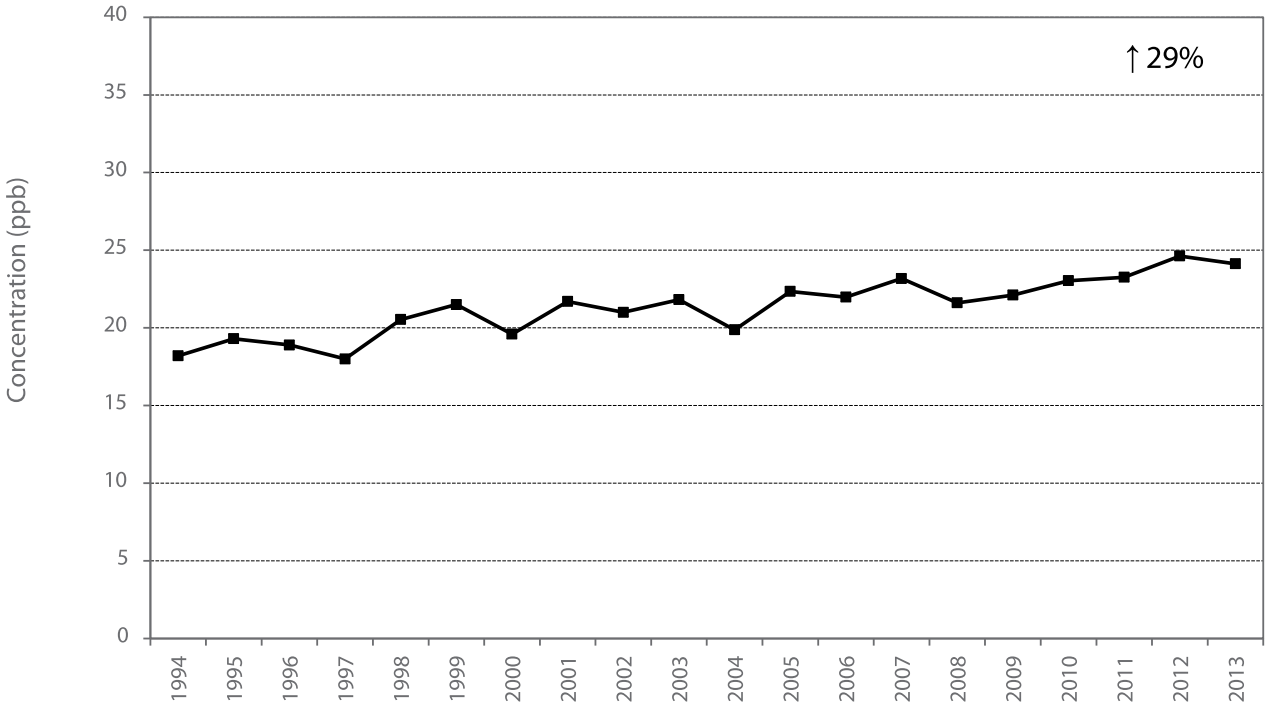


Figure A15: 20y Trend of Ozone Annual Mean at Toronto North

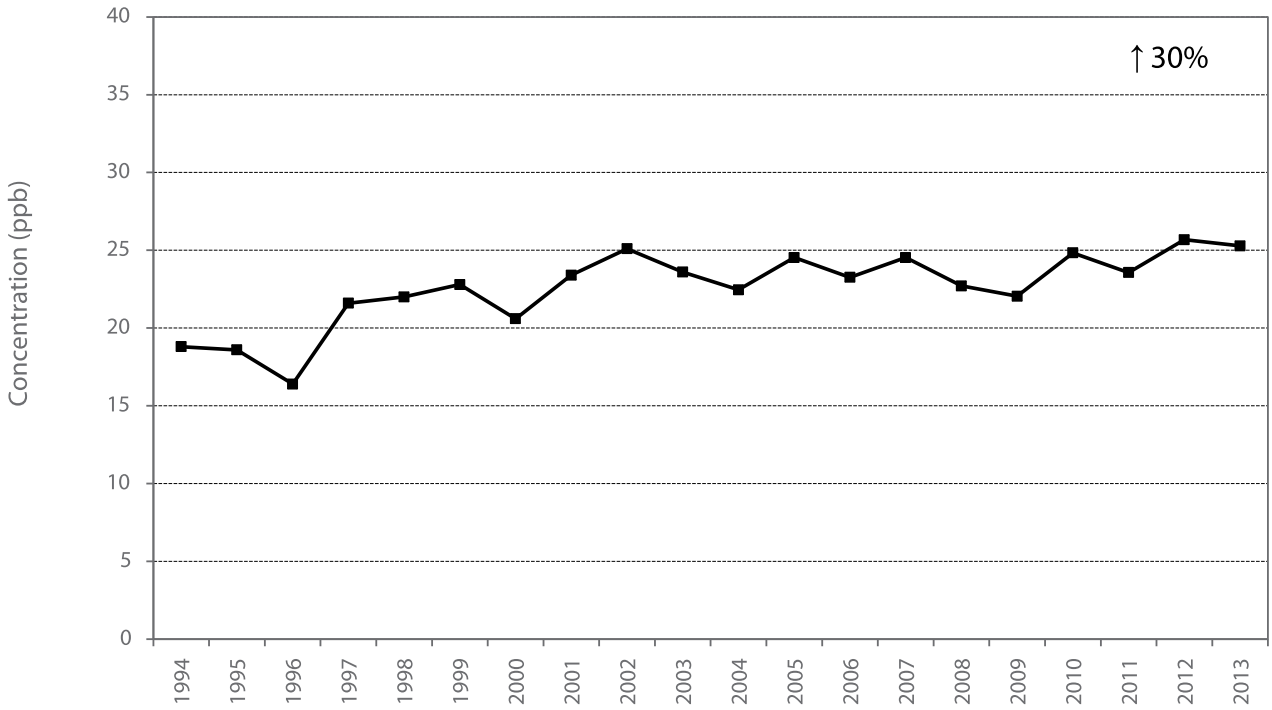


Figure A16: 20y Trend of Ozone Annual Mean at Burlington

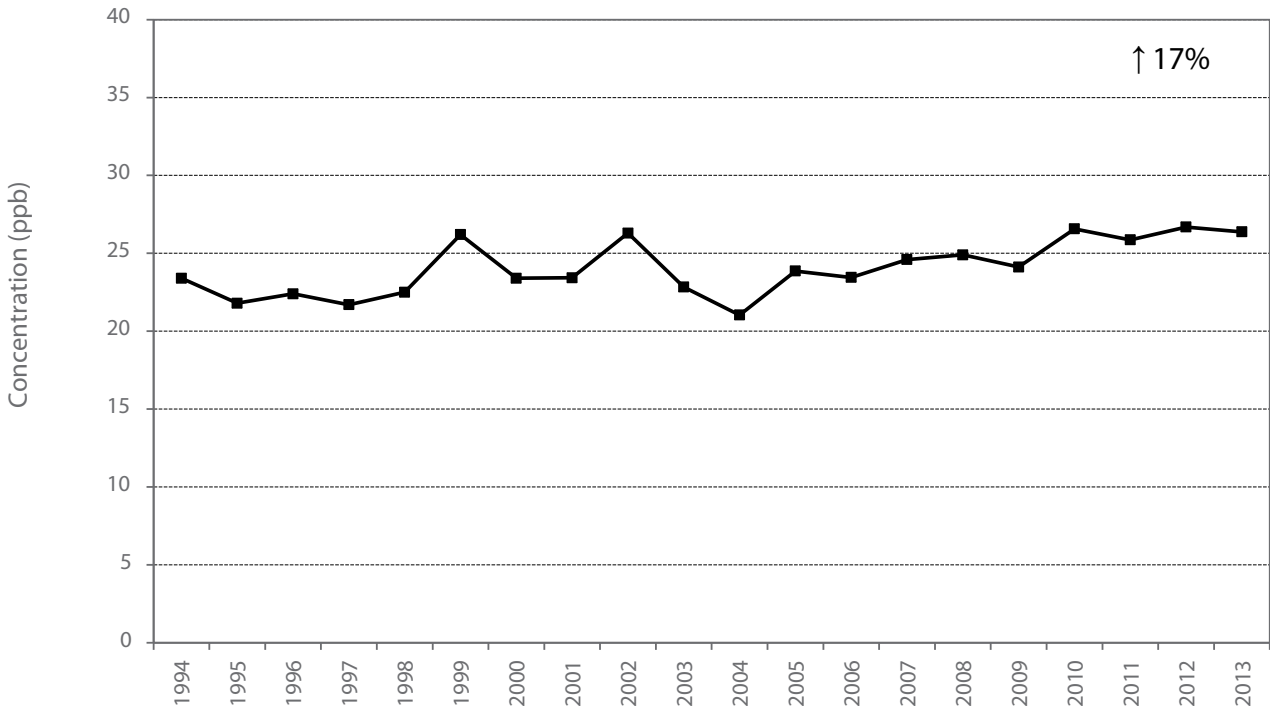


Figure A17: 20y Trend of Ozone Annual Mean at Oakville

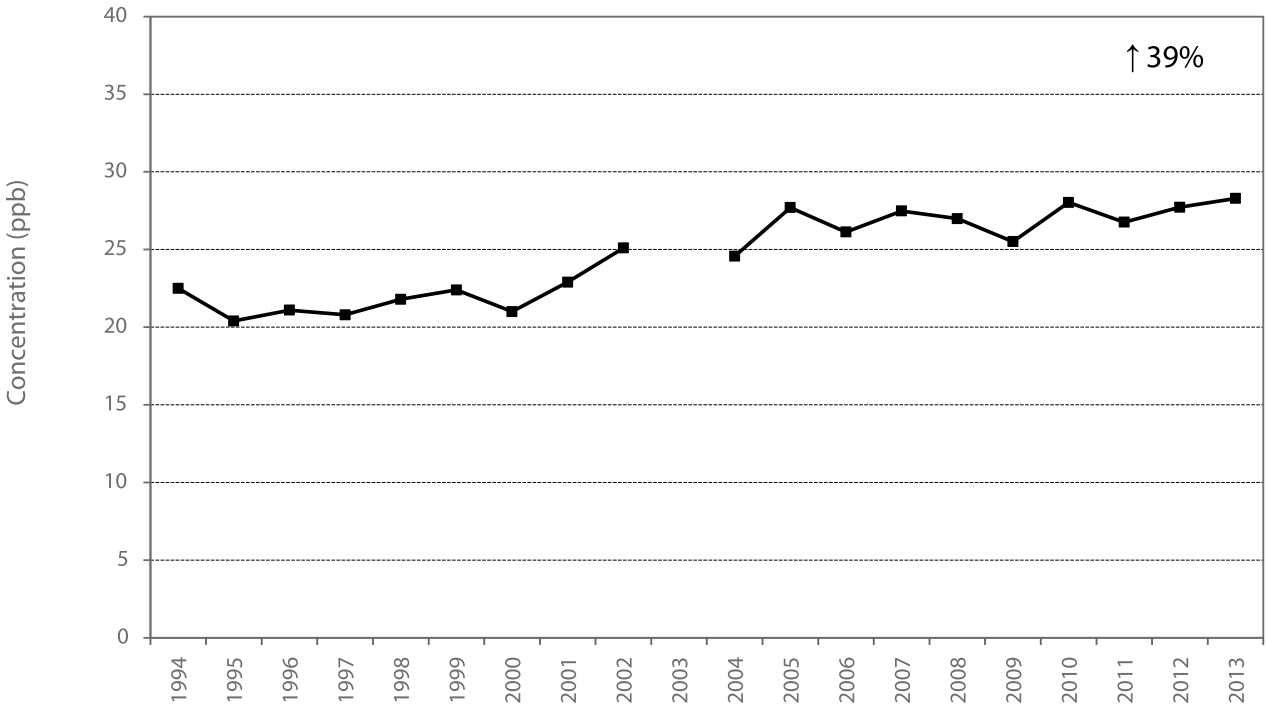


Figure A18: 20y Trend of Ozone Annual Mean at Oshawa

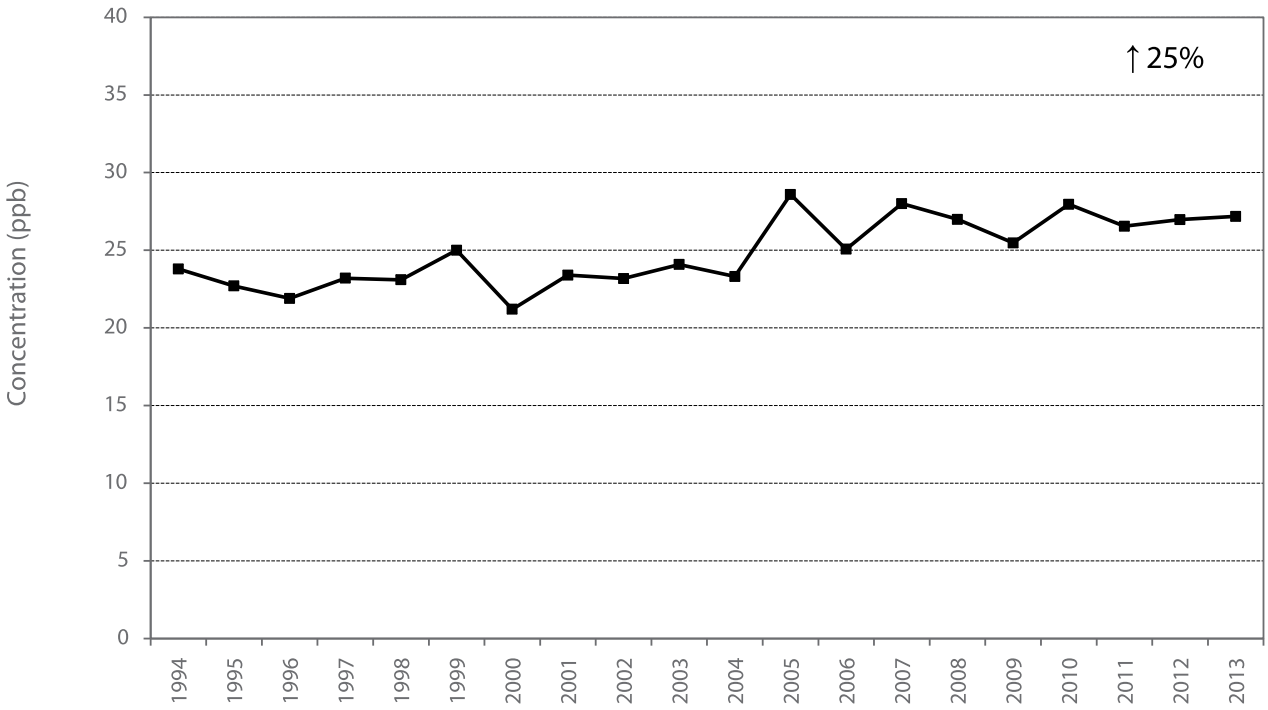


Figure A19: 20y Trend of Ozone Annual Mean at Mississauga

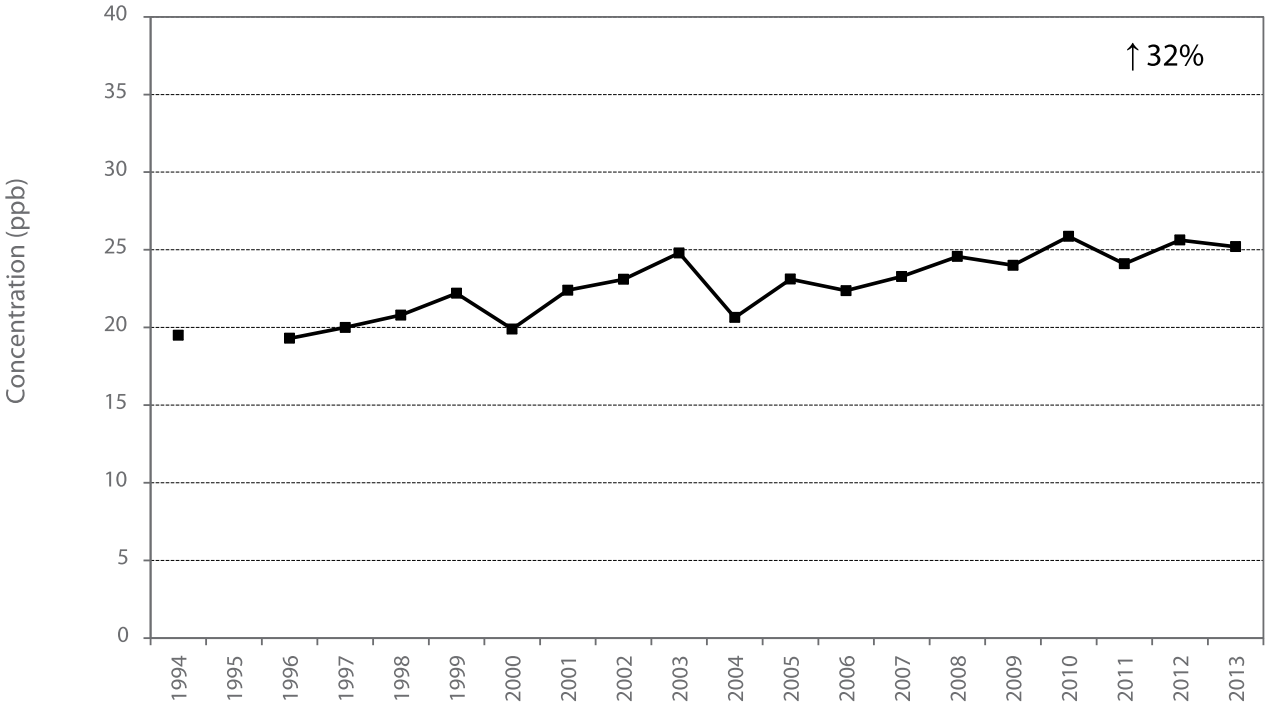


Figure A20: 20y Trend of Ozone Annual Mean at Dorset

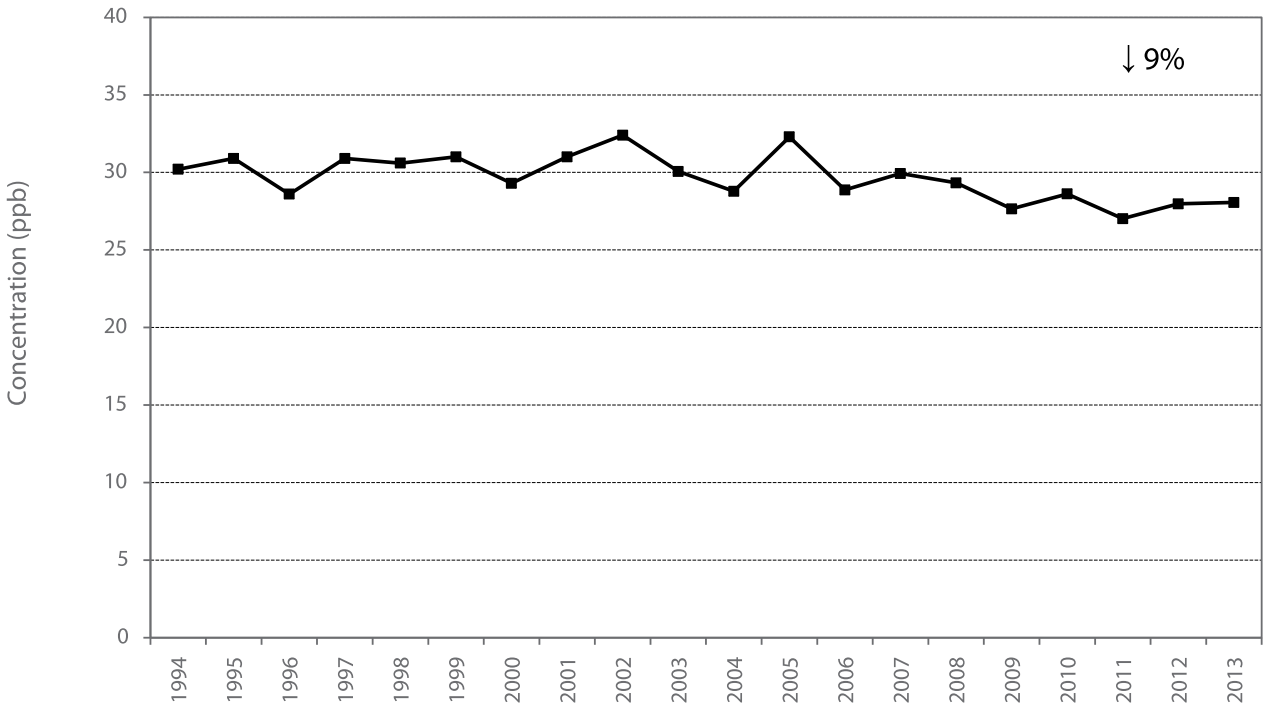


Figure A21: 20y Trend of Ozone Annual Mean at Ottawa Downtown

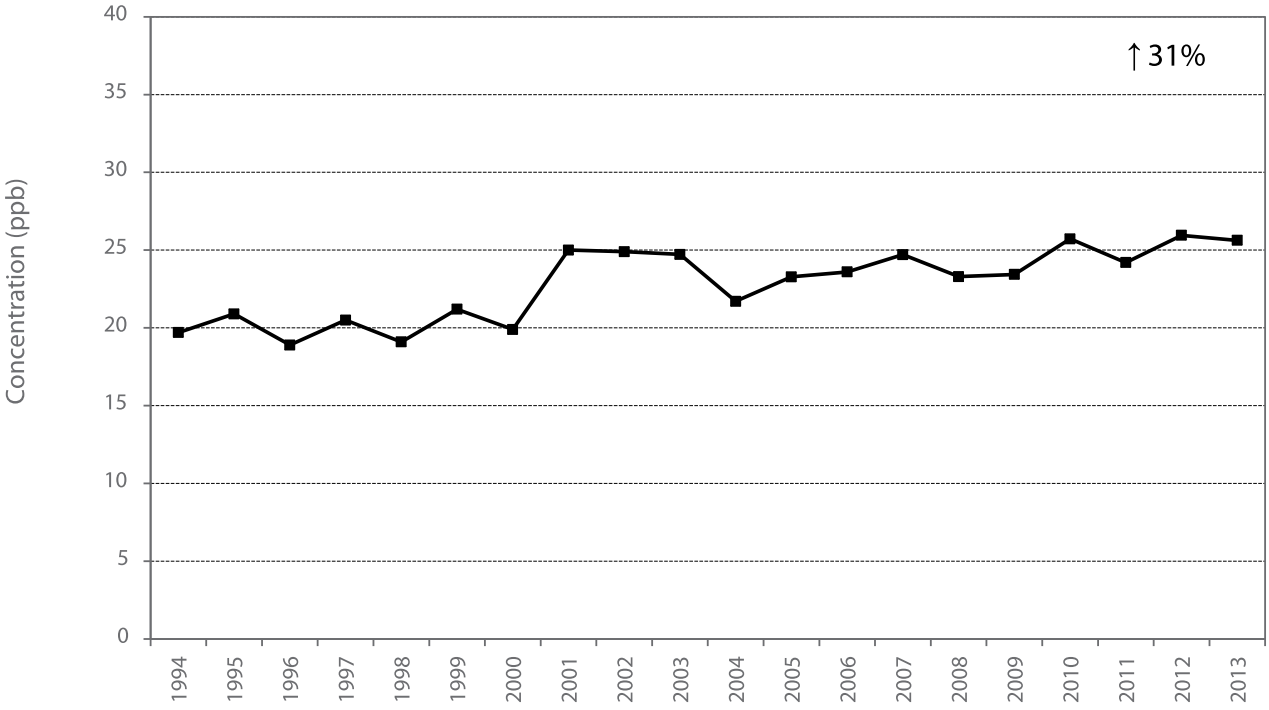


Figure A22: 20y Trend of Ozone Annual Mean at Cornwall

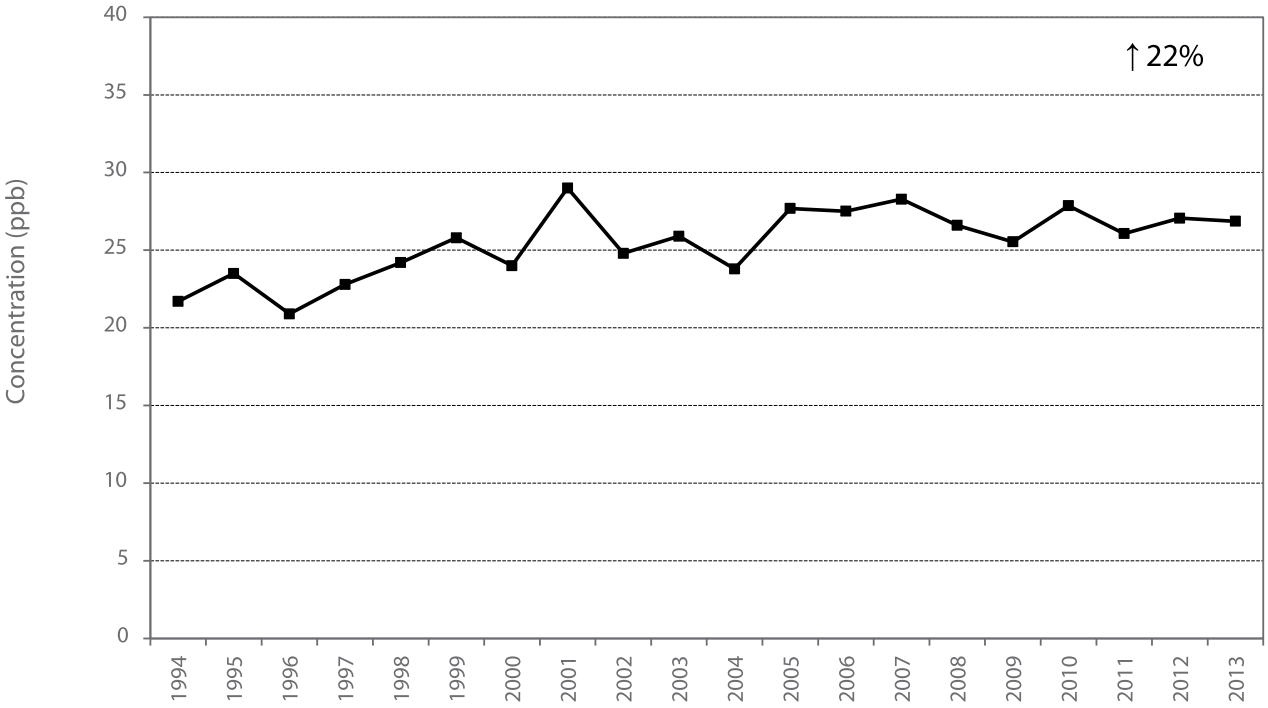


Figure A23: 20y Trend of Ozone Annual Mean at Thunder Bay

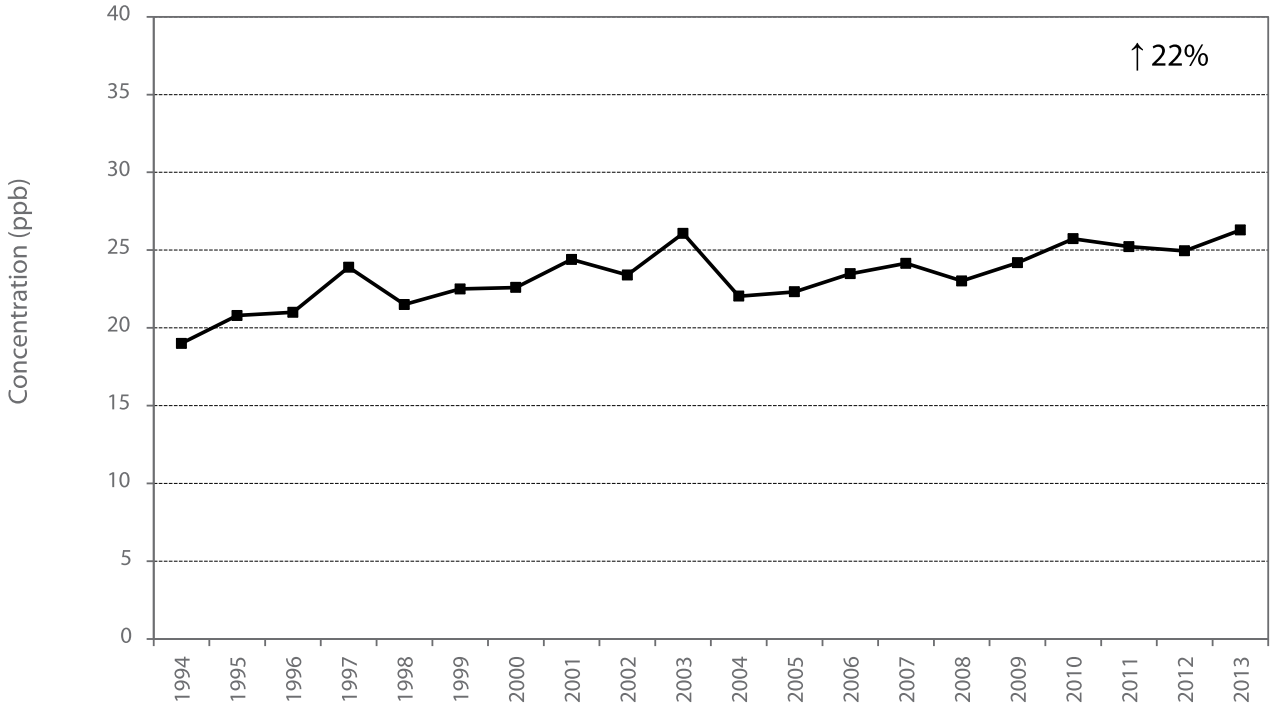


Figure A24: 20y Trend of Ozone Annual Mean at Sault Ste. Marie

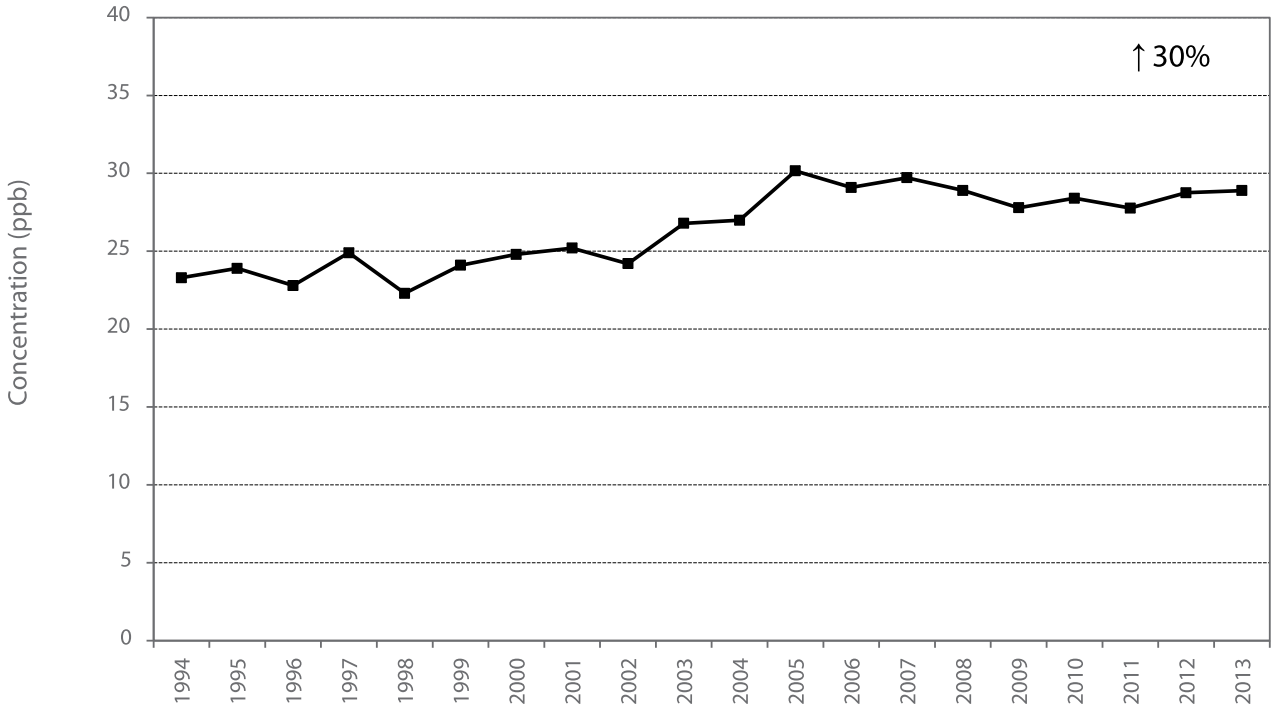


Figure A25: 20y Trend of Ozone Annual Mean at North Bay

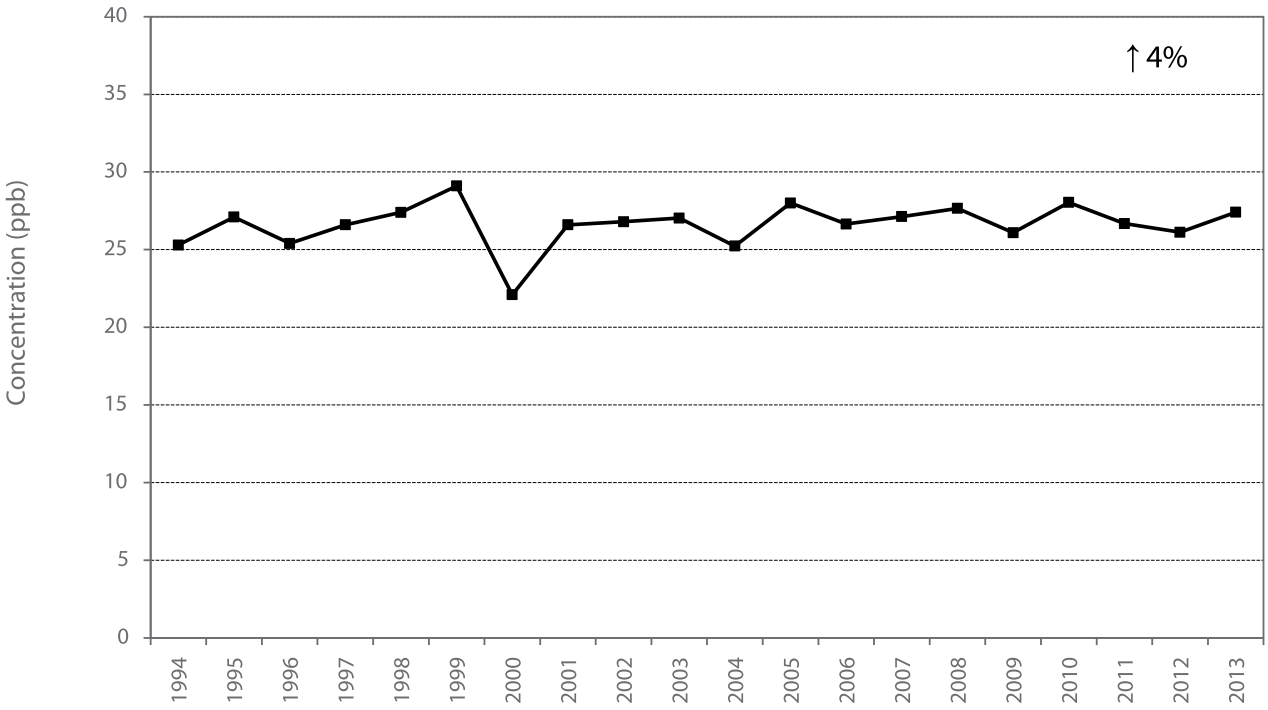


Figure A26: 20y Trend of Ozone Annual Mean at Sudbury

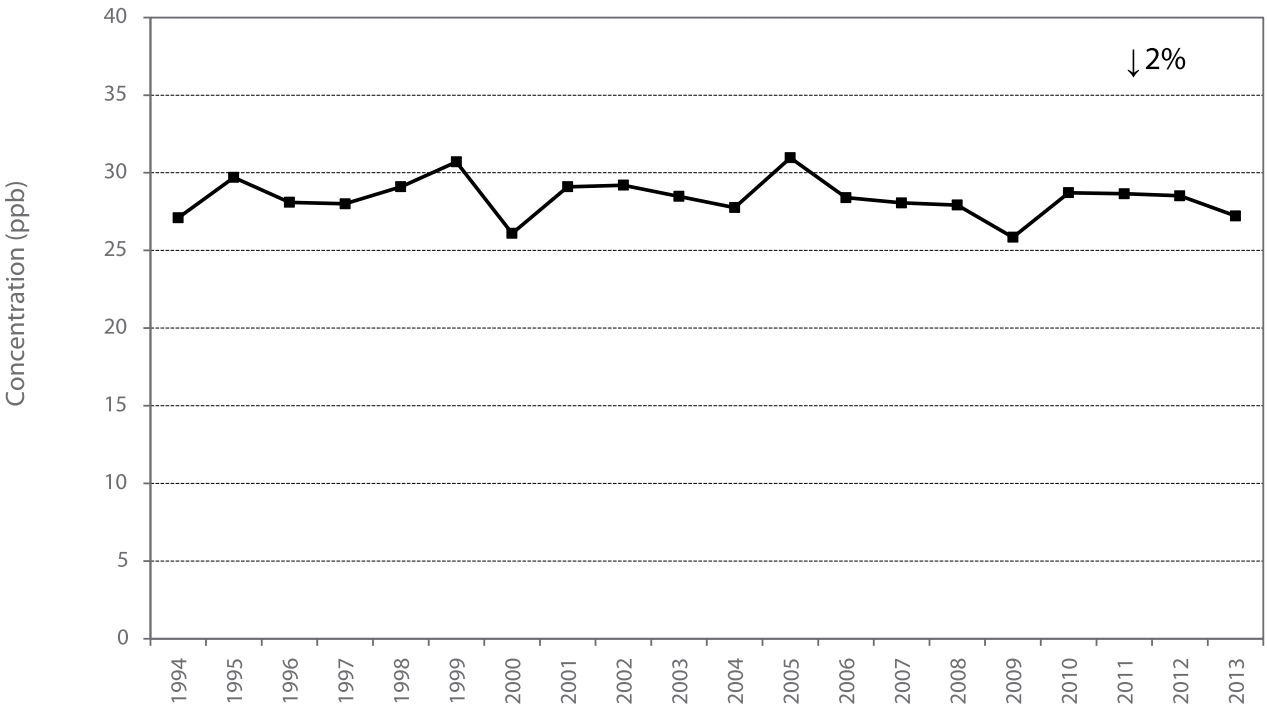


Figure A27: 20y Trend of NO_2 Annual Mean at Windsor Downtown

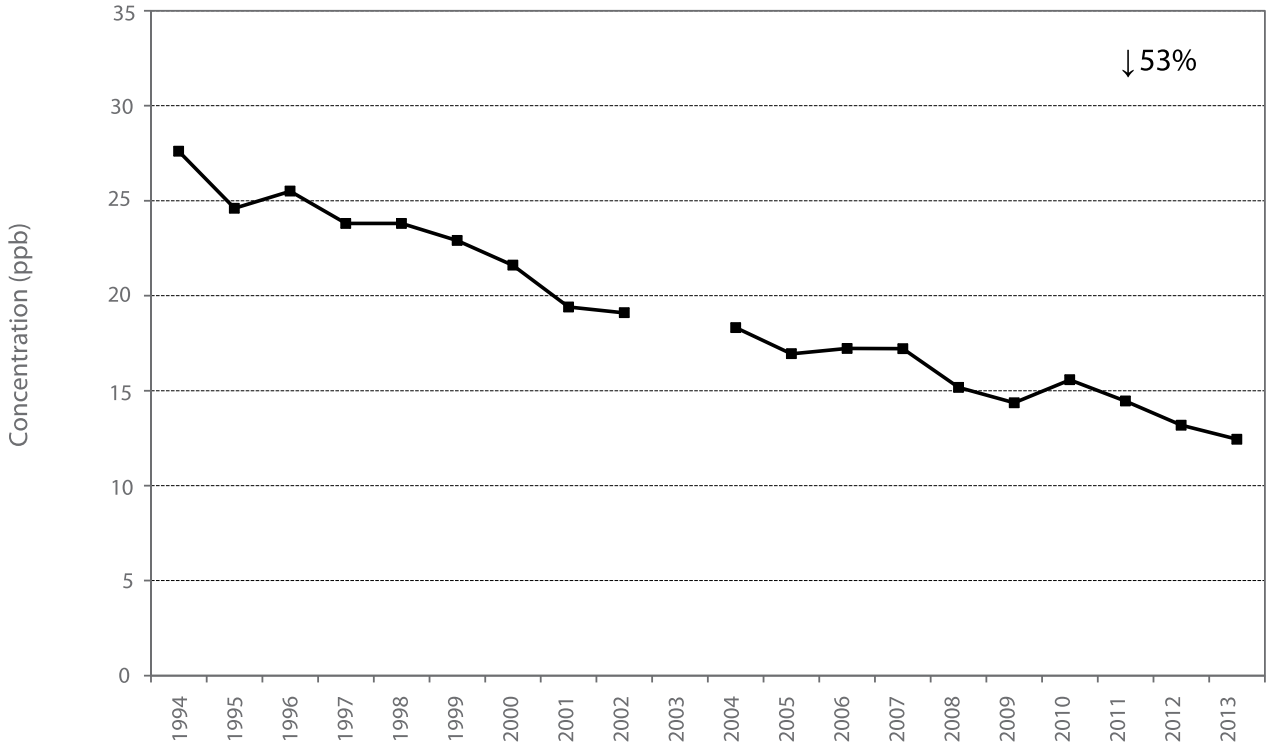


Figure A28: 20y Trend of NO_2 Annual Mean at Sarnia

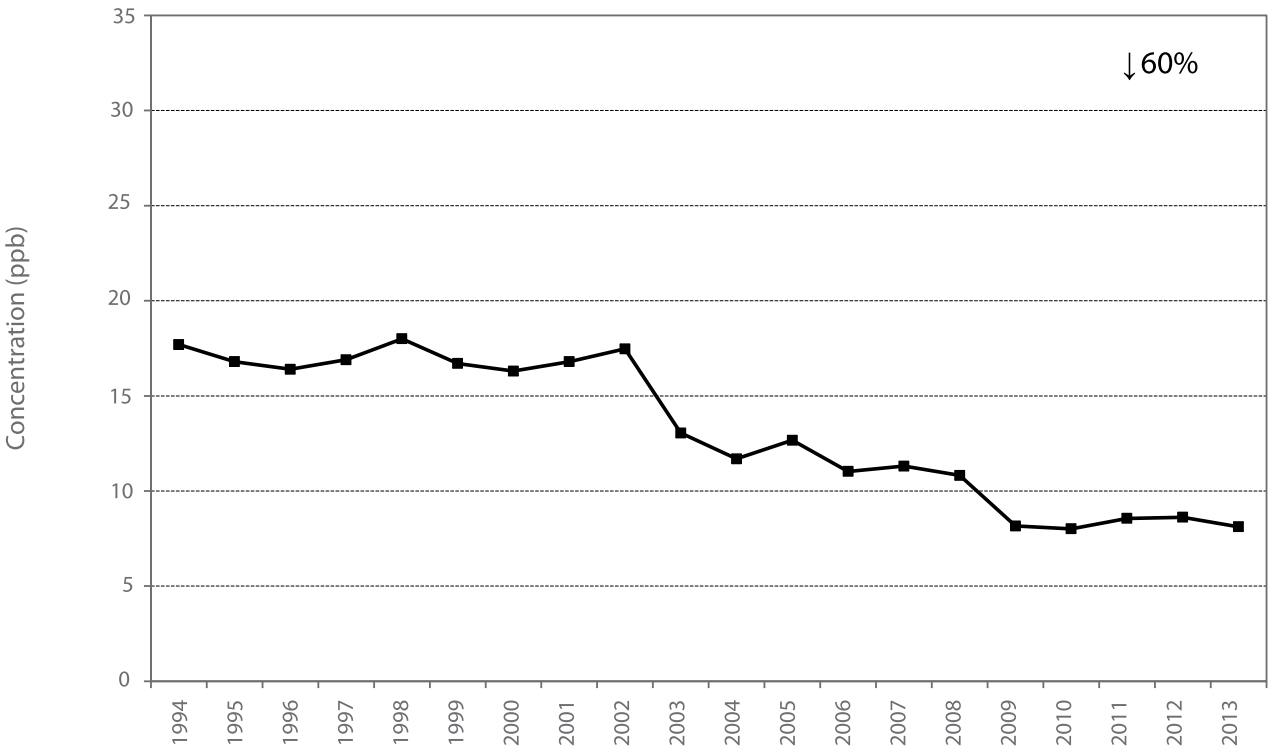


Figure A29: 20y Trend of NO_2 Annual Mean at London

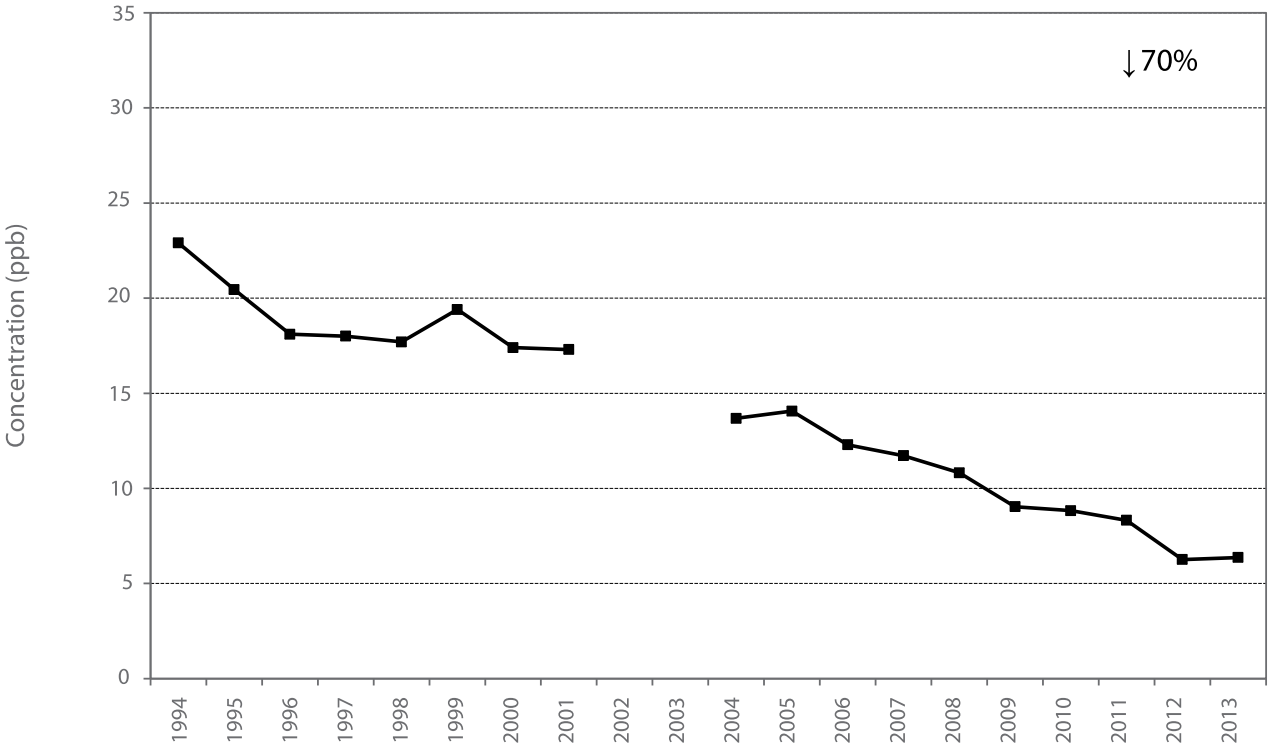


Figure A30: 20y Trend of NO_2 Annual Mean at Kitchener

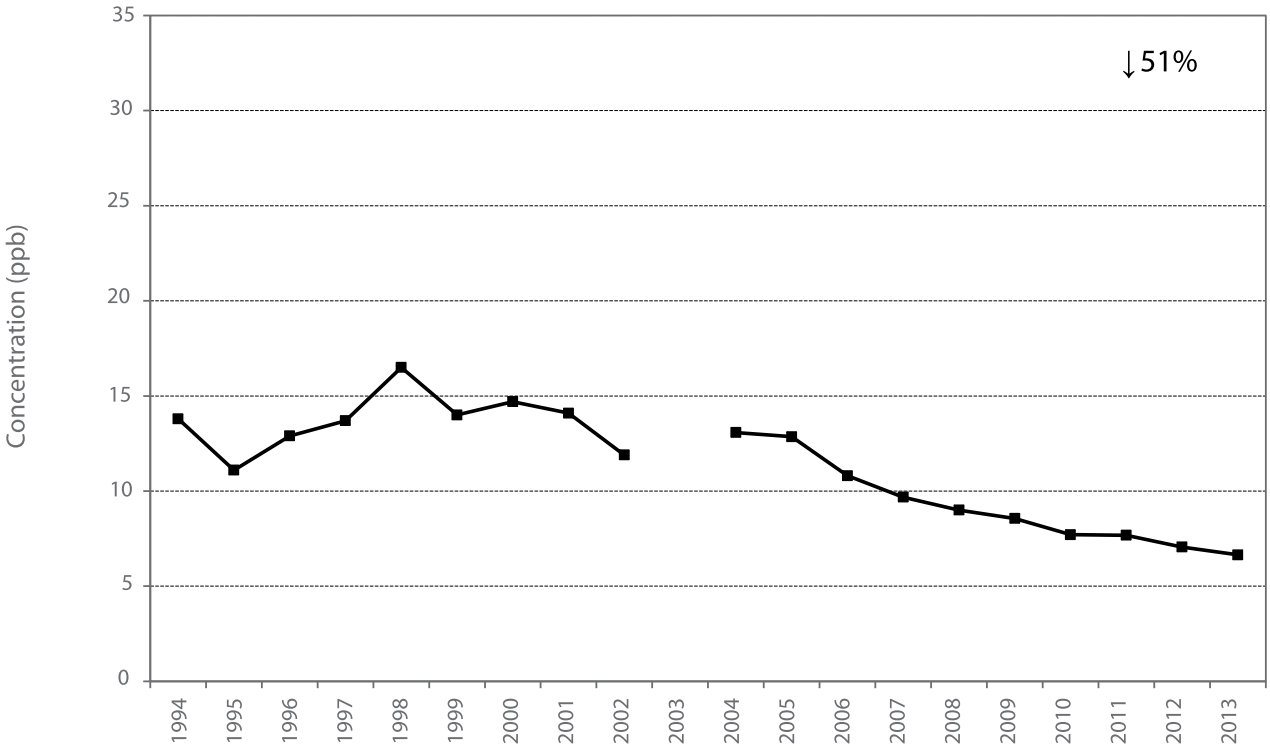


Figure A31: 20y Trend of NO_2 Annual Mean at St. Catharines

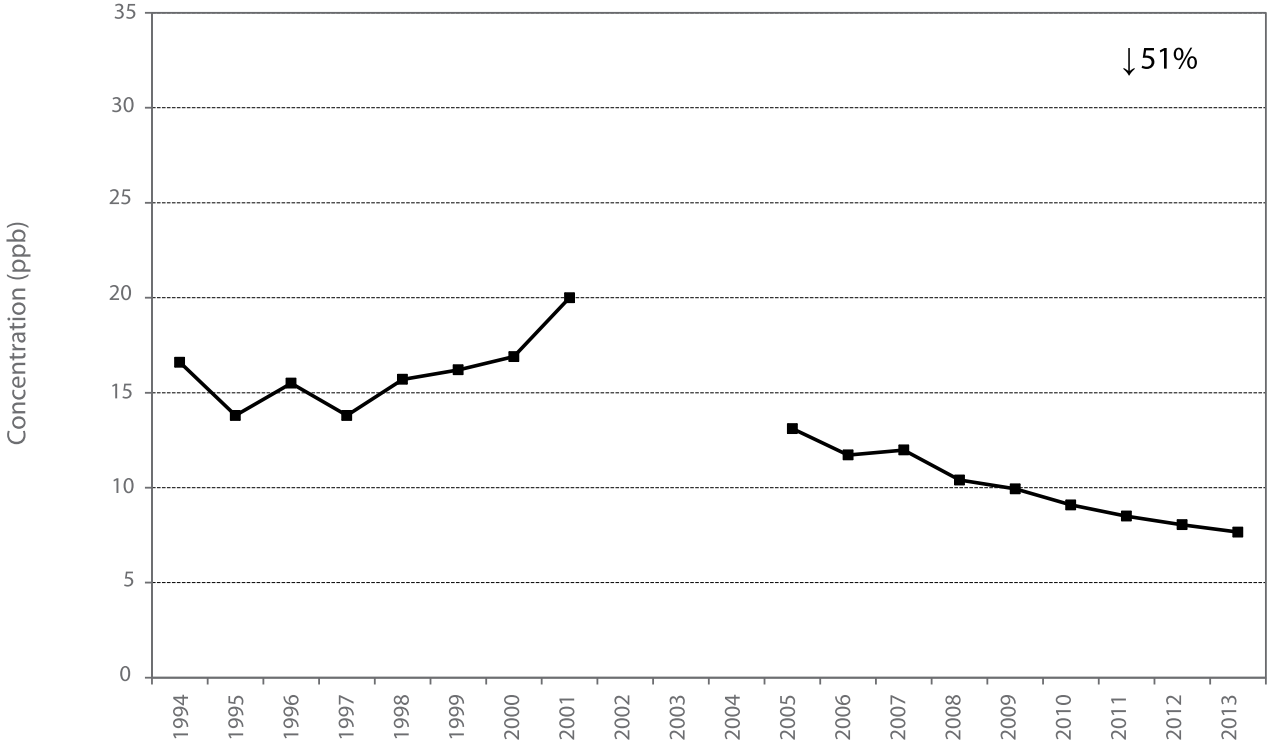


Figure A32: 20y Trend of NO_2 Annual Mean at Hamilton Downtown

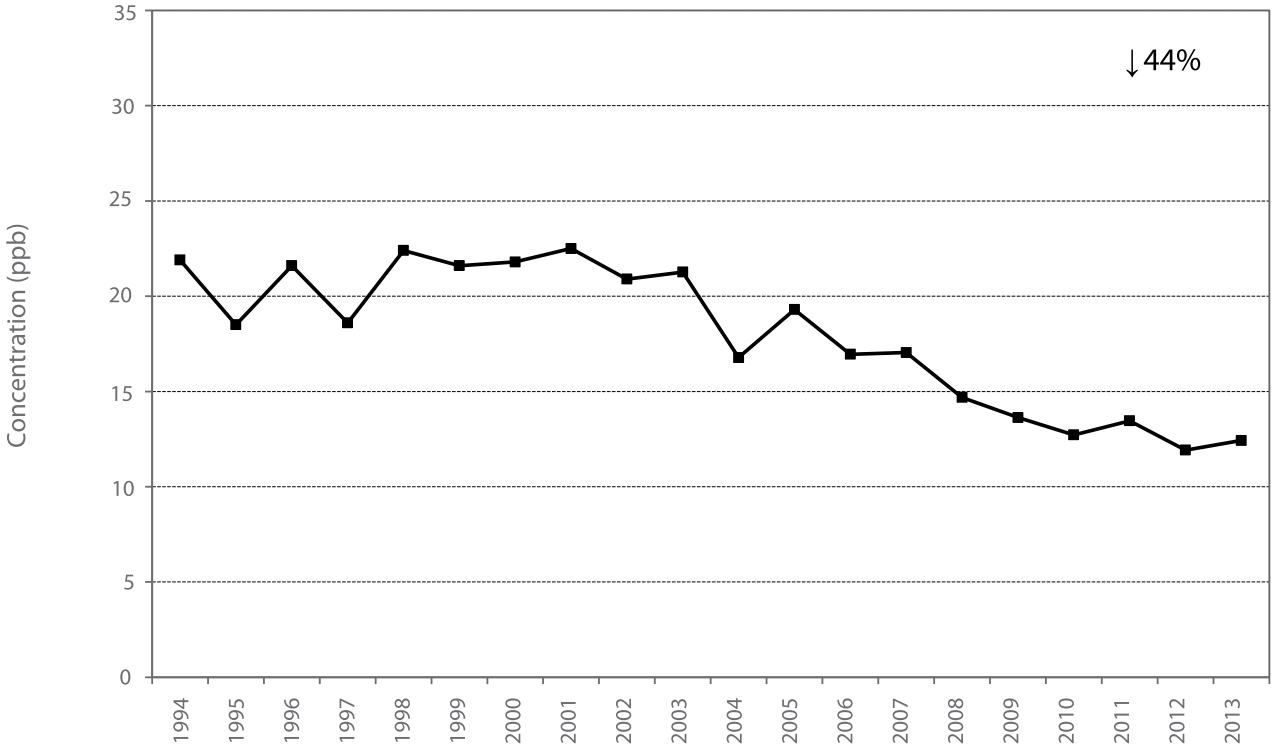


Figure A33: 20y Trend of NO_2 Annual Mean at Hamilton Mountain

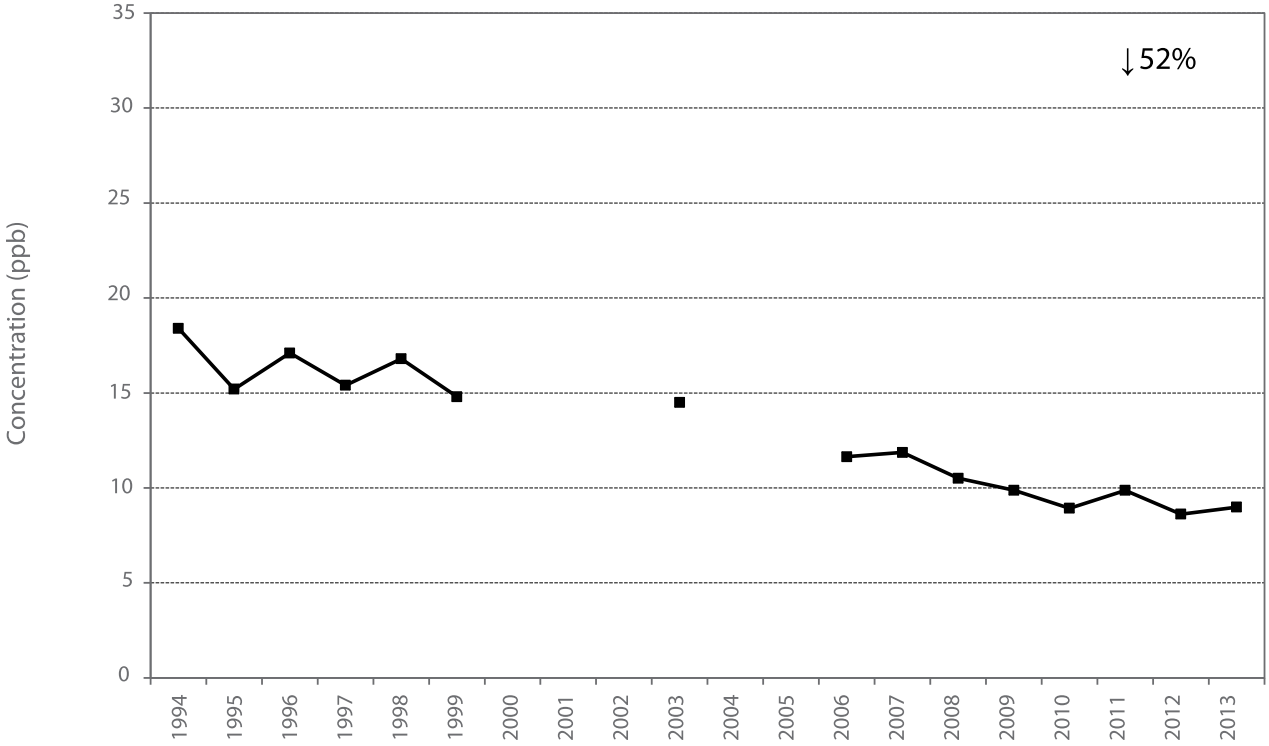


Figure A34: 20y Trend of NO_2 Annual Mean at Toronto Downtown

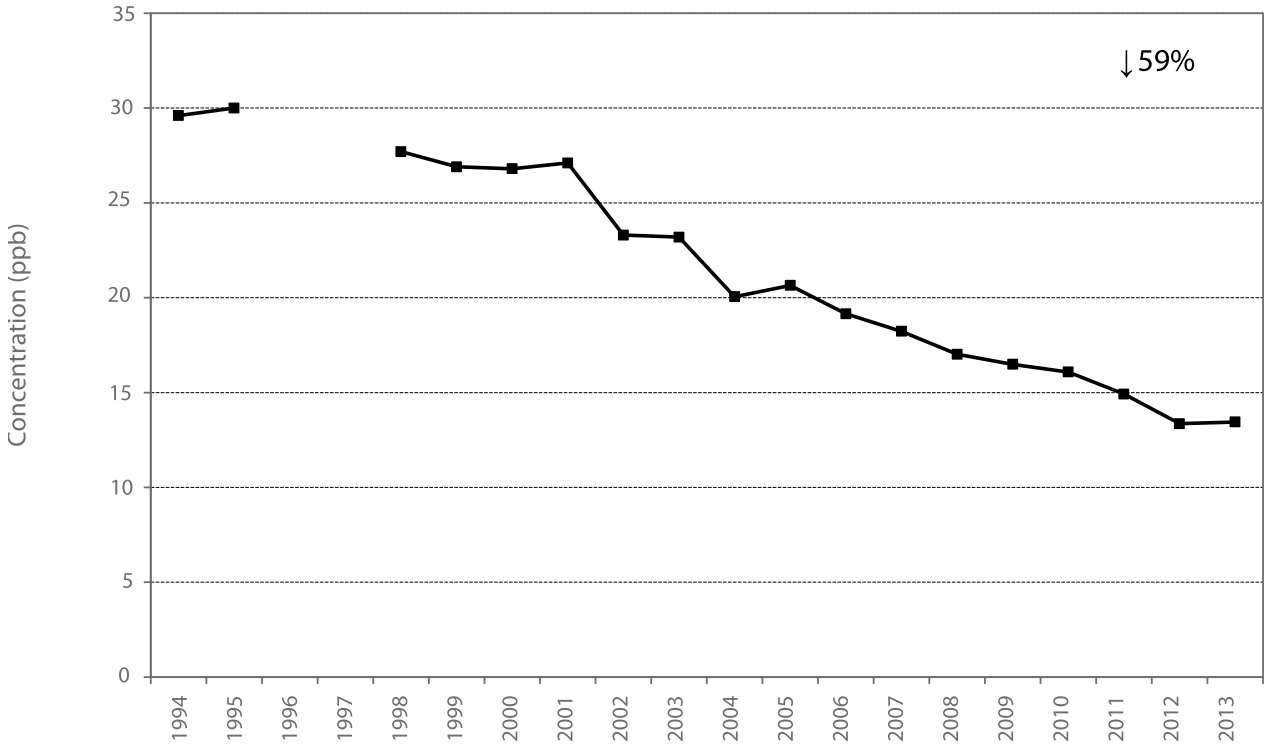


Figure A35: 20y Trend of NO_2 Annual Mean at Toronto East

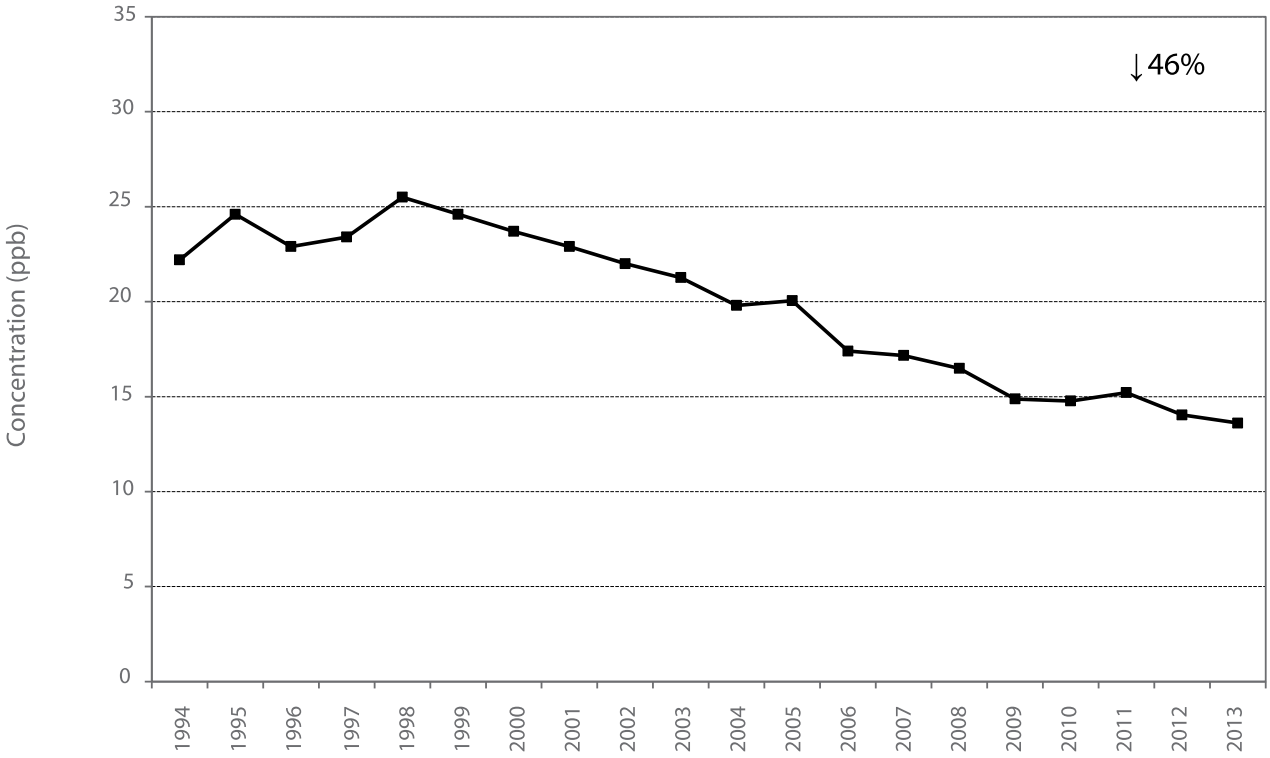


Figure A36: 20y Trend of NO_2 Annual Mean at Toronto North

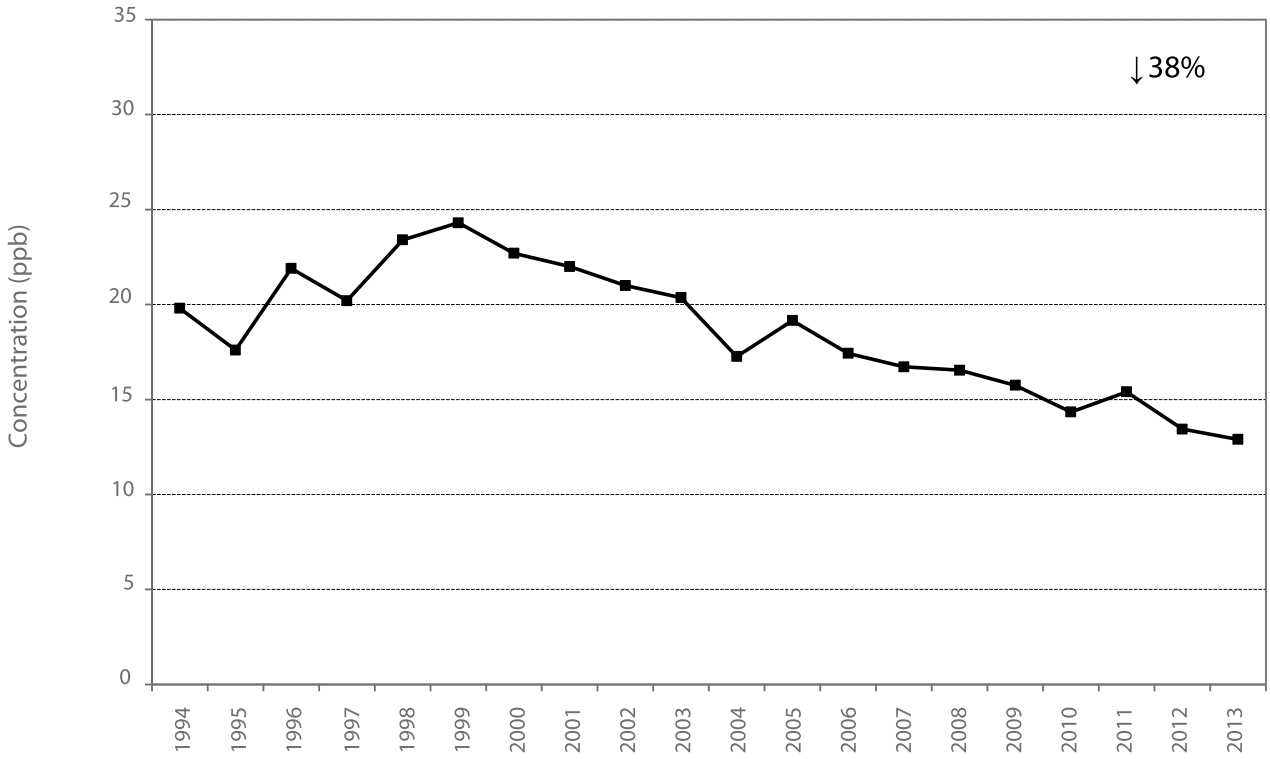


Figure A37: 20y Trend of NO_2 Annual Mean at Burlington

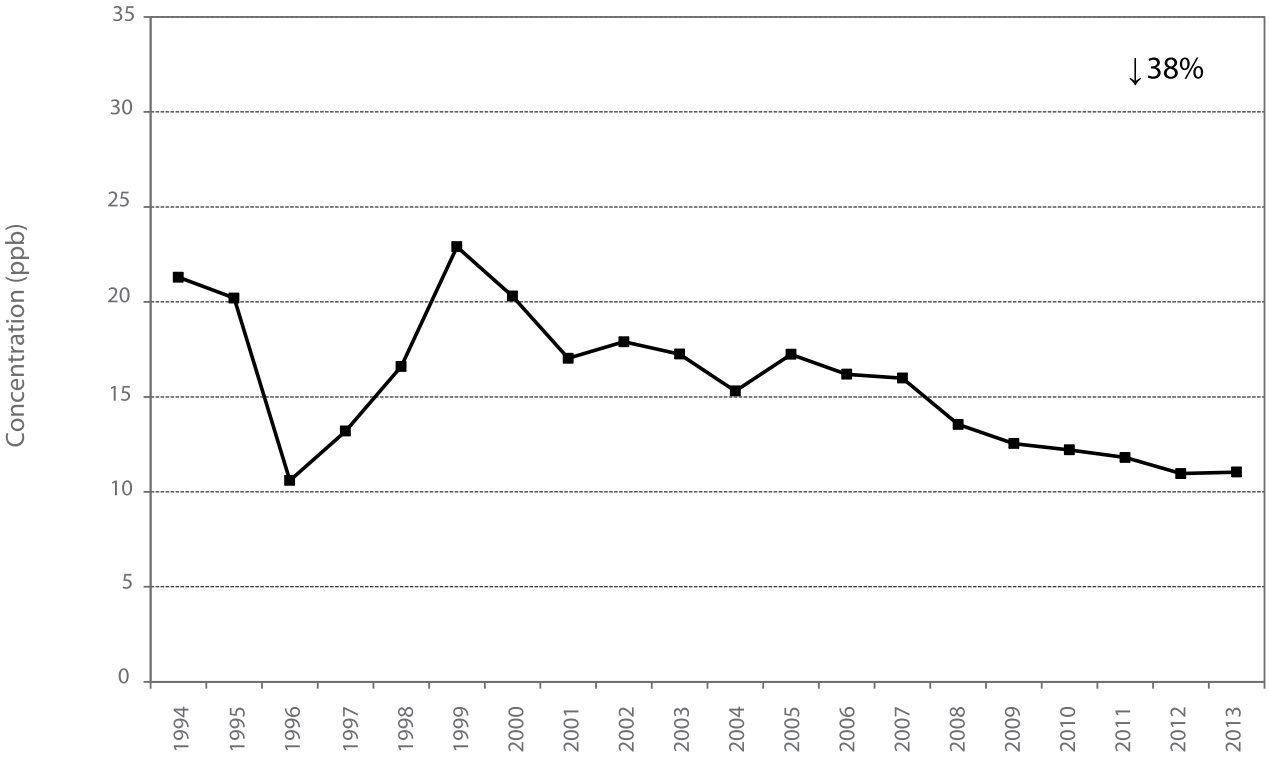


Figure A38: 20y Trend of NO_2 Annual Mean at Oakville

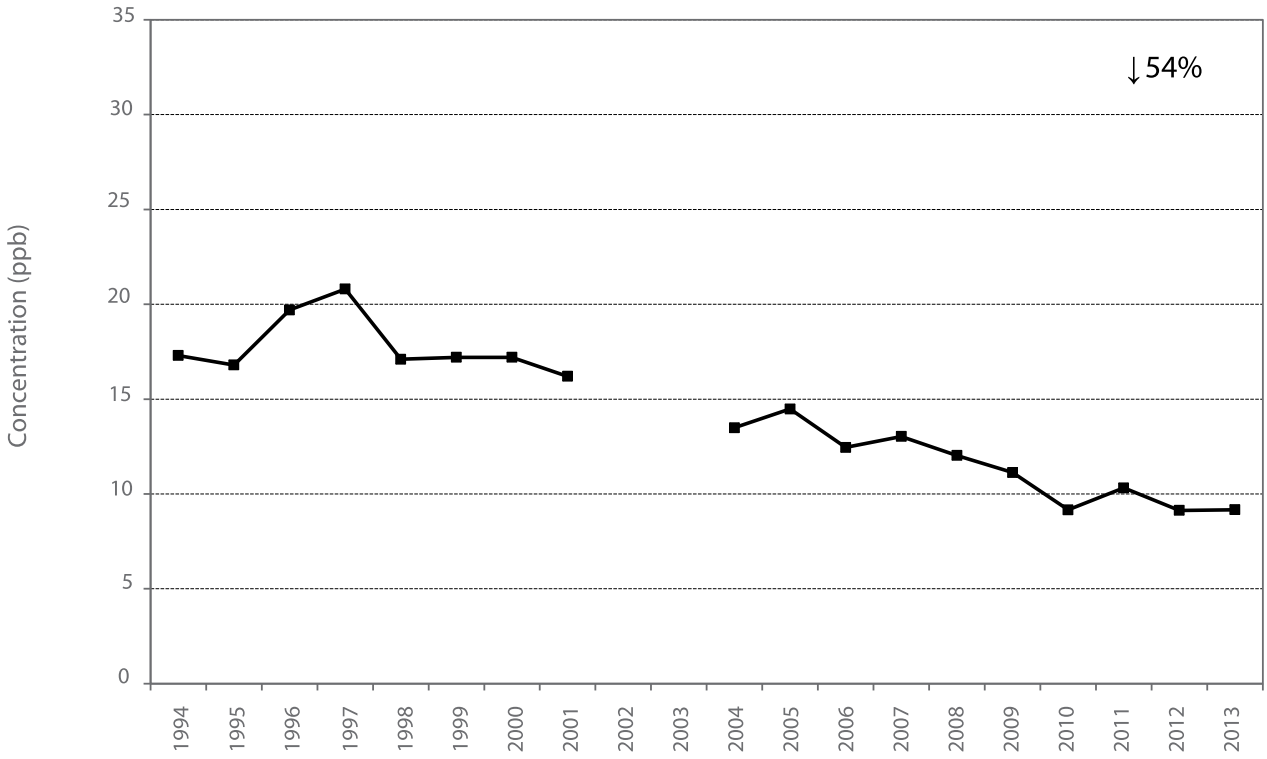


Figure A39: 20y Trend of NO_2 Annual Mean at Oshawa

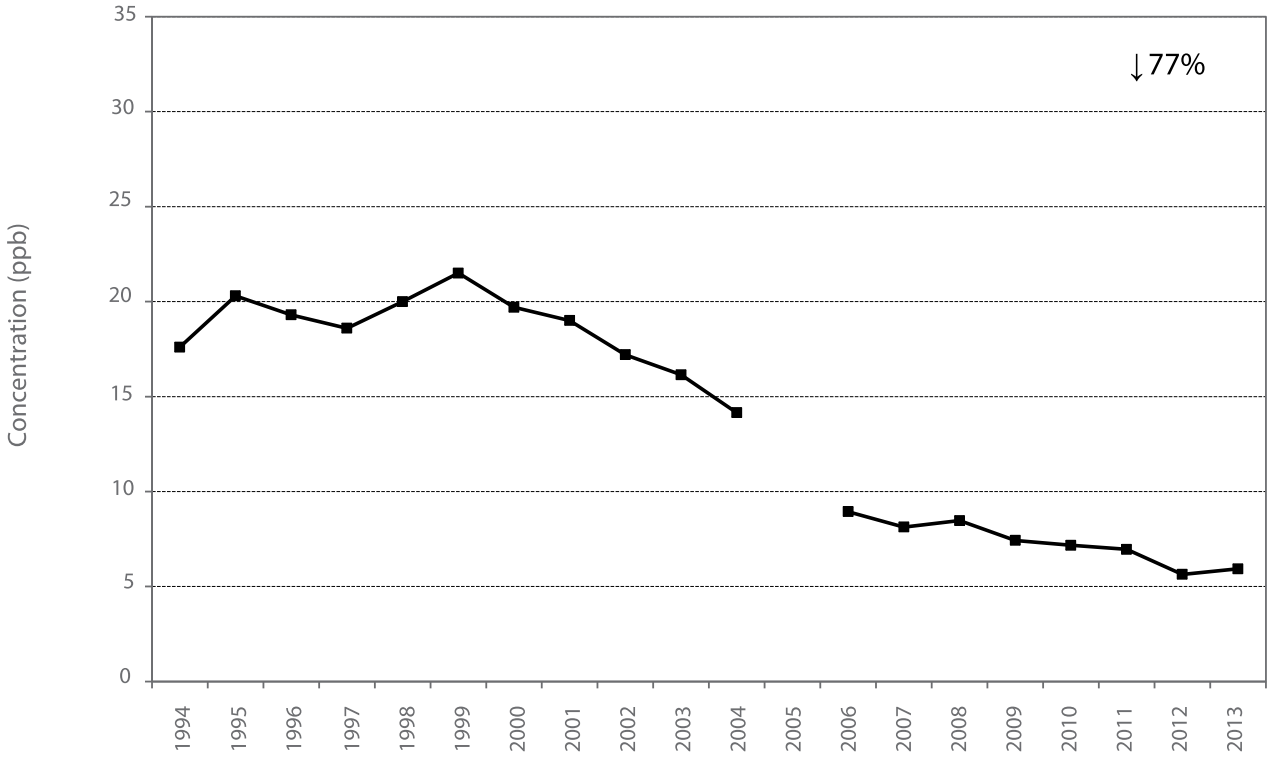


Figure A40: 20y Trend of NO_2 Annual Mean at Ottawa Downtown

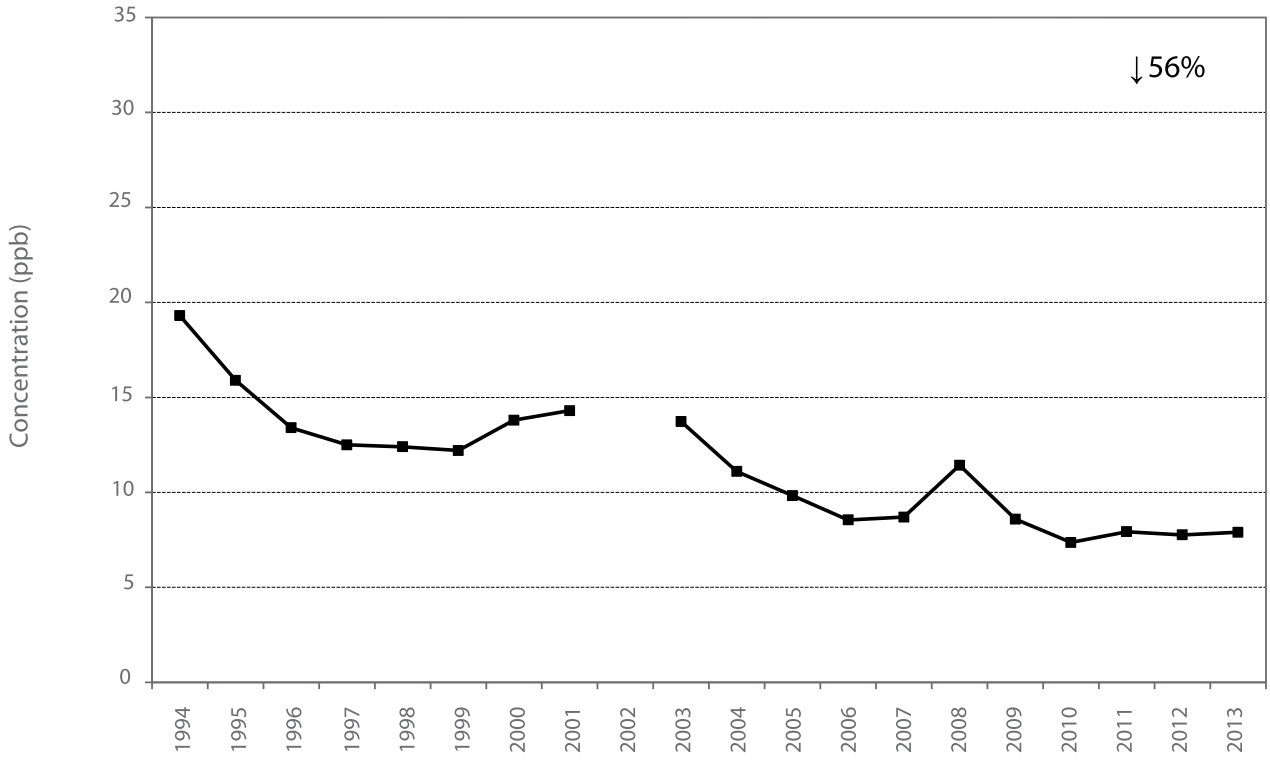


Figure A41: 20y Trend of SO_2 Annual Mean at Windsor Downtown

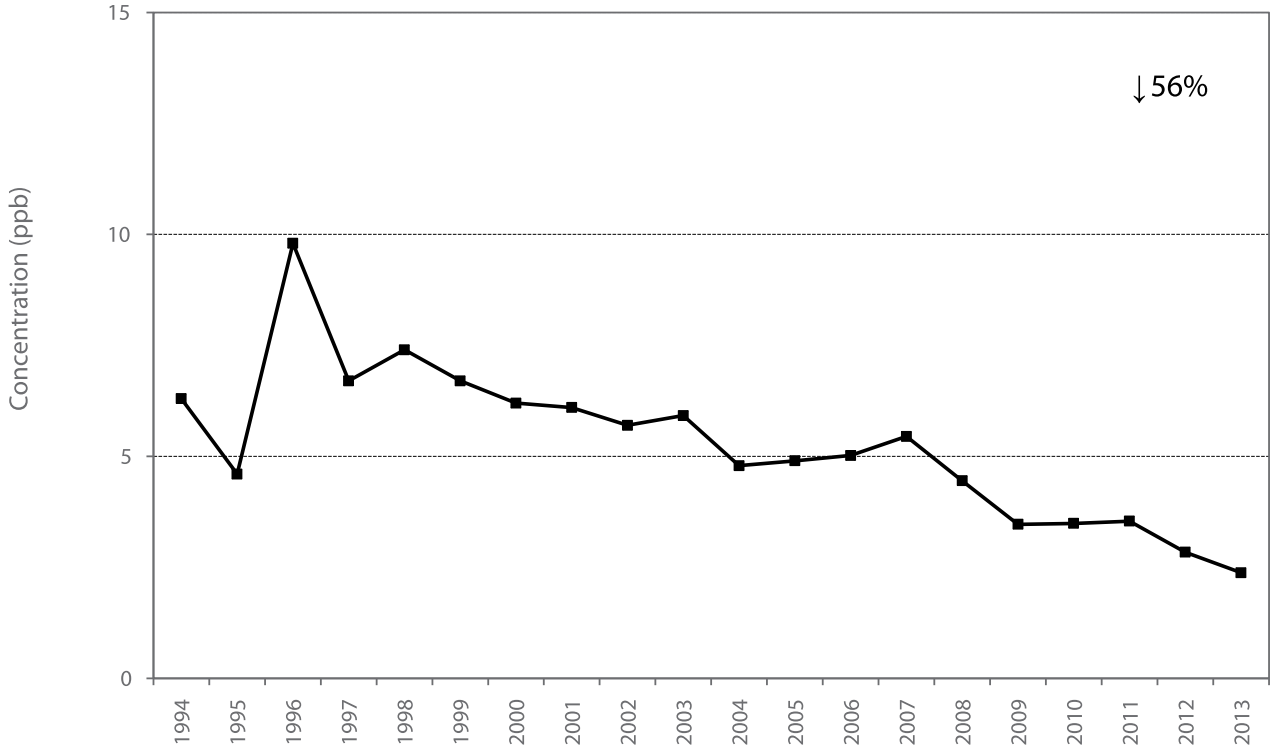


Figure A42: 20y Trend of SO_2 Annual Mean at Windsor West

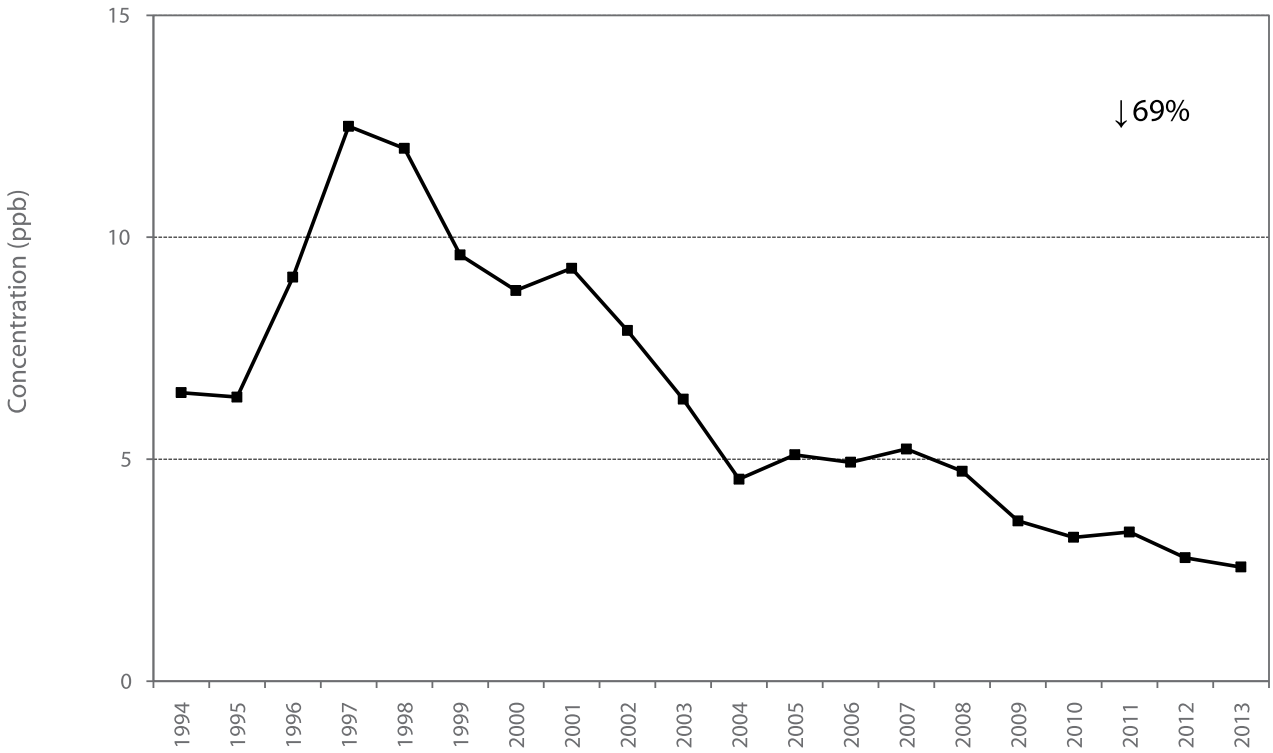


Figure A43: 20y Trend of SO_2 Annual Mean at Sarnia

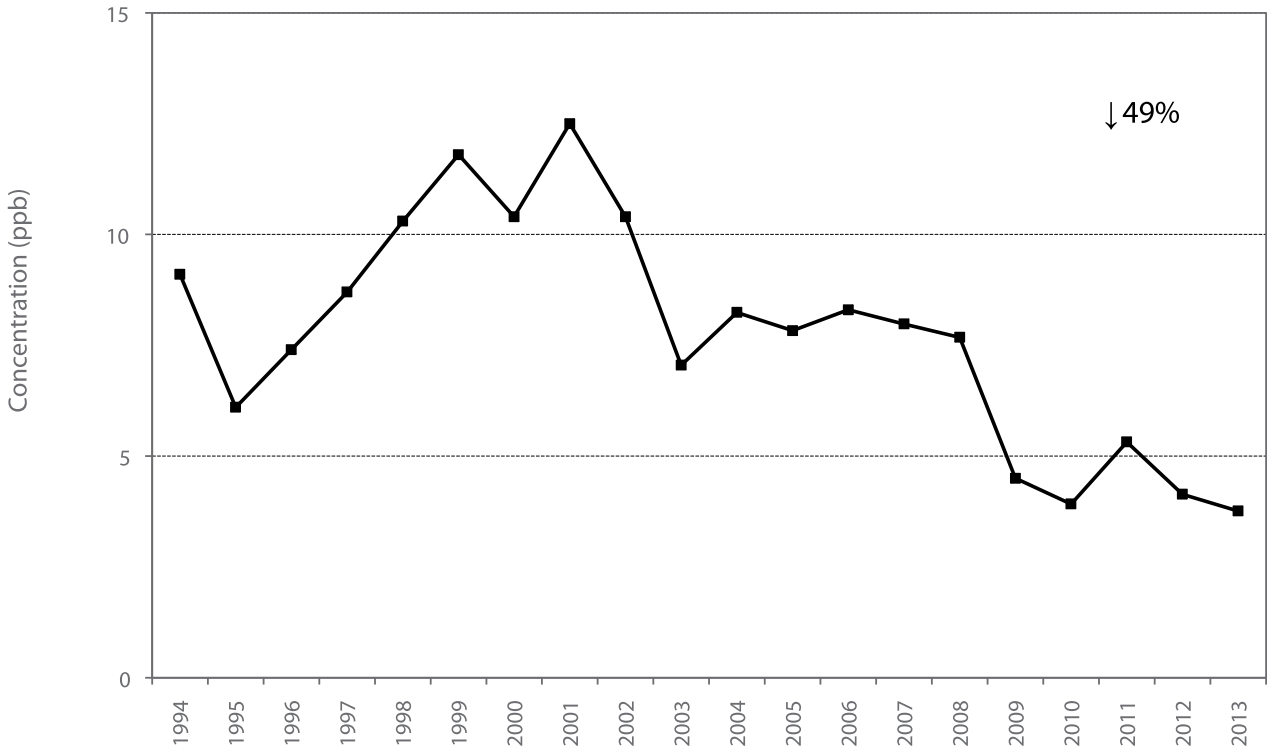


Figure A44: 20y Trend of SO_2 Annual Mean at Hamilton Downtown

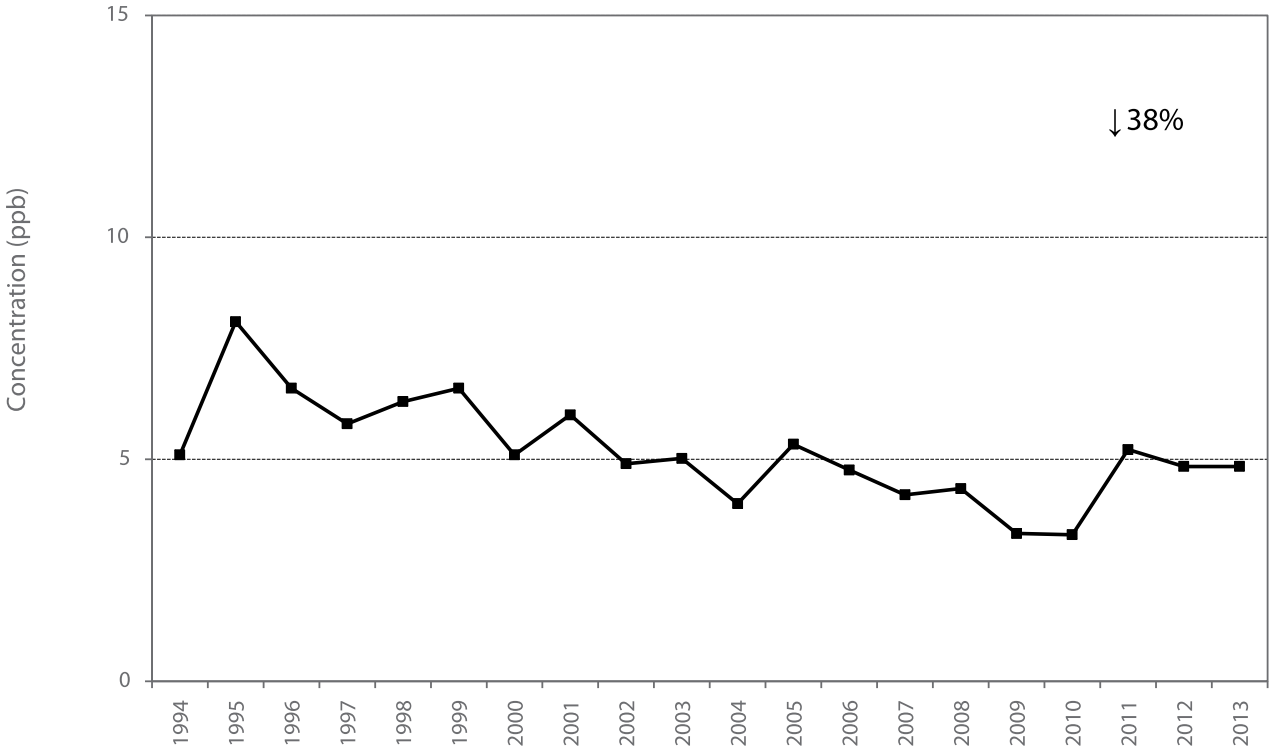


Figure A45: 20y Trend of SO_2 Annual Mean at Hamilton Mountain

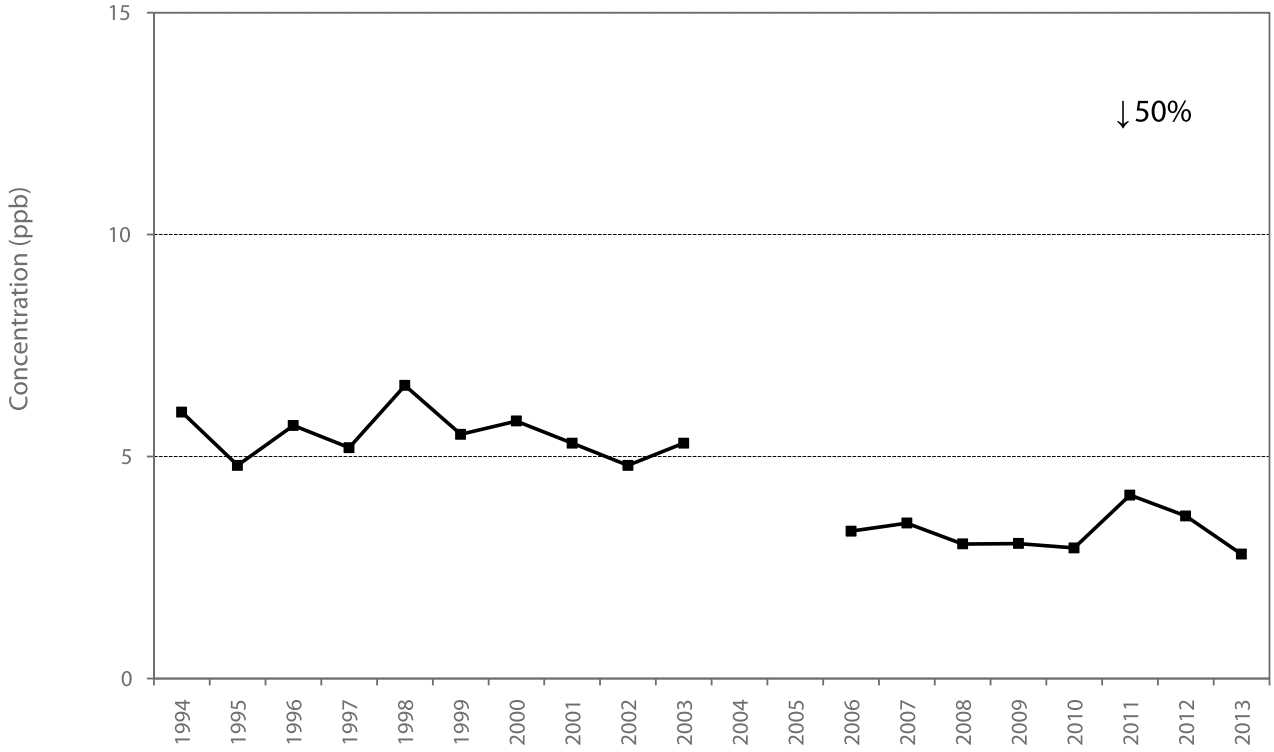


Figure A46: 20y Trend of SO_2 Annual Mean at Ottawa Downtown

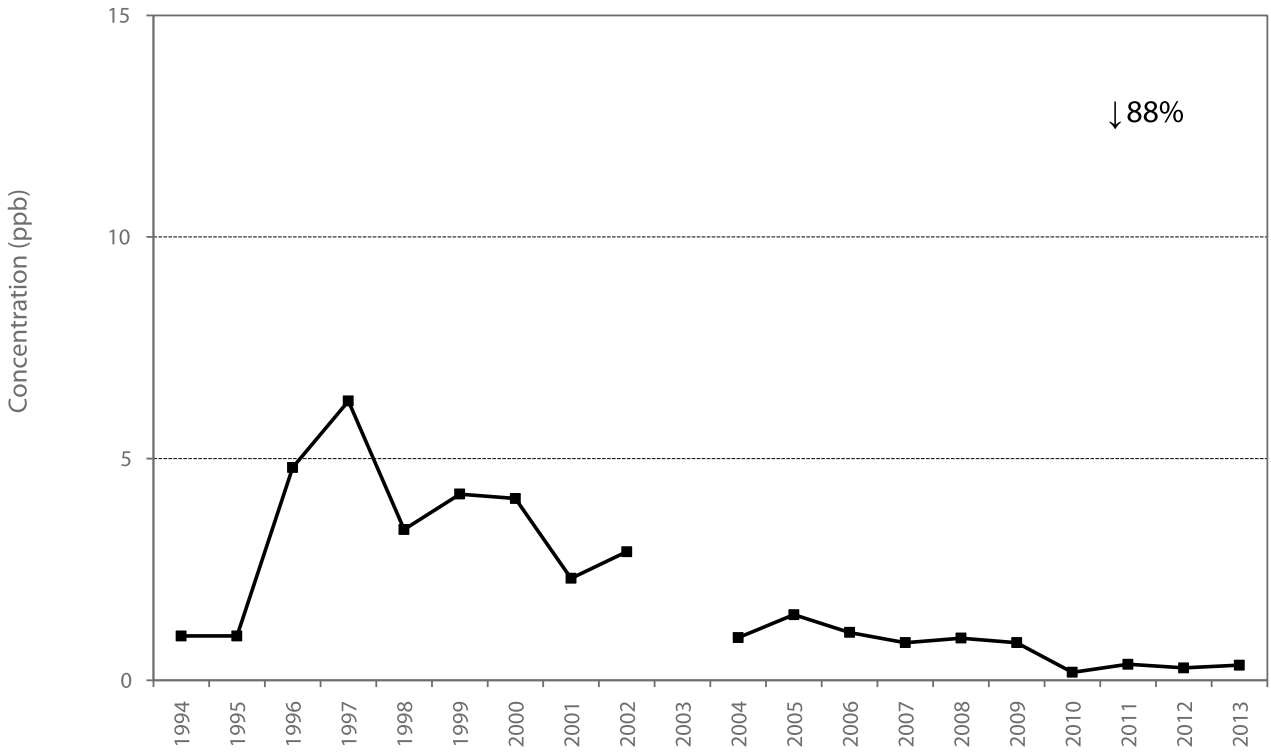


Figure A47: 20y Trend of SO_2 Annual Mean at Sault Ste. Marie

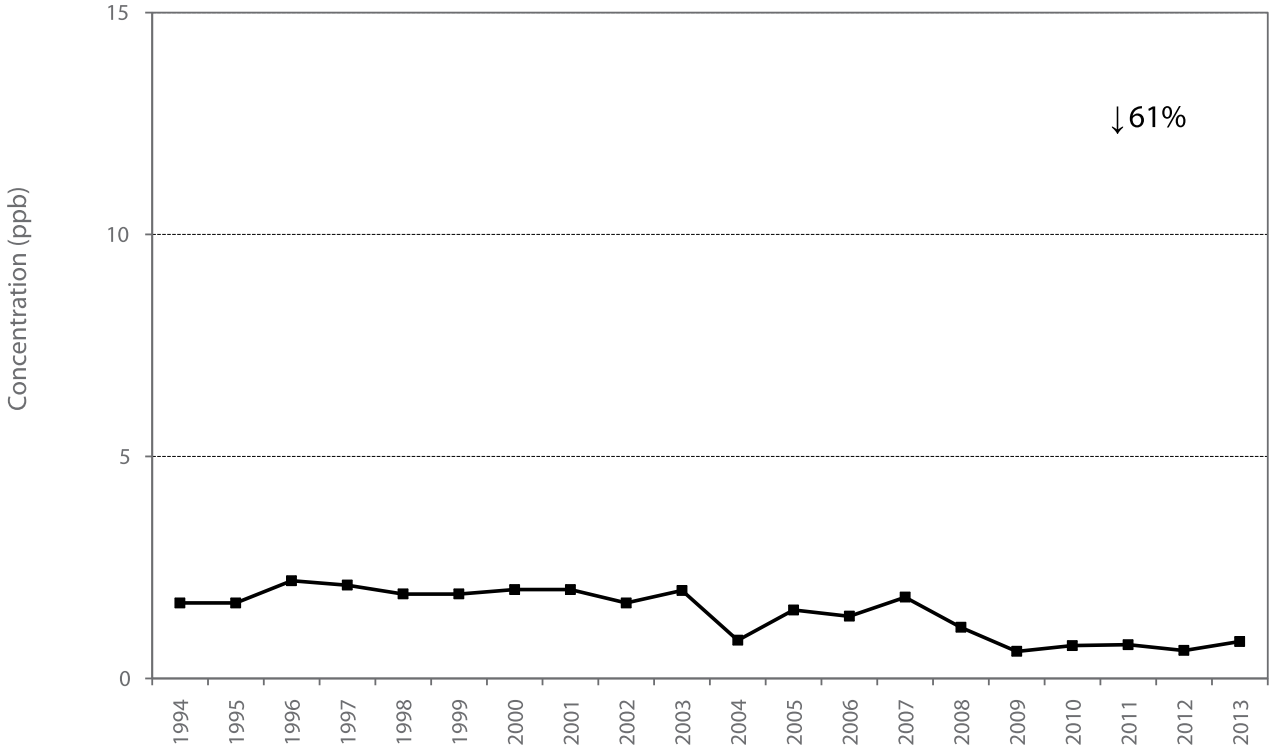
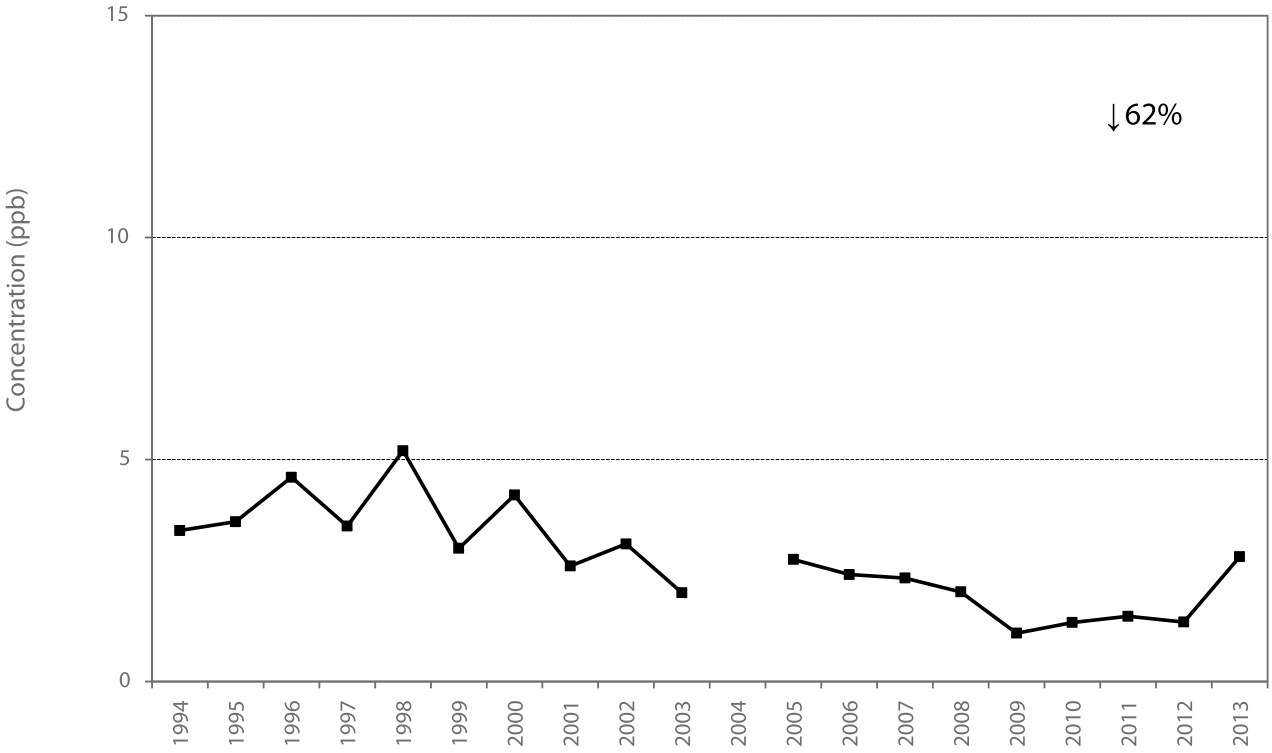


Figure A48: 20y Trend of SO_2 Annual Mean at Sudbury



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