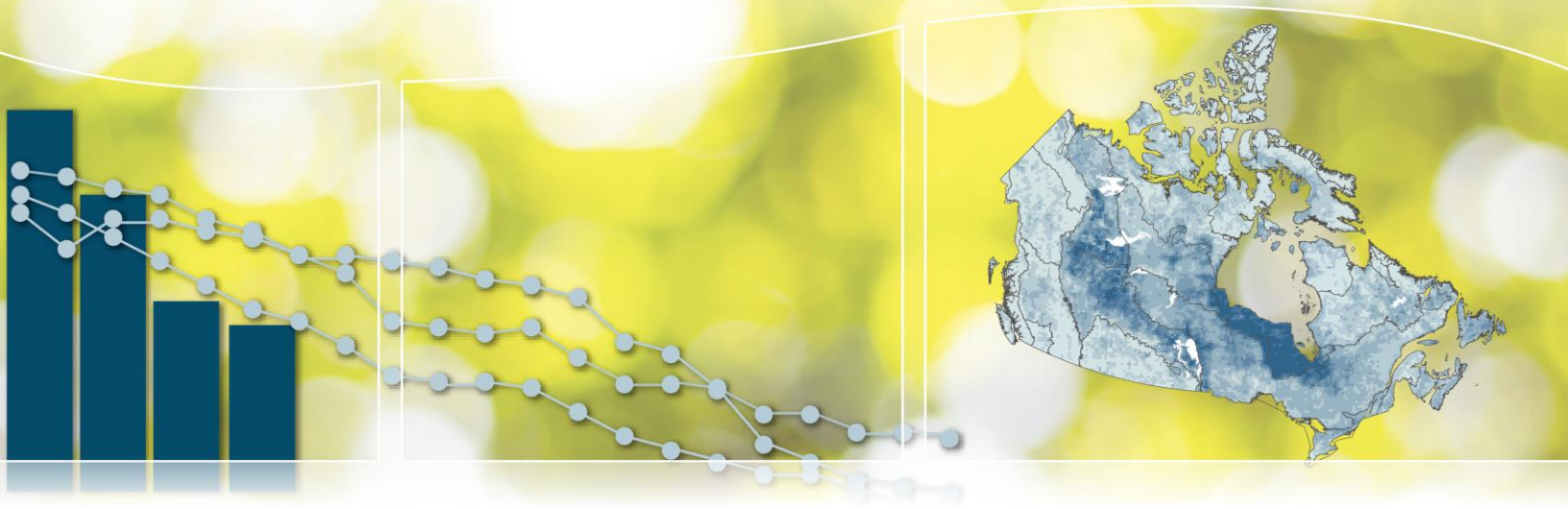
Environment and Climate Change Canada
Environnement et Changement climatique Canada

## Canadian Environmental Sustainability Indicators

# International Comparison of Urban Air Quality



Canada

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# Canadian Environmental Sustainability Indicators

# International Comparison of Urban Air Quality

**December 2016**

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# Part 1. International Comparison of Urban Air Quality Indicators

These indicators present and compare the air quality in selected Canadian urban areas with a population greater than one million to the air quality in selected international urban areas having comparable data.[1]

## Fine particulate matter

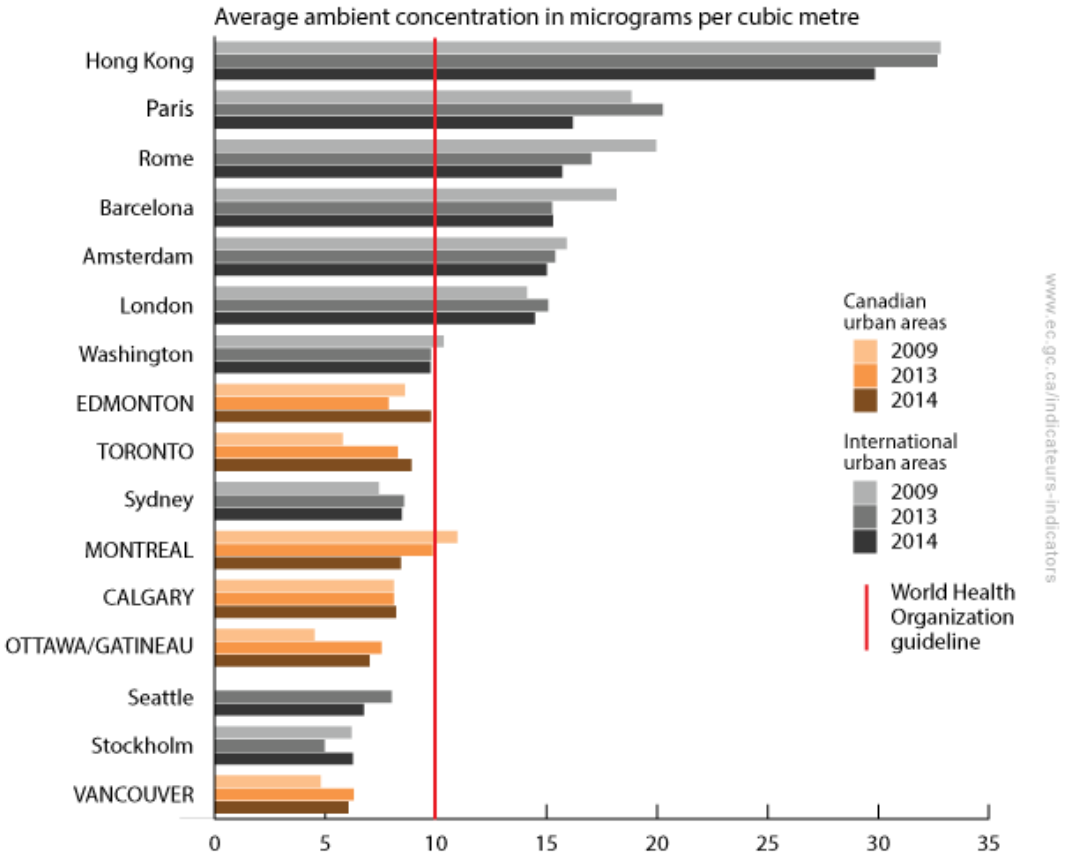
The fine particulate matter ($PM_{2.5}$) indicator is based on the annual average of daily 24-hour average concentrations. In 2014, among the selected Canadian and international urban areas, Vancouver had the lowest annual average $PM_{2.5}$ concentration. Edmonton was the Canadian urban area with the highest annual average concentration of $PM_{2.5}$ in 2014, a level comparable to Washington. The $PM_{2.5}$ concentrations measured in 2013 and 2014 in the Canadian urban areas were generally higher than those measured in 2009, with the exception of Montreal where they decreased.[2] Between 2013 and 2014, annual average $PM_{2.5}$ concentrations declined or stayed constant in most of the selected urban areas, except Stockholm, Edmonton, Toronto and Calgary, where they rose.

The World Health Organization's guideline for annual average concentration of $PM_{2.5}$ is 10.0 micrograms per cubic metre and is presented within the chart for comparison. This value also corresponds to the 2015 Canadian Ambient Air Quality Standard for $PM_{2.5}$. All selected Canadian urban areas had $PM_{2.5}$ concentrations under the World Health Organization's guideline in 2013 and 2014.

[1] Caution must be taken when comparing air quality in different urban areas. Factors such as climate, geography, local emissions and transboundary pollution influence air pollution. Technical and methodological factors such as the type of monitoring equipment used, station location and number of stations in one urban area can also influence the results of the comparison.

[2] This increase may be in part due to the gradual introduction of new $PM_{2.5}$ monitoring equipment deployed across the country to replace older instruments. The new monitoring equipment better captures the mass of semi-volatile particles ($PM_{2.5}$). Montreal was the sole Canadian urban area in the dataset that already had the newer technology monitors operating in 2009.

**Figure 1. Annual average concentrations of fine particulate matter for selected Canadian and international urban areas, selected years**



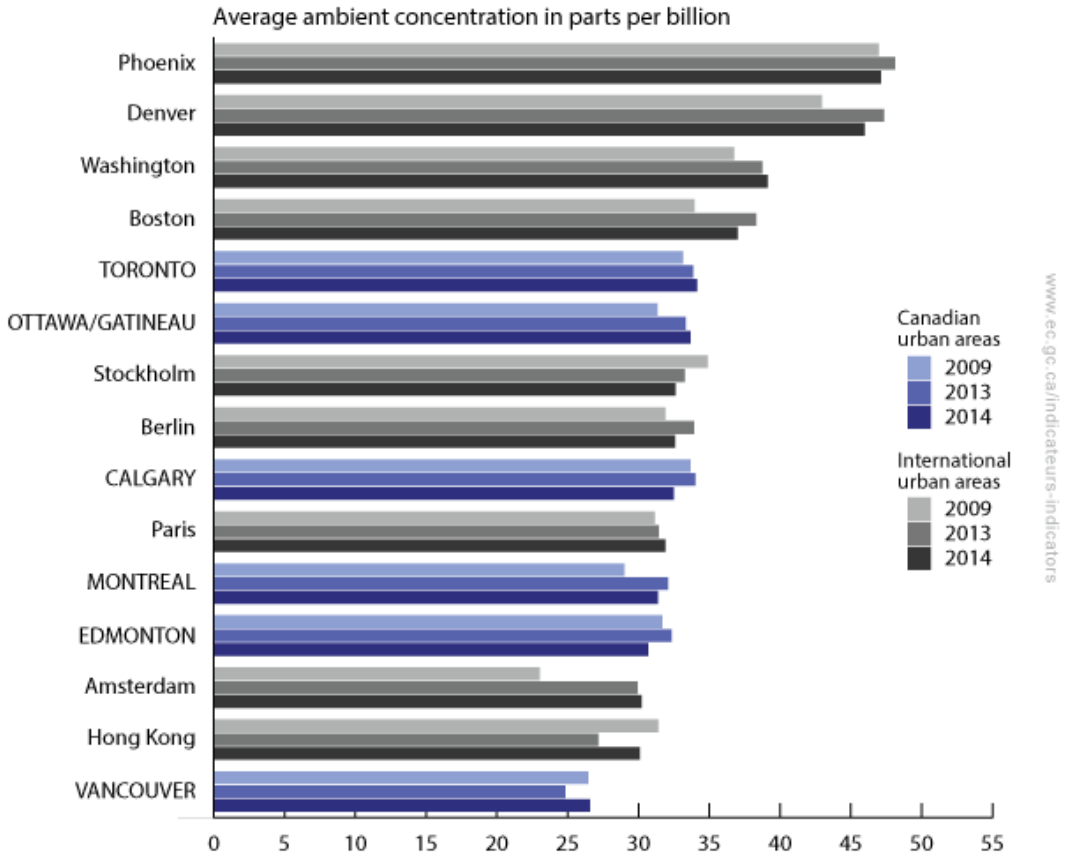

Data for Figure 1

**Note:** No data was available for Seattle in 2009.
**Source:** Environment and Climate Change Canada (2016) National Air Pollution Surveillance Program. Environmental Protection Department of Hong Kong (2016) Air Quality Data. European Environment Agency (2016) AirBase – The European Air Quality Database and Air Quality e-Reporting. Office of Environment and Heritage of New South Wales (2016) Air Quality Data Search. United States Environmental Protection Agency (2016) AirData Download Data Files.

## Ozone

The ground-level ozone ($O_3$) indicator is based on the annual average of the daily maximum 8-hour average concentrations. In 2014, Vancouver had the lowest annual average $O_3$ concentration among the selected urban areas. Of the selected Canadian urban areas, Toronto had the highest levels, comparable to Boston. Montreal, Ottawa/Gatineau and Toronto had small increases in $O_3$ concentrations from 2009 to 2014, while Edmonton and Calgary experienced small decreases. When compared to 2013, the 2014 $O_3$ concentrations declined in eight urban areas (including Calgary, Edmonton and Montreal in Canada) while they increased in seven (including Toronto, Ottawa/Gatineau and Vancouver in Canada). These variations may be in part due to changes in meteorology and ozone precursor emission levels.

**Figure 2. Annual average concentrations of ozone for selected Canadian and international urban areas, selected years**



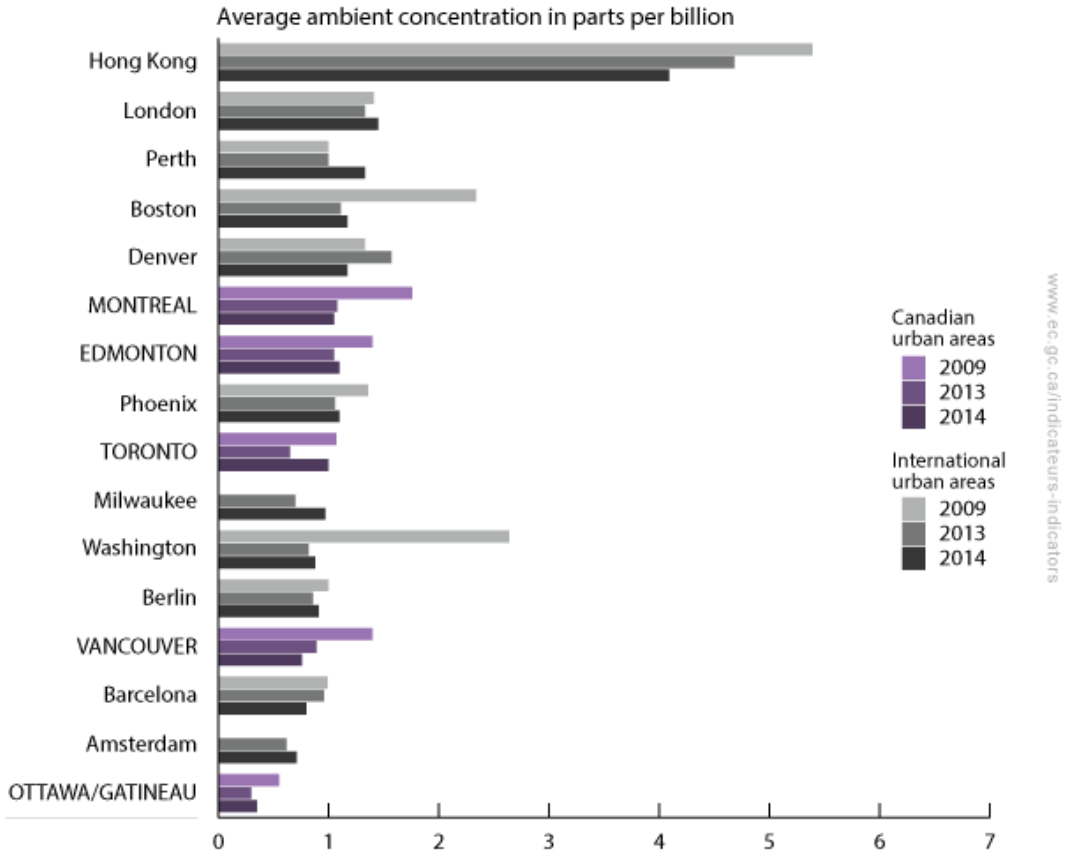

Data for Figure 2

**Source:** Environment and Climate Change Canada (2016) National Air Pollution Surveillance Program. Environmental Protection Department of Hong Kong (2016) Air Quality Data. European Environment Agency (2016) AirBase – The European Air Quality Database and Air Quality e-Reporting. United States Environmental Protection Agency (2016) AirData Download Data Files.

## Sulphur dioxide

The sulphur dioxide ($SO_2$) indicator is based on the annual average of the daily 24-hour average concentrations. In 2014, Ottawa/Gatineau had the lowest annual average $SO_2$ concentration of all urban areas. Montreal and Edmonton had the highest $SO_2$ concentrations among the selected Canadian urban areas, with levels comparable to Phoenix. Sulphur dioxide concentrations for Canadian urban areas were lower in 2014 than in 2009. When compared to 2013, the 2014 annual average $SO_2$ concentrations declined or stayed constant in half of the selected urban areas (including Montreal, Edmonton and Vancouver in Canada), while they increased in the other half (including Toronto and Ottawa/Gatineau in Canada).

**Figure 3. Annual average concentrations of sulphur dioxide for selected Canadian and international urban areas, selected years**




Data for Figure 3

**Note:** No data was available for Milwaukee and Amsterdam in 2009.
**Source:** Environment and Climate Change Canada (2016) National Air Pollution Surveillance Program. Environmental Protection Department of Hong Kong (2016) Air Quality Data. European Environment Agency (2016) AirBase – The European Air Quality Database and Air Quality e-Reporting. United States Environmental Protection Agency (2016) AirData Download Data Files. Department of Environment and Conservation of Western Australia (2010) Western Australia Air Monitoring Report 2009 (PDF; 2.3 MB). Department of Environment and Conservation of Western Australia (2011) Western Australia Air Monitoring Report 2010 (PDF; 2.3 MB). Department of Environment and Conservation of Western Australia (2012) Western Australia Air Monitoring Report 2011 (PDF; 1.8 MB). Department of Environment Regulation of Western Australia (2016) Air monitoring reports – Western Australia.

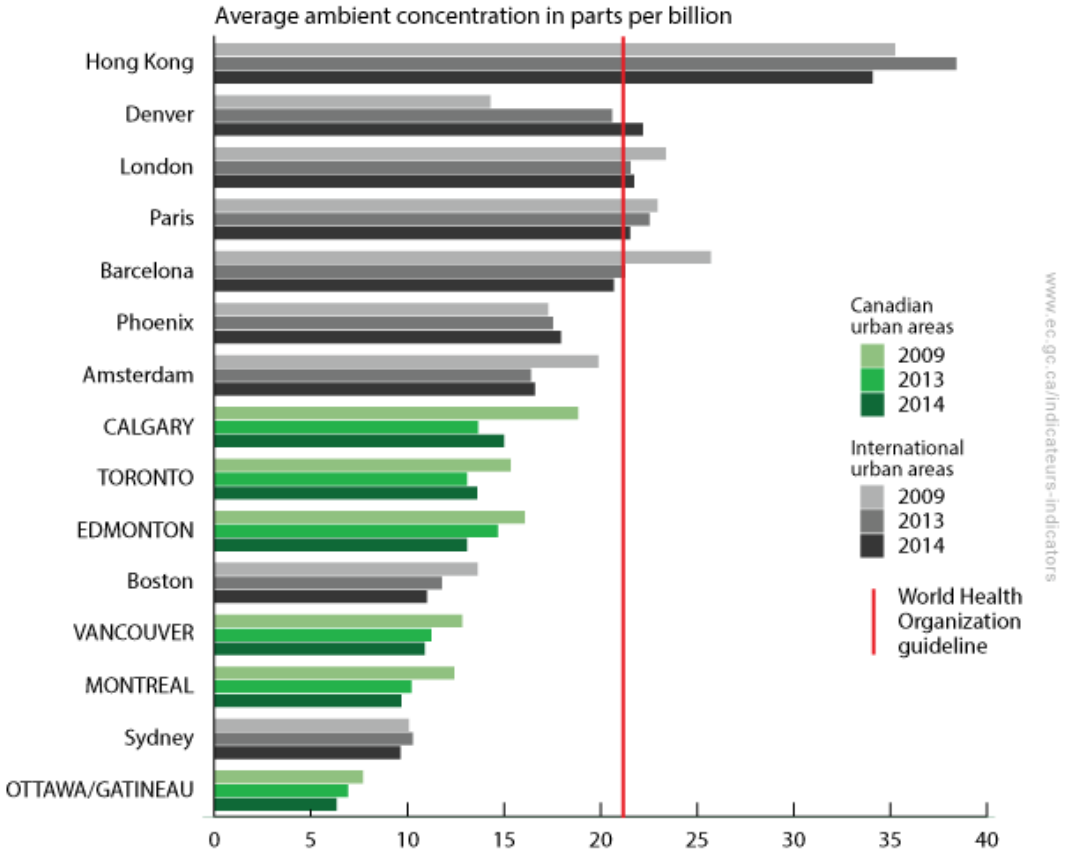
## Nitrogen dioxide

The nitrogen dioxide ($NO_2$) indicator is based on the annual average of the daily 24-hour average concentrations. The World Health Organization's guideline for the annual average concentration of $NO_2$ is 21.2 parts per billion and is presented within the chart for comparison only.

In 2014, Ottawa/Gatineau had the lowest annual average $NO_2$ concentration for all selected urban areas. Calgary had the highest $NO_2$ concentration among the selected Canadian urban areas. Between 2009 and 2014, average $NO_2$ concentrations decreased in all selected Canadian urban areas. Canadian urban areas were well below the World Health Organization's guideline for all years. When compared to 2013, the 2014 annual average $NO_2$ concentrations declined or stayed constant in nine of the urban areas covered (including

Edmonton, Vancouver, Montreal and Ottawa/Gatineau in Canada), while they increased in six (including Calgary and Toronto in Canada).

**Figure 4. Annual average concentrations of nitrogen dioxide for selected Canadian and international urban areas, selected years**




Data for Figure 4

**Source:** Environment and Climate Change Canada (2016) National Air Pollution Surveillance Program. Environmental Protection Department of Hong Kong (2016) Air Quality Data. European Environment Agency (2016) AirBase – The European Air Quality Database and Air Quality e-Reporting. United States Environmental Protection Agency (2016) AirData Download Data Files. Office of Environment and Heritage of New South Wales (2016) Air Quality Data Search.

# Part 2. Data Sources and Methods for the International Comparison of Urban Air Quality Indicators

## Introduction

The International Comparison of Urban Air Quality indicators are part of the Canadian Environmental Sustainability Indicators (CESI) program, which provides data and information to track Canada's performance on key environmental sustainability issues.

## Description and rationale of the International Comparison of Urban Air Quality indicators

### Description

The International Comparison of Urban Air Quality indicators compare ambient levels (concentrations) of air pollutants in selected Canadian urban areas with levels in selected international urban areas. The indicators report the concentration of ground-level ozone (as the annual average of the daily maximum 8-hour average), fine particulate matter, sulphur dioxide and nitrogen dioxide (as the annual average of the daily 24-hour average) in ambient air.

### Rationale

Fine particulate matter and ozone are key components of smog and two of the most widespread air pollutants to which people are exposed. Nitrogen dioxide and volatile organic compounds react in the presence of sunlight to produce ozone. Nitrogen dioxide and sulphur dioxide contribute to acid deposition and to the formation of fine particulate matter. Exposure to air pollution, even at low concentrations, has been linked to a number of adverse effects on health.

The air quality indicators are state/condition indicators intended to provide information about the progress made toward improving ambient air quality. These indicators are also intended to provide a general comparison of ambient levels of air pollutants in selected Canadian urban areas with those measured in other international urban areas.

### Recent changes to the indicators

The geographical coverage of the indicators has changed for this edition as data for South Africa (more specifically, Pretoria's metropolitan area) was not available at the time of production.

# Data

### Data source

The ambient levels of air pollutant data used for the international comparison were obtained from many different databases.

#### Canada

- The Canada-wide Air Quality Database maintained by Environment and Climate Change Canada, which includes data from the National Air Pollution Surveillance Program.

#### United States

- The United States Environmental Protection Agency's AirData Download Data Files from the AirData website, which provides access to monitored air quality data from the Air Quality System Data Mart.

#### Europe

- The European Environmental Agency's Air Quality e-Reporting system and the previous AirBase – The European Air Quality Database system.

#### Australia

- Sydney data were taken from the Office of Environment and Heritage of New South Wales, Australia's Air Quality Data Search.
- Perth data prior to 2012 were retrieved from the Department of Environment and Conservation of Western Australia's Western Australia Air Monitoring Report 2009 (PDF; 2.3 MB), Western Australia Air Monitoring Report 2010 (PDF; 2.3 MB) and Western Australia Air Monitoring Report 2011 (PDF; 1.8 MB). Data for 2012 and more recent years were taken from the Department of Environment Regulation of Western Australia's Air monitoring reports.

#### Hong Kong

- Hong Kong data were obtained from the Environmental Protection Department of Hong Kong's webtool Air Quality Data – Download by Parameter.

The guidelines for the air pollutants used in the international comparison were obtained from the World Health Organization's document entitled Air Quality Guidelines Global Update 2005. Particulate matter, ozone, nitrogen dioxide and sulfur dioxide.

### Spatial coverage

Ambient air levels in urban areas in Canada, the United States, Europe, Australia, and China are compared in these indicators. For the purpose of these indicators, an urban area is a city, group of cities (metropolitan area) or region with a population greater than one million. More specifically, an urban area corresponds to the census metropolitan area for Canadian cities. For the United States, the metropolitan statistical areas were used. For the European countries different urban areas corresponding to the areas covered by the available monitoring stations were used. Three different urban areas were considered: urban area, large urban zone and core city (or greater city). For Australian cities, the greater capital city statistical area was used. The Hong Kong Special Administrative region was used for Hong Kong.

### Temporal coverage

The indicators were calculated with concentrations measured from 2009 to 2014. All data are measured hourly and provided as hourly, daily or annual values depending on the web tools available from each country.

### Data completeness

For any given ozone or fine particulate matter monitoring station used in the calculation of pollutant concentrations for a particular urban area, measurements covering at least 75% of the year were required.

A sulphur dioxide or nitrogen dioxide monitoring station was used in the calculation of concentrations for an urban area only if the data available meets the following conditions:

- A valid month requires that at least 50% of the hours have valid measurements;
- A valid quarter (three months) requires data for at least two valid months; and
- A station is included only if 50% of hours in year are valid and has four valid quarters.

### Data timeliness

The gap between a given year and publication of air pollutant concentration data for that year varies considerably among urban areas. For some urban areas, annual data is publicly available within a few months of a reported year while for others, data validation takes longer. The year 2014 was selected as the latest year of data to accommodate the variation in data timelines.

## Methods

Air pollutant concentrations were obtained from the air quality monitoring networks and agencies listed in the Data source section. For ozone, the annual average of daily maximum 8-hour concentrations was used. For fine particulate matter, the annual average of 24-hour concentrations was used. For sulphur dioxide and nitrogen dioxide, the annual average of all hourly concentrations were used. When the ambient concentrations were not provided in the required metrics, hourly measurements were used to calculate the indicators for each station.

Annual average ambient levels from all stations found in an urban area were averaged to obtain the reported value. This average was an arithmetic average and not weighted by the population covered by each station.

The ambient concentrations for the fine particulate matter indicator are measured in micrograms per cubic metre, while those for the ozone, sulphur dioxide and nitrogen dioxide indicators are measured in parts per billion. When necessary, the ambient concentrations reported in micrograms per cubic metre by some jurisdictions were converted to parts per billion using a temperature of 25°C and a pressure of 101.325 kilopascals.

The World Health Organization's guidelines for fine particulate matter and nitrogen oxide were used within the charts solely for indicative purposes and to show how Canadian urban areas fare compared to the guidelines. The World Health Organization's guidelines for ozone and sulphur dioxide were not used because the definitions of the indicators and the guidelines were different.

### Urban areas selection

The urban areas for these indicators were selected on the basis of the following criteria.

- The urban area had to have a population of at least one million.
- Availability of the air quality data after the station selection criteria (see Data completeness) were applied.

## Caveats and limitations

Caution must be taken when comparing air quality among urban areas. Differences in monitoring equipment, in the placement of stations and in the number of stations can influence the comparability of the ambient concentrations provided from different urban areas and for different years. In Canada, since 2007, older fine particulate matter monitoring instruments have been gradually replaced by newer models that measure a portion (semi-volatile) of the fine particular matter mass that may not have been fully captured by the older monitors. This technology change may partly explain the increases in the fine particulate matter concentrations observed in some Canadian urban areas.

Furthermore, concentrations measured at monitoring stations can be influenced by many highly complex determinants such as climate, station elevation and geography, local emissions and transboundary pollution. Depending on these factors ambient air concentrations may vary substantially from one year to the next.

All data used for these comparisons have been published and revised by their respective institutions. However, no guarantee is given as to the accuracy of the data. Data collected through the various agencies were taken as they were publicly available at the time of production of these indicators.

# Part 3. Annexes

## Annex A. Data tables for the figures presented in this document

**Table A.1. Data for Figure 1. Annual average concentrations of fine particulate matter for selected Canadian and international urban areas, selected years**

| Urban area | 2009 (micrograms per cubic metre) | 2010 (micrograms per cubic metre) | 2011 (micrograms per cubic metre) | 2012 (micrograms per cubic metre) | 2013 (micrograms per cubic metre) | 2014 (micrograms per cubic metre) |
|---|---|---|---|---|---|---|
| Hong Kong, China | 32.8 | 31.8 | 35.0 | 29.5 | 32.7 | 29.8 |
| Paris, France | 18.8 | 18.5 | 19.9 | 18.1 | 20.2 | 16.2 |
| Rome, Italy | 20.0 | 18.2 | 20.9 | 18.7 | 17.0 | 15.7 |
| Barcelona, Spain | 18.2 | 17.0 | 19.4 | 18.5 | 15.3 | 15.3 |
| Amsterdam, Netherlands | 15.9 | 17.2 | 16.9 | 15.1 | 15.4 | 15.0 |
| London, United Kingdom | 14.1 | 15.0 | 17.0 | 14.8 | 15.1 | 14.5 |
| Washington, United States | 10.3 | 11.7 | 11.5 | 11.3 | 9.8 | 9.8 |
| Edmonton, Canada | 8.6 | 13.6 | 9.1 | 7.6 | 7.9 | 9.8 |
| Toronto, Canada | 5.8 | 6.2 | 6.5 | 6.5 | 8.3 | 8.9 |
| Sydney, Australia | 7.4 | 5.9 | 5.7 | 6.7 | 8.6 | 8.5 |
| Montreal, Canada | 11.0 | 10.4 | 10.1 | 11.4 | 9.9 | 8.4 |
| Calgary, Canada | 8.1 | 11.4 | 10.9 | 8.4 | 8.1 | 8.2 |
| Ottawa/Gatineau, Canada | 4.5 | 5.3 | 5.8 | 6.4 | 7.5 | 7.0 |
| Seattle, United States | n/a | n/a | 7.5 | 6.9 | 8.0 | 6.7 |
| Stockholm, Sweden | 6.2 | 7.0 | 6.8 | 5.9 | 5.0 | 6.2 |
| Vancouver, Canada | 4.8 | 4.0 | 4.1 | 4.0 | 6.3 | 6.0 |

**Note:** n/a = not available.
**Source:** Environment and Climate Change Canada (2016) National Air Pollution Surveillance Program. Environmental Protection Department of Hong Kong (2016) Air Quality Data. European Environment Agency (2016) AirBase – The European Air Quality Database and Air Quality e-Reporting. Office of Environment and Heritage of New South Wales (2016) Air Quality Data Search. United States Environmental Protection Agency (2016) AirData Download Data Files.

**Table A.2. Data for Figure 2. Annual average concentrations of ozone for selected Canadian and international urban areas, selected years**

| Urban area | 2009 (parts per billion) | 2010 (parts per billion) | 2011 (parts per billion) | 2012 (parts per billion) | 2013 (parts per billion) | 2014 (parts per billion) |
|---|---|---|---|---|---|---|
| Phoenix, United States | 47.0 | 47.7 | 48.5 | 48.6 | 48.1 | 47.1 |
| Denver, United States | 42.9 | 45.6 | 48.0 | 48.8 | 47.3 | 46.0 |
| Washington, United States | 36.8 | 43.1 | 39.5 | 41.4 | 38.7 | 39.1 |
| Boston, United States | 33.9 | 37.0 | 36.6 | 36.7 | 38.3 | 37.0 |
| Toronto, Canada | 33.1 | 34.6 | 33.4 | 36.0 | 33.9 | 34.1 |
| Ottawa/Gatineau, Canada | 31.3 | 34.0 | 32.7 | 34.7 | 33.3 | 33.7 |
| Stockholm, Sweden | 34.9 | 32.0 | 34.5 | 31.1 | 33.3 | 32.6 |
| Berlin, Germany | 31.9 | 34.9 | 34.6 | 33.2 | 33.9 | 32.6 |
| Calgary, Canada | 33.7 | 30.0 | 33.5 | 31.0 | 34.0 | 32.5 |
| Paris, France | 31.1 | 31.3 | 30.2 | 29.8 | 31.4 | 31.9 |
| Montreal, Canada | 29.0 | 30.9 | 30.4 | 31.6 | 32.1 | 31.4 |
| Edmonton, Canada | 31.7 | 28.0 | 33.3 | 30.7 | 32.3 | 30.7 |
| Amsterdam, Netherlands | 23.0 | 22.7 | 25.0 | 27.2 | 29.9 | 30.2 |
| Hong Kong, China | 31.4 | 28.8 | 26.3 | 25.6 | 27.2 | 30.1 |
| Vancouver, Canada | 26.5 | 26.4 | 26.5 | 27.5 | 24.8 | 26.6 |

**Source:** Environment and Climate Change Canada (2016) National Air Pollution Surveillance Program. Environmental Protection Department of Hong Kong (2016) Air Quality Data. European Environment Agency (2016) AirBase – The European Air Quality Database and Air Quality e-Reporting. United States Environmental Protection Agency (2016) AirData Download Data Files.

**Table A.3. Data for Figure 3. Annual average concentrations of sulphur dioxide for selected Canadian and international urban areas, selected years**

| Urban area | 2009 (parts per billion) | 2010 (parts per billion) | 2011 (parts per billion) | 2012 (parts per billion) | 2013 (parts per billion) | 2014 (parts per billion) |
|---|---|---|---|---|---|---|
| Hong Kong, China | 5.4 | 4.5 | 5.0 | 4.2 | 4.7 | 4.1 |
| London, United Kingdom | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.5 |
| Perth, Australia | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.3 |
| Boston, United States | 2.3 | 2.3 | 1.7 | 1.4 | 1.1 | 1.2 |
| Denver, United States | 1.3 | 1.3 | 1.7 | 1.5 | 1.6 | 1.2 |
| Montreal, Canada | 1.8 | 1.5 | 1.1 | 1.7 | 1.1 | 1.1 |
| Edmonton, Canada | 1.4 | 1.1 | 1.1 | 0.9 | 1.1 | 1.1 |

| Urban area | 2009 (parts per billion) | 2010 (parts per billion) | 2011 (parts per billion) | 2012 (parts per billion) | 2013 (parts per billion) | 2014 (parts per billion) |
|---|---|---|---|---|---|---|
| Phoenix, United States | 1.4 | 1.3 | 1.2 | 1.4 | 1.1 | 1.1 |
| Toronto, Canada | 1.1 | 0.9 | 1.4 | 0.6 | 0.7 | 1.0 |
| Milwaukee, United States | n/a | n/a | 1.2 | 1.0 | 0.7 | 1.0 |
| Washington, United States | 2.6 | 2.2 | 2.5 | 1.2 | 0.8 | 0.9 |
| Berlin, Germany | 1.0 | 1.3 | 1.0 | 0.9 | 0.9 | 0.9 |
| Vancouver, Canada | 1.4 | 1.1 | 1.1 | 1.2 | 0.9 | 0.8 |
| Barcelona, Spain | 1.0 | 0.8 | 1.6 | 1.1 | 1.0 | 0.8 |
| Amsterdam, Netherlands | n/a | n/a | n/a | 0.8 | 0.6 | 0.7 |
| Ottawa/Gatineau, Canada | 0.6 | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 |

**Note:** n/a = not available.
**Source:** Environment and Climate Change Canada (2016) National Air Pollution Surveillance Program. Environmental Protection Department of Hong Kong (2016) Air Quality Data. European Environment Agency (2016) AirBase – The European Air Quality Database and Air Quality e-Reporting. United States Environmental Protection Agency (2016) AirData Download Data Files. Department of Environment and Conservation of Western Australia (2010) Western Australia Air Monitoring Report 2009 (PDF; 2.3 MB). Department of Environment and Conservation of Western Australia (2011) Western Australia Air Monitoring Report 2010 (PDF; 2.3 MB). Department of Environment and Conservation of Western Australia (2012) Western Australia Air Monitoring Report 2011 (PDF; 1.8 MB). Department of Environment Regulation of Western Australia (2016) Air monitoring reports – Western Australia.

**Table A.4. Data for Figure 4. Annual average concentrations of nitrogen dioxide for selected Canadian and international urban areas, selected years**

| Urban area | 2009 (parts per billion) | 2010 (parts per billion) | 2011 (parts per billion) | 2012 (parts per billion) | 2013 (parts per billion) | 2014 (parts per billion) |
|---|---|---|---|---|---|---|
| Hong Kong, China | 35.2 | 37.0 | 38.3 | 36.9 | 38.4 | 34.1 |
| Denver, United States | 14.3 | 21.9 | 21.4 | 21.7 | 20.6 | 22.2 |
| London, United Kingdom | 23.4 | 23.9 | 21.7 | 22.6 | 21.5 | 21.7 |
| Paris, France | 22.9 | 23.1 | 23.1 | 22.4 | 22.5 | 21.5 |
| Barcelona, Spain | 25.7 | 24.9 | 25.6 | 23.6 | 21.3 | 20.7 |
| Phoenix, United States | 17.3 | 16.5 | 17.7 | 18.8 | 17.5 | 17.9 |
| Amsterdam, Netherlands | 19.9 | 19.6 | 18.9 | 17.7 | 16.4 | 16.6 |
| Calgary, Canada | 18.8 | 17.6 | 13.7 | 12.1 | 13.7 | 15.0 |
| Toronto, Canada | 15.3 | 15.1 | 15.0 | 13.4 | 13.1 | 13.6 |
| Edmonton, Canada | 16.1 | 15.1 | 14.1 | 14.0 | 14.7 | 13.1 |
| Boston, United States | 13.6 | 12.6 | 14.3 | 11.9 | 11.8 | 11.0 |
| Vancouver, Canada | 12.8 | 9.6 | 10.7 | 11.3 | 11.2 | 10.9 |

| Urban area | 2009 (parts per billion) | 2010 (parts per billion) | 2011 (parts per billion) | 2012 (parts per billion) | 2013 (parts per billion) | 2014 (parts per billion) |
|---|---|---|---|---|---|---|
| Montreal, Canada | 12.4 | 10.7 | 11.5 | 10.6 | 10.2 | 9.7 |
| Sydney, Australia | 10.1 | 10.5 | 10.2 | 9.8 | 10.3 | 9.6 |
| Ottawa/Gatineau, Canada | 7.7 | 6.7 | 7.1 | 6.8 | 6.9 | 6.3 |

**Source:** Environment and Climate Change Canada (2016) National Air Pollution Surveillance Program. Environmental Protection Department of Hong Kong (2016) Air Quality Data. European Environment Agency (2016) AirBase – The European Air Quality Database and Air Quality e-Reporting. United States Environmental Protection Agency (2016) AirData Download Data Files. Office of Environment and Heritage of New South Wales (2016) Air Quality Data Search.

# Annex B. References and additional information

### References and further reading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World Health Organization (2005) Air Quality Guidelines Global Update 2005. Particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Retrieved in May, 2016.


### Related information

Ambient Levels of Fine Particulate Matter

Ambient Levels of Nitrogen Dioxide

Ambient Levels of Ozone

Ambient Levels of Sulphur Dioxide

Ambient Levels of Volatile Organic Compounds

Smog

World Health Organization Global Urban Ambient Air Pollution Database 2016

## www.ec.gc.ca

Additional information can be obtained at:

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