



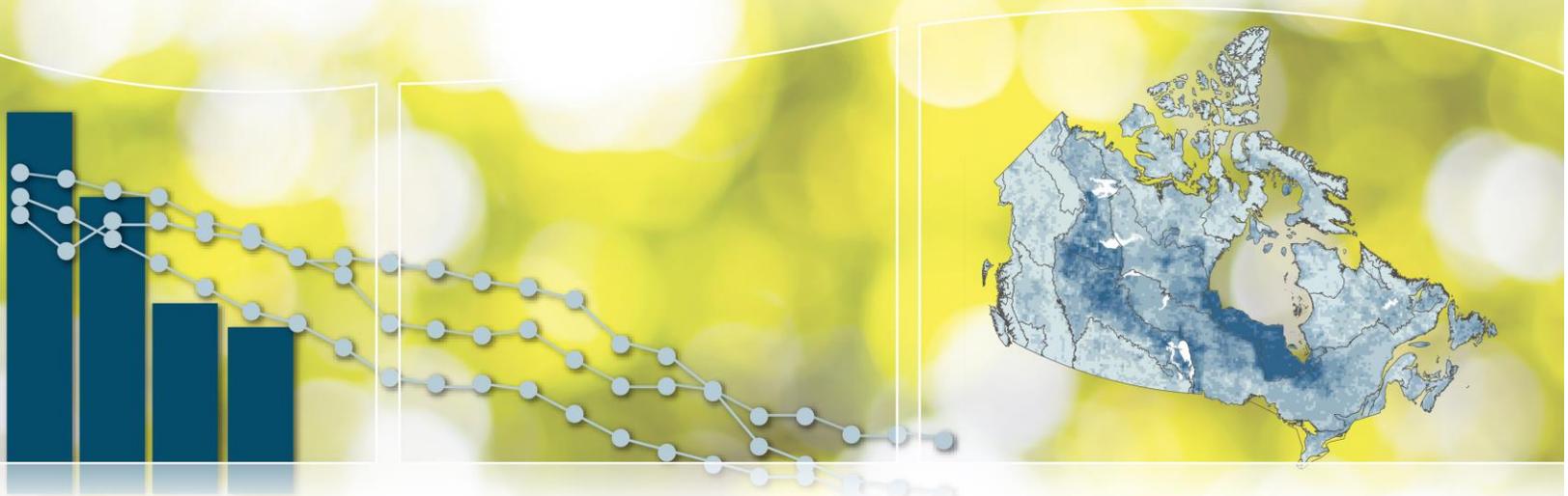
Environment and
Climate Change Canada

Environnement et
Changement climatique Canada



Canadian Environmental Sustainability Indicators

Emissions of harmful substances to air



Suggested citation for this document: Environment and Climate Change Canada (2017) Canadian Environmental Sustainability Indicators: Emissions of harmful substances to air. Consulted on *Month day, year*.

Available at: www.canada.ca/en/environment-climate-change/services/environmental-indicators/emissions-harmful-substances-air.html.

Cat. No.: En4-144/82-2017E-PDF
ISBN: 978-0-660-23528-8

Unless otherwise specified, you may not reproduce materials in this publication, in whole or in part, for the purposes of commercial redistribution without prior written permission from Environment and Climate Change Canada's copyright administrator. To obtain permission to reproduce Government of Canada materials for commercial purposes, apply for Crown Copyright Clearance by contacting:

Environment and Climate Change Canada
Public Inquiries Centre
12th floor, Fontaine Building
200 Sacré-Coeur boul.
Gatineau, QC K1A 0H3
Telephone: 819-938-3860
Toll Free: 1-800-668-6767 (in Canada only)
Fax: 819-938-3318
Email: ec.enviroinfo.ec@canada.ca

Photos: © Thinkstockphotos.ca; © Environment and Climate Change Canada

© Her Majesty the Queen in Right of Canada, represented by the Minister of Environment and Climate Change, 2017

Aussi disponible en français

Canadian Environmental Sustainability Indicators

Emissions of harmful substances to air

October 2017

Table of Contents

Emissions of harmful substances to air indicator	5
Key results	5
Emissions of mercury to air	6
Mercury emissions to air by province and territory	8
Mercury emissions to air from facilities	9
Global mercury emissions to air	9
Emissions of lead to air	10
Lead emissions to air by province and territory	11
Emissions of cadmium to air	12
Cadmium emissions to air by province and territory	13
About the indicators	14
What do the indicators measure	14
Why are these indicators important	14
What are the related indicators	14
Data sources and methods	15
What are the data sources	15
How are these indicators calculated	16
What has recently changed	21
What are the caveats and limitations	25
Resources	26
References	26

Annex	27
Annex A. Data tables for the figures presented in this document	27

List of Figures

Figure 1. Mercury, lead and cadmium emissions to air, Canada, 1990 to 2015.....	5
Figure 2. Mercury emissions to air by source, Canada, 1990 to 2015.....	6
Figure 3. Mercury emissions to air by province and territory, Canada, 2005 and 2015	8
Figure 4. Global mercury emissions to air, 2010.....	9
Figure 5. Lead emissions to air by source, Canada, 1990 to 2015.....	10
Figure 6. Lead emissions to air by province and territory, Canada, 2005 and 2015.....	11
Figure 7. Cadmium emissions to air by source, Canada, 1990 to 2015	12
Figure 8. Cadmium emissions to air by province and territory, Canada, 2005 and 2015	13

List of Tables

Table 1. Alignment of sources reported in the indicators and the Air Pollutant Emission Inventory	18
Table 2. Changes to sources reported in the indicators and alignment with Air Pollutant Emission Inventory categories	21
Table A.1. Data for Figure 1. Mercury, lead and cadmium emissions to air, Canada, 1990 to 2015.....	27
Table A.2. Data for Figure 2. Mercury emissions to air by source, Canada, 1990 to 2015	28
Table A.3. Data for Figure 3. Mercury emissions to air by province and territory, Canada, 2005 and 2015.....	29
Table A.4. Data for Figure 4. Global mercury emissions to air, 2010	29
Table A.5. Data for Figure 5. Lead emissions to air by source, Canada, 1990 to 2015	30
Table A.6. Data for Figure 6. Lead emissions to air by province and territory, Canada, 2005 and 2015.....	31
Table A.7. Data for Figure 7. Cadmium emissions to air by source, Canada, 1990 to 2015	32
Table A.8. Data for Figure 8. Cadmium emissions to air by province and territory, Canada, 2005 and 2015.....	33

Emissions of harmful substances to air indicator

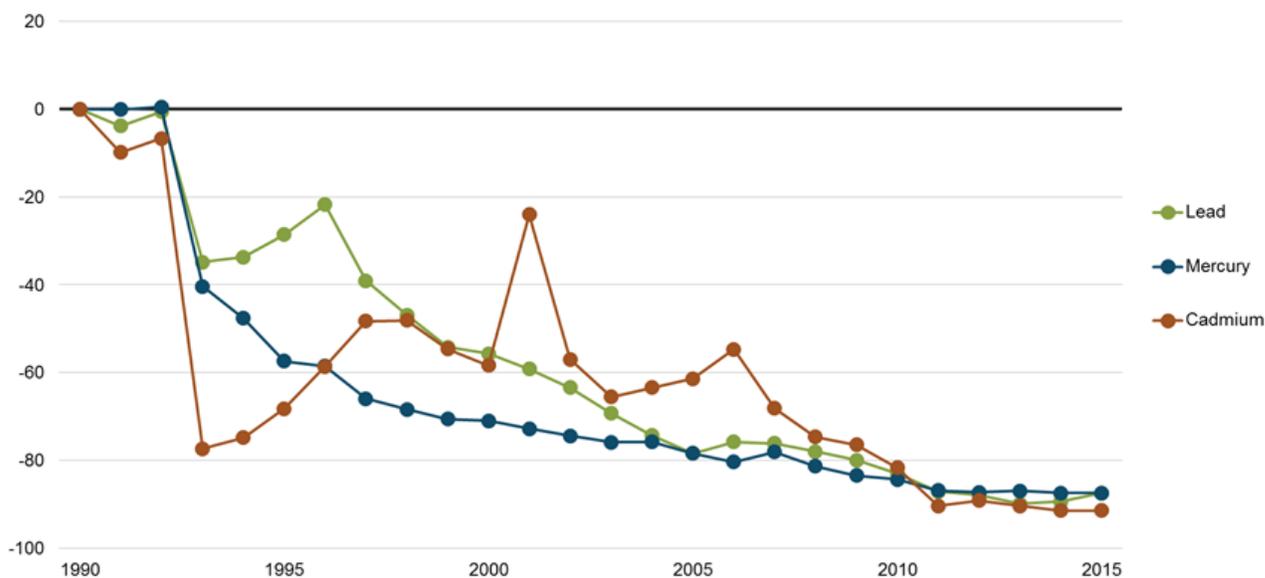
Emissions of some substances can harm human health, wildlife and biological diversity. For example, small particles of toxic metals in the air can be inhaled. They can also settle on the ground and in water. There, they can enter the food web and build up in the tissues of living organisms. Some of these substances can also travel great distances by air. Exposure to these substances, even in small amounts, can be hazardous to both humans and wildlife. These indicators track human-related emissions of mercury, lead and cadmium.

Key results

- In 2015, lead, mercury and cadmium emissions were about 90% lower than in 1990.
- The decrease in emissions came mostly from large reductions in non-ferrous smelting and the mining industry.

Figure 1. Mercury, lead and cadmium emissions to air, Canada, 1990 to 2015

Annual percentage change in emissions relative to 1990



[Data for Figure 1](#)

Note: The indicator reports emissions from human activities only.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Emissions of lead, mercury and cadmium decreased by 87%, 88% and 91%, respectively, between 1990 and 2015.

The decline in lead emissions resulted from the implementation of pollution prevention regulations, which limited or eliminated lead in some materials (such as gasoline and paints), and the implementation of pollution prevention measures for smelters, along with the closure of outdated smelters. Reductions in emissions from mining and rock quarrying from 1990 to 1998, as well as slight emission reductions in air transportation across the whole period, also influenced the overall decline in lead emissions since 1990.

Mercury emissions reductions were mostly attributed to a single large facility which undertook many emissions-reducing actions over that period. This included changing its zinc production method, improving its controls of particulate matter emissions and switching to cleaner fuels.

Cadmium emissions fluctuated greatly between 1990 and 2006, but decreased steadily from 2007 to 2014, followed by a small increase in 2015. As with lead emissions, reductions in cadmium emissions are attributed to the closure of outdated smelters and the introduction of pollution prevention regulations. Fluctuations in cadmium emissions prior to 2010 are almost entirely driven by emissions from a single smelter in Manitoba.

Mercury and its compounds, lead, and inorganic cadmium compounds are listed as toxic¹ under the Canadian Environmental Protection Act, 1999.

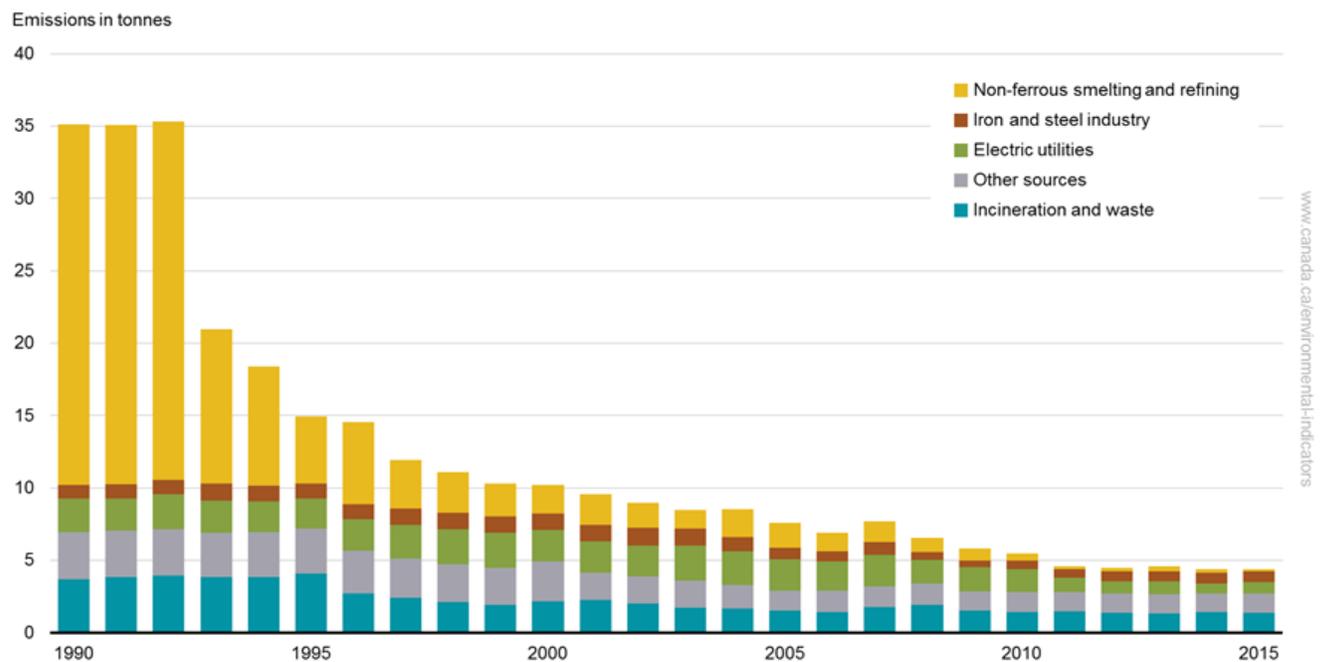
Emissions of mercury to air

Mercury is of global concern. It is carried long distances in the atmosphere and settles everywhere in Canada, including sensitive areas such as the Canadian Arctic and the Great Lakes. Mercury can be re-emitted to the air during forest fires, volcanic episodes and other geological activities.

Key results

- Mercury emissions decreased by 88% (or 31 tonnes) between 1990 and 2015. After a 41% decrease between 1992 and 1993, emissions declined steadily until 2011. They have been more or less stable since then.
- In 2015, the largest source of mercury emissions to air was the incineration and waste sector. It accounted for 31% of the total.

Figure 2. Mercury emissions to air by source, Canada, 1990 to 2015



[Data for Figure 2](#)

Note: The indicator reports emissions from human activities only. Other sources include agriculture (livestock, crop production and fertilizer), building heating and energy generation, home firewood burning, manufacturing, the oil and gas industry, ore and

¹ Section 64 of the Canadian Environmental Protection Act, 1999, defines a substance as toxic if it is "entering or may enter the environment in a quantity or concentration or under conditions that (a) have or may have an immediate or long-term harmful effect on the environment or its biological diversity; (b) constitute or may constitute a danger to the environment on which life depends; or (c) constitute or may constitute a danger in Canada to human life or health."

mineral industries except non-ferrous smelting and refining and iron and steel industry, transportation (road, rail, air and marine) and other miscellaneous sources. For more details on the sources, please consult the [Data sources and methods](#) section.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

The largest reduction in mercury emissions between 1990 and 2015 was in the non-ferrous smelting and refining industry with an emission reduction of 99% (25 tonnes), which contributed to 80% of the Canadian emissions reduction. This decline was due primarily to changes in facility processes and the adoption of emission-reduction technologies, the closing of facilities, and compliance with federal and provincial legislation and guidelines introduced over this period.

Emissions from incineration and waste and electric utilities (mostly coal power plants), which declined by about two thirds (2.3 tonnes and 1.5 tonnes, respectively) contributed a further 7.5% and 4.9% to the total decrease in emissions over the period.

Mercury is a naturally occurring metal that is used in certain products. Mercury can be emitted to the air by natural processes such as volcanic activity, and soil and rock erosion; by human activities such as metal smelting, iron and steel production, coal-fired electricity generation, industrial boilers, cement kilns and waste incineration; and from the improper disposal of products such as electrical switches and fluorescent lights.

Mercury has significant negative effects on human health and the environment. Its presence persists and bioaccumulates in ecosystems. Canadians' exposure to mercury poses a particular risk to populations, such as Indigenous people, who rely heavily on the consumption of predatory fish, such as freshwater trout or Arctic char, and traditional food items, including marine mammals. Mercury and its compounds are listed as toxic² under the Canadian Environmental Protection Act, 1999.

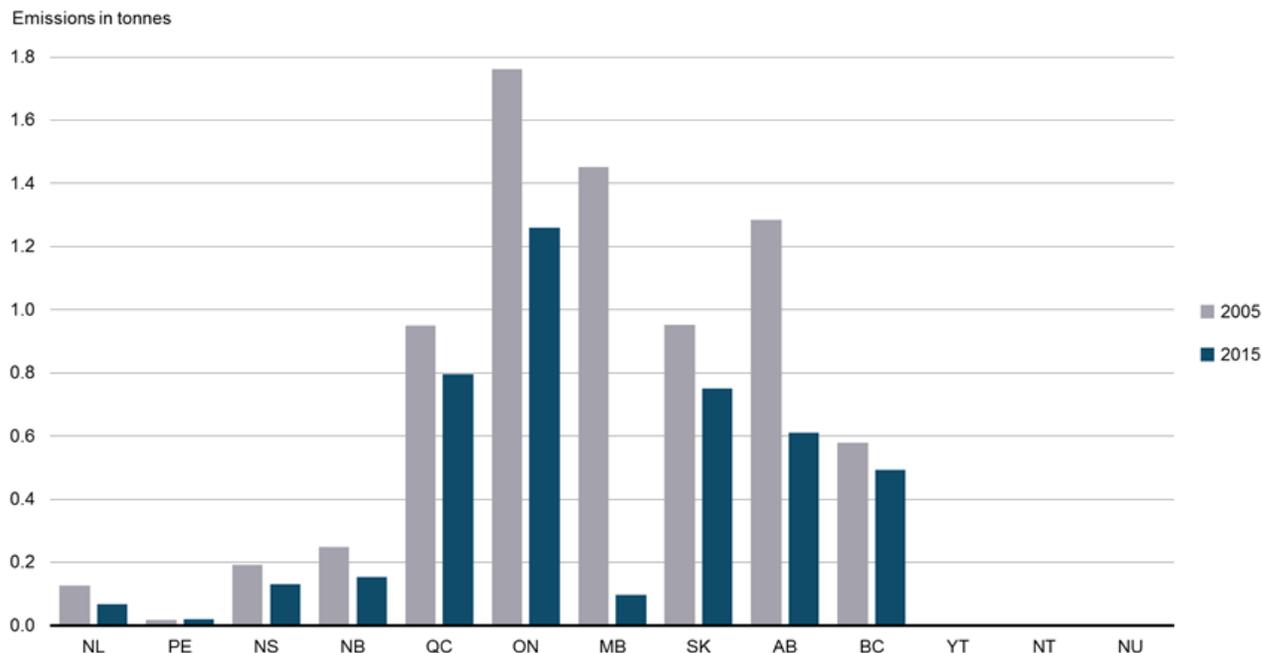
² Section 64 of the Canadian Environmental Protection Act, 1999, defines a substance as toxic if it is "entering or may enter the environment in a quantity or concentration or under conditions that (a) have or may have an immediate or long-term harmful effect on the environment or its biological diversity; (b) constitute or may constitute a danger to the environment on which life depends; or (c) constitute or may constitute a danger in Canada to human life or health."

Mercury emissions to air by province and territory

Key results

- In 2015, Ontario, Quebec and Saskatchewan accounted for 29%, 18% and 17% of Canadian mercury emissions, respectively.
- Between 2005 and 2015, emissions were reduced by 93% (or 1.4 tonnes) in Manitoba. This was the largest decrease observed during that time.

Figure 3. Mercury emissions to air by province and territory, Canada, 2005 and 2015



[Data for Figure 3](#)

Note: The indicator reports emissions from human activities only.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Mercury emissions were the highest in Ontario in 2015, accounting for 29% (1.3 tonnes) of Canadian emissions. These emissions mostly came from incineration and waste and the iron and steel industry, which together made up 61% of the total provincial emissions.

The largest decline in emissions between 2005 and 2015 was observed in Manitoba. This decline was mostly due to changes in production levels and the introduction of pollution prevention activities at a non-ferrous smelting and refining facility.

In 2015, incineration and waste was the largest source of emissions in British Columbia, Manitoba, Ontario, Quebec, Prince Edward Island, the Yukon and Nunavut. The largest source in Alberta, Saskatchewan and Nova Scotia was electric utilities (mostly coal power plants). In Newfoundland and Labrador and the Northwest Territories, the largest source was the ore and mineral industry (excluding non-ferrous smelting and refining). In New Brunswick, the largest source was non-ferrous smelting and refining.

Mercury emissions to air from facilities

Environment and Climate Change Canada's National Pollutant Release Inventory provides detailed information on emissions from industrial, commercial and institutional facilities that meet its reporting criteria.³

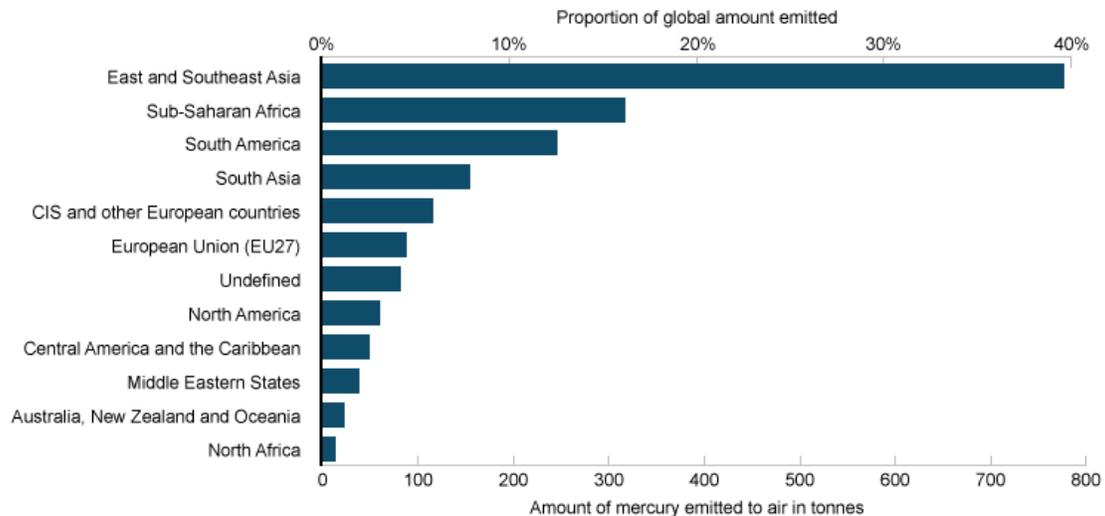
The Canadian Environmental Sustainability Indicators program provides access to this information through an online interactive map. With this map, you can zoom in on local areas and obtain details about [mercury emissions to air](#) from individual facilities.

Global mercury emissions to air

Key results

- In 2010 (the latest year with available data), global emissions⁴ of mercury to air from human activity were estimated to be 1 960 tonnes.
- East and Southeast Asia, Sub-Saharan Africa and South America accounted for 68% of the global total. China itself contributed about one third of the global total.
- As reported by the United Nations Environment Programme, North America emitted 61 tonnes in 2010, or about 3.1% of the global total. That same year, Canada emitted less than 5 tonnes,⁵ about 0.3% of the global total.

Figure 4. Global mercury emissions to air, 2010



www.canada.ca/environmental-indicators

[Data for Figure 4](#)

Note: CIS = Commonwealth of Independent States. CIS includes Azerbaijan, Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turkmenistan, Uzbekistan and Ukraine. The Undefined region includes emissions from contaminated sites.

Source: United Nations Environmental Program, Chemicals Branch (2013) [Global Mercury Assessment 2013: Sources, emissions, releases, and environmental transport](#).

³ Environment and Climate Change Canada (2017) [National Pollutant Release Inventory Data Search – 2015 Facility Reported Data](#).

⁴ United Nations Environment Programme, Chemicals Branch (2013) Transport Global. Retrieved in June 2017. The global emissions were calculated by the United Nations Environmental Programme and are independent of Canada's mercury emission estimates.

⁵ The use of different calculation estimations and different source classifications account for the differences in Canada's mercury emissions as reported in the global comparison indicator and in the Canadian mercury indicator for 2010.

Mercury emissions can travel hundreds to thousands of kilometres via air masses before being deposited.⁶ For example, the 2016 [Canadian Mercury Science Assessment](#) estimates that over 95% of the human-related mercury deposited in Canada comes from sources outside of the country (40% from East Asia, 17% from the United States, 8% from Europe, and 6% from South Asia).

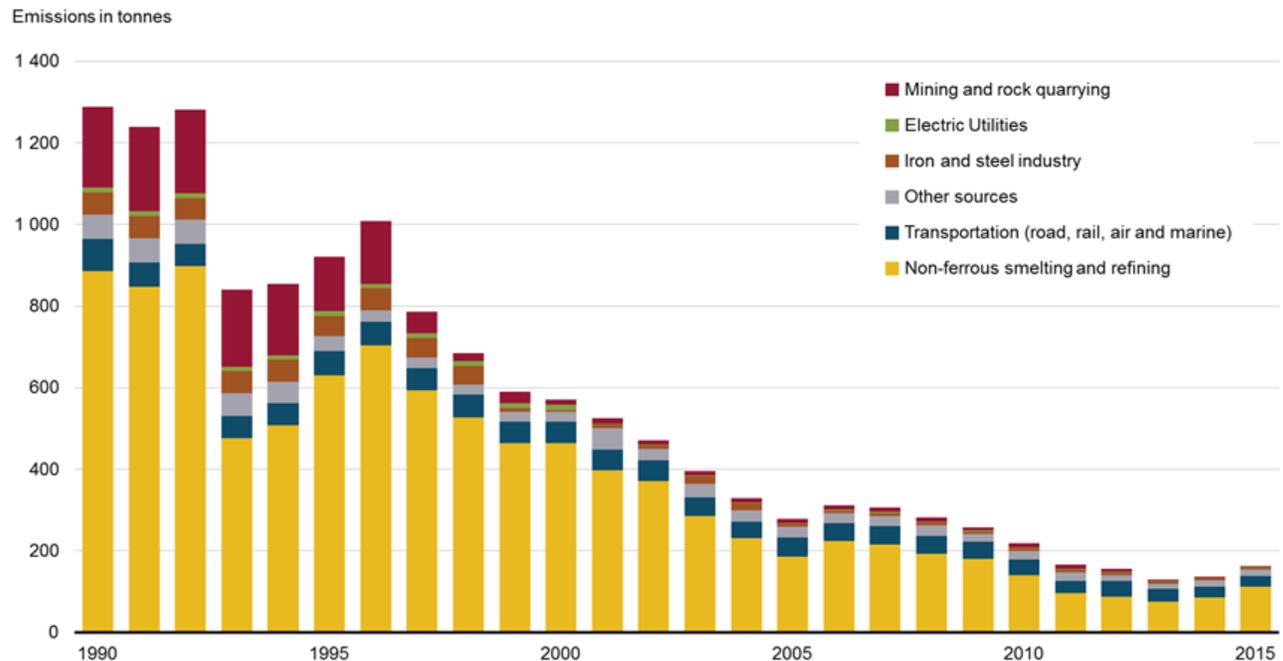
Emissions of lead to air

Lead can be deposited on land or water surfaces and then builds up in soils, sediments, humans and wildlife. Canadians are exposed to low levels of lead through food, drinking water, air, household dust, soil and various products. Exposure to lead, even in small amounts, can be hazardous to both humans and wildlife.

Key results

- Lead emissions decreased by 87% (or 1 127 tonnes) between 1990 and 2015.
- Since 1990, the largest source of lead emissions has been the non-ferrous smelting and refining industry. It accounted for 69% (or 112 tonnes) of the total in 2015.

Figure 5. Lead emissions to air by source, Canada, 1990 to 2015



[Data for Figure 5](#)

Note: The indicator reports emissions from human activities only. Other sources include agriculture (livestock, crop production and fertilizer), building heating and energy generation, home firewood burning, incineration and waste, manufacturing, the oil and gas industry, ore and mineral industries other than iron and steel, non-ferrous smelting and refining and mining and rock quarrying, paints and solvents and other miscellaneous sources. For more details on the sources, please consult the [Data sources and methods](#) section.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Between 1990 and 2015, the introduction of pollution prevention regulations and pollution prevention strategies in operating smelters, along with the closure of outdated smelters resulted in emissions from non-ferrous smelting and refining declining by 774 tonnes. During the same period, emissions

⁶ Durnford D et al. (2010) [Long-range transport of mercury to the Arctic and across Canada](#). Atmospheric Chemistry and Physics 10(2):4673–4717. Retrieved in March 2016.

from mining and rock quarrying declined by 198 tonnes. Combined, these 2 sectors contributed to 86% of the decline in lead emissions from 1990 to 2015.

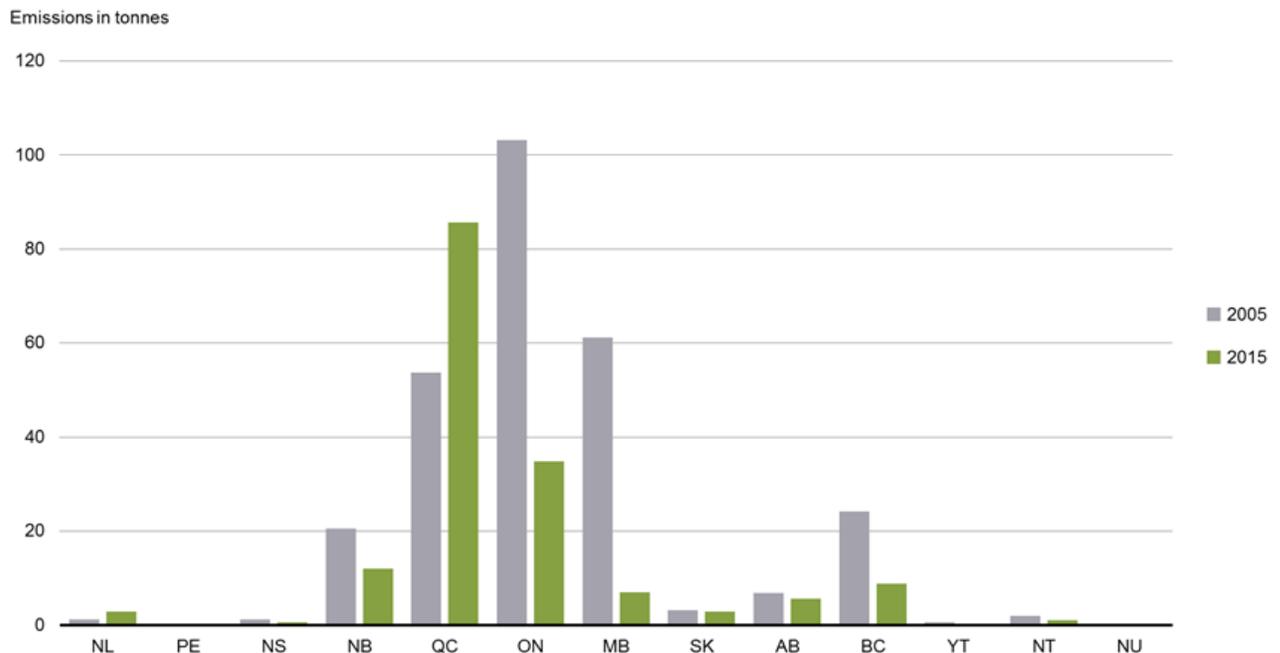
Lead is a metal that occurs naturally in the Earth's crust. Lead is emitted mainly as a result of industrial activities, such as metal smelting and refining and various combustion processes. It is also released from natural processes such as rock and soil erosion. Lead is listed as toxic⁷ under the Canadian Environmental Protection Act, 1999.

Lead emissions to air by province and territory

Key results

- In 2015, emissions in Quebec and Ontario accounted for about three quarters of total Canadian emissions.
- Between 2005 and 2015, the largest decrease in emissions was observed in Ontario. Emissions within the province decreased by 68 tonnes. This decline was mostly due to changes in production levels at a non-ferrous smelting and refining facility.

Figure 6. Lead emissions to air by province and territory, Canada, 2005 and 2015



[Data for Figure 6](#)

Note: The indicator reports emissions from human activities only.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

During the 2005 to 2015 period, lead emissions increased in Quebec. This change is due to an increase in emissions from a non-ferrous smelting and refining facility.

In 2015, lead emission levels in Quebec were the highest in Canada, accounting for 53% (86 tonnes) of Canadian emissions. In 2015, non-ferrous smelting and refining was the largest source of lead

⁷ Section 64 of the Canadian Environmental Protection Act, 1999, defines a substance as toxic if it is "entering or may enter the environment in a quantity or concentration or under conditions that (a) have or may have an immediate or long-term harmful effect on the environment or its biological diversity; (b) constitute or may constitute a danger to the environment on which life depends; or (c) constitute or may constitute a danger in Canada to human life or health."

emissions in Quebec, Ontario, New Brunswick, and Manitoba. Transportation (road, rail, air and marine) was the main source of emissions in all other provinces and territories except Newfoundland and Labrador and Nova Scotia (where the main sources were the iron ore industry and home firewood burning, respectively).

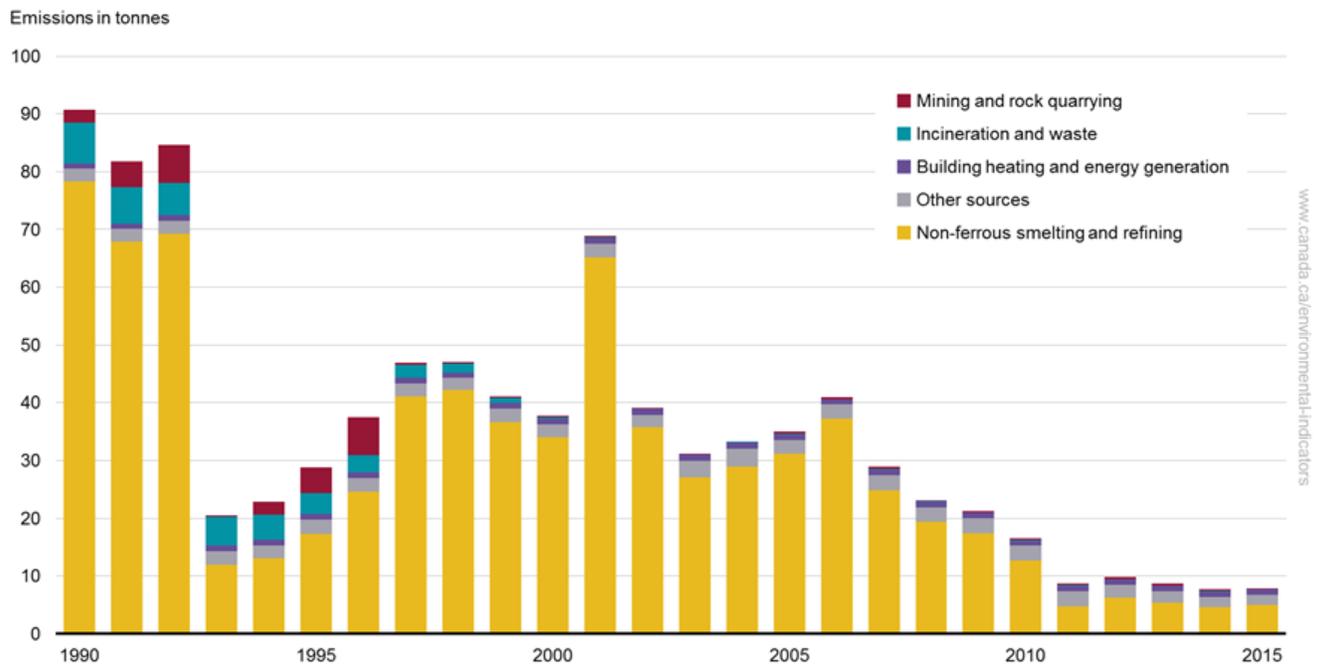
Emissions of cadmium to air

Cadmium is a naturally occurring metal. It is used in batteries and in electroplating to protect other metals from corrosion. Exposure to cadmium, which builds up in humans and wildlife, can be hazardous to both.

Key results

- Cadmium emissions were 91% (or 83 tonnes) lower in 2015 than in 1990.
- Cadmium emissions declined significantly between 1992 and 1993. Emissions fluctuated between 1993 and 2006 (peaking in 2001) but never reached 1990 levels. After 2006, emissions declined steadily.
- The non-ferrous smelting and refining industry contributed to 88% of the decrease in emissions between 1990 and 2015. Fluctuations observed in this sector prior to 2010 are attributed to a single smelter in Manitoba.

Figure 7. Cadmium emissions to air by source, Canada, 1990 to 2015



[Data for Figure 7](#)

Note: The indicator reports emissions from human activities only. Other sources include agriculture (livestock, crop production and fertilizer), electric utilities, home firewood burning, manufacturing, the oil and gas industry, ore and mineral industries other than non-ferrous smelting and refining and mining and rock quarrying, paints and solvents, transportation (road, rail, air and marine) and other miscellaneous sources. For more details on the sources, please consult the [Data sources and methods](#) section.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Between 1990 and 2015, the closure of outdated smelters and the introduction of pollution prevention regulations resulted in cadmium emissions from non-ferrous smelting and refining declining by 73 tonnes. In fact, fluctuations in emissions prior to 2010 are almost entirely driven by emissions from a single smelter in Manitoba. Emissions from incineration and waste declined by 7 tonnes during that same period. Combined, these two sectors contributed to 97% of the decline in cadmium emissions between 1990 and 2015.

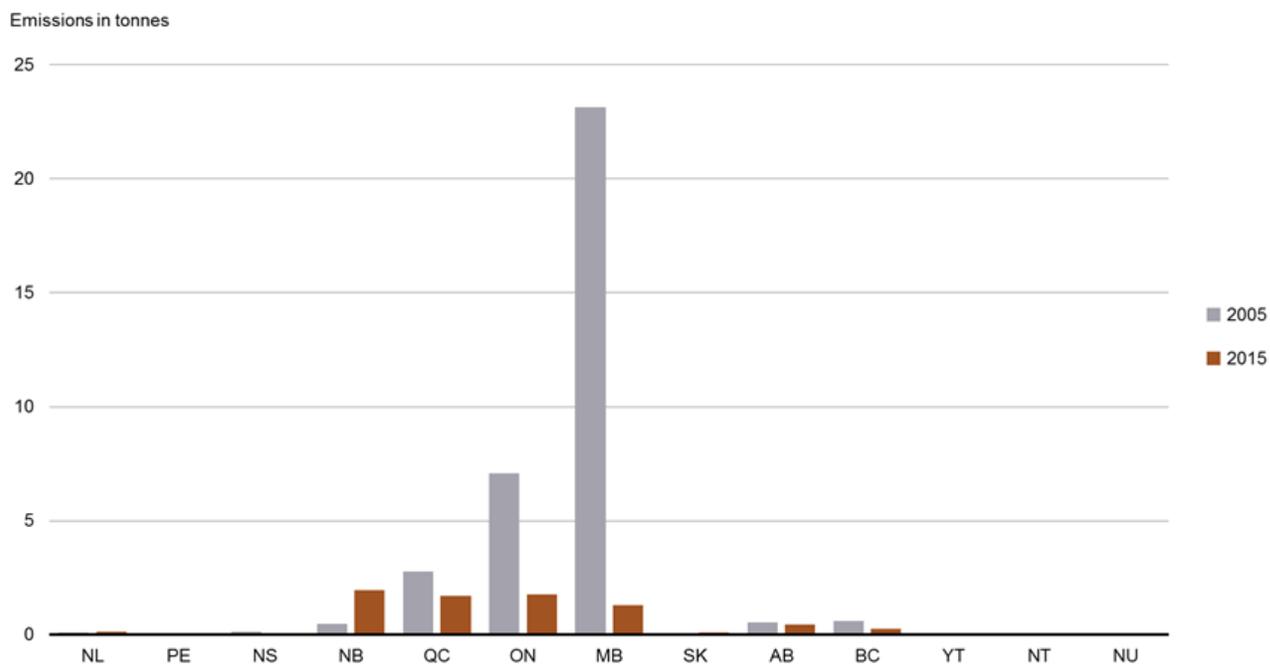
Inorganic cadmium compounds are listed as toxic⁸ under the Canadian Environmental Protection Act, 1999.

Cadmium emissions to air by province and territory

Key results

- In 2015, emission from New Brunswick, Ontario, Quebec and Manitoba accounted for 87% of Canadian emissions.
- Between 2005 and 2015, the largest decrease in emissions was observed in Manitoba. Emissions in that province decreased by 22 tonnes (or 94%). This was mostly due to a change in production levels and to the introduction of pollution prevention activities at a non-ferrous smelting and refining facility.

Figure 8. Cadmium emissions to air by province and territory, Canada, 2005 and 2015



[Data for Figure 8](#)

Note: The indicator reports emissions from human activities only.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

⁸ Section 64 of the Canadian Environmental Protection Act, 1999, defines a substance as toxic if it is "entering or may enter the environment in a quantity or concentration or under conditions that (a) have or may have an immediate or long-term harmful effect on the environment or its biological diversity; (b) constitute or may constitute a danger to the environment on which life depends; or (c) constitute or may constitute a danger in Canada to human life or health."

During the 2005 to 2015 period, cadmium emissions in New Brunswick. This increase was mostly due to a change in production levels at a facility. In 2015, New Brunswick had the highest level of cadmium emissions, accounting for 1 quarter of Canadian emissions.

In 2015, non-ferrous smelting and refining was the main source of cadmium emissions to air in New Brunswick, Ontario, Quebec, and Manitoba. Building heating and energy generation were the main sources of emissions in all other provinces except for Newfoundland and Labrador, Nunavut and the Northwest Territories, where the main sources were the iron ore industry, transportation (road, rail, air and marine), and mining and rock quarrying, respectively.

About the indicators

What do the indicators measure

These indicators track human-related emissions to air of 3 substances that are defined as toxic under the Canadian Environmental Protection Act, 1999: mercury, lead and cadmium and their compounds. Emissions to air are provided at the national and regional (provincial and territorial) level and by source for each substance. Facility and global emissions to air are also provided for mercury.

Why are these indicators important

Mercury and its compounds, lead and inorganic cadmium compounds are on the [Toxic Substances List](#) under Schedule 1 of the Canadian Environmental Protection Act, 1999. This means that these substances are "entering or may enter the environment in a quantity or concentration or under conditions that (a) have or may have an immediate or long-term harmful effect on the environment or its biological diversity; (b) constitute or may constitute a danger to the environment on which life depends; or (c) constitute or may constitute a danger in Canada to human life or health."

The indicators inform Canadians about emissions to air of these 3 substances from human activity in Canada. These indicators also help the government to identify priorities and develop or revise strategies to inform further risk management and to track progress on policies put in place to reduce or control these 3 substances and air pollution in general.

What are the related indicators

The [Releases of harmful substances to water](#) indicators track human-related releases to water of 3 toxic substances, namely mercury, lead and cadmium, and their compounds. For each toxic substance, releases to water are provided at the national, regional (provincial and territorial) and facility level and by source.



Safe and healthy communities

These indicators support the measurement of progress towards the following [2016–2019 Federal Sustainable Development Strategy](#) long-term goal: All Canadians live in clean, sustainable communities that contribute to their health and well-being.

Data sources and methods

What are the data sources

The Emissions of harmful substances to air indicators (mercury, lead and cadmium) are based on emission estimates reported in the [Air Pollutant Emission Inventory](#) compiled by Environment and Climate Change Canada. A complete set of the inventory data is available online at the [Government of Canada Open Portal website](#).

Facility data for mercury emissions to air reported in the [interactive map](#) come from the [National Pollutant Release Inventory](#) and are available for 2006 to 2015.

Mercury emissions by world regions are provided for international comparison and taken from the [Global Mercury Assessment 2013: Sources, emissions, releases and environmental transport](#) report of the United Nations Environment Programme.

More information

The Air Pollutant Emission Inventory provides data and estimates on releases from human activities of the air pollutants contributing to the issues of smog, acid rain, reduced air quality and climate change. Improvements are made periodically as new emission estimation methodologies are adopted and additional information is made available. Historical emissions are also updated on the basis of these improvements.

Air Pollutant Emission Inventory

The Air Pollutant Emission Inventory fulfills many of Canada's international pollution level reporting obligations. It is a comprehensive inventory of 17 air pollutants,⁹ combining emissions reported by facilities to the [National Pollutant Release Inventory](#) with emissions estimated by Environment and Climate Change Canada. Estimates are developed using the latest estimation methods and are based on published statistics or other sources of information such as surveys and reports. The Air Pollutant Emission inventory summaries and trends are compiled in collaboration with provincial, territorial and regional environmental agencies providing a comprehensive overview of pollutant emissions across Canada.

The national and provincial/territorial inventory data are current as of February 15, 2017, and cover the period from 1990 to 2015. Emissions data are reported in the inventory approximately 1 year after data collection, validation, calculation and interpretation have been completed. The Emissions of harmful substances to air indicators are reported following the public release of the inventory data.

National Pollutant Release Inventory

The National Pollutant Release Inventory is a database of pollutant releases (to air, water and land), disposals and transfers for recycling from industrial, commercial and institutional facilities. The data from these facilities are provided by the operators of the facilities as mandated by the Canadian Environmental Protection Act. Under the act, owners or operators of facilities that manufacture, process or otherwise use or release one or more of the substances tracked by the inventory and that meet substance-specific reporting thresholds and other requirements must report their pollutant releases annually to Environment and Climate Change Canada. The inventory data from 1990 to 2015 are current as of December 1, 2016.

⁹ Includes the 6 key air pollutants along with cadmium, lead, mercury, dioxins and furans, 4 types of polycyclic aromatic hydrocarbons, hexachlorobenzene, particulate matter less than or equal 10 micrometers (µm) and total particulate matter.

Global Mercury Assessment 2013

The Global Mercury Assessment 2013: Sources, emissions, releases and environmental transport and its [Technical Background Report](#) represent the second edition of the United Nations Environment Programme reporting on global mercury emissions. The first edition was published in 2003. The inventory is based on national emissions data for 2010. An update of the assessment is being planned for 2018. International comparison of mercury emissions to air is provided for 2010, the latest year that data are available.

How are these indicators calculated

The Emissions of harmful substances to air indicators are produced by grouping the calculated emissions data from Canada's national inventories in order to report on the key sources that contribute to the majority of emissions with respect to 3 harmful substances: mercury, lead and cadmium.

More information

Calculation of emissions

Emissions of air pollutants are measured or estimated using one of the following methods:

- continuous emission monitoring systems (CEMS)
- predictive emission monitoring (PEM)
- source testing
- mass balance
- site-specific emission factors
- published emission factors
- engineering estimates
- special studies

The methodologies used to estimate emissions are reviewed, updated and improved on a periodically. Collaborative work with sector experts from within and outside Environment and Climate Change Canada is undertaken to incorporate available expertise and the latest advances in scientific knowledge. Further information on these methods is available through Environment and Climate Change Canada's [Air Pollutant Emission Inventory](#) and [National Pollutant Release Inventory](#).

Compilation of emissions

The process of compiling emission estimates consists of developing estimates for many different emissions sources. These estimates are grouped into 3 main classes:

1. point sources
2. area and open sources
3. mobile sources

Emissions for each of the 3 main classes of sources are compiled using top-down (few details, mostly at the national or regional level) and bottom-up (with a lot of specific details at the facility level) approaches.

Point sources

Point sources are stationary sources that emit pollutants through stacks or other equipment at specific geographical locations. They are compiled through a bottom-up approach starting with emissions from facilities. The facility information reported to the National Pollutant Release Inventory is used in combination with some provincial information to compile the emissions from point sources.

Area and open sources

Area and open source emissions are sources too small or too numerous to be reported individually as point sources. They are usually compiled through a top-down approach using activity-level statistics such as production data or fuel use data, and emission factors that are specific to the source. Activity levels are multiplied by emission factors to estimate the emissions for the specific source.

Mobile sources

Mobile source emissions, such as those from transportation, are compiled using a combination of bottom-up and top-down approaches. As an example, road transportation emissions are estimated using an emissions estimation model (MOVES) developed by the United States Environmental Protection Agency. The model considers the number of vehicles, fuel consumed, distance travelled, technology used and many other parameters. This model has been adapted for Canadian conditions.

Emissions reconciliation and data quality

Care is taken to avoid double counting of emissions in the Air Pollutant Emission Inventory for the same source. A reconciliation of the emissions is conducted when point source emissions are already accounted for in the area source estimates. In these cases, the area source estimates are modified (reduced or removed) to avoid double counting. A data quality control process is also in place to avoid discrepancies in the database, both in data compilation and in the production of summary tables.

Temporal coverage

Historical data are provided at the national and source level for the period from 1990 to 2015. Regional emissions are presented for 2005 and 2015, as provincial data for the period from 1990 to 2004 are not available for all substances.

Air pollutant emissions by source classification

For the purposes of reporting the indicators, calculated emissions data from the Air Pollutant Emission Inventory are grouped into the following 13 sources:

1. agriculture (livestock, crop production and fertilizer)
2. building heating and energy generation
3. dust and fires
4. electric utilities
5. home firewood burning
6. incineration and waste
7. manufacturing
8. miscellaneous
9. off-road vehicles and mobile equipment
10. oil and gas industry
11. ore and mineral industries
12. paints and solvents
13. transportation (road, rail, air and marine)

Table 1 shows the allocation of sources of harmful substances reported in the indicators compared with those reported by the Air Pollutant Emission Inventory.

Table 1. Alignment of sources reported in the indicators and the Air Pollutant Emission Inventory

Sources in the indicators	Sources in the Air Pollutant Emission Inventory
Agriculture (livestock, crop production and fertilizer)	Crop production
Agriculture (livestock, crop production and fertilizer)	Agriculture fuel use
Agriculture (livestock, crop production and fertilizer)	Animal production
Building heating and energy generation	Commercial and institutional fuel combustion
Building heating and energy generation	Residential fuel combustion
Building heating and energy generation	Construction fuel combustion
Dust and fires	Structural fires
Dust and fires	Construction operations
Dust and fires	Paved roads
Dust and fires	Unpaved roads
Dust and fires	Coal transportation
Dust and fires	Mine tailings
Dust and fires	Prescribed forest burning
Electric utilities	Electric power generation: coal
Electric utilities	Electric power generation: natural gas
Electric utilities	Electric power generation: diesel
Electric utilities	Electric power generation: other
Electric utilities	Electric power generation: waste materials ¹⁰
Home firewood burning	Home firewood burning
Incineration and waste	Crematorium
Incineration and waste	Industrial and commercial incineration
Incineration and waste	Municipal incineration
Incineration and waste	Other incineration and utilities
Incineration and waste	Waste
Manufacturing	Chemical industry
Manufacturing	Grain processing
Manufacturing	Pulp and paper industry

¹⁰ Includes electric power generation from combustion of waste materials by utilities and by industry for commercial sale and/or private use.

Sources in the indicators	Sources in the Air Pollutant Emission Inventory
Manufacturing	Wood products
Manufacturing	Metal fabrication
Manufacturing	Glass manufacture
Manufacturing	Vehicle manufacture (engines, parts, assembly, painting)
Manufacturing	Electronics
Manufacturing	Plastics manufacture
Manufacturing	Food preparation
Manufacturing	Textiles
Manufacturing	Abrasives manufacture
Manufacturing	Bakeries
Manufacturing	Other manufacturing industries
Manufacturing	Biofuel production
Miscellaneous	Cigarette smoking
Miscellaneous	Marine cargo handling
Miscellaneous	Commercial cooking
Miscellaneous	Service stations
Miscellaneous	Human ¹¹
Miscellaneous	Other miscellaneous sources
Off-road vehicles and mobile equipment	Off-road diesel vehicles and equipment
Off-road vehicles and mobile equipment	Off-road gasoline / liquefied petroleum gas / compressed natural gas vehicles and equipment
Oil and gas industry	Upstream petroleum industry
Oil and gas industry	Downstream petroleum industry
Oil and gas industry	Petroleum product transportation and distribution
Ore and mineral industries	Aluminum industry
Ore and mineral industries	Asphalt paving industry
Ore and mineral industries	Cement and concrete industry
Ore and mineral industries	Mineral products industry
Ore and mineral industries	Foundries
Ore and mineral industries	Iron and steel industries ^[A]
Ore and mineral industries	Iron ore industry
Ore and mineral industries	Mining and rock quarrying ^[A]

¹¹ Includes human respiration, perspiration and dental amalgams.

Sources in the indicators	Sources in the Air Pollutant Emission Inventory
Ore and mineral industries	Non-ferrous mining and smelting industry ^[A]
Paints and solvents	Dry cleaning
Paints and solvents	General solvent use
Paints and solvents	Printing
Paints and solvents	Surface coatings
Transportation (road, rail, air and marine)	Air transportation
Transportation (road, rail, air and marine)	Heavy-duty diesel vehicles
Transportation (road, rail, air and marine)	Heavy-duty gasoline vehicles
Transportation (road, rail, air and marine)	Light-duty diesel trucks
Transportation (road, rail, air and marine)	Light-duty diesel vehicles
Transportation (road, rail, air and marine)	Light-duty gasoline trucks
Transportation (road, rail, air and marine)	Light-duty gasoline vehicles
Transportation (road, rail, air and marine)	Marine transportation
Transportation (road, rail, air and marine)	Motorcycles
Transportation (road, rail, air and marine)	Rail transportation
Transportation (road, rail, air and marine)	Tire wear and brake lining
Transportation (road, rail, air and marine)	Heavy-duty liquefied petroleum gas / natural gas vehicles
Transportation (road, rail, air and marine)	Light duty liquefied petroleum gas / compressed natural gas trucks
Transportation (road, rail, air and marine)	Light duty liquefied petroleum gas / compressed natural gas vehicles

^[A] These sectors from the Air Pollutant Emission Inventory are sometimes shown as individual sources.

For display purposes, smaller emitting sources are sometimes grouped together under the title Other sources in the charts of air pollutant emissions by source. The names of the sources grouped as such are listed in the notes of each chart.

What has recently changed

Since the last reporting of the indicators, the classification of emissions by source for each of 3 harmful substances (mercury, lead and cadmium) was revised to align with changes made to source classifications in Canada's Air Pollutant Emission Inventory. Specifically, emissions formerly reported under the inventory's high-level source category (industrial, non-industrial, mobile, incineration, miscellaneous and open sources) have been re-organized into 11 new source categories: ore and mineral industries, oil and gas industry, electric power generation (utilities), manufacturing, transportation and mobile equipment, agriculture, commercial/residential/institutional, incineration and waste, paints and solvents, dust and fires.

The emission estimates reported in the Air Pollutant Emission Inventory used in the indicators have undergone a number of significant recalculations. Specifically, the sector emissions for on-road and off-road vehicles (reported within the transportation and mobile equipment source category of the inventory) and dust from unpaved roads (source category dust) following the implementation of improved quantification methods. For more information about these recent changes, consult [Annex 2](#) of the Air Pollutant Emission Inventory report.

More information

Reclassification of sources presented in the indicators

To better reflect the reclassification of categories in the Air Pollutant Emissions Inventory, a number of changes have also been made to the categories used to present information in this version of the indicators. In particular, 4 categories have been removed (incineration and miscellaneous, fuel for electricity and heating, waste and other industries) and 8 categories have been added (agriculture [livestock, crop production and fertilizer], building heating and energy generation, dust and fires, electric utilities, incineration and waste, manufacturing, ore and mineral industries, miscellaneous, and paints and solvents).

Table 2 shows how emissions sources in the Air Pollutant Emission Inventory have been reallocated to the main source types for this version of the indicator.

Table 2. Changes to sources reported in the indicators and alignment with Air Pollutant Emission Inventory categories

Sources in the Air Pollutant Emission Inventory	Sources in the indicators	Sources in the previous version of the indicators
Commercial and institutional fuel combustion	Building heating and energy generation	Fuel for electricity and heating
Residential fuel combustion	Building heating and energy generation	Fuel for electricity and heating
Electric power generation: coal	Electric utilities	Fuel for electricity and heating
Electric power generation: natural gas	Electric utilities	Fuel for electricity and heating
Electric power generation: diesel	Electric utilities	Fuel for electricity and heating
Electric power generation: other	Electric utilities	Fuel for electricity and heating
Home firewood burning	Home firewood burning	Home firewood burning

Sources in the Air Pollutant Emission Inventory	Sources in the indicators	Sources in the previous version of the indicators
Crop production	Agriculture (livestock, crop production and fertilizer)	Incineration and miscellaneous
Agriculture fuel use	Agriculture (livestock, crop production and fertilizer)	Incineration and miscellaneous
Animal production	Agriculture (livestock, crop production and fertilizer)	Incineration and miscellaneous
Construction fuel combustion	Building heating and energy generation	Incineration and miscellaneous
Structural fires	Dust and fires	Incineration and miscellaneous
Construction operations	Dust and fires	Incineration and miscellaneous
Paved roads	Dust and fires	Incineration and miscellaneous
Unpaved roads	Dust and fires	Incineration and miscellaneous
Coal transportation	Dust and fires	Incineration and miscellaneous
Mine tailings	Dust and fires	Incineration and miscellaneous
Prescribed forest burning	Dust and fires	Incineration and miscellaneous
Crematorium	Incineration and waste	Incineration and miscellaneous
Industrial and commercial incineration	Incineration and waste	Incineration and miscellaneous
Municipal incineration	Incineration and waste	Incineration and miscellaneous
Other incineration and utilities	Incineration and waste	Incineration and miscellaneous
Cigarette smoking	Miscellaneous	Incineration and miscellaneous
Marine cargo handling	Miscellaneous	Incineration and miscellaneous
Commercial cooking	Miscellaneous	Incineration and miscellaneous
Service stations	Miscellaneous	Incineration and miscellaneous
Human	Miscellaneous	Incineration and miscellaneous
Other miscellaneous sources	Miscellaneous	Incineration and miscellaneous

Sources in the Air Pollutant Emission Inventory	Sources in the indicators	Sources in the previous version of the indicators
Dry cleaning	Paints and solvents	Incineration and miscellaneous
General solvent use	Paints and solvents	Incineration and miscellaneous
Printing	Paints and solvents	Incineration and miscellaneous
Surface coatings	Paints and solvents	Incineration and miscellaneous
Off-road diesel vehicles and equipment	Off-road vehicles and mobile equipment	Off-road vehicles
Off-road gasoline / liquefied petroleum gas (LPG) / compressed natural gas (CNG) vehicles and equipment	Off-road vehicles and mobile equipment	Off-road vehicles
Upstream petroleum industry	Oil and gas industry	Oil and gas industry
Downstream petroleum industry	Oil and gas industry	Oil and gas industry
Chemical industry	Manufacturing	Other industries
Grain processing	Manufacturing	Other industries
Pulp and paper industry	Manufacturing	Other industries
Wood products	Manufacturing	Other industries
Metal fabrication	Manufacturing	Other industries
Glass manufacture	Manufacturing	Other industries
Vehicle manufacture (engines, parts, assembly, painting)	Manufacturing	Other industries
Electronics	Manufacturing	Other industries
Plastics manufacture	Manufacturing	Other industries
Food preparation	Manufacturing	Other industries
Textiles	Manufacturing	Other industries
Abrasives manufacture	Manufacturing	Other industries
Bakeries	Manufacturing	Other industries
Other manufacturing industries	Manufacturing	Other industries
Biofuel production	Manufacturing	Other industries
Petroleum product transportation and distribution	Oil and gas industry	Other industries
Aluminum industry	Ore and mineral industries	Other industries

Sources in the Air Pollutant Emission Inventory	Sources in the indicators	Sources in the previous version of the indicators
Asphalt paving industry	Ore and mineral industries	Other industries
Cement and concrete industry	Ore and mineral industries	Other industries
Mineral products industry	Ore and mineral industries	Other industries
Foundries	Ore and mineral industries	Other industries
Iron and steel industries ^[A]	Ore and mineral industries	Other industries
Iron ore industry	Ore and mineral industries	Other industries
Mining and rock quarrying ^[A]	Ore and mineral industries	Other industries
Non-ferrous mining and smelting industry ^[A]	Ore and mineral industries	Other industries
Air transportation	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Heavy-duty diesel vehicles	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Heavy-duty gasoline vehicles	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Light-duty diesel trucks	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Light-duty diesel vehicles	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Light-duty gasoline trucks	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Light-duty gasoline vehicles	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Marine transportation	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Motorcycles	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Rail transportation	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Tire wear and brake lining	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Heavy-duty liquefied petroleum gas / natural gas vehicles	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Light duty liquefied petroleum gas / compressed natural gas trucks	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)
Light duty liquefied petroleum gas / compressed natural gas vehicles	Transportation (road, rail, air and marine)	Transportation (road, rail, air, marine)

Sources in the Air Pollutant Emission Inventory	Sources in the indicators	Sources in the previous version of the indicators
Electric power generation: Waste materials ¹²	Electric utilities	Waste
Waste	Incineration and waste	Waste

^[A] These sectors from the Air Pollutant Emission Inventory are sometimes shown as individual sources.

What are the caveats and limitations

Total emissions of mercury, lead and cadmium to air reported in these indicators exclude natural sources such as forest fires.

In order to provide a consistent global picture, the Canadian mercury emissions to air used for the international comparison are those that come from the [Global Mercury Assessment 2013: Sources, emissions, releases and environmental transport](#) report of the United Nations Environment Programme. However, it is important to note that the emissions data found in that report were estimated with different estimation techniques and different source classifications than the mercury emissions to air used for the national indicators. In addition, some air emissions sources were not quantified in the international comparison due to a lack of data.

More information

Air Pollutant Emission Inventory and National Pollutant Release Inventory

The methods used to estimate air pollutant emissions continue to evolve. Improvements are made every year to methodologies for estimating and compiling emissions summaries and analyzing trends. As a result of these improvements, emissions for a given year may be different from those previously published by Environment and Climate Change Canada, other government agencies and international organizations. Caution is advised when comparing different reports and different sources.

Some area source emissions were not updated for 2015 because activity level statistics were not available at the time of the compilation. In these cases, the emission estimates from 2014 were used.

The Air Pollutant Emission Inventory uses facility information from the National Pollutant Release Inventory and other sources. The version of the data published by the National Pollutant Release Inventory may not be identical to that used in the Air Pollutant Emission Inventory at any given time because of updates to point source data from the National Pollutant Release Inventory.

The number and composition of facilities that report releases to air to the National Pollutant Release Inventory can vary each year. This variation is due to the fact that only facilities that meet or exceed the reporting threshold are required to report to the National Pollutant Release Inventory. An analysis of how the changes in the number of facilities that report to the National Pollutant Release Inventory might affect the apparent trends has not been undertaken.

Facilities reporting to the National Pollutant Release Inventory use methods that may vary depending on the substance and/or facility, and may also change from year to year.

¹² Includes electric power generation from combustion of waste materials by utilities and by industry for commercial sale and/or private use.

International comparison of mercury emissions by region of the world

Air emissions sources that were not quantified in the international mercury emissions include biofuel production and combustion, vinyl-chloride monomer production, secondary metals production and ferro-alloys, oil and gas extraction, transport and processing other than refinery emissions, industrial/hazardous waste incineration and disposal sewage sludge incineration, preparation of dental amalgam fillings and disposal of removed fillings containing mercury.

Even though the Canadian mercury emissions to air used for the comparison follows the same reporting structure as the Global Mercury Assessment report and uses the best data, measurements and methods available, users must be cautious when comparing the data, as emissions estimation methodologies differ among countries.

Resources

References

Environment and Climate Change Canada (2016) [National Pollutant Release Inventory Datasets](#). September 2016 version. Retrieved on March 15, 2017.

Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory Report 1990–2015](#). Retrieved on March 15, 2017.

Environment and Climate Change Canada (2017) [Guide for Using and Interpreting National Pollutant Release Inventory Data](#). Retrieved in March 2017.

United Nations (2013) [Global Mercury Assessment 2013: Sources, emissions, releases and environmental transport](#). Retrieved on June 13, 2017.

Annex

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

Table A.1. Data for Figure 1. Mercury, lead and cadmium emissions to air, Canada, 1990 to 2015

Year	Lead (annual percentage change in emissions relative to 1990)	Mercury (annual percentage change in emissions relative to 1990)	Cadmium (annual percentage change in emissions relative to 1990)
1990	0	0	0
1991	-4	0	-10
1992	-1	1	-7
1993	-35	-40	-77
1994	-34	-48	-75
1995	-29	-57	-68
1996	-22	-59	-59
1997	-39	-66	-48
1998	-47	-68	-48
1999	-54	-71	-55
2000	-56	-71	-58
2001	-59	-73	-24
2002	-63	-74	-57
2003	-69	-76	-66
2004	-74	-76	-63
2005	-78	-78	-61
2006	-76	-80	-55
2007	-76	-78	-68
2008	-78	-81	-75
2009	-80	-83	-77
2010	-83	-84	-82
2011	-87	-87	-90
2012	-88	-87	-89
2013	-90	-87	-90
2014	-89	-87	-91
2015	-87	-88	-91

Note: The indicator reports emissions from human activities only.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Table A.2. Data for Figure 2. Mercury emissions to air by source, Canada, 1990 to 2015

Year	Incineration and waste (emissions in tonnes)	Other sources (emissions in tonnes)	Electric utilities (emissions in tonnes)	Iron and steel industry (emissions in tonnes)	Non-ferrous smelting and refining (emissions in tonnes)	Total (emissions in tonnes)
1990	3.68	3.26	2.32	0.95	24.90	35.12
1991	3.84	3.22	2.19	0.97	24.87	35.09
1992	3.95	3.17	2.42	0.99	24.78	35.31
1993	3.82	3.10	2.21	1.19	10.63	20.95
1994	3.85	3.11	2.13	1.06	8.26	18.40
1995	4.09	3.12	2.06	1.03	4.65	14.95
1996	2.70	2.98	2.16	1.05	5.68	14.56
1997	2.41	2.73	2.31	1.11	3.39	11.95
1998	2.11	2.59	2.44	1.12	2.84	11.10
1999	1.91	2.55	2.44	1.14	2.28	10.31
2000	2.16	2.78	2.16	1.14	1.94	10.18
2001	2.24	1.88	2.18	1.13	2.12	9.55
2002	2.00	1.90	2.11	1.21	1.75	8.97
2003	1.69	1.89	2.43	1.17	1.29	8.46
2004	1.65	1.62	2.34	0.99	1.90	8.50
2005	1.49	1.41	2.17	0.79	1.70	7.57
2006	1.41	1.48	2.01	0.71	1.28	6.89
2007	1.74	1.44	2.20	0.89	1.42	7.68
2008	1.90	1.48	1.65	0.52	1.01	6.55
2009	1.51	1.32	1.68	0.45	0.84	5.80
2010	1.43	1.36	1.59	0.56	0.54	5.48
2011	1.47	1.32	1.01	0.58	0.21	4.59
2012	1.37	1.31	0.86	0.68	0.25	4.47
2013	1.33	1.34	0.85	0.70	0.36	4.57
2014	1.39	1.29	0.71	0.72	0.29	4.40
2015	1.37	1.32	0.80	0.72	0.18	4.39

Note: The indicator reports emissions from human activities only. Other sources include agriculture (livestock, crop production and fertilizer), building heating and energy generation, home firewood burning, manufacturing, the oil and gas industry, ore and mineral industries except non-ferrous smelting and refining and iron and steel industry, transportation (road, rail, air and marine) and other miscellaneous sources. For more details on the sources, please consult the [Data sources and methods](#) section. Totals may not add up due to rounding.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Table A.3. Data for Figure 3. Mercury emissions to air by province and territory, Canada, 2005 and 2015

Province or territory	2005 (emissions in tonnes)	2015 (emissions in tonnes)
Newfoundland and Labrador	0.13	0.07
Prince Edward Island	0.02	0.02
Nova Scotia	0.19	0.13
New Brunswick	0.25	0.15
Quebec	0.95	0.80
Ontario	1.76	1.26
Manitoba	1.45	0.10
Saskatchewan	0.95	0.75
Alberta	1.28	0.61
British Columbia	0.58	0.49
Yukon	< 0.01	< 0.01
Northwest Territories	< 0.01	< 0.01
Nunavut	< 0.01	< 0.01
Canada	7.57	4.39

Note: The indicator reports emissions from human activities only. Totals may not add up due to rounding.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Table A.4. Data for Figure 4. Global mercury emissions to air, 2010

Region	Mercury emissions (emissions in tonnes)	Percentage of global emissions
East and Southeast Asia	777.0	39.7
Sub-Saharan Africa	316.0	16.1
South America	245.0	12.5
South Asia	154.0	7.9
Commonwealth of Independent States (CIS) and other European countries	115.0	5.9
European Union (EU27)	87.5	4.5
North America	60.7	3.1
Central America and the Caribbean	47.2	2.4
Middle Eastern States	37.0	1.9
Australia, New Zealand & Oceania	22.3	1.1

Region	Mercury emissions (emissions in tonnes)	Percentage of global emissions
North Africa	13.6	0.7
Undefined	82.0	4.2

Note: Commonwealth of Independent States includes Azerbaijan, Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turkmenistan, Uzbekistan and Ukraine. The Undefined region includes emissions from contaminated sites.

Source: United Nations Environmental Program, Chemicals Branch (2013) [Global Mercury Assessment 2013: Sources, emissions, releases, and environmental transport](#).

Table A.5. Data for Figure 5. Lead emissions to air by source, Canada, 1990 to 2015

Year	Non-ferrous smelting and refining (emissions in tonnes)	Transportation (road, rail, air and marine) (emissions in tonnes)	Other sources (emissions in tonnes)	Iron and steel industry (emissions in tonnes)	Electric utilities (emissions in tonnes)	Mining and rock quarrying (emissions in tonnes)	Total (emissions in tonnes)
1990	886.2	79.0	60.1	53.9	11.3	198.6	1 289.1
1991	847.5	60.1	59.9	53.9	11.5	207.7	1 240.5
1992	899.2	54.2	58.2	53.9	12.0	204.8	1 282.3
1993	476.1	54.0	56.6	53.9	11.3	188.6	840.4
1994	508.2	53.4	53.0	53.9	11.6	174.8	854.9
1995	630.7	59.6	36.6	48.5	11.9	134.0	921.4
1996	704.0	58.0	27.7	53.9	11.8	153.5	1 008.9
1997	593.7	54.7	25.9	46.8	12.7	51.9	785.7
1998	527.4	56.4	23.4	45.5	13.7	18.2	684.5
1999	464.7	51.8	25.0	7.6	13.3	27.9	590.4
2000	464.5	52.1	24.3	3.5	14.0	12.2	570.7
2001	397.7	51.2	52.1	8.8	1.5	14.8	526.1
2002	371.3	50.5	28.4	8.5	1.8	10.5	471.0
2003	285.6	45.6	33.4	18.7	2.1	10.3	395.7
2004	230.8	41.7	27.4	16.6	2.0	11.9	330.4
2005	185.6	48.2	26.5	5.7	1.6	10.7	278.3
2006	224.4	43.2	24.5	5.9	3.2	10.4	311.7
2007	216.3	44.9	24.5	6.6	3.3	11.5	307.1
2008	193.6	43.5	26.3	6.0	2.8	10.8	282.9
2009	181.1	41.4	20.3	4.5	2.7	7.8	257.7

Year	Non-ferrous smelting and refining (emissions in tonnes)	Transportation (road, rail, air and marine) (emissions in tonnes)	Other sources (emissions in tonnes)	Iron and steel industry (emissions in tonnes)	Electric utilities (emissions in tonnes)	Mining and rock quarrying (emissions in tonnes)	Total (emissions in tonnes)
2010	140.8	37.4	22.6	6.3	2.2	10.0	219.3
2011	96.2	30.7	20.6	6.1	2.8	9.6	166.1
2012	88.4	37.6	14.4	6.7	2.6	6.9	156.5
2013	74.9	31.8	13.6	5.2	1.4	3.0	129.8
2014	85.5	27.5	15.3	6.1	1.3	0.7	136.4
2015	111.8	27.5	14.8	5.5	1.4	0.8	161.9

Note: The indicator reports emissions from human activities only. Other sources include agriculture (livestock, crop production and fertilizer), building heating and energy generation, home firewood burning, incineration and waste, manufacturing, the oil and gas industry, ore and mineral industries other than iron and steel, non-ferrous smelting and refining and mining and rock quarrying, paints and solvents and other miscellaneous sources. For more details on the sources, please consult the [Data sources and methods](#) section. Totals may not add up due to rounding.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Table A.6. Data for Figure 6. Lead emissions to air by province and territory, Canada, 2005 and 2015

Province or territory	2005 (emissions in tonnes)	2015 (emissions in tonnes)
Newfoundland and Labrador	1.2	2.9
Prince Edward Island	0.2	0.1
Nova Scotia	1.2	0.5
New Brunswick	20.5	11.9
Quebec	53.6	85.7
Ontario	103.1	34.9
Manitoba	61.2	7.0
Saskatchewan	3.2	2.9
Alberta	6.9	5.7
British Columbia	24.2	8.8
Yukon	0.7	0.3
Northwest Territories	1.9	1.0
Nunavut	0.3	0.1
Canada	278.3	161.9

Note: The indicator reports emissions from human activities only. Totals may not add up due to rounding.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Table A.7. Data for Figure 7. Cadmium emissions to air by source, Canada, 1990 to 2015

Year	Non-ferrous smelting and refining (emissions in tonnes)	Other sources (emissions in tonnes)	Building heating and energy generation (emissions in tonnes)	Incineration and waste (emissions in tonnes)	Mining and rock quarrying (emissions in tonnes)	Total (emissions in tonnes)
1990	78.3	2.2	0.9	7.0	2.2	90.7
1991	67.8	2.3	0.9	6.3	4.4	81.7
1992	69.2	2.3	0.9	5.7	6.6	84.6
1993	11.9	2.4	0.9	5.0	0.3	20.5
1994	13.0	2.3	1.0	4.3	2.3	22.8
1995	17.3	2.4	1.0	3.6	4.4	28.8
1996	24.6	2.4	1.0	2.9	6.6	37.5
1997	41.0	2.3	1.0	2.2	0.3	46.9
1998	42.2	2.2	0.9	1.6	0.3	47.0
1999	36.6	2.4	0.9	0.9	0.3	41.2
2000	34.1	2.2	1.0	0.2	0.3	37.7
2001	65.2	2.3	1.0	0.2	0.2	68.9
2002	35.8	2.1	1.0	0.1	< 0.1	39.0
2003	27.0	3.0	1.0	0.1	0.1	31.2
2004	29.0	3.1	1.0	0.1	n/a	33.2
2005	31.1	2.5	1.0	0.1	0.4	35.0
2006	37.3	2.4	0.9	0.1	0.4	41.0
2007	24.8	2.6	1.0	0.1	0.4	28.9
2008	19.4	2.5	1.0	0.1	< 0.1	22.9
2009	17.4	2.7	0.9	< 0.1	0.3	21.3
2010	12.7	2.6	0.9	0.1	0.3	16.6
2011	4.8	2.6	1.0	< 0.1	0.3	8.7
2012	6.2	2.3	1.0	< 0.1	0.3	9.8
2013	5.3	2.1	0.9	0.1	0.3	8.7
2014	4.6	1.9	0.9	0.1	0.3	7.7
2015	5.1	1.7	0.9	< 0.1	< 0.1	7.8

Note: n/a = not available. The indicator reports emissions from human activities only. Other sources include agriculture (livestock, crop production and fertilizer), electric utilities, home firewood burning, manufacturing, the oil and gas industry, ore and mineral industries other than non-ferrous smelting and refining and mining and rock quarrying, paints and solvents, transportation (road, rail, air and marine) and other miscellaneous sources. For more details on the sources, please consult the [Data sources and methods](#) section. Totals may not add up due to rounding.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Table A.8. Data for Figure 8. Cadmium emissions to air by province and territory, Canada, 2005 and 2015

Province or territory	2005 (emissions in tonnes)	2015 (emissions in tonnes)
Newfoundland and Labrador	0.10	0.14
Prince Edward Island	0.02	0.01
Nova Scotia	0.15	0.06
New Brunswick	0.48	1.95
Quebec	2.76	1.70
Ontario	7.08	1.78
Manitoba	23.15	1.31
Saskatchewan	0.08	0.09
Alberta	0.54	0.46
British Columbia	0.61	0.27
Yukon	< 0.01	< 0.01
Northwest Territories	< 0.01	0.01
Nunavut	< 0.01	0.01
Canada	34.97	7.77

Note: The indicator reports emissions from human activities only. Totals may not add up due to rounding.

Source: Environment and Climate Change Canada (2017) [Air Pollutant Emission Inventory](#).

Additional information can be obtained at:

Environment and Climate Change Canada

Public Inquiries Centre

12th Floor, Fontaine Building

200 Sacré-Coeur boul.

Gatineau, QC K1A 0H3

Telephone: 1-800-668-6767 (in Canada only) or 819-938-3860

Fax: 819-938-3318

Email: ec.enviroinfo.ec@canada.ca