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# EMISSIONS OF HARMFUL SUBSTANCES TO AIR

CANADIAN ENVIRONMENTAL  
SUSTAINABILITY INDICATORS



Canada 

**Suggested citation for this document:** Environment and Climate Change Canada (2021) 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](http://www.canada.ca/en/environment-climate-change/services/environmental-indicators/emissions-harmful-substances-air.html).

Cat. No.: En4-144/82-2021E-PDF  
ISBN: 978-0-660-38604-1  
Project code: EC21032

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# CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

# EMISSIONS OF HARMFUL SUBSTANCES TO AIR

**November 2021**

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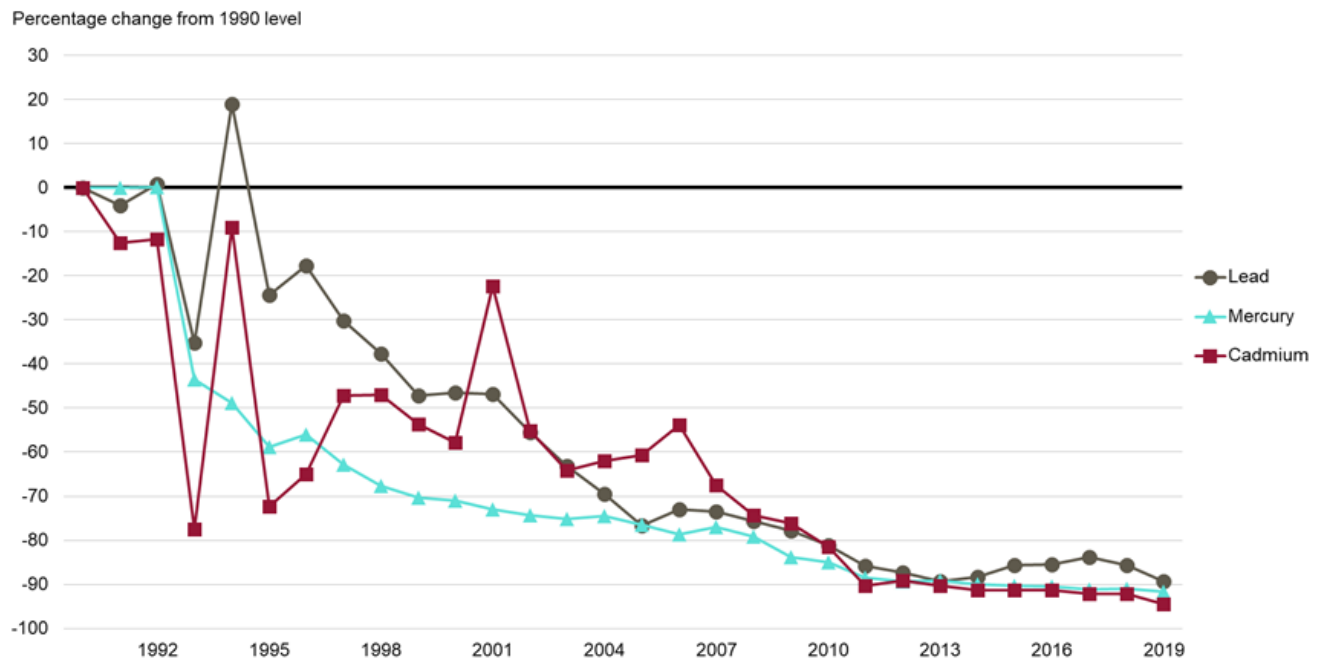
# Emissions of harmful substances to air

Emissions of some substances can harm human health, wildlife and biological diversity. For example, small particles of toxic metals can travel long distances in the air, be inhaled, or settle on the ground and in water. There, they can enter the food web and build up in the tissues of living organisms. Exposure to these substances, even in small amounts, can be hazardous to both humans and wildlife. Mercury and its compounds, lead, and inorganic cadmium compounds are listed as toxic<sup>1</sup> substances under the *Canadian Environmental Protection Act, 1999*. The mercury, lead and cadmium emissions to air indicators track the emissions of these substances from human-related activities.

## Key results

- Mercury, lead and cadmium emissions decreased by 92%,<sup>2</sup> 89% and 95%, respectively, between 1990 and 2019
- The decrease in emissions came mostly from large reductions in the non-ferrous refining and smelting industry

**Figure 1. Mercury, lead and cadmium emissions to air, Canada, 1990 to 2019**



[Data for Figure 1](#)

**Note:** The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. Mercury emission results in the indicators may differ from the results published in [Canada's Air Pollutant Emissions Inventory Report 1990-2019](#) (PDF; 4.14 MB), due to a facility flagging a significant data error in their submission to the National Pollutant Release Inventory. This correction was made after Canada's Air Pollutant Emissions Inventory Report 1990-2019 and the Air Pollutant Emissions Inventory data were released, and will be reflected in the next edition of the Air Pollutant Emissions Inventory.

<sup>1</sup> 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."

<sup>2</sup> Mercury emission results in the indicators may differ from the results published in [Canada's Air Pollutant Emissions Inventory Report 1990-2019](#) (PDF; 4.14 MB), due to a facility flagging a significant data error in their submission to the National Pollutant Release Inventory. This correction was made after Canada's Air Pollutant Emissions Inventory Report 1990-2019 and the Air Pollutant Emissions Inventory data were released, and will be reflected in the next edition of the Air Pollutant Emissions Inventory.

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#). Environment and Climate Change Canada (2021) [National Pollutant Release Inventory](#).

The decrease in mercury emissions between 1990 and 2019 are mostly attributed to a large drop in emissions from the non-ferrous refining and smelting industry. The decline was due primarily to changes in facility processes and adoption of emission reduction technologies, the closing of facilities (outdated smelters), and compliance with federal and provincial legislation and guidelines introduced over this period.

The decline in lead emissions over the 1990 to 2019 period resulted from implementing regulations that limited or eliminated lead in some products (such as gasoline and paints) and implementing [pollution prevention plans](#) in smelters, closing outdated smelters with high emission levels, and compliance with federal and provincial legislation and guidelines introduced over this period. Decreases in emissions from the iron and steel industry and manufacturing (particularly metal fabrication) also contributed.

Cadmium emissions fluctuated between 1990 and 2006, but decreased steadily from 2007 onward. As with mercury and lead emissions, reductions in cadmium emissions are attributed to the closure of outdated smelters with high emission levels, the implementation of pollution prevention plans, and compliance with federal and provincial legislation and guidelines. Fluctuations in cadmium emissions prior to 2010 are mostly driven by emissions from a non-ferrous refining and smelting facility in Manitoba.

Emissions of mercury and cadmium have not changed substantially since 2011. This may be due to a range of competing factors such as increases in production levels as well as the ongoing implementation of new cleaner technologies, facility closures and regulations coming into force in the earlier years. Although lead emissions slowly increased from 2014 to 2017, they decreased again in 2018 and 2019. This may be due to changes in lead concentrations in smelter feed and changes in production levels at particular facilities.

## Emissions of mercury to air<sup>3</sup>

Mercury is used in consumer products such as batteries, thermometers and thermostats, fluorescent lamps, switches and relays, medical and measuring devices, and dental amalgam. Mercury emissions are both a local and a global concern. It can travel long distances in the atmosphere and may settle anywhere in Canada, including sensitive areas such as the Canadian Arctic and the Great Lakes. While the indicator only tracks emissions from human-related activities, mercury can also be emitted to the air through natural processes such as forest fires, volcanic episodes and other geological activities.

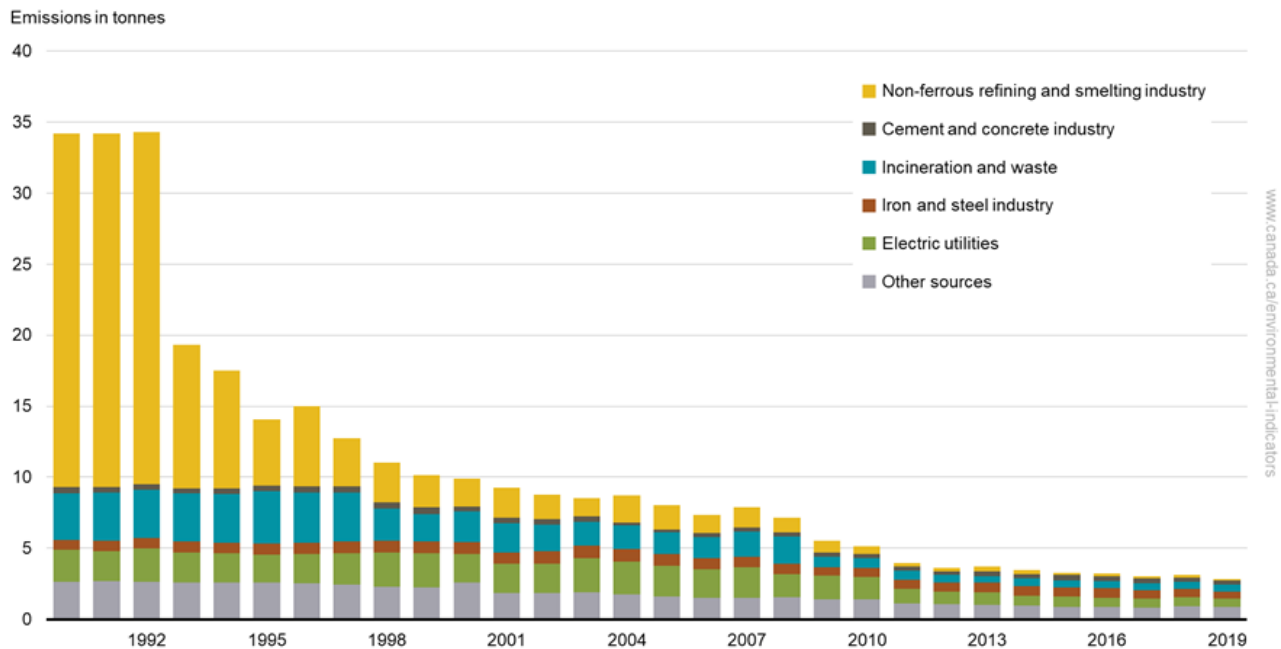
### Key results

- In 2019,
  - 2.8 tonnes of mercury were emitted in Canada
  - the largest emissions source was electric utilities, accounting for 20% (0.6 tonnes) of the annual total
- Between 1990 and 2019, mercury emissions decreased by 92% (or 31.4 tonnes)
  - after a 44% decrease between 1992 and 1993, emissions have since generally declined

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<sup>3</sup> Mercury emission results in the indicators may differ from the results published in [Canada's Air Pollutant Emissions Inventory Report 1990-2019](#) (PDF; 4.14 MB), due to a facility flagging a significant data error in their submission to the National Pollutant Release Inventory. This correction was made after Canada's Air Pollutant Emissions Inventory Report 1990-2019 and the Air Pollutant Emissions Inventory data were released, and will be reflected in the next edition of the Air Pollutant Emissions Inventory.

**Figure 2. Mercury emissions to air by source, Canada, 1990 to 2019**



[Data for Figure 2](#)

**Note:** The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. The category "other sources" includes agriculture (livestock, crop production and fertilizer), building heating and energy generation, home firewood burning, manufacturing, the oil and gas industry, ore and mineral industries (the aluminum industry, the asphalt paving industry, foundries, the iron ore industry and mining and rock quarrying), transportation (road, rail, air and marine) and other miscellaneous sources. For more details on the sources, consult the [Data sources and methods](#). Mercury emission results in the indicators may differ from the results published in [Canada's Air Pollutant Emissions Inventory Report 1990-2019](#) (PDF; 4.14 MB), due to a facility flagging a significant data error in their submission to the National Pollutant Release Inventory. This correction was made after Canada's Air Pollutant Emissions Inventory Report 1990-2019 and the Air Pollutant Emissions Inventory data were released, and will be reflected in the next edition of the Air Pollutant Emissions Inventory.

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#). Environment and Climate Change Canada (2021) [National Pollutant Release Inventory](#).

The largest reduction in mercury emissions between 1990 and 2019 was from the non-ferrous refining and smelting industry. This industry reduced its emissions by almost 100% (24.8 tonnes), contributing to 79% of the overall mercury emissions reduction. The reductions were due primarily to changes in facility processes and adoption of emission-reduction technologies, the closing of facilities, and compliance with federal and provincial legislation and guidelines. For example, the actions of a single large facility in Manitoba lowered its emissions by 99% from 1990 to 2010. These actions included changing its zinc production method, improving its controls of particulate matter emissions and switching to cleaner fuels, and ceasing operation of an outdated copper smelter.

Between 1990 and 2019, emissions from incineration and waste, and electric utilities declined by 85% and 75% (2.8 tonnes and 1.7 tonnes), respectively. The decrease from electric utilities was largely due to the closure of coal-fired power plants.<sup>4</sup> Combined, these sources contributed a further 14% to the total decrease in mercury emissions from 1990 to 2019.

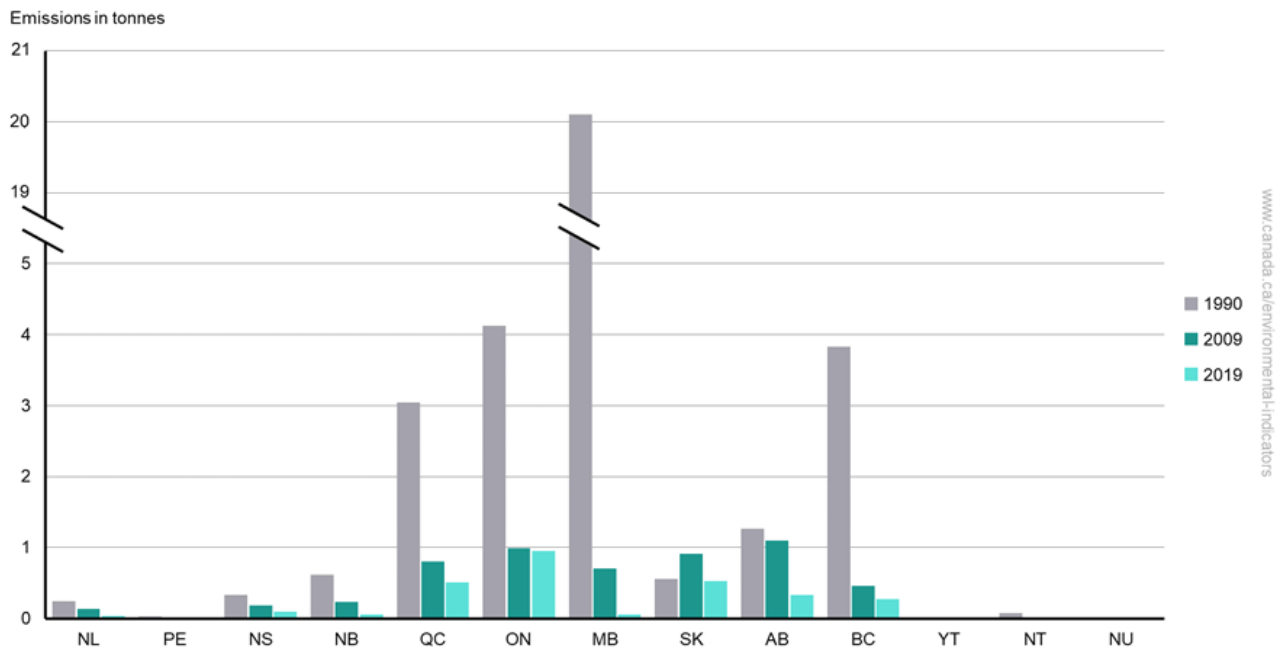
<sup>4</sup> In October 2006, the Canadian Council of Ministers of the Environment endorsed the [Canada-wide standards for mercury emissions from coal-fired electric power generation plants](#) (PDF; 137 kB) to significantly reduce mercury emissions from the coal-fired electric power generation sector.

## Mercury emissions to air by province and territory

### Key results

- In 2019, Ontario, Saskatchewan and Quebec accounted for 70% of national mercury emissions
- Between 1990 and 2019, Manitoba had the largest reduction in emissions with a decrease of almost 100% (or 20.0 tonnes)

**Figure 3. Mercury emissions to air by province and territory, Canada, 1990, 2009 and 2019**



[Data for Figure 3](#)

**Note:** Emissions from the Northwest Territories for 1990 includes emissions from Nunavut, which was officially separated from the Northwest Territories in 1999. The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. Some reported emissions from Newfoundland and Labrador, Prince Edward Island, Yukon, the Northwest Territories and Nunavut are too small to see in the figure. Mercury emission results in the indicators may differ from the results published in [Canada's Air Pollutant Emissions Inventory Report 1990-2019](#) (PDF; 4.14 MB), due to a facility flagging a significant data error in their submission to the National Pollutant Release Inventory. This correction was made after Canada's Air Pollutant Emissions Inventory Report 1990-2019 and the Air Pollutant Emissions Inventory data were released, and will be reflected in the next edition of the Air Pollutant Emissions Inventory.

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#). Environment and Climate Change Canada (2021) [National Pollutant Release Inventory](#).

In 2019, Ontario had the highest mercury emissions, accounting for 33% (0.9 tonnes) of the national total. These emissions came mostly from the iron and steel industry, incineration and waste, and the cement and concrete industry, which together accounted for 62% of the total provincial emissions.

All provinces and territories had lower emissions in 2019 compared to 1990. Manitoba had the largest decline in emissions between these years. This decline was mostly due to changes in production levels and the closure of an outdated smelter at a non-ferrous refining and smelting facility.

In 2019, the largest source within each province and territory was:

- the iron and steel industry in Ontario
- electric utilities (mostly coal power plants) in Saskatchewan, Alberta and Nova Scotia
- incineration and waste in Quebec, Manitoba, Prince Edward Island, Yukon and Nunavut
- the cement and concrete industry in British Columbia
- miscellaneous sources in New Brunswick
- the iron ore industry in Newfoundland and Labrador
- mining and rock quarrying in the Northwest Territories



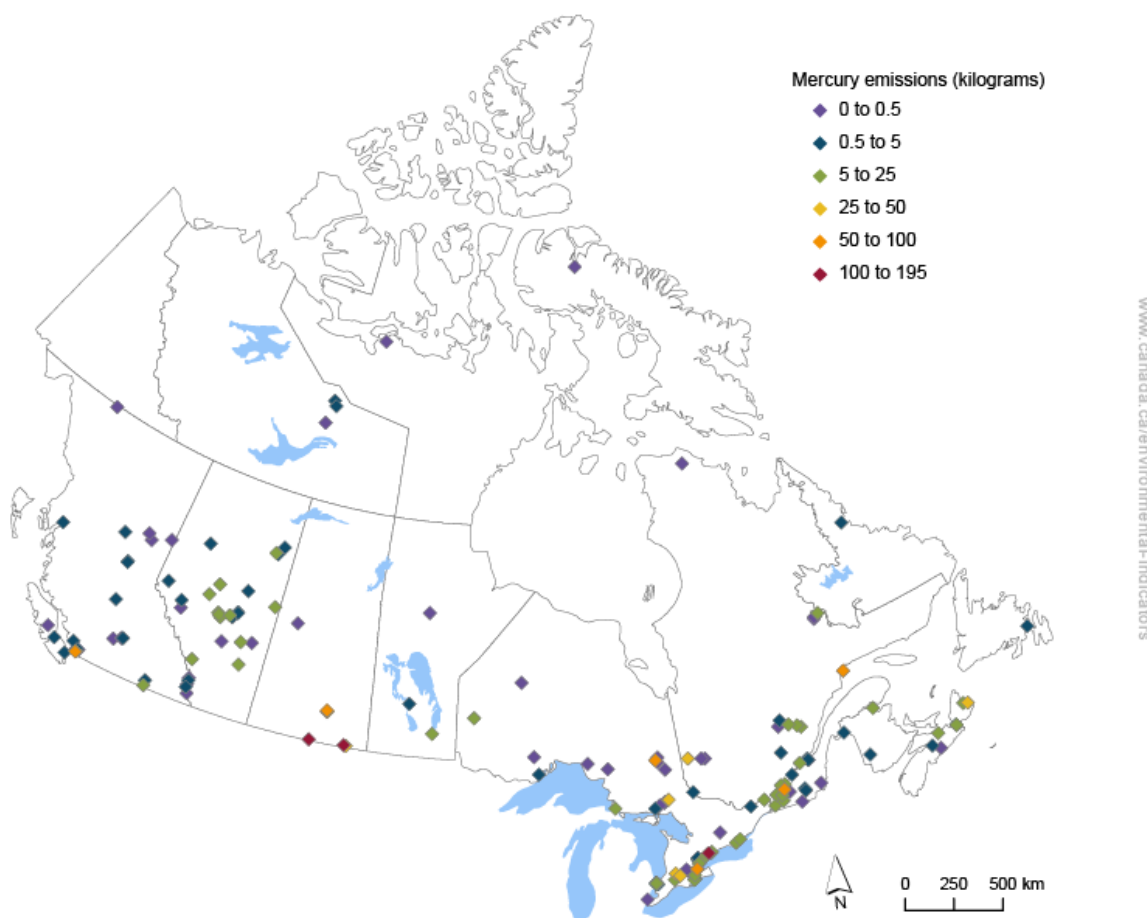
All provinces and the Northwest Territories had lower emissions in 2009 compared to 1990, with the exception of Saskatchewan. Although not shown in Figure 3, emissions in Saskatchewan jumped by 80% in 2003 and remained high until 2013. This increase was mostly due to increased production levels at coal-fired power plants and at an iron and steel industry facility. Emissions in the province peaked at 1.0 tonne in 2005. Between 2009 and 2019 Saskatchewan's reported releases declined by 42% (0.4 tonnes). Emissions continued to decrease from 2009 to 2019 in all provinces.

### Mercury emissions to air from facilities

The National Pollutant Release Inventory provides detailed information on emissions from industrial, commercial and institutional facilities that meet its reporting criteria.

The Canadian Environmental Sustainability Indicators provide access to this information through an online interactive map. The map allows you to explore [mercury emissions to air](#) from individual facilities.

**Figure 4. Mercury emissions to air by facility, Canada, 2019**



Navigate data using the [interactive map](#)

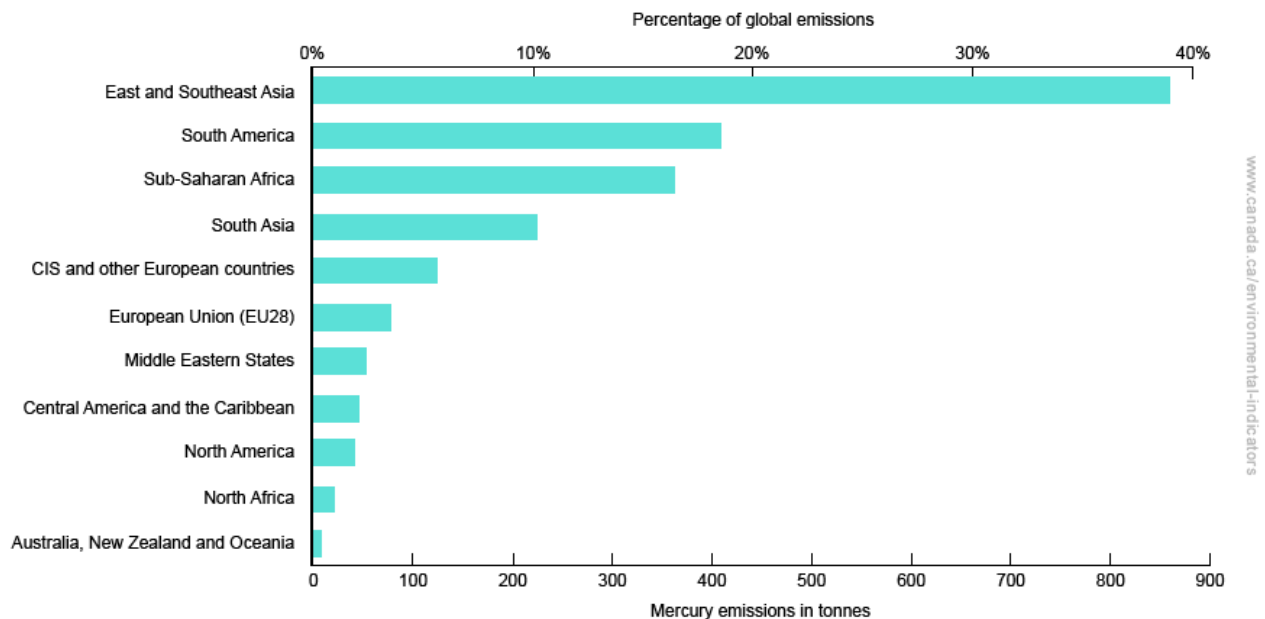
**Note:** Facility-reported mercury emissions represent 65% of total national mercury emissions.  
**Source:** Environment and Climate Change Canada (2021) [National Pollutant Release Inventory](#).

## Global mercury emissions to air

### Key results

- In 2015, the latest year for which data are available, global mercury emissions<sup>5</sup> to air from human activity were estimated to be 2 223 tonnes
- The East and Southeast Asia, South America and Sub-Saharan Africa regions accounted for 73% of the global total
- The North America region (includes only Canada and the United States) emitted 40 tonnes, or about 2% of the global total
  - Canada emitted less than 5 tonnes or about 0.2% of the global total

Figure 5. Global mercury emissions to air, 2015



[Data for Figure 5](#)

**Note:** CIS = Commonwealth of Independent States. The CIS includes Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. The 28 member countries of the European Union includes Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. The North America region includes only Canada and the United States, Mexico is grouped into the Central America and the Caribbean region.

**Source:** United Nations Environmental Program (2019) [Global Mercury Assessment 2018](#).

Mercury in the air can travel hundreds to thousands of kilometres via air masses before being deposited.<sup>6</sup> For example, Environment and Climate Change Canada<sup>7</sup> estimates that over 97% of the human-related mercury deposited in Canada came from sources outside of the country:

- 37% from East Asia
- 9% from Southeast Asia

<sup>5</sup> United Nations Environment Programme (2019) [Global Mercury Assessment 2018](#). The global emissions were compiled by the United Nations Environment Programme and are independent of Canada's mercury emission estimates. The use of different calculation estimates 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 2015.

<sup>6</sup> 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 on July 28, 2021.

<sup>7</sup> Environment and Climate Change Canada (2018) Air Quality Research Division. Canadian Council of Ministers of the Environment (2018) Mercury.

- 8% from both South Asia and Sub-Saharan Africa
- 7% from Europe
- 4% from the United States

## Sources of mercury emissions

Mercury is a naturally occurring metal. It can be emitted to the air by:

- natural processes such as volcanic activity and soil and rock erosion
- human activities such as metal smelting, iron and steel production, coal-fired electricity generation, industrial boilers, cement kilns, crematoriums, and waste incineration and treatment
- improper disposal of [products containing mercury](#) such as switches, batteries, thermometers and fluorescent lamps

## Health and environmental impacts of mercury emissions

Mercury has significant negative effects on [human health and the environment](#). It is transported in the air and settles in soil and water. Mercury persists in the environment and accumulates in terrestrial and aquatic food chains over time. Exposure of Canadians 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.

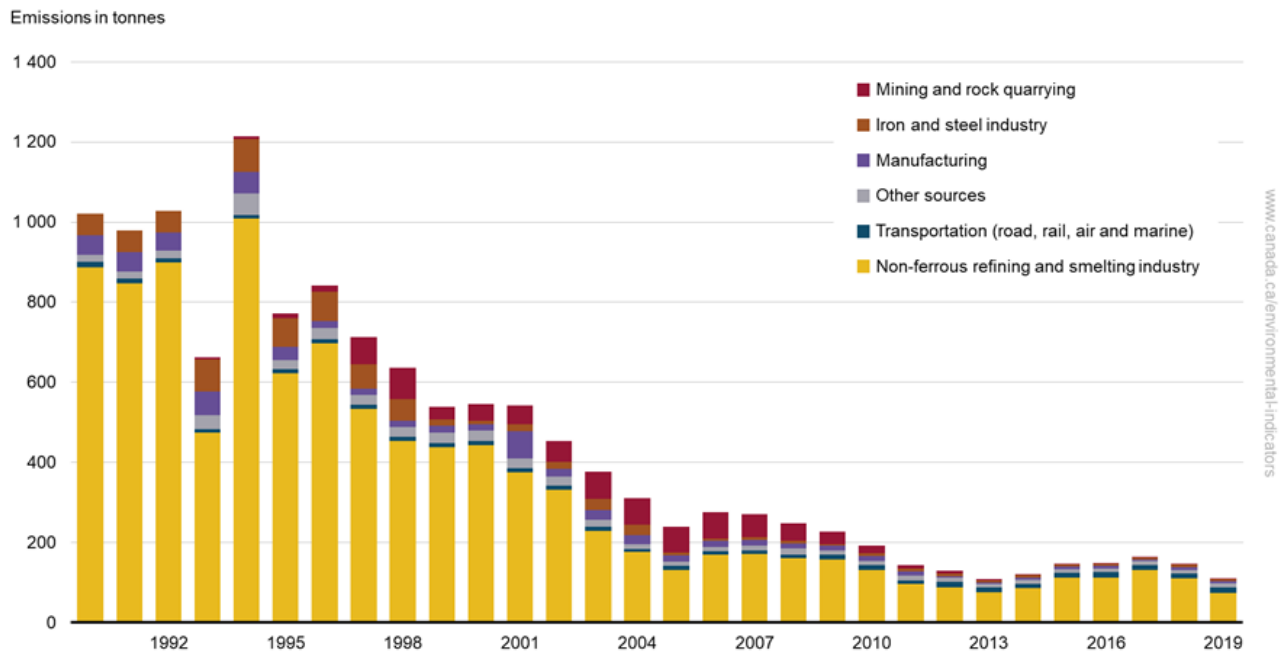
## Emissions of lead to air

Lead is primarily used in the manufacture of vehicle lead-acid batteries. Its properties make it useful to a wide range of consumer products including: pipes, sheeting, ammunition, fishing tackle, solder and within glass to prevent radiation exposure from television and computer screens. Lead emitted to air can be deposited on land or water surfaces and accumulate in soils, sediments, humans and wildlife. Exposure to lead, even in small amounts, can be hazardous to both humans and wildlife. Canadians are exposed to low levels of lead through food, drinking water, air, household dust, soil and various products.

### Key results

- In 2019, 109.5 tonnes of lead were emitted in Canada
- Between 1990 and 2019, lead emissions decreased by 89% (or 911.2 tonnes)
- Since 1990, the largest source of lead emissions has been the non-ferrous refining and smelting industry, accounting for 67% (or 73.2 tonnes) of the total in 2019
- From 2014 to 2017 national lead emissions had gradually increased but emissions declined again in 2018 and 2019

**Figure 6. Lead emissions to air by source, Canada, 1990 to 2019**



[Data for Figure 6](#)

**Note:** The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. The category "other sources" includes agriculture (livestock, crop production and fertilizer), building heating and energy generation, electric utilities, home firewood burning, incineration and waste, the oil and gas industry, ore and mineral industries (the aluminum industry, the asphalt paving industry, the cement and concrete industry, foundries, the iron ore industry and the mineral products industry), paints and solvents and other miscellaneous sources. For more details on the sources, consult the [Data sources and methods](#).  
**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#).

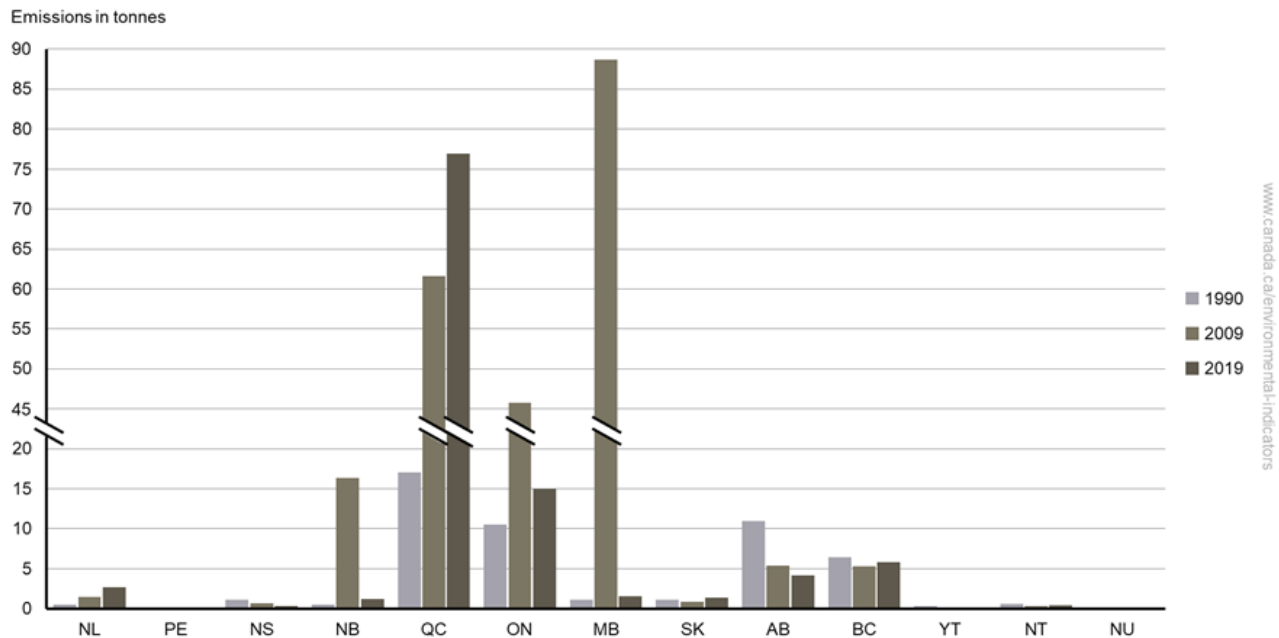
The largest reduction in lead emissions between 1990 and 2019 was from the non-ferrous refining and smelting industry. This industry reduced its emissions by 92% (813.0 tonnes), contributing to 89% of the overall lead emissions reduction. The decline was due to the introduction of [pollution prevention plans and strategies in operating smelters](#), along with the closure of outdated smelters in 2010 and 2019. From 2014 to 2017 national lead emissions increased; however, emissions decreased again in 2018 and 2019. This may be due to changes in lead concentrations in smelter feed, changes in production levels at particular facilities and the closure of a smelter in New Brunswick in 2019.

## Lead emissions to air by province and territory

### Key results

- In 2019, Quebec and Ontario accounted for 70% and 14% of national lead emissions, respectively
- Between 1990 and 2019
  - Alberta had the largest decrease in emissions with a decrease of 62% (or 6.8 tonnes)
  - Quebec had the largest increase in emissions with an increase of 351% (or 59.9 tonnes)

**Figure 7. Lead emissions to air by province and territory, Canada, 1990, 2009 and 2019**



[Data for Figure 7](#)

**Note:** Emissions from the Northwest Territories for 1990 includes emissions from Nunavut, which was officially separated from the Northwest Territories in 1999. The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. Some reported emissions from Prince Edward Island, Nova Scotia, New Brunswick, Yukon, the Northwest Territories and Nunavut are too small to see in the figure. Legacy data for 1990 that cannot be attributed to any province or territory are excluded from the figure.

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#).

In 2019, Quebec had the highest lead emissions in Canada, accounting for 70% (76.9 tonnes) of national emissions. These emissions came mostly from the non-ferrous refining and smelting industry and accounted for 85% of the total provincial emissions.

Between 1990 and 2019, Quebec had the greatest increase in lead emissions. The non-ferrous refining and smelting industry was the largest source of emissions in the province from 1993 to 2019. Ontario, Newfoundland and Labrador, New Brunswick, Manitoba and Saskatchewan also reported increased emissions from 1990 to 2019. Over this same period, Alberta had the largest decrease in emissions, largely due to an alumina and aluminum production and processing facility that no longer reported lead emissions after 2001 from the facility's paint line.

In 2019, the largest source within each province and territory was:

- the non-ferrous refining and smelting industry in Quebec and Ontario
- air transportation in British Columbia, Alberta, New Brunswick, Manitoba, Saskatchewan, the Northwest Territories, Yukon, Prince Edward Island and Nunavut
- the iron ore industry in Newfoundland and Labrador
- home firewood burning in Nova Scotia

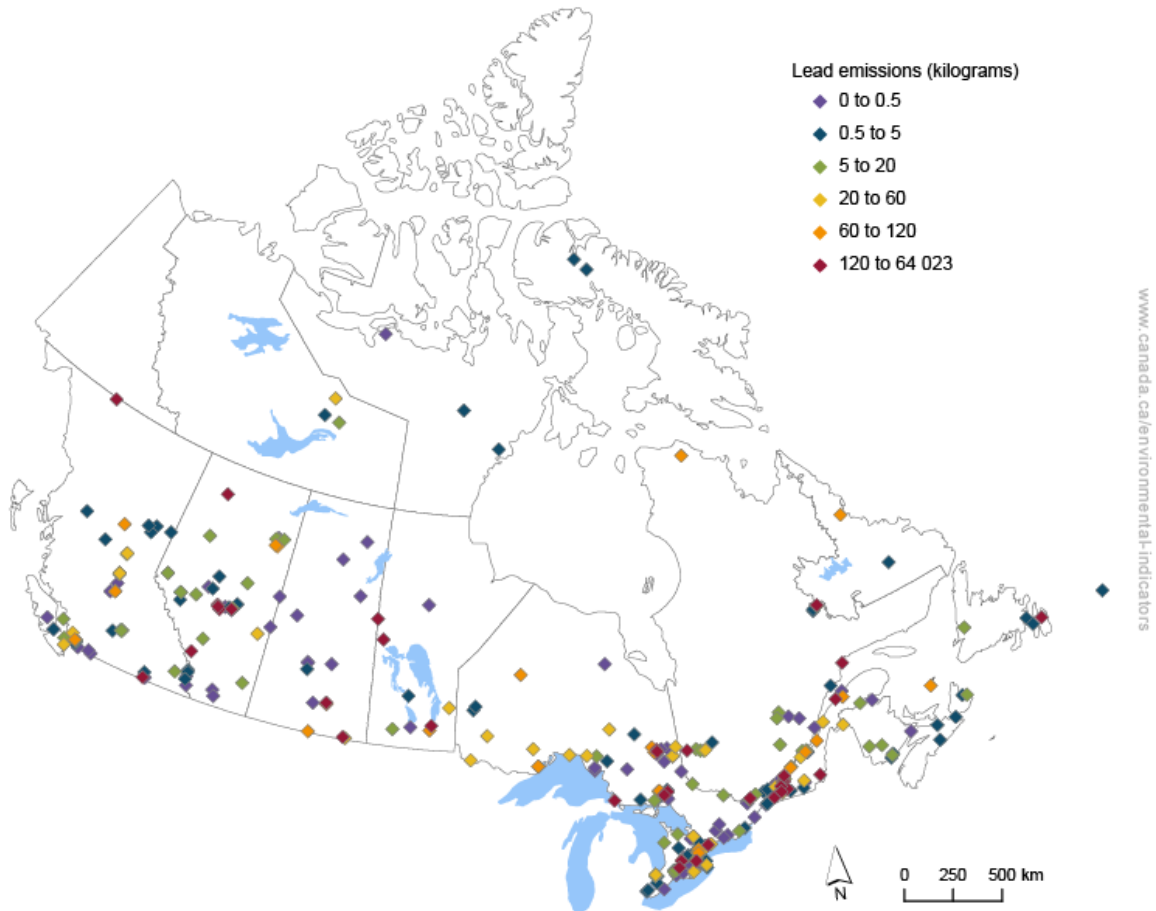
Manitoba, New Brunswick and Ontario had higher lead emissions in 2009 compared to 1990. However, between 2009 and 2019 reported emissions in these provinces declined by 98%, 93% and 67%, respectively. Manitoba had the largest decrease in emissions over this period, largely from the non-ferrous refining and smelting industry. This decrease was mostly due to changes in production levels, the [introduction of pollution prevention activities](#) and the closure of an outdated smelter. Quebec and Newfoundland and Labrador reported higher lead emissions in 2009 compared to 1990. Emissions in the 2 provinces continued to rise from 2009 to 2019. These increases were primarily due to increased operations in the non-ferrous refining and smelting, and iron ore industries in Quebec and Newfoundland and Labrador, respectively.

## Lead emissions to air from facilities

The National Pollutant Release Inventory provides detailed information on emissions from industrial, commercial and institutional facilities that meet its reporting criteria.

The Canadian Environmental Sustainability Indicators provide access to this information through an online interactive map. The map allows you to explore [lead emissions to air](#) from individual facilities.

**Figure 8. Lead emissions to air by facility, Canada, 2019**



Navigate data using the [interactive map](#)

**Note:** Facility-reported lead emissions represent 83% of total national lead emissions.

**Source:** Environment and Climate Change Canada (2021) [National Pollutant Release Inventory](#).

## Sources of lead emissions

Lead is a metal that occurs naturally in the Earth's crust and can be released during natural processes such as rock and soil erosion. Although these natural releases of lead occur, most lead emissions come from industrial activities, such as metal refining and smelting, and various combustion processes.

## Health and environmental impacts of lead emissions

Lead is a highly toxic metal. 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](#). In humans, chronic exposure to relatively low levels may affect the central and peripheral nervous systems, blood pressure, and renal function and may result in reproductive problems and developmental neurotoxicity.

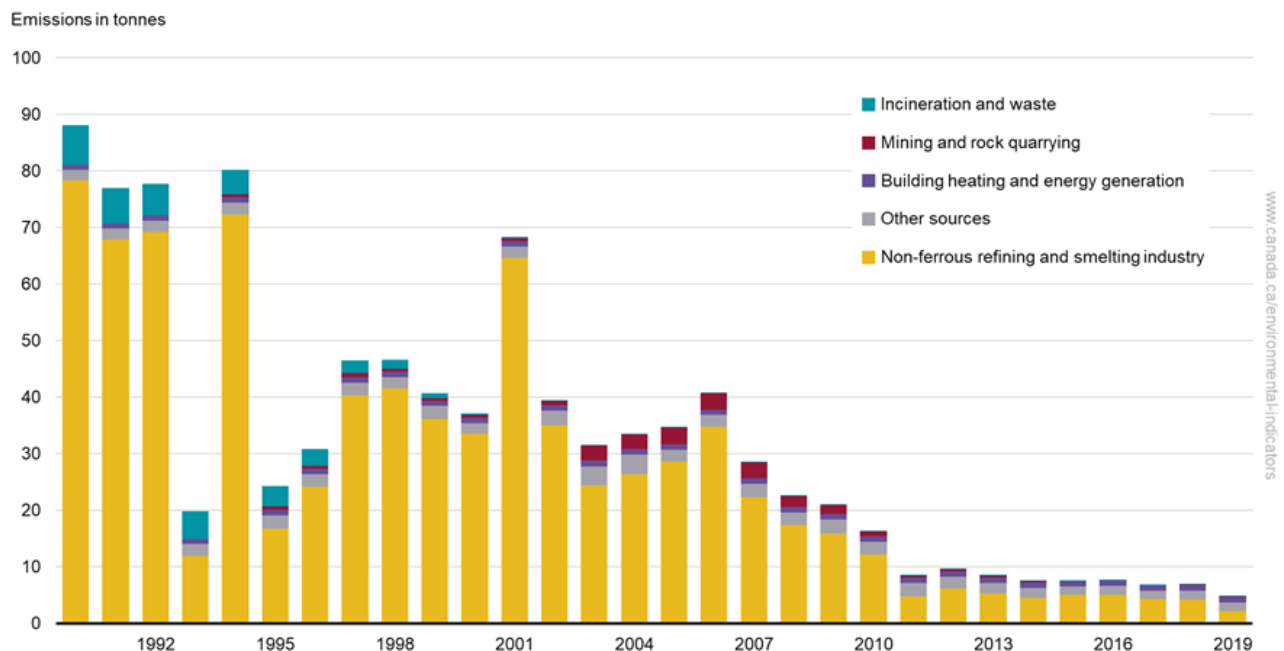
## Emissions of cadmium to air

Cadmium is a naturally occurring metal. It is used in batteries and in electroplating to protect other metals from corrosion. Exposure to cadmium can be hazardous to both humans and wildlife since it accumulates in the food chain over time. While the indicator only tracks emissions from human-related activities, cadmium can also be emitted to the air through natural processes such as soil and rock erosion, forest fires and volcanic episodes.

### Key results

- In 2019, 4.8 tonnes of cadmium were emitted in Canada
- Between 1990 and 2019, cadmium emissions decreased by 95% (or 83.3 tonnes)
- Since 1990, the largest source of cadmium emissions has been the non-ferrous refining and smelting industry, accounting for 47% (or 2.3 tonnes) of the total in 2019

**Figure 9. Cadmium emissions to air by source, Canada, 1990 to 2019**



[Data for Figure 9](#)

**Note:** The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. The category "other sources" includes agriculture (livestock, crop production and fertilizer), electric utilities, home firewood burning, manufacturing, the oil and gas industry, ore and mineral industries (the aluminum industry, the asphalt paving industry, the cement and concrete industry, foundries, the iron and steel industry and the iron ore industry), paints and solvents, transportation (road, rail, air and marine) and other miscellaneous sources. For more details on the sources, consult the [Data sources and methods](#).

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#).

Between 1990 and 2019, cadmium emissions from the non-ferrous refining and smelting industry declined by 97% (76.0 tonnes). This decline was due to the closure of outdated smelters in 2010 and 2019 and the introduction of pollution prevention plans, in addition to the collateral benefits from environmental performance agreements. Emissions from incineration and waste declined by 7.0 tonnes over the same period. Combined, these 2 sources contributed to almost 100% of the decline in cadmium emissions between 1990 and 2019.

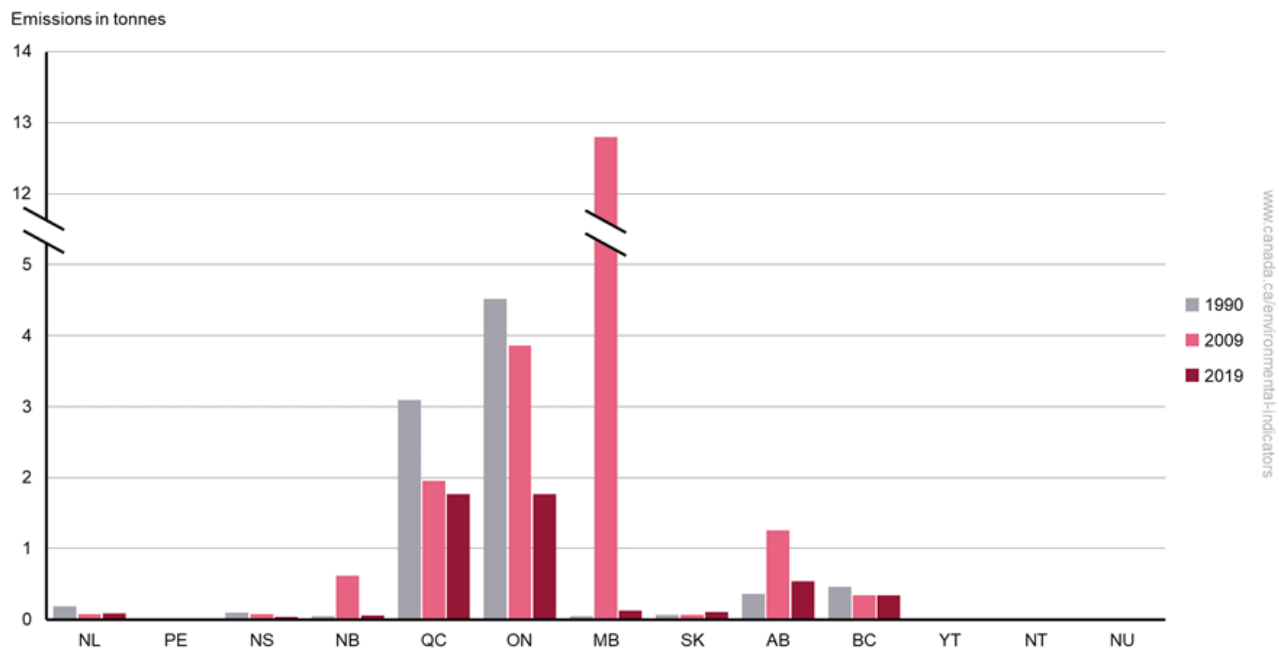
## Cadmium emissions to air by province and territory

### Key results

- In 2019, Quebec and Ontario accounted for 73% of national cadmium emissions
- Between 1990 and 2019
  - Ontario had the largest decrease in emissions with a decrease of 61% (or 2.8 tonnes)

- Alberta had the largest increase in emissions with a 49% (or 0.2 tonne) increase

**Figure 10. Cadmium emissions to air by province and territory, Canada, 1990, 2009 and 2019**



[Data for Figure 10](#)

**Note:** Emissions from the Northwest Territories for 1990 includes emissions from Nunavut, which was officially separated from the Northwest Territories in 1999. The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. Some reported emissions from Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Yukon, the Northwest Territories and Nunavut are too small to see in the figure. Legacy data for 1990 that cannot be attributed to any province or territory are excluded from the figure.

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#).

In 2019, Quebec and Ontario reported similar cadmium emissions, each accounting for 37% (1.8 tonnes) of national emissions. These emissions came mostly from the non-ferrous refining and smelting industry, manufacturing industries, and building heating and energy generation.

Between 1990 and 2019, Alberta had the largest increase in cadmium emissions. This increase was mostly due to increases in the oil and gas industry and in building heating and energy generation. Manitoba, Saskatchewan and New Brunswick also reported increased emissions from 1990 to 2019. Over this period, Ontario had the largest decrease in emissions. This decrease was mostly due to fewer reported emissions from the waste incineration sector.

In 2019, the largest source within each province and territory was:

- the non-ferrous refining and smelting industry in Ontario, Quebec and British Columbia
- building heating and energy generation in Alberta, Saskatchewan, Manitoba, Nova Scotia, the Northwest Territories, Prince Edward Island and Yukon
- the iron ore industry in Newfoundland and Labrador
- the pulp and paper industry in New Brunswick
- marine transportation in Nunavut

Manitoba, New Brunswick and Alberta had higher cadmium emissions in 2009 compared to 1990. However, between 2009 and 2019 reported emissions declined by 99%, 92% and 57%, respectively.

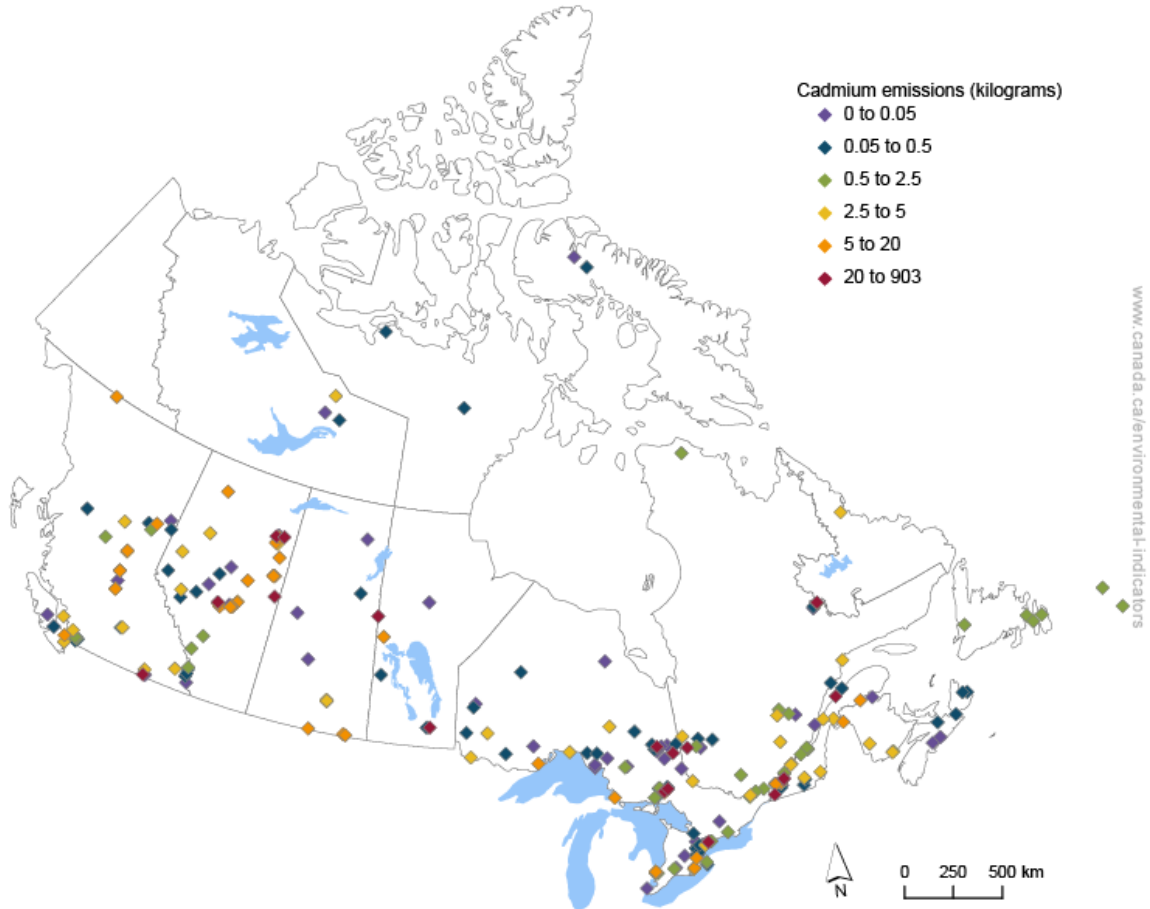


## Cadmium emissions to air from facilities

The National Pollutant Release Inventory provides detailed information on emissions from industrial, commercial and institutional facilities that meet its reporting criteria.

The Canadian Environmental Sustainability Indicators provide access to this information through an online interactive map. The map allows you to explore [cadmium emissions to air](#) from individual facilities.

**Figure 11. Cadmium emissions to air by facility, Canada, 2019**



Navigate this data using the [interactive map](#)

**Note:** Facility-reported cadmium emissions represent 72% of total national cadmium emissions.

**Source:** Environment and Climate Change Canada (2021) [National Pollutant Release Inventory](#).

## Sources of cadmium emissions

Cadmium is a naturally occurring metal in the Earth's crust. It can be released during natural processes such as weathering and erosion of cadmium-bearing rocks. Human-related sources of cadmium include metal production (particularly base metal smelting and refining), power generation and heating, transportation, solid waste disposal, and sewage sludge application.

## Health and environmental impacts of cadmium emissions

Exposure to cadmium can be [hazardous to both humans and wildlife](#) since it accumulates in the food chain over time. The Government of Canada concluded cadmium compounds may be harmful to the environment and may constitute a danger based on their carcinogenic potential. Exposure to cadmium has been associated with gastrointestinal irritation and harmful effects to the kidneys and bones.

## About the indicators

### What 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. For each substance, data are provided at the national, regional (provincial and territorial) and facility level and by source. Global emissions data are also provided for mercury.

### Why these indicators are 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.



### Safe and healthy communities

These indicators support the measurement of progress towards the following [2019 to 2022 Federal Sustainable Development Strategy](#) long-term goal: All Canadians live in clean, sustainable communities that contribute to their health and well-being.

In addition, the indicators contribute to the [Sustainable Development Goals of the 2030 Agenda for Sustainable Development](#). They are linked to Goal 12, Responsible consumption and production and Target 12.4, "By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment."

### 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 substance, data are provided at the national, provincial/territorial and facility level and by source.

The [Human exposure to harmful substances](#) indicators track the concentrations of 4 substances (mercury, lead, cadmium and bisphenol A) in Canadians.

The [Air pollutant emissions](#) indicators track emissions from human activities of 6 key air pollutants: sulphur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOC), ammonia (NH<sub>3</sub>), carbon monoxide (CO) and fine particulate matter (PM<sub>2.5</sub>). Black carbon, which is a component of PM<sub>2.5</sub>, is also reported. For each air pollutant, data are provided at the national, provincial/territorial and facility level and by major source.

The [Air quality](#) indicators track ambient concentrations of PM<sub>2.5</sub>, O<sub>3</sub>, SO<sub>2</sub>, NO<sub>2</sub> and VOCs at the national and regional level and at local monitoring stations.

## Data sources and methods

### Data sources

Data for the indicators are based on emission estimates reported in the [Air Pollutant Emissions Inventory](#). The inventory data are available online on the [Open Data](#) website. Facility data for the interactive maps come from the [National Pollutant Release Inventory](#), which are also available on [Open Data](#).

Global mercury emissions data were taken from the United Nations Environment Programme's [Global Mercury Assessment 2018](#) report.

#### More information

##### Air Pollutant Emissions Inventory

Canada's Air Pollutant Emissions Inventory is prepared and published by Environment and Climate Change Canada. The inventory provides data and estimates on releases of air pollutants from human activities. These pollutants contribute to the issues of smog, acid rain, reduced air quality and climate change. Improvements to the inventory are made periodically as new emission estimation methods are adopted and additional information is made available. Historical emissions are updated on the basis of these improvements.

This inventory fulfills many of Canada's international reporting obligations on pollution. It is a comprehensive inventory of 17 air pollutants<sup>8</sup> that combines facility emissions reported to the National Pollutant Release Inventory with non-facility emissions estimated by Environment and Climate Change Canada (the department). Estimates are developed using the latest estimation methods and are largely based on published statistics or other sources of information, such as surveys and reports. The Air Pollutant Emissions Inventory provides a comprehensive overview of pollutant emissions across Canada.

The national and provincial/territorial inventory data are current as of March 15, 2021, and cover the period from 1990 to 2019. Emissions data are reported in the inventory approximately 1 year after data collection, validation, calculation and interpretation have been completed. The 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 for these facilities are provided by the facility operators as mandated by the *Canadian Environmental Protection Act, 1999*. 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, disposals and transfers annually to the department. The [inventory data for 2019](#) are current as of March 12, 2021.

##### Global Mercury Assessment

The Global Mercury Assessment 2018 report is the third edition of the United Nations Environment Programme reporting on global mercury emissions. This edition was based on national emissions inventories for 2015. Data for global mercury emissions were taken directly from the Global Mercury Assessment 2018 report.

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<sup>8</sup> Includes the 6 key air pollutants (sulphur oxides, nitrogen oxides, volatile organic compounds, ammonia, carbon monoxide and fine particulate matter) along with cadmium, lead, mercury, dioxins and furans, 4 types of polycyclic aromatic hydrocarbons, hexachlorobenzene, particulate matter less than or equal to 10 microns and total particulate matter.

## Methods

The indicators are produced by grouping the calculated emissions data from Canada's national inventories to report on the key sources that contribute to the majority of mercury, lead and cadmium emissions.

### More information

#### Compilation of emissions

The Air Pollutant Emissions Inventory is developed using 2 types of information:

- facility-reported data, consisting of emissions from relatively large industrial, commercial and institutional facilities
- in-house estimates, including diffuse sources and other sources that are too numerous to be accounted for individually, such as road and non-road vehicles, agricultural activities, construction and solvent use

The Air Pollutant Emissions Inventory is developed using many sources of information, procedures and emission estimation models. Emissions data reported by individual facilities to the department's National Pollutant Release Inventory are supplemented with documented, science-based estimation tools to quantify total emissions. Together, these data sources provide a comprehensive overview of pollutant emissions across Canada.

A compilation framework has been developed that makes use of the best available data, while ensuring that there is no double-counting or omissions. Additional information on the inventory compilation process is provided in [Chapter 3 of the Air Pollutant Emissions Inventory Report](#) (PDF; 4.14 MB).

#### Facility-reported emissions data

Facility-reported emissions data generally refers to any stationary sources that emit pollutants through stacks or other equipment at specific locations. Environment and Climate Change Canada collects most facility-reported data through the National Pollutant Release Inventory.

Facility-reported data from the National Pollutant Release Inventory are used in the Air Pollutant Emissions Inventory without modifications, except when data quality issues are detected and not addressed during the quality control exercise. The National Pollutant Release Inventory reporting requirements and thresholds vary by pollutant and, in some cases, by industry. Details on these reporting requirements and thresholds are available on the [National Pollutant Release Inventory](#) website.

Within the Air Pollutant Emissions Inventory, a distinction has been made between reporting facilities and non-reporting facilities. Reporting facilities meet the threshold required to report to the National Pollutant Release Inventory, while non-reporting facilities do not meet these thresholds due to their size or emission levels, and therefore are not required to report to the National Pollutant Release Inventory. Some facilities may be required to report emissions on only certain pollutants. Therefore, emissions from the non-reporting facilities or of non-reported pollutants are estimated by the department to ensure complete coverage.

#### In-house emission estimates

Emissions estimates are calculated by the department using information such as production data and activity data, using various estimation methodologies and emission models. These emission estimates are at the national level rather than at any specific geographic locations. The Air Pollutant Emissions Inventory uses in-house estimates for the following emission sources:

- any residential, governmental, institutional or commercial operation that does not report to the National Pollutant Release Inventory
- on-site solid waste disposal facilities
- motor vehicles, aircraft, vessels or other transportation equipment or devices
- other sources, such as open burning, agricultural activities and construction operations

In general, in-house emission estimates are calculated from activity data and emission factors.<sup>9</sup> Activity data usually comprise statistical production or process data at the provincial, territorial or national level. This information is typically provided by provincial/territorial agencies, federal government departments, industry associations, etc. For each source category, activity data are combined with emission factors to produce provincial/territorial-level emission estimates.

The in-house emission estimate methodologies and emission models used in Canada are often based on those developed by the United States Environmental Protection Agency (U.S. EPA) and are adapted to reflect the Canadian climate, fuels, technologies and practices. Methods used in Canada's Air Pollutant Emissions Inventory are therefore generally consistent with those used in the United States or those recommended in the emission inventory guidebook.<sup>10</sup>

The Air Pollutant Emissions Inventory reports air pollutant emissions from mobile sources such as on-road vehicles, off-road vehicles and engines. For the current edition of the Air Pollutant Emissions Inventory, an emissions estimation model developed by the U.S. EPA (MOVES) was used. The emissions for off-road vehicles and engines (such as graders, heavy trucks, outboard motors and lawnmowers) were estimated using the U.S. EPA's NONROAD emission estimation model (see "off-road vehicles and equipment" in [Table A2-4 of Annex 2 of the Air Pollutant Emissions Inventory Report](#) [PDF; 4.14 MB]). The parameters in both models were modified to take into account variations in the Canadian vehicle fleet, emission control technologies, types of fuels, vehicle standards, and types of equipment engines and their application in various industries. The emission estimates for civil and international aviation, railways and navigation are estimated using detailed vehicle movement statistics coupled with fuel consumption, engine information and emission rates by vehicle type.

### **Recalculations**

Emission recalculation is an essential practice in the maintenance of an up-to-date air pollutant emissions inventory. The Air Pollutant Emissions Inventory is continuously updated with improved estimation methodologies, statistics, and more recent and appropriate emission factors. As new information and data become available, previous estimates are updated and recalculated to ensure a consistent and comparable trend in emissions. Recalculations of previously reported emission estimates are common for both in-house estimates and facility-reported emission data. More information on recalculations is provided in [Chapter 3.7 and Annex 3 of the Air Pollutant Emissions Inventory Report](#) (PDF; 4.14 MB).

### **Emissions reconciliation**

In several sectors, estimation of total emissions involves combining estimates provided by facilities with estimates developed in-house by the department. To prevent double counting of emissions and to confirm that the Air Pollutant Emissions Inventory includes all emissions, a comparison and reconciliation of emission estimates from various sources is performed for each pollutant, industry sector and geographical region, as appropriate. More information on the reconciliation process is provided in [Chapter 3.4 of the Air Pollutant Emissions Inventory Report](#) (PDF; 4.14 MB).

### **Temporal coverage**

Historical data are provided at the national and source level for the period from 1990 to 2019. For the regional indicators (provincial/territorial), emissions are presented for 1990, 2009 and 2019.

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<sup>9</sup> The United States Environmental Protection Agency defines an emission factor as "...a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant (for example, kilograms of particulate emitted per megagram of coal burned)."

<sup>10</sup> European Monitoring and Evaluation Programme/European Environment Agency (2013) EMEP/EEA Air Pollutant Emission Inventory Guidebook 2013. Technical Guidance to Prepare National Emission Inventories. Luxembourg: Publications Office of the European Union. Technical Report No. 12/2013.

### Air pollutant emissions by source classification

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

- agriculture (livestock, crop production and fertilizer)
- building heating and energy generation
- dust and fires
- electric utilities
- home firewood burning
- incineration and waste
- manufacturing
- miscellaneous
- off-road vehicles and mobile equipment
- oil and gas industry
- ore and mineral industries
- paints and solvents
- transportation (road, rail, air and marine)

Table 1 shows the allocation of sources of harmful substances reported in the indicators compared with the sources and sectors reported by the Air Pollutant Emissions Inventory.

**Table 1. Alignment of sources reported in the indicators with the sources and sectors from the Air Pollutant Emissions Inventory**

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory
Agriculture (livestock, crop production and fertilizer)	Agriculture: Animal production
Agriculture (livestock, crop production and fertilizer)	Agriculture: Crop production
Agriculture (livestock, crop production and fertilizer)	Agriculture: Fuel use
Building heating and energy generation	Commercial/residential/institutional: Commercial and institutional fuel combustion
Building heating and energy generation	Commercial/residential/institutional: Construction fuel combustion
Building heating and energy generation	Commercial/residential/institutional: Residential fuel combustion
Dust and fires	Dust: Coal transportation
Dust and fires	Dust: Construction operations
Dust and fires	Dust: Mine tailings
Dust and fires	Dust: Paved roads
Dust and fires	Dust: Unpaved roads
Dust and fires	Fires: Prescribed burning
Dust and fires	Fires: Structural fires
Electric utilities	Electric power generation (utilities): Coal
Electric utilities	Electric power generation (utilities): Diesel
Electric utilities	Electric power generation (utilities): Natural gas

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory
Electric utilities	Electric power generation (utilities): Waste materials <sup>[A]</sup>
Electric utilities	Electric power generation (utilities): Other (electric power generation)
Home firewood burning	Commercial/residential/institutional: Home firewood burning
Incineration and waste	Incineration and waste sources: Crematoriums
Incineration and waste	Incineration and waste sources: Waste incineration
Incineration and waste	Incineration and waste sources: Waste treatment and disposal
Manufacturing	Manufacturing: Abrasives manufacture
Manufacturing	Manufacturing: Bakeries
Manufacturing	Manufacturing: Biofuel production
Manufacturing	Manufacturing: Chemicals industry
Manufacturing	Manufacturing: Electronics
Manufacturing	Manufacturing: Food preparation
Manufacturing	Manufacturing: Glass manufacturing
Manufacturing	Manufacturing: Grain industry
Manufacturing	Manufacturing: Metal fabrication
Manufacturing	Manufacturing: Plastics manufacturing
Manufacturing	Manufacturing: Pulp and paper industry
Manufacturing	Manufacturing: Textiles
Manufacturing	Manufacturing: Vehicle manufacturing (engines, parts, assembly, painting)
Manufacturing	Manufacturing: Wood products
Manufacturing	Manufacturing: Other (manufacturing)
Miscellaneous	Commercial/residential/institutional: Commercial cooking
Miscellaneous	Commercial/residential/institutional: Human <sup>[B]</sup>
Miscellaneous	Commercial/residential/institutional: Marine cargo handling industry
Miscellaneous	Commercial/residential/institutional: Service stations
Miscellaneous	Commercial/residential/institutional: Other (miscellaneous)
Off-road vehicles and mobile equipment	Transportation and mobile equipment: Off-road diesel vehicles and equipment
Off-road vehicles and mobile equipment	Transportation and mobile equipment: Off-road gasoline, liquefied petroleum gas, compressed natural gas vehicles and equipment

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory
Oil and gas industry	Oil and gas industry: Downstream oil and gas industry
Oil and gas industry	Oil and gas industry: Upstream oil and gas industry
Ore and mineral industries	Ore and mineral industries: Aluminum industry
Ore and mineral industries	Ore and mineral industries: Asphalt paving industry
Ore and mineral industries	Ore and mineral industries: Cement and concrete industry <sup>[C]</sup>
Ore and mineral industries	Ore and mineral industries: Foundries
Ore and mineral industries	Ore and mineral industries: Iron and steel industry <sup>[C]</sup>
Ore and mineral industries	Ore and mineral industries: Iron ore industry
Ore and mineral industries	Ore and mineral industries: Mineral products industry
Ore and mineral industries	Ore and mineral industries: Mining and rock quarrying <sup>[C]</sup>
Ore and mineral industries	Ore and mineral industries: Non-ferrous refining and smelting industry <sup>[C]</sup>
Paints and solvents	Paints and solvents: Dry cleaning
Paints and solvents	Paints and solvents: General solvent use
Paints and solvents	Paints and solvents: Printing
Paints and solvents	Paints and solvents: Surface coatings
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Air transportation (landing and takeoff)
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Heavy-duty diesel vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Heavy-duty gasoline vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Heavy-duty liquefied petroleum gas / natural gas vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty diesel trucks
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty diesel vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty gasoline trucks
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty gasoline vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty liquefied petroleum gas / compressed natural gas trucks



Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty liquefied petroleum gas / compressed natural gas vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Domestic marine navigation, fishing and military
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Motorcycles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Rail transportation
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Tire wear and brake lining

**Note:** <sup>[A]</sup> Includes electric power generation from combustion of waste materials by utilities and by industry for commercial sale and/or private use. <sup>[B]</sup> Includes human respiration, perspiration and dental amalgams. <sup>[C]</sup> These sectors from the Air Pollutant Emissions Inventory are sometimes shown as individual sources in the indicators when they have significant emissions. The sectors may vary from one substance to the next.

For display purposes, smaller emitting sources are sometimes grouped together under the title "Other sources" in the figures and corresponding data tables of emissions by source. The grouped sources may differ by substance and are listed in the notes of each figure and data table.

## Recent changes

The provincial/territorial comparison of emissions to air was expanded to include 1990, the first year data was available. The comparison also includes the latest year data was available (2019) and a 10-year comparison to the latest year (2009). Because Nunavut only officially separated from the Northwest Territories in 1999, emissions from the Northwest Territories for 1990 include emissions from the region that would eventually become Nunavut.

The emission estimates reported in the Air Pollutant Emissions Inventory used in the indicators have undergone a number of significant recalculations. Specifically, the sector emissions for manufacturing, transportation, agriculture, commercial/residential/institutional, paints and solvents, and mercury in products, following the implementation of improved quantification methods. For more information about these recent changes, consult [Annex 3 of the Air Pollutant Emissions Inventory Report](#) (PDF; 4.14 MB).

## Caveats and limitations

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

To provide a consistent global picture, Canadian mercury emissions data used for the international comparison came from the United Nations Environment Programme's [Global Mercury Assessment 2018](#) report. However, it is important to note that the emissions data found in this report were estimated using different estimation techniques and different source classifications than the data used for the national indicators. In addition, some sources were not quantified in the international comparison due to a lack of data.

## More information

Prior to the launch of the National Pollutant Release Inventory, emissions data were collected and compiled by provincial, territorial and regional environmental authorities. As such, in the provincial/territorial comparisons in the indicators, some legacy data for 1990 could not be attributed to any province or territory. The legacy data were captured under unspecified region in the data tables.

## **Air Pollutant Emissions Inventory and National Pollutant Release Inventory**

The methods used to estimate air pollutant emissions continue to evolve. In general, improvements are made every year to methodologies for estimating emissions. As a result of these improvements, emissions for a given year may differ from those previously published by the department. Caution is advised when comparing different reports and different sources.

The Air Pollutant Emissions Inventory uses facility information from the National Pollutant Release Inventory and other sources. The National Pollutant Release Inventory started providing facility-reported data to the Air Pollutant Emissions Inventory for heavy metals (mercury, lead and cadmium) in 1994. The version of the data published by the National Pollutant Release Inventory may not be identical to that used in the Air Pollutant Emissions Inventory at any given time because of updates or corrections to the facility-reported 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 inventory. An analysis of how this might affect the apparent trends has not been undertaken. Events or changes at facilities can also alter facility emissions outputs from one year to the next. Some of changes can include:

- changes in production levels
- upgrades to operating practices
- plant expansions
- change of ownership
- temporary or permanent closures
- pollution prevention measures
- accidental releases

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

Since the launch of the National Pollutant Release Inventory in 1993, the [substance list and reporting requirements have continuously evolved](#).

### **Global mercury emissions**

Air emissions sources that were not quantified in the international mercury emissions comparison include:

- chemical manufacturing processes
- other mineral products (for example, lime manufacturing)
- secondary non-ferrous metal production
- oil and gas extraction
- pulp and paper industry
- food industry
- transport and processing other than refinery emissions
- industrial/hazardous waste incineration and sewage sludge incineration
- preparation of dental amalgam fillings and disposal of removed fillings containing mercury

The Canadian mercury emissions data follows the same reporting structure as the Global Mercury Assessment report and uses the best data, measurements and methods available. Nonetheless, users must be cautious when comparing the data, as emissions estimation methodologies differ among countries.

## Resources

### References

Environment and Climate Change Canada (2017) [Using and interpreting data from the National Pollutant Release Inventory](#). Retrieved on July 28, 2021.

Environment and Climate Change Canada (2021) [Canada's Air Pollutant Emissions Inventory](#). Retrieved on July 28, 2021.

Environment and Climate Change Canada (2021) [National Pollutant Release Inventory bulk data](#). Retrieved on July 28, 2021.

United Nations Environment Programme (2019) [Global Mercury Assessment 2018](#). Retrieved on July 28, 2021.

## 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 2019

Year	Mercury (percentage change from 1990 level)	Lead (percentage change from 1990 level)	Cadmium (percentage change from 1990 level)
1990	0	0	0
1991	0	-4	-13
1992	0	1	-12
1993	-43	-35	-77
1994	-49	19	-9
1995	-59	-24	-72
1996	-56	-18	-65
1997	-63	-30	-47
1998	-68	-38	-47
1999	-70	-47	-54
2000	-71	-47	-58
2001	-73	-47	-22
2002	-74	-56	-55
2003	-75	-63	-64
2004	-75	-70	-62
2005	-77	-77	-61
2006	-79	-73	-54
2007	-77	-74	-68
2008	-79	-76	-74
2009	-84	-78	-76
2010	-85	-81	-81
2011	-88	-86	-90
2012	-89	-87	-89
2013	-89	-89	-90
2014	-90	-88	-91
2015	-90	-86	-91
2016	-91	-86	-91
2017	-91	-84	-92
2018	-91	-86	-92
2019	-92	-89	-95

**Note:** The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. Mercury emission results in the indicators may differ from the results published in [Canada's Air Pollutant Emissions Inventory Report 1990-2019](#) (PDF; 4.14 MB), due to a facility flagging a significant data error in their submission to the National Pollutant Release Inventory. This correction was made after Canada's Air Pollutant Emissions Inventory Report 1990-2019 and the Air Pollutant Emissions Inventory data were released, and will be reflected in the next edition of the Air Pollutant Emissions Inventory.

Source: Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#). Environment and Climate Change Canada (2021) [National Pollutant Release Inventory](#).

**Table A.2. Data for Figure 2. Mercury emissions to air by source, Canada, 1990 to 2019**

Year	Other sources (emissions in tonnes)	Electric utilities (emissions in tonnes)	Iron and steel industry (emissions in tonnes)	Incineration and waste (emissions in tonnes)	Cement and concrete industry (emissions in tonnes)	Non-ferrous refining and smelting industry (emissions in tonnes)	Total (emissions in tonnes)
1990	2.63	2.25	0.71	3.25	0.46	24.90	34.20
1991	2.67	2.12	0.73	3.41	0.38	24.87	34.18
1992	2.64	2.35	0.74	3.40	0.36	24.78	34.27
1993	2.57	2.14	0.75	3.39	0.37	10.12	19.34
1994	2.59	2.06	0.74	3.42	0.41	8.26	17.48
1995	2.57	1.99	0.75	3.70	0.41	4.65	14.08
1996	2.52	2.09	0.76	3.53	0.44	5.68	15.02
1997	2.41	2.24	0.81	3.43	0.45	3.39	12.74
1998	2.31	2.37	0.83	2.25	0.45	2.84	11.04
1999	2.25	2.37	0.84	1.94	0.47	2.28	10.14
2000	2.56	2.05	0.80	2.16	0.39	1.94	9.89
2001	1.83	2.09	0.79	2.05	0.37	2.12	9.26
2002	1.85	2.06	0.85	1.89	0.37	1.75	8.78
2003	1.89	2.40	0.91	1.68	0.35	1.29	8.51
2004	1.76	2.31	0.86	1.67	0.22	1.90	8.72
2005	1.59	2.17	0.86	1.51	0.21	1.70	8.03
2006	1.52	2.00	0.78	1.44	0.30	1.28	7.33
2007	1.50	2.17	0.73	1.75	0.32	1.41	7.88
2008	1.55	1.62	0.72	1.93	0.30	1.00	7.12
2009	1.41	1.67	0.60	0.72	0.29	0.83	5.52
2010	1.39	1.58	0.67	0.65	0.31	0.54	5.13
2011	1.12	1.02	0.62	0.67	0.30	0.21	3.94
2012	1.07	0.86	0.66	0.52	0.27	0.25	3.63
2013	1.03	0.85	0.69	0.47	0.31	0.36	3.71
2014	0.95	0.71	0.68	0.53	0.30	0.29	3.44
2015	0.88	0.73	0.64	0.47	0.38	0.18	3.29
2016	0.85	0.67	0.68	0.47	0.34	0.22	3.24
2017	0.83	0.63	0.61	0.47	0.33	0.14	3.01
2018	0.94	0.61	0.60	0.46	0.30	0.20	3.11
2019	0.88	0.57	0.52	0.48	0.30	0.09	2.84

**Note:** Totals may not add up due to rounding. The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. The category "other sources" includes agriculture (livestock, crop production and fertilizer), building heating and energy generation, home firewood burning, manufacturing, the oil and gas industry, ore and mineral industries (the aluminum industry, the asphalt paving industry, foundries, the iron ore industry and mining and rock quarrying), transportation (road, rail, air and marine) and other miscellaneous sources. For more details on the sources, consult the [Data sources and methods](#). Mercury emission

results in the indicators may differ from the results published in [Canada's Air Pollutant Emissions Inventory Report 1990-2019](#) (PDF; 4.14 MB), due to a facility flagging a significant data error in their submission to the National Pollutant Release Inventory. This correction was made after Canada's Air Pollutant Emissions Inventory Report 1990-2019 and the Air Pollutant Emissions Inventory data were released, and will be reflected in the next edition of the Air Pollutant Emissions Inventory.

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#). Environment and Climate Change Canada (2021) [National Pollutant Release Inventory](#).

**Table A.3. Data for Figure 3. Mercury emissions to air by province and territory, Canada, 1990, 2009 and 2019**

Province or territory	1990 (emissions in tonnes)	2009 (emissions in tonnes)	2019 (emissions in tonnes)
Newfoundland and Labrador	0.24	0.13	0.04
Prince Edward Island	0.03	0.01	< 0.01
Nova Scotia	0.33	0.18	0.09
New Brunswick	0.62	0.23	0.05
Quebec	3.04	0.80	0.51
Ontario	4.12	0.99	0.95
Manitoba	20.10	0.70	0.05
Saskatchewan	0.55	0.91	0.53
Alberta	1.26	1.09	0.33
British Columbia	3.83	0.46	0.28
Yukon	< 0.01	< 0.01	< 0.01
Northwest Territories	0.08 <sup>[A]</sup>	< 0.01	< 0.01
Nunavut	n/a	< 0.01	< 0.01
Canada	34.20	5.52	2.84

**Note:** n/a = not applicable. <sup>[A]</sup> Value for 1990 includes emissions from Nunavut, which was officially separated from the Northwest Territories in 1999. Totals may not add up due to rounding. The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. Mercury emission results in the indicators may differ from the results published in [Canada's Air Pollutant Emissions Inventory Report 1990-2019](#) (PDF; 4.14 MB), due to a facility flagging a significant data error in their submission to the National Pollutant Release Inventory. This correction was made after Canada's Air Pollutant Emissions Inventory Report 1990-2019 and the Air Pollutant Emissions Inventory data were released, and will be reflected in the next edition of the Air Pollutant Emissions Inventory.

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#). Environment and Climate Change Canada (2021) [National Pollutant Release Inventory](#).

**Table A.4. Data for Figure 5. Global mercury emissions to air, 2015**

Region	Mercury emissions (tonnes)	Percentage of global emissions
East and Southeast Asia	859	38.6
South America	409	18.4
Sub-Saharan Africa	360	16.2
South Asia	225	10.1
Commonwealth of Independent States (CIS) and other European countries	124	5.6
European Union (EU28)	77	3.5
Middle Eastern States	53	2.4
Central America and the Caribbean	46	2.1
North America	40	1.8

Region	Mercury emissions (tonnes)	Percentage of global emissions
North Africa	21	0.9
Australia, New Zealand and Oceania	9	0.4

**Note:** The Commonwealth of Independent States includes Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. The 28 member countries of the European Union includes Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. The North America region includes only Canada and the United States, Mexico is grouped into the Central America and the Caribbean region.

**Source:** United Nations Environmental Program (2019) [Global Mercury Assessment 2018](#).

**Table A.5. Data for Figure 6. Lead emissions to air by source, Canada, 1990 to 2019** Error! Reference source not found.

Year	Non-ferrous refining and smelting industry (emissions in tonnes)	Transportation (road, rail, air and marine) (emissions in tonnes)	Other sources (emissions in tonnes)	Manufacturing (emissions in tonnes)	Iron and steel industry (emissions in tonnes)	Mining and rock quarrying (emissions in tonnes)	Total (emissions in tonnes)
1990	886.23	13.70	18.49	48.38	53.89	0.00	1 020.69
1991	847.45	10.72	18.41	48.40	53.89	0.00	978.87
1992	899.20	9.45	19.40	46.34	53.89	0.00	1 028.28
1993	473.73	9.25	35.31	58.52	79.77	4.96	661.54
1994	1 008.57	8.59	53.93	53.84	82.26	6.15	1 213.35
1995	622.87	10.21	22.29	32.87	71.08	12.22	771.53
1996	696.90	10.68	27.61	17.45	74.02	14.12	840.77
1997	533.17	10.10	24.11	17.24	59.98	68.61	713.21
1998	453.75	10.73	24.30	14.44	53.86	78.60	635.67
1999	437.89	10.00	26.43	16.63	16.09	32.29	539.33
2000	442.75	10.11	26.78	16.21	7.99	41.91	545.76
2001	374.37	10.16	25.09	67.45	18.35	46.58	542.00
2002	331.38	10.21	23.57	18.05	17.09	53.40	453.70
2003	229.14	9.68	17.79	24.44	27.36	67.89	376.29
2004	175.99	8.29	11.91	21.98	25.41	67.52	311.11
2005	131.57	9.58	10.18	16.88	5.66	64.81	238.68
2006	168.78	8.63	11.32	14.95	5.88	66.10	275.67
2007	170.76	9.43	12.69	13.77	6.57	57.06	270.27
2008	160.52	9.54	15.02	12.85	5.99	43.87	247.78
2009	158.05	11.58	10.28	11.49	4.45	30.87	226.72
2010	131.10	11.79	11.48	11.78	6.28	19.74	192.18
2011	96.03	9.64	11.38	10.96	6.10	9.82	143.92
2012	88.19	12.55	10.71	4.65	6.68	7.10	129.87
2013	74.71	12.22	9.01	4.67	5.20	3.15	108.96

Year	Non-ferrous refining and smelting industry (emissions in tonnes)	Transportation (road, rail, air and marine) (emissions in tonnes)	Other sources (emissions in tonnes)	Manufacturing (emissions in tonnes)	Iron and steel industry (emissions in tonnes)	Mining and rock quarrying (emissions in tonnes)	Total (emissions in tonnes)
2014	85.30	11.43	9.46	6.50	6.11	0.90	119.71
2015	111.66	12.92	9.13	5.94	5.51	0.98	146.13
2016	111.49	14.01	9.60	6.52	5.21	1.13	147.94
2017	130.58	13.59	10.18	3.71	5.14	1.21	164.41
2018	110.37	12.55	8.82	6.83	6.20	1.77	146.54
2019	73.19	15.13	9.75	5.29	4.90	1.28	109.53

**Note:** Totals may not add up due to rounding. The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. The category "other sources" includes agriculture (livestock, crop production and fertilizer), building heating and energy generation, electric utilities, home firewood burning, incineration and waste, the oil and gas industry, ore and mineral industries (the aluminum industry, the asphalt paving industry, the cement and concrete industry, foundries, the iron ore industry and the mineral products industry), paints and solvents and other miscellaneous sources. For more details on the sources, consult the [Data sources and methods](#).

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#).

**Table A.6. Data for Figure 7. Lead emissions to air by province and territory, Canada, 1990, 2009 and 2019**Error! Reference source not found.

Province or territory	1990 (emissions in tonnes)	2009 (emissions in tonnes)	2019 (emissions in tonnes)
Newfoundland and Labrador	0.51	1.49	2.66
Prince Edward Island	0.16	0.09	0.10
Nova Scotia	1.10	0.65	0.31
New Brunswick	0.51	16.34	1.19
Quebec	17.07	61.59	76.91
Ontario	10.52	45.79	14.93
Manitoba	1.11	88.68	1.53
Saskatchewan	1.15	0.88	1.33
Alberta	10.93	5.36	4.17
British Columbia	6.39	5.31	5.79
Yukon	0.34	0.14	0.18
Northwest Territories	0.57 <sup>[A]</sup>	0.35	0.38
Nunavut	n/a	0.06	0.04
Unspecified region <sup>[B]</sup>	970.34	n/a	n/a
Canada	1 020.69	226.72	109.53

**Note:** n/a = not applicable. <sup>[A]</sup> Value for 1990 includes emissions from Nunavut, which was officially separated from the Northwest Territories in 1999. <sup>[B]</sup> Legacy data for 1990 cannot be attributed to any province or territory. Totals may not add up due to rounding. The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes.

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#).



**Table A.7. Data for Figure 9. Cadmium emissions to air by source, Canada, 1990 to 2019**

Year	Non-ferrous refining and smelting industry (emissions in tonnes)	Other sources (emissions in tonnes)	Building heating and energy generation (emissions in tonnes)	Mining and rock quarrying (emissions in tonnes)	Incineration and waste (emissions in tonnes)	Total (emissions in tonnes)
1990	78.29	1.90	0.90	0.00	7.02	88.11
1991	67.85	1.94	0.90	0.00	6.34	77.02
1992	69.20	2.01	0.90	0.00	5.66	77.77
1993	11.95	2.06	0.92	0.00	4.97	19.90
1994	72.31	2.10	0.97	0.47	4.29	80.13
1995	16.73	2.39	1.02	0.57	3.61	24.32
1996	24.15	2.23	1.04	0.46	2.93	30.81
1997	40.34	2.17	1.03	0.70	2.25	46.49
1998	41.58	2.02	0.90	0.57	1.56	46.64
1999	36.16	2.29	0.94	0.48	0.88	40.76
2000	33.53	1.83	1.02	0.55	0.20	37.13
2001	64.69	1.94	0.99	0.53	0.18	68.33
2002	35.06	2.51	1.02	0.76	0.17	39.52
2003	24.43	3.38	1.05	2.59	0.07	31.52
2004	26.42	3.45	1.02	2.57	0.07	33.54
2005	28.59	2.16	0.99	2.91	0.05	34.69
2006	34.77	2.09	0.94	2.87	0.05	40.73
2007	22.33	2.35	1.01	2.87	0.05	28.61
2008	17.33	2.22	1.02	2.03	0.08	22.68
2009	15.95	2.42	0.97	1.69	0.04	21.06
2010	12.20	2.27	0.95	0.86	0.04	16.33
2011	4.76	2.36	1.02	0.31	0.04	8.50
2012	6.20	2.05	1.00	0.33	0.03	9.61
2013	5.30	1.90	0.96	0.32	0.03	8.51
2014	4.56	1.74	0.95	0.33	0.04	7.62
2015	5.02	1.55	0.93	0.05	0.04	7.59
2016	5.10	1.55	0.94	0.05	0.03	7.68
2017	4.28	1.52	0.96	0.05	0.04	6.85
2018	4.23	1.53	0.96	0.13	0.04	6.90
2019	2.25	1.46	1.00	0.07	0.04	4.81

**Note:** Totals may not add up due to rounding. The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes. The category "other sources" includes agriculture (livestock, crop production and fertilizer), electric utilities, home firewood burning, manufacturing, the oil and gas industry, ore and mineral industries (the aluminum industry, the asphalt paving industry, the cement and concrete industry, foundries, the iron and steel industry and the iron ore industry), paints and solvents, transportation (road, rail, air and marine) and other miscellaneous sources. For more details on the sources, consult the [Data sources and methods](#).

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#).

**Table A.8. Data for Figure 10. Cadmium emissions to air by province and territory, Canada, 1990, 2009 and 2019** Error! Reference source not found.

Province or territory	1990 (emissions in tonnes)	2009 (emissions in tonnes)	2019 (emissions in tonnes)
Newfoundland and Labrador	0.18	0.07	0.08
Prince Edward Island	0.01	0.01	0.01
Nova Scotia	0.09	0.08	0.03
New Brunswick	0.04	0.62	0.05
Quebec	3.09	1.95	1.76
Ontario	4.51	3.86	1.76
Manitoba	0.05	12.80	0.12
Saskatchewan	0.07	0.06	0.10
Alberta	0.36	1.26	0.54
British Columbia	0.45	0.34	0.34
Yukon	< 0.01	< 0.01	< 0.01
Northwest Territories	0.01 <sup>[A]</sup>	0.01	0.01
Nunavut	n/a	< 0.01	< 0.01
Unspecified region <sup>[B]</sup>	79.24	n/a	n/a
Canada	88.11	21.06	4.81

**Note:** n/a = not applicable. <sup>[A]</sup> Value for 1990 includes emissions from Nunavut, which was officially separated from the Northwest Territories in 1999. <sup>[B]</sup> Legacy data for 1990 cannot be attributed to any province or territory. Totals may not add up due to rounding. The indicator reports emissions from human-related activities only. It does not include emissions from natural sources such as forest fires or volcanoes.

**Source:** Environment and Climate Change Canada (2021) [Air Pollutant Emissions Inventory](#).

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