



Environment and
Climate Change Canada

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EMISSIONS OF HARMFUL SUBSTANCES TO AIR

CANADIAN ENVIRONMENTAL
SUSTAINABILITY INDICATORS



Canada 

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CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

EMISSIONS OF HARMFUL SUBSTANCES TO AIR

August 2024

Table of contents

- Emissions of harmful substances to air5**
 - Key results5
 - Emissions of mercury to air6
 - Mercury emissions to air by province and territory7
 - Mercury emissions to air from facilities9
 - Global mercury emissions to air10
 - Emissions of lead to air11
 - Lead emissions to air by province and territory13
 - Lead emissions to air from facilities14
 - Emissions of cadmium to air.....15
 - Cadmium emissions to air by province and territory16
 - Cadmium emissions to air from facilities18
- About the indicators19
 - What the indicators measure19
 - Why these indicators are important19
 - Related Initiatives20
 - Related indicators20
- Data sources and methods20
 - Data sources20
 - Methods21
 - Recent changes26
 - Caveats and limitations26
- Resources28

References	28
------------------	----

Annex	29
--------------------	-----------

Annex A. Data tables for the figures presented in this document	29
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List of Figures

Figure 1. Percentage change of mercury, lead and cadmium emissions from 1990 level, Canada	5
Figure 2. Mercury emissions to air by source, Canada, 1990 to 2022.....	7
Figure 3. Mercury emissions to air by province and territory, Canada, 1994, 2012 and 2022	8
Figure 4. Mercury emissions to air by facility, Canada, 2022.....	10
Figure 5. Global mercury emissions to air, 2015.....	11
Figure 6. Lead emissions to air by source, Canada, 1990 to 2022	12
Figure 7. Lead emissions to air by province and territory, Canada, 1994, 2012 and 2022	13
Figure 8. Lead emissions to air by facility, Canada, 2022.....	15
Figure 9. Cadmium emissions to air by source, Canada, 1990 to 2022	16
Figure 10. Cadmium emissions to air by province and territory, Canada, 1994, 2012 and 2022	17
Figure 11. Cadmium emissions to air by facility, Canada, 2022	19

List of Tables

Table 1. The largest source of mercury emissions to air within each province and territory, 2022	8
Table 2. The largest source of lead emissions to air within each province and territory, 2022.....	13
Table 3. The largest source of cadmium emissions to air within each province and territory, 2022.....	17
Table 4. Alignment of sources reported in the indicators with the sources and sectors from the Air Pollutant Emissions Inventory	24
Table A.1. Data for Figure 1. Percentage change of mercury, lead and cadmium emissions from 1990 level, Canada	29
Table A.2. Data for Figure 2. Mercury emissions to air by source, Canada, 1990 to 2022	30
Table A.3. Data for Figure 3. Mercury emissions to air by province and territory, Canada, 1994, 2012 and 2022	31
Table A.4. Data for Figure 5. Global mercury emissions to air, 2015	32
Table A.5. Data for Figure 6. Lead emissions to air by source, Canada, 1990 to 2022	32
Table A.6. Data for Figure 7. Lead emissions to air by province and territory, Canada, 1994, 2012 and 2022	33
Table A.7. Data for Figure 9. Cadmium emissions to air by source, Canada, 1990 to 2022	34
Table A.8. Data for Figure 10. Cadmium emissions to air by province and territory, Canada, 1994, 2012 and 2022.....	35

Emissions of harmful substances to air

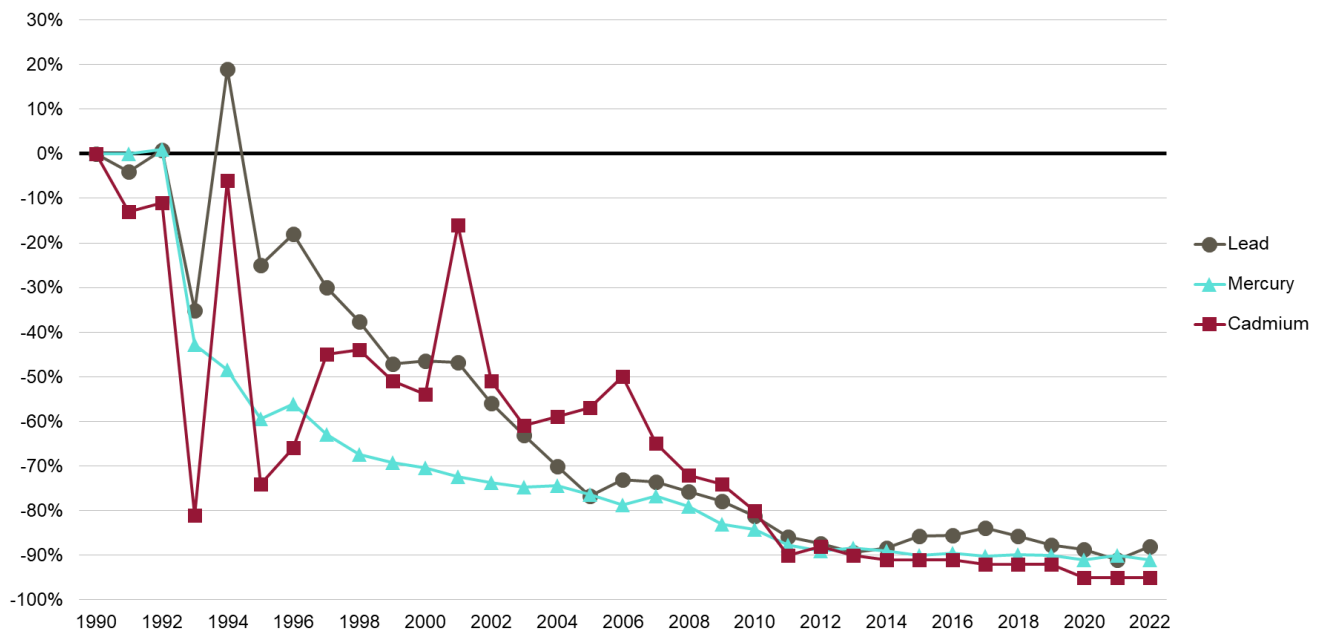
Emissions of some substances can harm human health, wildlife and biological diversity. For example, small particles of toxic metals can travel long distances in the air, be inhaled, or settle on the ground and in water. From there, the particles can enter the food web and build up in the tissues of living organisms. Exposure to these substances, even in small amounts, can be hazardous to both humans and ecosystems. Mercury and its compounds, lead, and inorganic cadmium compounds are listed as toxic¹ substances under the *Canadian Environmental Protection Act, 1999*. The emissions of harmful substances to air indicator reports on mercury, lead and cadmium emissions from human-related activities.

Key results

- In 2022, mercury, lead and cadmium emissions had decreased by 91%, 88% and 95%, respectively from 1990 levels

Figure 1. Percentage change of mercury, lead and cadmium emissions from 1990 level, Canada

Percent change from 1990 levels



www.canada.ca/environmental-indicators

[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.

Source: Environment and Climate Change Canada (2024) [Air Pollutant Emissions Inventory](#).

The decrease in mercury, lead and cadmium emissions are mostly attributed to a large reduction in emissions from the non-ferrous refining and smelting industry. This decline was primarily due to the implementation of [pollution prevention plans](#), the closing of outdated smelters, compliance with federal and provincial legislation, and conformance with guidelines introduced over this period. The changes in facility processes and adoption of emission reduction technologies also contributed to the reduction of mercury emissions.

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."

Emissions of mercury 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 cleaner technologies, facility closures and regulations coming into force in the earlier years.

While overall lead emissions declined between 1990 and 2022, they did increase slightly from 2014 to 2017 but continued to decline afterwards. These reductions are partly due to the closure of some non-ferrous metal smelting and refining facilities, the installation of more efficient emission control equipment, changes in lead concentrations in smelter feed and changes in production levels at some facilities.

Cadmium emissions fluctuated between 1990 and 2006 but decreased steadily starting in 2007, before declining sharply in 2010. Fluctuations in cadmium emissions prior to 2010 are mostly driven by emissions from a non-ferrous refining and smelting facility in Manitoba that is now closed.

Emissions of mercury to air

Mercury is a naturally occurring metal that can be emitted to the air by natural processes (like melting permafrost, volcanic activity, and soil and rock erosion), human activities (such as coal-fired electricity generation and waste incineration and treatment) and the improper disposal of [mercury-containing products](#) (such as batteries, thermometers and fluorescent lamps).

Mercury emissions are both a local and a global concern. Mercury can travel long distances in the atmosphere and may settle anywhere in Canada, including in ecologically sensitive areas such as the Canadian Arctic and the Great Lakes. Mercury accumulated in the environment can be re-emitted into the atmosphere through, either, natural processes, such as temperature change and microbial activity, or human activities that disturb mercury-laden sites. Re-emission is a more significant source of atmospheric mercury pollution than anthropogenic emissions from Canadian sources because it involves mercury that has been accumulated over decades in the environment, which exceeds current direct emissions.²

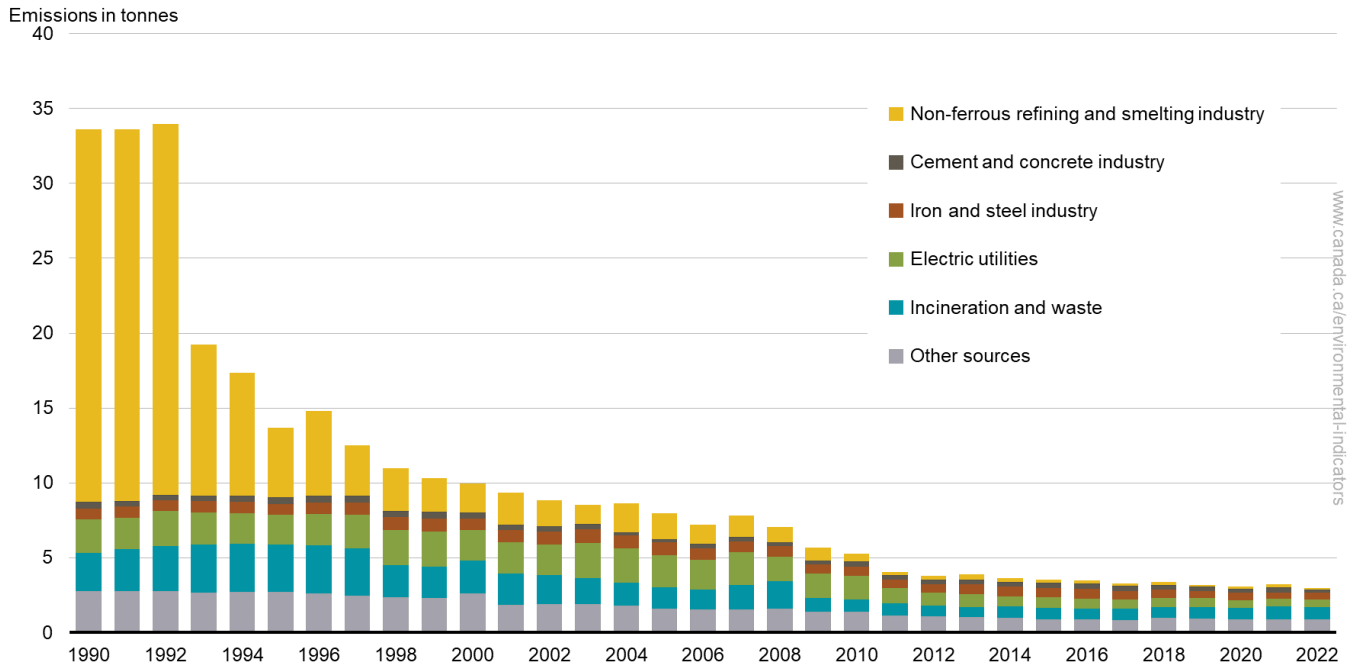
Mercury can have significant negative impacts on [human health and the environment](#) as mercury persists in the environment and accumulates in food chains over time, up to several decades. In humans, exposure poses a particular risk to populations who rely heavily on the consumption of aquatic and marine species, such as northern and Indigenous communities, whose traditional diets typically include predatory fish (for example, freshwater trout and Arctic char) and marine mammals.

Key results

- In 2022, 2.96 tonnes of mercury were emitted from anthropogenic sources in Canada
 - Incineration and waste represented the highest emitting sector, emitting 28% (or 0.8 tonnes) of the annual total
 - Combined emissions from the ore and mineral industries, including the non-ferrous refining and smelting industry (3% or 0.10 tonnes), the cement and concrete industry (8% or 0.23 tonnes), the iron and steel industry (15% or 0.45 tonnes) and other ore and mineral industries (8% or 0.23 tonnes), collectively emitted 34% (or 1.0 tonnes) of the annual total
- Between 1990 and 2022, mercury emissions decreased by 91% (or 30.7 tonnes)

² Environment and Climate Change Canada (2016) [Mercury Science Assessment Report](#). Retrieved on June 17, 2024.

Figure 2. Mercury emissions to air by source, Canada, 1990 to 2022



[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, other ore and mineral industries (the aluminum industry, the asphalt paving industry, foundries, iron pelletizing 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](#).

Source: Environment and Climate Change Canada (2024) [Air Pollutant Emissions Inventory](#).

The largest reduction in mercury emissions from a single anthropogenic source between 1990 and 2022 was from the non-ferrous refining and smelting industry. This industry reduced its emissions by 99.6% (from 24.9 tonnes in 1990 to 0.10 tonnes in 2022), contributing to 81% of the overall emissions reduction of mercury. National emissions drastically decreased by 43% between 1992 and 1993 and have generally continued to steadily decrease since. The reductions between 1990 and 2022 were primarily due to changes in facility processes and adoption of emission reduction technologies, the closing of outdated smelters, compliance with federal and provincial legislation, and conformance with guidelines.

Between 1990 and 2022, emissions from electric utilities, and incineration and waste declined by 78% and 68% (1.8 tonnes each), respectively. The decrease from electric utilities was largely due to the closure of coal-fired power plants.³ Combined, these two sources contributed 11% to the total decrease in mercury emissions.

Mercury emissions to air by province and territory

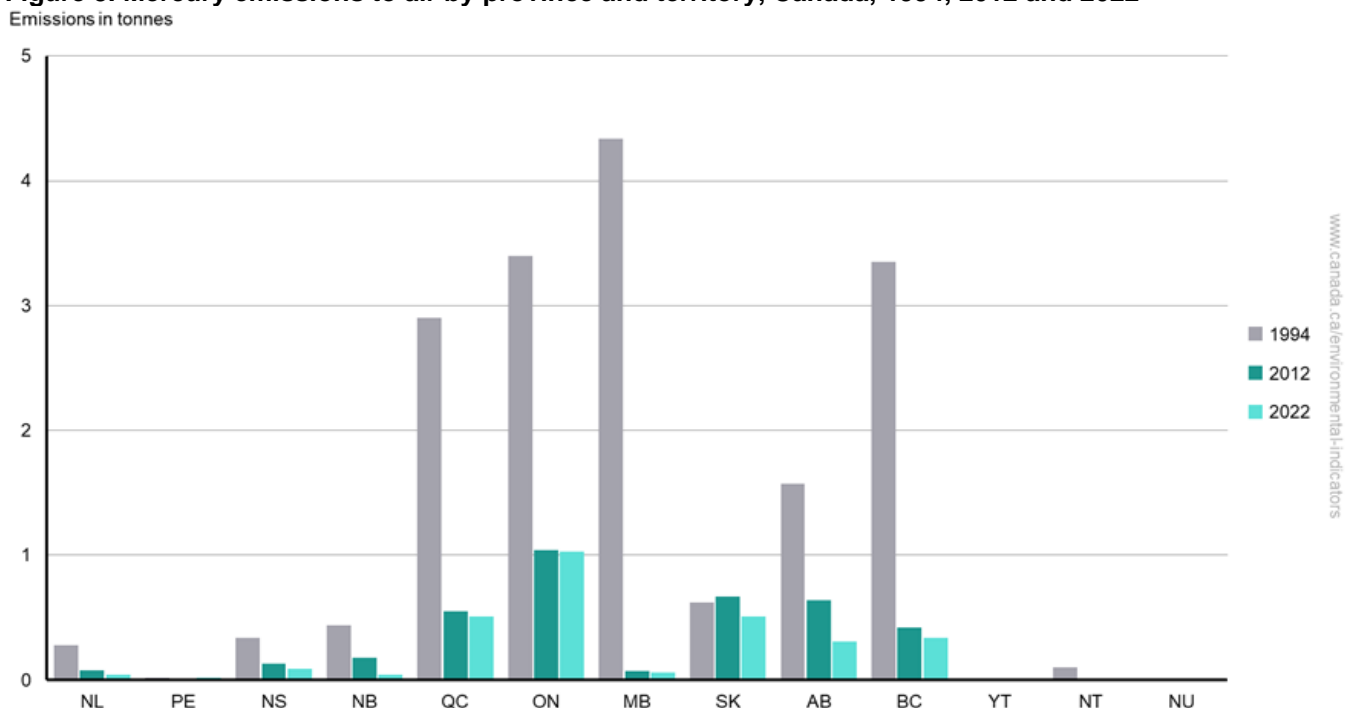
Key results

- In 2022, Ontario (35%), Quebec (17%) and Saskatchewan (17%) accounted for 70% of national mercury emissions

³ 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.

- Between 1994 and 2022⁴, Manitoba had the largest reduction in annual emissions with a decrease of 4.3 tonnes

Figure 3. Mercury emissions to air by province and territory, Canada, 1994, 2012 and 2022



[Data for Figure 3](#)

Note: Emissions from the Northwest Territories for 1994 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, New Brunswick, Yukon, the Northwest Territories and Nunavut are too small to see in the figure. To access all available years data please refer to the indicator's [interactive figures](#) or, for the full dataset, to the [Air Pollutant Emissions Inventory](#).

Source: Environment and Climate Change Canada (2024) [Air Pollutant Emissions Inventory](#).

In 2022, Ontario had the highest mercury emissions, accounting for 35% (1.0 tonne) of the national total. These emissions came mostly from the incineration and waste sector, the iron and steel industry, and the cement and concrete industry, which together accounted for 66% of the total provincial emissions.

Table 1. The largest source of mercury emissions to air within each province and territory, 2022

Province and Territory	Largest source of mercury emissions
Newfoundland and Labrador	Iron ore industry
Prince Edward Island	Incineration and waste industry
Nova Scotia	Electric utilities (mostly coal power plants)
New Brunswick	Incineration and waste industry
Quebec	Incineration and waste industry
Ontario	Incineration and waste industry
Manitoba	Incineration and waste industry
Saskatchewan	Electric utilities (mostly coal power plants)

⁴ Data from 1990 to 1993 were not considered in the provincial and territorial indicators, as a significant amount of emissions could not be assigned to any province or territory.

Province and Territory	Largest source of mercury emissions
Alberta	Incineration and waste industry
British Columbia	Incineration and waste industry
Yukon	Incineration and waste industry
Northwest Territories	Mining and rock quarrying industry
Nunavut	Incineration and waste industry

All provinces and territories had lower emissions in 2022 compared to 1994, excluding Nunavut, which separated from the Northwest Territories in 1999 and thus lacks data for comparison to 1994. Manitoba had the largest decline in emissions between 1994 and 2022. This decline was mostly due to changes in zinc processing technology and production levels, and the closure of an outdated copper smelter at a non-ferrous refining and smelting facility.

Mercury emissions from most of the provinces and territories have declined or remained stable since 1994, except for Saskatchewan. The province had an overall increase in emissions from 1994 to 2008, followed by a gradual decline until 2014.

Alberta had the largest decrease in emissions between 2012 and 2022 (0.3 tonnes). This decline was largely from electric utilities, likely due to the closure of coal-fired power plants.⁵

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 users to explore rates of [mercury emissions to air](#) from individual facilities.

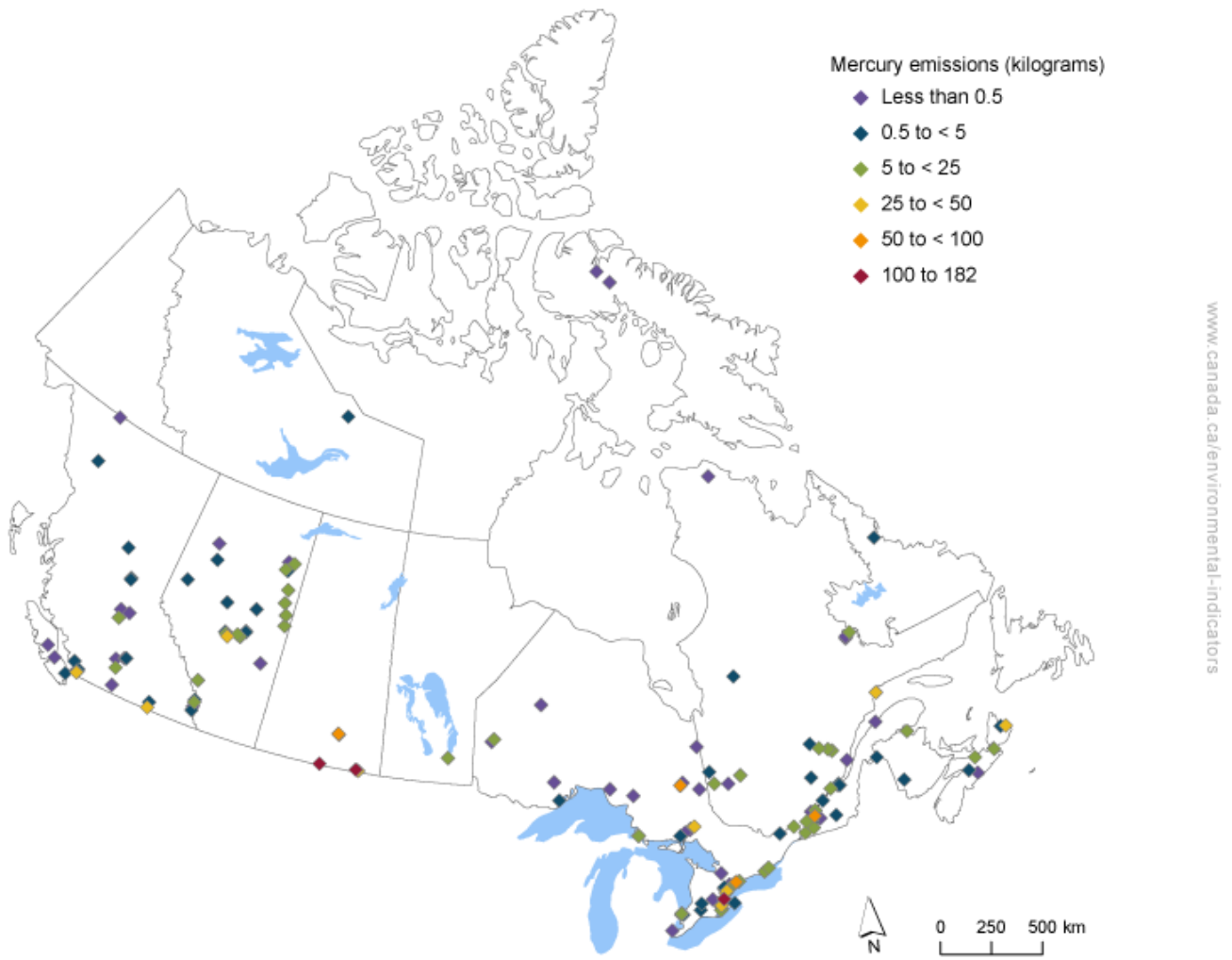
In 2022, facility-reported mercury emissions represent 57% of total national mercury emissions.⁶ Of these facilities:

- 59 facilities reported emissions under 0.5 kilogram (kg)
- 107 facilities reported emissions between 0.5 to 100 kg
- 3 facilities reported emissions over 100 kg, located in Ontario (1) and Saskatchewan (2)

⁵ 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.

⁶ The percentage of facility-reported emissions are calculated using the total facility-reported emissions from National Pollutant Release Inventory. As facilities are only mandated to report when the [reporting criteria](#) is met, the percentage may not align with the Air Pollutant Emissions Inventory.

Figure 4. Mercury emissions to air by facility, Canada, 2022



Navigate data using the [interactive map](#)

Source: Environment and Climate Change Canada (2024) [National Pollutant Release Inventory](#).

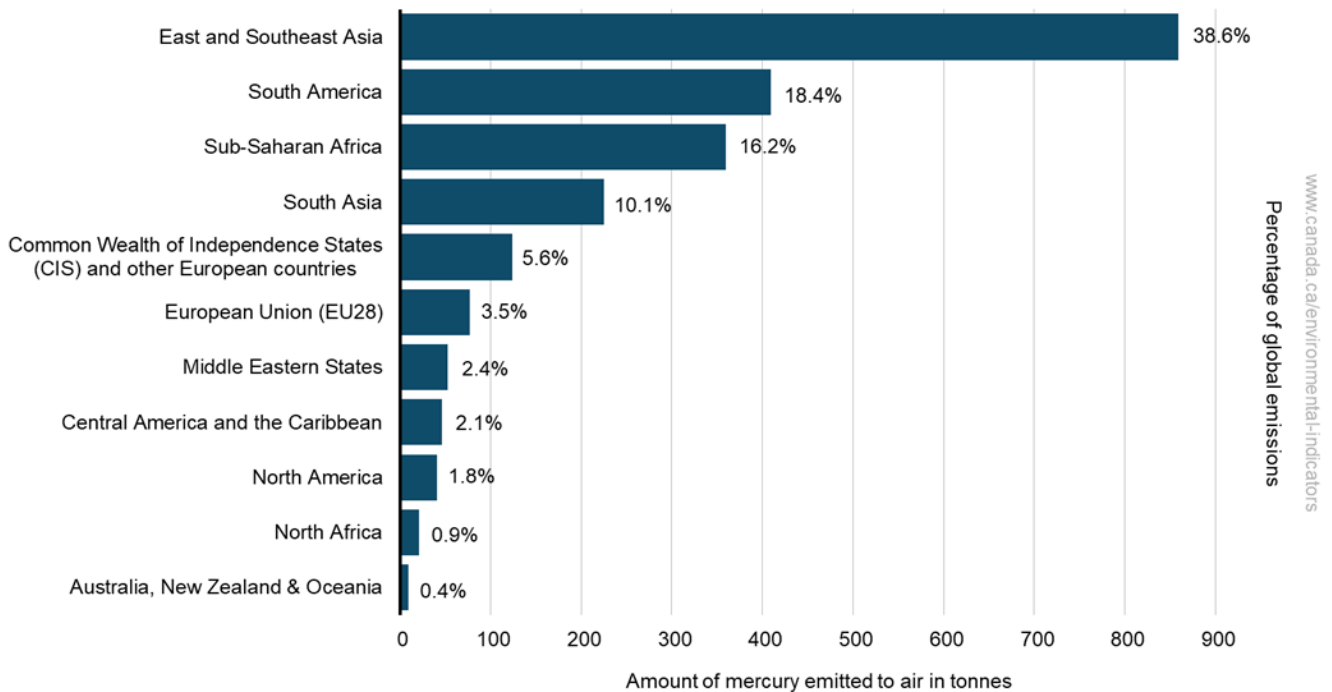
Global mercury emissions to air

Key results

- In 2015, the latest year for which data are available, global mercury emissions⁷ to air from human activity were estimated to be 2 220 tonnes
- The East and Southeast Asia, South America and Sub-Saharan Africa regions accounted for 73% of the global total
- The North America region (which 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

⁷ 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.

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 to the environment.⁸ Environment and Climate Change Canada⁹ estimates that over 95% of the human-related mercury deposited in Canada came from sources outside of the country.

Emissions of lead to air

Lead is a naturally occurring metal found in the Earth's crust and can be released during natural processes, such as rock and soil erosion. However, in Canada, most lead emissions come from industrial activities, such as metal refining and smelting, and various combustion processes. Lead is also used in the manufacture of vehicle lead-acid batteries worldwide, as well as pipes, sheeting, and within glass to prevent radiation exposure from television and computer screens.

Lead emissions 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](#). 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.

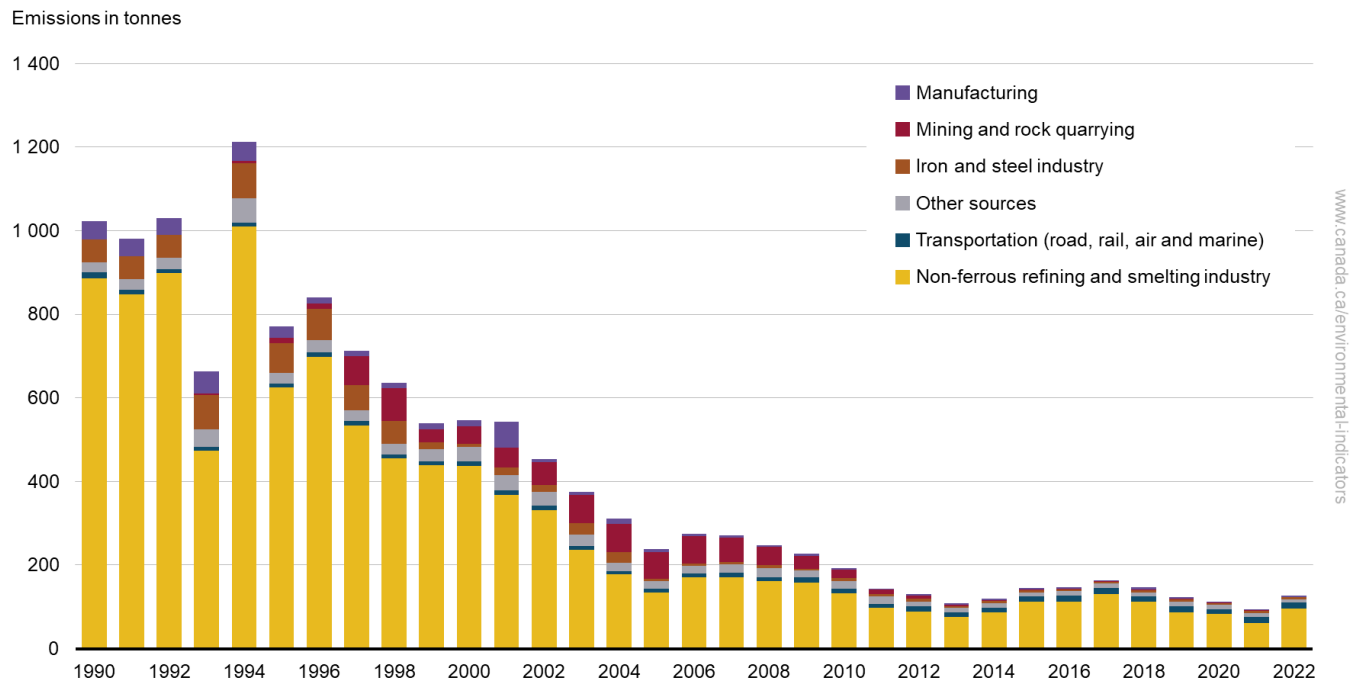
⁸ Durnford D et al. (2010) [Long range transport of mercury to the Arctic and across Canada](#). Atmospheric Chemistry and Physics 10(2):4673–4717. Retrieved on June 17, 2024.

⁹ Environment and Climate Change Canada (2016) [Canadian Mercury Science Assessment Report](#). Retrieved on June 17, 2024.

Key results

- In 2022, 126.5 tonnes of lead were emitted in Canada
- The largest source of lead emissions has been the non-ferrous smelting and refining industry since 1990. These emissions accounted for 76% (or 95.9 tonnes) of total emissions in 2022
- Between 1990 and 2022, national lead emissions decreased by 88% (or 896.4 tonnes)

Figure 6. Lead emissions to air by source, Canada, 1990 to 2022



[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, other ore and mineral industries (the aluminum industry, the asphalt paving industry, the cement and concrete industry, foundries, iron pelletizing 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 (2024) [Air Pollutant Emissions Inventory](#).

The largest reduction in lead emissions between 1990 and 2022 was from the non-ferrous refining and smelting industry (89% or 790 tonnes). The decline was due to the introduction of [pollution prevention plans](#) and the installation of more efficient emission control equipment in operating smelters, along with the closure of outdated smelters in 2010 and 2019. The majority of emissions prior to 2010 are attributed to a single non-ferrous refining and smelting facility located in Manitoba.

From 2014 to 2017, national lead emissions increased slightly; however, emissions began to decrease gradually from 2018 onwards. The decrease in lead emissions is mostly attributable to the implementations of pollution prevention plans and [base-level industrial emissions requirements \(BLIERs\)](#). Some fluctuations in national emissions may be due to changes in lead concentrations in smelter feed, changes in production levels at some facilities and the closure of a smelter in New Brunswick in 2019.

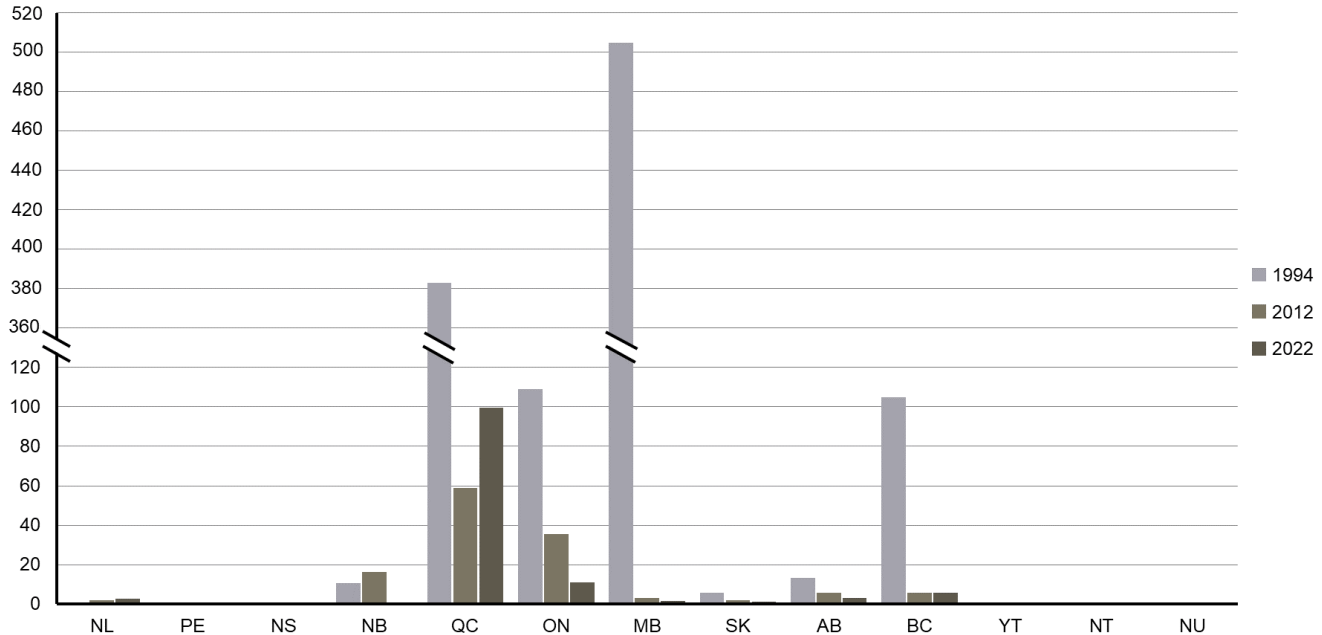
Lead emissions to air by province and territory

Key results

- In 2022, Quebec and Ontario accounted for 79% and 9% of national lead emissions, respectively
- Between 1994 and 2022¹⁰, Manitoba had the largest decrease in annual emissions of 503.4 tonnes

Figure 7. Lead emissions to air by province and territory, Canada, 1994, 2012 and 2022

Emissions in tonnes



[Data for Figure 7](#)

Note: Emissions from the Northwest Territories for 1994 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, Nova Scotia, Saskatchewan, Yukon, the Northwest Territories and Nunavut are too small to see in the figure. Some legacy data for 1994 that cannot be attributed to any province or territory are excluded from the figure. To access all available years data please refer to the indicator's [interactive figures](#) or, for the full dataset, to the [Air Pollutant Emissions Inventory](#).

Source: Environment and Climate Change Canada (2024) [Air Pollutant Emissions Inventory](#).

In 2022, Quebec had the highest lead emissions in Canada, accounting for 79% (99.7 tonnes) of national emissions. These emissions came mostly from the non-ferrous refining and smelting industry and accounted for 91% of the total provincial emissions.

Table 2. The largest source of lead emissions to air within each province and territory, 2022

Province and Territory	Largest source of lead emissions
Newfoundland and Labrador	Iron ore industry
Prince Edward Island	Transportation (road, rail, air and marine)
Nova Scotia	Transportation (road, rail, air and marine)
New Brunswick	Transportation (road, rail, air and marine)
Quebec	Non-ferrous smelting and refining industry
Ontario	Non-ferrous smelting and refining industry

¹⁰ Data from 1990 to 1993 were not considered in the provincial and territorial indicators, as a significant amount of emissions could not be assigned to any province or territory.

Province and Territory	Largest source of lead emissions
Manitoba	Transportation (road, rail, air and marine)
Saskatchewan	Transportation (road, rail, air and marine)
Alberta	Transportation (road, rail, air and marine)
British Columbia	Transportation (road, rail, air and marine)
Yukon	Transportation (road, rail, air and marine)
Northwest Territories	Transportation (road, rail, air and marine)
Nunavut	Incineration and waste industry

Between 1994 and 2022, all provinces and territories had a decrease in lead emissions, with Manitoba and Quebec experiencing the largest declines of 503.4 tonnes (99.7%) and 283.2 tonnes (74%), respectively. These declines were mostly due to the reduced emissions from the non-ferrous refining and smelting industry.

New Brunswick and Newfoundland and Labrador had slight increases in lead emissions between 1994 and 2012, although emissions in New Brunswick declined between 2012 and 2022.

In most provinces, emissions continued to decrease or remained stable from 2012 to 2022, except for Quebec. Ontario had the largest decrease in emissions (24.4 tonnes, 69%) between 2012 and 2022, largely from the non-ferrous refining and smelting industry. This decrease was mostly due to changes in production levels and the [introduction of pollution prevention activities](#).

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](#).

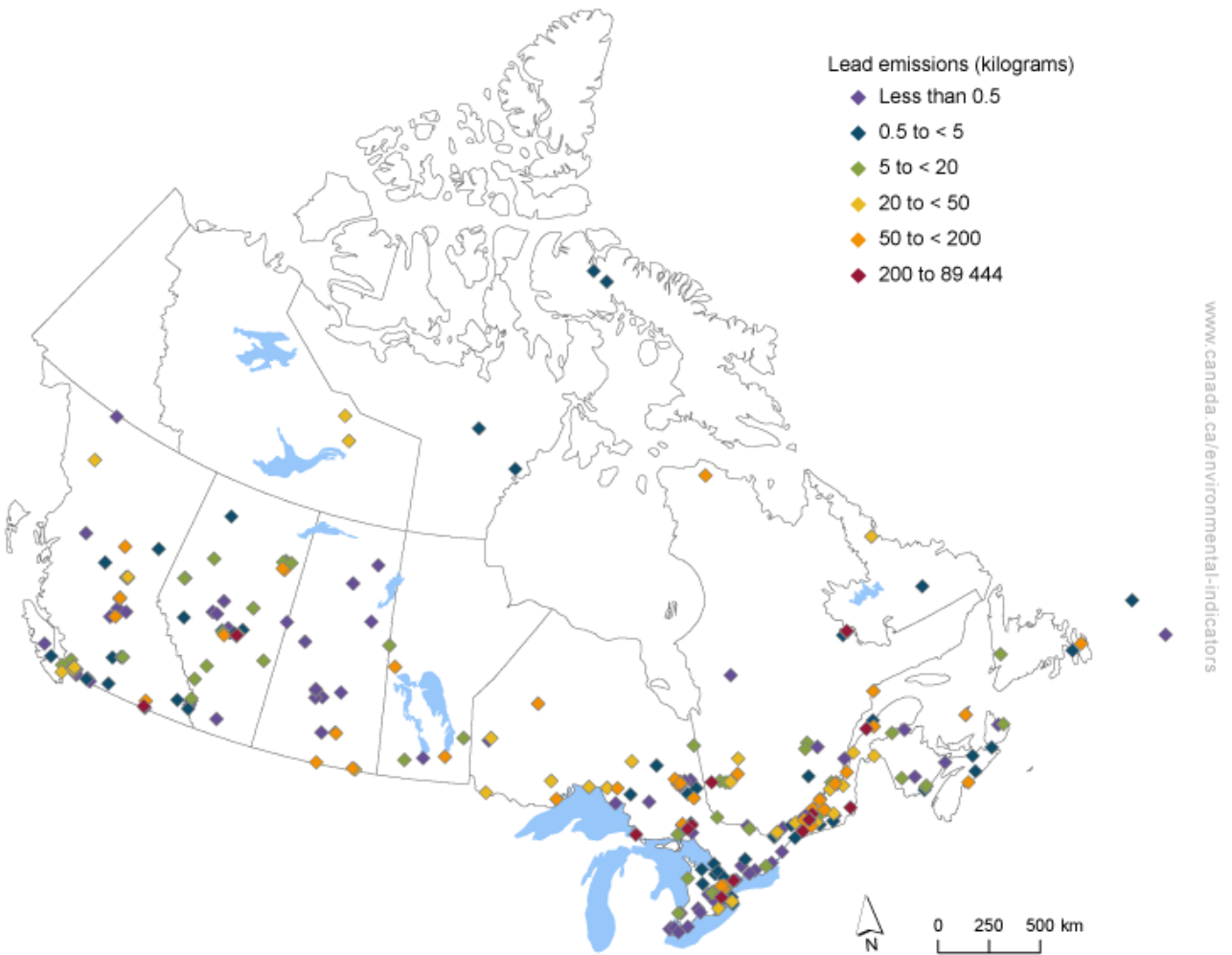
The Canadian Environmental Sustainability Indicators provide access to this information through an online interactive map. The map allows you to explore [lead emissions to air](#) from individual facilities.

In 2022, facility-reported lead emissions represent 87% of total national lead emissions.¹¹ Of these facilities:

- 118 facilities reported emissions under 0.5 kilogram (kg)
- 212 facilities reported emissions between 0.5 to 200 kg
- 17 facilities reported emissions over 200 kg, located in British Columbia (1), Newfoundland and Labrador (1), Alberta (1), Ontario (6) and Quebec (8)
- One (1) non-ferrous smelting and refining facility in Quebec accounted for 81% (or 89 444 kg) of the total facility-reported emissions of lead in 2022

¹¹ The percentage of facility-reported emissions are calculated using the total facility-reported emissions from National Pollutant Release Inventory. As facilities are only mandated to report when the [reporting criteria](#) is met, the percentage may not align with the Air Pollutant Emissions Inventory.

Figure 8. Lead emissions to air by facility, Canada, 2022



Navigate data using the [interactive map](#)

Source: Environment and Climate Change Canada (2024) [National Pollutant Release Inventory](#).

Emissions of cadmium to air

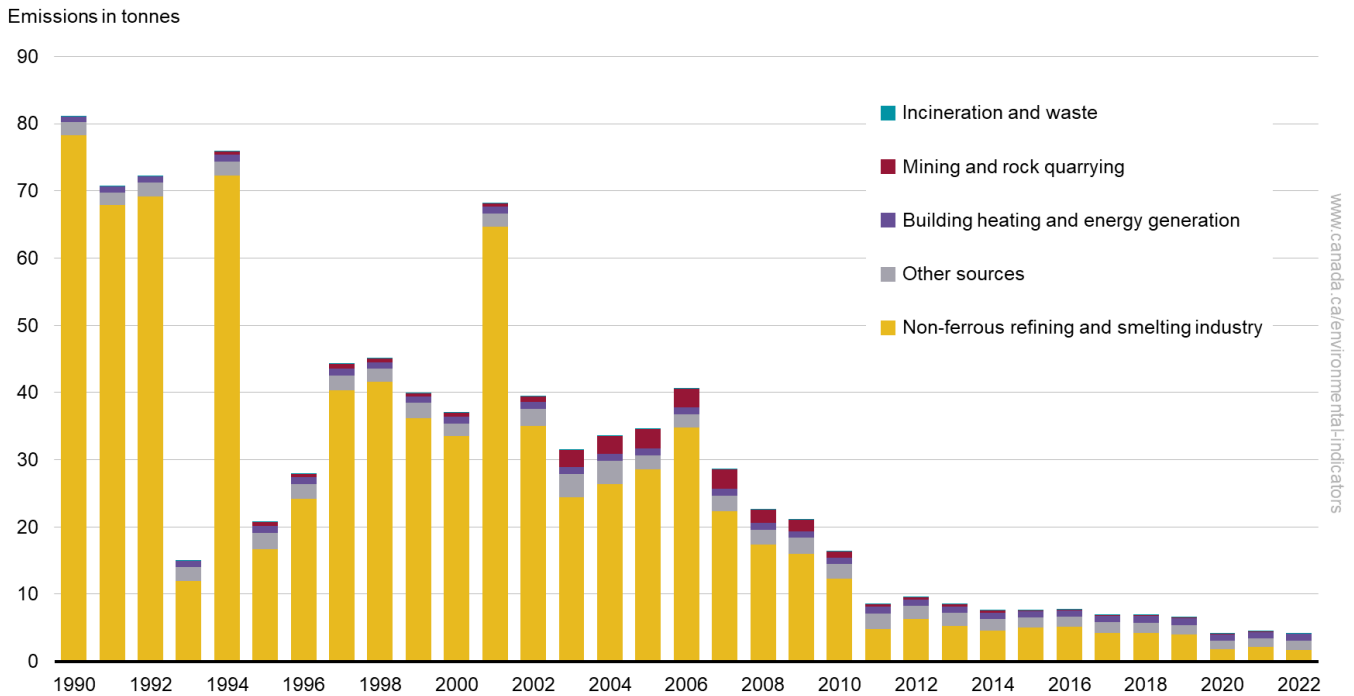
Cadmium is a naturally occurring metal in the Earth's crust. This metal can be released during natural processes, such as weathering and erosion of cadmium-bearing rocks, forest fires, and volcanic activity. Human activity can also contribute to cadmium emissions, such as through the manufacture of batteries, electroplating, power generation and heating, transportation, solid waste disposal, and sewage sludge application.

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

Key results

- In 2022, 4.1 tonnes of cadmium were emitted in Canada
- Since 1990, the largest source of cadmium emissions has been the non-ferrous refining and smelting industry. It accounted for 41% (or 1.7 tonnes) of the national total in 2022
- Between 1990 and 2022, cadmium emissions decreased by 95% (or 77.0 tonnes)

Figure 9. Cadmium emissions to air by source, Canada, 1990 to 2022



[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, other ore and mineral industries (the aluminum industry, the asphalt paving industry, the cement and concrete industry, foundries, the iron and steel industry and iron pelletizing), 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 (2024) [Air Pollutant Emissions Inventory](#).

Between 1990 and 2022, cadmium emissions from the non-ferrous refining and smelting industry declined by 98% (76.6 tonnes). This decline was responsible for nearly 100% of the total reduction in national cadmium emissions between 1990 and 2022. The 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.

The fluctuations in cadmium emissions prior to 2010 were mostly driven by changes in emissions from a single non-ferrous refining and smelting facility in Manitoba that is now closed.

Cadmium emissions to air by province and territory

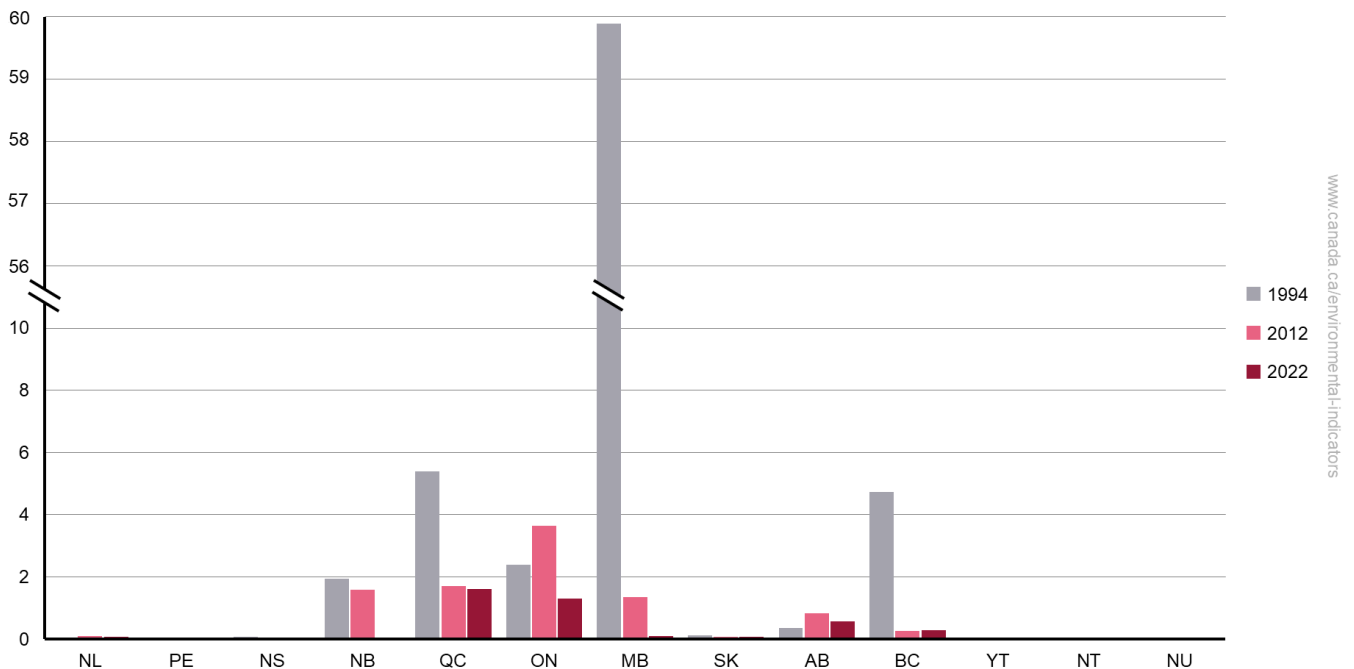
Key results

- In 2022, Ontario and Quebec accounted for 70% (2.9 tonnes) of national cadmium emissions
- Between 1994 and 2022¹², Manitoba had the largest decline in emissions (59.7 tonnes)

¹² Data from 1990 to 1993 were not considered in the provincial and territorial indicators, as a significant amount of emissions could not be assigned to any province or territory.

Figure 10. Cadmium emissions to air by province and territory, Canada, 1994, 2012 and 2022

Emissions in tonnes



[Data for Figure 10](#)

Note: Emissions from the Northwest Territories for 1994 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, Nova Scotia, Manitoba, Saskatchewan, Yukon, the Northwest Territories and Nunavut are too small to see in the figure. Legacy data for 1994 that cannot be attributed to any province or territory are excluded from the figure. To access all available years data please refer to the indicator's [interactive figures](#) or, for the full dataset, to the [Air Pollutant Emissions Inventory](#).

Source: Environment and Climate Change Canada (2024) [Air Pollutant Emissions Inventory](#).

In 2022, Ontario and Quebec reported the highest cadmium emissions of all the provinces and territories, accounting for 31% (1.3 tonnes) and 39% (1.6 tonnes) of national emissions, respectively. These emissions came mostly from the non-ferrous refining and smelting industry, manufacturing industries, and building heating and energy generation.

Table 3. The largest source of cadmium emissions to air within each province and territory, 2022

Province and Territory	Largest source of cadmium emissions
Newfoundland and Labrador	Iron ore industry
Prince Edward Island	Building heating and energy generation
Nova Scotia	Building heating and energy generation
New Brunswick	Manufacturing
Quebec	Non-ferrous smelting and refining industry
Ontario	Non-ferrous smelting and refining industry
Manitoba	Non-ferrous smelting and refining industry
Saskatchewan	Building heating and energy generation
Alberta	Oil and gas industry
British Columbia	Building heating and energy generation
Yukon	Building heating and energy generation
Northwest Territories	Building heating and energy generation

Province and Territory	Largest source of cadmium emissions
Nunavut	Incineration and waste industry

Between 1994 and 2022, emissions declined or remained stable for all provinces and territories, except Alberta and Newfoundland and Labrador. During this period, Manitoba experienced the largest decline in cadmium emissions (99.8% or 59.7 tonnes).

While Ontario, Alberta, and Newfoundland and Labrador had higher cadmium emissions in 2012 compared to 1994, emissions from all provinces and territories continued to decrease or remained stable from 2012 to 2022. Ontario experienced the largest decline between 2012 and 2022 (2.3 tonnes), largely from the non-ferrous refining and smelting industry. This decrease was mostly due to changes in production levels and the [introduction of pollution prevention activities](#).

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](#).

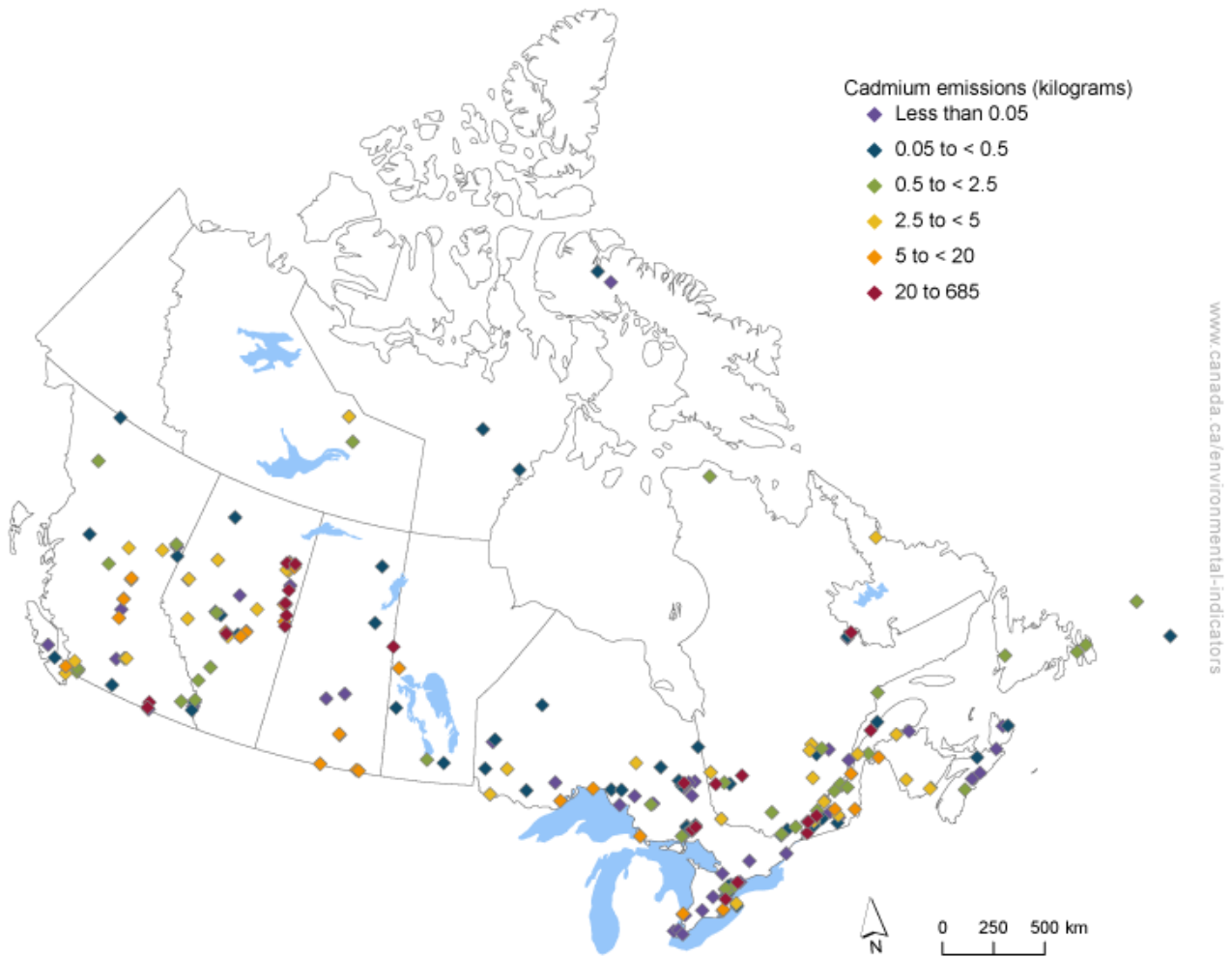
The Canadian Environmental Sustainability Indicators provide access to this information through an online interactive map. The map allows you to explore [cadmium emissions to air](#) from individual facilities.

In 2022, facility-reported cadmium emissions represent 71% of total national cadmium emissions.¹³ Of these facilities:

- 125 facilities reported emissions under 0.5 kilogram (kg)
- 112 facilities reported emissions between 0.5 to 20 kg
- 23 facilities reported emissions over 20 kg, located in Alberta (7), Quebec (7), Ontario (5), British Columbia (2), Manitoba (1) and Newfoundland and Labrador (1)

¹³ The percentage of facility-reported emissions are calculated using the total facility-reported emissions from National Pollutant Release Inventory. As facilities are only mandated to report when the [reporting criteria](#) is met, the percentage may not align with the Air Pollutant Emissions Inventory.

Figure 11. Cadmium emissions to air by facility, Canada, 2022



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

Source: Environment and Climate Change Canada (2024) [National Pollutant Release Inventory](#).

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.

Related Initiatives

These indicators support the measurement of progress towards the following [2022 to 2026 Federal Sustainable Development Strategy](#) Goal 11: Improve access to affordable housing, clean air, transportation, parks, and green spaces, as well as cultural heritage in Canada.

In addition, the indicators contribute to the [Sustainable Development Goals of the 2030 Agenda for Sustainable Development](#). They are linked to the 2030 Agenda's Goal 11: Sustainable Cities and Communities and Target 11.6: "By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management."

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_x), nitrogen oxides (NO_x), volatile organic compounds (VOCs), ammonia (NH₃), carbon monoxide (CO) and fine particulate matter (PM_{2.5}). Black carbon, which is a component of PM_{2.5}, is also reported. Mercury, lead and cadmium can also be components of particulate matter. 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 fine particulate matter (PM_{2.5}), ozone (O₃), sulphur dioxide (SO₂), nitrogen dioxide (NO₂), and volatile organic compounds (VOCs) at the national and regional levels 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 (APEI) 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 formation of smog and acid rain; reduced air quality and contribute to 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 based on these improvements.

This inventory fulfills many of Canada's international reporting obligations on pollution. The APEI is a comprehensive inventory of 17 air pollutants¹⁴ 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, 2024. While the national indicators cover the period from 1990 to 2022, the provincial/territorial indicators only cover the period from 1994 to 2022. Data from 1990 to 1993 were not considered in the provincial/territorial indicators as a significant amount of legacy emissions could not be attributed to any province or territory. 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 2022](#) are current as of March 28, 2024.

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.

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 and models to quantify total emissions. Together, these data sources provide a comprehensive overview of pollutant emissions across Canada.

¹⁴ 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.

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](#).

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 (the department) 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, provincial and territorial levels 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.¹⁵ 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.¹⁶

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

¹⁵ 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)."

¹⁶ European Monitoring and Evaluation Programme/European Environment Agency (2019) EMEP/EEA Air Pollutant Emission Inventory Guidebook 2019. [Technical Guidance to Prepare National Emission Inventories](#). Luxembourg: Publications Office of the European Union. Technical Report No. 13/2019.

estimated using the U.S. EPA's NONROAD emission estimation model (see "off-road vehicles and equipment" in [section A2-4 of Annex 2 of the Air Pollutant Emissions Inventory Report](#)). 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.

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](#).

Temporal coverage

Historical data are provided at the national and source level for the period from 1990 to 2022. For the regional indicators (provincial/territorial), emissions are presented for 1994, 2012 and 2022. However, because Nunavut only officially separated from the Northwest Territories in 1999, emissions from the Northwest Territories for 1994 include emissions from the region that would eventually become Nunavut.

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 4 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 4. 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: Agricultural fuel combustion
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
Electric utilities	Electric power generation (utilities): Landfill gas ^[A]
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: Human crematoriums
Incineration and waste	Incineration and waste sources: Pet crematoriums
Incineration and waste	Incineration and waste sources: Waste incineration
Incineration and waste	Incineration and waste sources: Waste treatment and disposal
Manufacturing	Manufacturing: Abrasives manufacturing
Manufacturing	Manufacturing: Bakeries
Manufacturing	Manufacturing: Biofuel production
Manufacturing	Manufacturing: Chemicals industry
Manufacturing	Manufacturing: Electronics
Manufacturing	Manufacturing: Food preparation
Manufacturing	Manufacturing: Glass manufacturing

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory
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 ^[B]
Miscellaneous	Commercial/residential/institutional: Marine cargo handling
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, natural gas vehicles and equipment
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 ^[C]
Ore and mineral industries	Ore and mineral industries: Foundries
Ore and mineral industries	Ore and mineral industries: Iron and steel industry ^[C]
Ore and mineral industries	Ore and mineral industries: Iron ore pelletizing
Ore and mineral industries	Ore and mineral industries: Mineral products industry
Ore and mineral industries	Ore and mineral industries: Mining and rock quarrying ^[C]
Ore and mineral industries	Ore and mineral industries: Non-ferrous refining and smelting industry ^[C]
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)

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory
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 / natural gas trucks
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty liquefied petroleum gas / 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: ^[A] Includes electric power generation from combustion of waste materials by utilities and by industry for commercial sale and/or private use. ^[B] Includes human respiration, perspiration and dental amalgams. ^[C] 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 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 agriculture, dust sources and incineration and waste, following the implementation of improved quantification methods and activity data. As a result, emissions reported in this indicator may be different from previous years. For more information about these recent changes, consult [Annex 3 of the Air Pollutant Emissions Inventory Report](#).

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.

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.

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, the base year used differs from that used in the national indicators. Furthermore, some legacy data for 1994 could not be attributed to any province or territory. The legacy data were captured under unspecified region in the data tables.

The years 2020 and 2021 were marked by the COVID-19 pandemic which had an impact on a wide range of economic sectors, especially the energy and transport sectors. The emissions change must be interpreted with caution as the impact of the pandemic on the emissions is not discussed in detail.

More information

Air Pollutant Emissions Inventory and National Pollutant Release Inventory

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

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Annex

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

Table A.1. Data for Figure 1. Percentage change of mercury, lead and cadmium emissions from 1990 level, Canada

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	1	1	-11
1993	-43	-35	-81
1994	-48	19	-6
1995	-59	-25	-74
1996	-56	-18	-66
1997	-63	-30	-45
1998	-67	-38	-44
1999	-69	-47	-51
2000	-70	-47	-54
2001	-72	-47	-16
2002	-74	-56	-51
2003	-75	-63	-61
2004	-74	-70	-59
2005	-76	-77	-57
2006	-79	-73	-50
2007	-77	-74	-65
2008	-79	-76	-72
2009	-83	-78	-74
2010	-84	-81	-80
2011	-88	-86	-90
2012	-89	-87	-88
2013	-88	-89	-90
2014	-89	-88	-91
2015	-90	-86	-91
2016	-90	-86	-91
2017	-90	-84	-92
2018	-90	-86	-92
2019	-90	-88	-92
2020	-91	-89	-95

Year	Mercury (percentage change from 1990 level)	Lead (percentage change from 1990 level)	Cadmium (percentage change from 1990 level)
2021	-90	-91	-95
2022	-91	-88	-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.

Source: Environment and Climate Change Canada (2024) [Air Pollutant Emissions Inventory](#).

Table A.2. Data for Figure 2. Mercury emissions to air by source, Canada, 1990 to 2022

Year	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)	Other sources (emissions in tonnes)	Total (emissions in tonnes)
1990	2.25	0.71	2.58	0.46	24.89	2.75	33.64
1991	2.12	0.72	2.77	0.38	24.86	2.79	33.64
1992	2.35	0.73	3.01	0.36	24.77	2.76	33.98
1993	2.14	0.74	3.19	0.37	10.11	2.69	19.24
1994	2.06	0.74	3.20	0.41	8.25	2.71	17.37
1995	1.99	0.75	3.17	0.41	4.64	2.69	13.65
1996	2.09	0.76	3.22	0.44	5.67	2.60	14.78
1997	2.24	0.81	3.17	0.45	3.38	2.46	12.51
1998	2.37	0.82	2.16	0.45	2.83	2.34	10.97
1999	2.37	0.83	2.11	0.47	2.27	2.28	10.33
2000	2.05	0.79	2.20	0.39	1.94	2.59	9.95
2001	2.09	0.79	2.10	0.37	2.12	1.85	9.33
2002	2.06	0.85	1.94	0.37	1.75	1.87	8.84
2003	2.37	0.91	1.70	0.35	1.29	1.91	8.52
2004	2.31	0.86	1.55	0.22	1.90	1.78	8.61
2005	2.17	0.85	1.42	0.21	1.70	1.59	7.94
2006	2.00	0.78	1.34	0.30	1.25	1.52	7.19
2007	2.17	0.72	1.67	0.32	1.41	1.52	7.82
2008	1.63	0.70	1.85	0.30	1.01	1.57	7.05
2009	1.67	0.57	0.90	0.29	0.84	1.39	5.67
2010	1.58	0.63	0.82	0.31	0.55	1.38	5.28
2011	1.02	0.57	0.84	0.30	0.22	1.11	4.06
2012	0.86	0.59	0.71	0.30	0.26	1.08	3.80
2013	0.85	0.64	0.67	0.31	0.36	1.05	3.88
2014	0.71	0.63	0.75	0.30	0.29	0.97	3.64
2015	0.73	0.60	0.73	0.38	0.18	0.90	3.52
2016	0.67	0.64	0.73	0.34	0.22	0.87	3.49
2017	0.63	0.57	0.74	0.33	0.14	0.85	3.26

Year	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)	Other sources (emissions in tonnes)	Total (emissions in tonnes)
2018	0.61	0.57	0.74	0.30	0.20	0.96	3.38
2019	0.61	0.49	0.75	0.30	0.12	0.92	3.20
2020	0.50	0.47	0.81	0.29	0.16	0.86	3.09
2021	0.50	0.46	0.86	0.35	0.19	0.87	3.23
2022	0.49	0.45	0.82	0.23	0.10	0.88	2.96

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, other ore and mineral industries (the aluminum industry, the asphalt paving industry, foundries, iron pelletizing 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](#).

Source: Environment and Climate Change Canada (2024) [Air Pollutant Emissions Inventory](#).

Table A.3. Data for Figure 3. Mercury emissions to air by province and territory, Canada, 1994, 2012 and 2022

Province or territory	1994 (emissions in tonnes)	2012 (emissions in tonnes)	2022 (emissions in tonnes)
Newfoundland and Labrador	0.28	0.08	0.04
Prince Edward Island	0.02	0.01	0.02
Nova Scotia	0.34	0.13	0.09
New Brunswick	0.44	0.18	0.04
Quebec	2.90	0.55	0.51
Ontario	3.40	1.04	1.03
Manitoba	4.34	0.07	0.06
Saskatchewan	0.62	0.67	0.51
Alberta	1.57	0.64	0.31
British Columbia	3.35	0.42	0.34
Yukon	< 0.01	< 0.01	< 0.01
Northwest Territories	0.10 ^[A]	< 0.01	< 0.01
Nunavut	n/a	0.01	0.01
Canada	17.37	3.80	2.96

Note: n/a = not applicable. ^[A] Value for 1994 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. To access all available years data please refer to the indicator's [interactive figures](#) or, for the full dataset, to the [Air Pollutant Emissions Inventory](#).

Source: Environment and Climate Change Canada (2024) [Air Pollutant Emissions 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
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 2022

Year	Non-ferrous refining and smelting industry (emissions in tonnes)	Transportation (road, rail, air and marine) (emissions in tonnes)	Manufacturing (emissions in tonnes)	Iron and steel industry (emissions in tonnes)	Mining and rock quarrying (emissions in tonnes)	Other sources (emissions in tonnes)	Total (emissions in tonnes)
1990	886.28	13.71	42.94	54.92	0.00	25.04	1 022.90
1991	847.51	10.73	42.03	55.09	0.00	25.77	981.13
1992	899.27	9.46	41.06	55.15	0.00	25.74	1 030.68
1993	473.81	9.26	52.92	81.00	4.96	42.07	664.03
1994	1 010.17	8.60	46.66	83.41	6.15	58.52	1 213.53
1995	624.47	10.22	27.79	71.86	12.22	25.21	771.78
1996	698.38	10.69	14.49	74.38	14.12	29.07	841.13
1997	534.65	10.11	14.06	60.43	68.61	25.59	713.46
1998	454.48	10.75	12.49	54.14	78.60	25.34	635.79
1999	438.70	10.01	14.09	16.47	32.29	28.00	539.57
2000	437.09	10.13	13.64	8.34	41.91	34.88	546.00
2001	368.36	10.18	61.22	19.50	46.58	36.27	542.10
2002	331.58	10.23	7.84	16.42	53.40	34.10	453.57
2003	235.69	9.70	7.71	27.36	67.89	27.51	375.87
2004	177.80	8.31	12.29	25.42	67.52	19.32	310.65
2005	133.73	9.60	7.41	5.67	64.81	17.43	238.65
2006	170.85	8.65	5.77	5.89	66.10	18.34	275.61

Year	Non-ferrous refining and smelting industry (emissions in tonnes)	Transportation (road, rail, air and marine) (emissions in tonnes)	Manufacturing (emissions in tonnes)	Iron and steel industry (emissions in tonnes)	Mining and rock quarrying (emissions in tonnes)	Other sources (emissions in tonnes)	Total (emissions in tonnes)
2007	171.40	9.45	5.23	6.57	57.06	20.48	270.19
2008	161.10	9.56	4.68	5.99	43.87	22.57	247.77
2009	158.60	11.60	4.73	4.46	30.88	16.44	226.70
2010	131.68	11.81	3.80	6.28	19.76	18.82	192.14
2011	96.91	9.59	2.92	6.10	9.87	18.42	143.82
2012	88.72	12.45	2.91	6.68	7.17	11.79	129.72
2013	74.94	12.06	3.20	5.20	3.23	10.06	108.68
2014	86.95	11.21	3.66	6.11	0.95	10.49	119.37
2015	111.81	12.88	4.63	5.51	0.98	10.20	146.01
2016	113.02	13.96	3.83	5.21	1.13	10.23	147.38
2017	130.75	13.54	2.46	5.14	1.21	11.12	164.21
2018	112.04	12.50	4.02	6.20	1.65	9.68	146.10
2019	86.90	15.04	3.02	4.91	2.29	10.51	122.67
2020	82.25	12.64	2.53	4.79	1.51	9.42	113.15
2021	61.86	14.27	2.58	5.37	1.77	8.76	94.61
2022	95.86	13.79	2.54	4.83	1.30	8.17	126.48

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, other ore and mineral industries (the aluminum industry, the asphalt paving industry, the cement and concrete industry, foundries, iron pelletizing 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 (2024) [Air Pollutant Emissions Inventory](#).

Table A.6. Data for Figure 7. Lead emissions to air by province and territory, Canada, 1994, 2012 and 2022

Province or territory	1994 (emissions in tonnes)	2012 (emissions in tonnes)	2022 (emissions in tonnes)
Newfoundland and Labrador	0.39	1.95	2.52
Prince Edward Island	0.13	0.06	0.09
Nova Scotia	0.93	0.45	0.34
New Brunswick	10.46	16.14	0.78
Quebec	382.94	58.77	99.71
Ontario	109.12	35.47	11.12
Manitoba	504.83	3.11	1.42
Saskatchewan	5.60	1.73	1.14
Alberta	13.16	5.68	3.22
British Columbia	104.95	5.62	5.64
Yukon	0.22	0.15	0.11
Northwest Territories	0.54 ^[A]	0.52	0.38

Province or territory	1994 (emissions in tonnes)	2012 (emissions in tonnes)	2022 (emissions in tonnes)
Nunavut	n/a	0.06	0.02
Unspecified region ^[B]	80.25	n/a	n/a
Canada	1 213.53	129.72	126.48

Note: n/a = not applicable. ^[A] Value for 1994 includes emissions from Nunavut, which was officially separated from the Northwest Territories in 1999. ^[B] Legacy data for 1994 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. To access all available years data please refer to the indicator's [interactive figures](#) or, for the full dataset, to the [Air Pollutant Emissions Inventory](#).

Source: Environment and Climate Change Canada (2024) [Air Pollutant Emissions Inventory](#).

Table A.7. Data for Figure 9. Cadmium emissions to air by source, Canada, 1990 to 2022

Year	Non-ferrous refining and smelting industry (emissions in tonnes)	Building heating and energy generation (emissions in tonnes)	Mining and rock quarrying (emissions in tonnes)	Incineration and waste (emissions in tonnes)	Other sources (emissions in tonnes)	Total (emissions in tonnes)
1990	78.29	0.90	0.00	0.08	1.91	81.18
1991	67.85	0.90	0.00	0.08	1.94	70.77
1992	69.20	0.90	0.00	0.08	2.01	72.20
1993	11.95	0.92	0.00	0.08	2.07	15.02
1994	72.31	0.97	0.47	0.08	2.11	75.93
1995	16.73	1.02	0.57	0.08	2.40	20.80
1996	24.15	1.04	0.46	0.08	2.24	27.97
1997	40.34	1.03	0.70	0.08	2.18	44.33
1998	41.58	0.90	0.57	0.08	2.03	45.16
1999	36.16	0.94	0.48	0.08	2.30	39.97
2000	33.53	1.02	0.55	0.09	1.84	37.03
2001	64.69	0.98	0.53	0.09	1.95	68.25
2002	35.06	1.02	0.76	0.14	2.52	39.50
2003	24.43	1.05	2.59	0.04	3.40	31.51
2004	26.43	1.02	2.57	0.04	3.46	33.52
2005	28.59	0.99	2.91	0.04	2.11	34.63
2006	34.77	0.93	2.87	0.04	2.04	40.66
2007	22.37	1.01	2.87	0.03	2.32	28.60
2008	17.38	1.02	2.03	0.07	2.19	22.68
2009	16.02	0.96	1.70	0.03	2.35	21.06
2010	12.27	0.95	0.87	0.04	2.20	16.33
2011	4.84	1.02	0.32	0.03	2.28	8.48
2012	6.28	1.00	0.34	0.02	1.96	9.60
2013	5.30	0.96	0.33	0.03	1.87	8.49
2014	4.56	0.95	0.34	0.02	1.71	7.58
2015	5.02	0.93	0.05	0.02	1.53	7.56
2016	5.10	0.96	0.05	0.02	1.52	7.65

Year	Non-ferrous refining and smelting industry (emissions in tonnes)	Building heating and energy generation (emissions in tonnes)	Mining and rock quarrying (emissions in tonnes)	Incineration and waste (emissions in tonnes)	Other sources (emissions in tonnes)	Total (emissions in tonnes)
2017	4.28	0.99	0.05	0.02	1.52	6.86
2018	4.23	0.99	0.10	0.02	1.50	6.86
2019	3.96	1.02	0.07	0.03	1.44	6.51
2020	1.81	0.93	0.06	0.04	1.28	4.12
2021	2.21	0.91	0.05	0.04	1.25	4.46
2022	1.69	0.96	0.05	0.03	1.41	4.15

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, other ore and mineral industries (the aluminum industry, the asphalt paving industry, the cement and concrete industry, foundries, the iron and steel industry and iron pelletizing), 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 (2024) [Air Pollutant Emissions Inventory](#).

Table A.8. Data for Figure 10. Cadmium emissions to air by province and territory, Canada, 1994, 2012 and 2022

Province or territory	1994 (emissions in tonnes)	2012 (emissions in tonnes)	2022 (emissions in tonnes)
Newfoundland and Labrador	0.03	0.10	0.07
Prince Edward Island	0.01	0.01	0.01
Nova Scotia	0.07	0.06	0.04
New Brunswick	1.94	1.58	0.04
Quebec	5.39	1.70	1.62
Ontario	2.40	3.64	1.30
Manitoba	59.78	1.34	0.09
Saskatchewan	0.11	0.08	0.08
Alberta	0.36	0.82	0.58
British Columbia	4.74	0.26	0.29
Yukon	< 0.01	< 0.01	< 0.01
Northwest Territories	0.01 ^[A]	0.01	0.01
Nunavut	n/a	< 0.01	< 0.01
Unspecified region ^[B]	1.08	n/a	n/a
Canada	75.93	9.60	4.15

Note: n/a = not applicable. ^[A] Value for 1994 includes emissions from Nunavut, which was officially separated from the Northwest Territories in 1999. ^[B] Legacy data for 1994 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. To access all available years data please refer to the indicator's [interactive figures](#) or, for the full dataset, to the [Air Pollutant Emissions Inventory](#).

Source: Environment and Climate Change Canada (2024) [Air Pollutant Emissions Inventory](#).

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