Environment and Climate Change Canada
Environnement et Changement climatique Canada

AIR POLLUTANT EMISSIONS

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

Canada

Suggested citation for this document: Environment and Climate Change Canada (2024) Canadian Environmental Sustainability Indicators: Air pollutant emissions. Consulted on *Month day, year*. Available at: www.canada.ca/en/environment-climate-change/services/environmental-indicators/air-pollutant-emissions.html

Cat. No.: En4-144/22-2024E-PDF
ISBN: 978-0-660-70445-6
Project code: EC24019

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Aussi disponible en français

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

AIR POLLUTANT EMISSIONS

June 2024

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Air pollutant emissions

Air pollution problems, such as smog and acid rain, result from the release of pollutants into the atmosphere. These pollutants can affect Canadians' health, the environment, buildings, structures and the economy. The majority of these pollutants are released through human activities, such as transportation, the burning of fuels for electricity and heating, and a variety of industrial activities. The indicators on sulphur oxides (SO_X), nitrogen oxides (NO_X), volatile organic compounds (VOCs), carbon monoxide (CO), ammonia (NH_3), fine particulate matter ($PM_{2.5}$) and black carbon, a component of $PM_{2.5}$, report emissions released through human activities.

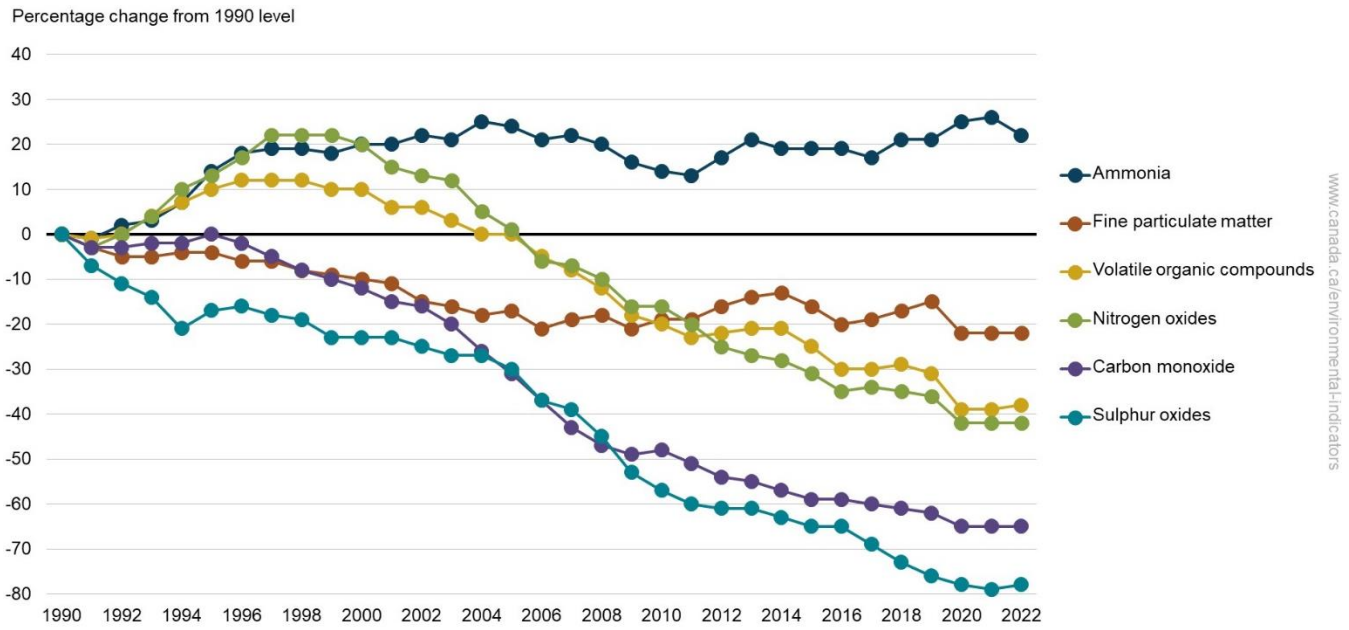
National air pollutant trends

This section presents a summary of Canada's emissions of 6 key air pollutants between 1990 to 2022 along with highlights of the main sources and provincial and territorial distributions for 2022. Detailed analysis by pollutant, including black carbon, along with information on emissions from 3 of the largest source sectors in Canada is presented following the indicators.

Key results

- In 2022, emissions of 5 key air pollutants were lower than in 1990:
  - SO_X 78% lower
  - NO_X 42% lower
  - VOCs 38% lower
  - CO 65% lower, and
  - $PM_{2.5}$ 22% lower
- Emissions of NH_3 were 22% higher in 2022 than in 1990

Figure 1. Air pollutant emissions, Canada, 1990 to 2022



Data for Figure 1

Note: This indicator reports emissions of 6 key air pollutants from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. Emissions from black carbon, a component of $PM_{2.5}$, are also not included. Consult the black carbon section for a detailed analysis of the pollutant or the interactive figures to explore the national results and emissions from black carbon in a dynamic and customizable format.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

The years 2020 and 2021 were marked by the COVID-19 pandemic. This coincides with decreases in emissions between the years 2019 and 2020 for all the pollutants except for NH_3. In 2021, the second year of the pandemic,

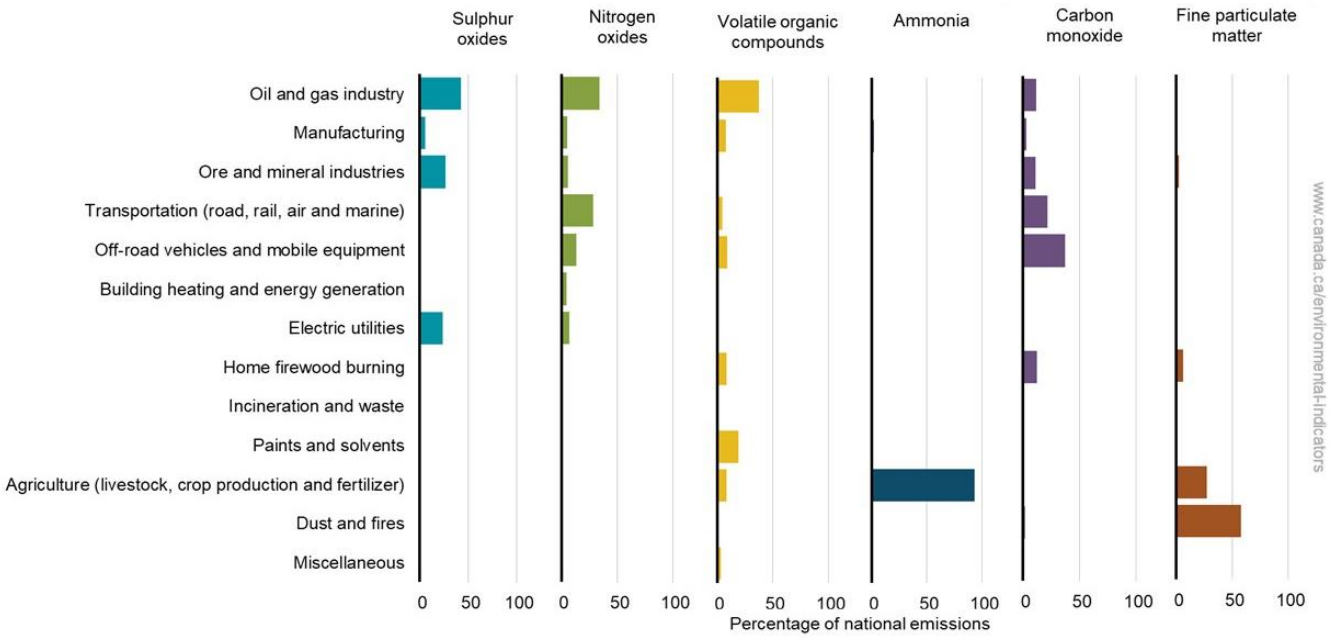
most of the pollutant emissions increased compared to 2020 levels but stayed below their 2019 pre-pandemic levels. The following year, 2022, has shown decreases in CO, NH_3, NOx and $PM_{2.5}$ compared to 2021. In contrast, emissions of SOx and VOCs increased between 2021 and 2022. For all pollutants except NH_3, emissions in 2022 remained below 2019 pre-pandemic levels.

Air pollutant emissions by source

Key results

- In 2022, the largest sources of emissions of the 6 key air pollutants in Canada were the oil and gas industry, transportation, off-road vehicles and mobile equipment, agriculture, and dust and fires (for example, road dust, dust from construction operations and prescribed burning, but excluding forest fires)

Figure 2. Distribution of air pollutant emissions by source, Canada, 2022



Data for Figure 2

Note: The indicator reports emissions of 6 key air pollutants from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. Emissions from black carbon, a component of $PM_{2.5}$, are also not included. Consult the black carbon section for a detailed analysis of the pollutant. The category "dust and fires" includes emissions from human activities such as prescribed burning and dust from roads. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

In 2022, the human-made sources most contributing to Canada's air pollutant emissions were the following:

- the oil and gas industry, electric utilities and ore and mineral industries together represented the majority of SO_X emissions
- the oil and gas industries, transportation (road, rail, air and marine) and off-road vehicles and mobile equipment were key sources of NO_X emissions
- most of the VOC emissions came from the oil and gas industry and from the use of paints and solvents
- agriculture (livestock, crop production and fertilizer) accounted for the majority of NH_3 emissions
- off-road vehicles and mobile equipment, transportation, home firewood burning, and the oil and gas industry were major sources of CO emissions
- dust and fires were the most important sources of $PM_{2.5}$ emissions, agriculture being the second largest source

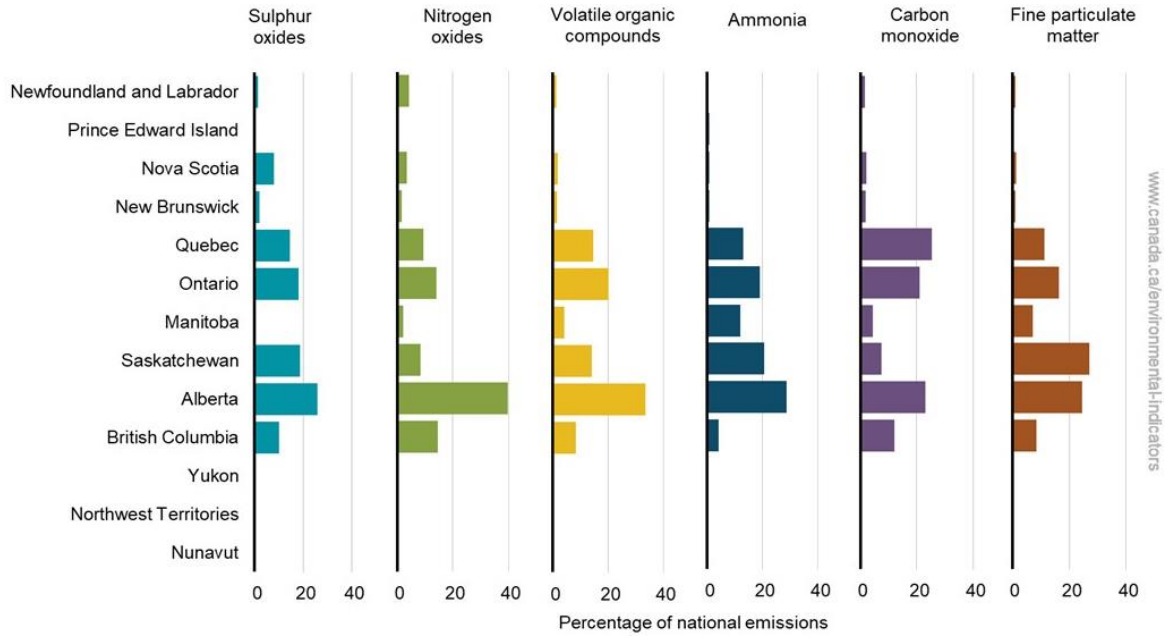
Air pollutant emissions by province and territory

Key results

At the provincial and territorial level, emissions of the 6 key air pollutants in 2022 were:

- the highest in Alberta for SO_X (26% of national emissions), NO_X (40%), VOCs (34%), and NH_3 (29%); second highest for CO (23%) and $PM_{2.5}$ (25%)
- the highest in Quebec for CO (25%)
- the highest in Saskatchewan for $PM_{2.5}$ (27%); second highest for SO_X (19% of national emissions) and NH_3 (21%)
- the second highest in Ontario for VOCs (20% of national emissions)
- also important in British Columbia for NO_X, accounting for 15% of the national emissions of this pollutant, Quebec for VOCs, accounting for 15% of the national emissions of this pollutant and in Ontario for SO_X, NH_3, NO_X, CO, $PM_{2.5}$, accounting for 18%, 19%, 14%, 21%, and 17% of the national emissions of these pollutants

Figure 3. Distribution of air pollutant emissions by province and territory, Canada, 2022



Data for Figure 3

Note: The indicator reports emissions of 6 key air pollutants from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. Emissions from black carbon, a component of $PM_{2.5}$, are also not included. Consult the black carbon section for a detailed analysis of the pollutant.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

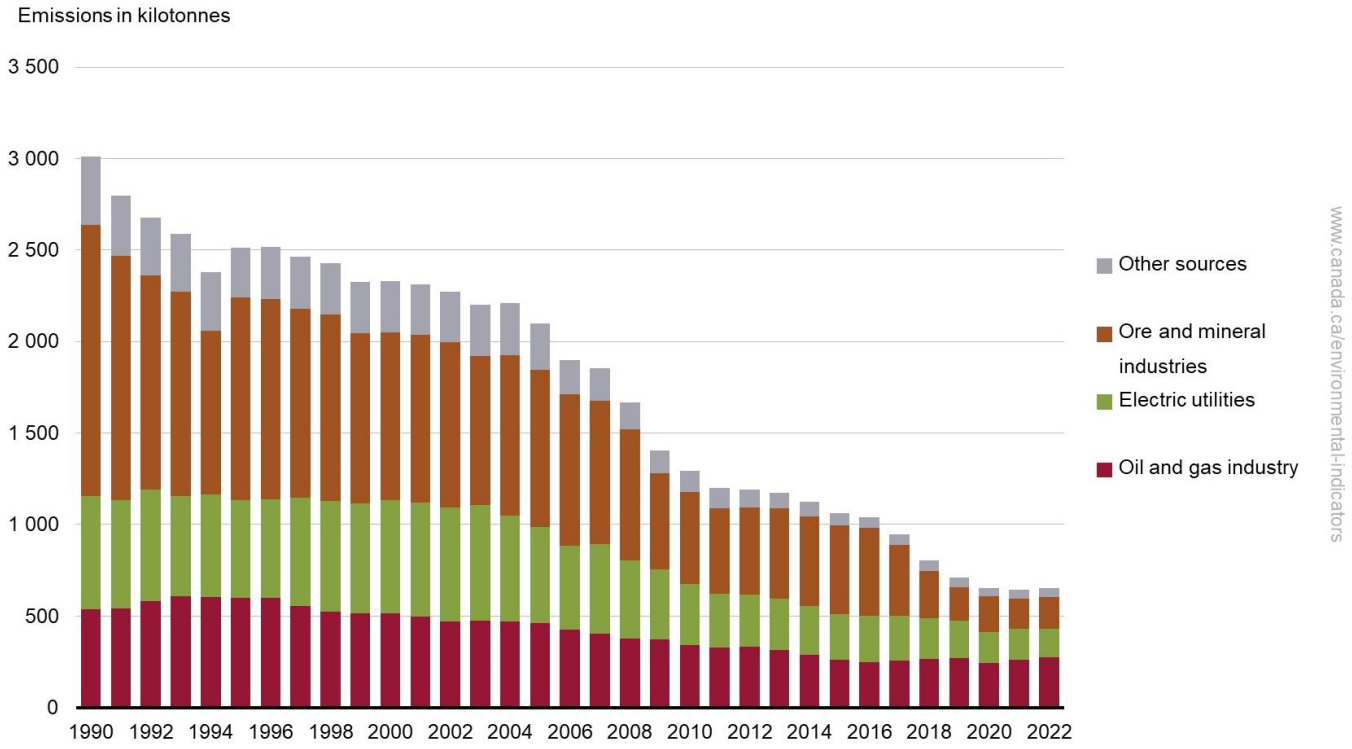
Sulphur oxide emissions by source

Emissions of sulphur oxides (SO_X) in the atmosphere can have adverse effects on human health and the environment. The SO_X emissions released by human activities consist mostly of sulphur dioxides (SO_2). Sulphur dioxide can affect respiratory systems of humans and animals and cause damage to vegetation, buildings and materials. It also contributes to the formation of fine particulate matter ($PM_{2.5}$) and acid rain.

Key results

- Between 1990 and 2022, SO_X emissions decreased by 78% from 3 012 kilotonnes (kt) to 652 kt
- In 2022, 3 sources accounted for 93% (604 kt) of the total SO_X emissions: the oil and gas industry, electric utilities and ore and mineral industries

Figure 4. Total sulphur oxide emissions by source, Canada, 1990 to 2022



Data for Figure 4

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from transportation (road, rail, air and marine), off-road vehicles and mobile equipment, home firewood burning, incineration and waste, agriculture (livestock, crop production and fertilizer), dust and fires, paints and solvents, building heating and energy generation, manufacturing, and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. New interactive figures provide a dynamic and customizable format to explore the emissions.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

In 2022, the oil and gas industry accounted for approximately 42% of total national SO_X emissions (275 kt). Electric utilities and ore and mineral industries followed with 24% (154 kt) and 27% (175 kt) of national emissions. For the ore and mineral industries, 41% (73 kt) of its SO_X emissions came from the non-ferrous refining and smelting industry.

The largest reduction in emissions between 1990 and 2022 was from ore and mineral industries with a reduction in emissions of approximately 1 308 kt. The largest driver of the reduction from this source was from the non-ferrous refining and smelting industry with a reduction of 1 193 kt over the period.

This significant decrease in SO_X emissions from 1990 to 2022 (78%) is due in large part to government actions to fight acid rain and related federal-provincial and United States agreements[1,2] on capping SO_X emissions by 1994. Further reductions were also realized through:

- technological upgrades, new air pollution controls for non-ferrous metal smelters and the closure of 4 major smelters in Manitoba, Ontario, Quebec and New Brunswick
- lower emissions from fossil-fuel-fired (for example, coal-fired) power-generating utilities as a result of better technologies and plant closures (for example, the phase-out of coal electricity generation in Ontario)
- implementation of regulations on low-sulphur fuels[3,4]

More recently, between 2021 and 2022, SO_X emissions have declined due to decreases in emissions from the electric utilities industry of 15 kt (9%). In contrast, an increase in SO_X emissions was observed for ore and mineral industries (13 kt, 8%), oil and gas industry (12 kt, 5%) and other sources (0.1 kt, <1%).

Sulphur oxide emissions by province and territory

Key results

- In 2022, Alberta and Saskatchewan accounted for 45% (293 kt) of national SO_X emissions
- Between 1990 and 2022
    - the largest reductions were observed in Ontario and Manitoba. Emissions in these provinces decreased by 1 006 kt (89%) and 507 kt (99.6%), respectively
    - Saskatchewan was the only province that experienced an increase in SO_X (20% or 20 kt)

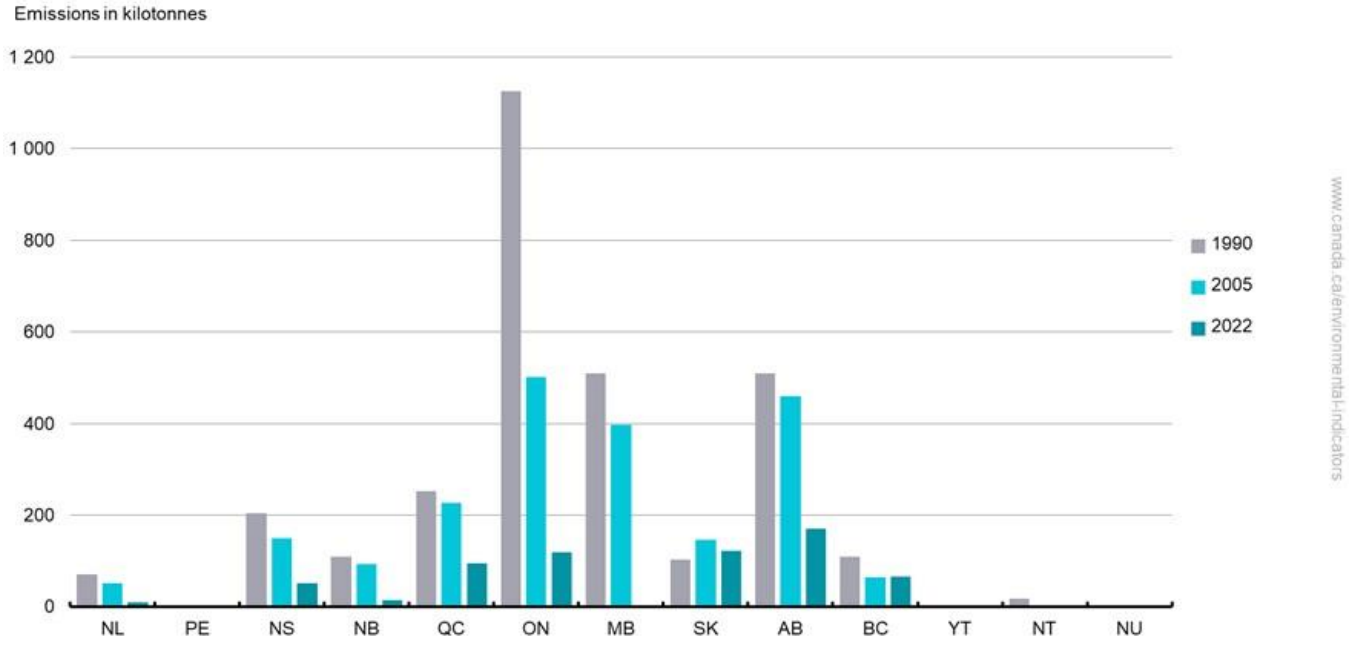
[1] Environment and Climate Change Canada (1991) Canada-United States Air Quality Agreement. Retrieved on March 18, 2024.

[2] Canadian Council of Ministers of the Environment (1998) The Canada-Wide Acid Rain Strategy for Post-2000. Retrieved on March 18, 2024.

[3] Environment and Climate Change Canada (2020) Sulphur in Gasoline Regulations. Retrieved on March 18, 2024.

[4] Environment and Climate Change Canada (2017) Sulphur in Diesel Fuel Regulations. Retrieved on March 18, 2024.

Figure 5. Sulphur oxide emissions by province and territory, Canada, 1990, 2005 and 2022



Data for Figure 5

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Alberta had the highest SO_X emissions level in 2022, accounting for 26% (170 kt) of total national emissions. Emissions in the province mainly came from the oil and gas industry and electric utilities, combined, accounting for 94% (161 kt) of the emissions. Between 2005 and 2022, the province experienced a 63% decline in emissions (289 kt) with the oil and gas industry, notably reductions from natural gas processing and oil sands mining extraction and processing, accounting for a large part of the reductions since 2005.

Saskatchewan was the second-highest emitter of SO_X in 2022, accounting for 19% (123 kt) of total national emissions. Emissions from electric utilities, specifically coal electric power generation, was the largest contributor to SO_X emissions in the province.

Ontario ranked third, with 18% (119 kt) of total national emissions of SO_X; the ore and mineral industries sector was the most important source of emissions in the province in 2022.

Sulphur oxide emissions by facilities

The National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities that meet its reporting criteria.[5]

The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore SO_X emissions from individual facilities.

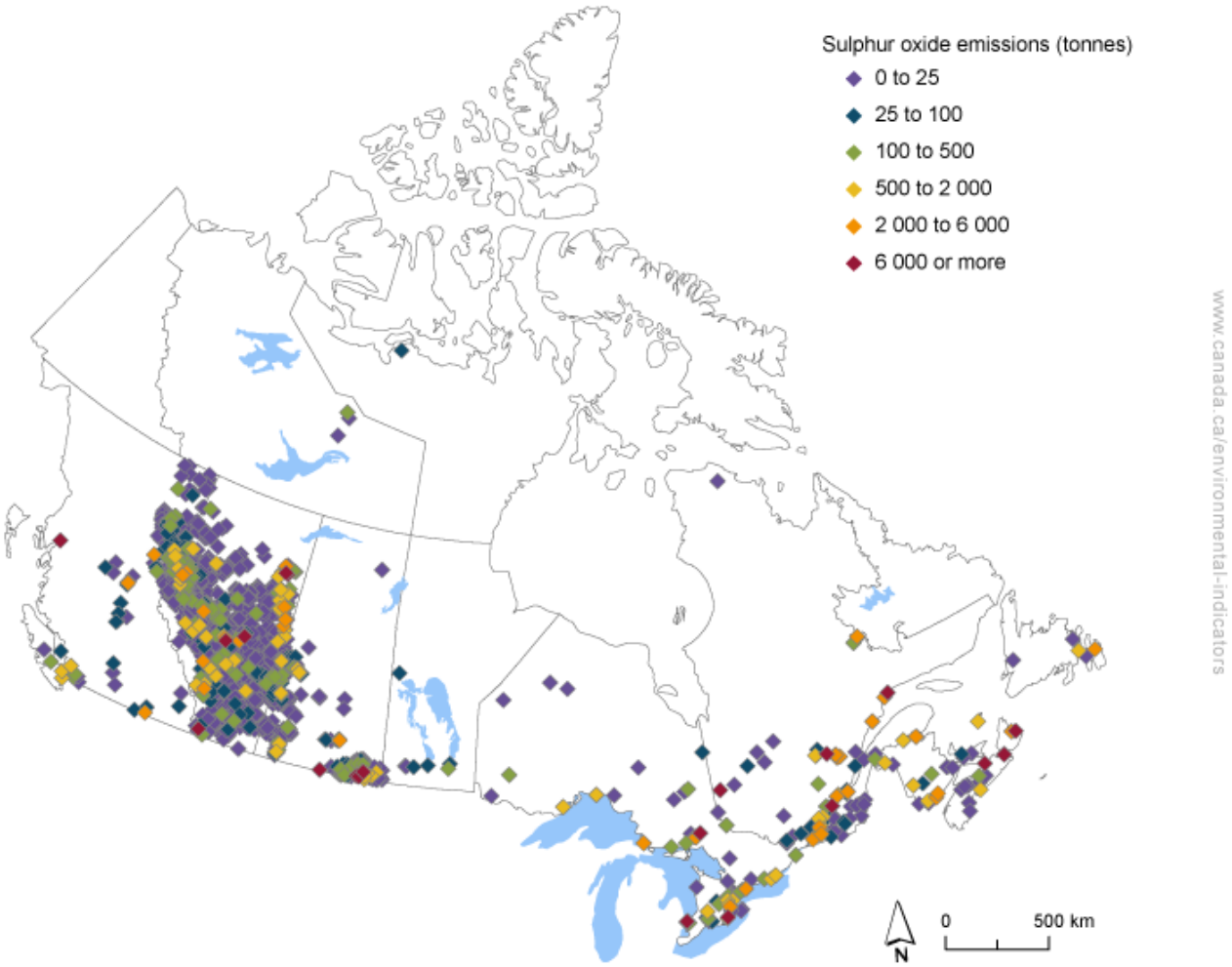
Key results

- In 2022, 2 391 facilities across Canada reported SO_X emissions representing 88% of total national emissions. Of these facilities:
  - 1 967 facilities reported emissions under 25 tonnes (t)
  - 406 facilities reported emissions between 25 to 6 000 t

[5] The National Pollutant Release Inventory only collects data for sulphur dioxide (SO_2), which is the predominant member of the SO_X group of gases.

- 18 facilities reported emissions of 6 000 t or more located in Ontario (5), Alberta (4), Quebec (3), Saskatchewan (3) and Nova Scotia (3)

Figure 6. Sulphur oxide emissions by reporting facilities, Canada, 2022



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

Navigate data using the interactive map

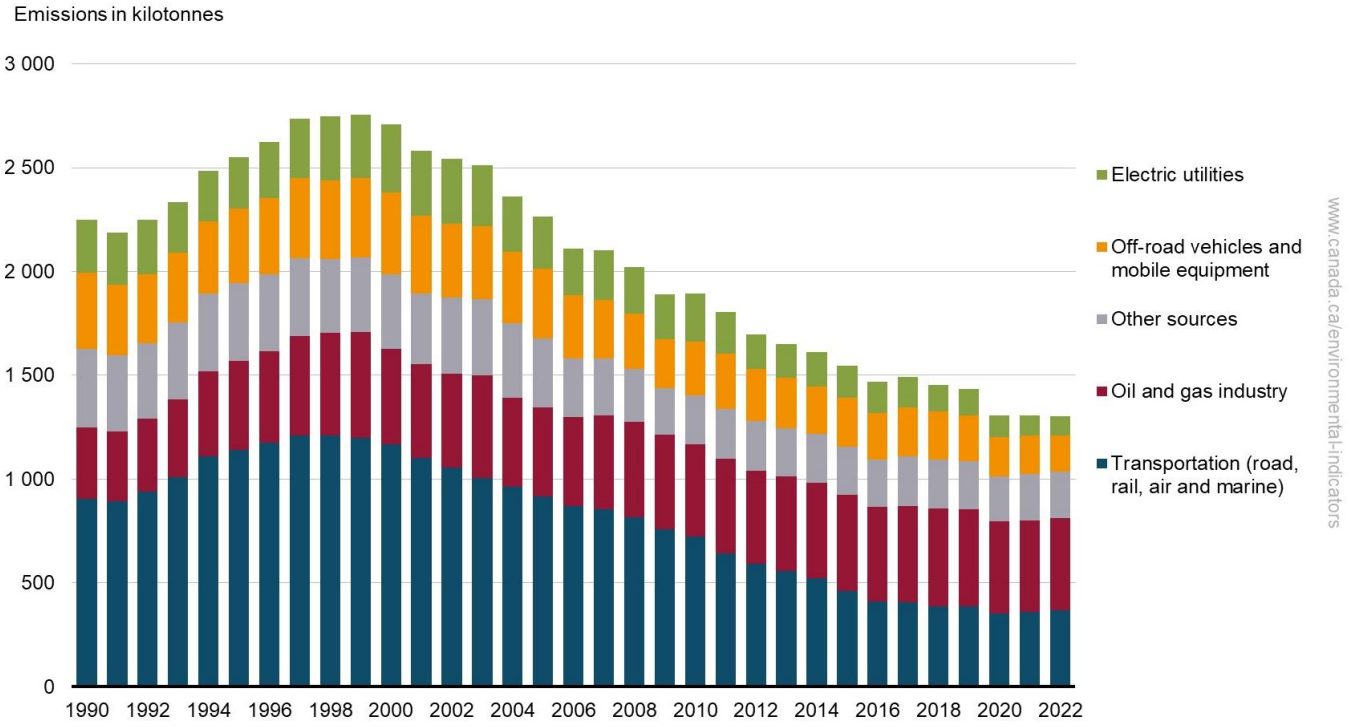
Nitrogen oxide emissions by source

Nitrogen oxides (NO_X) include emissions of nitric oxide (NO) and nitrogen dioxide (NO_2). Nitrogen dioxide can have adverse effects on human health and the environment. Nitrogen oxides contribute to acid rain, which can lead to the acidification of aquatic and terrestrial ecosystems. It also contributes to the eutrophication of lakes and to the formation of ground-level ozone (O_3) and fine particulate matter ($PM_{2.5}$).

Key results

- In 2022, NO_X emissions were 1 303 kilotonnes (kt); this is 42% lower than in 1990
- The oil and gas industry was the largest source of NO_X representing 34% (443 kt) of total emissions in 2022

Figure 7. Total nitrogen oxide emissions by source, Canada, 1990 to 2022



Data for Figure 7

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from ore and mineral industries, manufacturing, building heating and energy generation, home firewood burning, incineration and waste, agriculture (livestock, crop production and fertilizer), dust and fires, paints and solvents, and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. New interactive figures provide a dynamic and customizable format to explore the emissions.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

The oil and gas industry was the largest contributor of NO_X emissions between 1990 and 2022. Emissions of NO_X from this sector increased by 100 kt (29%) during that period.

The transportation (road, rail, air, and marine) sector emitted the next largest proportion of NO_X emissions in 2022, representing 28% (370 kt) of total national emissions. This sector also experienced the largest decrease in emissions (534 kt or 59%) between 1990 and 2022.

The decline in NO_X emissions between 1990 and 2022 is mostly attributable to 2 factors:

- the reduction in emissions from transportation after 2000, given the progressive introduction of cleaner technology and fuels for vehicles

- lower emissions from fossil-fuel-fired (for example, coal-fired) power-generating utilities as a result of better emission control technologies and certain plant closures (for example, the closure of coal power plants in Ontario)

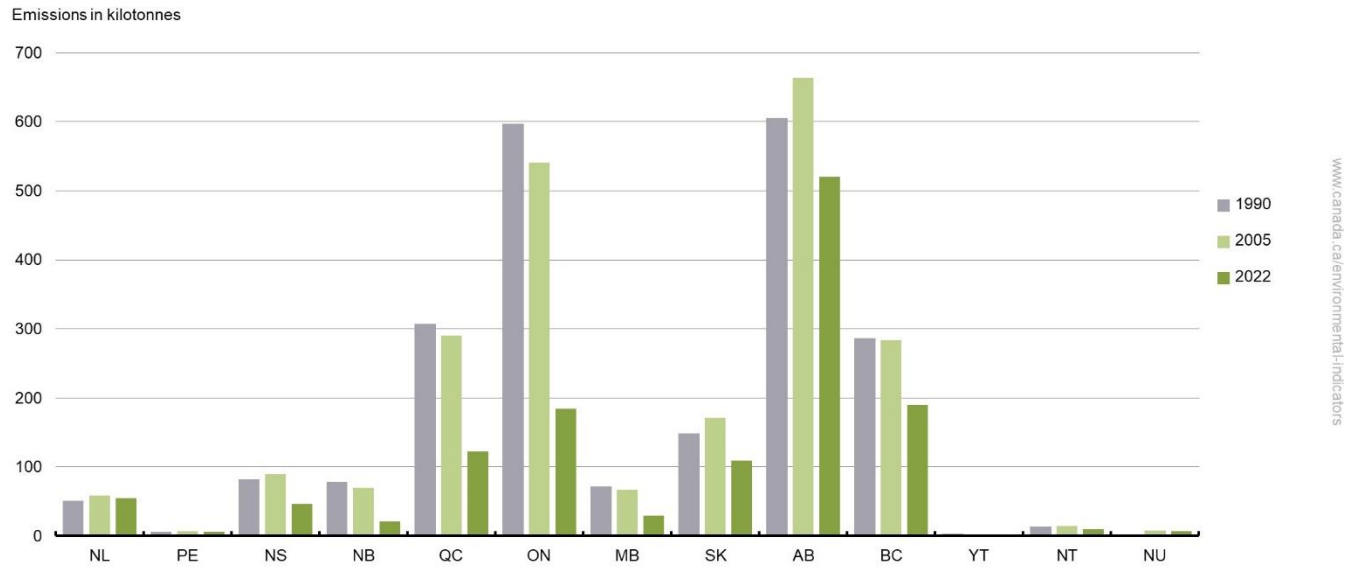
More recently, between 2021 and 2022, NO_X emissions from transportation (road, rail, air and marine) sources have increased by 7 kt (2%), notably from domestic marine navigation. Likewise, the oil and gas industry saw NOx emissions increase by 5 kt (1%) between 2021 and 2022.

Nitrogen oxide emissions by province and territory

Key results

- In 2022, among provinces and territories, Alberta emitted the most NO_X. The province accounted for 40% (520 kt) of national emissions
- Between 1990 and 2022,
  - the largest reduction was observed in Ontario. Emissions decreased by 413 kt (69%) in the province
  - NO_X emissions increased in Newfoundland and Labrador by 7% (4 kt) and in Northwest Territories and Nunavut by 26% (4 kt)[6]

Figure 8. Nitrogen oxide emissions by province and territory, Canada, 1990, 2005 and 2022



Data for Figure 8

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

The oil and gas industry is an important source of NO_X emissions in Alberta, accounting for 66% (345 kt) of the province's NO_X emissions in 2022. The increasing contribution of this sector to the province's emissions between 1990 and 2022 was more than offset by emission reductions from the transport and electric utilities sectors.

British Columbia and Ontario contributed the second and third largest proportions of NO_X emissions in 2022, with British Columbia accounting for 15% (190 kt) and Ontario accounting for 14% (184 kt) of total national emissions, with transportation (road, rail, air and marine) being the most important source in both provinces followed by the oil and gas industry in British Columbia and off-road vehicles and mobile equipment in Ontario. However, Ontario experienced the largest decrease in emissions (413 kt) between 1990 and 2022 in large part due to emission

[6] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999. Therefore, emissions for Northwest Territories and Nunavut are measured together and displayed as one value.

reductions from transportation (road, rail, air and marine), electric utilities, manufacturing, ore and mineral industries and off-road vehicles and mobile equipment. In Ontario, the majority of total NO_X emission reductions occurred between 2005 and 2022 (357 kt).

Quebec ranked fourth, with 9% (123 kt) of total national emissions. Transportation (road, rail, air and marine) was the most important source of NO_X in this province. Quebec also experienced a large decrease in emissions (167 kt) between 2005 and 2022 mainly due to emission reductions from transportation (road, rail, air and marine).

Nitrogen oxide emissions by facilities

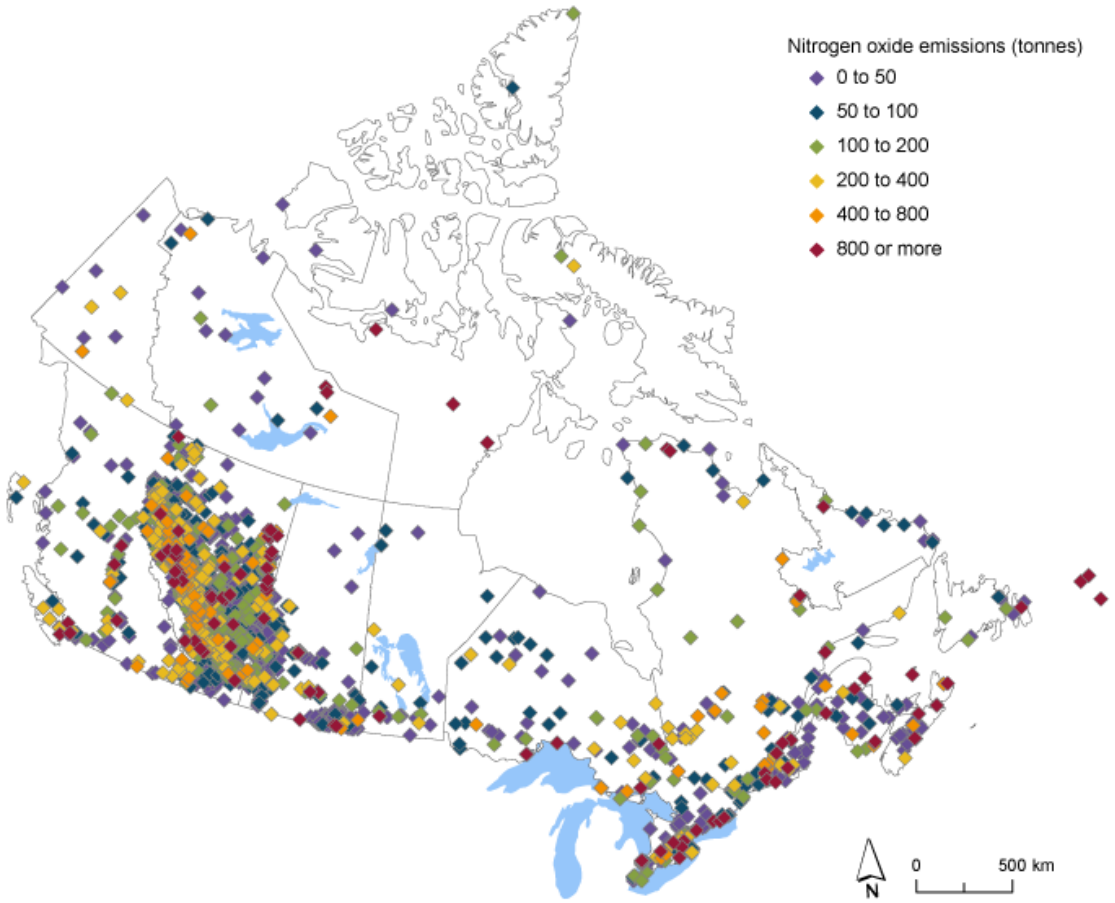
The National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities that meet its reporting criteria.

The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore NO_X emissions from individual facilities.

Key results

- In 2022, 3 646 facilities across Canada reported NO_X emissions representing 39% of total national emissions. Of these facilities:
  - 2 211 facilities reported emissions under 50 tonnes (t)
  - 1 313 facilities reported emissions between 50 to 800 t
  - 122 facilities reported emissions of 800 t or more located in Alberta (53), Ontario (19), Quebec (12), British Columbia (11), Saskatchewan (7), Newfoundland and Labrador (6), Nova Scotia (5), New Brunswick (4), Northwest Territories (2), Nunavut (2), and Manitoba (1)

Figure 9. Nitrogen oxide emissions by reporting facilities, Canada, 2022



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

Navigate data using the interactive map

Volatile organic compound emissions by source

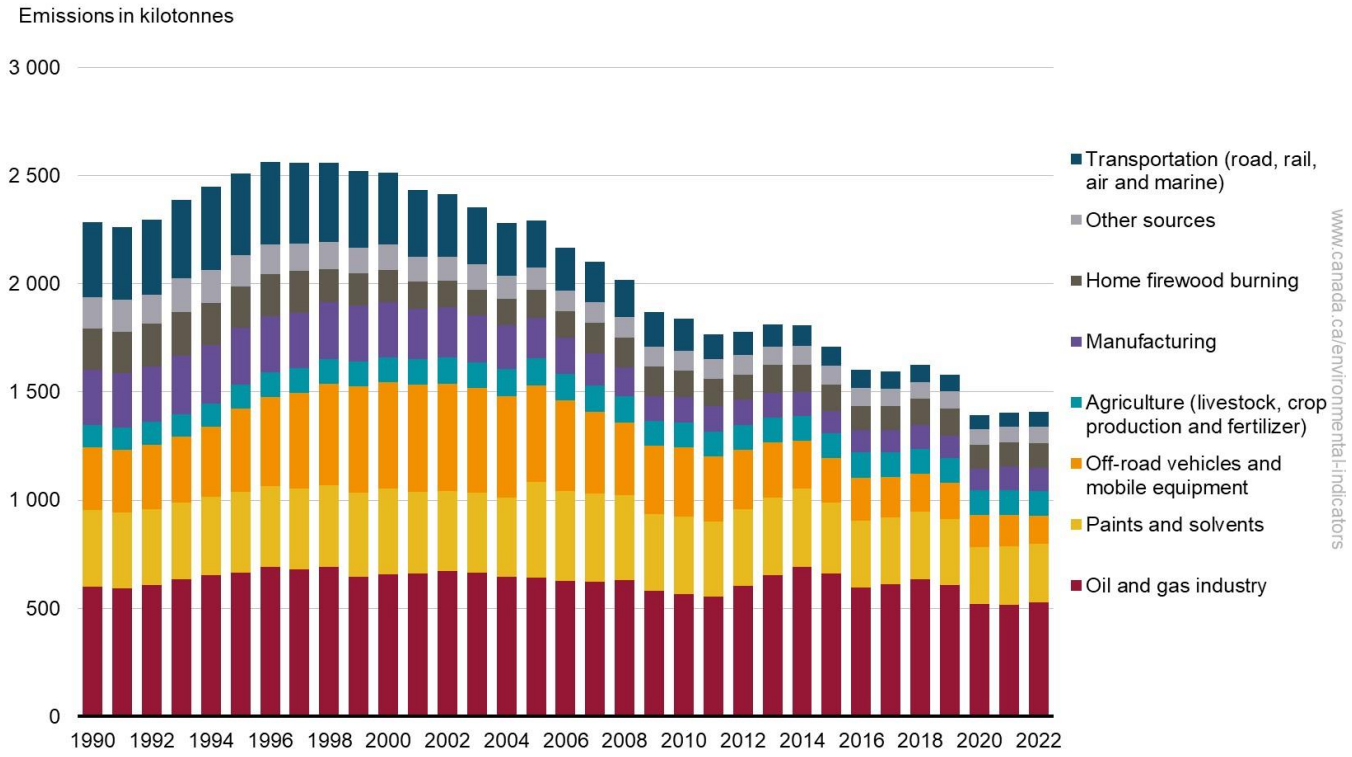
Volatile organic compounds (VOCs) are carbon-containing gases and vapours released into the atmosphere by natural sources and human activities.[7] There are hundreds of VOCs that are emitted and that affect the health of Canadians and the environment. VOCs are primary precursors to the formation of ground-level ozone and particulate matter which are the main pollutants contributing to the formation of smog.

Key results

- In 2022, VOC emissions in Canada were 1 407 kilotonnes (kt); this is a 38% (880 kt) decrease from 1990 levels
- Since 1990, the oil and gas industry has been the highest contributor to VOC emissions. In 2022, the sector accounted for 37% (526 kt) of total emissions

[7] Under the *Canadian Environmental Protection Act*, carbon dioxide, carbon monoxide, methane and chlorofluorocarbons are not considered volatile organic compounds.

Figure 10. Total volatile organic compound emissions by source, Canada, 1990 to 2022



Data for Figure 10

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from incineration and waste, ore and mineral industries, dust and fires, building heating and energy generation, electric utilities and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. New interactive figures provide a dynamic and customizable format to explore the emissions.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Apart from the oil and gas industry, paints and solvents, and off-road vehicles and mobile equipment were also important sources of VOC emissions in 2022 contributing 19% (271 kt) and 9% (131 kt) of total emissions, respectively.

The largest emissions reduction between 1990 and 2022 was from transportation (road, rail, air and marine), with emissions reductions of 281 kt (81%).

The long-term decrease in VOC emissions is mainly attributable to 3 factors:

- the progressive introduction of cleaner technologies and fuels resulting in emission reductions from transportation, off-road vehicles and mobile equipment
- emission reductions from most industrial and non-industrial sources from facility closures, decrease in production and improved emission controls
- lower levels of VOCs in products such as paints, solvents and cleaners

Compared to the previous year, VOC emissions increased by less than 2 kt (0.13%) in 2022. The largest increase was from the oil and gas industry 11 kt (2%), notably light medium crude oil production.

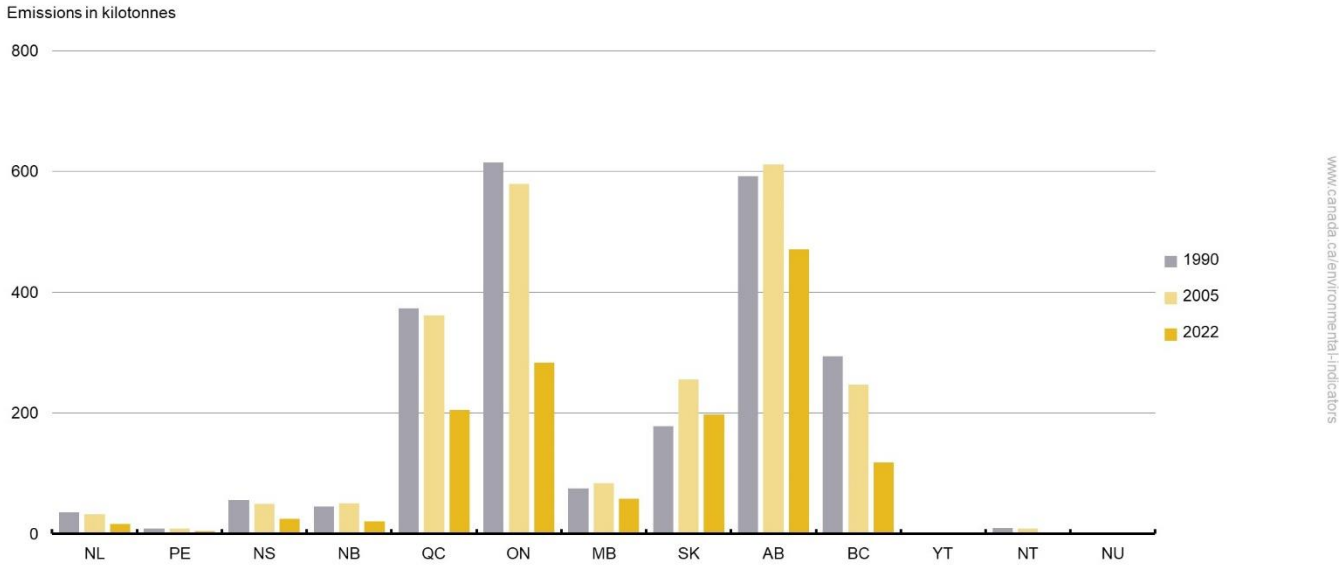
Volatile organic compound emissions by province and territory

Key results

- Alberta emitted the highest proportion of VOCs in 2022; the province represented 34% (472 kt) of national emissions

- Between 1990 and 2022,
    - Ontario experienced the largest reduction in VOC emissions; emissions in the province decreased by 330 kt (54%)
    - Saskatchewan was the only province that experienced an increase in VOC emissions, with 19 kt (11%), the oil and gas industry being responsible for the increase in emissions

Figure 11. Volatile organic compound emissions by province and territory, Canada, 1990, 2005 and 2022



Data for Figure 11

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Alberta was the highest emitting province of VOCs in 2022 (472 kt), with the oil and gas industry as the main source, contributing 72% (340 kt) of the province's emissions.

Ontario was the second-highest emitter of VOCs, accounting for 20% (284 kt) of total national emissions in 2022. The main emission sources are paints and solvents, off-road vehicles and mobile equipment, and manufacturing. Ontario also experienced the largest reduction in emissions, with 330 kt (-54%) between 1990 and 2022, mainly as a result of emission reductions from manufacturing and transportation (road, rail, air and marine). The majority of the reductions in Ontario occurred between 2005 and 2022 (295 kt).

Quebec was the third largest emitter, with 15% (205 kt) of total national emissions in 2022, where paints and solvents and home firewood burning collectively accounted for 52% of the emissions in that province.

Volatile organic compound emissions by facilities

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

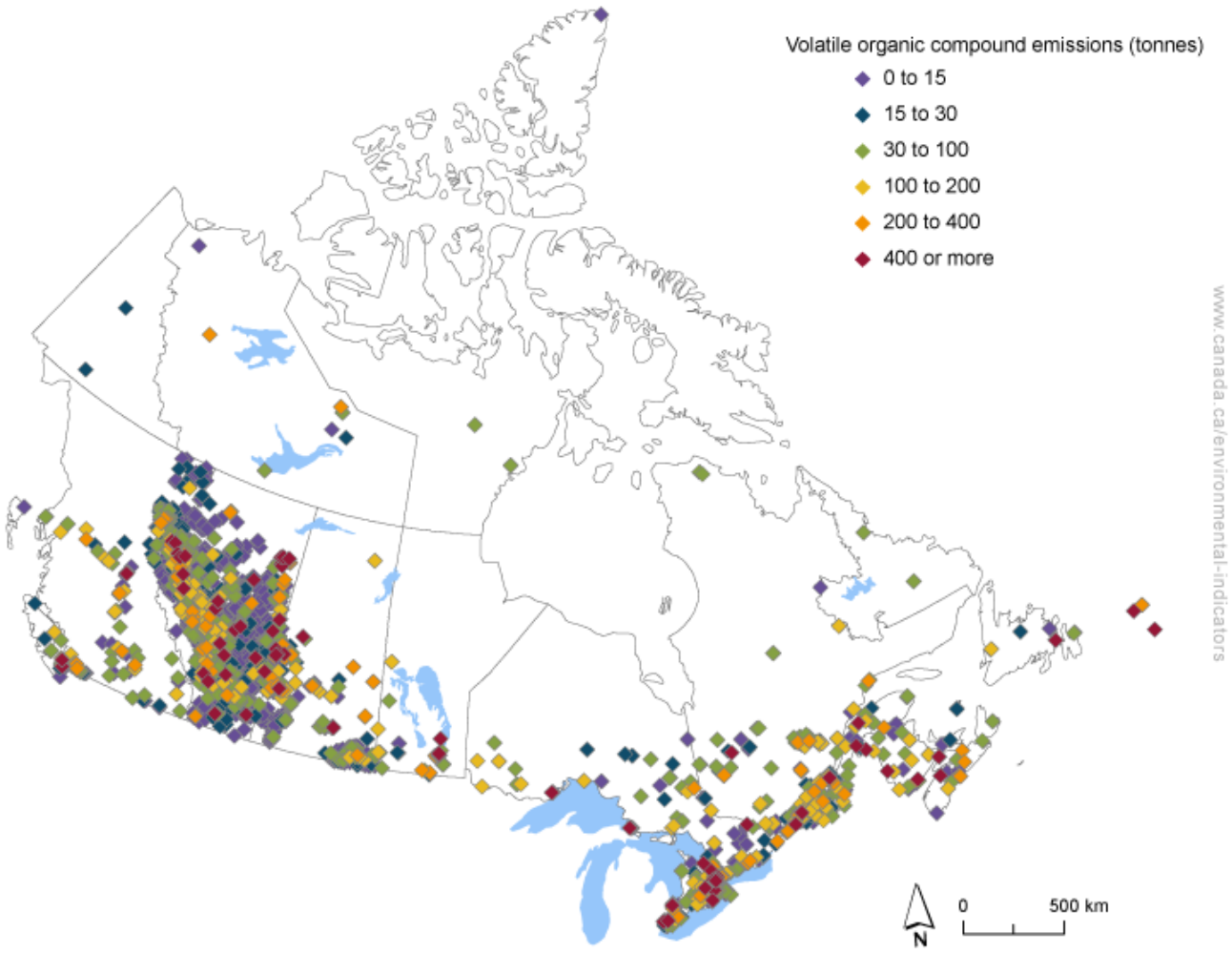
The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore VOC emissions from individual facilities.

Key results

- In 2022, 4 427 facilities across Canada reported VOC emissions representing 17% of total national emissions. Of these facilities:
    - 2 722 facilities reported emissions under 15 tonnes (t)
    - 1 626 facilities reported emissions between 15 to 400 t

- 79 facilities reported emissions of 400 t or more located in Alberta (31), Ontario (19), Saskatchewan (7), Quebec (7), British Columbia (6), Manitoba (3), New Brunswick (3), Newfoundland and Labrador (2) and Nova Scotia (1)

Figure 12. Volatile organic compound emissions by reporting facilities, Canada, 2022



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

Navigate data using the interactive map

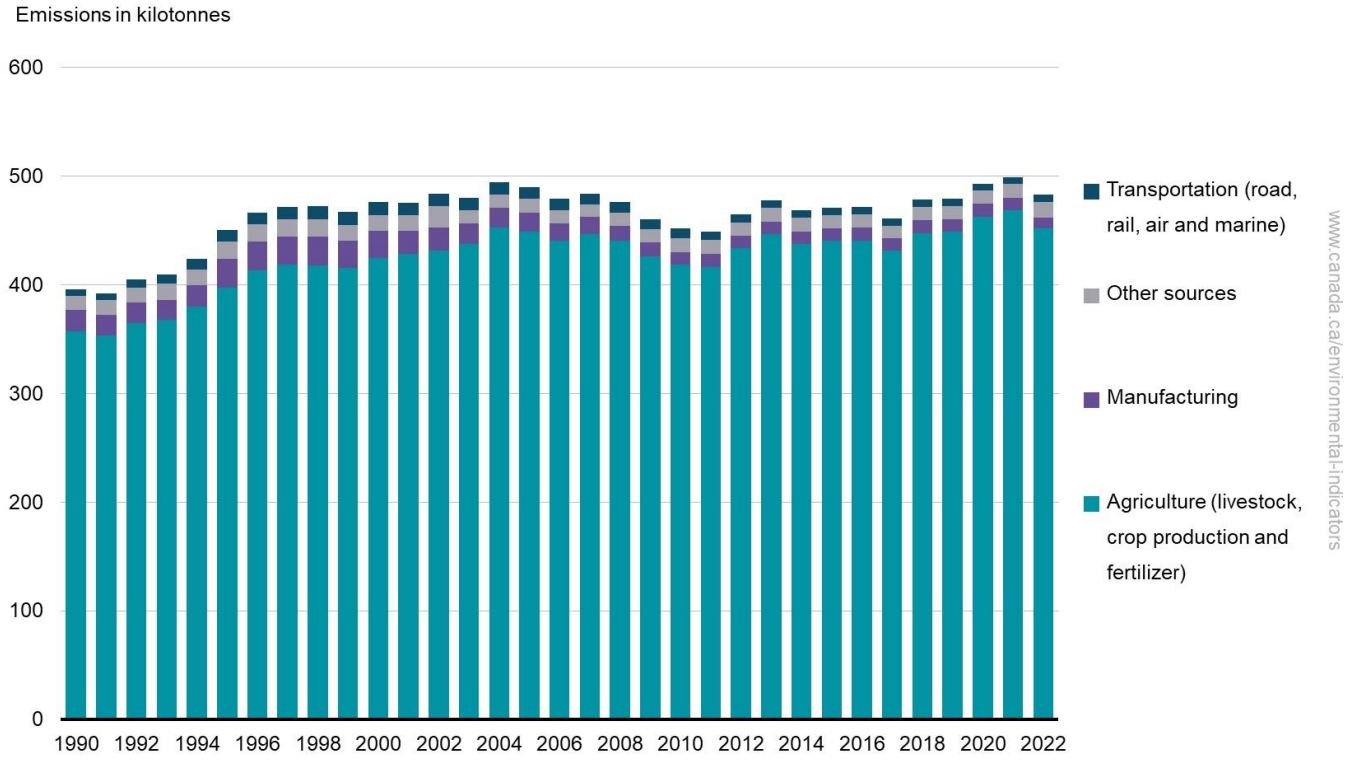
Ammonia emissions by source

Ammonia (NH_3) is a colourless gas with a noticeable odour at high concentrations. It can be poisonous if inhaled in great quantities and is irritating to the eyes, nose, and throat. It can also contribute to the nitrification and eutrophication of aquatic systems. In the air, the gas combines with sulphates and nitrates to form secondary fine particulate matter ($PM_{2.5}$).

Key results

- In 2022, NH_3 emissions were 482 kilotonnes (kt). This is 22% higher than in 1990
- Agriculture (livestock, crop production and fertilizer) was the main source of NH_3 emissions in 2022. Emissions from this source accounted for more than 94% (451 kt) of total national emissions

Figure 13. Total ammonia emissions by source, Canada, 1990 to 2022



Data for Figure 13

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from incineration and waste, the oil and gas industry, home firewood burning, ore and mineral industries, electric utilities, building heating and energy generation, off-road vehicles and mobile equipment, dust and fires, paints and solvents, and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. New interactive figures provide a dynamic and customizable format to explore the emissions.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Between 1990 and 2022, agriculture (livestock, crop production and fertilizer) experienced the largest increase (95 kt or 27%) in NH_3 emissions. It also remained the key source of NH_3 emissions throughout that period. Emissions from manufacturing (10 kt), other sources (7 kt), incineration and waste (7 kt) and transportation (road, rail, air and marine) (6 kt) combined represented 6% of national emissions in 2022.

The growth in NH_3 emissions from agriculture (livestock, crop production and fertilizer) between 1990 and 2022 is mainly due to the increased use of synthetic nitrogen fertilizers in crop production. Up to 2005, larger livestock populations also added to the growth. However, from 2006 to 2011, livestock populations decreased and NH_3

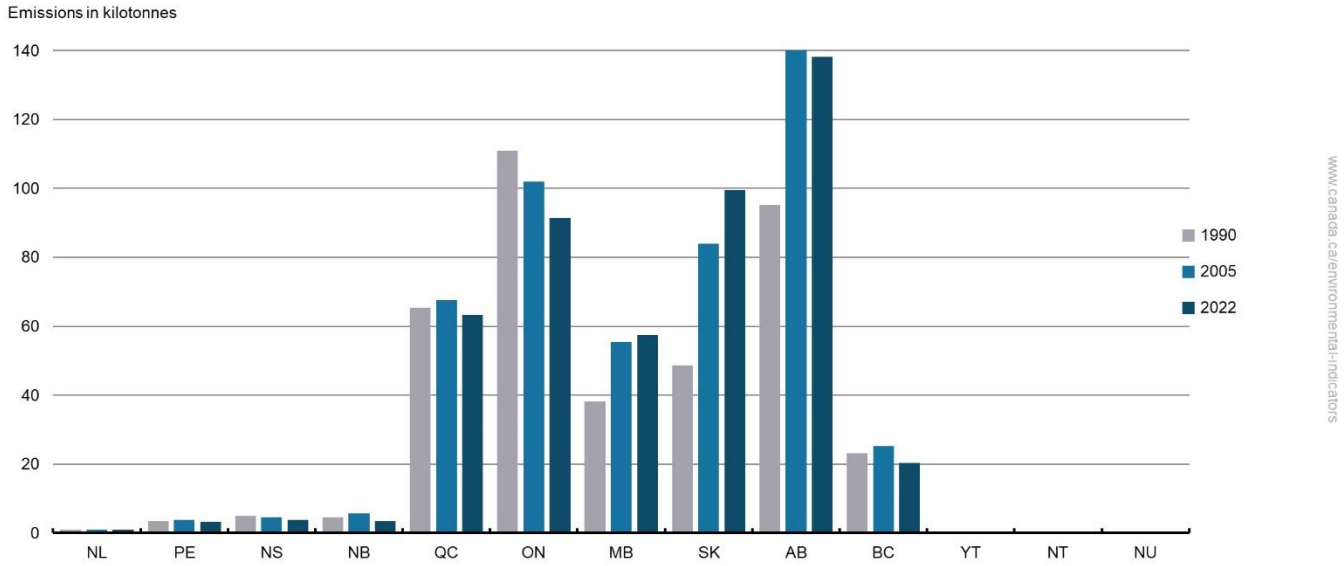
emissions from that source have since declined slowly. More recently, emissions from crop production have been steadily increasing since 2006.[8]

Ammonia emissions by province and territory

Key results

- In 2022, Alberta and Saskatchewan accounted for almost half (238 kt) of national NH_3 emissions
- Between 1990 and 2022,
  - Ontario experienced the largest emissions reduction with 20 kt (18%)
  - The largest increase in NH_3 emissions was in Saskatchewan with emissions more than doubling (a 51 kt increase)

Figure 14. Ammonia emissions by province and territory, Canada, 1990, 2005 and 2022



Data for Figure 14

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

In 2022, Alberta emitted the most NH_3 of all the provinces and territories, accounting for 29% (138 kt) of total national emissions. Saskatchewan contributed the second-largest proportion of NH_3, representing 21% (99 kt).

Ontario followed with 19% (91 kt) of total national emissions. Livestock farms and the application of fertilizers were the most important sources of NH_3 emissions.

Virtually almost all of the increase in emissions between 1990 and 2022 took place in Saskatchewan, Alberta and Manitoba.

Ammonia emissions by facilities

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

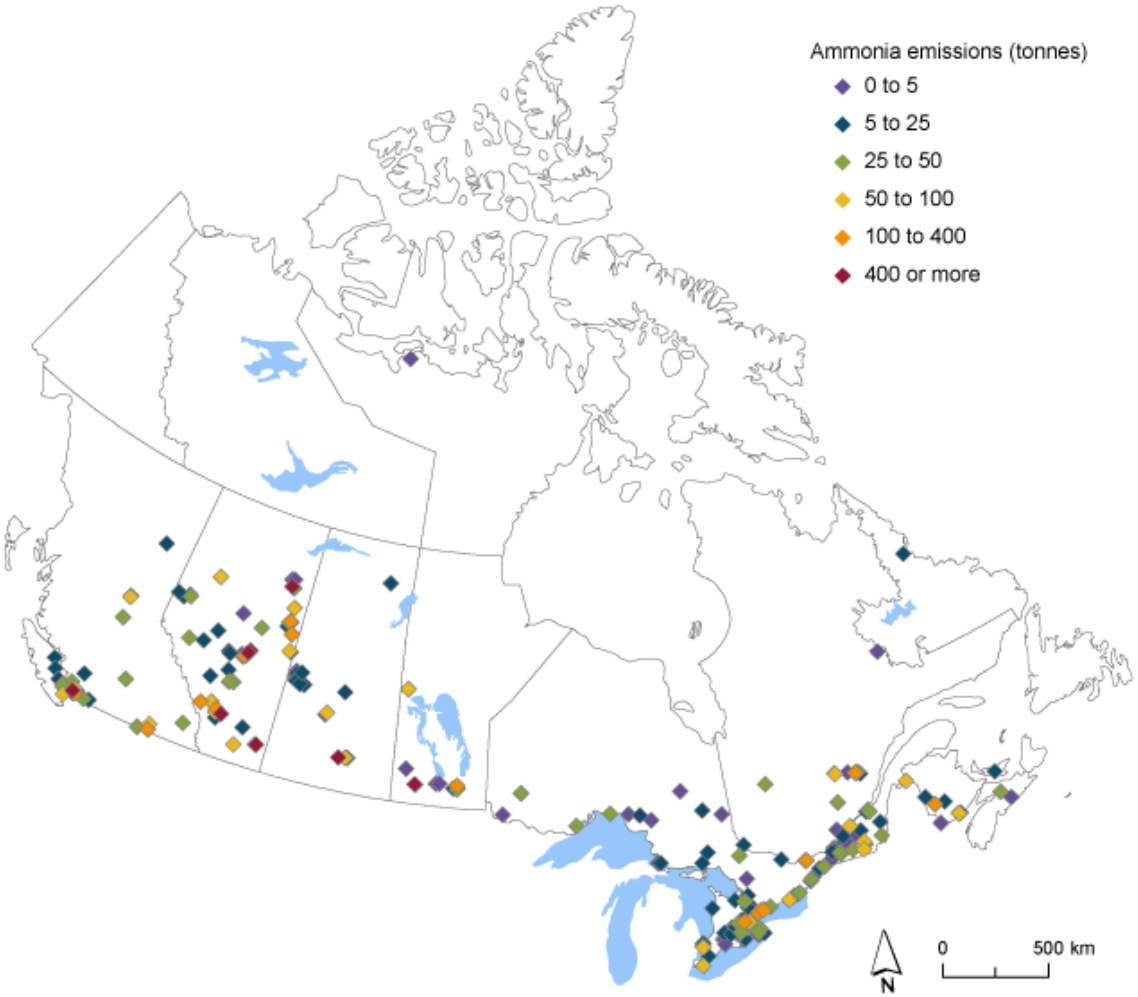
[8] Figure 2.6 in the Air Pollutant Emissions Inventory Report 2024 displays the 3 major contributors to national ammonia emissions; Animal Production, Crop Production and Other.

The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore NH_3 emissions from individual facilities.

Key results

- In 2022, 299 facilities across Canada reported NH_3 emissions representing 4% of total national emissions. Of these facilities:
  - 196 facilities reported emissions under 25 tonnes (t)
  - 95 facilities reported emissions between 25 to 400 t
  - 8 facilities reported emissions of 400 t or more located in Alberta (5), British Columbia (1), Manitoba (1) and Saskatchewan (1)

Figure 15. Ammonia emissions by reporting facilities, Canada, 2022



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

Navigate data using the interactive map

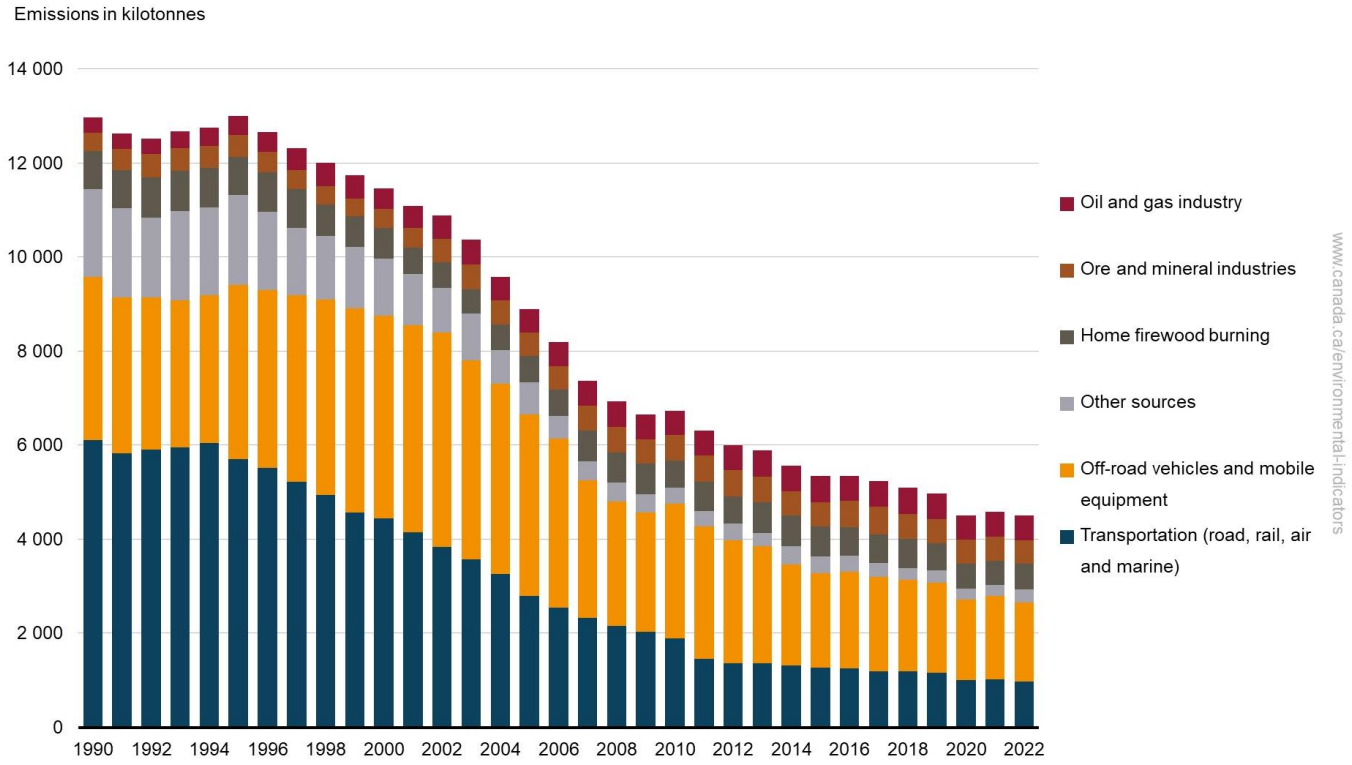
Carbon monoxide emissions by source

Carbon monoxide (CO) is a colourless, odourless, tasteless and poisonous gas. Once inhaled into the bloodstream, it can inhibit the blood's capacity to carry oxygen to organs and tissues, affecting human health.

Key results

- In 2022,
  - CO emissions in Canada were 4 499 kilotonnes (kt), a decrease of 65% from 1990 levels
  - Off-road vehicles and mobile equipment was the largest source of CO emissions in Canada, representing 37% (1 681 kt) of total emissions

Figure 16. Total carbon monoxide emissions by source, Canada, 1990 to 2022



Data for Figure 16

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from dust and fires, electric utilities, building heating and energy generation, incineration and waste, agriculture (livestock, crop production and fertilizer), paints and solvents, manufacturing and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. New interactive figures provide a dynamic and customizable format to explore the emissions.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

In 2022, transportation, and off-road vehicles and mobile equipment were the 2 most important sources of CO. These sources combined represented 59% (2 656 kt) of national emissions.

The largest reduction in emissions between 1990 and 2022 occurred in transportation (road, rail, air and marine) with an emission decrease of 5 125 kt (84%).

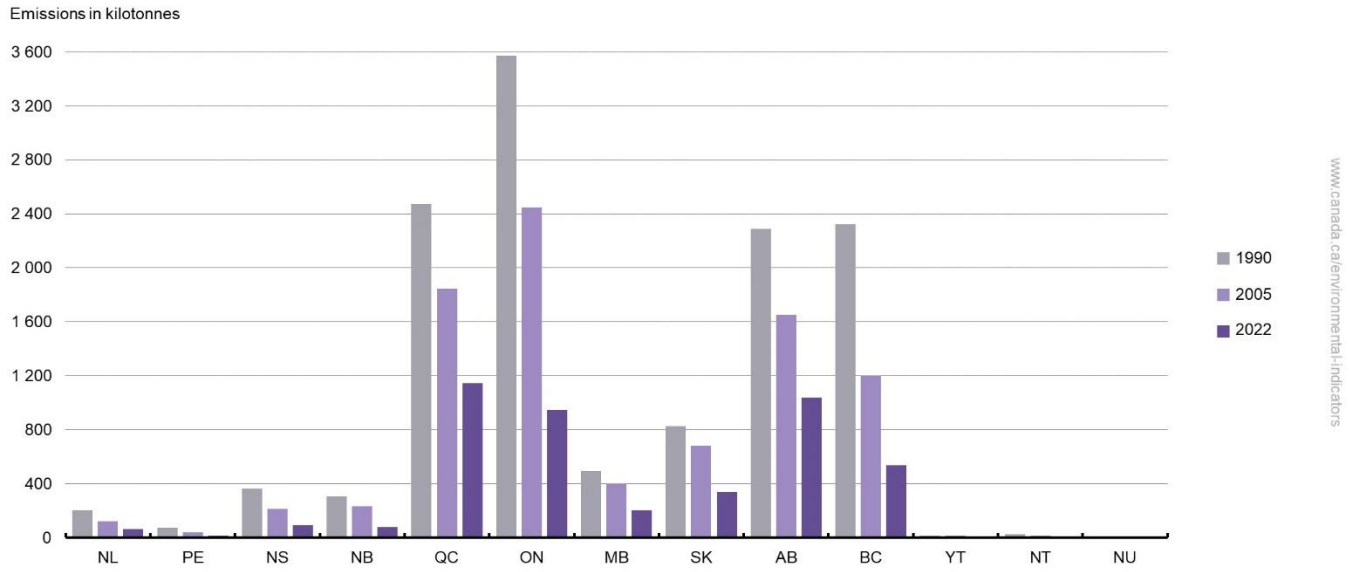
The decline in CO emissions between 1990 and 2022 is mainly due to increasingly stringent engine and vehicle regulations and the progressive introduction of cleaner and more efficient technology in vehicles (for example, catalytic converters).

Carbon monoxide emissions by province and territory

Key results

- In 2022, Quebec and Alberta accounted for 49% (2 186 kt) of national CO emissions
- Between 1990 and 2022,
    - all provinces and territories experienced reductions in emissions
    - the largest reductions occurred in Ontario (2 625 kt or 73%), British Columbia (1 782 kt or 77%) and Quebec (1 326 kt or 54%)

Figure 17. Carbon monoxide emissions by province and territory, Canada, 1990, 2005 and 2022



Data for Figure 17

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

In 2022, Quebec emitted the most CO of all the provinces and territories, representing 25% (1 144 kt) of the total national emissions. Ore and mineral industries, specifically the aluminum industry representing 92% (358 kt) of the source's emissions, was the most important source of CO emissions for Quebec.

The province of Alberta ranked second, with 23% (1 042 kt) of total national emissions in 2022, with 74% of those emissions from 2 sources, namely off-road vehicles and mobile equipment and the oil and gas industry.

Ontario, the third largest CO emitter, accounted for 21% (950 kt) of total national emissions. The off-road vehicles and mobile equipment sector accounted for 41% of the province's CO emissions.

The sharp decrease in emissions between 1990 and 2022 in all provinces and territories is mainly attributable to emission reductions from transportation (road, rail, air and marine). Some of the largest reductions occurred between 2005 and 2022, notably for Ontario, with emissions decreasing by 1 498 kt (61%).

Carbon monoxide emissions by facilities

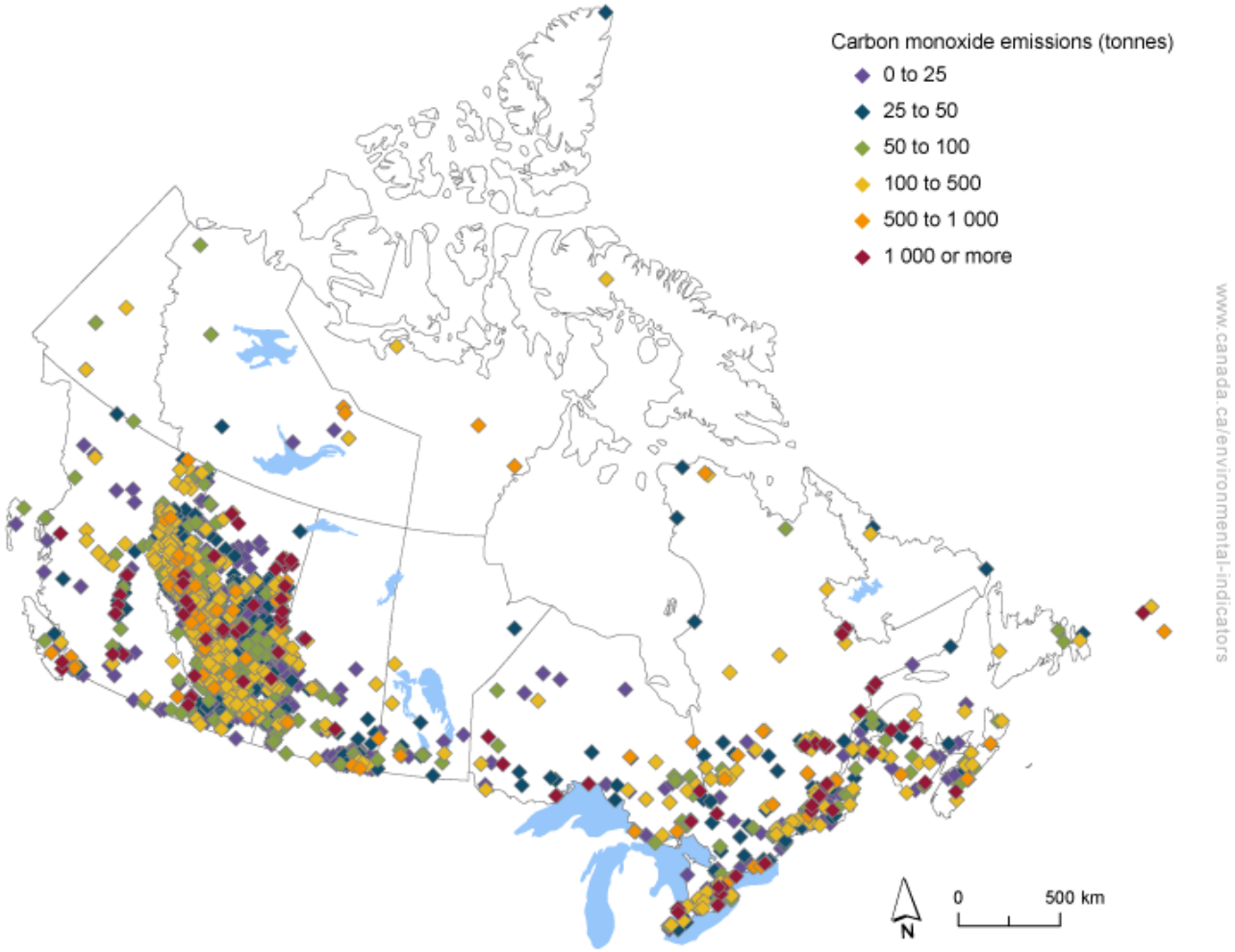
The National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities that meet its reporting criteria.

The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore CO emissions from individual facilities.

Key results

- In 2022, 3 490 facilities across Canada reported CO emissions representing 18% of total national emissions. Of these facilities:
  - 1 698 facilities reported emissions under 25 tonnes (t)
  - 1 701 facilities reported emissions between 25 to 1 000 t
  - 91 facilities reported emissions of 1 000 t or more located in Alberta (31), Quebec (19), Ontario (19), British Columbia (10), New Brunswick (5), Saskatchewan (5) and Newfoundland and Labrador (2)

Figure 18. Carbon monoxide emissions by reporting facilities, Canada, 2022



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

Navigate data using the interactive map

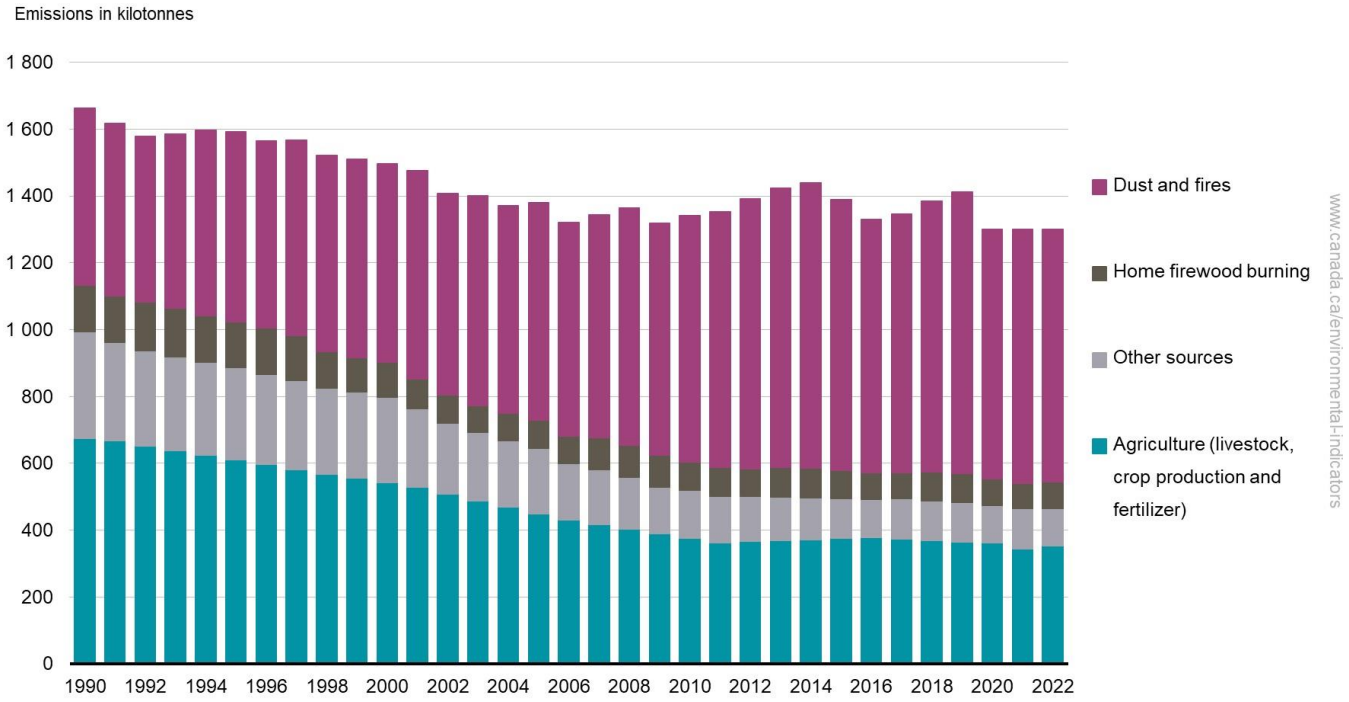
Fine particulate matter emissions by source

Particulate matter (PM) is directly emitted into the air in solid or liquid form. It is also formed in the air from precursor substances such as sulphur oxides, nitrogen oxides, volatile organic compounds and ammonia.[9] Fine particulate matter ($PM_{2.5}$) refers to particulate matter with a size of less than 2.5 micrometres (also called microns). It is one of the major components of smog. When inhaled deeply into the lungs, even small amounts of $PM_{2.5}$ can cause serious health problems. It can also damage vegetation and structures, contribute to haze and reduce visibility.

Key results

- In 2022, $PM_{2.5}$ emissions were 1 299 kilotonnes (kt); this is 22% lower than in 1990
- Emissions from dust and fires (for example, road dust, dust from construction operations and prescribed burning) accounted for the majority of $PM_{2.5}$ emissions, reaching 58% (755 kt) of total national emissions in 2022
    - These emissions increased by 43% (225 kt) between 1990 and 2022. Dust from construction operations, specifically non-residential construction, and unpaved roads accounted for the majority of the increase

Figure 19. Total fine particulate matter emissions by source, Canada, 1990 to 2022



Data for Figure 19

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from ore and mineral industries, transportation (road, rail, air and marine), manufacturing, off-road vehicles and mobile equipment, the oil and gas industry, building heating and energy generation, electric utilities, incineration and wastes, paints and solvents, and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. New interactive figures provide a dynamic and customizable format to explore the emissions.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

[9] PM formed in the air from chemical and physical reactions involving the precursor substances are not included in the indicator.

In 2022, 85% of $PM_{2.5}$ emissions came from open source emissions, such as dust and prescribed fires, and agriculture (livestock[10], crop production and fertilizer). $PM_{2.5}$ emissions does not include emissions from natural sources such as wildfires and vegetation. In general, these open source emissions are spread over large geographical areas, are highly dependent on weather conditions (for example, wind and rain) and are located outside of urban areas. As such, exposure of $PM_{2.5}$ to most people in Canda is not driven by emissions from open sources, but rather from $PM_{2.5}$ that forms when pollutants react in the atmosphere.

The remaining 15% of $PM_{2.5}$ emissions in 2022 came from home firewood burning (80 kt or 6%) and other sources, including:

- ore and mineral industries, representing 3% (34 kt) of the emissions
- manufacturing and miscellaneous sources, such as emissions from commercial cooking, each representing about 1% (15 kt and 16 kt) of emissions
- off-road vehicles and mobile equipment, representing about 1% (15 kt)
- the oil and gas industry, representing about 1% (14 kt)
- transportation (road, rail, air and marine), representing less than 1% (9 kt)
- other emissions (less than 1%; 8 kt) coming from building heating and energy generation, electric utilities, incineration and waste, and the use of paints and solvents

Many of the sources above, despite representing a small proportion of national emissions, can have a disproportionate health impact on the population because they are generally concentrated in populated areas.

The decreases in $PM_{2.5}$ emissions between 1990 and 2022 are mainly attributable to emission reductions from agriculture (crop production) (322 kt or 48%), manufacturing (99 kt or 87%) and home firewood burning (60 kt or 43%). These reductions outweigh the increase in emissions from dust and prescribed fires (225 kt or 43%), specifically road dust and dust from construction operations, over the period. The adoption of conservation practices in crop production and the use of new fireplace inserts, furnaces and stoves that burn more efficiently to control home firewood burning emissions were the main drivers leading to the reductions.

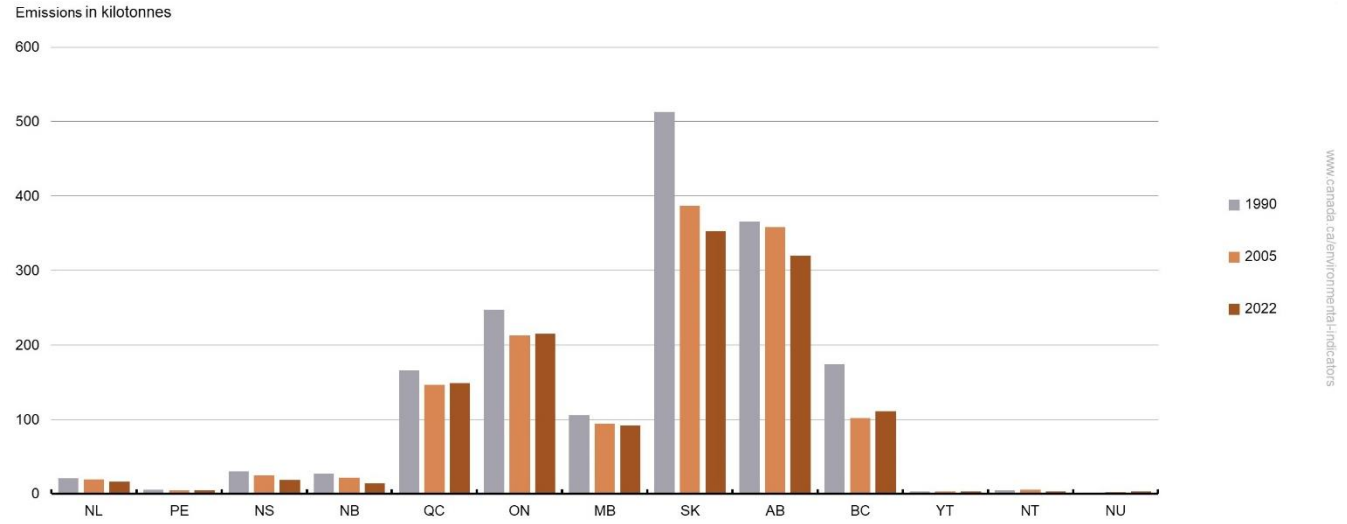
Fine particulate matter emissions by province and territory

Key results

- In 2022, Saskatchewan emitted the most $PM_{2.5}$. The province represented 27% (353 kt) of total national emissions
- Between 1990 and 2022, all provinces decreased their emissions
    - The largest decrease was observed in Saskatchewan with 160 kt (31%)
    - $PM_{2.5}$ emissions increased by 0.1 kt (5%) in Yukon and 1 kt (25%) in Northwest Territories and Nunavut

[10] $PM_{2.5}$ emissions are produced as a result of the aerial transport of feed particles, feather fragments, fecal material, dander, etc. from ventilation systems in livestock buildings.

Figure 20. Fine particulate matter emissions by province and territory, Canada, 1990, 2005 and 2022



Data for Figure 20

Note: The indicator reports air pollutant emissions from human activities only, including open sources. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

In 2022, Saskatchewan was the highest emitting province of $PM_{2.5}$ emissions, accounting for 27% (353 kt) of total national emissions. Agriculture (specifically wind erosion) and dust and fires (specifically dust from unpaved roads) were the largest sources of $PM_{2.5}$ emissions in the province.

Alberta ranked second in 2022, with 25% (320 kt) of total national $PM_{2.5}$ emissions. Dust and fires (specifically dust from unpaved roads) were the largest sources, with agriculture (livestock, crop production and fertilizer) being the second-largest source of $PM_{2.5}$, specifically from wind erosion, tillage practices and harvesting.

Ontario ranked third, with 17% (215 kt), and Quebec ranked fourth with 11% (148 kt). For these 2 provinces, dust and prescribed fires were the largest source of emissions.

The exclusion of emissions from dust, prescribed fires and agriculture (livestock, crop production and fertilizer) provides a different breakdown of $PM_{2.5}$ emissions in each province and territory. With these emissions removed, Quebec becomes the largest emitting province of $PM_{2.5}$ in 2022, representing 30% (57 kt) of total emissions (191 kt). Ontario ranks second with 24% (45 kt) of emissions. Alberta and British Columbia rank third and fourth, representing 14% and 13% (27 kt and 26 kt, respectively) of emissions. Between 1990 and 2022, with dust, prescribed fires and agriculture excluded, all of the provinces and territories experienced emissions reductions between 74% (British Columbia, with a 74 kt emission reduction) and 40% (Prince Edward Island, with a 0.8 kt emission reduction).

Fine particulate matter emissions by facilities

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

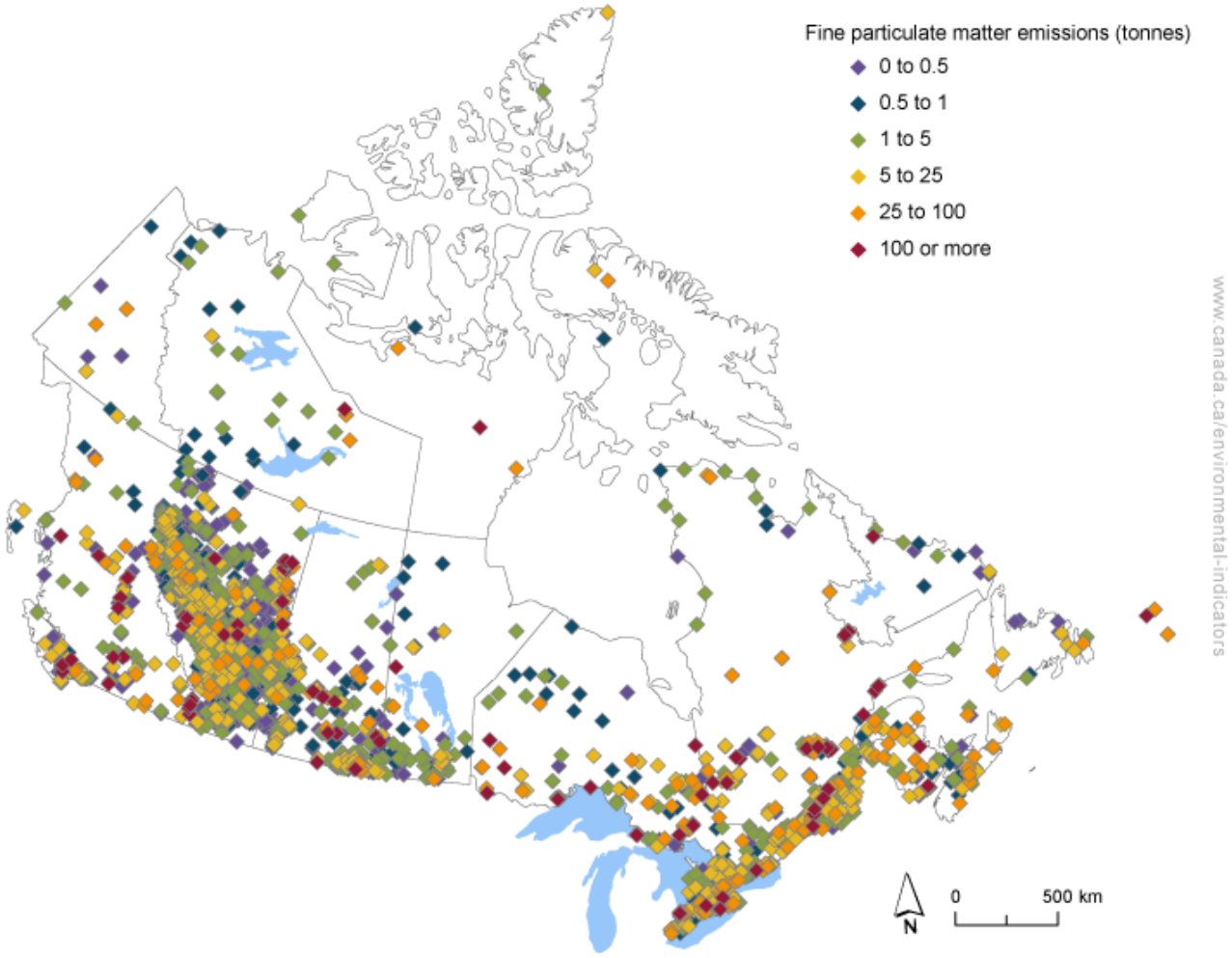
The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore $PM_{2.5}$ emissions from individual facilities.

Key results

- In 2022, 4 621 facilities across Canada reported $PM_{2.5}$ emissions representing 4% of total national emissions. Of these facilities:
  - 2 512 facilities reported emissions under 1 tonne (t)
  - 2 016 facilities reported emissions between 1 to 100 t

- 93 facilities reported emissions of 100 t or more located in Quebec (21), British Columbia (18), Alberta (17), Ontario (16), Saskatchewan (11), Newfoundland and Labrador (4), New Brunswick (2), Northwest Territories (1), Nunavut (1), Nova Scotia (1) and Manitoba (1)

Figure 21. Fine particulate matter by reporting facilities, Canada, 2022



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

Navigate data using the interactive map

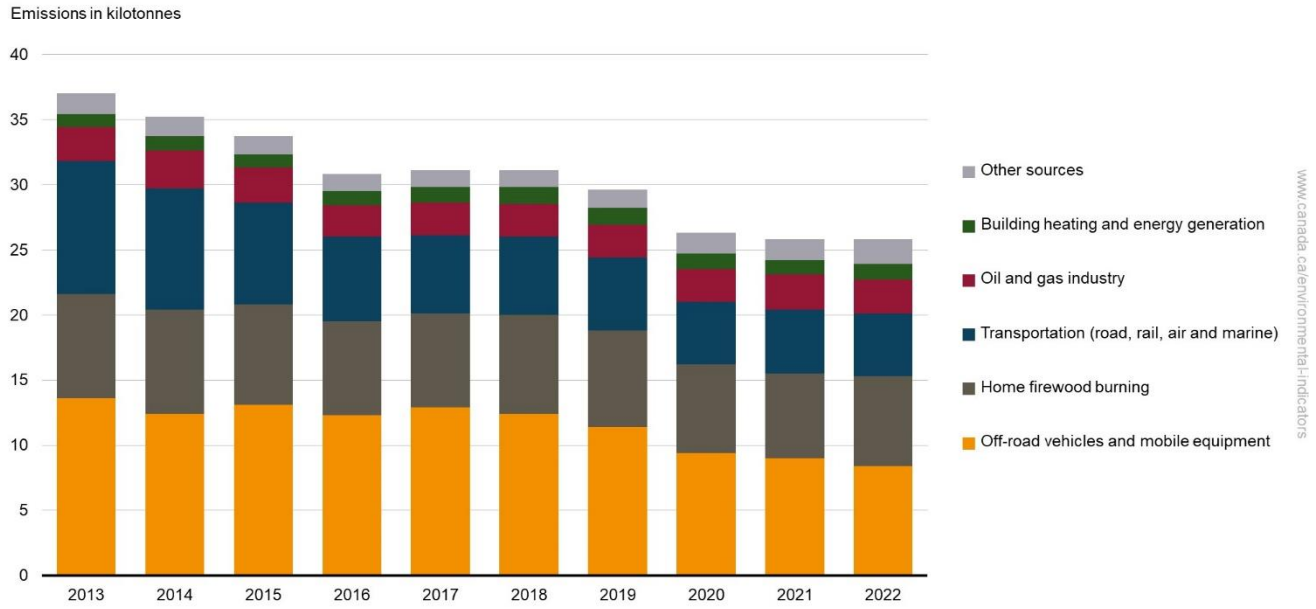
Black carbon emissions by source

Black carbon is a component of $PM_{2.5}$ and is generated by the incomplete combustion of fossil fuels and biomass. It is a short-lived climate pollutant, and is linked to both climate warming and adverse human health effects. Reductions in black carbon emissions have near-term climate and local benefits such as improving air quality, slowing climate warming, reducing snow and ice melts, increasing crop yields and reducing negative impacts to ecosystem health and human health.

Key results

- Emissions of black carbon were 25.7 kt in 2022, a decrease of 31% from 2013
- In 2022, 3 sectors accounted for 78% of national black carbon emissions:
    - off-road vehicles and mobile equipment
    - home firewood burning
    - transportation (road, rail, air and marine)

Figure 22. Total black carbon emissions by source, Canada, 2013 to 2022



Data for Figure 22

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires. The chart includes emissions from the most significant sources of black carbon. "Other sources" includes emissions from ore and mineral industries, manufacturing, electric utilities and agriculture. Consult Table 1 in the Data sources and methods for more details. New interactive figures provide a dynamic and customizable format to explore the emissions.
Source: Environment and Climate Change Canada (2024) Canada's Black Carbon Emissions Inventory.

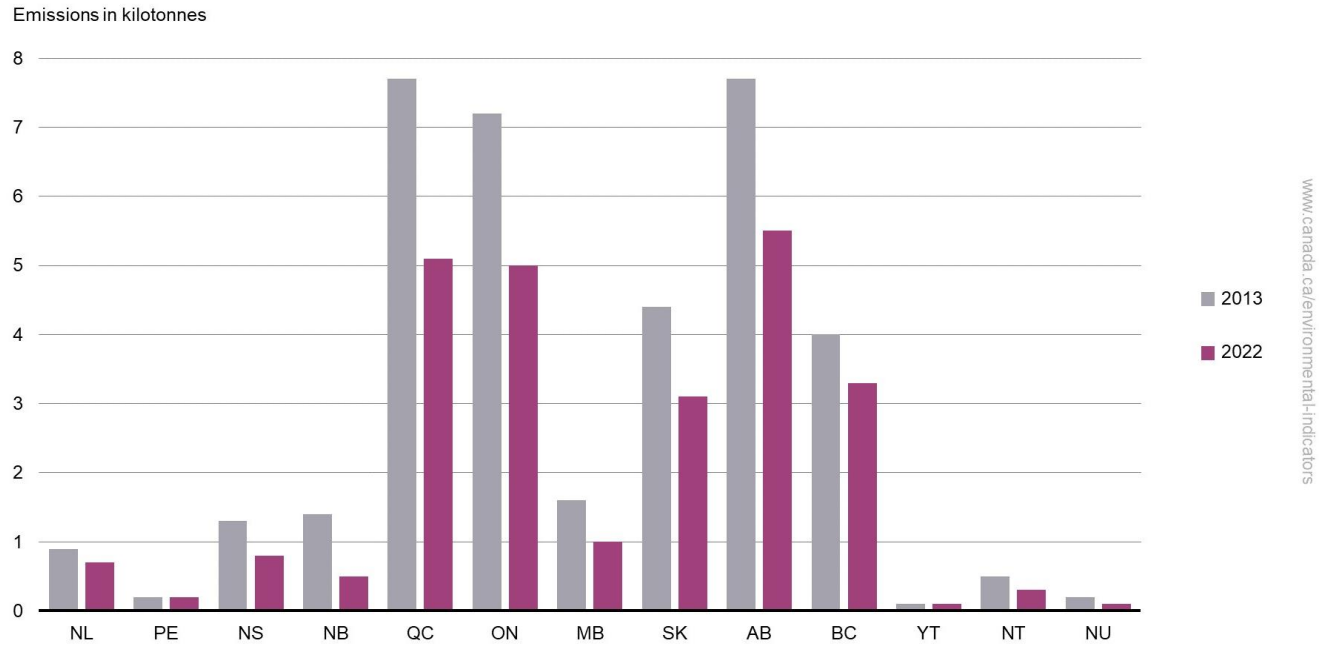
In 2022, off-road vehicles and mobile equipment (for example, lawn and garden equipment, recreational vehicles, excavators, graders) accounted for the largest proportion of total national emissions, representing 33% (8 kt) of emissions. Home firewood burning and transportation (road, rail, air and marine) were also large contributors, representing 27% (7 kt) and 19% (5 kt) of total national emissions. The remaining 21% of emissions came from the oil and gas industry, building heating and energy generation and other sources (such as ore and mineral industries).

Black carbon emissions by province and territory

Key results

- In 2022, 3 provinces, Alberta, Quebec and Ontario, accounted for 61% (16 kt) of total national black carbon emissions
- Between 2013 and 2022:
  - all provinces and territories experienced reductions in black carbon emissions between 2% to 66%
  - Alberta, Ontario and Quebec experienced the largest reductions in emissions with decreases of 2.2 kt, 2.2 kt and 2.6 kt, respectively. For these 3 provinces, the reductions were mainly attributable to lower emissions from transportation (road, rail, air and marine) and off-road vehicles and mobile equipment

Figure 23. Black carbon emissions by province and territory, Canada, 2013 and 2022



Data for Figure 23

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires.
Source: Environment and Climate Change Canada (2024) Canada's Black Carbon Emissions Inventory.

Alberta, Ontario and Quebec had the highest black carbon emissions in 2022.

Emissions in Alberta primarily came from 3 sources: off-road vehicles and mobile equipment, transportation (road, rail, air and marine) and the oil and gas industry representing 89% (4.9 kt) of the emissions.

Ontario's emissions also came primarily from off-road vehicles and mobile equipment (1.5 kt), and transportation (road, rail, air and marine) (1.0 kt) as well as home firewood burning (1.7 kt), representing 85% (4.2 kt) of emissions in the province.

In Quebec, emissions came primarily from home firewood burning representing 57% (2.9 kt) of emissions.

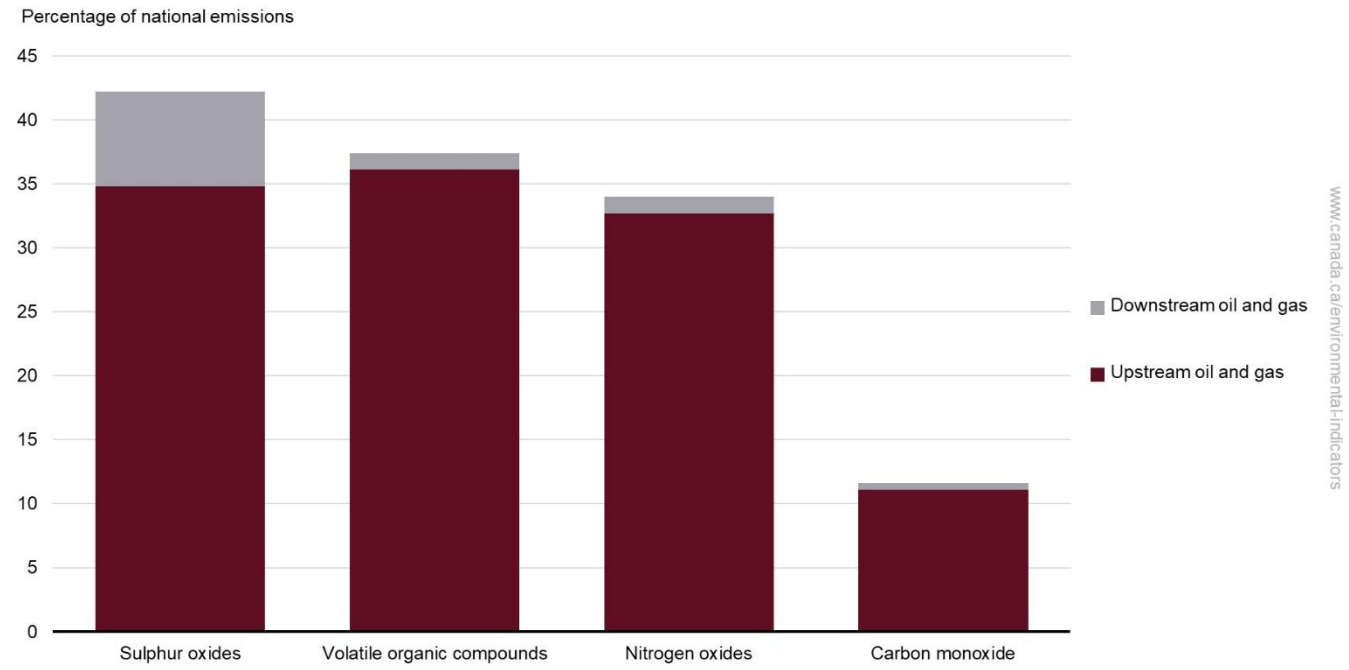
Air pollutant emissions from the oil and gas industry

The oil and gas sector is an important contributor to air pollutant emissions. Most emissions from the oil and gas sector come from upstream (i.e., exploration, drilling, production and field processing) activities and to a lesser extent from downstream (i.e., refining, storage and distribution) activities. Air pollutants are responsible for the formation of fine particulate matter ($PM_{2.5}$), ozone (O_3), smog and acid rain. They also adversely affect human health, the environment, and the economy.

Key results

- In 2022, the oil and gas industry was a major contributor to total national emissions of sulphur oxides (SO_X) (42%), volatile organic compounds (VOCs) (37%), nitrogen oxides (NO_X) (34%) and carbon monoxide (CO) (12%)
- The oil and gas industry is also a source of emissions of fine particulate matter ($PM_{2.5}$) and ammonia (NH_3). However, in 2022, it made up only 1% of the respective total emissions of these pollutants

Figure 24. Contribution of the oil and gas industry to total air pollutant emissions by activity type, Canada, 2022



Data for Figure 24

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2022. In the oil and gas industry, upstream activities include exploration, drilling, production and field processing and downstream activities include refining, storage and distribution.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

In 2022, the oil and gas industry was the sector contributing the most to total national emissions of SO_X, VOCs and NO_X. It was also the third-largest contributor to emissions of CO.

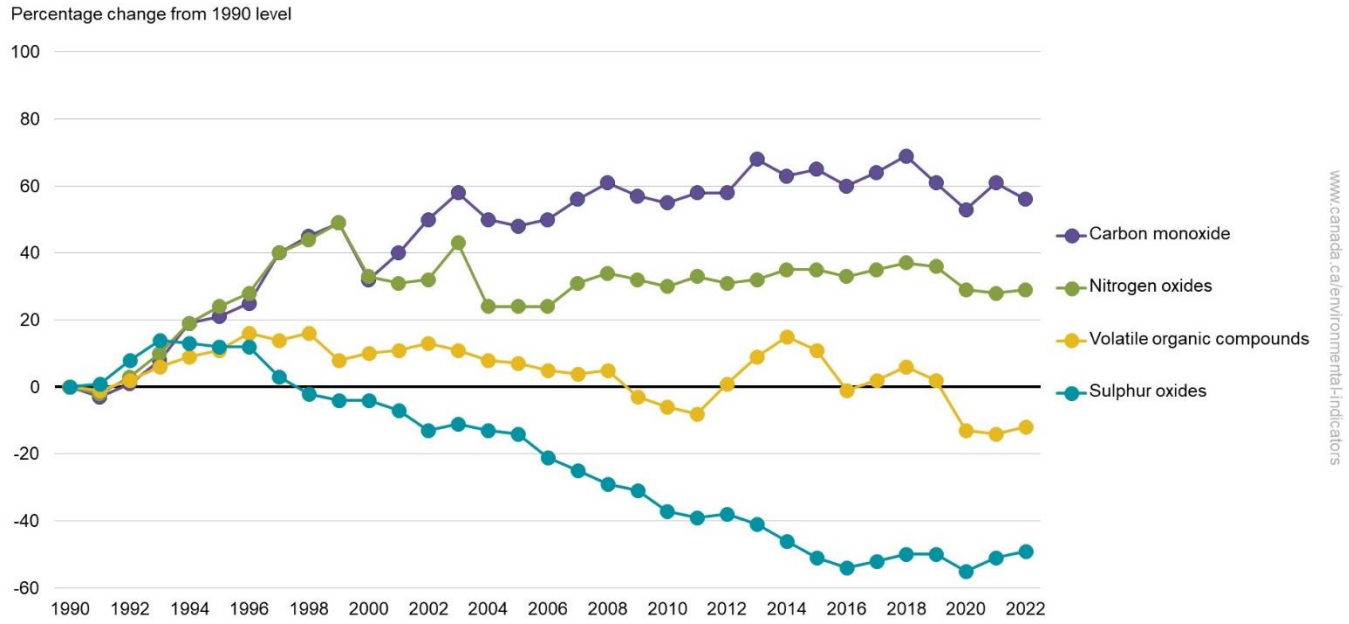
Most emissions from the oil and gas industry came from upstream activities compared to downstream activities. In 2022, 98% of NH_3, 96% of VOC, NO_X and CO, 90% of $PM_{2.5}$ and 82% of SO_X emissions from the oil and gas sector were from upstream activities.

Changes in emissions from the oil and gas industry

Key results

- Emissions of SO_X and VOC emissions decreased 49% and 12%, respectively, between 1990 and 2022
- CO and NO_X increased by 56% and 29% over that period

Figure 25. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2022



Data for Figure 25

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2022.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

The increases in CO and NO_X emissions between 1990 and 2022 were due to growth in oil and gas production (the upstream sector of the industry), as emissions from the downstream sector declined due to facility closures during that period.[11] This increase is in part explained by the fact that crude oil production more than doubled in Canada since 1990. The growth was mostly driven by a rapid increase in oil sands production. During the same period, production of natural gas from unconventional sources, such as those requiring the use of multi-stage fracturing techniques, also increased significantly.

The decrease in SO_X emissions was mostly the result of a decrease in emissions from oil sands mining, extraction and upgrading, and natural gas production and processing, attributed to better emission control technologies.

For VOCs, the recent decline was partly due to reductions in crude oil production and petroleum refining, storage and distribution. In addition in 2020, federal and provincial regulations to reduce fugitive emissions from the sector came into effect contributing further to the decline.

[11] In the oil and gas industry, upstream activities include exploration, drilling, production and field processing and downstream activities include refining, storage and distribution.

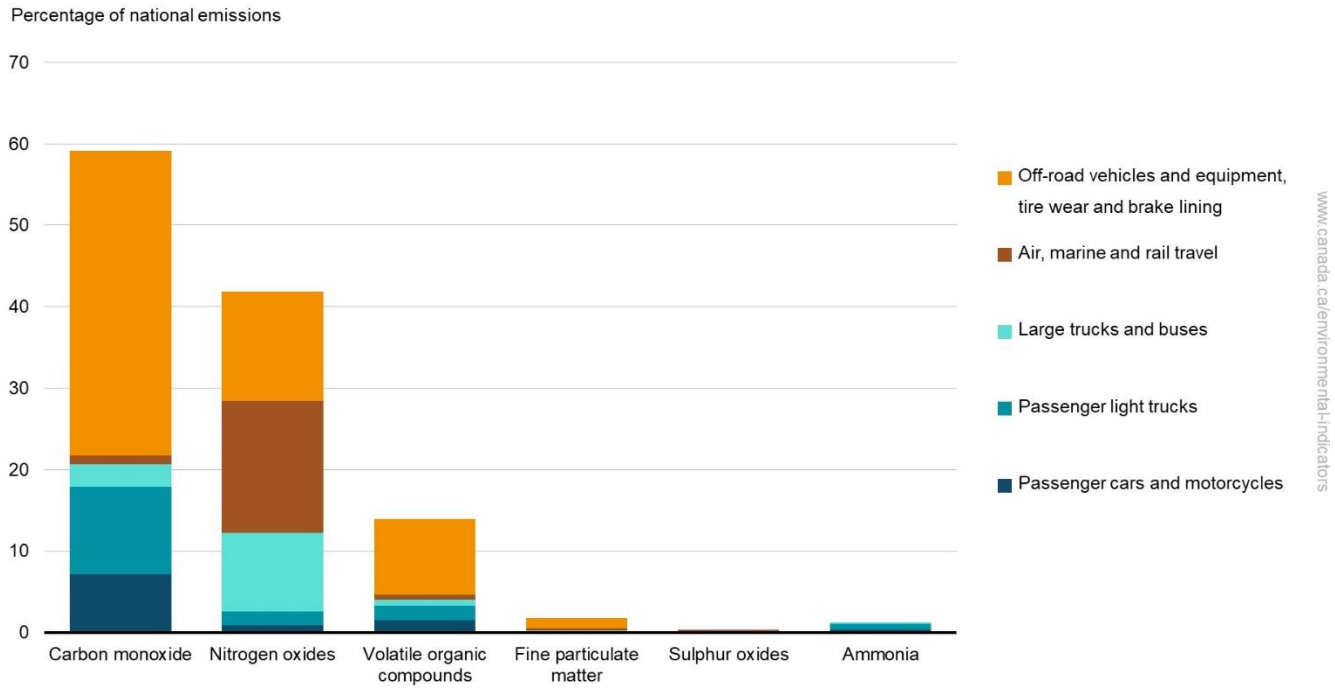
Air pollutant emissions from transportation, off-road vehicles and mobile equipment

Transportation, off-road vehicles and mobile equipment are among the largest sources of air pollutants in Canada. Burning fossil fuels to power vehicles and engines causes emissions of many air pollutants. Air pollutants are responsible for the formation of fine particulate matter, ozone, smog and acid rain. They also adversely affect human health, the environment and the economy.

Key results

- In 2022, transportation, off-road vehicles and mobile equipment accounted for more than half (59%) of total national emissions of carbon monoxide (CO), 42% of nitrogen oxides (NO_X) and 14% of total emissions of volatile organic compounds (VOCs)
- While also a source of emissions for fine particulate matter ($PM_{2.5}$), ammonia (NH_3) and sulphur oxides (SOx), the sectors represented less than 2% of total emissions, respectively

Figure 26. Contribution of transportation, off-road vehicles and mobile equipment to total air pollutant emissions by transportation mode, Canada, 2022



Data for Figure 26

Note: "Passenger cars and motorcycles" include cars powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines as well as all types of motorcycles. "Passenger light trucks" include light-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines. "Large trucks and buses" include heavy-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

The contribution of each transportation mode to emissions of different air pollutants is in large part explained by the mix of fuels used in these modes.

Large trucks and buses, and rail and marine travel rely predominantly on diesel fuel. Aviation relies on turbo aviation fuel. These transportation modes are the largest sources of NO_X transportation-related emissions accounting for 26% (337 kilotonnes [kt]) of total NO_X emissions.

Passenger cars and light trucks mostly use gasoline and are an important source of pollutants, especially in urban centres. In 2022, emissions from passenger cars, motorcycles and light trucks amounted to 804 kt of CO, 33 kt of

NO_X and 46 kt of VOCs. These emissions represented 18%, 3% and 3% of all emissions of these pollutants, respectively.

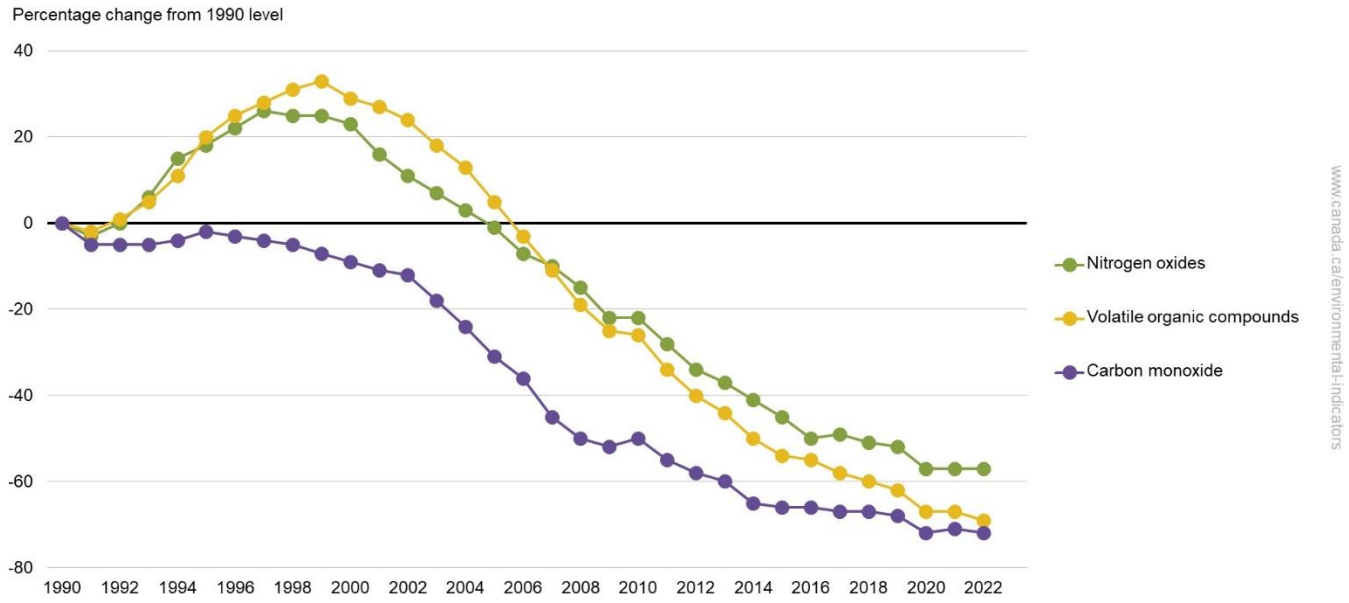
Other sources (mainly composed of off-road vehicles and equipment)[12] are also a significant source of pollution. Their combined emissions make up 37%, 13% and 9% of the total emissions of CO, NO_X and VOCs, respectively. Emissions mostly come from household use of gasoline- or diesel-powered recreational and lawn and garden equipment and from the operation of agricultural, construction and mining equipment.

Changes in emissions from transportation, off-road vehicles and mobile equipment

Key results

- Between 1990 and 2022, total emissions of NO_X, VOCs and CO from transportation, off-road vehicles and mobile equipment decreased by 57%, 69% and 72%, respectively
- Since 2000, all 3 pollutants demonstrated the same downward trend in their emissions level

Figure 27. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2022



Data for Figure 27

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the chart due to their low share (≤ 5%) of total emissions in 2022.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Pollutant emissions have decreased despite economic and population growth as well as growth in transport activities for the period between 1990 and 2022. This decrease is mainly attributable to the adoption of new regulations that lead to the gradual introduction of emission control technologies and clean fuel for vehicles.

Between 1990 and 2000, NO_X emissions increased by 23%. It includes the increase in emissions from light trucks (116%), large trucks and buses (20%) and marine transportation (19%). From 2000 to 2022, new regulations contributed to a decrease in emissions from light trucks (91%), large trucks and buses (72%) and emissions from

[12] Off-road vehicles and mobile equipment include airport ground support equipment, commercial equipment (such as forklifts and ice resurfacers), farming, construction, forestry and mining equipment, industrial equipment, lawn and garden equipment, railway maintenance equipment, and recreational equipment and recreational marine equipment.

marine travel by 79%. Emissions from air, marine and rail travel represented 16% of national emissions of NO_x in 2022.

Transportation emissions are influenced by a variety of factors. These include population and economic growth, volume of passenger and freight travel, vehicle type, emission control technologies, fuel efficiency and fuel type.

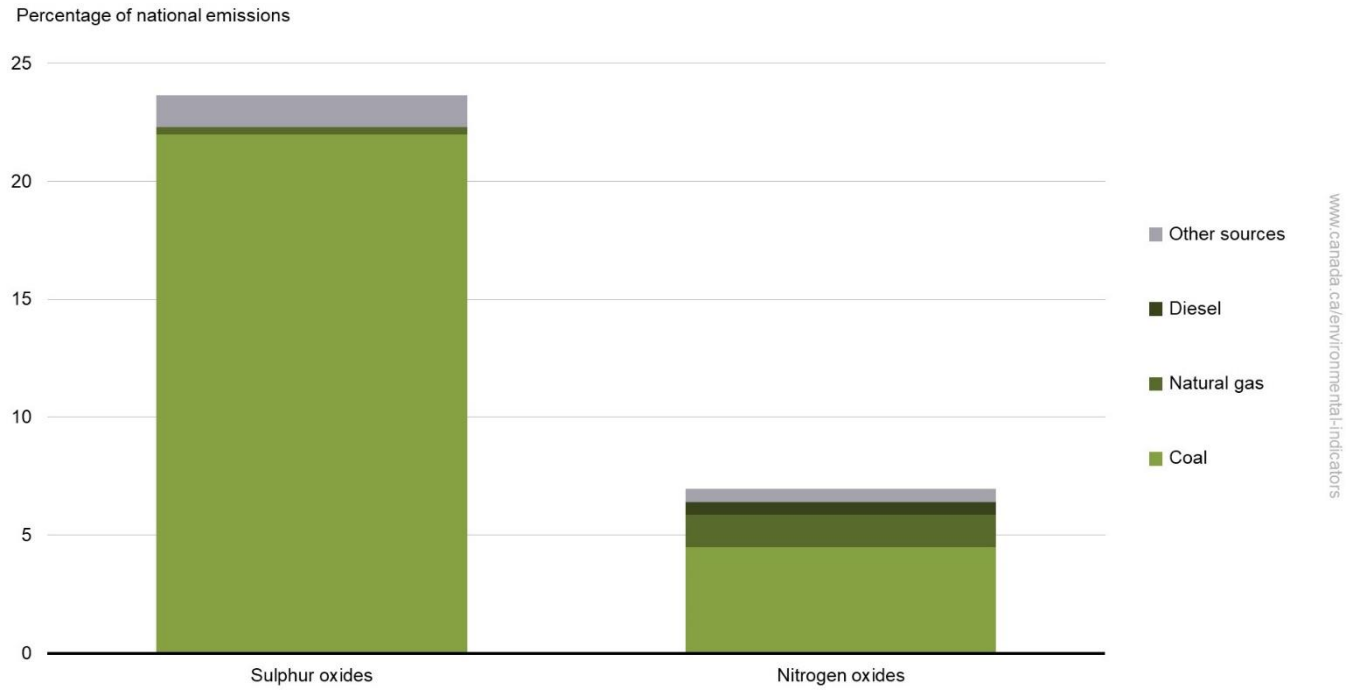
Air pollutant emissions from electric utilities

Electricity generation produces a large share of total national sulphur oxides (SO_X) and nitrogen oxides (NO_X). SO_X and NO_X are mostly emitted from power plants burning fossil fuels such as coal and, to a lesser extent, natural gas and diesel. These air pollutants are responsible for the formation of fine particulate matter, ozone, smog and acid rain. They also adversely affect human health, the environment, and the economy.

Key results

- In 2022, electric utilities were the source of 24% and 7% of total national emissions of sulphur oxides (SO_X) and nitrogen oxides (NO_X), respectively
- Most of the air pollutant emissions from electric utilities come from burning coal
- Electric utilities are also a source of carbon monoxide (CO), volatile organic compounds (VOCs), fine particulate matter ($PM_{2.5}$) and ammonia (NH_3) emissions. However, they account for less than 1% of the total national emissions of these pollutants

Figure 28. Contribution of electric utilities to total air pollutant emissions by fuel source, Canada, 2022



Data for Figure 28

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2022. The indicator excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose. "Other sources" include fuel sources such as waste material and other uncategorized sources of electricity generation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

In 2022, 93% of SO_X and 64% of NO_X emissions from electric utilities came from burning coal.

While generating electricity by burning fossil fuels causes air pollutant emissions, the use of non-fossil energy sources, such as hydro, nuclear and other renewable sources to generate electricity does not emit air pollutants. A large share of the electricity generated in Canada comes from sources that do not emit air pollutants:

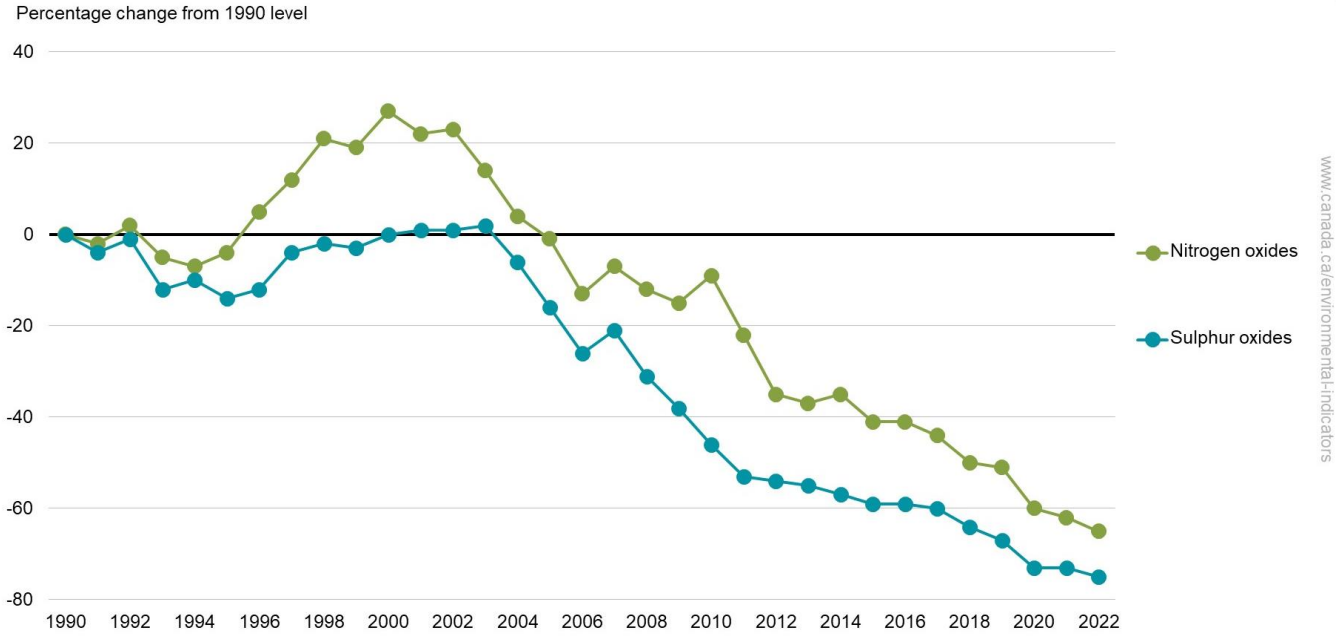
- 60% of electricity comes from hydro
- 15% comes from nuclear power plants
- 8% comes from non-hydro renewable sources, such as wind, solar, tidal power and biomass[13]

Changes in emissions from electric utilities

Key results

- Emissions of SO_X and NO_X from electric utilities declined by 75% and 65%, respectively, between 1990 and 2022
- Most of that decline occurred from 2005 onward

Figure 29. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2022



Data for Figure 29

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2022. Excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

The majority of the decline in SO_X and NO_X emissions between 1990 and 2022 occurred from 2005 onwards. Between 2005 and 2022, the share of electricity that came from burning fossil fuels fell from 22% to 19%. This decrease was mostly the result of a drop in electricity generation from coal power plants.[14] The emissions reductions since 2005 are mainly due to:

- the change in the mix of energy sources used to generate electricity
- the introduction of regulations
- domestic and international agreements
- better removal technologies
- plant closures

[13] Natural Resources Canada (2021) Clean Power and Low Carbon Fuels. Retrieved on March 18, 2024.

[14] Statistics Canada (2022) CANSIM Table 127-0007 - Electric power generation, by class of electricity producer, annual (megawatt hour). Retrieved on March 18, 2024.

About the indicators

What the indicators measure

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 (NH_3), carbon monoxide (CO) and fine particulate matter ($PM_{2.5}$). Black carbon, which is a component of $PM_{2.5}$, is also reported.[15] Sectoral indicators on air pollutant emissions from transportation, off-road vehicles and mobile equipment, electric utilities and the oil and gas industry provide additional analysis on the largest sources of Canada's air pollutant emissions.

For each air pollutant, the indicators are provided at the national and provincial/territorial levels. They also identify the major sources of emissions and provide links to detailed information on air pollutant emissions from facilities.[16] The provincial/territorial graphs refer to the year 2005 to allow comparison with the amended Gothenburg Protocol reference year (reductions from 2005 levels to be achieved by 2020 and maintained thereafter). The Gothenburg Protocol is an international treaty that commits countries to implement measures to reduce their emissions of air pollutants. This ultimately improves Canadian air quality by reducing the transboundary flow of pollution Canada received from other countries.

Why these indicators are important

Canadians are exposed to air pollutants on a daily basis, which can cause adverse health and environmental effects. Fine particulate matter ($PM_{2.5}$) and ground-level ozone (O_3) are key components of smog and have been associated with pulmonary and cardiovascular health issues even at very low levels. While causing effects of their own, NO_X (such as nitrogen dioxide [NO_2]) and VOCs are the main contributors to the formation of O_3. Nitrogen oxides, SO_X (such as sulphur dioxide [SO_2]), NH_3 and VOCs also lead to the formation of $PM_{2.5}$ in the air, in addition to the $PM_{2.5}$ that is emitted directly. Sulphur oxides and NO_X can also lead to the formation of acid deposition (acid rain) that can harm the environment, materials, living organisms, and humans.

Consult the *Canadian Environmental Protection Act (*1999) for more information on the federal regulations related to addressing air pollution.

Black carbon is an air pollutant as well as a powerful climate forcer. Black carbon is of particular significance in polar regions, where the deposition of particles on ice and snow darken the surface, increasing the absorption of sunlight, and accelerate melting. Climate modelling shows that cutting emissions of black carbon is the most powerful action available to countries to slow the pace of near-term warming in the Arctic[17], a region that is already warming at 3 times the global average.

The Air pollutant emissions indicators are intended to inform Canadians and decision makers about progress made towards reducing emissions from human-related sources of air pollutants and about the effectiveness of emission reduction measures in reducing emissions to improve ambient air quality in Canada.

Related initiatives

The indicators are relevant 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."

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[15] Black carbon is emitted from combustion processes in the form of $PM_{2.5}$. It is not emitted on its own, but as a component of $PM_{2.5}$ along with other components, such as organic carbon and inorganic compounds like sulphates. Fine particulate matter emissions from non-combustion sources, such as dust raised by traffic on paved and unpaved roads or by wind and machinery on open fields or mine sites, are not considered sources of black carbon. Environment and Climate Change Canada (2024) Canada's Black Carbon Emissions Inventory. Retrieved on March 18, 2024.

[16] Only facilities that had air pollutant emissions over a certain reporting threshold were included in the National Pollutant Releases Inventory (NPRI) reported data.

[17] von Salzen, K., Whaley, C.H., Anenberg, S.C. et al. Clean air policies are key for successfully mitigating Arctic warming. Nature Commun Earth Environ 3, 222 (2022). https://doi.org/10.1038/s43247-022-00555-x

The indicators also help Canada report against its international compliance commitments under the Convention on Long-range Transboundary Air Pollution's amended Gothenburg Protocol. Under the amended protocol, Canada has committed to emission reductions by 2020 and beyond for 4 air pollutants:

- sulphur dioxide (SO_X) (55% reduction from 2005 levels by 2020 and beyond)
- nitrogen oxides (NO_X) (35% reduction from 2005 levels by 2020 and beyond)
- volatile organic compounds (VOCs) (20% reduction from 2005 levels by 2020 and beyond)
- fine particulate matter ($PM_{2.5}$) (25% reduction from 2005 levels by 2020 and beyond)

Canada has been able to meet its emissions reduction commitments. In 2022, emissions were:

- 69% below 2005 levels for SO_X
- 43% below 2005 levels for NO_X
- 39% below 2005 levels for VOCs
- 31% below 2005 levels for $PM_{2.5}$ (excludes open source emissions from road dust, construction operations, and crop production)

Related indicators

The Air health trends indicator provides an overview of the public health impacts attributable to outdoor air pollution in Canada.

The Air quality indicators track ambient concentrations of fine particulate matter ($PM_{2.5}$), ozone (O_3), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and volatile organic compounds (VOCs) at the national and regional levels and at local monitoring stations.

The Emissions of harmful substances to air indicators track human-related emissions to air 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. Global emissions to air are also provided for mercury.

The Greenhouse gas emissions indicators report trends in total anthropogenic (human-made) GHG emissions at the national level, per person and per unit gross domestic product, by province and territory and by economic sector.

The Greenhouse gas emissions from large facilities indicator reports GHG emissions from the largest GHG emitters in Canada (industrial and other types of facilities).

The International comparison: air pollutant emissions in selected countries indicators compare Canada's emissions of 5 key air pollutants with those of top emitting member countries of the Organisation for Economic Co-operation and Development (OECD).

The Population exposure to outdoor air pollutants indicator tracks the proportion of the Canadian population living in areas where outdoor concentrations of air pollutants are less than or equal to the 2020 Canadian Ambient Air Quality Standards.

Data sources and methods

Data sources

The Air pollutant emissions indicators track emissions of 6 key air pollutants: sulphur oxides (SO_X), nitrogen oxides (NO_X), volatile organic compounds (VOCs), ammonia (NH_3), carbon monoxide (CO) and fine particulate matter ($PM_{2.5}$). The emissions data used are from Canada's Air Pollutant Emissions Inventory for the years 1990 to 2022.

Data for the black carbon indicator, a component of $PM_{2.5}$, come from Canada's Black Carbon Emissions Inventory and are reported for the years 2013 to 2022 by source at the national level and by province and territory.

Facility data for local air pollutant emissions reported in interactive maps come from the National Pollutant Release Inventory and are available for the years 1993 to 2022.

More information

The Air Pollutant Emissions Inventory and the Black Carbon Emissions Inventory provide data and estimates on releases of air pollutants from human activities. These pollutants contribute to smog, acid rain, reduced air quality and climate change. Improvements to data and the analysis of trends are made periodically as new emission estimation methodologies are adopted and additional information is made available. Historical emissions are updated on the basis of these improvements.

Air Pollutant Emissions Inventory

The Air Pollutant Emissions Inventory fulfills many of Canada's international pollution levels reporting obligations. Specifically, under the 1979 Convention on Long-range Transboundary Air Pollution, Canada is committed to submitting an annual inventory of emissions of key air pollutants to the United Nations Economic Commission for Europe. The inventory is a comprehensive assessment of 17 air pollutants,[18] combining emissions reported by facilities to the National Pollutant Release Inventory, with emissions estimated by Environment and Climate Change Canada. Estimates are developed using the latest estimation methods and are based on published statistics or other sources of information such as surveys and reports. The Air Pollutant Emission Inventory provides a comprehensive overview of pollutant emissions across Canada.

The national and provincial/territorial inventory data are current as of March 15, 2024 and cover the period from 1990 to 2022. Emissions data are compiled into a database for reporting approximately one year after data collection, validation and calculation have been completed. After this process is the interpretation of results and public reporting of the inventory. The Air pollutant emissions indicators are reported following the public release of the inventory data.

Black carbon emissions inventory

As a member of the Arctic Council, Canada committed under the Framework for Action on Enhanced Black Carbon and Methane Emissions Reductions (2015) to submit annual inventories of its black carbon emissions to the United Nations Economic Commission for Europe and to share these with the Arctic Council Secretariat. Canada already voluntarily reports black carbon emissions to the United Nations Economic Commission for Europe as a Party to the Gothenburg Protocol, which was amended in 2012 to include black carbon as a component of fine particulate matter. The Black Carbon Emissions Inventory is compiled using $PM_{2.5}$ emissions data from combustion-related sources from the Air Pollutant Emissions Inventory. Black carbon estimates are published separately from the Air Pollutant Emissions Inventory. The data are current as of March 15, 2024.

Black carbon is considered a short-lived climate pollutant, meaning it contributes to warming but has a relatively short lifespan in the atmosphere (from a few days to a few weeks) compared to carbon dioxide

[18] 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, coarse particulate matter and total particulate matter.

(CO_2) (which can persist in the atmosphere for thousands of years) and other longer-lived greenhouse gases (GHGs). Although their life spans are short, short-lived climate pollutants are potent global warmers contributing to warming of the Earth's surface.[19] When black carbon deposits on snow and ice, it darkens the surface, accelerating heating and melting, creating a warming impact that is particularly strong in the Arctic and other snow covered areas (including glaciers).[20] Short-lived climate pollutants, including black carbon, are important pollutants to consider when addressing climate change because they can respond relatively quickly to efforts to control their releases and thus taking action to reduce their emissions can have nearly immediate impacts to slow near-term warming. The Intergovernmental Panel on Climate Change (IPCC) special report on Global Warming states that reductions in short-lived climate pollutants are required to limit warming to a maximum of 1.5°C, and Canada's Changing Climate Report flags short-lived climate pollutants as an important part of climate policy discussions.

National Pollutant Release Inventory

The National Pollutant Release Inventory is a database of pollutant releases (to air, water and land), disposals and transfers for recycling from industrial, commercial and institutional facilities. The data from these facilities is provided by the operators of the facilities as mandated by the *Canadian Environmental Protection Act* (the Act). Under the Act, owners or operators of facilities that manufacture, process or otherwise use or release one or more of the substances tracked by the inventory, and meet substance-specific reporting thresholds and other requirements, must report their pollutant releases, disposals and transfers annually to the department. The inventory data from 1993 to 2022 are current as of November 23, 2023.

Methods

Emissions data from Canada's national inventories are used to produce the indicators for the 6 key air pollutants. Data are grouped to report on the sources that contribute the majority of emissions for each pollutant. Canada's national inventories use the latest advancements in scientific knowledge to estimate or measure emissions for the various air pollutant sources.

More information

Compilation of air pollutant 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.

[19] Environment and Climate Change Canada (2019) Short-lived climate pollutants. Retrieved on March 18, 2024.

[20] Climate and Clean Air Coalition (2022) Science: Black carbon. Retrieved on March 18, 2024.

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. The major source of facility-reported data is 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.

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 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 must be estimated in-house to ensure complete coverage.

In-house emission estimates

In-house emission estimates are calculated with 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. These include emissions from non-industrial, residential, commercial, transportation, and other sources, such as open burning, agricultural activities and construction operations. 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.[21] 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.[22]

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

[21] 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)."

[22] 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 Table 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 types.

Calculation of black carbon emissions

Emissions of black carbon are calculated by applying factors to estimate the fraction of black carbon in $PM_{2.5}$ emissions from combustion-related sources, with some exceptions, for example, the mobile sources, where models are used. The factors primarily come from the United States Environmental Protection Agency's SPECIATE database. SPECIATE is a repository of particulate matter speciation profiles[23] of air pollution sources. Annex 2 of Canada's Black Carbon Emissions Inventory lists all the ratios used for each source.

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 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 section 3.4 of the Air Pollutant Emissions Inventory Report.

Temporal coverage

Historical data are provided at the national level for the period from 1990 to 2022. For the regional indicators (provincial/territorial), emissions are presented for 1990 and 2022. Facility level emissions information are available from 2011 to 2022.

Air pollutant emissions by source classification

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

1. agriculture (livestock, crop production and fertilizer)
2. building heating and energy generation
3. dust and fires
4. electric utilities
5. home firewood burning
6. incineration and waste

[23] A speciation profile is the dataset that breaks down $PM_{2.5}$ emitted from a particular source into its different components (black carbon and organic carbon). Environment and Climate Change Canada (2024) Canada's Black Carbon Emissions Inventory 2024. Retrieved on March 18, 2024.

7. manufacturing
8. miscellaneous
9. off-road vehicles and mobile equipment
10. oil and gas industry
11. ore and mineral industries
12. paints and solvents
13. transportation (road, rail, air and marine)

Table 1 shows the allocation of air pollutant emission sources 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/Black Carbon Emissions Inventory

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon 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: Human crematoriums
Incineration and waste	Incineration and waste: Pet crematoriums

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Incineration and waste	Incineration and waste: Waste incineration
Incineration and waste	Incineration and waste: 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[B]
Miscellaneous	Commercial/Residential/Institutional: Marine cargo handling
Miscellaneous	Commercial/Residential/Institutional: Other (miscellaneous)
Miscellaneous	Commercial/Residential/Institutional: Service stations
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
Ore and mineral industries	Ore and mineral industries: Foundries
Ore and mineral industries	Ore and mineral industries: Iron and steel industry
Ore and mineral industries	Ore and mineral industries: Iron ore pelletizing
Ore and mineral industries	Ore and mineral industries: Mineral products industry

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Ore and mineral industries	Ore and mineral industries: Mining and rock quarrying
Ore and mineral industries	Ore and mineral industries: Non-ferrous refining and smelting industry
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 / 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.

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

Sectoral indicators

Sectoral indicators on air pollutant emissions from transportation, off-road vehicles and mobile equipment, electric utilities and the oil and gas industry provide additional analysis on the largest sources of Canada's

air pollutant emissions. These indicators also rely on calculated emissions data from the Air Pollutant Emissions Inventory.

These indicators are provided at the national level. They identify the contribution of each sector to the national emissions of air pollutants for the year 2022. They also provide information about emissions of selected pollutants, by sector, for the period from 1990 to 2022.

Tables 2 through 4 below show the alignment of air pollutant emission sources reported in the Air pollutant emissions indicators compared with those reported by the sectoral indicators.

Table 2. Alignment of sources reported in the transportation, off-road vehicles and mobile equipment indicator of Air pollutant emissions with the sources and sectors from the Air Pollutant Emissions Inventory/Black Carbon Emissions Inventory

Air pollutant emissions from transportation, off-road vehicles and mobile equipment	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Air, marine and rail travel	Transportation and mobile equipment: Air transportation (Landing and takeoff)
Air, marine and rail travel	Transportation and mobile equipment: Domestic marine navigation, fishing and military
Air, marine and rail travel	Transportation and mobile equipment: Rail transportation
Large trucks and buses	Transportation and mobile equipment: Heavy-duty diesel vehicles
Large trucks and buses	Transportation and mobile equipment: Heavy-duty gasoline vehicles
Large trucks and buses	Transportation and mobile equipment: Heavy-duty liquefied petroleum gas / natural gas vehicles
Off-road vehicles and equipment, tire wear and brake lining	Transportation and mobile equipment: Off-road diesel vehicles and equipment
Off-road vehicles and equipment, tire wear and brake lining	Transportation and mobile equipment: Off-road gasoline / liquefied petroleum gas / natural gas vehicles and equipment
Off-road vehicles and equipment, tire wear and brake lining	Transportation and mobile equipment: Tire wear and brake lining
Passenger cars and motorcycles	Transportation and mobile equipment: Light-duty diesel vehicles
Passenger cars and motorcycles	Transportation and mobile equipment: Light-duty gasoline vehicles
Passenger cars and motorcycles	Transportation and mobile equipment: Light-duty liquefied petroleum gas / natural gas vehicles
Passenger cars and motorcycles	Transportation and mobile equipment: Motorcycles
Passenger light trucks	Transportation and mobile equipment: Light-duty diesel trucks
Passenger light trucks	Transportation and mobile equipment: Light-duty gasoline trucks
Passenger light trucks	Transportation and mobile equipment: Light-duty liquefied petroleum gas / natural gas trucks

Table 3. Alignment of sources reported in the electric utilities indicator of Air pollutant emissions with the sources and sectors from the Air Pollutant Emissions Inventory/Black Carbon Emissions Inventory

Air pollutant emissions from electric utilities	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Coal	Electric power generation (utilities): Coal
Diesel	Electric power generation (utilities): Diesel
Natural gas	Electric power generation (utilities): Natural gas
Other	Electric power generation (utilities): Waste materials[A]
Other	Electric power generation (utilities): Other (electric power generation)

Note: [A] Includes electric power generation from combustion of waste materials by utilities and by industry for commercial sale and/or private use.

Table 4. Alignment of sources reported in the oil and gas industry indicator of Air pollutant emissions with the sources and sectors from the Air Pollutant Emissions Inventory/Black Carbon Emissions Inventory

Air pollutant emissions from the oil and gas industry	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Downstream oil and gas	Oil and gas industry: Downstream oil and gas industry
Upstream oil and gas	Oil and gas industry: Upstream oil and gas industry

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. For more information about these recent changes, consult Annex 3 of the Air Pollutant Emissions Inventory Report.

Canada's Black Carbon Emissions Inventory has undergone some minor recalculations of emissions estimates. Specifically, methodological improvements have been made to ore and mineral industries, oil and gas industry and off-road transportation and mobile equipment to improve the accuracy of estimates. Consult section 3.2 of Canada's Black Carbon Emissions Inventory for more information.

Caveats and limitations

The methodologies for compiling air pollutant emissions generally improve over time, and revisions are made to the Air Pollution Emissions Inventory. As a result of this, the emissions and trends reported for the indicators may be different from those previously published.

Some area source emissions were not updated for 2022 due to the unavailability of activity-level statistics at the time of compilation. In these cases, the emission estimates from the most recent year available were used.

The Air Pollutant Emissions Inventory (APEI) uses facility information from the National Pollutant Release Inventory and other sources. The version of the data published by the National Pollutant Release Inventory may not be identical to that used in the Air Pollutant Emissions Inventory at a given time because of updates to point source data from National Pollutant Release Inventory reporting. The inventory also uses different rounding protocols in its final report and total emissions reported in the indicators may be slightly different.

The Black Carbon Emissions Inventory generally use the same sources as the APEI, however, emissions from certain sectors are not yet captured, for example, fires, incineration and waste and the chemicals industry. It is estimated that emissions from home firewood burning, off-road vehicles and mobile equipment, oil and gas and transportation represent approximately 88% of the national anthropogenic black carbon emissions.

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 first year following the end of the pandemic (2022), has shown decreases in CO, NH_3, NOx and $PM_{2.5}$ compared to 2021. However, emissions in SOx and VOCs increased compared to 2021. The emissions change for the periods from 1990 to 2022 must be interpreted with caution as the level of incidence of the pandemic on the emissions is not discussed in detail in the indicators.

Resources

References

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Related information

Air Pollutant Emissions Inventory: overview

Black Carbon Emissions Inventory: overview

Annex

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

Table A. 1. Data for Figure 1. Air pollutant emissions, Canada, 1990 to 2022

Year	Sulphur oxides (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)	Ammonia (percentage change from 1990 level)	Carbon monoxide (percentage change from 1990 level)	Fine particulate matter (percentage change from 1990 level)
1990	0	0	0	0	0	0
1991	-7	-3	-1	-1	-3	-3
1992	-11	0	0	2	-3	-5
1993	-14	4	4	3	-2	-5
1994	-21	10	7	7	-2	-4
1995	-17	13	10	14	0	-4
1996	-16	17	12	18	-2	-6
1997	-18	22	12	19	-5	-6
1998	-19	22	12	19	-8	-8
1999	-23	22	10	18	-10	-9
2000	-23	20	10	20	-12	-10
2001	-23	15	6	20	-15	-11
2002	-25	13	6	22	-16	-15
2003	-27	12	3	21	-20	-16
2004	-27	5	0	25	-26	-18
2005	-30	1	0	24	-31	-17
2006	-37	-6	-5	21	-37	-21
2007	-39	-7	-8	22	-43	-19
2008	-45	-10	-12	20	-47	-18
2009	-53	-16	-18	16	-49	-21
2010	-57	-16	-20	14	-48	-19
2011	-60	-20	-23	13	-51	-19
2012	-61	-25	-22	17	-54	-16

Year	Sulphur oxides (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)	Ammonia (percentage change from 1990 level)	Carbon monoxide (percentage change from 1990 level)	Fine particulate matter (percentage change from 1990 level)
2013	-61	-27	-21	21	-55	-14
2014	-63	-28	-21	19	-57	-13
2015	-65	-31	-25	19	-59	-16
2016	-65	-35	-30	19	-59	-20
2017	-69	-34	-30	17	-60	-19
2018	-73	-35	-29	21	-61	-17
2019	-76	-36	-31	21	-62	-15
2020	-78	-42	-39	25	-65	-22
2021	-79	-42	-39	26	-65	-22
2022	-78	-42	-38	22	-65	-22

Note: The indicator reports emissions of 6 key air pollutants from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. Emissions from black carbon, a component of $PM_{2.5}$, are also not included.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 2. Data for Figure 2. Distribution of air pollutant emissions by source, Canada, 2022

Source	Sulphur oxides (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Ammonia (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)
Oil and gas industry	42.2	34.0	37.4	0.5	11.6	1.1
Manufacturing	5.9	5.1	7.6	2.2	2.9	1.1
Ore and mineral industries	26.8	6.0	0.5	0.4	11.1	2.6
Transportation (road, rail, air and marine)	0.5	28.4	4.7	1.3	21.7	0.7
Off-road vehicles and mobile equipment	n/a	13.4	9.3	<0.1	37.4	1.2
Building heating and energy generation	0.4	4.8	0.2	0.1	0.8	0.4
Electric utilities	23.6	7.0	<0.1	<0.1	0.9	0.2
Home firewood burning	0.2	0.7	8.2	0.2	12.0	6.1
Incineration and waste	0.3	0.4	0.8	1.5	0.2	<0.1

Source	Sulphur oxides (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Ammonia (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)
Paints and solvents	n/a	n/a	19.3	n/a	n/a	n/a
Agriculture (livestock, crop production and fertilizer)	n/a	0.2	8.2	93.6	n/a	27.2
Dust and fires	n/a	<0.1	0.3	n/a	1.3	58.1
Miscellaneous	n/a	n/a	3.5	0.1	0.1	1.1

Note: n/a = not available. The indicator reports emissions of 6 key air pollutants from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. Emissions from black carbon, a component of $PM_{2.5}$, are also not included. The percentages have been rounded off and their sum may not add up to 100.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 3. Data for Figure 3. Distribution of air pollutant emissions by province and territory, Canada, 2022

Province or territory	Sulphur oxides (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Ammonia (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)
Newfoundland and Labrador	1.4	4.2	1.2	0.2	1.5	1.2
Prince Edward Island	<0.1	0.5	0.3	0.7	0.4	0.3
Nova Scotia	8.0	3.5	1.8	0.8	2.1	1.4
New Brunswick	2.1	1.6	1.5	0.7	1.8	1.1
Quebec	14.6	9.4	14.6	13.1	25.4	11.4
Ontario	18.2	14.2	20.2	19.0	21.1	16.5
Manitoba	0.3	2.2	4.1	11.9	4.5	7.1
Saskatchewan	18.8	8.4	14.1	20.6	7.6	27.1
Alberta	26.1	39.9	33.5	28.7	23.2	24.6
British Columbia	10.2	14.6	8.4	4.2	12.0	8.5
Yukon	<0.1	0.2	<0.1	<0.1	0.1	0.2
Northwest Territories	<0.1	0.7	0.2	<0.1	0.2	0.2
Nunavut	<0.1	0.6	<0.1	<0.1	<0.1	0.2

Note: The indicator reports emissions of 6 key air pollutants from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. Emissions from black carbon, a component of $PM_{2.5}$, are also not included. The percentages have been rounded off and their sum may not add up to 100.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 4. Data for Figure 4. Total sulphur oxide emissions by source, Canada, 1990 to 2022

Year	Oil and gas industry (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Ore and mineral industries (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	535.6	618.4	1 483.3	375.0	3 012.3
1991	541.6	592.1	1 336.3	327.7	2 797.7
1992	580.9	610.7	1 171.5	314.2	2 677.3
1993	608.5	547.2	1 114.9	319.3	2 589.9
1994	604.6	559.8	894.5	320.0	2 379.0
1995	598.4	532.6	1 108.3	272.1	2 511.4
1996	597.3	542.2	1 091.3	285.5	2 516.3
1997	552.8	591.3	1 034.1	284.5	2 462.8
1998	523.4	603.6	1 021.7	277.3	2 426.0
1999	516.1	601.1	927.7	282.3	2 327.2
2000	513.3	619.2	916.8	282.6	2 331.9
2001	497.9	623.9	914.2	277.4	2 313.4
2002	468.1	624.3	905.7	272.1	2 270.2
2003	475.6	630.4	814.1	279.2	2 199.3
2004	468.1	581.5	876.3	284.6	2 210.5
2005	462.2	521.9	859.1	254.9	2 098.1
2006	424.3	458.9	827.6	186.2	1 897.1
2007	402.4	491.9	779.8	178.1	1 852.1
2008	378.3	427.5	716.1	145.3	1 667.2
2009	371.8	384.0	523.1	124.3	1 403.3
2010	339.3	333.9	502.1	117.7	1 293.0
2011	328.5	293.2	467.8	112.4	1 201.9
2012	330.5	284.2	478.1	96.2	1 189.1
2013	315.5	278.2	492.9	87.7	1 174.3
2014	286.8	269.2	487.8	82.1	1 125.8
2015	260.5	251.5	483.5	66.4	1 061.9

Year	Oil and gas industry (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Ore and mineral industries (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2016	246.2	253.1	481.5	59.2	1 040.0
2017	254.7	245.4	389.1	56.1	945.2
2018	265.7	220.2	258.2	57.6	801.6
2019	267.7	205.4	183.3	54.1	710.5
2020	242.3	168.2	195.2	44.6	650.4
2021	262.9	169.0	162.2	47.4	641.5
2022	275.3	154.2	175.0	47.5	652.0

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from transportation (road, rail, air and marine), off-road vehicles and mobile equipment, home firewood burning, incineration and waste, agriculture (livestock, crop production and fertilizer), dust and fires, paints and solvents, building heating and energy generation, manufacturing, and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 5. Data for

Figure 5. Sulphur oxide emissions by province and territory, Canada, 1990, 2005 and 2022

Province or territory	1990 (emissions in kilotonnes)	2005 (emissions in kilotonnes)	2022 (emissions in kilotonnes)
Newfoundland and Labrador	70.3	51.6	9.3
Prince Edward Island	3.7	2.7	0.2
Nova Scotia	203.5	150.3	52.1
New Brunswick	109.1	93.4	14.0
Quebec	251.7	226.8	94.9
Ontario	1 125.0	501.1	119.0
Manitoba	508.8	397.0	2.2
Saskatchewan	102.4	147.0	122.7
Alberta	510.3	459.3	170.2
British Columbia	109.0	65.1	66.8
Yukon	0.6	1.3	<0.1
Northwest Territories	18.0[A]	0.9	0.5
Nunavut[A]	n/a	1.7	0.2

Note: [A] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999. n/a = not applicable. The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 6. Data for Figure 7. Total nitrogen oxide emissions by source, Canada, 1990 to 2022

Year	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	903.6	343.5	381.4	365.3	257.0	2 250.8
1991	892.4	337.1	367.9	337.5	250.9	2 186.0
1992	939.8	353.0	362.4	331.6	262.9	2 249.7
1993	1 007.5	378.4	369.7	335.8	243.0	2 334.4
1994	1 110.3	410.3	375.2	347.4	240.0	2 483.2
1995	1 141.7	426.3	374.9	359.9	248.1	2 550.8
1996	1 177.3	438.2	372.4	367.4	269.0	2 624.4
1997	1 208.6	482.1	372.0	386.0	287.7	2 736.4
1998	1 210.1	493.7	354.4	380.7	310.1	2 749.0
1999	1 198.6	511.1	357.6	383.3	306.4	2 757.0
2000	1 169.5	456.4	361.1	394.1	326.8	2 707.9
2001	1 103.2	450.9	340.3	373.4	313.0	2 580.8
2002	1 056.4	451.8	367.9	352.7	314.9	2 543.7
2003	1 006.8	492.9	365.4	352.5	293.0	2 510.6
2004	964.4	427.2	360.8	342.4	267.5	2 362.3

Year	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2005	918.6	427.5	332.0	334.5	253.7	2 266.2
2006	869.9	427.3	282.3	307.3	224.3	2 111.2
2007	856.2	450.1	273.8	283.9	238.8	2 102.8
2008	817.6	460.0	252.8	267.0	225.1	2 022.5
2009	758.5	455.0	226.1	233.4	218.0	1 890.9
2010	724.6	445.1	233.2	259.1	233.7	1 895.6
2011	641.5	457.0	239.4	266.2	199.8	1 803.9
2012	592.3	449.8	237.3	249.7	166.3	1 695.5
2013	557.8	454.0	233.0	244.4	162.0	1 651.3
2014	521.2	462.5	234.6	225.7	167.2	1 611.2
2015	461.4	463.9	231.1	235.9	152.1	1 544.5
2016	410.8	456.1	226.2	223.9	152.2	1 469.4
2017	408.4	463.8	238.3	236.6	144.8	1 491.8
2018	389.4	470.0	234.2	231.4	128.9	1 453.9
2019	388.3	468.4	231.4	219.6	124.9	1 432.5
2020	351.5	444.1	219.4	188.1	101.8	1 304.9
2021	362.3	438.8	225.1	183.9	98.4	1 308.5
2022	369.8	443.3	224.1	174.7	90.9	1 302.8

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from ore and mineral industries, manufacturing, building heating and energy generation, home firewood burning, incineration and waste, agriculture (livestock, crop production and fertilizer), dust and fires, paints and solvents, and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 7. Data for Figure 8. Nitrogen oxide emissions by province and territory, Canada, 1990, 2005 and 2022

Province or territory	1990 (emissions in kilotonnes)	2005 (emissions in kilotonnes)	2022 (emissions in kilotonnes)
Newfoundland and Labrador	51.1	58.6	54.9
Prince Edward Island	6.3	6.8	6.0
Nova Scotia	82.2	89.6	46.2
New Brunswick	78.6	70.1	20.8
Quebec	307.5	290.1	122.7
Ontario	597.2	540.9	184.3
Manitoba	71.3	66.6	29.2
Saskatchewan	148.5	171.4	109.1
Alberta	605.1	663.3	520.0

Province or territory	1990 (emissions in kilotonnes)	2005 (emissions in kilotonnes)	2022 (emissions in kilotonnes)
British Columbia	286.1	284.2	190.1
Yukon	3.3	2.5	2.2
Northwest Territories	13.6[A]	14.5	9.7
Nunavut[A]	n/a	7.8	7.4

Note: [A] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999. n/a = not applicable. The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 8. Data for Figure 10. Total volatile organic compound emissions by source, Canada, 1990 to 2022

Year	Oil and gas industry (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes	Manufacturing (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	598.6	357.5	147.8	287.5	257.0	188.3	103.6	346.8	2 287.2
1991	594.1	350.0	149.0	287.6	253.7	189.5	103.6	335.4	2 262.9
1992	607.9	352.2	133.8	296.8	254.6	199.2	105.3	345.4	2 295.2
1993	635.9	351.4	157.0	305.5	271.1	200.0	105.1	362.3	2 388.3
1994	653.2	362.1	153.3	322.6	273.0	194.3	107.5	384.1	2 450.1
1995	664.6	375.2	148.3	382.9	262.8	189.6	111.5	376.9	2 511.7
1996	692.7	373.0	137.8	410.1	262.2	193.7	114.5	380.2	2 564.3
1997	679.7	374.9	126.0	440.5	257.4	191.1	115.2	373.5	2 558.3
1998	691.9	377.5	127.2	467.7	261.5	153.1	115.6	366.4	2 560.9
1999	644.4	389.5	120.5	491.2	259.3	148.1	116.0	351.4	2 520.3
2000	658.6	395.9	117.4	489.7	254.5	149.7	116.9	330.2	2 512.8
2001	662.8	375.7	112.9	495.6	229.5	128.8	119.9	309.9	2 435.1
2002	673.9	366.9	108.3	498.0	232.8	124.1	121.0	290.1	2 415.2
2003	666.5	368.8	120.5	483.2	216.0	116.5	120.6	263.6	2 355.7
2004	645.6	364.3	108.5	471.8	200.9	123.4	124.5	243.9	2 282.9
2005	641.9	441.0	105.9	449.2	187.1	126.8	125.6	215.9	2 293.3
2006	626.6	417.1	96.6	418.4	165.2	124.0	123.0	198.2	2 169.2
2007	623.2	409.4	93.1	376.0	149.7	142.9	120.9	188.4	2 103.7
2008	629.5	392.3	92.2	338.7	133.8	140.3	118.9	173.1	2 018.7
2009	582.0	353.3	91.2	315.4	113.0	139.0	116.2	160.2	1 870.3
2010	564.1	361.4	91.1	320.0	118.1	120.8	115.2	148.7	1 839.5

Year	Oil and gas industry (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes	Manufacturing (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2011	552.9	349.7	92.6	301.2	116.0	125.7	114.1	115.2	1 767.5
2012	603.1	354.6	89.9	275.1	117.6	116.5	114.8	107.8	1 779.4
2013	653.7	357.0	84.3	255.2	115.9	126.1	116.1	103.4	1 811.8
2014	689.6	363.6	90.1	220.5	109.9	125.7	115.3	96.0	1 810.6
2015	661.9	326.9	86.7	205.6	105.6	120.3	114.0	89.2	1 710.0
2016	594.8	310.4	83.5	200.0	104.4	111.8	114.6	84.0	1 603.6
2017	612.2	307.2	81.9	188.3	100.7	110.6	114.9	79.9	1 595.6
2018	633.1	313.1	77.7	176.2	108.7	122.2	115.7	79.0	1 625.8
2019	609.0	305.2	78.5	166.0	103.7	124.2	115.4	77.0	1 579.0
2020	521.6	262.1	70.9	147.5	97.7	113.5	115.2	64.3	1 392.8
2021	514.7	272.6	72.8	143.8	111.8	108.4	115.7	65.3	1 405.0
2022	526.2	271.5	76.1	131.0	106.5	114.8	114.9	65.8	1 406.8

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from incineration and waste, ore and mineral industries, dust and fires, building heating and energy generation, electric utilities and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 9. Data for Figure 11. Volatile organic compound emissions by province and territory, Canada, 1990, 2005 and 2022

Province or territory	1990 (emissions in kilotonnes)	2005 (emissions in kilotonnes)	2022 (emissions in kilotonnes)
Newfoundland and Labrador	35.7	32.5	17.0
Prince Edward Island	9.1	8.7	4.5
Nova Scotia	56.2	50.1	25.5
New Brunswick	45.0	50.9	21.0
Quebec	373.8	361.3	205.5
Ontario	614.4	579.3	284.0
Manitoba	75.3	83.6	57.9
Saskatchewan	178.5	256.0	197.7
Alberta	592.3	611.9	471.6
British Columbia	294.7	246.8	118.2
Yukon	1.7	2.2	1.0
Northwest Territories	10.4[A]	8.6	2.3
Nunavut[A]	n/a	1.3	0.8

Note: [A] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999. n/a = not applicable. The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 10. Data for Figure 13. Total ammonia emissions by source, Canada, 1990 to 2022

Year	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	356.6	20.0	13.1	5.6	395.3
1991	353.5	19.0	13.4	6.2	392.2
1992	364.8	19.0	13.7	7.2	404.7
1993	367.6	18.5	14.5	8.3	408.8
1994	379.6	19.9	14.6	9.4	423.5
1995	396.8	26.6	16.5	9.9	449.8
1996	413.1	26.1	16.2	10.7	466.2
1997	418.7	25.2	16.4	11.1	471.3
1998	417.9	26.0	16.5	11.5	471.9
1999	415.6	24.8	14.6	11.6	466.7
2000	424.7	24.9	14.4	11.8	475.7
2001	427.9	21.7	14.0	11.9	475.5
2002	431.0	21.6	19.5	11.7	483.9

Year	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2003	437.5	18.8	12.1	11.5	479.9
2004	452.4	18.5	11.7	11.3	493.9
2005	448.7	17.2	13.3	10.7	489.9
2006	440.4	16.1	12.1	10.2	478.9
2007	446.2	16.0	11.5	10.1	483.8
2008	440.1	13.6	12.6	9.5	475.8
2009	425.9	12.6	12.4	9.0	459.9
2010	418.3	11.5	13.0	8.7	451.6
2011	416.2	11.9	12.8	7.7	448.5
2012	433.2	11.9	11.8	7.4	464.3
2013	446.3	11.3	12.9	7.3	477.8
2014	437.1	11.3	13.2	7.0	468.6
2015	440.0	11.7	11.9	6.9	470.6
2016	440.0	12.1	12.2	6.9	471.2
2017	431.2	11.3	11.8	6.8	461.1
2018	447.4	12.1	12.1	6.9	478.4
2019	448.8	11.1	12.5	6.9	479.3
2020	462.6	12.1	11.9	5.8	492.5
2021	468.3	11.4	13.2	6.1	499.0
2022	451.5	10.4	14.2	6.3	482.4

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from incineration and waste, the oil and gas industry, home firewood burning, ore and mineral industries, electric utilities, building heating and energy generation, off-road vehicles and mobile equipment, dust and fires, paints and solvents, and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 11. Data for Figure 14. Ammonia emissions by province and territory, Canada, 1990, 2005 and 2022

Province or territory	1990 (emissions in kilotonnes)	2005 (emissions in kilotonnes)	2022 (emissions in kilotonnes)
Newfoundland and Labrador	1.0	1.1	1.1
Prince Edward Island	3.4	3.8	3.2
Nova Scotia	4.9	4.6	3.9
New Brunswick	4.6	5.7	3.5
Quebec	65.3	67.7	63.4

Province or territory	1990 (emissions in kilotonnes)	2005 (emissions in kilotonnes)	2022 (emissions in kilotonnes)
Ontario	111.0	101.9	91.5
Manitoba	38.1	55.4	57.5
Saskatchewan	48.6	84.0	99.5
Alberta	95.3	140.4	138.2
British Columbia	23.1	25.3	20.4
Yukon	<0.1	<0.1	<0.1
Northwest Territories	<0.1[A]	<0.1	<0.1
Nunavut[A]	n/a	<0.1	<0.1

Note: [A] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999. n/a = not applicable. The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 12. Data for Figure 16. Total carbon monoxide emissions by source, Canada, 1990 to 2022

Year	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Ore and mineral industries (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	6 099.8	3 475.8	1 861.1	812.1	333.7	389.8	12 972.2
1991	5 830.5	3 305.1	1 898.0	817.1	323.8	453.5	12 628.1
1992	5 907.2	3 235.9	1 697.1	859.4	338.4	482.8	12 520.8
1993	5 951.3	3 128.4	1 896.4	863.0	360.7	478.3	12 677.9
1994	6 040.7	3 154.1	1 861.3	838.6	397.8	461.9	12 754.4
1995	5 697.1	3 714.8	1 903.5	817.5	405.2	457.7	12 996.0
1996	5 520.6	3 779.1	1 660.0	835.2	417.5	447.3	12 659.6
1997	5 213.1	3 973.7	1 427.9	825.8	466.6	413.7	12 320.9
1998	4 935.6	4 160.1	1 357.3	661.9	484.7	397.9	11 997.7
1999	4 566.7	4 340.3	1 312.5	643.1	497.0	374.0	11 733.6
2000	4 439.0	4 314.8	1 217.3	652.0	441.9	396.1	11 461.1
2001	4 143.5	4 413.2	1 081.6	561.8	466.1	421.9	11 088.0
2002	3 840.2	4 558.3	945.7	542.9	499.6	491.6	10 878.2
2003	3 569.8	4 240.3	990.9	512.6	528.8	521.6	10 364.0
2004	3 258.6	4 052.0	717.0	544.2	501.0	499.9	9 572.7
2005	2 796.5	3 849.2	685.6	560.7	492.6	505.7	8 890.2
2006	2 545.7	3 591.9	486.5	549.7	502.1	509.8	8 185.7
2007	2 331.0	2 920.6	409.0	645.0	521.7	532.1	7 359.5
2008	2 154.9	2 643.0	402.1	645.0	538.8	546.8	6 930.6

Year	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Ore and mineral industries (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2009	2 035.1	2 534.9	388.5	651.7	523.2	512.7	6 646.0
2010	1 891.8	2 860.9	346.0	577.5	518.0	537.1	6 731.3
2011	1 458.5	2 813.0	331.2	614.0	527.0	560.5	6 304.2
2012	1 368.4	2 610.8	352.0	582.5	528.5	552.3	5 994.7
2013	1 356.7	2 486.7	293.6	643.8	560.6	546.2	5 887.6
2014	1 319.4	2 149.1	380.9	656.9	544.2	515.0	5 565.4
2015	1 263.4	2 010.1	357.7	643.9	551.7	513.3	5 340.1
2016	1 248.5	2 055.9	342.1	608.2	533.0	557.7	5 345.3
2017	1 198.3	2 005.7	281.9	609.7	546.7	588.8	5 231.2
2018	1 188.6	1 944.0	254.0	618.2	563.7	526.6	5 095.2
2019	1 165.7	1 903.2	263.8	586.1	537.6	507.9	4 964.4
2020	1 000.0	1 720.2	228.7	534.9	509.7	512.3	4 505.7
2021	1 020.9	1 772.0	237.1	510.7	535.7	511.7	4 588.1
2022	975.1	1 681.4	278.2	541.8	521.8	500.4	4 498.6

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from dust and fires, electric utilities, building heating and energy generation, incineration and waste, agriculture (livestock, crop production and fertilizer), paints and solvents, manufacturing and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 13. Data for Figure 17. Carbon monoxide emissions by province and territory, Canada, 1990, 2005 and 2022

Province or territory	1990 (emissions in kilotonnes)	2005 (emissions in kilotonnes)	2022 (emissions in kilotonnes)
Newfoundland and Labrador	207.1	122.1	65.3
Prince Edward Island	72.5	42.2	16.9
Nova Scotia	364.0	216.5	95.8
New Brunswick	305.6	234.0	79.4
Quebec	2 470.4	1 844.5	1 143.9
Ontario	3 574.8	2 447.3	949.8
Manitoba	496.7	401.7	203.2
Saskatchewan	826.7	680.9	342.0
Alberta	2 287.1	1 654.0	1 041.8
British Columbia	2 321.9	1 205.6	540.1
Yukon	17.1	17.5	6.3
Northwest Territories	28.4[A]	17.7	8.6
Nunavut[A]	n/a	6.3	5.5

Note: [A] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999. n/a = not applicable. The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 14. Data for Figure 19. Total fine particulate matter emissions by source, Canada, 1990 to 2022

Year	Dust and fires (emissions in kilotonnes)	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	529.5	675.2	318.6	139.7	1 663.0
1991	516.3	667.9	293.7	139.6	1 617.6
1992	493.4	653.0	285.2	145.8	1 577.5
1993	519.6	638.8	279.8	145.6	1 583.7
1994	553.1	624.4	278.1	140.6	1 596.2
1995	567.7	610.1	276.6	136.2	1 590.6
1996	558.8	596.4	269.9	138.4	1 563.5
1997	583.4	582.5	265.6	135.3	1 566.9
1998	587.7	568.9	257.7	107.6	1 522.0
1999	593.2	555.4	258.4	103.5	1 510.5
2000	593.4	541.9	256.7	103.8	1 495.9
2001	622.1	528.8	234.8	88.6	1 474.3
2002	602.9	508.9	210.9	84.7	1 407.3
2003	626.4	489.2	204.7	78.9	1 399.2

Year	Dust and fires (emissions in kilotonnes)	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2004	619.9	469.0	198.5	82.7	1 370.1
2005	649.9	449.5	196.6	84.2	1 380.2
2006	638.5	430.0	170.5	81.6	1 320.5
2007	666.0	416.7	165.0	95.1	1 342.7
2008	710.2	403.1	156.2	94.5	1 364.0
2009	693.5	389.8	140.0	94.8	1 318.1
2010	736.7	376.8	143.1	83.5	1 340.0
2011	763.1	363.5	137.6	88.1	1 352.3
2012	807.8	366.6	134.1	82.9	1 391.5
2013	834.7	369.4	129.3	89.5	1 422.8
2014	851.7	372.3	125.7	88.9	1 438.6
2015	809.5	375.4	119.9	84.8	1 389.7
2016	758.3	378.3	115.0	78.5	1 330.0
2017	773.4	374.1	120.2	77.2	1 344.9
2018	810.8	369.9	118.6	85.1	1 384.4
2019	842.8	365.8	117.1	86.4	1 412.2
2020	745.3	361.8	113.5	78.9	1 299.4
2021	760.8	344.8	119.6	75.3	1 300.4
2022	754.9	353.0	111.5	79.9	1 299.3

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from ore and mineral industries, transportation (road, rail, air and marine), manufacturing, off-road vehicles and mobile equipment, the oil and gas industry, building heating and energy generation, electric utilities, incineration and wastes, paints and solvents, and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 15. Additional information for Figure 19. Total fine particulate matter emissions by source, Canada, 1990 to 2022

Year	Dust and fires (emissions in kilotonnes)	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Ore and mineral industries (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Miscellaneous (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Building heating and energy generation (emissions in kilotonnes)
1990	529.5	675.2	139.7	54.3	33.4	113.9	14.0	36.0	11.8	4.6
1991	516.3	667.9	139.6	51.5	31.9	103.0	12.1	32.7	12.4	4.6
1992	493.4	653.0	145.8	49.3	32.2	99.8	12.1	31.5	12.6	4.7
1993	519.6	638.8	145.6	49.2	32.4	100.5	12.4	32.8	12.8	4.9
1994	553.1	624.4	140.6	51.0	33.9	100.3	12.9	34.0	13.7	4.9
1995	567.7	610.1	136.2	50.7	34.8	101.4	13.3	34.4	14.0	4.9
1996	558.8	596.4	138.4	52.6	34.6	93.1	13.4	35.5	14.1	5.2
1997	583.4	582.5	135.3	53.0	34.4	85.2	13.8	37.4	14.4	5.0
1998	587.7	568.9	107.6	50.6	32.6	80.1	14.6	37.1	16.1	4.6
1999	593.2	555.4	103.5	50.1	33.3	79.7	15.1	37.8	13.7	4.8
2000	593.4	541.9	103.8	51.2	32.1	74.7	15.6	39.0	13.5	5.3
2001	622.1	528.8	88.6	47.4	30.3	63.9	15.9	37.3	13.4	5.0
2002	602.9	508.9	84.7	37.3	29.7	55.2	16.4	35.7	13.9	5.2
2003	626.4	489.2	78.9	37.6	31.3	52.9	16.5	34.9	12.5	5.6
2004	619.9	469.0	82.7	36.0	31.7	50.5	16.9	33.8	11.8	5.3
2005	649.9	449.5	84.2	41.3	32.1	44.8	17.2	32.8	12.2	5.2
2006	638.5	430.0	81.6	39.4	30.8	28.8	17.4	30.1	11.6	4.9
2007	666.0	416.7	95.1	37.8	30.0	27.0	17.4	27.7	11.3	5.2
2008	710.2	403.1	94.5	36.0	29.0	24.0	17.8	26.1	9.8	5.1
2009	693.5	389.8	94.8	30.4	27.2	19.8	17.9	23.2	9.0	5.0

Year	Dust and fires (emissions in kilotonnes)	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Ore and mineral industries (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Miscellaneous (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Building heating and energy generation (emissions in kilotonnes)
2010	736.7	376.8	83.5	34.0	26.2	19.4	17.6	25.3	8.9	4.8
2011	763.1	363.5	88.1	32.9	22.4	20.0	16.8	25.6	9.3	5.0
2012	807.8	366.6	82.9	35.2	20.0	19.2	16.9	24.1	9.8	4.6
2013	834.7	369.4	89.5	31.9	18.4	19.5	16.8	23.3	10.5	4.8
2014	851.7	372.3	88.9	31.6	16.5	18.6	16.1	21.2	12.3	4.9
2015	809.5	375.4	84.8	30.2	13.7	18.6	15.3	21.8	11.3	4.8
2016	758.3	378.3	78.5	30.3	11.7	17.1	15.3	21.1	10.4	4.9
2017	773.4	374.1	77.2	34.1	11.0	17.2	15.4	21.6	11.7	5.1
2018	810.8	369.9	85.1	33.1	10.9	17.2	15.4	20.9	11.8	5.3
2019	842.8	365.8	86.4	34.8	10.3	16.3	15.5	19.5	11.7	5.4
2020	745.3	361.8	78.9	35.3	8.9	16.4	15.6	16.6	12.2	5.0
2021	760.8	344.8	75.3	36.7	9.1	19.7	15.7	16.3	14.4	4.8
2022	754.9	353.0	79.9	34.2	9.0	14.8	15.8	15.3	14.4	5.1

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from ore and mineral industries, transportation (road, rail, air and marine), manufacturing, off-road vehicles and mobile equipment, the oil and gas industry, building heating and energy generation, electric utilities, incineration and wastes, paints and solvents, and other miscellaneous sources. Consult Table 1 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 16. Data for Figure 20. Fine particulate matter emissions by province and territory, Canada, 1990, 2005 and 2022

Province or territory	1990 (emissions in kilotonnes)	2005 (emissions in kilotonnes)	2022 (emissions in kilotonnes)	1990, excluding open sources [A] (emissions in kilotonnes)	2005, excluding open sources [A] (emissions in kilotonnes)	2022, excluding open sources [A] (emissions in kilotonnes)
Newfoundland and Labrador	21.1	19.6	15.9	12.5	8.5	5.0
Prince Edward Island	5.0	4.4	4.3	2.0	1.8	1.2
Nova Scotia	30.3	24.6	18.4	18.6	12.7	6.7
New Brunswick	27.3	21.7	14.1	17.8	12.9	5.1
Quebec	165.7	146.3	148.5	95.4	71.5	56.9
Ontario	247.6	212.5	214.7	107.6	70.1	45.3
Manitoba	105.4	93.6	91.8	13.1	9.5	6.3
Saskatchewan	512.8	386.6	352.6	21.5	17.4	11.0
Alberta	366.2	358.5	319.8	67.7	33.1	27.1
British Columbia	174.3	101.9	110.6	100.0	41.6	25.8
Yukon	2.7	3.0	2.8	0.5	0.3	0.2
Northwest Territories	4.7[B]	5.2	3.0	1.6[B]	0.9	0.6
Nunavut[B]	n/a	2.3	2.8	n/a	0.6	0.3

Note: [A] Open sources include emissions associated with dust and fires and agriculture (livestock, crop production and fertilizer). [B] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999. n/a = not applicable. The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 17. Data for Figure 22. Total black carbon emissions by source, Canada, 2013 to 2022

Year	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Building heating and energy generation (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2013	13.6	8.0	10.2	2.6	1.0	1.6	37.1
2014	12.4	8.0	9.3	2.9	1.1	1.5	35.2
2015	13.1	7.7	7.8	2.7	1.0	1.4	33.7
2016	12.3	7.2	6.5	2.4	1.1	1.3	30.8
2017	12.9	7.2	6.0	2.5	1.2	1.3	31.1
2018	12.4	7.6	6.0	2.5	1.3	1.3	31.1
2019	11.4	7.4	5.6	2.5	1.3	1.4	29.6

Year	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Building heating and energy generation (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2020	9.4	6.8	4.8	2.5	1.2	1.6	26.3
2021	9.0	6.5	4.9	2.7	1.1	1.6	25.8
2022	8.4	6.9	4.8	2.6	1.2	1.9	25.7

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires. "Other sources" includes emissions from ore and mineral industries, manufacturing, electric utilities and agriculture. Consult Table 1 in the Data sources and methods for more details. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2024) Canada's Black Carbon Emissions Inventory.

Table A. 18. Data for In 2022, 3 provinces, Alberta, Quebec and Ontario, accounted for 61% (16 kt) of total national black carbon emissions

- Between 2013 and 2022:
  - all provinces and territories experienced reductions in black carbon emissions between 2% to 66%
  - Alberta, Ontario and Quebec experienced the largest reductions in emissions with decreases of 2.2 kt, 2.2 kt and 2.6 kt, respectively. For these 3 provinces, the reductions were mainly attributable to lower emissions from transportation (road, rail, air and marine) and off-road vehicles and mobile equipment

Figure 23. Black carbon emissions by province and territory, Canada, 2013 and 2022

Province or territory	2013 (emissions in kilotonnes)	2022 (emissions in kilotonnes)
Newfoundland and Labrador	0.9	0.7
Prince Edward Island	0.2	0.2
Nova Scotia	1.3	0.8
New Brunswick	1.4	0.5
Quebec	7.7	5.1
Ontario	7.2	5.0
Manitoba	1.6	1.0
Saskatchewan	4.4	3.1
Alberta	7.7	5.5
British Columbia	4.0	3.3
Yukon	0.1	0.1
Northwest Territories	0.5	0.3
Nunavut	0.2	0.1

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires.
Source: Environment and Climate Change Canada (2024) Canada's Black Carbon Emissions Inventory.

Table A.19. Data for Figure 24. Contribution of the oil and gas industry to total air pollutant emissions by activity type, Canada, 2022

Activity type	Sulphur oxides (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)	Ammonia (percentage of national emissions)
Upstream oil and gas	34.8	36.1	32.7	11.1	1.0	0.5
Downstream oil and gas	7.4	1.3	1.3	0.5	<0.1	<0.1

Note: In the oil and gas industry, upstream activities include exploration, drilling, production and field processing and downstream activities include refining, storage and distribution.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Additional information for Figure 24. Contribution of the oil and gas industry to total air pollutant emissions by activity type, Canada, 2022

Activity type	Sulphur oxides (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Carbon monoxide (emissions in kilotonnes)	Fine particulate matter (emissions in kilotonnes)	Ammonia (emissions in kilotonnes)
Upstream oil and gas	226.9	507.6	426.5	499.7	13.1	2.5
Downstream oil and gas	48.4	18.5	16.8	22.1	1.4	<0.1

Note: In the oil and gas industry, upstream activities include exploration, drilling, production and field processing and downstream activities include refining, storage and distribution.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 20. Data for Figure 25. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2022

Year	Carbon monoxide (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)	Sulphur oxides (percentage change from 1990 level)
1990	0	0	0	0
1991	-3	-2	-1	1
1992	1	3	2	8
1993	8	10	6	14
1994	19	19	9	13
1995	21	24	11	12
1996	25	28	16	12
1997	40	40	14	3

Year	Carbon monoxide (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)	Sulphur oxides (percentage change from 1990 level)
1998	45	44	16	-2
1999	49	49	8	-4
2000	32	33	10	-4
2001	40	31	11	-7
2002	50	32	13	-13
2003	58	43	11	-11
2004	50	24	8	-13
2005	48	24	7	-14
2006	50	24	5	-21
2007	56	31	4	-25
2008	61	34	5	-29
2009	57	32	-3	-31
2010	55	30	-6	-37
2011	58	33	-8	-39
2012	58	31	1	-38
2013	68	32	9	-41
2014	63	35	15	-46
2015	65	35	11	-51
2016	60	33	-1	-54
2017	64	35	2	-52
2018	69	37	6	-50
2019	61	36	2	-50
2020	53	29	-13	-55
2021	61	28	-14	-51
2022	56	29	-12	-49

Note: Fine particulate matter and ammonia are not shown in the table due to their low share (≤ 1%) of total emissions in 2022.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Additional information for Figure 25. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2022

Year	Carbon monoxide (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Sulphur oxides (emissions in kilotonnes)
1990	334	344	599	536
1991	324	337	594	542
1992	338	353	608	581

Year	Carbon monoxide (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Sulphur oxides (emissions in kilotonnes)
1993	361	378	636	608
1994	398	410	653	605
1995	405	426	665	598
1996	417	438	693	597
1997	467	482	680	553
1998	485	494	692	523
1999	497	511	644	516
2000	442	456	659	513
2001	466	451	663	498
2002	500	452	674	468
2003	529	493	667	476
2004	501	427	646	468
2005	493	428	642	462
2006	502	427	627	424
2007	522	450	623	402
2008	539	460	629	378
2009	523	455	582	372
2010	518	445	564	339
2011	527	457	553	328
2012	528	450	603	331
2013	561	454	654	315
2014	544	462	690	287
2015	552	464	662	261
2016	533	456	595	246
2017	547	464	612	255
2018	564	470	633	266
2019	538	468	609	268
2020	510	444	522	242
2021	536	439	515	263
2022	522	443	526	275

Note: Fine particulate matter and ammonia are not shown in the table due to their low share (≤ 1%) of total emissions in 2022.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 21. Data for Figure 26. Contribution of transportation, off-road vehicles and mobile equipment to total air pollutant emissions by transportation mode, Canada, 2022

Transportation mode	Carbon monoxide (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Fine particulate matter (percentage of national emissions)	Sulphur oxides (percentage of national emissions)	Ammonia (percentage of national emissions)
Passenger cars and motorcycles	7.1	0.9	1.5	<0.1	<0.1	0.4
Passenger light trucks	10.7	1.7	1.8	<0.1	<0.1	0.7
Large trucks and buses	2.8	9.7	0.7	0.3	<0.1	0.2
Air, marine and rail travel	1.0	16.2	0.7	0.2	0.4	<0.1
Off-road vehicles and equipment, tire wear and brake lining	37.4	13.4	9.3	1.3	<0.1	<0.1

Note: "Passenger cars and motorcycles" include light-duty vehicles powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines as well as all types of motorcycles. "Passenger light trucks" include light-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines. "Large trucks and buses" include heavy-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Additional information for Figure 26. Contribution of transportation, off-road vehicles and mobile equipment to total air pollutant emissions by transportation mode, Canada, 2022

Transportation mode	Carbon monoxide (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Fine particulate matter (emissions in kilotonnes)	Sulphur oxides (emissions in kilotonnes)	Ammonia (emissions in kilotonnes)
Passenger cars and motorcycles	321.4	11.1	20.7	0.4	0.2	1.8
Passenger light trucks	482.4	22.1	25.4	0.8	0.4	3.2
Large trucks and buses	124.5	125.8	10.3	3.5	0.2	1.2
Air, marine and rail travel	46.8	210.7	9.3	3.0	2.3	<0.1
Off-road vehicles and equipment, tire wear and brake lining	1 681.4	174.7	131.0	16.4	0.2	0.4

Note: "Passenger cars and motorcycles" include light-duty vehicles powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines as well as all types of motorcycles. "Passenger light trucks" include light-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines. "Large trucks and buses" include heavy-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 22. Data for Figure 27. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2022

Year	Nitrogen oxides (percentage change from 1990 level)	Carbon monoxide (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)
1990	0	0	0
1991	-3	-5	-2
1992	0	-5	1
1993	6	-5	5
1994	15	-4	11
1995	18	-2	20
1996	22	-3	25
1997	26	-4	28
1998	25	-5	31
1999	25	-7	33
2000	23	-9	29
2001	16	-11	27
2002	11	-12	24
2003	7	-18	18
2004	3	-24	13
2005	-1	-31	5
2006	-7	-36	-3
2007	-10	-45	-11
2008	-15	-50	-19
2009	-22	-52	-25
2010	-22	-50	-26
2011	-28	-55	-34
2012	-34	-58	-40
2013	-37	-60	-43
2014	-41	-64	-50
2015	-45	-66	-54
2016	-50	-65	-55
2017	-49	-67	-58
2018	-51	-67	-60
2019	-52	-68	-62
2020	-57	-72	-67
2021	-57	-71	-67
2022	-57	-72	-69

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the table due to their low share (≤ 5%) of total emissions in 2022.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Additional information for Figure 27. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2022

Year	Nitrogen oxides (emissions in kilotonnes)	Carbon monoxide (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)
1990	1 269	9 576	634
1991	1 230	9 136	623
1992	1 271	9 143	642
1993	1 343	9 080	668
1994	1 458	9 195	707
1995	1 502	9 412	760
1996	1 545	9 300	790
1997	1 595	9 187	814
1998	1 591	9 096	834
1999	1 582	8 907	843
2000	1 564	8 754	820
2001	1 477	8 557	805
2002	1 409	8 399	788
2003	1 359	7 810	747
2004	1 307	7 311	716
2005	1 253	6 646	665
2006	1 177	6 138	617
2007	1 140	5 252	564
2008	1 085	4 798	512
2009	992	4 570	476
2010	984	4 753	469
2011	908	4 272	416
2012	842	3 979	383
2013	802	3 843	359
2014	747	3 468	317
2015	697	3 274	295
2016	635	3 304	284
2017	645	3 204	268
2018	621	3 133	255
2019	608	3 069	243
2020	540	2 720	212
2021	546	2 793	209
2022	544	2 657	197

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the table due to their low share (≤ 5%) of total emissions in 2022.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A.23. Data for Figure 28. Contribution of electric utilities to total air pollutant emissions by fuel source, Canada, 2022

Fuel source	Sulphur oxides (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Ammonia (percentage of national emissions)
Coal	22.0	4.5	0.5	<0.1	<0.1	<0.1
Natural gas	0.3	1.4	0.2	<0.1	<0.1	<0.1
Diesel	<0.1	0.5	<0.1	<0.1	<0.1	n/a
Other sources	1.3	0.6	0.1	<0.1	<0.1	<0.1

Note: n/a = not available. Excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose. "Other" fuel sources include waste material and other uncategorized sources of electricity generation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Additional information for Figure 28. Contribution of electric utilities to total air pollutant emissions by fuel source, Canada, 2022

Fuel source	Sulphur oxides (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Carbon monoxide (emissions in kilotonnes)	Fine particulate matter (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Ammonia (emissions in kilotonnes)
Coal	143.3	58.6	21.6	1.2	0.3	<0.1
Natural gas	2.1	17.9	10.4	0.4	0.8	0.1
Diesel	<0.1	7.1	1.4	0.1	<0.1	n/a
Other sources	8.8	7.2	6.3	0.3	0.2	0.1

Note: n/a = not available. Excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose. "Other" fuel sources include waste material and other uncategorized sources of electricity generation.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Table A. 24. Data for Figure 29. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2022

Year	Sulphur oxides (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)
1990	0	0
1991	-4	-2
1992	-1	2
1993	-12	-5
1994	-9	-7
1995	-14	-3
1996	-12	5
1997	-4	12
1998	-2	21

Year	Sulphur oxides (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)
1999	-3	19
2000	0	27
2001	1	22
2002	1	23
2003	2	14
2004	-6	4
2005	-16	-1
2006	-26	-13
2007	-20	-7
2008	-31	-12
2009	-38	-15
2010	-46	-9
2011	-53	-22
2012	-54	-35
2013	-55	-37
2014	-56	-35
2015	-59	-41
2016	-59	-41
2017	-60	-44
2018	-64	-50
2019	-67	-51
2020	-73	-60
2021	-73	-62
2022	-75	-65

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the table due to their low share (≤ 1%) of total emissions in 2022. The indicator excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

Additional information for Figure 29. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2022

Year	Sulphur oxides (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)
1990	618	257
1991	592	251
1992	611	263
1993	547	243
1994	560	240

Year	Sulphur oxides (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)
1995	533	248
1996	542	269
1997	591	288
1998	604	310
1999	601	306
2000	619	327
2001	624	313
2002	624	315
2003	630	293
2004	582	268
2005	522	254
2006	459	224
2007	492	239
2008	428	225
2009	384	218
2010	334	234
2011	293	200
2012	284	166
2013	278	162
2014	269	167
2015	252	152
2016	253	152
2017	245	145
2018	220	129
2019	205	125
2020	168	102
2021	169	98
2022	154	91

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the table due to their low share (≤ 1%) of total emissions in 2022. The indicator excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose.
Source: Environment and Climate Change Canada (2024) Air Pollutant Emissions Inventory.

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