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AIR POLLUTANT EMISSIONS

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

Canada

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CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

AIR POLLUTANT EMISSIONS

July 2021

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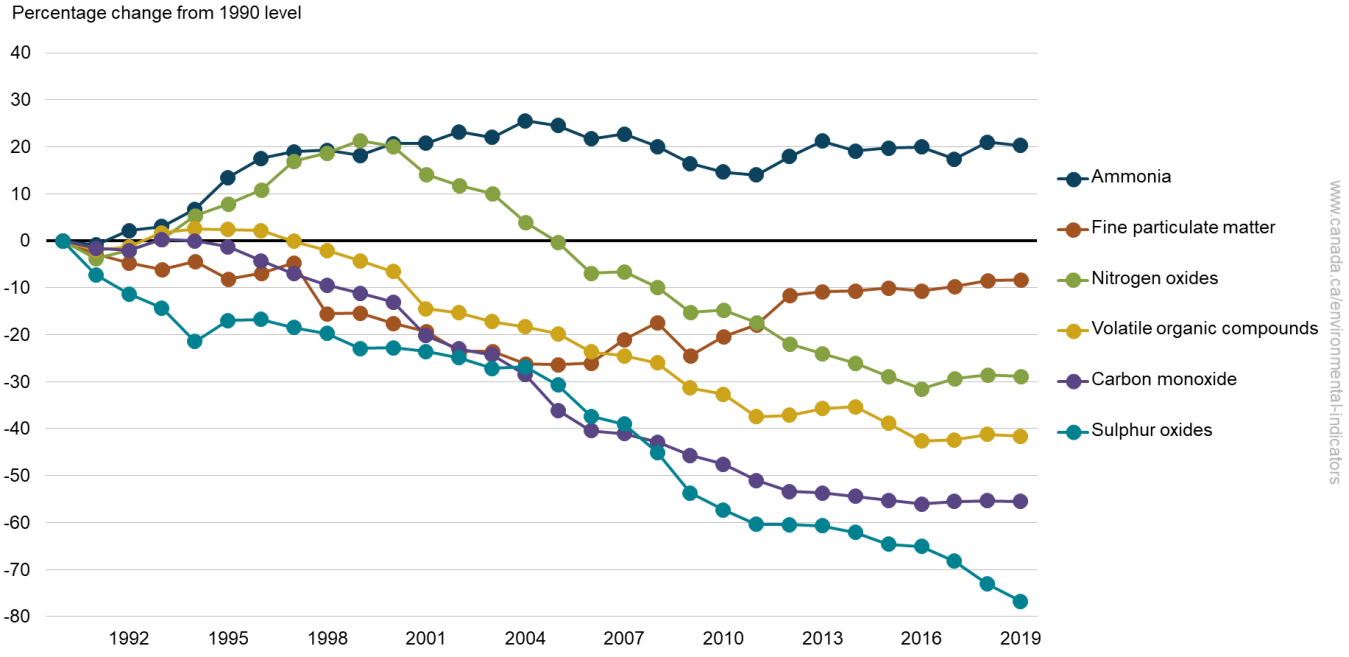
Air pollutant emissions

Air pollution problems, such as smog and acid rain, result from the release of pollutants into the atmosphere. 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.

Key results

- In 2019, emissions of 5 key air pollutants SO_X, NO_X, VOCs, CO and $PM_{2.5}$ ranged from 77% to 8% lower than in 1990
- Emissions of NH_3 were 20% higher than in 1990

Figure 1. Air pollutant emissions, Canada, 1990 to 2019



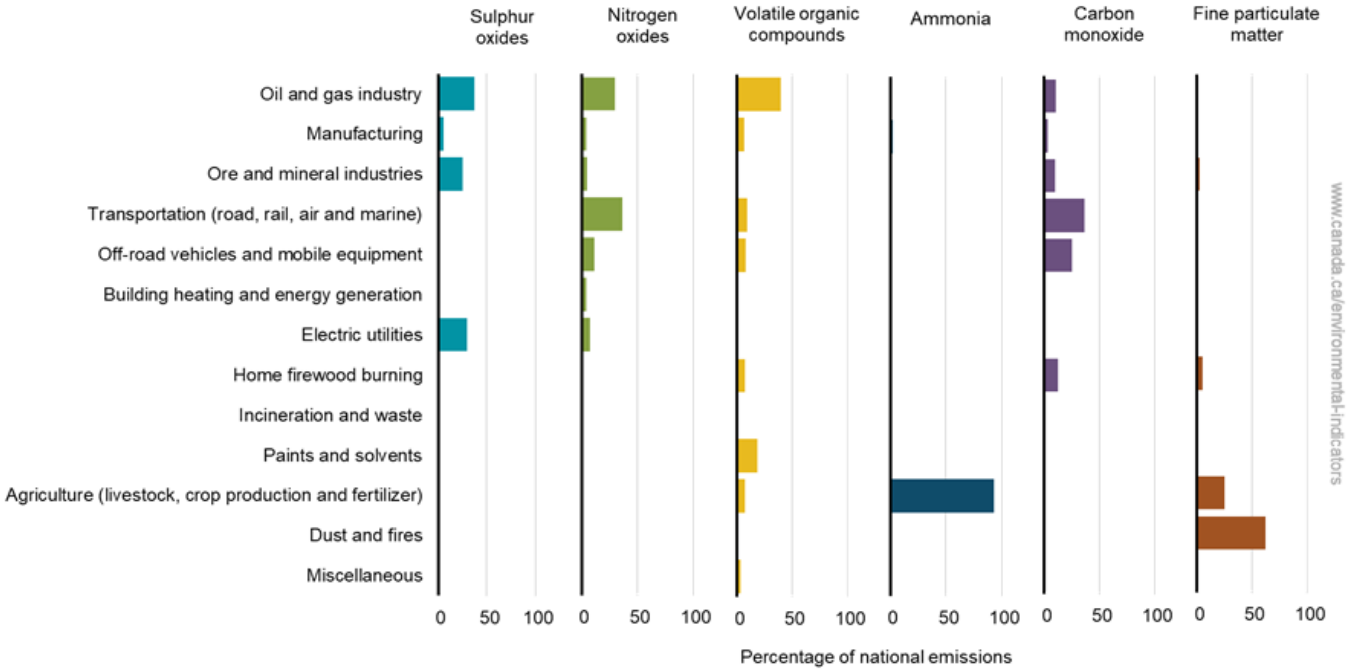
Data for Figure 1

Note: This 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 (2021) Air Pollutant Emissions Inventory.

Between 1990 and 2019, the largest emission reductions were observed for SO_X, which decreased by 77%. It was followed by CO emissions (55% reduction), VOCs (42%), NO_X (29%) and $PM_{2.5}$ (8%). These reductions since 1990 are due in part to government actions and voluntary initiatives from key industrial emitters that were put in place to restrict or eliminate the release of air pollutants in Canada. For $PM_{2.5}$, since 2009, emissions have been steadily increasing, outweighing the reductions observed over the period. Compared to 2018, in 2019 there has been a slight downward trend in all the pollutants with the exception of $PM_{2.5}$.

In 2019, the majority of emissions of the 6 key air pollutants in Canada came from the oil and gas industry, transportation, agriculture, and dust and fires (for example, road dust, dust from construction operations and prescribed burning).

Figure 2. Distribution of air pollutant emissions by source, Canada, 2019



Data for Figure 2

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 "dust and fires" includes emissions from human activities such as prescribed burning and dust from roads. Consult Table 2 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 (2021) Air Pollutant Emissions Inventory.

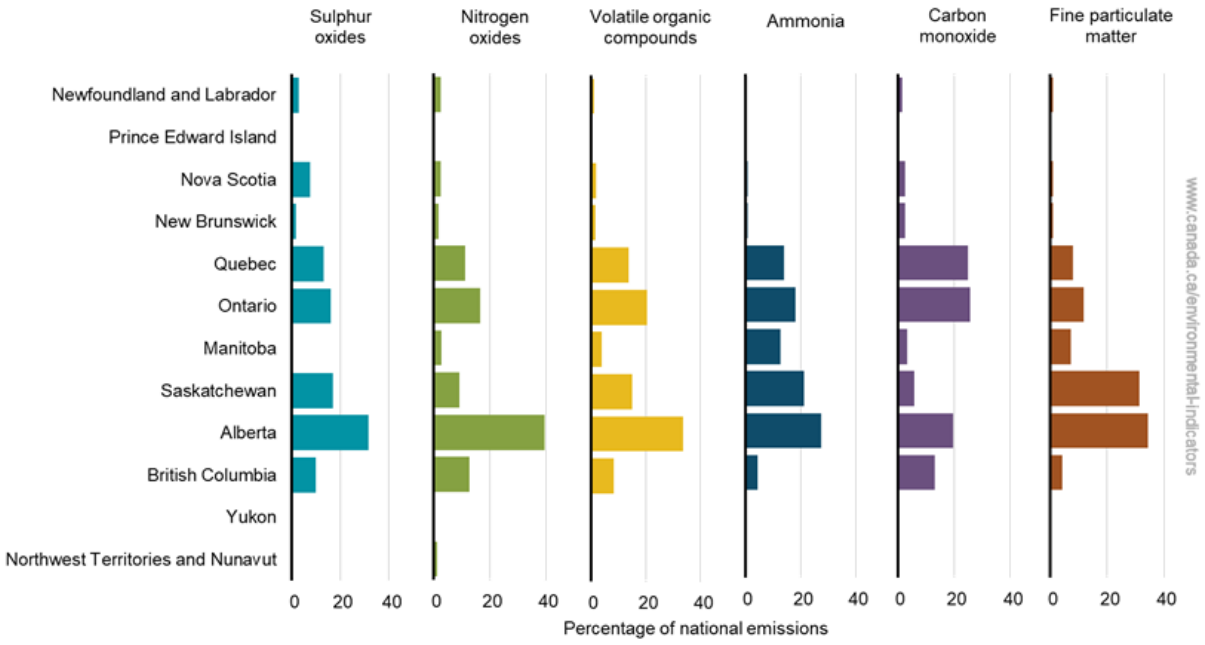
The human made sources most contributing to Canada's air pollutant emissions in 2019 were the following:

- the oil and gas industry, electric utilities and ore and mineral industries together represented the majority of SO_X emissions
- transportation (road, rail, air and marine) was a key source of NO_X and CO emissions
- off-road vehicles and mobile equipment and home firewood burning were also important sources of CO emissions and the oil and gas industry was an important source 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
- dust and fires were the most important sources of $PM_{2.5}$ emissions

At the provincial level, emissions of the 6 key air pollutants in 2019 were:

- the highest in Alberta for SO_X, (32% of national emissions), NO_X (39%), VOCs (34%), NH_3 (27%) and $PM_{2.5}$ (34%)
- the highest in Ontario for CO (26%)
- the second highest in Ontario for NO_X (17% of national emissions) and VOCs (20%)
- also important in Saskatchewan for SO_X, NH_3 and $PM_{2.5,}$ and Quebec for CO, accounting for 17%, 21%, 31% and 25% of the national emissions of these pollutants

Figure 3. Distribution of air pollutant emissions by province and territory, Canada, 2019



Data for Figure 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.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

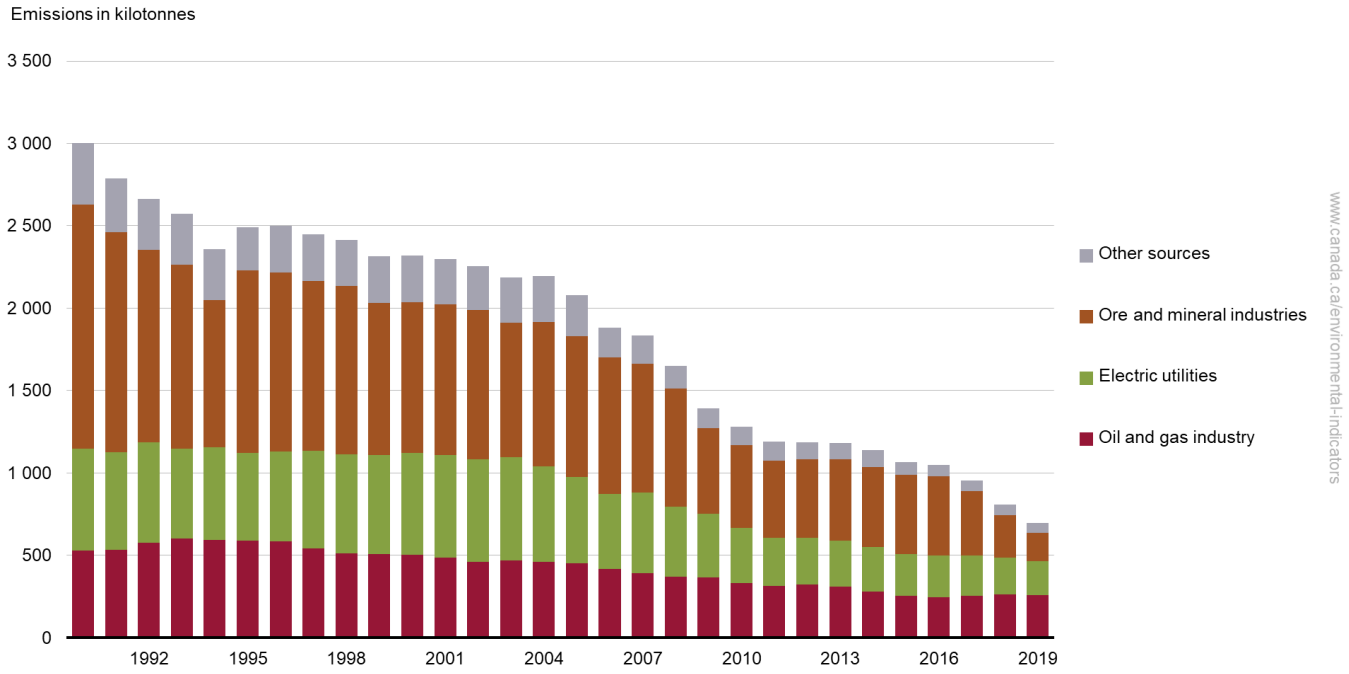
Sulphur oxide emissions by source

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 is also a precursor to fine particulate matter ($PM_{2.5}$) and acid rain.

Key results

- Between 1990 and 2019, SO_X emissions decreased by 77% to 699 kilotonnes (kt) in 2019
- In 2019, three sources accounted for 91% (638 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 2019



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 2 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 (2021) Air Pollutant Emissions Inventory.

In 2019, the oil and gas industry accounted for approximately 37% of total national SO_X emissions (259 kt). Electric utilities and ore and mineral industries followed with 29% (205 kt) and 25% (173kt) of national emissions. For the ore and mineral industries, 35% (61 kt) of its SO_X emissions came from the non-ferrous refining and smelting industry.

The largest reduction in emissions between 1990 and 2019 was from ore and mineral industries with a reduction in emissions of 1 308 kt. The largest driver of the reduction from the source was from the non-ferrous refining and smelting industry with a reduction of 1 211 kt over the period.

This significant decrease in SO_X emissions from 1990 to 2019 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:

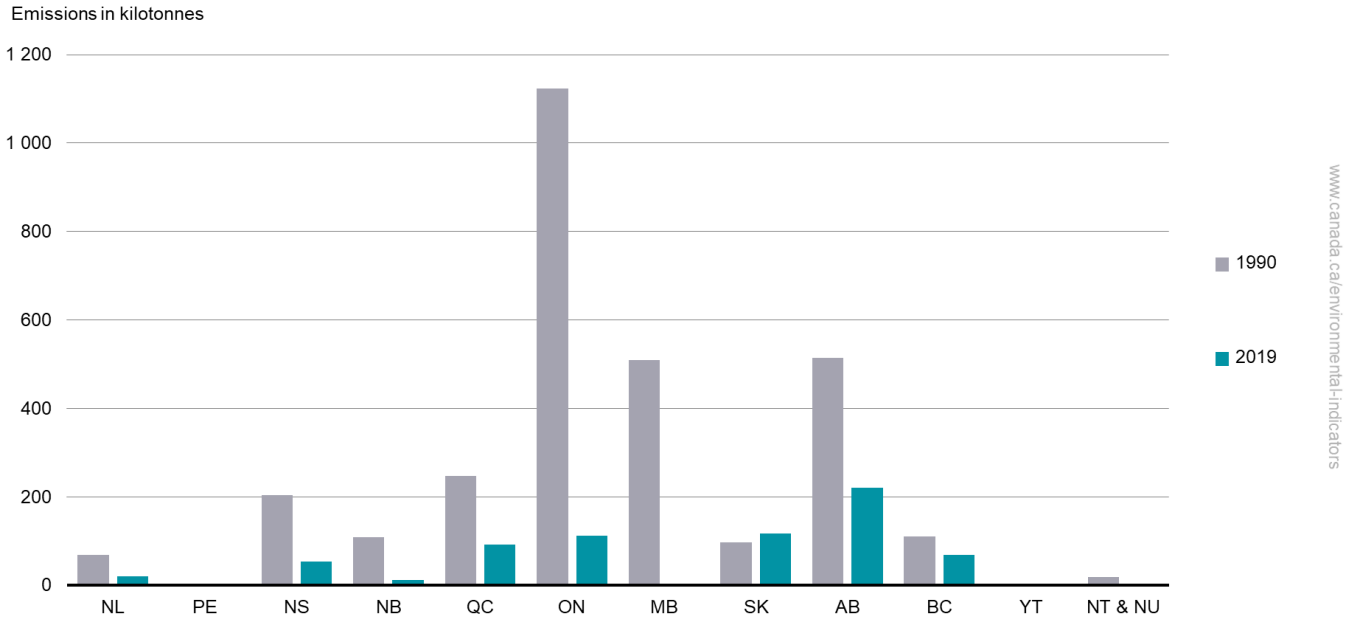
- technological upgrades, new air pollution controls for non-ferrous metal smelters and the closure of 4 major smelters in Manitoba, Ontario, Quebec and New Brunswick
- lower emissions from fossil-fuel-fired (for example, coal-fired) power-generating utilities as a result of better technologies and plant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

Sulphur oxide emissions by province and territory

Key results

- In 2019, Saskatchewan and Alberta accounted for 48% (338 kt) of national SO_X emissions
- Between 1990 and 2019,
  - the largest reduction were observed in Ontario and Manitoba. Emissions in these provinces decreased by 1 011 kt (90%) and 507 kt (99%)
  - Saskatchewan was the only province that experienced an increase in SO_X (21%, or 20 kt)

Figure 5. Sulphur oxide emissions by province and territory, Canada, 1990 and 2019



Data for Figure 5

[1] Environment and Climate Change Canada (1991) Canada-United States Air Quality Agreement. Retrieved on February 16, 2021.

[2] Canadian Council of Ministers of the Environment (1998) The Canada-Wide Acid Rain Strategy for Post-2000. Retrieved on February 16, 2021.

[3] Environment and Climate Change Canada (2015) Sulphur in Gasoline Regulations. Retrieved on February 16, 2021.

[4] Environment and Climate Change Canada (2017) Sulphur in Diesel Fuel Regulations. Retrieved on February 16, 2021.

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 (2021) Air Pollutant Emissions Inventory.

Alberta had the highest SO_X emissions level in 2019, accounting for 32% (221 kt) of total national emissions. Emissions in the province mainly came from the oil and gas industry and electric utilities, combined accounting for 95% (209 kt) of the emissions.

Saskatchewan was the second-highest emitter of SO_X in 2019, accounting for 17% (117 kt) of total national emissions. Emissions from electric utilities and the oil and gas industry were the largest contributors to SO_X emissions in the province in 2019.

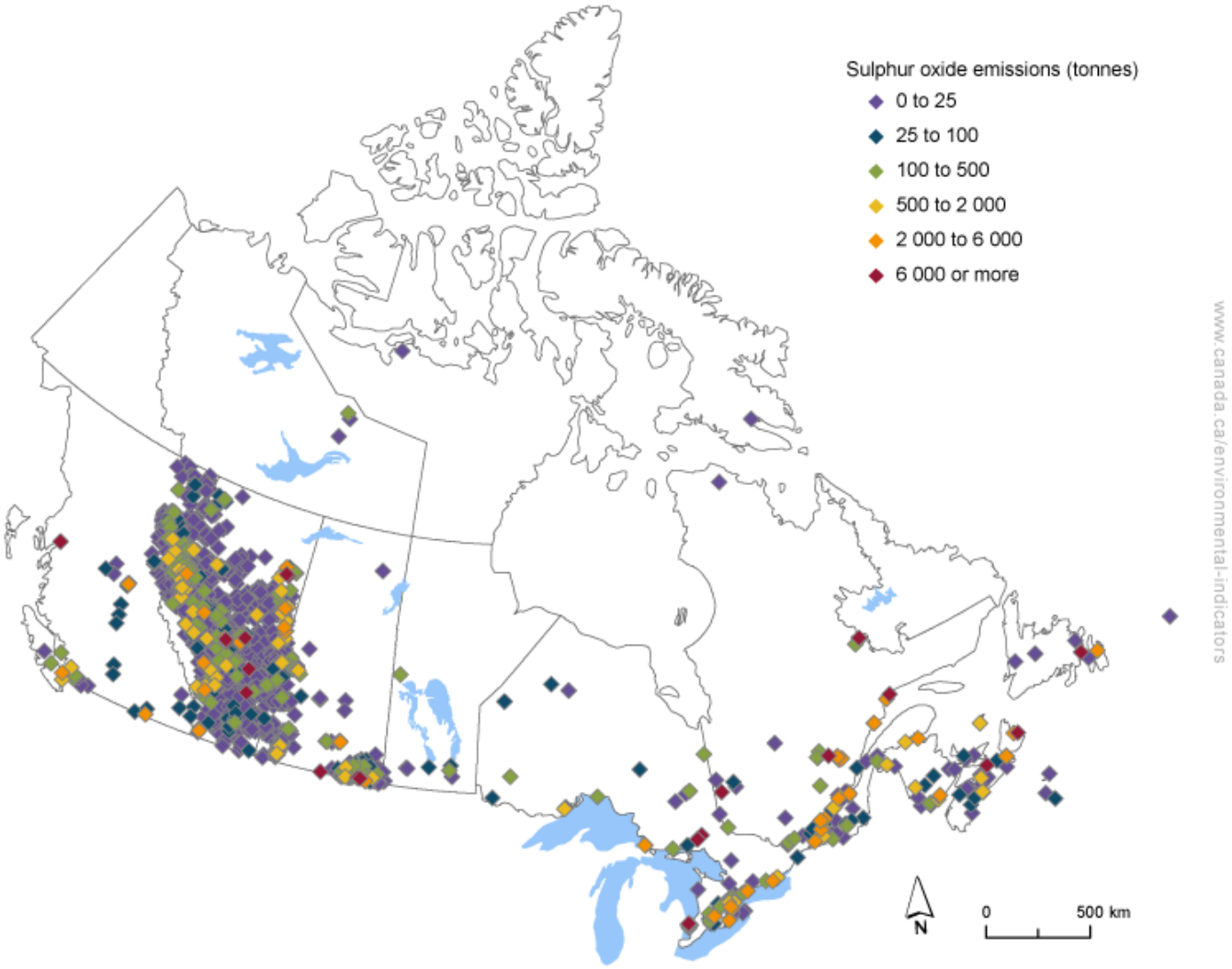
Ontario ranked third, with 16% (113 kt) of total national emissions; ore and mineral industries was the most important source of emissions in the province. The sharp reduction in SO_X emissions in Ontario between 1990 and 2019 was mainly due to emission reductions from ore and mineral industries (notably the non-ferrous refining and smelting industry) and electric utilities.

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.

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.

Figure 6. Sulphur oxide emissions by reporting facilities, Canada, 2019



Note: Facility-reported sulphur oxide emissions represent 87% of total national sulphur oxide emissions.
Source: Environment and Climate Change Canada (2021) National Pollutant Release Inventory.

Navigate data using the interactive map

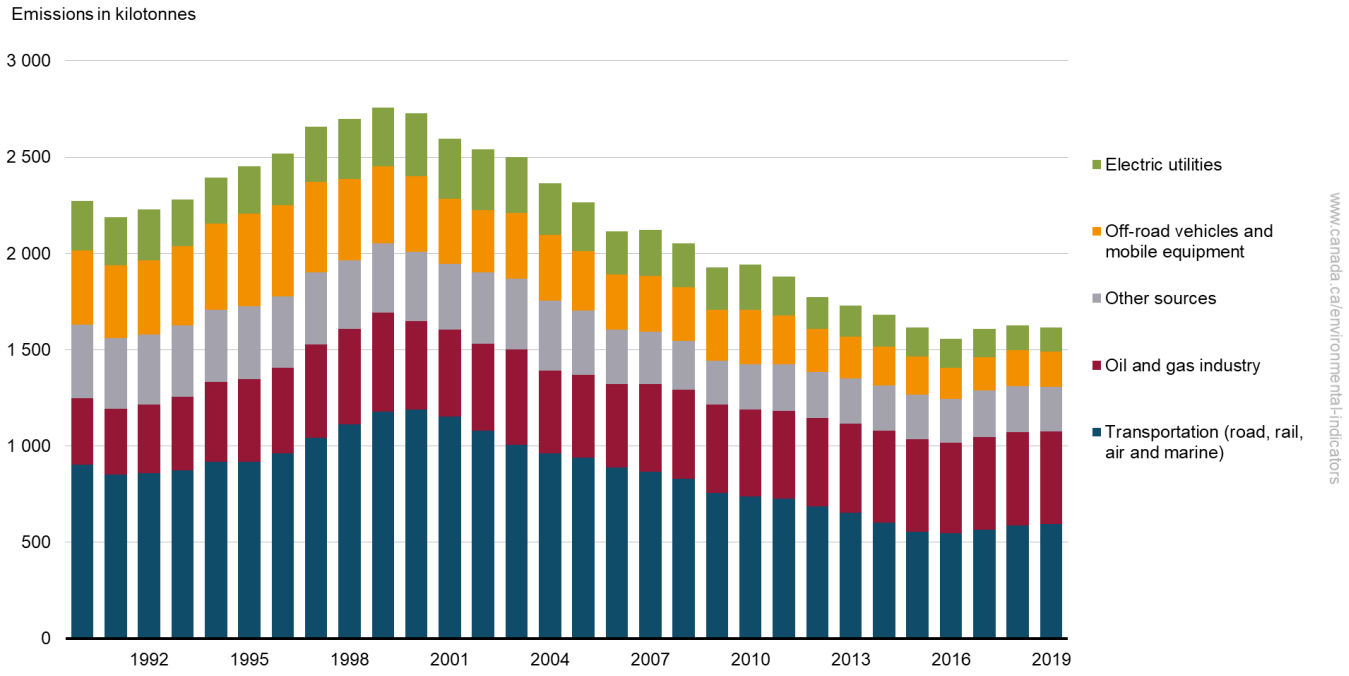
Nitrogen oxide emissions by source

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 2019, NO_X emissions were 1 617 kilotonnes (kt). This is 29% lower than in 1990
- Transportation (road, rail, air and marine) was a major source of NO_X representing 37% (593 kt) of total emissions in 2019

Figure 7. Total nitrogen oxide emissions by source, Canada, 1990 to 2019



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 2 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 (2021) Air Pollutant Emissions Inventory.

While transportation (road, rail, air and marine) was the main contributor of NO_X, it was also the sector that experienced the largest reduction between 1990 and 2019. Emissions of NO_X from this sector decreased by 308 kt (34%) during that period.

The oil and gas industry emitted the next largest proportions of NO_X emissions in 2019, representing 30% (481 kt) of total national emissions. This sector also experienced the largest increase 39% (135 kt) in emissions between 1990 and 2019, partly offsetting reductions from other sectors.

The decline in NO_X emissions between 1990 and 2019 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)

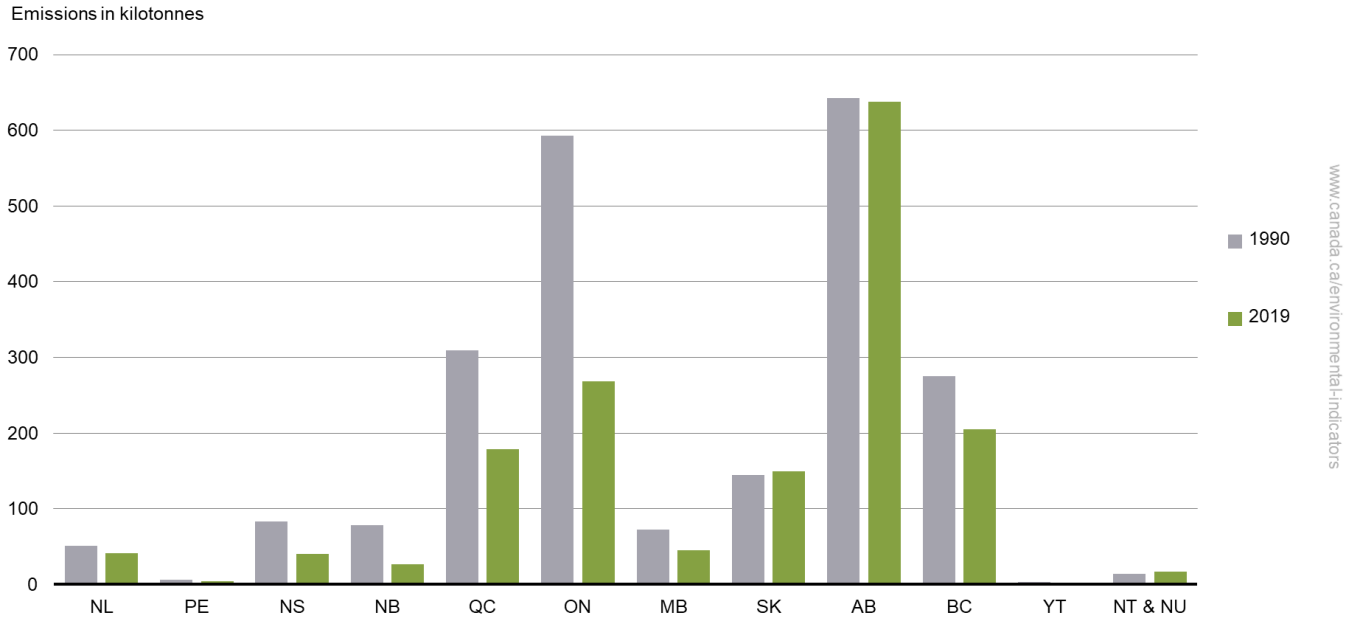
More recently, since 2016, NO_X emissions have started to trend up mainly due to increases in emissions from transportation and the oil and gas industry.

Nitrogen oxide emissions by province and territory

Key results

- Among provinces and territories, Alberta emitted the most NO_X in 2019. The province accounted for 39% (638 kt) of national emissions
- Between 1990 and 2019,
- the largest reduction was observed in Ontario. Emissions decreased by 324 kt (55%) in the province
- NO_X emissions slightly increased in Saskatchewan and increased by 24% (3 kt) in Nunavut and Northwest Territories combined

Figure 8. Nitrogen oxide emissions by province and territory, Canada, 1990 and 2019



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 (2021) Air Pollutant Emissions Inventory.

The oil and gas industry is an important source of NO_X emissions in Alberta, accounting for 60% (384 kt) of the province's NO_X emissions in 2019. The increasing contribution of this sector to the province's emissions between 1990 and 2019 was offset by emission reductions from the transport and electric utilities sectors.

Ontario and British Columbia both contributed the second and third largest proportion of NO_X emissions in 2019, accounting for 17% (269 kt) and 13% (205 kt) of total national emissions, with transportation (road, rail, air and marine) being the most important source in both provinces followed by off-road vehicles and mobile equipment in Ontario and the oil and gas industry in British Columbia. However, Ontario experienced the largest decrease in emissions levels (324 kt) between 1990 and 2019 in large part due to emission reductions from transportation, electric utilities and off-road vehicles and mobile equipment.

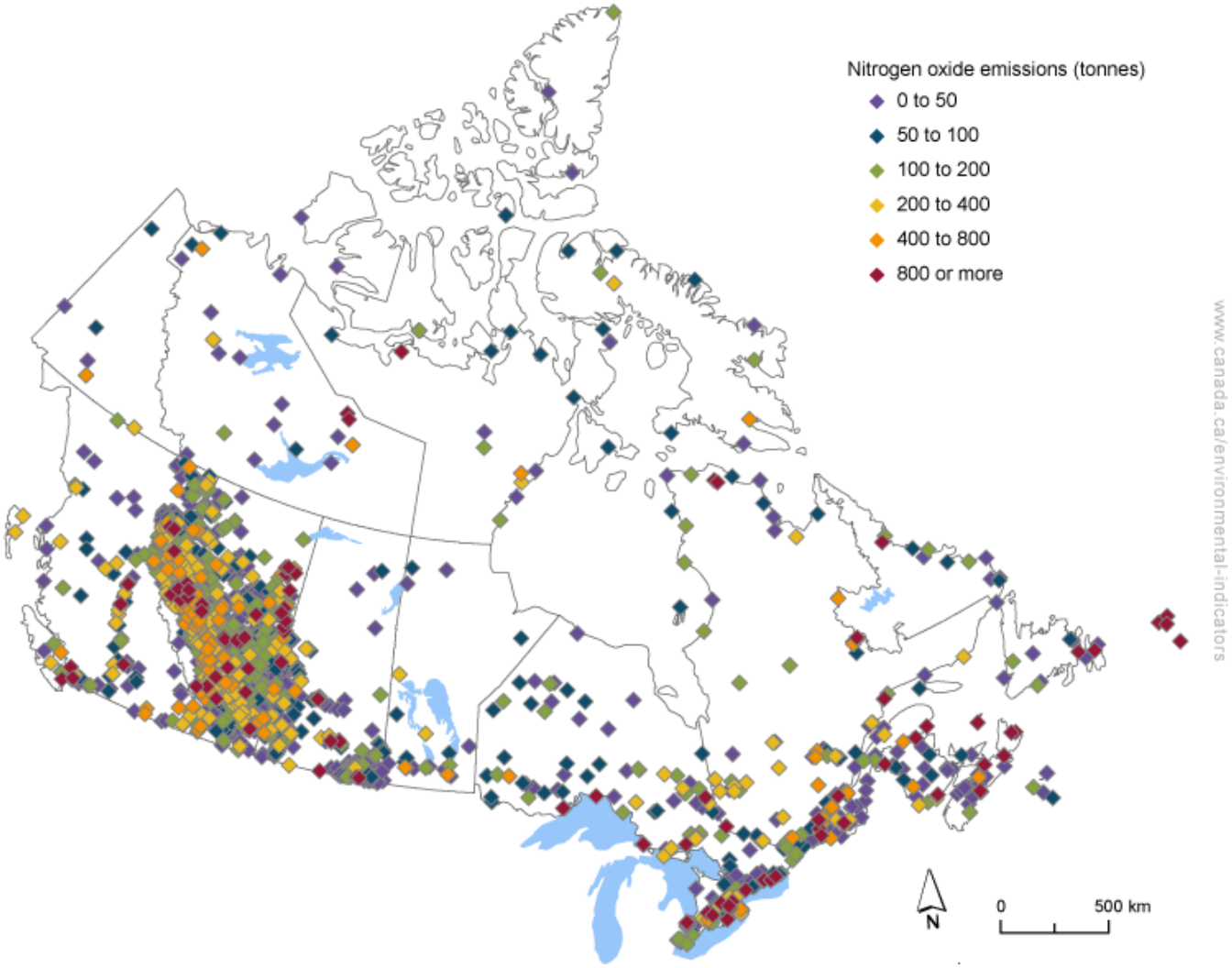
Quebec ranked fourth, with 11% (179 kt) of total national emissions. Transportation (road, rail, air and marine) was the most important source of NO_X in this province.

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.

Figure 9. Nitrogen oxide emissions by reporting facilities, Canada, 2019



Note: Facility-reported nitrogen oxide emissions represent 35% of total national nitrogen oxide emissions.
Source: Environment and Climate Change Canada (2021) National Pollutant Release Inventory.

Navigate data using the interactive map

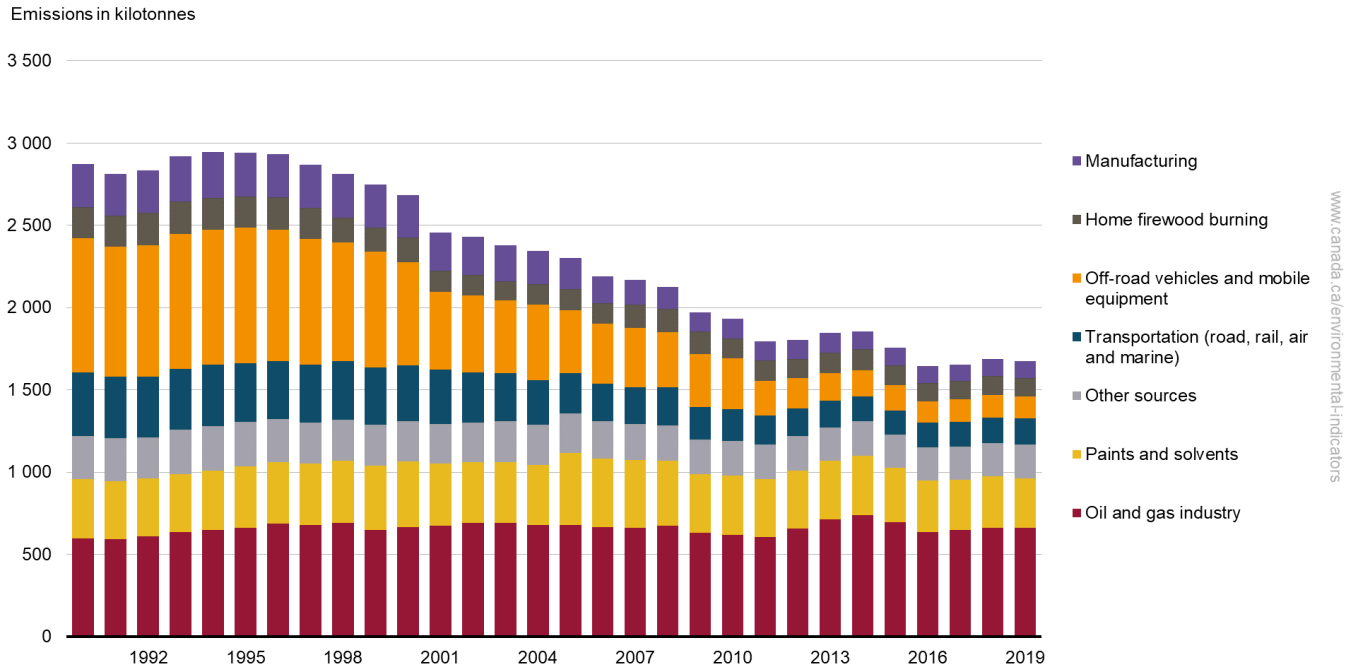
Volatile organic compound emissions by source

Volatile organic compounds (VOCs) are carbon-containing gases and vapours released into the atmosphere by natural sources and human activities.[5] 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 2019, VOC emissions in Canada were 1 675 kilotonnes (kt). This is a 1 195 kt (42%) decrease from 1990 levels
- Since 2000, the oil and gas industry has been the highest contributor to VOC emissions. In 2019, the sector accounted for 39% (659 kt) of total emissions

Figure 10. Total volatile organic compound emissions by source, Canada, 1990 to 2019



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, agriculture (livestock, crop production and fertilizer) and other miscellaneous sources. Consult Table 2 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 (2021) Air Pollutant Emissions Inventory.

Paints and solvents and transportation (road, rail, air and marine) were also important sources of VOC emissions in 2019 contributing 18% (303 kt) and 9% (155 kt) of total emissions.

The source with the largest emissions reduction between 1990 and 2019 was off-road vehicles and mobile equipment, with emissions reductions of 683 kt (84%).

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

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

- 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 improved emission controls
- lower levels of VOCs in products such as paints, solvents and cleaners

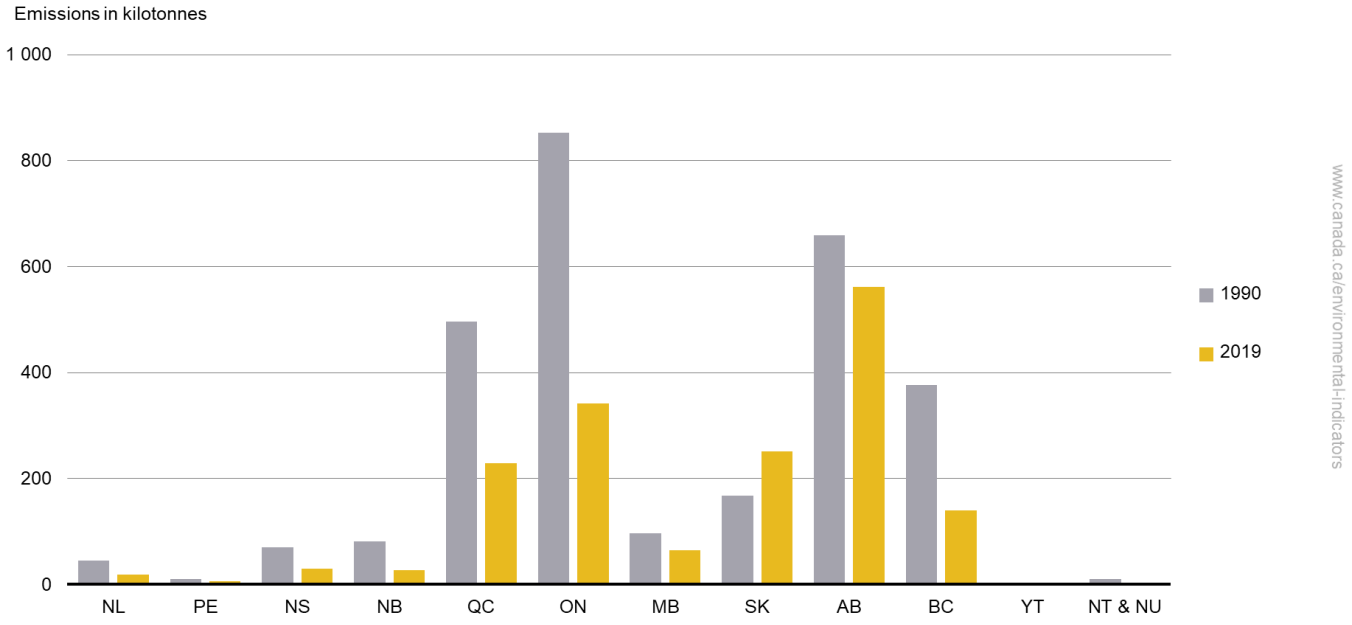
The source with the most significant emissions growth over the 1990 to 2019 period was the oil and gas industry with an increase of 60 kt (10%).

Volatile organic compound emissions by province and territory

Key results

- Alberta emitted the highest proportion of VOCs in 2019. The province represented 34% (561 kt) of national emissions
- Between 1990 and 2019,
- Ontario experienced the largest reduction in VOC emissions. Emissions in the province decreased by 60% (511 kt)
- Saskatchewan was the only province that experienced an increase in VOC emissions of 49% (83 kt)

Figure 11. Volatile organic compound emissions by province and territory, Canada, 1990 and 2019



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 (2021) Air Pollutant Emissions Inventory.

Alberta was the highest emitting province of VOCs in 2019 (561 kt), with the oil and gas industry as the main source, contributing 74% (415 kt) of the province's emissions.

Ontario was the second-highest emitter of VOCs, accounting for 20% (342 kt) of total national emissions in 2019. The main emission sources are paints and solvents, off-road vehicles and mobile equipment, and transportation (road, rail, air and marine). Ontario also experienced the largest reduction in emissions, with 511 kt (60%) between 1990 and 2019, mainly as a result of emission reductions from off-road vehicles and mobile equipment and transportation (road, rail, air and marine).

Saskatchewan was the third largest emitter, with 15% (251 kt) of total national emissions, where the oil and gas industry accounted for 77% of the emissions in that province.

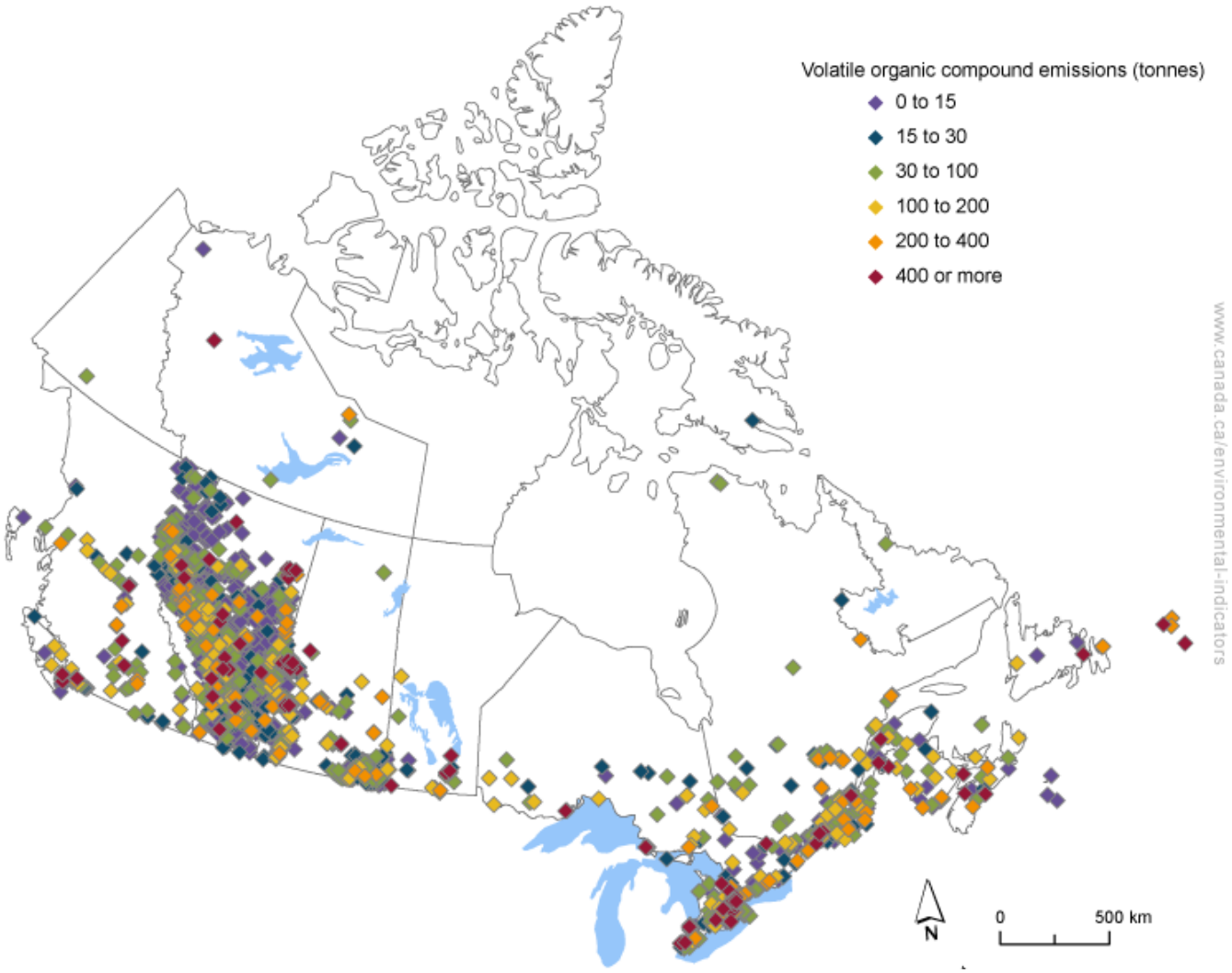
Most provinces and territories experienced significant reductions in emissions between 1990 and 2019 with the exception of Saskatchewan, where emissions increased 49% over the period. The oil and gas industry is responsible for the increase in emissions in Saskatchewan.

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.

Figure 12. Volatile organic compound emissions by reporting facilities, Canada, 2019



Note: Facility-reported volatile organic compound emissions represent 15% of total national volatile organic compound emissions.
Source: Environment and Climate Change Canada (2021) National Pollutant Release Inventory.

Navigate data using the interactive map

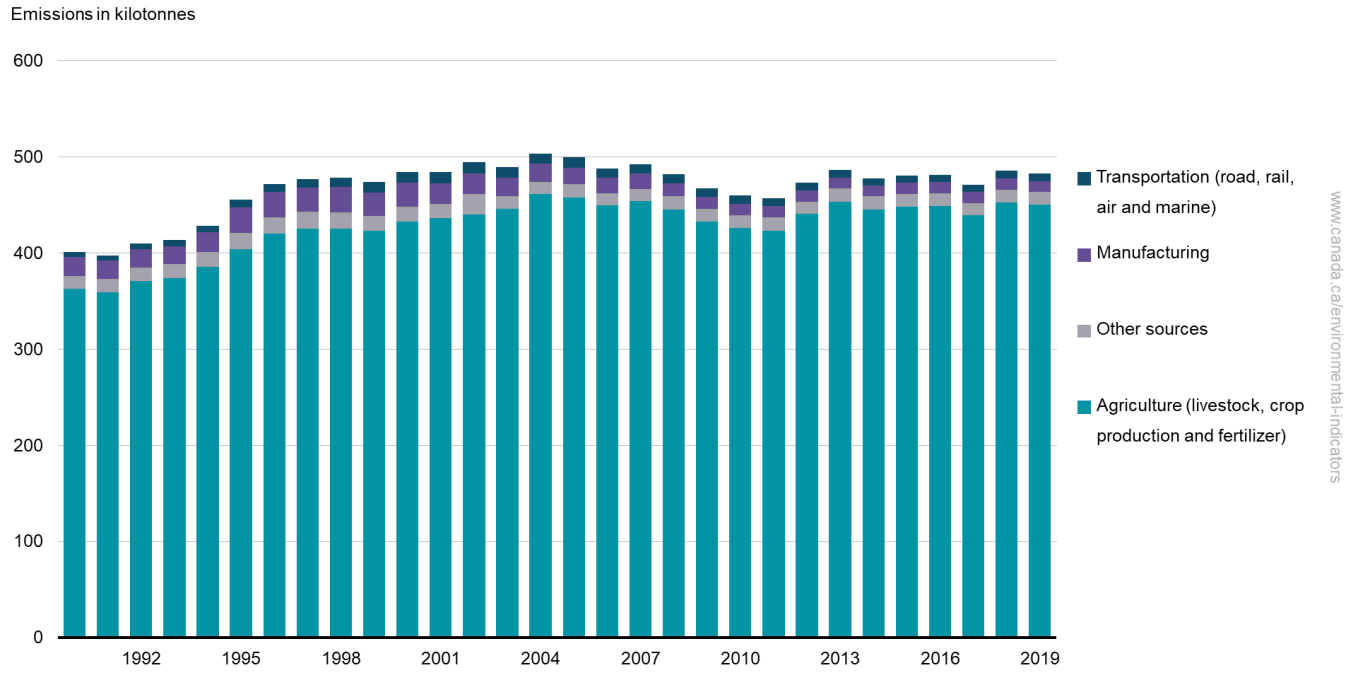
Ammonia emissions by source

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 2019, NH_3 emissions were 483 kilotonnes (kt). This is 20% higher than in 1990
- Agriculture (livestock, crop production and fertilizer) was the main source of NH_3 emissions in 2019. Emissions from this source accounted for more than 93% (450 kt) of total national emissions

Figure 13. Total ammonia emissions by source, Canada, 1990 to 2019



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 2 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 (2021) Air Pollutant Emissions Inventory.

Between 1990 and 2019, agriculture (livestock, crop production and fertilizer) experienced the largest increase (24% or 87 kt) in NH_3 emissions. It also remained the key source of NH_3 emissions throughout that period. Emissions from other sources (14 kt), manufacturing (11 kt) and transportation (road, rail, air and marine) (8 kt) combined represented 7% of national emissions in 2019.

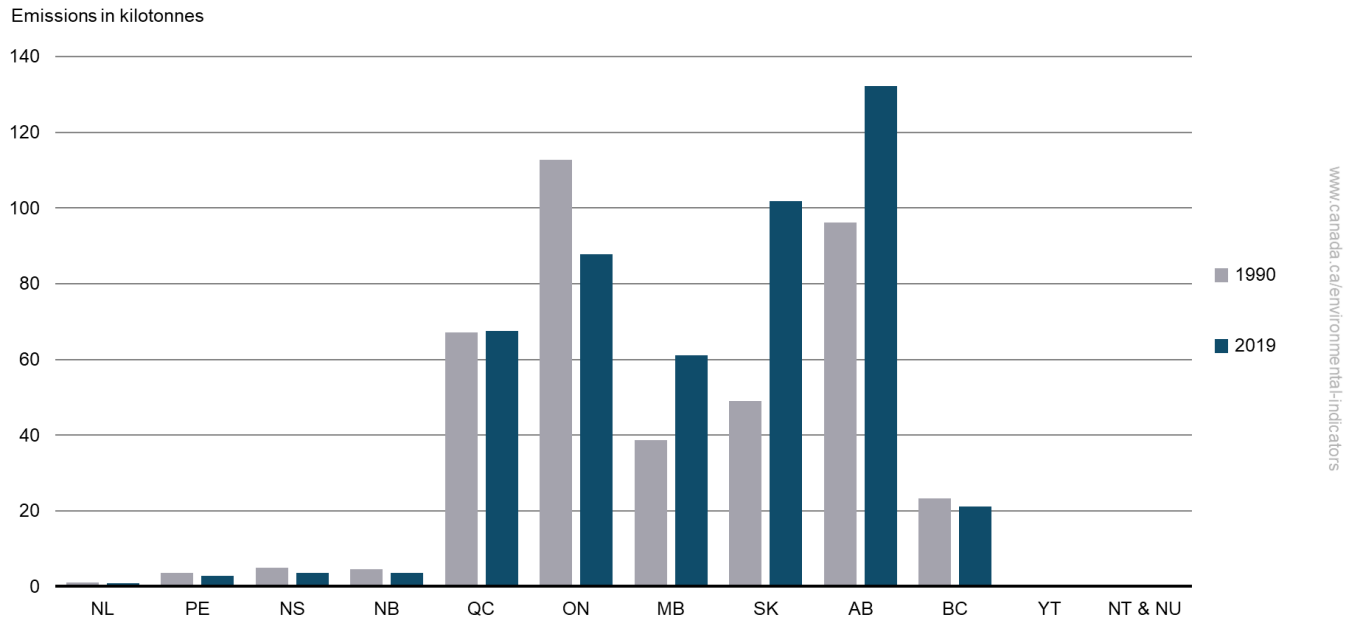
The growth in NH_3 emissions from agriculture (livestock, crop production and fertilizer) between 1990 and 2019 is mainly due to the increased use of synthetic nitrogen fertilizers. Up to 2005, larger livestock populations also added to the growth. However, from 2006 to 2012, livestock populations decreased and have since remained stable. More recently, emissions from crop production have been steadily increasing since 2006.

Ammonia emissions by province and territory

Key results

- In 2019, Alberta and Saskatchewan accounted for almost half (234 kt) of national NH_3 emissions
- Between 1990 and 2019,
    - Ontario experienced the largest emissions reduction. Emissions in the province decreased by 25 kt (22%)
    - The largest increase in NH_3 emissions was in Saskatchewan. Emissions in the province more than doubled (a 53 kt increase)

Figure 14. Ammonia emissions by province and territory, Canada, 1990 and 2019



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 (2021) Air Pollutant Emissions Inventory.

In 2019, Alberta emitted the most NH_3 of all the provinces and territories, accounting for 27% (132 kt) of total national emissions. Saskatchewan contributed the second-largest proportion of NH_3, representing 21% (102 kt).

Ontario and Quebec followed with 18% and 14% (88 kt and 67 kt) of total national emissions, respectively. For all provinces, livestock farms and the application of fertilizers were the most important sources of NH_3 emissions.

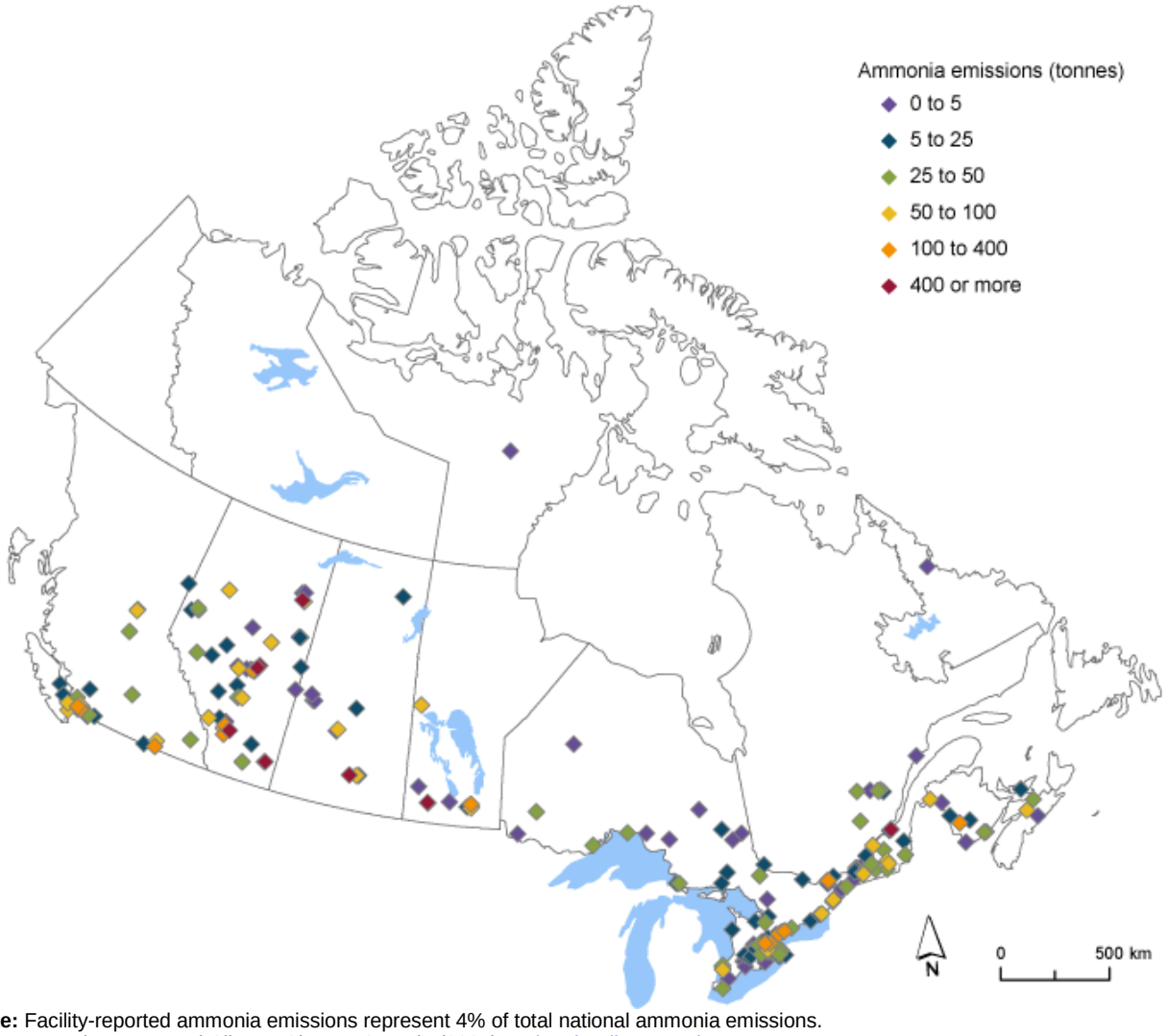
All of the increase in emissions between 1990 and 2019 took place in Saskatchewan, Alberta, Manitoba and Quebec.

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.

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.

Figure 15. Ammonia emissions by reporting facilities, Canada, 2019



Note: Facility-reported ammonia emissions represent 4% of total national ammonia emissions.
Source: Environment and Climate Change Canada (2021) National Pollutant Release Inventory.

Navigate data using the interactive map

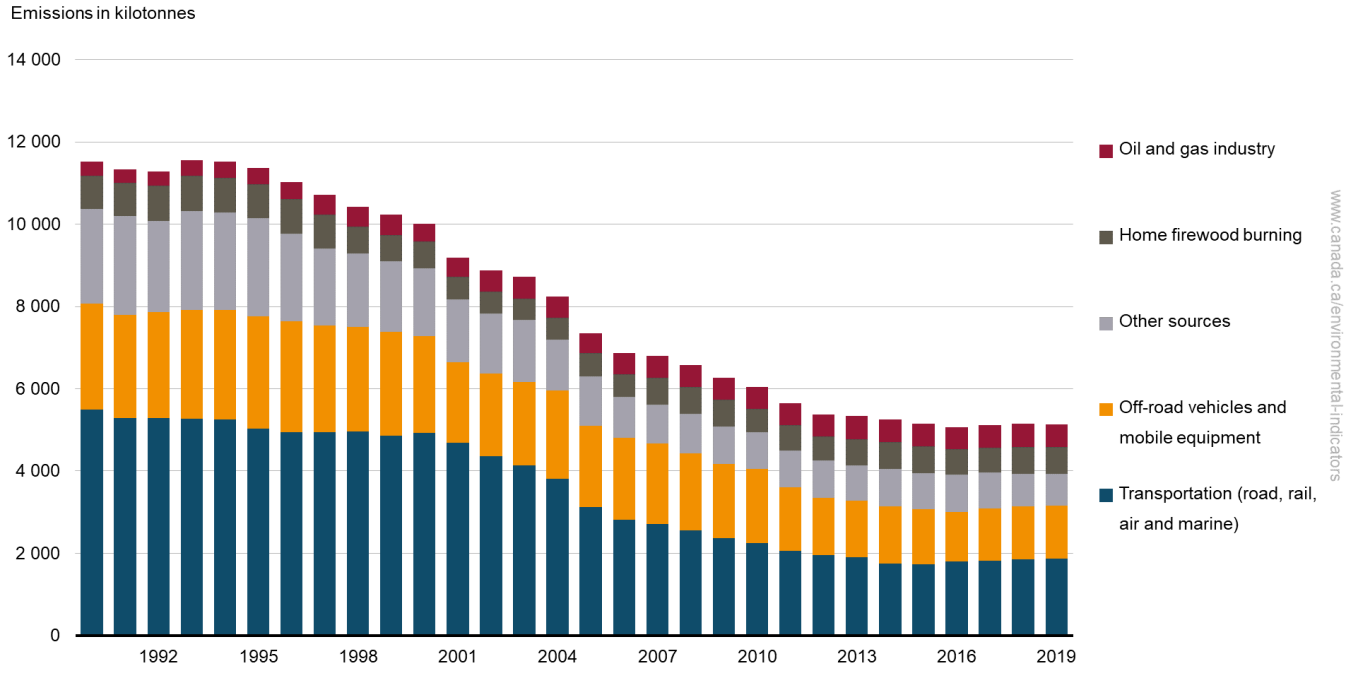
Carbon monoxide emissions by source

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 2019, CO emissions in Canada were 5 129 kilotonnes (kt), a decrease of 55% from 1990 levels
- Transportation (road, rail, air and marine) was the largest source of CO emissions in Canada. In 2019, the sector represented 37% (1 872 kt) of total emissions

Figure 16. Total carbon monoxide emissions by source, Canada, 1990 to 2019



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, ore and mineral industries, manufacturing and other miscellaneous sources. Consult Table 2 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 (2021) Air Pollutant Emissions Inventory.

In 2019, transportation, off-road vehicles and mobile equipment, and home firewood burning were the 3 most important sources of CO. These sources combined represented 74% (3 814 kt) of national emissions.

The largest reduction in emissions between 1990 and 2019 occurred in transportation (road, rail, air and marine) with an emission decrease of 3 622 kt (66%).

The decline in CO emissions between 1990 and 2019 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).

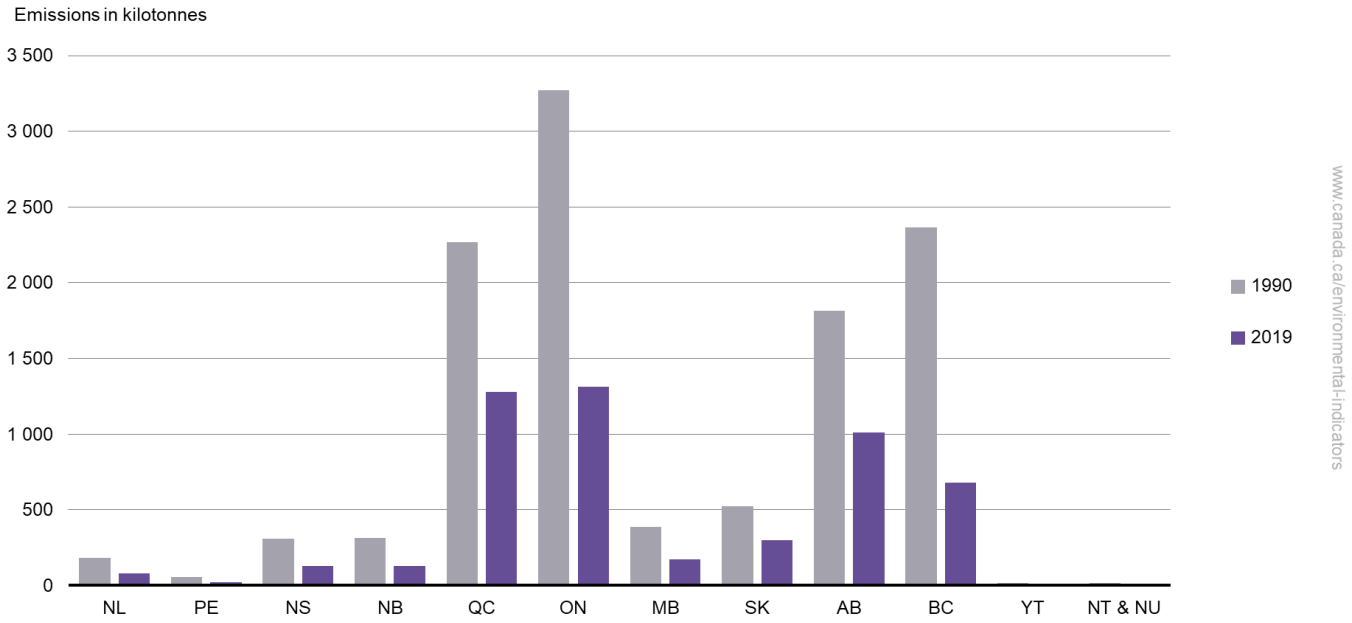
Carbon monoxide emissions by province and territory

Key results

- In 2019, Ontario and Quebec accounted for 50% (2 590 kt) of national CO emissions
- Between 1990 and 2019,

- all provinces and territories experienced significant reductions in emissions
- the largest reductions occurred in Ontario (1 956 kt or 60%), British Columbia (1 686 kt or 71%) and Quebec (989 kt or 44%)

Figure 17. Carbon monoxide emissions by province and territory, Canada, 1990 and 2019



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 (2021) Air Pollutant Emissions Inventory.

In 2019, Ontario emitted the most CO of all the provinces and territories, representing 26% (1 313 kt) of the total national emissions. Transportation (road, rail, air and marine) was the most important source of CO emissions for Ontario.

The province of Quebec ranked second, with 25% (1 277 kt) of total national emissions in 2019, with 28% of those emissions from ore and mineral industries.

Alberta, the third largest CO emitter, accounted for 20% (1 010 kt) of total national emissions. The oil and gas industry accounted for 42% of the province's CO emissions.

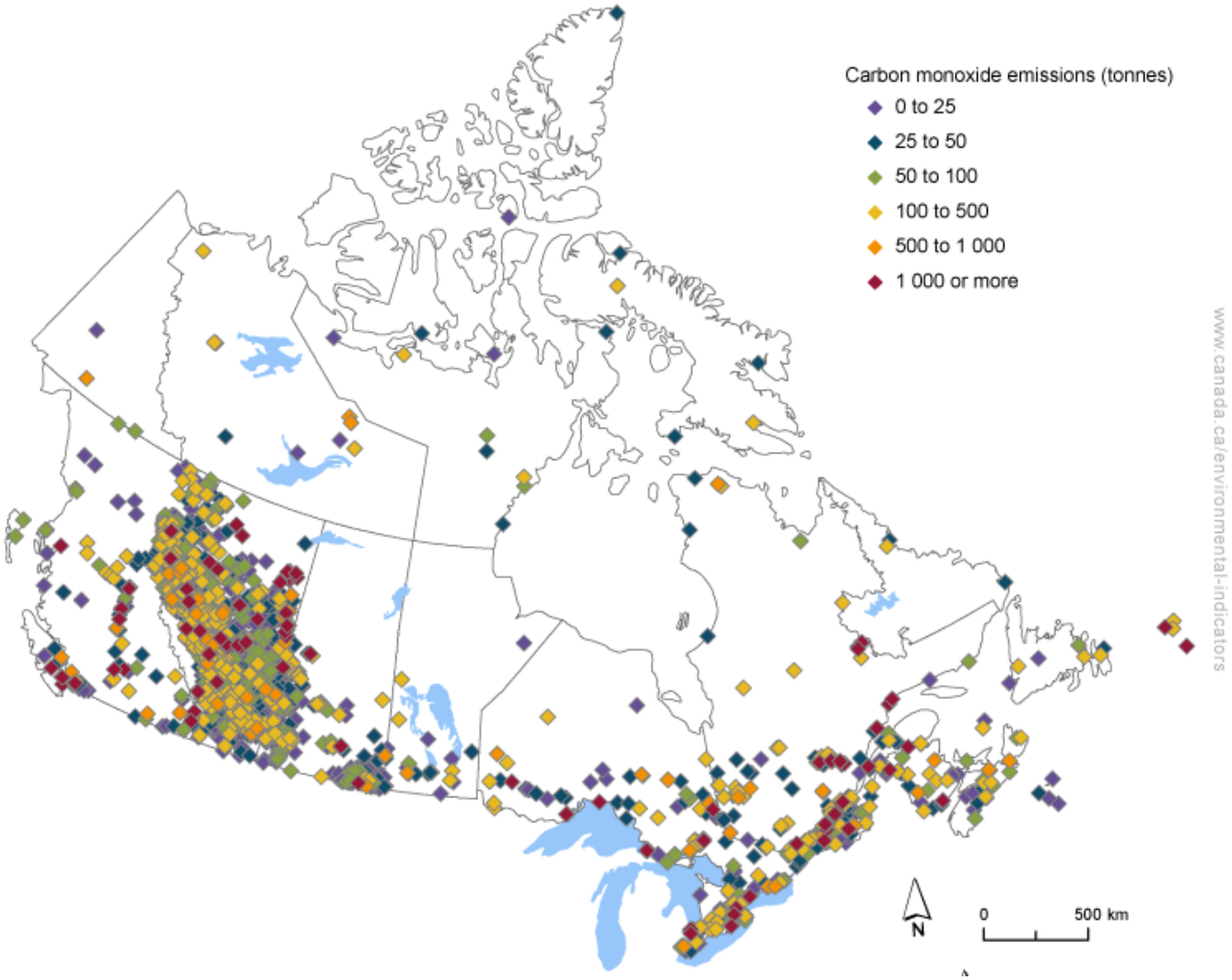
The sharp decrease in emissions between 1990 and 2019 in all provinces is mainly attributable to emission reductions from transportation (road, rail, air and marine).

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.

Figure 18. Carbon monoxide emissions by reporting facilities, Canada, 2019



Note: Facility-reported carbon monoxide emissions represent 16% of total national carbon monoxide emissions.
Source: Environment and Climate Change Canada (2021) National Pollutant Release Inventory.

Navigate data using the interactive map

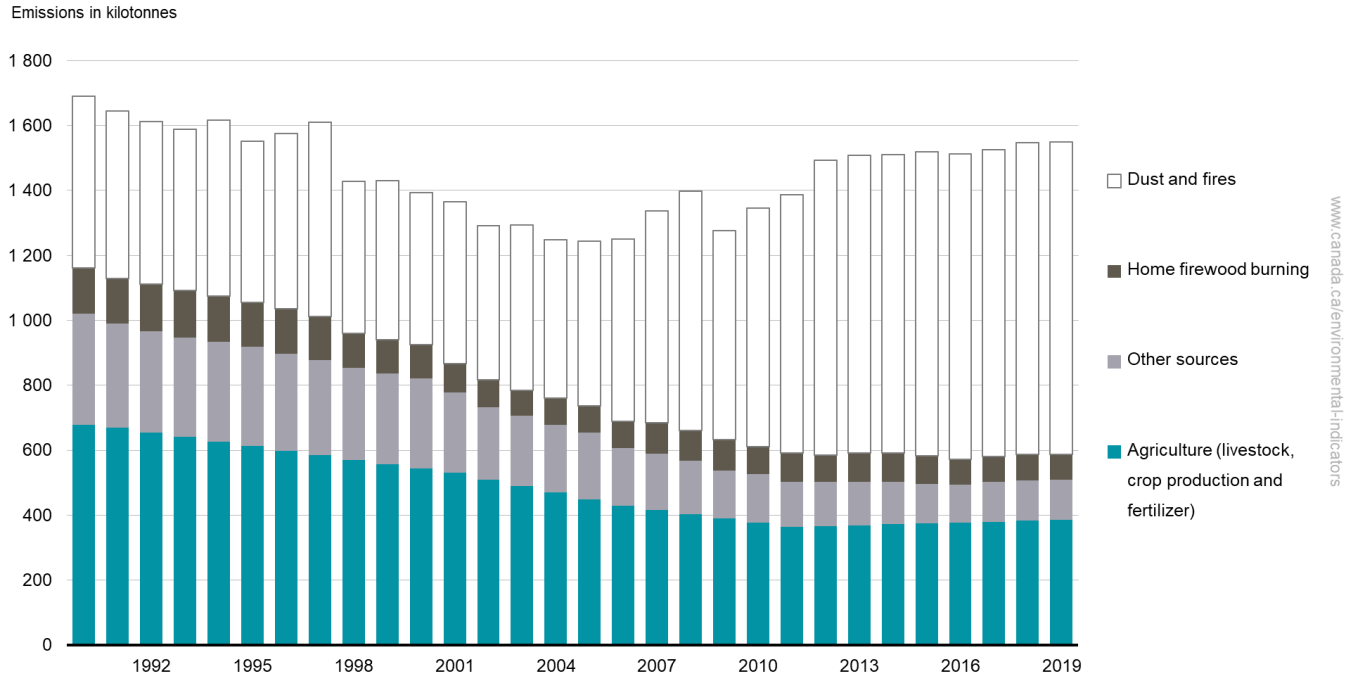
Fine particulate matter emissions by source

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.[6] 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 2019, $PM_{2.5}$ emissions were 1 550 kilotonnes (kt). This is 8% 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 62% (962 kt) of total national emissions in 2019.
    - These emissions increased by 81% (432 kt) between 1990 and 2019. Dust from construction operations and unpaved roads accounted for the majority of the increase.

Figure 19. Total fine particulate matter emissions by source, Canada, 1990 to 2019



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 2 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 (2021) Air Pollutant Emissions Inventory.

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

In 2019, 87% of $PM_{2.5}$ emissions came from open source emissions, such as dust and fires, and agriculture (livestock[7], crop production and fertilizer). In general, these 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.

The remaining 13% of $PM_{2.5}$ emissions in 2019 came from home firewood burning (79 kt or 5%) and other sources, including:

- ore and mineral industries, representing 2% (35 kt) of the emissions
- transportation (road, rail, air and marine), representing 1% (18 kt)
- manufacturing and off-road vehicles and mobile equipment, each representing about 1% (16 kt) of emissions
- miscellaneous sources, such as emissions from commercial cooking, representing 1% (16 kt)
- the oil and gas industry, representing less than 1% (13 kt)
- other emissions (less than 1%) coming from building heating and energy generation, electric utilities, incineration and wastes, and the use of paints and solvents

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

The decreases in $PM_{2.5}$ emissions between 1990 and 2019 are mainly attributable to emission reductions from agriculture (livestock, crop production and fertilizer), manufacturing and home firewood burning. These reductions outweigh the increase in emissions from dust and fires over the period. The adoption of conservation practices in crop production and the use of new fireplace inserts, furnaces and stoves in homes that control emissions and burn more efficiently were the main drivers leading to the reductions. Since 2010, however, emissions from dust and fires have gradually increased offsetting reductions from the other sources.

Table 1. Source emissions changes between 1990 and 2019

Source	$PM_{2.5}$ (change in kilotonnes from 1990 to 2019)	$PM_{2.5}$ (percentage change from 1990 to 2019)
Dust and fires	431.7	81.4
Miscellaneous	1.5	10.5
Building heating and energy generation	0.7	14.4
Oil and gas industry	0.7	5.7
Paints and solvents	0.02	n/a
Incineration and waste	-1.8	-40.3
Transportation (road, rail, air and marine)	-16.5	-47.6
Ore and mineral industries	-20.5	-37.0
Off-road vehicles and mobile equipment	-37.9	-70.7
Electric utilities	-45.7	-94.3

[7] $PM_{2.5}$ 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.

Manufacturing	-99.8	-86.0
Home firewood burning	-60.4	-43.3
Agriculture (livestock, crop production and fertilizer)	-292.5	-43.2
Total	**-140.6**	**-8.3**

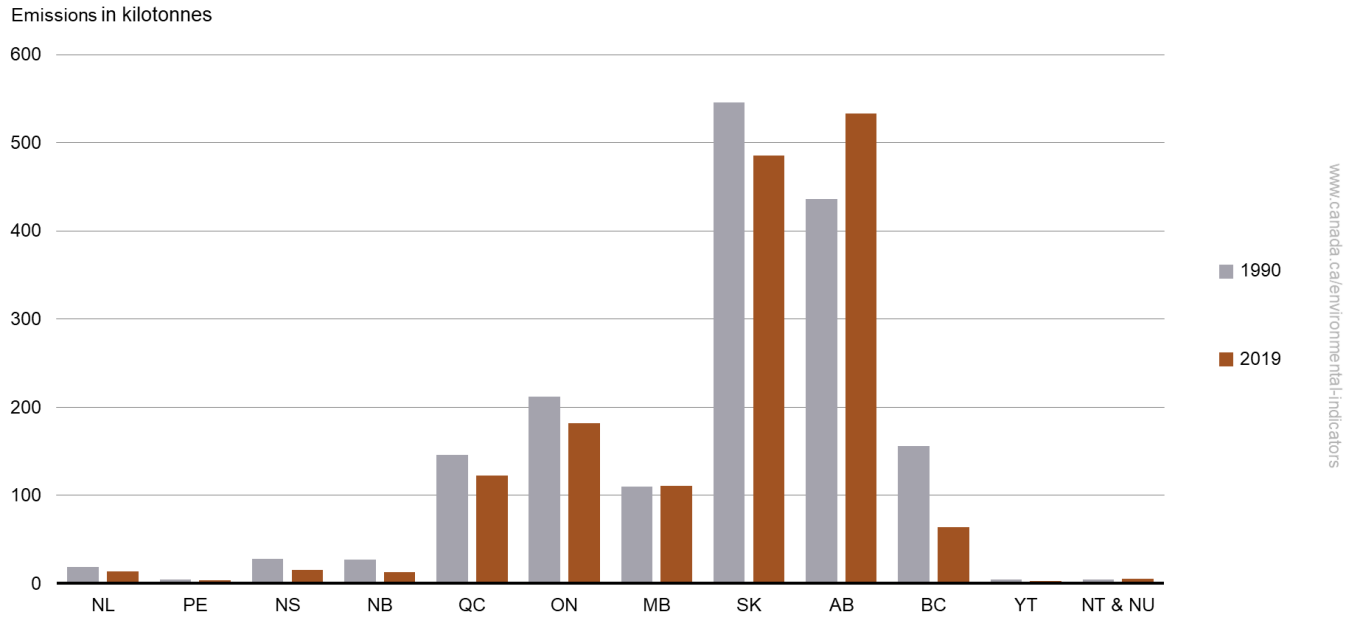
Note: n/a = not available. The changes have been calculated using source data that are not rounded.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Fine particulate matter emissions by province and territory

Key results

- In 2019, Alberta emitted the most $PM_{2.5}$. The province represented 34% (533 kt) of total national emissions
- Between 1990 and 2019, all provinces and territories, with the exception of Alberta, Manitoba, Nunavut and the Northwest Territories, decreased their emissions
    - The largest decrease was observed in British Columbia with 92 kt (59%)
    - Alberta experienced the largest increase in $PM_{2.5}$ emissions by 22% (98 kt)

Figure 20. Fine particulate matter emissions by province and territory, Canada, 1990 and 2019



Data for Figure 20

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 (2021) Air Pollutant Emissions Inventory.

Dust and fires (for example, road dust and prescribed burning) were the largest sources of $PM_{2.5}$ emissions in Alberta, the highest emitting province in 2019, accounting for 41% (398 kt) of total national dust and fires emissions in 2019.

Saskatchewan ranked second in 2019, with 31% (485 kt) of $PM_{2.5}$ emissions. Dust and fires were the largest sources, with agriculture (livestock, crop production and fertilizer) being the second-largest source of $PM_{2.5}$.

Ontario ranked third, with 12% (182 kt), and Quebec ranked fourth with 8% (122 kt). For the two provinces, dust and fires were the largest source of emissions.

The increase in emissions in Alberta between 1990 and 2019 can be attributed to growth in construction operations for the oil and gas industries.

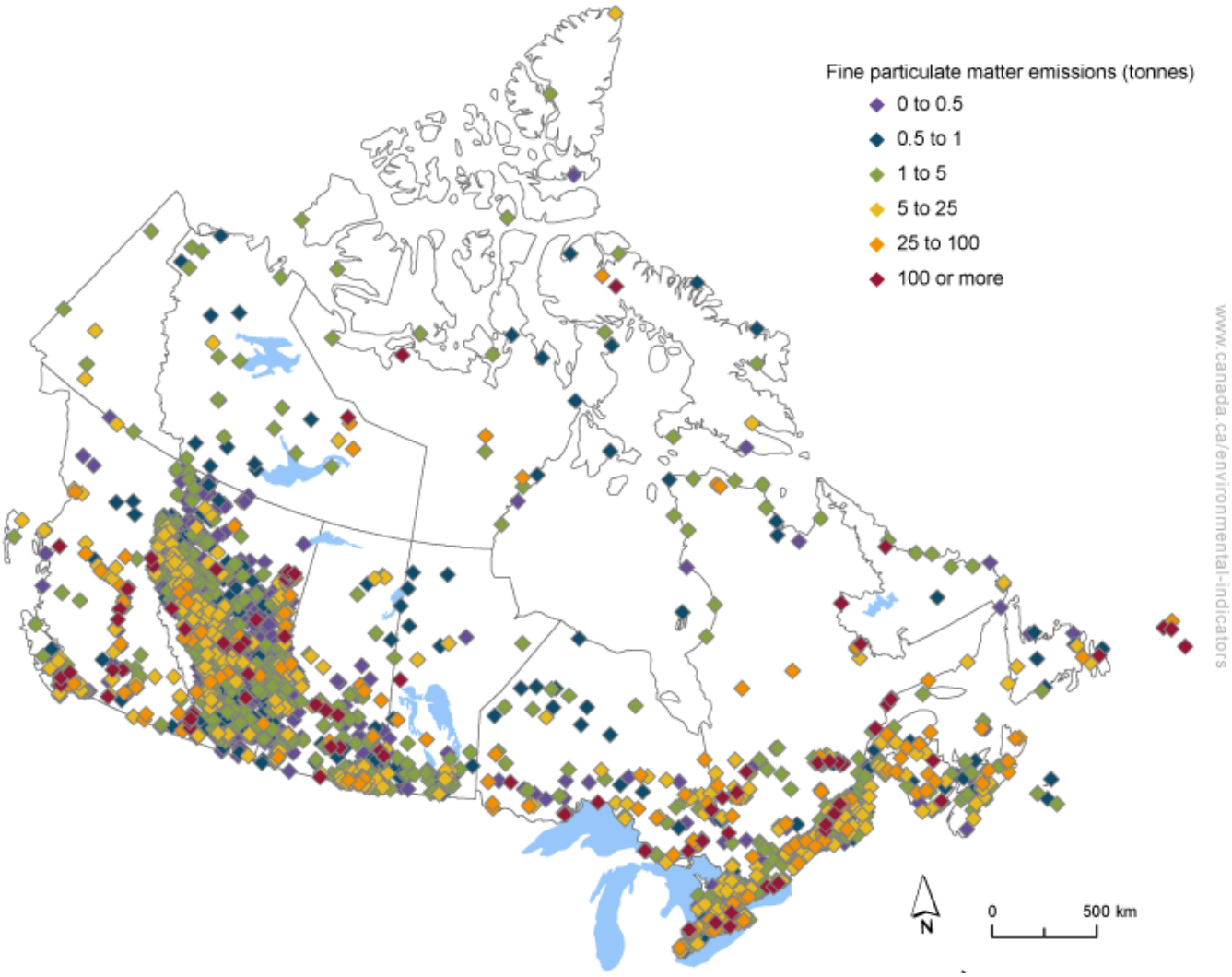
The exclusion of emissions from dust and fires and agriculture (livestock, crop production and fertilizer) provides a different breakdown of $PM_{2.5}$ emissions in each province and territory. With these emissions removed, Quebec becomes the largest emitting province of $PM_{2.5}$ in 2019, representing 28% (57 kt) of total emissions (203 kt). Ontario ranks second with 25% (50 kt) of emissions. Alberta and British Columbia rank third and fourth, both representing 15% and 12% (30 kt and 25 kt, respectively) of emissions. Between 1990 and 2019, all of the provinces and territories experienced emissions reductions between 78% (Yukon) and 42% (Northwest Territories and Nunavut).

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.

Figure 21. Fine particulate matter by reporting facilities, Canada, 2019



Note: Facility-reported fine particulate matter emissions represent 3% of total national fine particulate matter emissions.
Source: Environment and Climate Change Canada (2021) National Pollutant Release Inventory.

Navigate data using the interactive map

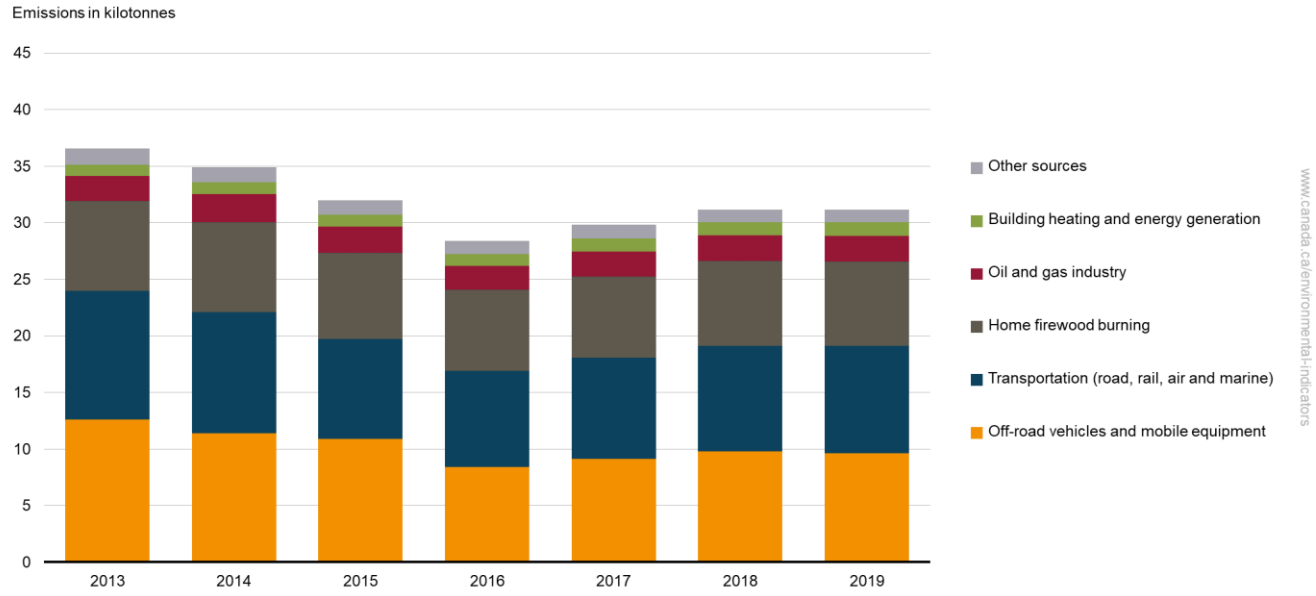
Black carbon emissions by source

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-immediate and local benefits.

Key results

- Emissions of black carbon were 31 kt in 2019, a decrease of 15% from 2013
- In 2019, 3 sectors accounted for 85% of national black carbon emissions:
    - off-road vehicles and mobile equipment
    - transportation (road, rail, air and marine)
    - home firewood burning

Figure 22. Total black carbon emissions by source, Canada, 2013 to 2019



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 2 in the Data sources and methods for more details.
Source: Environment and Climate Change Canada (2021) Canada's Black Carbon Emissions Inventory.

In 2019, off-road vehicles and mobile equipment (for example, lawn and garden equipment, recreational vehicles, excavators, graders) and transportation (road, rail, air and marine) accounted for the largest proportions of total national emissions, representing 31% and 30% (10 kt) of emissions. Home firewood burning was also a large contributor, representing about 24% (7 kt) of total national emissions. The remaining 15% of emissions came from the oil and gas industry, building heating and energy generation and other sources (such as ore and mineral industries).

For both transportation and off-road vehicles and mobile equipment, the use of diesel engines was the main source of black carbon emissions.

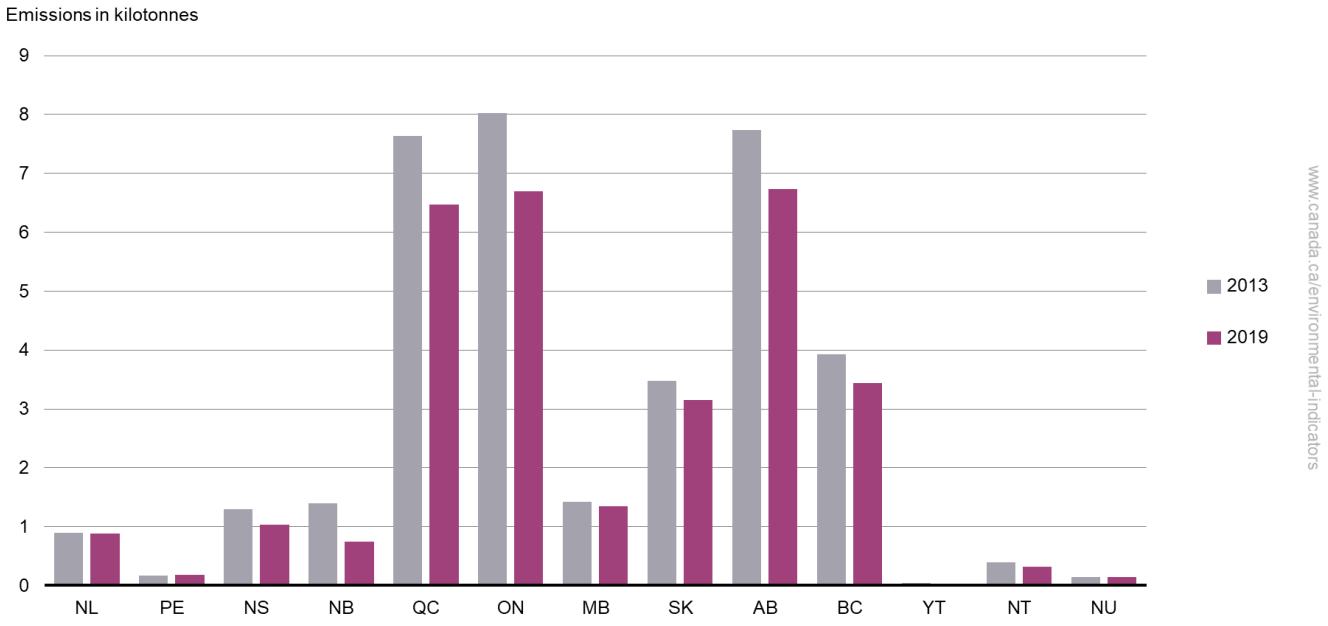
Black carbon emissions by province and territory

Key results

- In 2019, three provinces, Alberta, Ontario and Quebec, accounted for 64% (20 kt) of total national black carbon emissions

- Between 2013 and 2019,
    - all provinces and territories, with the exception of Prince Edward Island, experienced reductions in black carbon emissions between 1% to 46%
    - Ontario and Quebec experienced the largest reductions in emissions of 1.3 kt and 1.2 kt, respectively

Figure 23. Black carbon emissions by province and territory, Canada, 2013 and 2019



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 (2021) Canada's Black Carbon Emissions Inventory.

Alberta, Ontario and Quebec had the highest black carbon emissions in 2019, combined accounting for 64% (20 kt) of total national emissions. Emissions in Alberta primarily came from three sources, off-road vehicles and mobile equipment, transporation (road, rail, air and marine) and the oil and gas industry representing 87% (6 kt) of the emissions. Ontario's emissions also came from off-road vehicles and mobile equipment, and transporation (road, rail, air and marine) as well as home firewood burning each representing about 2 kt of emissions in the province. In Quebec, emissions came primarily from home firewood burning representing 47% (3 kt) of emissions.

Between 2013 and 2019, all the provinces and territories, with the exception of Prince Edward Island, experienced reductions in black carbon emissions with Ontario and Quebec experiencing the largest reductions of 1.3 kt and 1.2 kt, respectively. For both provinces, the reductions were mainly attributable to lower emissions from off-road vehicles and mobile equipment.

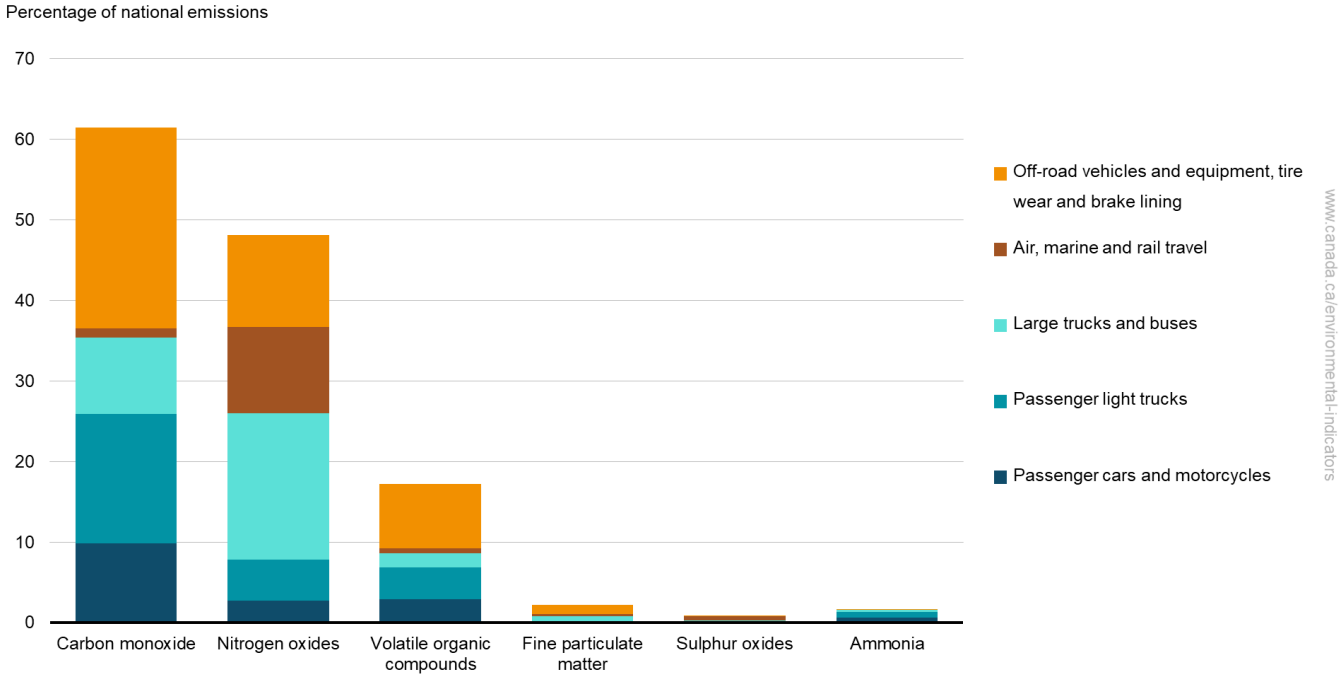
Air pollutant emissions from transportation, off-road vehicles and mobile equipment

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 2019, transportation, off-road vehicles and mobile equipment accounted for more than half (61%) of total national emissions of carbon monoxide (CO), 48% of nitrogen oxides (NO_X) and 17% of total emissions of volatile organic compounds (VOCs)
- While also a source of emissions for fine particulate matter ($PM_{2.5}$), sulphur oxides (SO_X) and ammonia (NH_3), the sectors represented less than 3% of total national emissions of these other pollutants

Figure 24. Contribution of transportation, off-road vehicles and mobile equipment to total air pollutant emissions by transportation mode, Canada, 2019



Data for Figure 24

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 (2021) 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 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 29% (467 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 2019, emissions from passenger cars, motorcycles and light trucks amounted to 1 330 kt of CO, 126 kt

of NO_X and 114 kt of VOCs. These emissions represented 26%, 8% and 7% of all emissions of these pollutants respectively.

Other sources (mainly composed of off-road vehicles and equipment)[8] are also a significant source of pollution. Their combined emissions make up 25%, 11% and 8% 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.

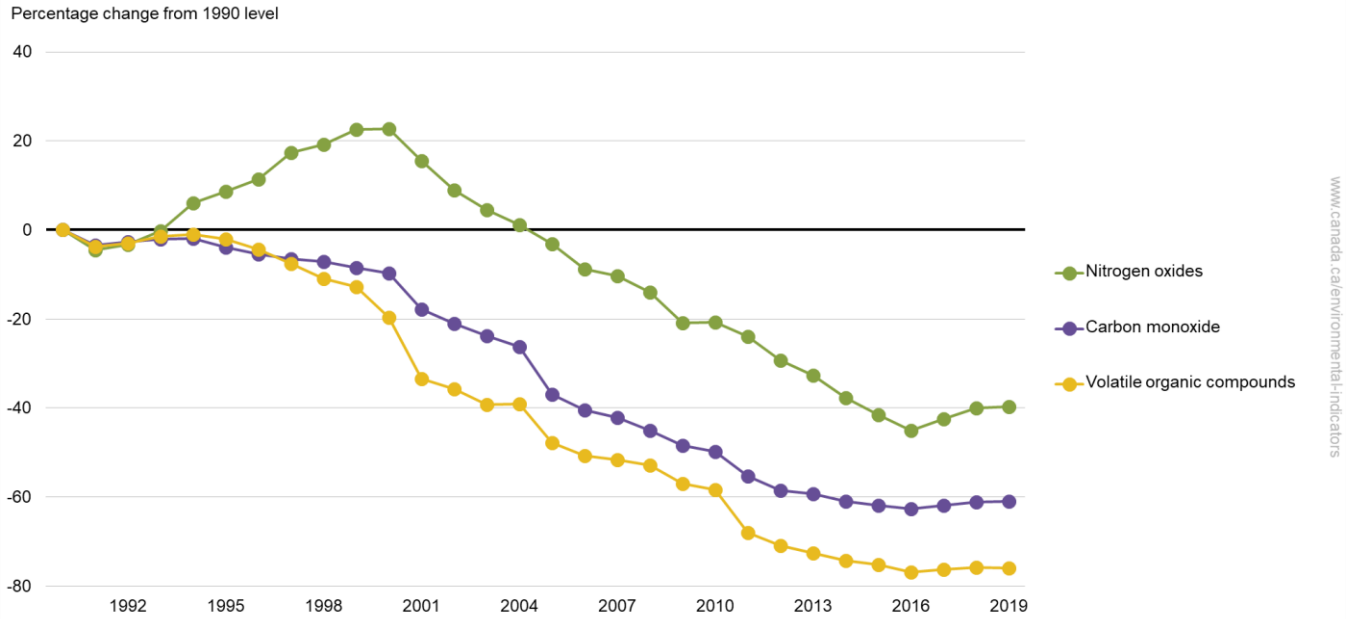
The largest source of sulphur oxide (SO_X) emissions in the transportation sector is marine vessels. Emissions of SO_X from marine vessels decreased by 87% between 2014 and 2019 due to the introduction of more stringent regulations.

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

Key results

- Between 1990 and 2019, total emissions of NO_X, CO and VOCs from transportation, off-road vehicles and mobile equipment decreased by 40%, 61% and 76%, respectively
- Since 2000, all pollutants demonstrated the same downward trend in their emissions level

Figure 25. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2019



Data for Figure 25

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the chart due to their low share (≤ 5%) of total emissions in 2019.
Source: Environment and Climate Change Canada (2021) 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 2019. This decrease is mainly attributable to the adoption of new regulations that lead to the gradual introduction of technologies and clean fuel for vehicles.

[8] 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.

Between 1990 and 2000, NO_X emissions increased by 23%. It includes the increase in emissions from light trucks (92%), large trucks and buses (44%) and marine transportation (19%). From 2000 to 2019, new regulations contributed to a decrease in emissions from light trucks (60%), large trucks and buses (44%) and emissions from marine travel by 2%. Emissions from air, marine and rail travel represented 11% of national emissions of NO_x in 2019.

More recently, since 2017, emissions of all pollutants have started to increase. This can be attributed to an increase in emissions from large trucks and buses for NO_X of 5% and light trucks for CO and VOCs of 7% each; and to a lesser extent emissions from marine transportation of 11% for NO_X and large trucks and buses of 2% for CO and 3% for VOCs.

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.

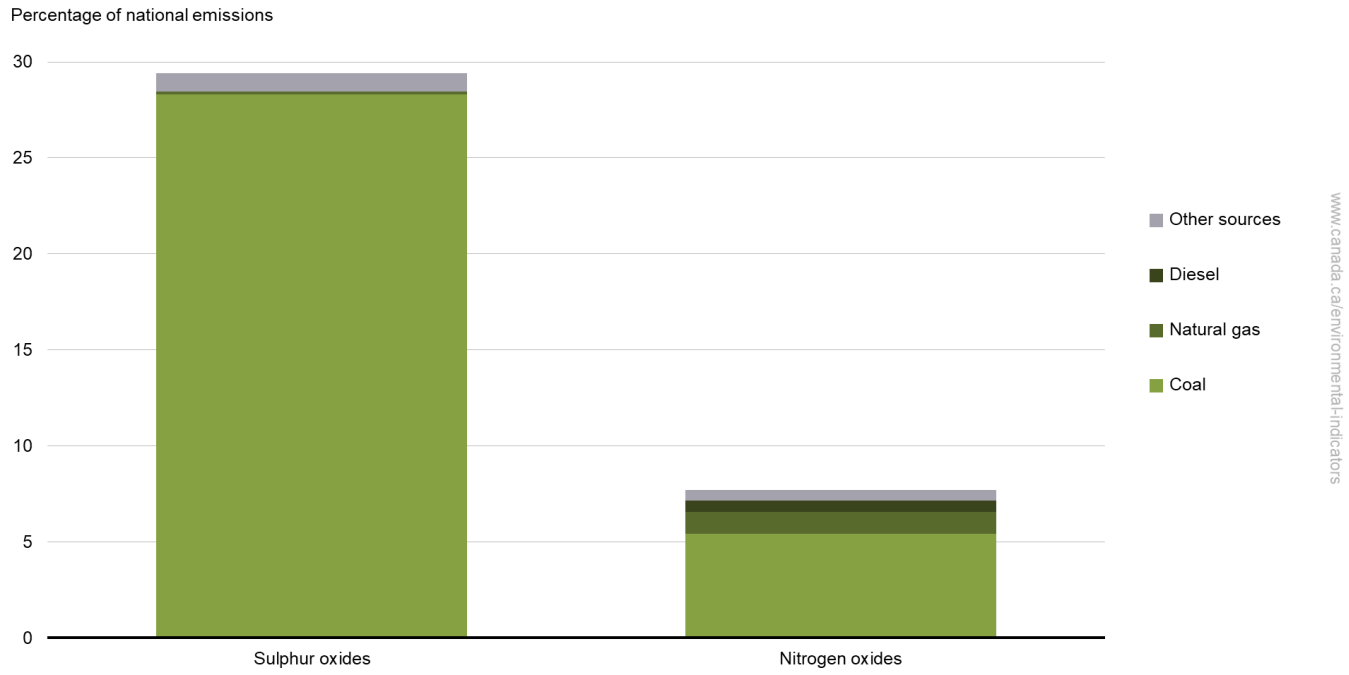
Air pollutant emissions from electric utilities

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 2019, electric utilities were the source of 29% and 8% of total national emissions of sulphur oxides (SO_X) and nitrogen oxides (NO_X)
- 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 26. Contribution of electric utilities to total air pollutant emissions by fuel source, Canada, 2019



Data for Figure 26

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 2019. 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 (2021) Air Pollutant Emissions Inventory.

In 2019, 96% of SO_X and 70% 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 wind, 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

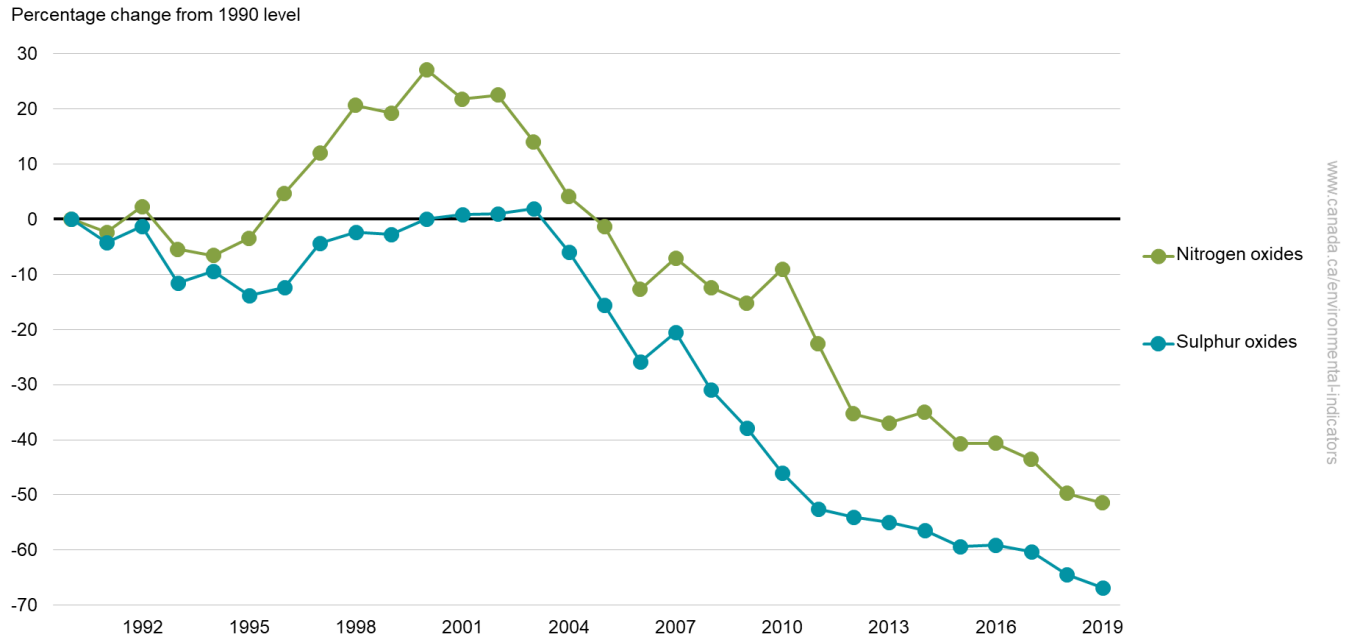
- 7% comes from non-hydro renewable sources, such as wind, solar, tidal power and biomass[9]

Changes in emissions from electric utilities

Key results

- Emissions of SO_X and NO_X from electric utilities declined by 67% and 51%, respectively, between 1990 and 2019
- Most of that decline occurred from 2005 onward

Figure 27. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2019



Data for Figure 27

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 2019. 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 (2021) Air Pollutant Emissions Inventory.

Between 1990 and 2019, emissions of NO_X and SO_X from electric utilities decreased by 51% and 67% respectively. The majority of the decline in emissions occurred from 2005 onwards. Between 2005 and 2019, the share of electricity that came from burning fossil fuels fell from 22% to 20%. This decline was mostly the result of a drop in electricity generation from coal power plants.[10] 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

[9] Natural Resources Canada (2018) Electricity facts. Retrieved on March 2, 2021.

[10] Statistics Canada (2021) CANSIM Table 127-0007 - Electric power generation, by class of electricity producer, annual (megawatt hour). Retrieved on March 2, 2021.

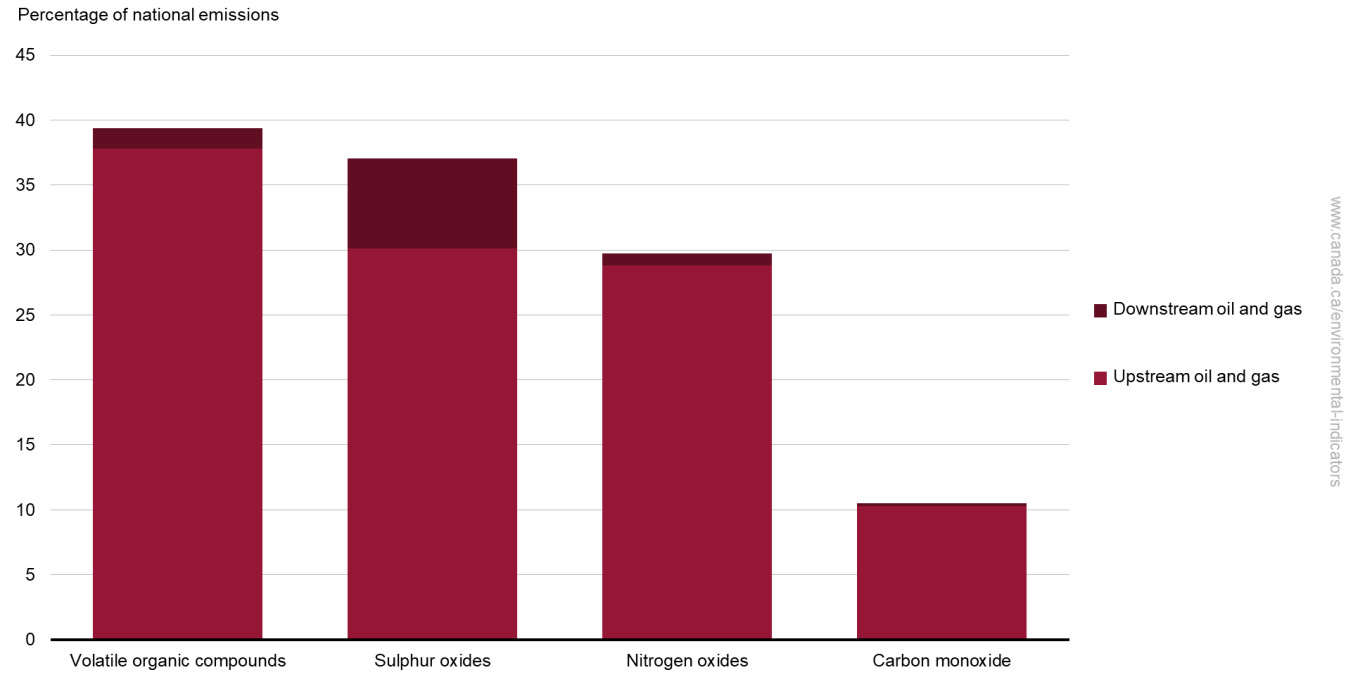
Air pollutant emissions from the oil and gas industry

The oil and gas sector is an important contributor to air pollutant emissions. Most emissions from the oil and gas sector come from activities such as exploration, drilling, production and field processing. 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 2019, the oil and gas industry was a major contributor to total national emissions of volatile organic compounds (VOCs) (39%), sulphur oxides (SO_X) (37%), nitrogen oxides (NO_X) (30%) and carbon monoxide (CO) (11%)
- The oil and gas industry is also a source of emissions of fine particulate matter ($PM_{2.5}$) and ammonia (NH_3). However, in 2019, it made up less than 1% of the total emissions of these pollutants

Figure 28. Contribution of the oil and gas industry to total air pollutant emissions by activity type, Canada, 2019



Data for Figure 28

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2019.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

In 2019, the oil and gas industry was the sector contributing the most to total national emissions of VOCs and SO_X. It was also the second-largest contributor to emissions of NO_X, and the fourth-largest contributor to emissions of CO.

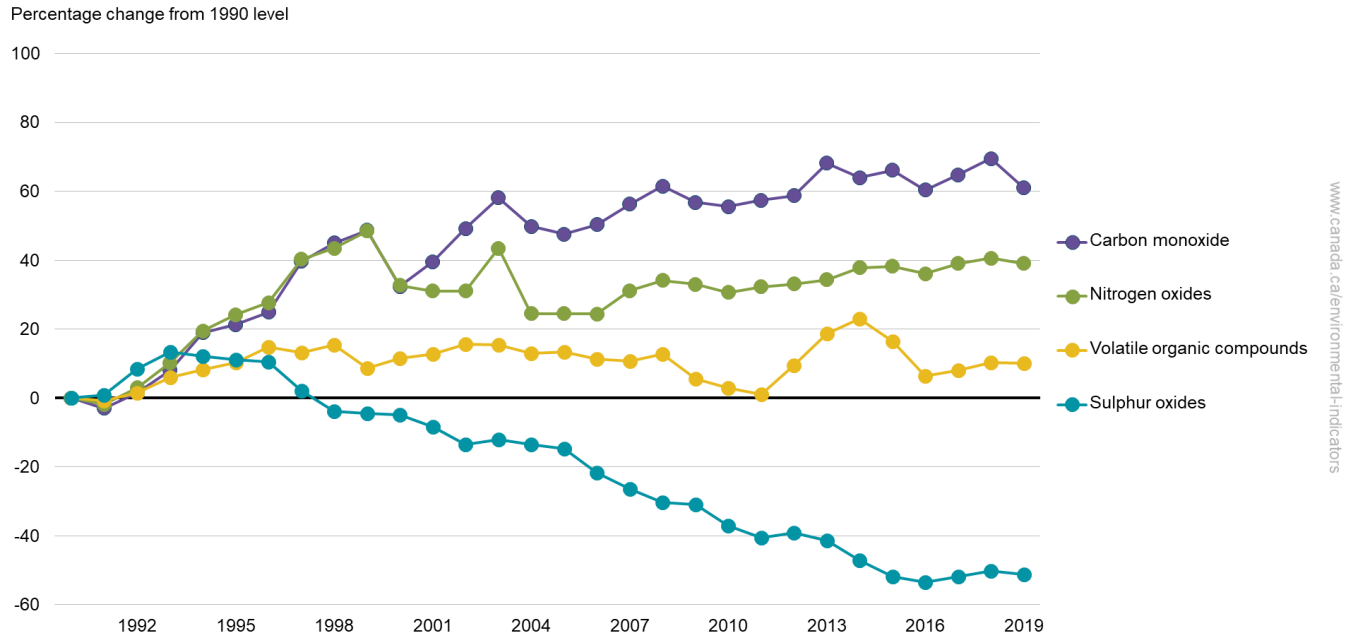
Most of emissions from the oil and gas industry came from upstream activities (exploration, drilling, production and field processing) compared to downstream activities (refining, storage and distribution). In 2019, 96% of VOC, 97% of NO_X and CO, and 81% of SO_X emissions from the oil and gas sector were from upstream activities.

Changes in emissions from the oil and gas industry

Key results

- Emissions of CO, NO_X and VOCs increased by 61%, 39% and 10%, respectively, between 1990 and 2019
- SO_X emissions decreased (51%) over that period

Figure 29. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2019



Data for Figure 29

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2019.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

The increases in CO, NO_X and VOC emissions 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. 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 bitumen and heavy oil upgrading and natural gas processing, attributed to better emission control technologies.

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.[11] 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.[12]

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 Air pollution: drivers and impacts for information on the impacts of air pollution on health, the economy and the environment, as well as information on the federal regulations administered under the *Canadian Environmental Protection Act (*1999) addressing air pollution.

Black carbon is estimated to be the third largest contributor in the world to current global warming. 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.

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 implemented to improve ambient air quality in Canada.

Safe and healthy communities

These indicators track progress on the 2019 to 2022 Federal Sustainable Development Strategy, supporting the target: Continued decrease in emissions from 1990 of fine particulate matter, nitrogen oxides, sulphur oxides and volatile organic compounds from all sources. The most recent data available shows that, in 2019, emissions of fine particulate matter, nitrogen oxides, volatile organic compounds and sulphur oxides were 8% to 77% lower than in 1990.

In addition, the indicators contribute to the Sustainable Development Goals of the 2030 Agenda for Sustainable Development. They are linked to Goal 11: Sustainable cities and communities.

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[11] 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 (2021) Canada's Black Carbon Emissions Inventory. Retrieved on March 15, 2021.

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

Related indicators

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.

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 $PM_{2.5}$, O_3, SO_2, NO_2, and VOCs at the national and regional level 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 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 2019.

Data for the black carbon indicator, a component of $PM_{2.5}$, come from Canada's Black Carbon Emissions Inventory and are reported for 2019 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 2009 to 2018.

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,[13] 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, 2021, and cover the period from 1990 to 2019. 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 to submit annual inventories of its black carbon emissions to the United Nations Economic Commission for Europe beginning in 2015. 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, 2021.

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

[13] 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.

Earth's surface.[14] Black carbon absorbs solar radiation 460 to 1 500 times more than CO_2.[15] 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 impact near-term warming, which is particularly important in the Polar Regions, such as the Arctic.[16] 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 1994 to 2019 are current as of March 12, 2021.

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 (PDF;4.14 MB) of the Air Pollutant Emissions Inventory Report.

Facility-reported emissions data

Facility-reported emissions data generally refers to any stationary sources that emit pollutants through stacks or other equipment at specific locations. The major source of facility-reported data is the National Pollutant Release Inventory.

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[14] Environment and Climate Change Canada (2019) Short-lived climate pollutants. Retrieved on March 4, 2021.

[15] Climate and Clean Air Coalition (2020) Science: Black carbon. Retrieved on March 4, 2021.

[16] Environment and Climate Change Canada (2021) Canada's Black Carbon Inventory Report 2021. Retrieved on March 15, 2021.

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 level 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.[17] 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.[18]

The Air Pollutant Emissions Inventory reports air pollutant emissions from mobile sources such as on-road vehicles, off-road vehicles and engines. For the current edition of the Air Pollutant Emissions Inventory, an emissions estimation model developed by the U.S. EPA (MOVES) was used. The emissions for off-road vehicles and engines (such as graders, heavy trucks, outboard motors and lawnmowers) were estimated using the U.S. EPA's NONROAD emission estimation model (see "off-road vehicles and equipment" in Table A2-4 of Annex 2 (PDF;4.14 MB) 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

[17] 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)."

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

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 the exception of 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[19] 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 (PDF;4.14 MB) 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 (PDF;4.14 MB) of the Air Pollutant Emissions Inventory Report.

Temporal coverage

Historical data are provided at the national level for the period from 1990 to 2019. For the regional indicators (provincial/territorial), emissions are presented for 1990 and 2019. Facility level emissions information are available from 2009 to 2018.

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
7. manufacturing
8. miscellaneous
9. off-road vehicles and mobile equipment
10. oil and gas industry

[19] 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 (2021) Canada's Black Carbon Emissions Inventory. Retrieved on March 15, 2021.

11. ore and mineral industries
12. paints and solvents
13. transportation (road, rail, air and marine)

Table 2 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 2. 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: Fuel use
Building heating and energy generation	Commercial/Residential/Institutional: Commercial and institutional fuel combustion
Building heating and energy generation	Commercial/Residential/Institutional: Construction fuel combustion
Building heating and energy generation	Commercial/Residential/Institutional: Residential fuel combustion
Dust and fires	Dust: Coal transportation
Dust and fires	Dust: Construction operations
Dust and fires	Dust: Mine tailings
Dust and fires	Dust: Paved roads
Dust and fires	Dust: Unpaved roads
Dust and fires	Fires: Prescribed burning
Dust and fires	Fires: Structural fires
Electric utilities	Electric power generation (utilities): Coal
Electric utilities	Electric power generation (utilities): Diesel
Electric utilities	Electric power generation (utilities): Natural gas
Electric utilities	Electric power generation (utilities): Waste materials[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: Crematoriums
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

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
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 (commercial/residential/institutional)
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 industry
Ore and mineral industries	Ore and mineral industries: Mineral products industry
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[C]
Paints and solvents	Paints and solvents: Dry cleaning
Paints and solvents	Paints and solvents: General solvent use
Paints and solvents	Paints and solvents: Printing
Paints and solvents	Paints and solvents: Surface coatings

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
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. [C] These sectors from the Air Pollutant Emissions Inventory are sometimes shown as individual sources in the indicators.

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 2019. They also provide information about emissions of selected pollutants, by sector, for the period from 1990 to 2019.

Tables 3 through 5 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 3. 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 4. 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

Air pollutant emissions from electric utilities	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
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 5. 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 ore and mineral industires, the oil and gas industry, manufacturing, transportation, agriculture, commercial/residential/institutional, incineration and waste, paints and solvents and fires, following the implementation of improved quantification methods. These recalculations can be particularly observed with the large emissions reduction in volatile organic compounds from previously reported 2018 emissions. For more information about these recent changes, consult Annex 3 (PDF;4.14 MB) of the Air Pollutant Emissions Inventory Report.

Canada's Black Carbon Emissions Inventory has undergone a number of recalculations of emissions estimates. Specifically, methodological improvements have been made to all sources to improve the accuracy of estimates. Consult section 3.3 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 2019 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 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.

Only the most significant sources of black carbon have been reported. It is estimated that emissions from these sources (home firewood burning, off-road vehicles and mobile equipment and transportation) represent approximately 88% of the national anthropogenic black carbon emissions.

Resources

References

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Related information

Air pollution: drivers and impacts

Air Pollutant 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 2019

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	-4	-2	-1	-2	-3
1992	-11	-2	-1	2	-2	-5
1993	-14	0	2	3	0	-6
1994	-21	5	3	7	0	-4
1995	-17	8	2	13	-1	-8
1996	-17	11	2	18	-4	-7
1997	-18	17	0	19	-7	-5
1998	-20	19	-2	19	-9	-16
1999	-23	21	-4	18	-11	-15
2000	-23	20	-7	21	-13	-18
2001	-24	14	-14	21	-20	-19
2002	-25	12	-15	23	-23	-24
2003	-27	10	-17	22	-24	-23
2004	-27	4	-18	26	-29	-26
2005	-31	0	-20	24	-36	-26
2006	-37	-7	-24	22	-40	-26
2007	-39	-7	-24	23	-41	-21
2008	-45	-10	-26	20	-43	-17
2009	-54	-15	-31	16	-46	-24
2010	-57	-15	-33	15	-48	-20
2011	-60	-17	-37	14	-51	-18
2012	-60	-22	-37	18	-53	-12

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	-24	-36	21	-54	-11
2014	-62	-26	-35	19	-54	-11
2015	-65	-29	-39	20	-55	-10
2016	-65	-32	-43	20	-56	-11
2017	-68	-29	-42	17	-56	-10
2018	-73	-29	-41	21	-55	-8
2019	-77	-29	-42	20	-55	-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 (2021) Air Pollutant Emissions Inventory.

Table A. 2. Data for Figure 2. Distribution of air pollutant emissions by source, Canada, 2019

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	37.1	29.7	39.4	0.6	10.5	0.8
Manufacturing	5.9	4.1	6.1	2.3	3.0	1.0
Ore and mineral industries	24.8	5.0	0.7	0.3	9.7	2.2
Transportation (road, rail, air and marine)	0.8	36.7	9.3	1.6	36.5	1.2
Off-road vehicles and mobile equipment	<0.1	11.4	8.0	<0.1	25.0	1.0
Building heating and energy generation	0.5	4.0	0.2	0.1	0.7	0.3
Electric utilities	29.4	7.7	<0.1	<0.1	0.6	0.2
Home firewood burning	0.3	0.8	6.8	0.2	12.9	5.1
Incineration and waste	0.4	0.3	1.1	1.3	0.3	0.2

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	<0.1	<0.1	18.1	<0.1	<0.1	<0.1
Agriculture (livestock, crop production and fertilizer)	0.8	0.2	6.9	93.3	<0.1	24.8
Dust and fires	<0.1	<0.1	0.2	<0.1	0.7	62.0
Miscellaneous	<0.1	<0.1	3.2	0.1	0.1	1.0

Note: n/a = not available. 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 percentages have been rounded off and their sum may not add up to 100.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Table A. 3. Data for Figure 3. Distribution of air pollutant emissions by province and territory, Canada, 2019

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	3.0	2.5	1.2	0.2	1.6	0.9
Prince Edward Island	<0.1	0.3	0.4	0.6	0.4	0.2
Nova Scotia	7.6	2.5	1.8	0.7	2.5	1.0
New Brunswick	1.6	1.7	1.6	0.8	2.5	0.8
Quebec	13.1	11.1	13.7	14.0	24.9	7.9
Ontario	16.1	16.6	20.4	18.2	25.6	11.8
Manitoba	0.3	2.8	3.9	12.6	3.3	7.1
Saskatchewan	16.7	9.2	15.0	21.1	5.8	31.3
Alberta	31.6	39.5	33.5	27.4	19.7	34.4
British Columbia	9.8	12.7	8.3	4.4	13.2	4.1
Yukon	<0.1	0.1	<0.1	<0.1	0.1	0.2
Northwest Territories and Nunavut	0.2	1.1	0.2	<0.1	0.2	0.3

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 percentages have been rounded off and their sum may not add up to 100.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Table A. 4. Data for Figure 4. Total sulphur oxide emissions by source, Canada, 1990 to 2019

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	531.0	618.4	1 481.2	373.8	3 004.3
1991	535.2	592.1	1 334.3	324.1	2 785.6
1992	575.6	610.7	1 169.3	307.9	2 663.4
1993	602.4	547.2	1 112.6	312.4	2 574.6
1994	595.5	559.8	891.9	312.5	2 359.7
1995	589.6	532.6	1 105.6	265.3	2 493.1
1996	587.2	542.2	1 089.0	282.0	2 500.4
1997	542.1	591.3	1 032.1	283.3	2 448.9
1998	511.0	603.6	1 019.4	278.7	2 412.7
1999	507.1	601.1	925.3	281.9	2 315.5
2000	504.7	619.2	914.4	281.0	2 319.3
2001	486.8	623.9	911.6	274.3	2 296.7
2002	459.2	624.3	903.8	268.0	2 255.3
2003	467.5	630.4	812.2	276.5	2 186.6
2004	459.9	581.5	874.4	280.5	2 196.4
2005	452.6	521.9	857.2	249.0	2 080.8
2006	416.2	458.9	828.1	178.8	1 882.0
2007	391.2	491.9	778.9	170.7	1 832.7
2008	369.8	427.5	715.1	138.9	1 651.3
2009	367.0	384.0	523.0	117.9	1 391.8
2010	334.0	334.0	501.9	112.8	1 282.6
2011	315.7	293.2	467.2	113.6	1 189.7
2012	323.2	284.2	477.2	103.7	1 188.4
2013	311.3	278.2	492.1	98.9	1 180.5
2014	280.4	269.2	487.2	102.8	1 139.6
2015	256.1	251.5	482.8	74.0	1 064.4

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	247.3	253.1	481.2	66.7	1 048.3
2017	256.0	245.5	388.9	64.6	955.1
2018	264.4	220.3	258.7	66.2	809.6
2019	259.0	205.5	173.3	61.2	698.9

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 2 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 (2021) Air Pollutant Emissions Inventory.

Table A. 5. Data for Figure 5. Sulphur oxide emissions by province and territory, Canada, 1990 and 2019

Province or territory	1990 (emissions in kilotonnes)	2019 (emissions in kilotonnes)
Newfoundland and Labrador	68.8	20.7
Prince Edward Island	3.4	0.3
Nova Scotia	203.2	53.1
New Brunswick	109.3	11.1
Quebec	247.8	91.9
Ontario	1 123.2	112.6
Manitoba	509.1	2.0
Saskatchewan	96.9	117.1
Alberta	513.4	220.7
British Columbia	110.4	68.4
Yukon	0.6	<0.1
Northwest Territories and Nunavut	18.0	1.1

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.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Table A. 6. Data for Figure 7. Total nitrogen oxide emissions by source, Canada, 1990 to 2019

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	901.4	345.8	382.8	387.0	257.0	2 274.0
1991	852.5	339.4	369.0	377.4	250.9	2 189.2
1992	860.0	356.0	363.1	386.7	262.9	2 228.8
1993	873.3	381.2	370.6	412.6	243.0	2 280.7

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)
1994	919.0	413.1	376.6	446.4	240.0	2 395.1
1995	918.8	429.5	376.0	481.1	248.1	2 453.5
1996	962.8	441.6	373.5	472.6	269.0	2 519.5
1997	1 042.4	485.2	372.8	469.8	287.7	2 658.0
1998	1 112.4	496.3	355.3	422.9	310.1	2 697.0
1999	1 179.8	513.5	358.9	400.4	306.4	2 758.8
2000	1 188.2	459.1	362.2	393.3	326.8	2 729.6
2001	1 151.3	453.3	341.1	337.9	313.0	2 596.6
2002	1 078.5	453.3	369.6	324.8	314.9	2 541.1
2003	1 005.9	496.0	366.6	340.5	293.0	2 502.0
2004	961.2	430.5	362.5	341.5	267.5	2 363.2
2005	938.7	430.7	333.2	309.9	253.7	2 266.2
2006	889.8	430.3	285.6	286.1	224.3	2 116.1
2007	867.7	453.6	273.7	288.5	238.8	2 122.4
2008	828.4	464.0	253.8	279.7	225.1	2 051.0
2009	755.5	460.1	227.8	264.8	218.0	1 926.1
2010	736.9	451.9	234.3	283.5	233.7	1 940.4
2011	726.0	457.6	241.2	254.2	198.9	1 878.0
2012	687.0	460.3	237.2	223.0	166.3	1 773.7
2013	652.3	464.6	235.0	214.5	162.0	1 728.4
2014	601.5	476.7	236.8	200.9	167.2	1 683.2
2015	555.9	478.1	233.1	196.6	152.4	1 616.0
2016	546.2	470.6	226.3	161.7	152.5	1 557.4
2017	566.8	480.9	239.5	174.2	145.1	1 606.4
2018	587.3	486.2	237.2	185.8	129.2	1 625.6
2019	593.3	481.0	233.7	184.2	124.8	1 617.0

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 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 2 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 (2021) Air Pollutant Emissions Inventory.

Table A. 7. Data for Figure 8. Nitrogen oxide emissions by province and territory, Canada, 1990 and 2019

Province or territory	1990 (emissions in kilotonnes)	2019 (emissions in kilotonnes)
Newfoundland and Labrador	50.7	41.2
Prince Edward Island	6.7	4.1
Nova Scotia	82.9	40.8

Province or territory	1990 (emissions in kilotonnes)	2019 (emissions in kilotonnes)
New Brunswick	78.3	27.0
Quebec	309.6	178.8
Ontario	592.7	268.6
Manitoba	72.7	45.1
Saskatchewan	144.5	149.4
Alberta	642.6	638.1
British Columbia	275.7	204.7
Yukon	3.7	2.0
Northwest Territories and Nunavut	13.9	17.2

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 (2021) Air Pollutant Emissions Inventory.

Table A. 8. Data for Figure 10. Total volatile organic compound emissions by source, Canada, 1990 to 2019

Year	Oil and gas industry (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	598.8	357.5	261.5	388.5	816.8	188.3	258.8	2 870.2
1991	593.7	350.0	263.1	371.9	789.1	189.5	255.4	2 812.7
1992	608.2	352.2	249.0	371.0	797.7	199.2	256.5	2 833.8
1993	634.8	351.4	271.7	369.5	817.6	200.0	273.3	2 918.4
1994	648.4	362.1	270.3	370.6	821.9	194.3	275.5	2 943.1
1995	660.2	375.2	268.7	358.4	822.3	189.6	265.3	2 939.8
1996	688.1	373.0	261.0	351.7	800.8	193.7	264.3	2 932.6
1997	678.0	374.9	249.7	352.1	761.5	191.1	259.1	2 866.5
1998	690.7	377.5	251.6	352.5	721.6	153.1	263.2	2 810.2
1999	650.3	389.5	246.9	347.8	703.8	148.1	261.0	2 747.3
2000	667.3	395.9	244.6	338.9	629.4	149.7	256.1	2 681.9
2001	675.6	375.7	242.2	328.1	473.6	128.8	230.9	2 454.9
2002	692.3	368.4	238.4	308.6	465.2	124.1	233.5	2 430.5
2003	690.7	370.0	249.9	288.9	444.1	116.5	217.0	2 377.2
2004	677.1	366.4	242.4	274.3	459.1	123.4	202.4	2 345.1
2005	678.9	438.9	239.4	244.9	383.4	126.8	188.5	2 300.7
2006	666.4	417.1	224.6	227.3	366.1	124.0	165.3	2 190.9
2007	662.8	409.4	219.4	224.4	359.0	142.9	149.4	2 167.5
2008	675.0	392.3	214.6	233.1	335.1	140.3	134.6	2 124.9
2009	632.9	353.3	213.3	197.7	320.4	139.0	114.1	1 970.7
2010	616.3	361.5	211.0	191.9	310.5	120.8	119.7	1 931.6
2011	605.8	349.7	212.3	177.8	207.9	125.7	116.9	1 796.2
2012	656.2	354.6	208.6	169.1	181.1	116.5	118.5	1 804.6
2013	710.8	357.0	204.0	162.0	167.4	126.2	116.9	1 844.4
2014	737.2	363.6	209.2	148.9	161.5	125.8	110.3	1 856.5

Year	Oil and gas industry (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2015	697.7	326.5	205.3	144.8	154.0	120.3	106.0	1 754.5
2016	636.9	310.2	204.8	148.8	128.7	111.9	104.7	1 646.0
2017	647.0	305.8	203.6	150.6	134.5	110.7	100.5	1 652.6
2018	660.4	312.0	204.8	153.3	138.4	114.8	104.4	1 688.2
2019	659.1	303.4	206.8	155.2	133.9	114.3	102.3	1 674.9

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, agriculture (livestock, crop production and fertilizer) and other miscellaneous sources. Consult Table 2 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 (2021) Air Pollutant Emissions Inventory.

Table A. 9. Data for Figure 11. Volatile organic compound emissions by province and territory, Canada, 1990 and 2019

Province or territory	1990 (emissions in kilotonnes)	2019 (emissions in kilotonnes)
Newfoundland and Labrador	45.7	19.4
Prince Edward Island	10.6	6.2
Nova Scotia	70.7	30.4
New Brunswick	82.1	27.5
Quebec	495.8	228.9
Ontario	852.2	341.7
Manitoba	96.1	64.6
Saskatchewan	168.2	250.8
Alberta	659.5	561.3
British Columbia	376.3	139.4
Yukon	2.4	1.1
Northwest Territories and Nunavut	10.6	3.5

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 (2021) Air Pollutant Emissions Inventory.

Table A. 10. Data for Figure 13. Total ammonia emissions by source, Canada, 1990 to 2019

Year	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	362.6	13.5	20.0	5.1	401.2
1991	359.5	13.8	19.1	5.2	397.6
1992	371.1	14.1	19.0	5.6	409.9
1993	373.8	15.0	18.5	6.0	413.3
1994	385.9	15.5	19.9	6.8	428.2
1995	403.7	17.4	26.6	7.5	455.2
1996	420.1	17.0	26.2	8.2	471.5
1997	425.7	17.1	25.3	9.1	477.1
1998	425.2	17.1	26.1	10.0	478.5
1999	423.2	15.2	24.9	10.9	474.2
2000	432.6	15.5	25.0	11.1	484.2
2001	436.2	14.7	21.8	11.6	484.3
2002	439.9	21.2	21.8	11.3	494.2
2003	446.3	13.2	18.8	11.0	489.4
2004	461.2	12.9	18.6	10.7	503.5
2005	457.8	13.9	17.2	10.5	499.4
2006	449.4	12.8	16.1	9.9	488.2

Year	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2007	454.3	12.1	16.1	9.8	492.3
2008	445.6	13.4	13.6	9.2	481.7
2009	432.5	13.2	12.6	8.8	467.1
2010	425.8	13.8	11.5	8.7	459.8
2011	423.5	13.7	11.8	8.4	457.3
2012	440.6	12.6	11.9	7.9	473.0
2013	453.7	13.7	11.2	7.8	486.5
2014	445.3	14.1	11.2	7.3	477.9
2015	448.5	12.9	11.7	7.2	480.3
2016	448.7	13.2	12.0	7.4	481.3
2017	439.3	12.8	11.3	7.5	470.8
2018	452.8	13.2	12.0	7.6	485.5
2019	450.1	13.7	11.1	7.6	482.5

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. 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 2 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 (2021) Air Pollutant Emissions Inventory.

Table A. 11. Data for Figure 14. Ammonia emissions by province and territory, Canada, 1990 and 2019

Province or territory	1990 (emissions in kilotonnes)	2019 (emissions in kilotonnes)
Newfoundland and Labrador	1.0	0.9
Prince Edward Island	3.5	2.8
Nova Scotia	4.9	3.6
New Brunswick	4.6	3.7
Quebec	67.1	67.5
Ontario	112.7	87.7
Manitoba	38.7	61.0
Saskatchewan	49.1	101.9
Alberta	96.3	132.3
British Columbia	23.2	21.1
Yukon	<0.1	<0.1
Northwest Territories and Nunavut	<0.1	<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 and from vegetation.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Table A. 12. Data for Figure 16. Total carbon monoxide emissions by source, Canada, 1990 to 2019

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)	Total emissions (emissions in kilotonnes)
1990	5 494.3	2 581.7	2 294.9	812.0	335.2	11 518.2
1991	5 289.2	2 511.4	2 390.9	817.0	325.1	11 333.7
1992	5 288.5	2 572.2	2 218.1	859.4	340.4	11 278.7
1993	5 272.4	2 640.0	2 409.8	862.9	362.3	11 547.4
1994	5 250.1	2 672.0	2 356.4	838.5	398.9	11 516.0
1995	5 034.4	2 720.3	2 392.3	817.5	406.6	11 371.1
1996	4 935.5	2 698.4	2 134.5	835.1	418.9	11 022.5
1997	4 938.1	2 606.6	1 867.0	825.7	468.3	10 705.7
1998	4 969.0	2 532.2	1 778.5	661.9	486.2	10 427.8
1999	4 860.1	2 525.4	1 707.0	643.0	498.4	10 234.0
2000	4 934.8	2 352.2	1 633.5	651.9	443.8	10 016.2
2001	4 684.5	1 956.4	1 523.0	561.7	467.9	9 193.6
2002	4 355.6	2 016.4	1 453.6	542.8	500.0	8 868.6
2003	4 131.5	2 023.7	1 527.1	512.6	530.0	8 724.8
2004	3 806.0	2 151.0	1 231.1	544.2	502.3	8 234.6
2005	3 123.6	1 969.5	1 205.0	560.6	494.7	7 353.5
2006	2 822.8	1 981.2	1 004.7	549.6	504.0	6 862.3
2007	2 703.2	1 970.7	947.8	645.0	523.8	6 790.4
2008	2 557.8	1 878.9	956.1	645.0	541.4	6 579.1
2009	2 364.5	1 805.3	911.1	651.7	525.7	6 258.2
2010	2 256.4	1 792.0	891.3	577.4	521.4	6 038.5
2011	2 056.5	1 545.2	901.1	613.9	527.6	5 644.5
2012	1 953.7	1 392.3	909.5	582.5	532.2	5 370.2
2013	1 910.0	1 372.8	847.5	643.8	563.8	5 337.9
2014	1 755.9	1 389.2	901.4	656.9	549.6	5 253.0
2015	1 730.0	1 344.6	879.5	643.9	557.0	5 154.9
2016	1 804.4	1 204.7	909.2	608.2	537.8	5 064.3
2017	1 823.9	1 257.9	878.1	609.8	552.3	5 121.9
2018	1 849.5	1 292.1	788.3	647.8	568.1	5 145.8
2019	1 872.2	1 281.6	775.5	660.1	539.6	5 129.0

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 dust and fires, electric utilities, building heating and energy generation, incineration and waste, agriculture (livestock, crop production and fertilizer), paints and solvents, ore and mineral industries, manufacturing and other miscellaneous sources. Consult Table 2 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 (2021) Air Pollutant Emissions Inventory.

Table A. 13. Data for Figure 17. Carbon monoxide emissions by province and territory, Canada, 1990 and 2019

Province or territory	1990 (emissions in kilotonnes)	2019 (emissions in kilotonnes)
Newfoundland and Labrador	184.7	80.9
Prince Edward Island	54.9	20.7
Nova Scotia	309.1	130.6
New Brunswick	316.1	128.8
Quebec	2 265.9	1 276.8
Ontario	3 269.4	1 313.3
Manitoba	385.9	171.1
Saskatchewan	521.4	299.4
Alberta	1 813.2	1 010.5
British Columbia	2 363.9	677.8
Yukon	16.4	7.3
Northwest Territories and Nunavut	17.4	11.7

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.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Table A. 14. Data for Figure 19. Total fine particulate matter emissions by source, Canada, 1990 to 2019

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	530.2	677.6	343.3	139.7	1 690.8
1991	514.6	670.5	319.3	139.6	1 644.0
1992	499.4	655.5	311.4	145.8	1 612.1
1993	495.1	641.0	306.0	145.6	1 587.7
1994	542.2	626.6	306.8	140.5	1 616.2
1995	497.5	612.2	306.1	136.2	1 552.0
1996	538.5	598.3	299.4	138.4	1 574.6
1997	597.4	584.4	293.1	135.3	1 610.2
1998	467.2	570.6	282.6	107.6	1 428.0
1999	490.4	557.0	279.9	103.5	1 430.7
2000	468.5	543.4	277.7	103.8	1 393.4
2001	499.5	530.1	247.5	88.6	1 365.7
2002	475.1	509.8	222.6	84.7	1 292.2
2003	509.8	489.7	215.8	78.9	1 294.2
2004	487.0	469.2	209.4	82.7	1 248.3
2005	506.6	449.4	204.2	84.2	1 244.4
2006	562.2	429.6	177.7	81.6	1 251.1
2007	652.2	415.9	173.0	95.1	1 336.1

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)
2008	735.9	402.4	164.3	94.5	1 397.1
2009	644.0	389.3	148.8	94.8	1 276.9
2010	735.0	376.4	151.1	83.5	1 346.0
2011	796.2	363.2	140.4	88.1	1 387.9
2012	907.9	366.3	136.8	82.9	1 493.9
2013	917.2	369.0	132.8	89.5	1 508.4
2014	919.0	371.8	130.0	89.0	1 509.8
2015	938.1	374.7	122.3	84.9	1 520.0
2016	938.8	377.5	116.8	78.6	1 511.6
2017	944.9	380.1	123.2	77.2	1 525.4
2018	961.0	382.6	123.8	79.8	1 547.2
2019	961.9	385.1	124.0	79.2	1 550.2

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 2 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 (2021) Air Pollutant Emissions Inventory.

Table A. 15. Additional information for Figure 19. Total fine particulate matter emissions by source, Canada, 1990 to 2019

Year	Ore and mineral industries (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Miscellaneous (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Building heating and energy generation (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Incineration and waste (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)
1990	55.3	34.8	116.0	53.7	14.0	12.0	4.6	48.4	4.6	<0.1
1991	52.3	31.9	106.7	51.4	12.1	12.4	4.6	43.4	4.5	<0.1
1992	50.2	31.0	103.7	51.6	12.1	12.8	4.7	40.6	4.6	<0.1
1993	49.9	30.6	102.4	55.6	12.4	12.9	4.9	32.5	4.7	<0.1
1994	51.4	31.0	102.7	60.3	12.9	13.7	4.9	24.9	5.1	<0.1
1995	51.5	29.9	103.6	63.1	13.3	14.0	4.9	20.7	5.0	<0.1
1996	52.9	30.1	98.0	62.2	13.4	14.0	5.2	18.9	4.7	<0.1
1997	54.2	31.5	87.8	61.9	13.8	14.3	5.0	20.1	4.5	<0.1
1998	51.1	32.4	83.2	56.9	14.6	15.9	4.6	19.7	4.3	<0.1
1999	50.0	33.2	83.2	54.2	15.1	13.6	4.8	21.4	4.3	<0.1
2000	51.7	33.9	78.5	52.2	15.6	13.4	5.3	23.0	4.2	<0.1
2001	48.4	33.1	65.1	43.2	15.9	13.3	5.0	19.2	4.1	<0.1
2002	38.2	31.7	56.0	41.3	17.0	13.9	5.2	15.0	4.3	<0.1
2003	38.1	31.4	54.2	41.8	17.0	12.6	5.6	10.9	4.1	<0.1
2004	37.0	31.3	51.0	41.4	17.1	11.9	5.3	10.2	4.2	<0.1
2005	42.0	33.1	45.3	35.9	17.4	12.4	5.2	8.9	3.9	<0.1
2006	40.8	31.4	29.5	32.9	17.4	11.7	4.9	6.0	3.1	<0.1
2007	39.0	30.0	27.4	32.6	17.4	11.4	5.2	7.0	3.0	<0.1
2008	36.9	28.9	24.5	31.4	17.8	10.0	5.1	6.8	2.9	<0.1
2009	31.5	26.3	20.3	29.5	17.9	9.2	5.0	6.1	2.9	<0.1
2010	34.6	25.6	20.1	30.9	17.6	9.1	4.7	5.7	2.8	<0.1
2011	33.1	24.3	20.4	24.6	16.8	9.0	5.0	4.3	2.7	<0.1
2012	35.6	22.9	19.8	21.2	16.9	9.9	4.6	3.2	2.6	<0.1
2013	32.8	21.8	19.9	19.8	16.8	11.0	4.8	3.2	2.5	<0.1
2014	32.6	20.2	18.8	18.3	16.1	12.9	4.9	3.6	2.5	<0.1

Year	Ore and mineral industries (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Miscellaneous (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Building heating and energy generation (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Incineration and waste (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)
2015	31.3	17.1	18.2	17.7	15.3	12.0	4.8	3.5	2.6	<0.1
2016	32.0	16.8	16.7	14.0	15.4	11.3	4.7	3.4	2.6	<0.1
2017	34.7	17.5	16.8	15.0	15.4	12.9	5.0	3.3	2.6	<0.1
2018	34.1	18.2	16.7	16.0	15.4	12.4	5.2	3.2	2.7	<0.1
2019	34.8	18.2	16.2	15.8	15.5	12.7	5.3	2.8	2.7	<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 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 2 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 (2021) Air Pollutant Emissions Inventory.

Table A. 16. Data for Figure 20. Fine particulate matter emissions by province and territory, Canada, 1990 and 2019

Province or territory	1990 (emissions in kilotonnes)	2019 (emissions in kilotonnes)	1990, excluding open sources [A] (emissions in kilotonnes)	2019, excluding open sources [A] (emissions in kilotonnes)
Newfoundland and Labrador	18.7	13.9	12.9	5.1
Prince Edward Island	4.6	3.4	2.1	1.2
Nova Scotia	27.7	15.3	19.0	7.7
New Brunswick	27.1	12.7	18.7	7.0
Quebec	145.4	122.1	101.4	56.9
Ontario	211.7	182.2	114.3	50.3
Manitoba	109.8	110.7	14.5	6.5
Saskatchewan	545.3	485.0	22.8	12.4
Alberta	435.8	533.4	73.1	30.0
British Columbia	156.2	64.1	102.0	25.2
Yukon	4.1	2.5	0.5	0.1
Northwest Territories and Nunavut	4.4	4.9	1.7	1.0

Note: [A] Open sources include emissions associated with dust and fires and agriculture (livestock, crop production and fertilizer). 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 (2021) Air Pollutant Emissions Inventory.

Table A. 17. Data for Figure 22. Total black carbon emissions by source, Canada, 2013 to 2019

Year	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Home firewood burning (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	12.6	11.3	8.0	2.2	1.0	1.4	36.6
2014	11.4	10.7	8.0	2.5	1.1	1.3	34.9
2015	10.9	8.8	7.7	2.3	1.0	1.3	32.0
2016	8.4	8.5	7.2	2.1	1.0	1.2	28.4
2017	9.1	9.0	7.2	2.2	1.1	1.2	29.8
2018	9.8	9.4	7.5	2.2	1.2	1.1	31.2
2019	9.6	9.5	7.4	2.3	1.2	1.1	31.2

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 2 in the Data sources and methods for more details.
Source: Environment and Climate Change Canada (2021) Canada's Black Carbon Emissions Inventory.

Table A. 18. Data for In 2019, three provinces, Alberta, Ontario and Quebec, accounted for 64% (20 kt) of total national black carbon emissions

- Between 2013 and 2019,
    - all provinces and territories, with the exception of Prince Edward Island, experienced reductions in black carbon emissions between 1% to 46%

- Ontario and Quebec experienced the largest reductions in emissions of 1.3 kt and 1.2 kt, respectively

Figure 23. Black carbon emissions by province and territory, Canada, 2013 and 2019

Province or territory	2013 (emissions in kilotonnes)	2019 (emissions in kilotonnes)
Newfoundland and Labrador	0.9	0.9
Prince Edward Island	0.2	0.2
Nova Scotia	1.3	1.0
New Brunswick	1.4	0.7
Quebec	7.6	6.5
Ontario	8.0	6.7
Manitoba	1.4	1.3
Saskatchewan	3.5	3.1
Alberta	7.7	6.7
British Columbia	3.9	3.4
Yukon	<0.1	<0.1
Northwest Territories	0.4	0.3
Nunavut	0.1	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 (2021) Canada's Black Carbon Emissions Inventory.

Table A. 19. Data for Figure 24. Contribution of transportation, off-road vehicles and mobile equipment to total air pollutant emissions by transportation mode, Canada, 2019

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	9.9	2.8	2.9	<0.1	<0.1	0.6
Passenger light trucks	16.1	5.0	3.9	<0.1	0.1	0.7
Large trucks and buses	9.5	18.2	1.8	0.7	<0.1	0.2
Air, marine and rail travel	1.1	10.7	0.6	0.2	0.6	<0.1
Off-road vehicles and equipment, tire wear and brake lining	25.0	11.4	8.0	1.1	<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 (2021) Air Pollutant Emissions Inventory.

Additional information for Figure 24. Contribution of transportation, off-road vehicles and mobile equipment to total air pollutant emissions by transportation mode, Canada, 2019

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	505.2	44.7	48.4	1.1	0.5	2.9
Passenger light trucks	824.8	81.3	65.7	1.5	0.8	3.5
Large trucks and buses	486.2	294.7	30.5	10.3	0.4	1.1
Air, marine and rail travel	55.9	172.6	10.6	3.8	4.1	0.2
Off-road vehicles and equipment, tire wear and brake lining	1 281.6	184.2	133.9	17.4	0.2	0.3

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 (2021) Air Pollutant Emissions Inventory.

Table A. 20. Data for Figure 25. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2019

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	-5	-3	-4
1992	-3	-3	-3
1993	0	-2	-2
1994	6	-2	-1
1995	9	-4	-2
1996	11	-5	-4
1997	17	-7	-8
1998	19	-7	-11
1999	23	-9	-13
2000	23	-10	-20
2001	16	-18	-33
2002	9	-21	-36
2003	5	-24	-39
2004	1	-26	-39
2005	-3	-37	-48
2006	-9	-41	-51
2007	-10	-42	-52
2008	-14	-45	-53

Year	Nitrogen oxides (percentage change from 1990 level)	Carbon monoxide (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)
2009	-21	-48	-57
2010	-21	-50	-58
2011	-24	-55	-68
2012	-29	-59	-71
2013	-33	-59	-73
2014	-38	-61	-74
2015	-42	-62	-75
2016	-45	-63	-77
2017	-42	-62	-76
2018	-40	-61	-76
2019	-40	-61	-76

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the chart due to their low share (≤ 5%) of total emissions in 2019.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Additional information for Figure 25. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2019

Year	Nitrogen oxides (emissions in kilotonnes)	Carbon monoxide (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)
1990	1 288.4	8 076.1	1 205.3
1991	1 229.9	7 800.6	1 161.0
1992	1 246.7	7 860.7	1 168.7
1993	1 285.9	7 912.4	1 187.1
1994	1 365.4	7 922.2	1 192.5
1995	1 399.9	7 754.7	1 180.7
1996	1 435.4	7 633.9	1 152.5
1997	1 512.2	7 544.7	1 113.7
1998	1 535.4	7 501.2	1 074.1
1999	1 580.1	7 385.5	1 051.6
2000	1 581.6	7 287.0	968.3
2001	1 489.3	6 641.0	801.7
2002	1 403.3	6 372.0	773.9
2003	1 346.4	6 155.2	733.0
2004	1 302.7	5 957.0	733.4
2005	1 248.6	5 093.1	628.3
2006	1 175.8	4 804.0	593.4
2007	1 156.3	4 673.8	583.4
2008	1 108.1	4 436.7	568.1
2009	1 020.2	4 169.7	518.1
2010	1 020.4	4 048.4	502.3
2011	980.3	3 601.8	385.7

Year	Nitrogen oxides (emissions in kilotonnes)	Carbon monoxide (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)
2012	910.0	3 346.0	350.1
2013	866.8	3 282.8	329.4
2014	802.4	3 145.1	310.4
2015	752.5	3 074.6	298.7
2016	708.0	3 009.1	277.5
2017	741.0	3 081.8	285.1
2018	773.1	3 141.6	291.7
2019	777.5	3 153.8	289.1

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the chart due to their low share (≤ 5%) of total emissions in 2019.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Table A.21. Data for Figure 26. Contribution of electric utilities to total air pollutant emissions by fuel source, Canada, 2019

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	28.3	5.4	0.2	0.1	<0.1	<0.1
Natural gas	0.2	1.1	0.2	<0.1	<0.1	<0.1
Diesel	<0.1	0.6	<0.1	<0.1	<0.1	n/a
Other sources	0.9	0.6	0.1	<0.1	<0.1	<0.1

Note: n/a = not available. 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 2019. 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 (2021) Air Pollutant Emissions Inventory.

Additional information for Figure 26. Contribution of electric utilities to total air pollutant emissions by fuel source, Canada, 2019

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	197.8	87.7	10.9	1.8	0.3	<0.1
Natural gas	1.1	18.3	10.4	0.3	0.6	0.1
Diesel	0.1	9.8	2.3	0.2	<0.1	n/a
Other sources	6.5	9.0	5.6	0.5	0.2	<0.1

Note: n/a = not available. 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 2019. 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 (2021) Air Pollutant Emissions Inventory.

Table A. 22. Data for Figure 27. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2019

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
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	-23
2012	-54	-35
2013	-55	-37
2014	-56	-35
2015	-59	-41
2016	-59	-41
2017	-60	-44
2018	-64	-50
2019	-67	-51

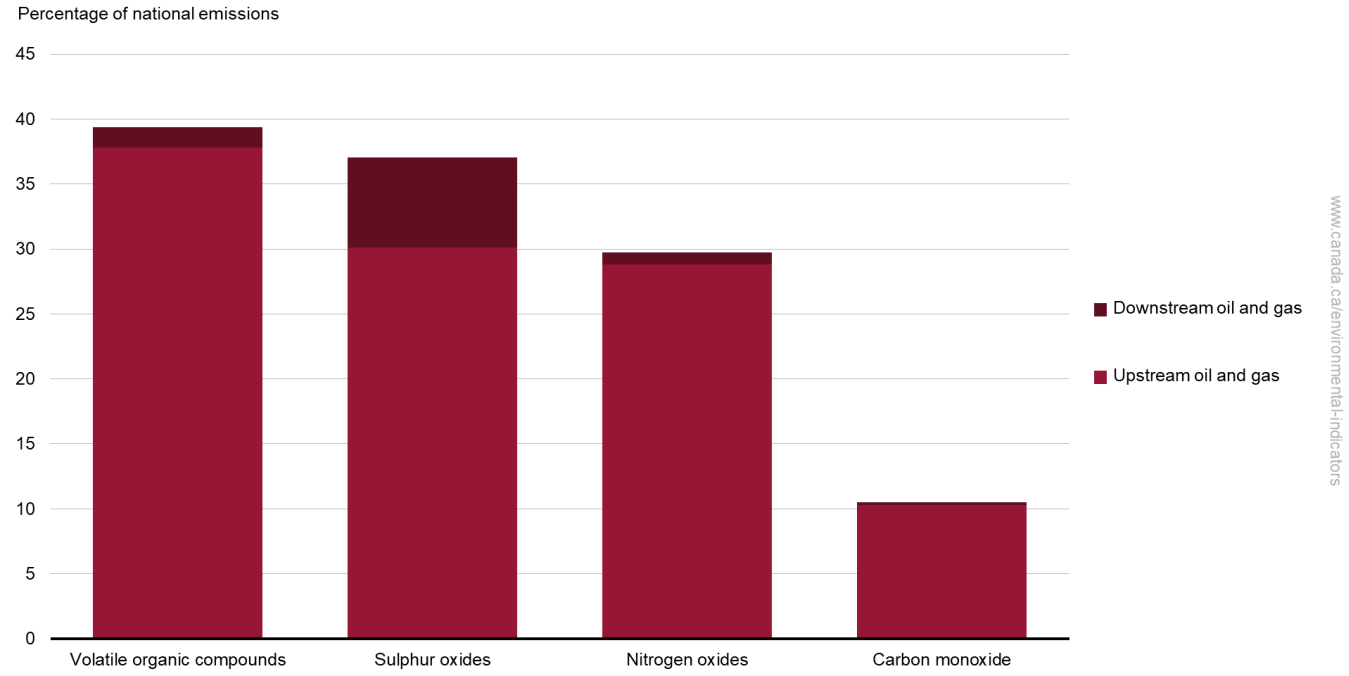
Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2019. Excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Additional information for Figure 27. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2019

Year	Sulphur oxides (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)
1990	618.4	257.0
1991	592.1	250.9
1992	610.7	262.9
1993	547.2	243.0
1994	559.8	240.0
1995	532.6	248.1
1996	542.2	269.0
1997	591.3	287.7
1998	603.6	310.1
1999	601.1	306.4
2000	619.2	326.8
2001	623.9	313.0
2002	624.3	314.9
2003	630.4	293.0
2004	581.5	267.5
2005	521.9	253.7
2006	458.9	224.3
2007	491.9	238.8
2008	427.5	225.1
2009	384.0	218.0
2010	334.0	233.7
2011	293.2	198.9
2012	284.2	166.3
2013	278.2	162.0
2014	269.2	167.2
2015	251.5	152.4
2016	253.1	152.5
2017	245.5	145.1
2018	220.3	129.2
2019	205.5	124.8

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 2019. 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 (2021) Air Pollutant Emissions Inventory.

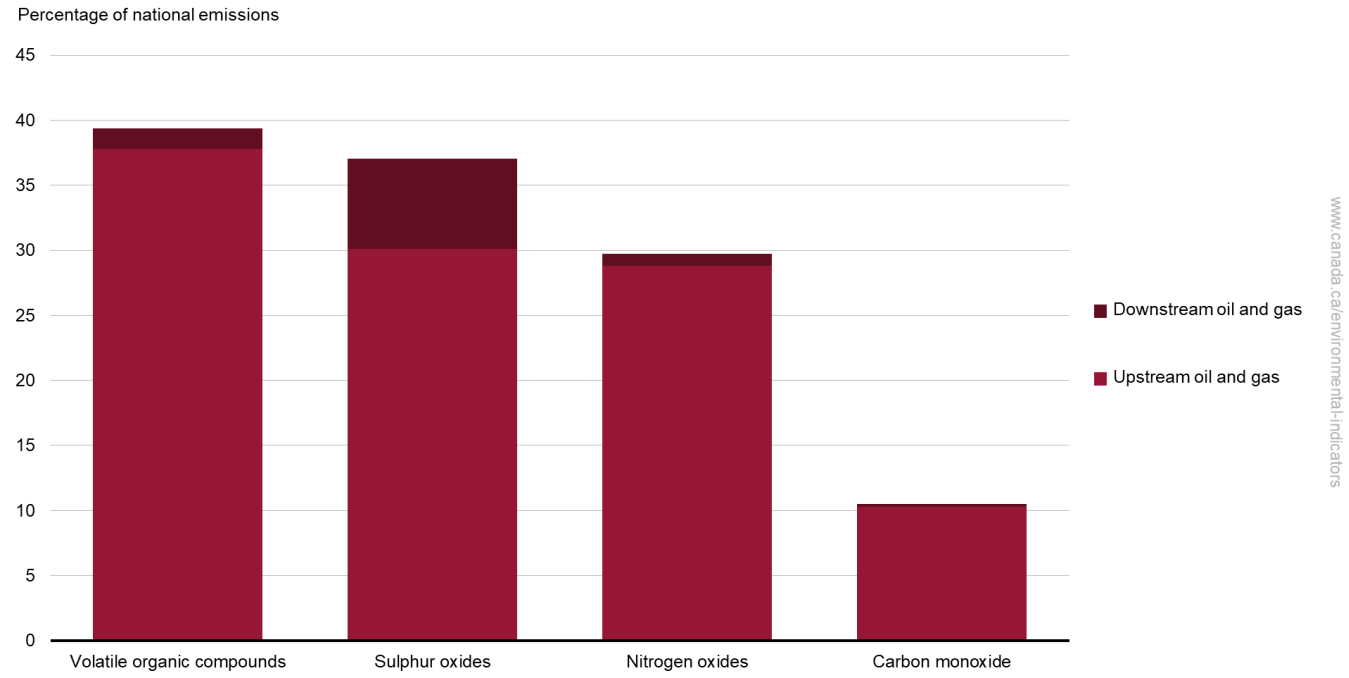
Table A.23. Data for Figure 28. Contribution of the oil and gas industry to total air pollutant emissions by activity type, Canada, 2019



Activity type	Volatile organic compounds (percentage of national emissions)	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)	Ammonia (percentage of national emissions)
Upstream oil and gas	37.8	30.1	28.8	10.3	0.7	0.6
Downstream oil and gas	1.6	6.9	0.9	0.3	<0.1	<0.1

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2019.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Additional information for Figure 28. Contribution of the oil and gas industry to total air pollutant emissions by activity type, Canada, 2019



Activity type	Volatile organic compounds (emissions in kilotonnes)	Sulphur oxides (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	633.0	210.5	465.7	526.0	11.2	2.9
Downstream oil and gas	26.1	48.4	15.3	13.6	1.5	<0.1

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2019.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Table A. 24. Data for Figure 29. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2019

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	2	3	2	8
1993	8	10	6	13
1994	19	19	8	12
1995	21	24	10	11
1996	25	28	15	11
1997	40	40	13	2
1998	45	44	15	-4
1999	49	48	9	-4

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)
2000	32	33	11	-5
2001	40	31	13	-8
2002	49	31	16	-14
2003	58	43	15	-12
2004	50	24	13	-13
2005	48	25	13	-15
2006	50	24	11	-22
2007	56	31	11	-26
2008	62	34	13	-30
2009	57	33	6	-31
2010	56	31	3	-37
2011	57	32	1	-41
2012	59	33	10	-39
2013	68	34	19	-41
2014	64	38	23	-47
2015	66	38	17	-52
2016	60	36	6	-53
2017	65	39	8	-52
2018	69	41	10	-50
2019	61	39	10	-51

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2019.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Additional information for Figure 29. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2019

Year	Carbon monoxide (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Sulphur oxides (emissions in kilotonnes)
1990	335.2	345.8	598.8	531.0
1991	325.1	339.4	593.7	535.2
1992	340.4	356.0	608.2	575.6
1993	362.3	381.2	634.8	602.4
1994	398.9	413.1	648.4	595.5
1995	406.6	429.5	660.2	589.6
1996	418.9	441.6	688.1	587.2
1997	468.3	485.2	678.0	542.1
1998	486.2	496.3	690.7	511.0
1999	498.4	513.5	650.3	507.1
2000	443.8	459.1	667.3	504.7
2001	467.9	453.3	675.6	486.8
2002	500.0	453.3	692.3	459.2
2003	530.0	496.0	690.7	467.5
2004	502.3	430.5	677.1	459.9
2005	494.7	430.7	678.9	452.6

Year	Carbon monoxide (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Sulphur oxides (emissions in kilotonnes)
2006	504.0	430.3	666.4	416.2
2007	523.8	453.6	662.8	391.2
2008	541.4	464.0	675.0	369.8
2009	525.7	460.1	632.9	367.0
2010	521.4	451.9	616.3	334.0
2011	527.6	457.6	605.8	315.7
2012	532.2	460.3	656.2	323.2
2013	563.8	464.6	710.8	311.3
2014	549.6	476.7	737.2	280.4
2015	557.0	478.1	697.7	256.1
2016	537.8	470.6	636.9	247.3
2017	552.3	480.9	647.0	256.0
2018	568.1	486.2	660.4	264.4
2019	539.6	481.0	659.1	259.0

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2019.
Source: Environment and Climate Change Canada (2021) Air Pollutant Emissions Inventory.

Additional information can be obtained at:

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