



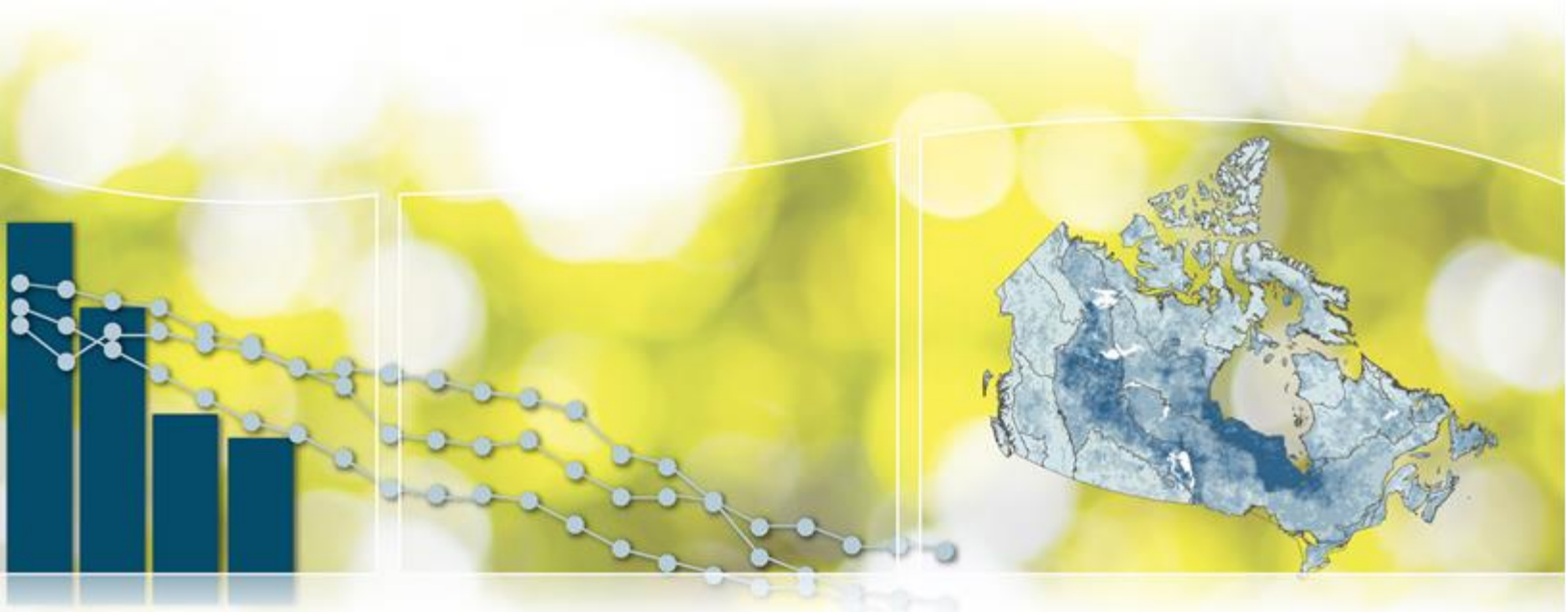
Environment and
Climate Change Canada

Environnement et
Changement climatique Canada



Canadian Environmental Sustainability Indicators

Air pollutant emissions



Canada 

Suggested citation for this document: Environment and Climate Change Canada (2018) Canadian Environmental Sustainability Indicators: Air pollutant emissions. Consulted on *Month day, year*. Available at: www.canada.ca/en/environment-climate-change/services/environmental-indicators/air-pollutant-emissions.html.

Cat. No.: En4-144/22-2018E-PDF
ISBN: 978-0-660-27512-3

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

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

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

© Her Majesty the Queen in Right of Canada, represented by the Minister of Environment and Climate Change, 2018

Aussi disponible en français

Canadian Environmental Sustainability Indicators

Air pollutant emissions

August 2018

Table of Contents

Air pollutant emissions	8
Summary	8
Key results	8
Sulphur oxide emissions by source	11
Key results	11
Sulphur oxide emissions by province and territory	12
Key results	12
Sulphur oxide emissions by facilities	13
Nitrogen oxide emissions by source	14
Key results	14
Nitrogen oxide emissions by province and territory	15
Key results	15
Nitrogen oxide emissions by facilities	16
Volatile organic compound emissions by source	17
Key results	17
Volatile organic compound emissions by province and territory	18
Key results	18
Volatile organic compound emissions by facilities	19
Ammonia emissions by source	20
Key results	20
Ammonia emissions by province and territory	21
Key results	21

Ammonia emissions by facilities.....	22
Carbon monoxide emissions by source	23
Key results.....	23
Carbon monoxide emissions by province and territory	24
Key results.....	24
Carbon monoxide emissions by facilities	25
Fine particulate matter emissions by source	26
Key results.....	26
Fine particulate matter emissions by province and territory	28
Key results.....	28
Fine particulate matter emissions by facilities	29
Black carbon emissions by source	30
Key results.....	30
Air pollutant emissions from transportation, off-road vehicles and mobile equipment.....	31
Key results.....	31
Changes in emissions from transportation, off-road vehicles and mobile equipment.....	32
Key results.....	32
Air pollutant emissions from the electric utilities.....	33
Changes in emissions from the electric utilities.....	34
Key results.....	34
Air pollutant emissions from the oil and gas industry	35
Key results.....	35
Changes in emissions from the oil and gas industry.....	36
Key results.....	36
About the indicators.....	37
What the indicators measure.....	37
Why these indicators are important.....	37
Related indicators.....	37
Data sources and methods.....	38
Data sources	38
Methods.....	39
Recent changes.....	48
Caveats and limitations	48
Resources.....	49
References	49
Related information	49

Annex	50
Annex A. Data tables for the figures presented in this document	50

List of Figures

Figure 1. Air pollutant emissions, Canada, 1990 to 2016	8
Figure 2. Distribution of air pollutant emissions by source, Canada, 2016	9
Figure 3. Distribution of air pollutant emissions by province and territory, Canada, 2016	10
Figure 4. Total sulphur oxide emissions by source, Canada, 1990 to 2016	11
Figure 5. Sulphur oxide emissions by province and territory, Canada, 1990 and 2016	12
Figure 6. Total nitrogen oxide emissions by source, Canada, 1990 to 2016	14
Figure 7. Nitrogen oxide emissions by province and territory, Canada, 1990 and 2016	15
Figure 8. Total volatile organic compound emissions by source, Canada, 1990 to 2016	17
Figure 9. Volatile organic compound emissions by province and territory, Canada, 1990 and 2016	18
Figure 10. Total ammonia emissions by source, Canada, 1990 to 2016	20
Figure 11. Ammonia emissions by province and territory, Canada, 1990 and 2016	21
Figure 12. Total carbon monoxide emissions by source, Canada, 1990 to 2016	23
Figure 13. Carbon monoxide emissions by province and territory, Canada, 1990 and 2016	24
Figure 14. Total fine particulate matter emissions by source, Canada, 1990 to 2016	26
Figure 15. Fine particulate matter emissions by province and territory, Canada, 1990 and 2016 ..	28
Figure 16. Total black carbon emissions by source, Canada, 2016	30
Figure 17. Contribution of transportation, off-road vehicles and mobile equipment to air pollutant emissions by transportation mode, Canada, 2016	31
Figure 18. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, 1990 to 2016	32
Figure 19. Contribution of electric utilities to air pollutant emissions by fuel source, Canada, 2016	33
Figure 20. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2016	34
Figure 21. Contribution of the oil and gas industry to air pollutant emissions by activity type, Canada, 2016	35
Figure 22. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2016	36

List of Tables

Table 1. Source emissions changes between 1990 and 2016	27
Table 2. Alignment of sources reported in the indicators with the sources and sectors from the Air Pollutant Emission Inventory/Black Carbon Emissions Inventory	42
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 Emission Inventory/Black Carbon Emissions	46
Table 4. Alignment of sources reported in the electric utilities indicator of Air pollutant emissions with the sources and sectors from the Air Pollutant Emission Inventory/Black Carbon Emissions	47

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 Emission Inventory/Black Carbon Emissions	48
Table A.1. Data for Figure 1. Air pollutant emissions, Canada, 1990 to 2016	50
Table A.2. Data for Figure 2. Distribution of air pollutant emissions by source, Canada, 2016	51
Table A.3. Data for Figure 3. Distribution of air pollutant emissions by province and territory, Canada, 2016	52
Table A.4. Data for Figure 4. Total sulphur oxide emissions by source, Canada, 1990 to 2016	53
Table A.5. Data for Figure 5. Sulphur oxide emissions by province and territory, Canada, 1990 and 2016	54
Table A.6. Data for Figure 6. Total nitrogen oxide emissions by source, Canada, 1990 to 2016	55
Table A.7. Data for Figure 7. Nitrogen oxide emissions by province and territory, Canada, 1990 and 2016	56
Table A.8. Data for Figure 8. Total volatile organic compound emissions by source, Canada, 1990 to 2016	57
Table A.9. Data for Figure 9. Volatile organic compound emissions by province and territory, Canada, 1990 and 2016	58
Table A.10. Data for Figure 10. Total ammonia emissions by source, Canada, 1990 to 2016	59
Table A.11. Data for Figure 11. Ammonia emissions by province and territory, Canada, 1990 and 2016	60
Table A.12. Data for Figure 12. Total carbon monoxide emissions by source, Canada, 1990 to 2016	61
Table A.13. Data for Figure 13. Carbon monoxide emissions by province and territory, Canada, 1990 and 2016	62
Table A.14A. Data for Figure 14. Total fine particulate matter emissions by source, Canada, 1990 to 2016	63
Table A.14B. Data for Figure 14. Total fine particulate matter emissions by source, Canada, 1990 to 2016	65
Table A.15. Data for Figure 15. Fine particulate matter emissions by province and territory, Canada, 1990 and 2016	67
Table A.16. Data for Figure 16. Total black carbon emissions by source, Canada, 2016	67
Table A.17A. Data for Figure 17. Contribution of transportation, off-road vehicles and mobile equipment to air pollutant emissions by transportation mode, Canada, 2016	68
Table A.17B. Data for Figure 17. Emissions of air pollutants from transportation, off-road vehicles and mobile equipment by transportation mode, Canada, 2016	68
Table A.18A. Data for Figure 18. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, 1990 to 2016	69
Table A.18B. Data for Figure 18. Emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2016	70
Table A.19A. Data for Figure 19. Contribution of electric utilities to air pollutant emissions by fuel source, Canada, 2016	71
Table A.19B. Data for Figure 19. Emissions of air pollutants from electric utilities by fuel source, Canada, 2016	71
Table A.20A. Data for Figure 20. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2016	72
Table A.20B. Data for Figure 20. Emissions of key air pollutants from electric utilities, Canada, 1990 to 2016	73

Table A.21A. Data for Figure 21. Contribution of the oil and gas industry to air pollutant emissions by activity type, Canada, 2016	74
Table A.21B. Data for Figure 21. Emissions of air pollutants from the oil and gas industry, Canada, 2016	75
Table A.22A. Data for Figure 22. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2016	75
Table A.22B. Data for Figure 22. Emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2016	77

Air pollutant emissions

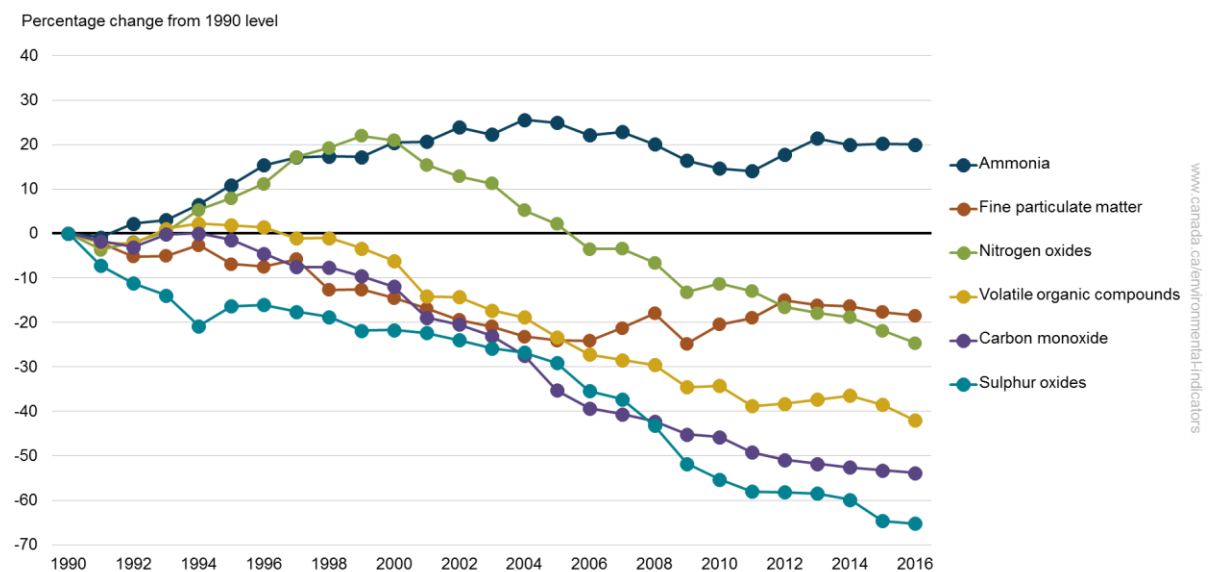
Air pollution problems, such as smog and acid rain, result from the release of pollutants into the atmosphere. The majority of these pollutants come from human activities, such as transportation, the burning of fuels for electricity and heating, and industry. They are also released from natural sources, such as forest fires and from vegetation. The indicators report emissions released through human activities for 6 key air pollutants.

Summary

Key results

- In 2016, emissions of 5 key air pollutants ([sulphur oxides](#) [SO_x], [nitrogen oxides](#) [NO_x], [volatile organic compounds](#) [VOCs], [carbon monoxide](#) [CO] and [fine particulate matter](#) [PM_{2.5}]) ranged from 65% to 18% lower than in 1990
- Emissions of [ammonia](#) (NH₃) were 20% higher than in 1990

Figure 1. Air pollutant emissions, Canada, 1990 to 2016



[Data for Figure 1](#)

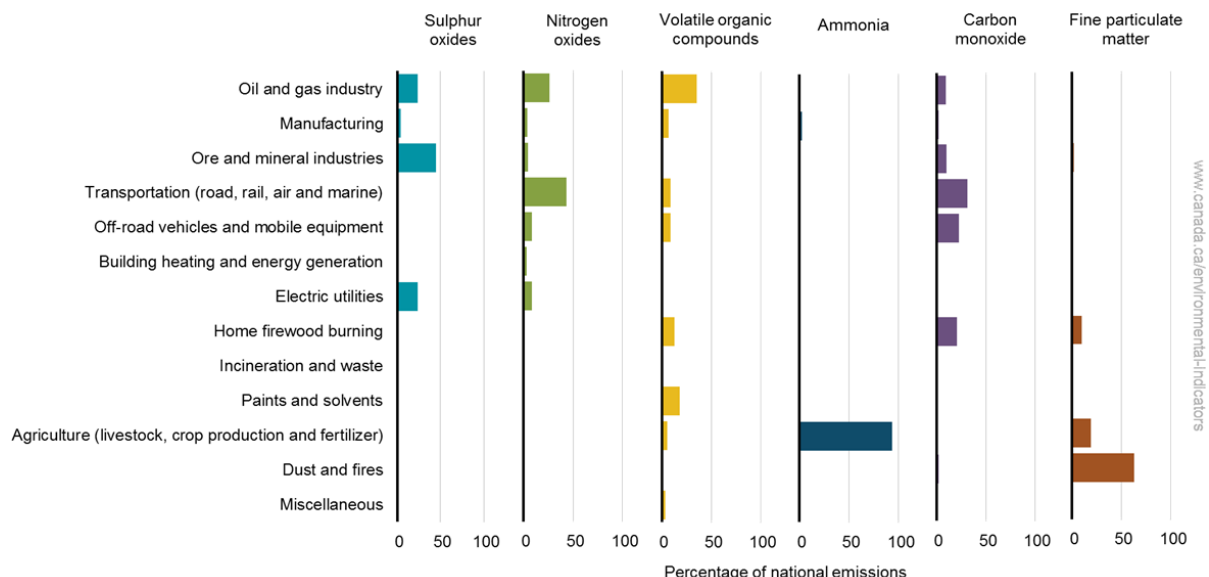
Note: This indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emissions Inventory](#).

Between 1990 and 2016, the largest emission reductions were observed for SO_x, which decreased by 65%. It was followed by CO emissions (54% reduction), VOCs (42%), NO_x (25%) and PM_{2.5} (18%). 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.

In 2016, the majority of emissions of the 6 key air pollutants in Canada came from ore and mineral industries, transportation, the oil and gas industry, agriculture, and dust and fires (for example, road dust, prescribed forest burning).

Figure 2. Distribution of air pollutant emissions by source, Canada, 2016



[Data for Figure 2](#)

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emissions Inventory](#).

The human made sources most contributing to Canada's air pollutant emissions in 2016 were the following:

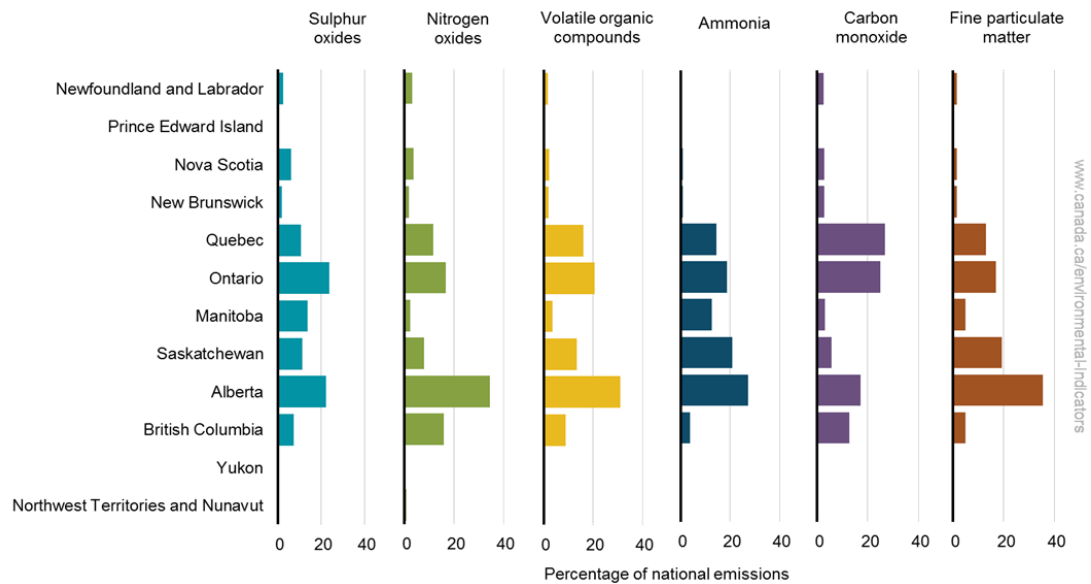
- the ore and mineral industries, electric utilities and the oil and gas industries together represented the majority of SO_x emissions
- transportation (road, rail, air and marine) was the main source of NO_x and CO emissions
- off-road vehicles and mobile equipment and home firewood burning were also 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 $\text{PM}_{2.5}$ emissions

In 2016, emissions of the 6 key air pollutants were highest in Alberta, Ontario and Quebec.

- Alberta had the highest NO_x (35% of national emissions), VOCs (31%), NH_3 (27%) and $\text{PM}_{2.5}$ (35%) emissions
- Ontario had the highest SO_x emissions (24%), followed by Alberta (22%)
- Quebec had the highest CO emissions (27%), followed by Ontario (25%)

Saskatchewan was also an important emitter of NH_3 and $\text{PM}_{2.5}$, accounting for about 20% of the national emissions of these pollutants.

Figure 3. Distribution of air pollutant emissions by province and territory, Canada, 2016



[Data for Figure 3](#)

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emissions Inventory](#).

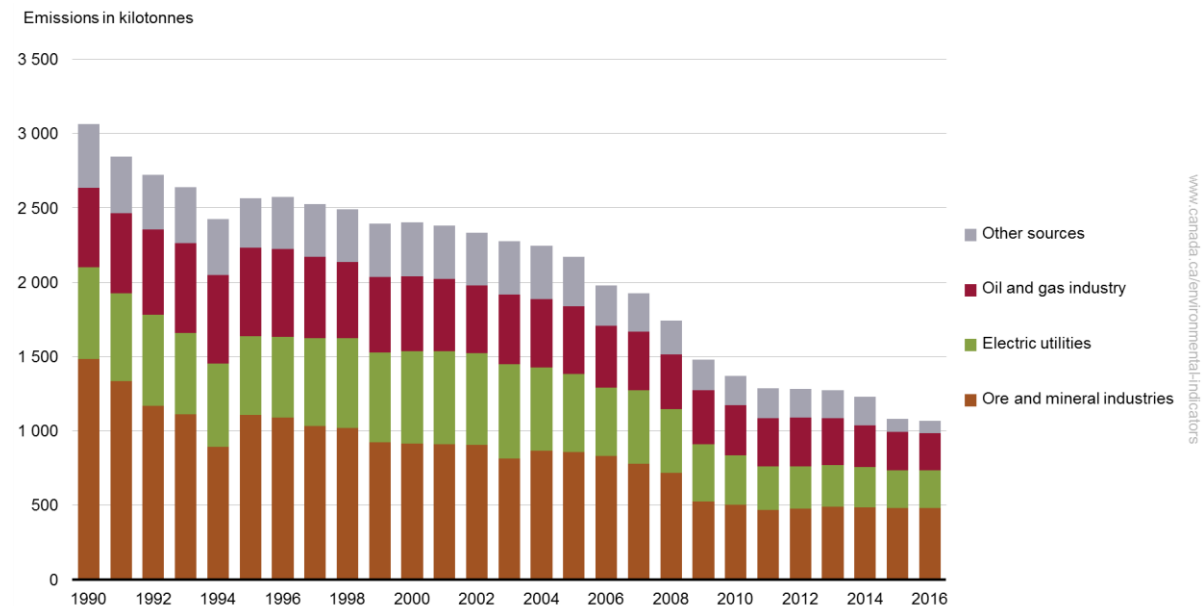
Sulphur oxide emissions by source

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 (SO₂). 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 2016, SO_x emissions decreased by 65% to 1 067 kilotonnes (kt) in 2016
- In 2016, the largest proportion of SO_x emissions came from ore and mineral industries. The source represented 45% (481 kt) of total emissions

Figure 4. Total sulphur oxide emissions by source, Canada, 1990 to 2016



[Data for Figure 4](#)

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emissions Inventory](#).

In 2016, the non-ferrous mining and smelting industry accounted for 75% (360 kt) of SO_x emissions from the ore and mineral industries, the main contributor to total national emissions. Emissions from [electric utilities](#) and the [oil and gas industry](#) followed with 24% (253 kt) and 23% (249 kt) of total national emissions, respectively.

The largest reduction in emissions between 1990 and 2016 was from ore and mineral industries (the largest driver of the reduction was from the non-ferrous mining and smelting industry), with a reduction in emissions of 1 002 kt.

This significant decrease in SO_x emissions from 1990 to 2016 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:

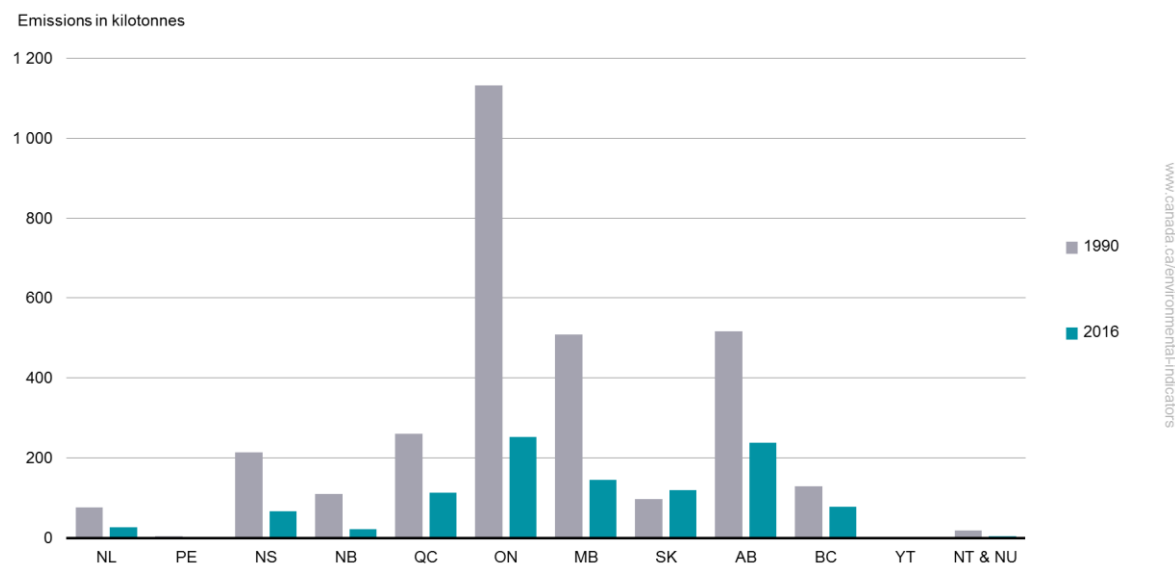
- technological upgrades, new air pollution controls for non-ferrous metal smelters and the closure of 3 major smelters in Manitoba, Ontario and Quebec
- lower emissions from fossil-fuel-fired (for example, coal-fired) power-generating utilities as a result of better technologies and plant closures (for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

Sulphur oxide emissions by province and territory

Key results

- In 2016, Ontario and Alberta accounted for 46% (491 kt) of national SO_x emissions
- Between 1990 and 2016, the largest reduction was observed in Ontario. Emissions in the province decreased by 878 kt (78%)

Figure 5. Sulphur oxide emissions by province and territory, Canada, 1990 and 2016



[Data for Figure 5](#)

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emissions Inventory](#).

Ontario had the highest SO_x emissions level in 2016, accounting for 24% (253 kt) of total national emissions. Emissions in the province mainly came from ore and mineral industries, accounting for 84% (212 kt) of the emissions. The sharp reduction in SO_x emissions in Ontario between 1990 and

¹ Environment and Climate Change Canada (1991) [Canada-United States Air Quality Agreement](#). Retrieved on May 15, 2018.

² Canadian Council of Ministers of the Environment (1998) [The Canada-Wide Acid Rain Strategy for Post-2000](#). Retrieved on May 15, 2018.

³ Environment and Climate Change Canada (2015) [Sulphur in Gasoline Regulations](#). Retrieved on May 15, 2018.

⁴ Environment and Climate Change Canada (2012) [Sulphur in Diesel Fuel Regulations](#). Retrieved on May 15, 2018.

2016 was mainly due to emission reductions from ore and mineral industries (notably the non-ferrous mining and smelting industry) and electric utilities.

Alberta was the second-highest emitter of SO_x in 2016, accounting for 22% (238 kt) of total national emissions. The oil and gas industry and electric utilities were the largest contributor to SO_x emissions of the province in 2016.

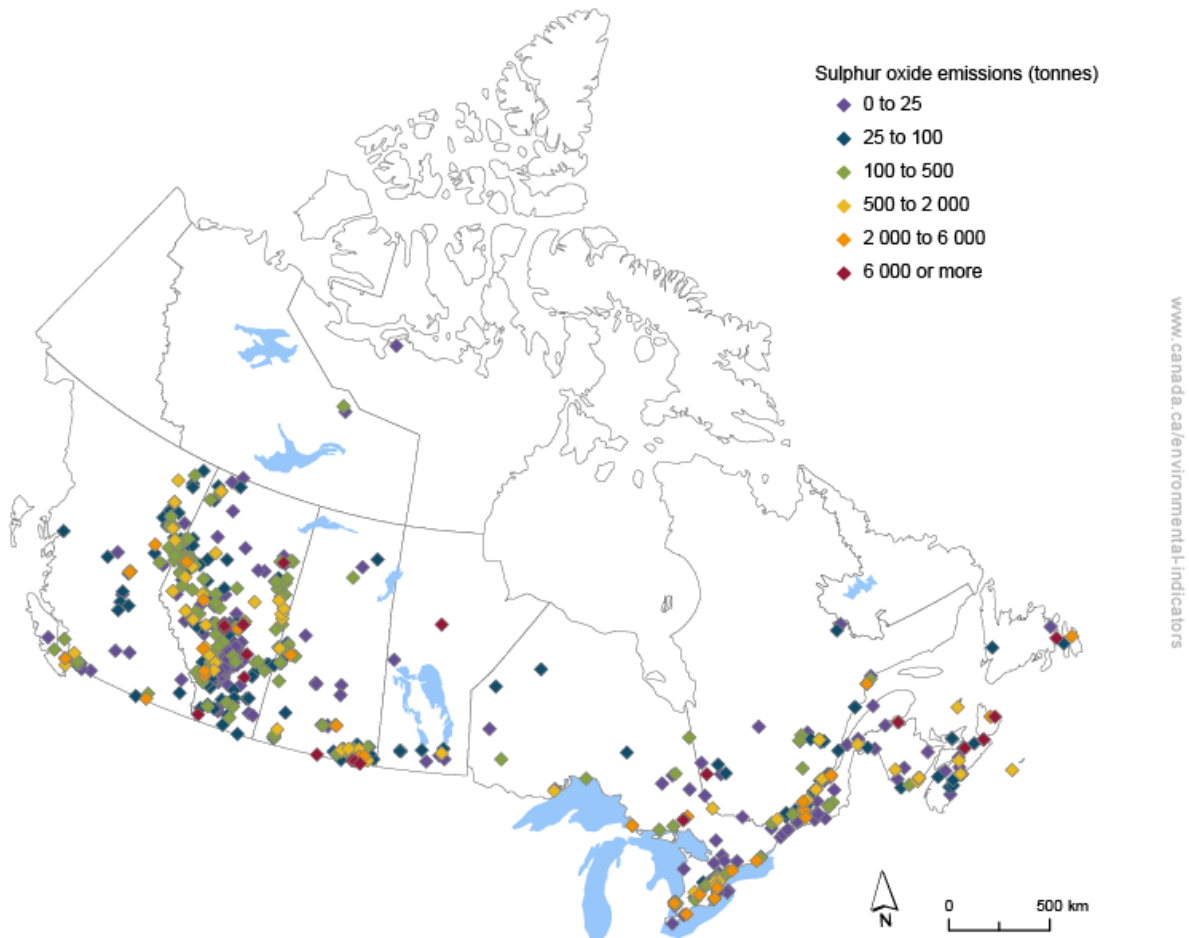
Manitoba ranked third, with 14% (145 kt) of total national emissions; ore and mineral industries was the most important source of emissions in that province.

Sulphur oxide emissions by facilities

Environment and Climate Change Canada's National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities.

The Canadian Environmental Sustainability Indicators provide this information through an interactive map. With the interactive map, you can drill down to the SO_x emissions at specific reporting facilities.

Sulphur oxide emissions by reporting facilities, Canada, 2016



Navigate data using the [interactive map](#)

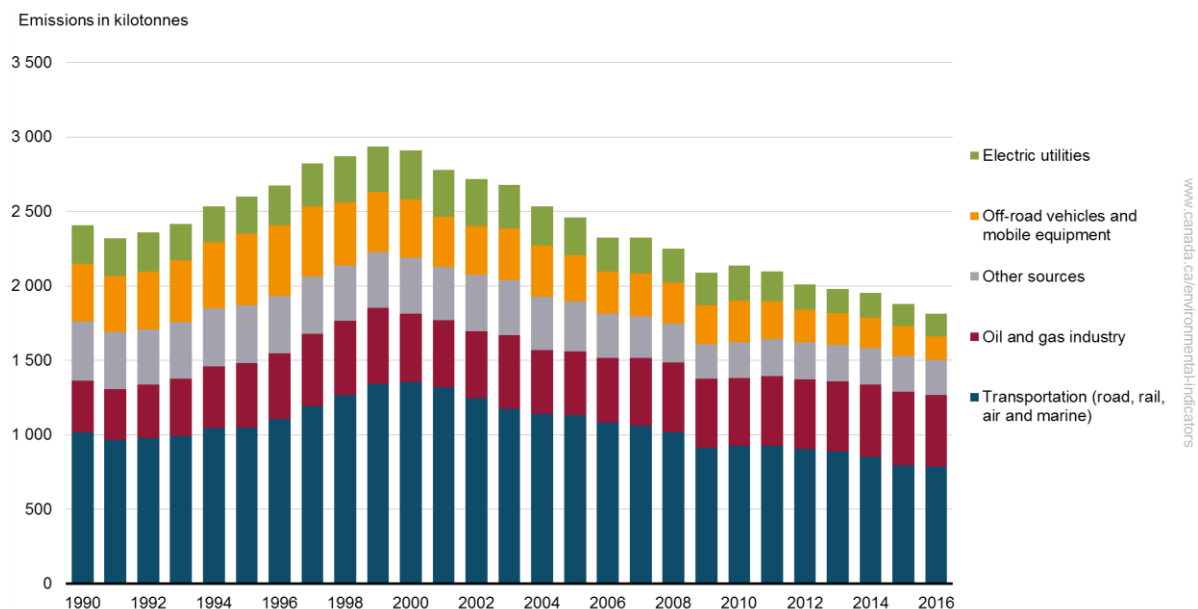
Nitrogen oxide emissions by source

[Nitrogen oxides](#) (NO_x) include emissions of nitric oxide (NO) and nitrogen dioxide (NO₂). 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 (O₃) and fine particulate matter (P_{2.5}).

Key results

- In 2016, NO_x emissions were 1 814 kilotonnes (kt). This is 25% lower than in 1990
- Transportation (road, rail, air and marine) was a major source of NO_x representing 43% (786 kt) of total emissions in 2016

Figure 6. Total nitrogen oxide emissions by source, Canada, 1990 to 2016



[Data for Figure 6](#)

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emission 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 2016. Emissions of NO_x from this sector decreased by 232 kt (23%) during that period.

The [oil and gas industry](#) emitted the next largest proportions of NO_x emissions in 2016, representing 26% (480 kt) of total national emissions. This sector also experienced the largest increase 39% (134 kt) in emissions between 1990 and 2016, partly offsetting reductions from other sectors.

The decline in NO_x emissions between 1990 and 2016 is mostly attributable to 2 factors:

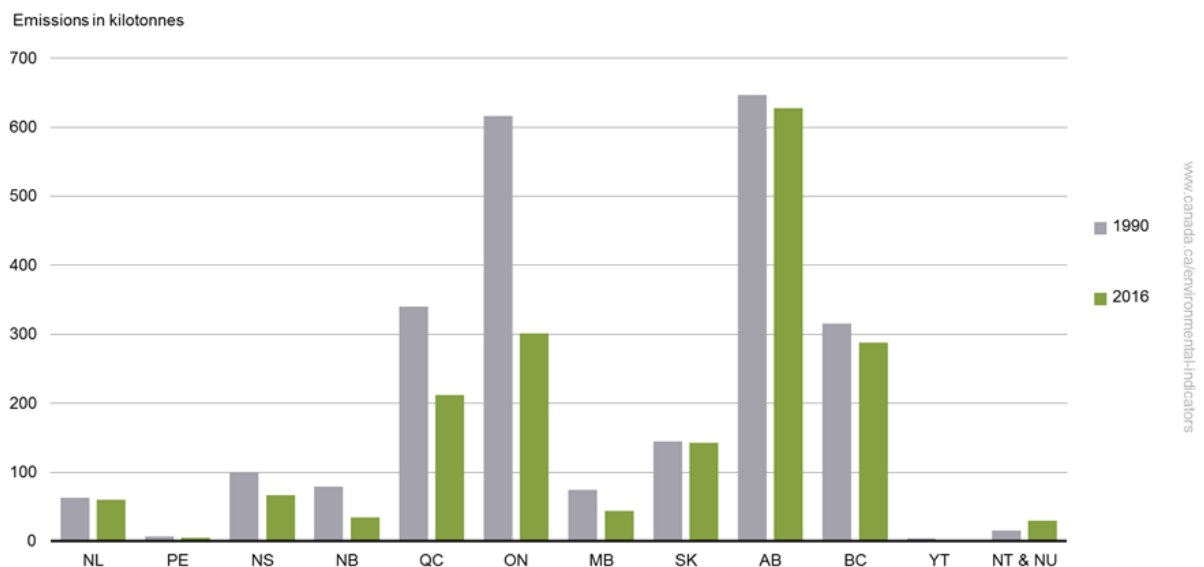
- the reduction in emissions from [transportation](#) after 2000, given the progressive introduction of cleaner technology and fuels for vehicles
- lower emissions from fossil-fuel-fired (for example, coal-fired) power-generating utilities as a result of better emissions control technologies and certain plant closures (for example, the closure of coal power plants in Ontario)

Nitrogen oxide emissions by province and territory

Key results

- Among provinces and territories, Alberta emitted the most NO_x in 2016. The province accounted for 35% (628 kt) of national emissions
- Between 1990 and 2016, the largest reduction was observed in Ontario. Emissions decreased by 315 kt (51%) in the province

Figure 7. Nitrogen oxide emissions by province and territory, Canada, 1990 and 2016



[Data for Figure 7](#)

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

The oil and gas industry is an important source of NO_x emissions in Alberta, accounting for 58% (361 kt) of the province's NO_x emissions in 2016. The increasing contribution of this sector to the province's emissions between 1990 and 2016 was offset by similar emission reductions from the transport and electric utilities sectors.

Ontario contributed the second-largest proportion of NO_x emissions in 2016, accounting for 17% (302 kt) of total national emissions, with transportation (road, rail, air and marine) being the most important source followed by off-road vehicles and mobile equipment. Ontario experienced the largest decrease in emissions levels (315 kt) between 1990 and 2016 in large part due to emission reductions from transportation, electric utilities and off-road vehicles and mobile equipment.

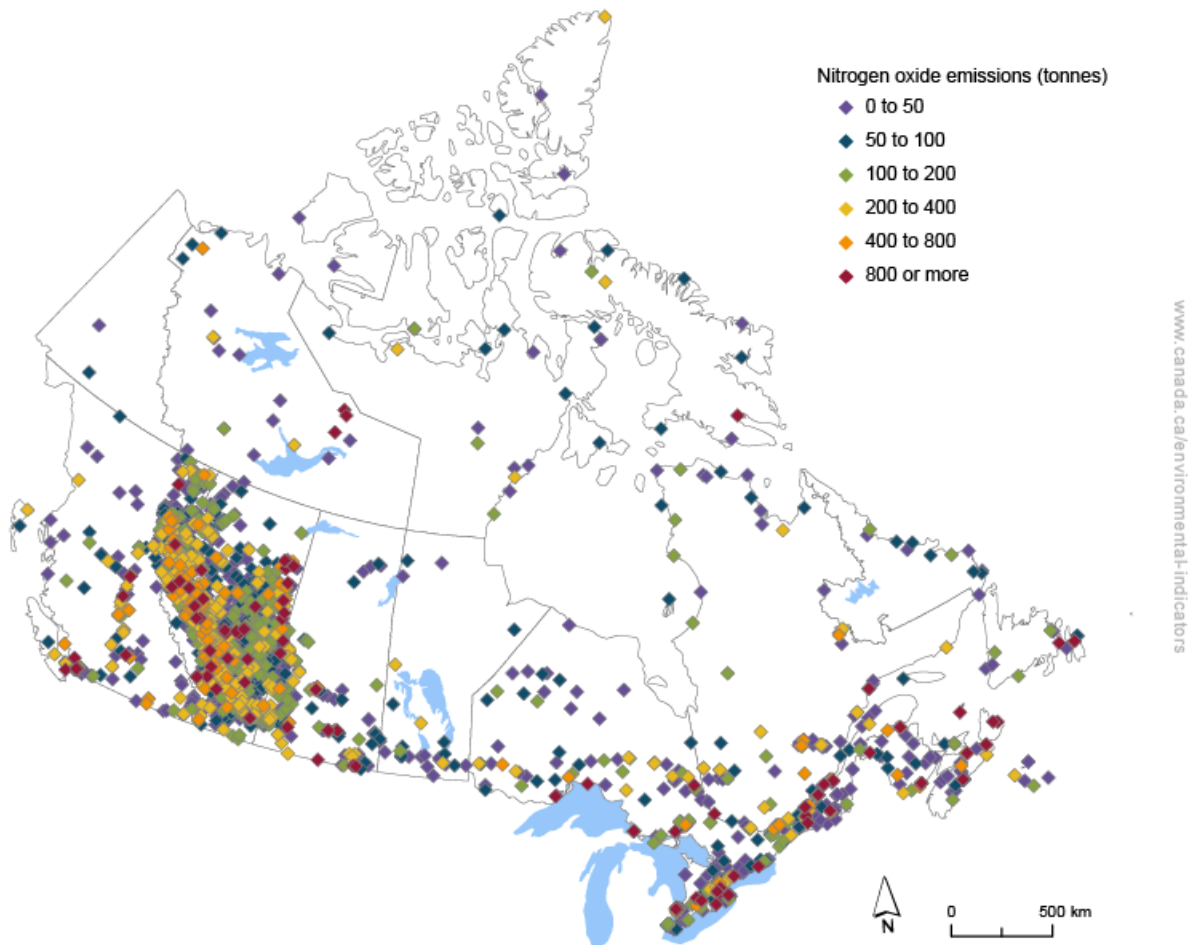
British Columbia ranked third, with 16% (288 kt) of total national emissions. Transportation (road, rail, air and marine) was the most important source of NO_x in this province.

Nitrogen oxide emissions by facilities

Environment and Climate Change Canada's National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities.

The Canadian Environmental Sustainability Indicators provide this information through an interactive map. With the interactive map, you can drill down to the NO_x emissions at specific reporting facilities.

Nitrogen oxide emissions by reporting facilities, Canada, 2016



Source: Environment and Climate Change Canada (2018) [National Pollutant Release Inventory Data search - facility reported data](#).

Navigate data using the [interactive map](#)

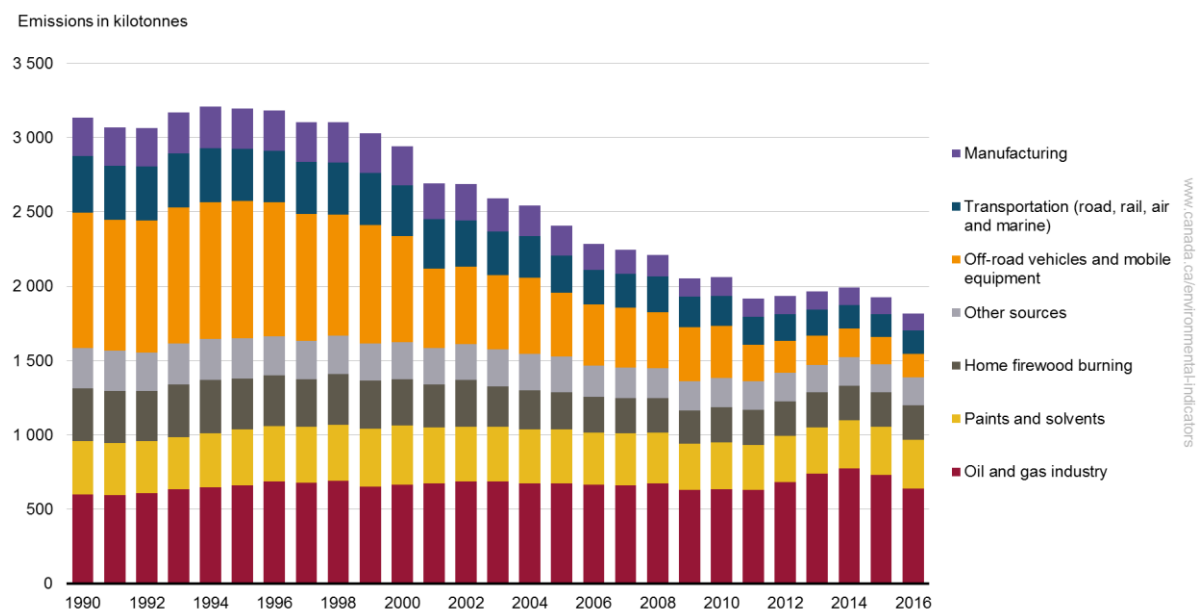
Volatile organic compound emissions by source

[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 2016, VOC emissions in Canada were 1 818 kilotonnes (kt). This is a 1 319 kt (42%) decrease from 1990 levels
- Since 2001, the oil and gas industry has been the highest contributor to VOC emissions. In 2016, the sector accounted for 35% (641 kt) of total emissions

Figure 8. Total volatile organic compound emissions by source, Canada, 1990 to 2016



[Data for Figure 8](#)

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emissions Inventory](#).

The [oil and gas industry](#) was the main source of VOC emissions in 2016 with 641 kt emitted (35% of total emissions). Paints and solvents and home firewood burning were also important sources contributing 18% (326 kt) and 13% (231 kt) of total emissions.

The source with the largest emissions reduction between 1990 and 2016 was off-road vehicles and mobile equipment, with emissions reductions of 753 kt (83%). From 1990 to 2000, off-road vehicles and mobile equipment was the highest contributor to national VOC emissions.

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

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

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

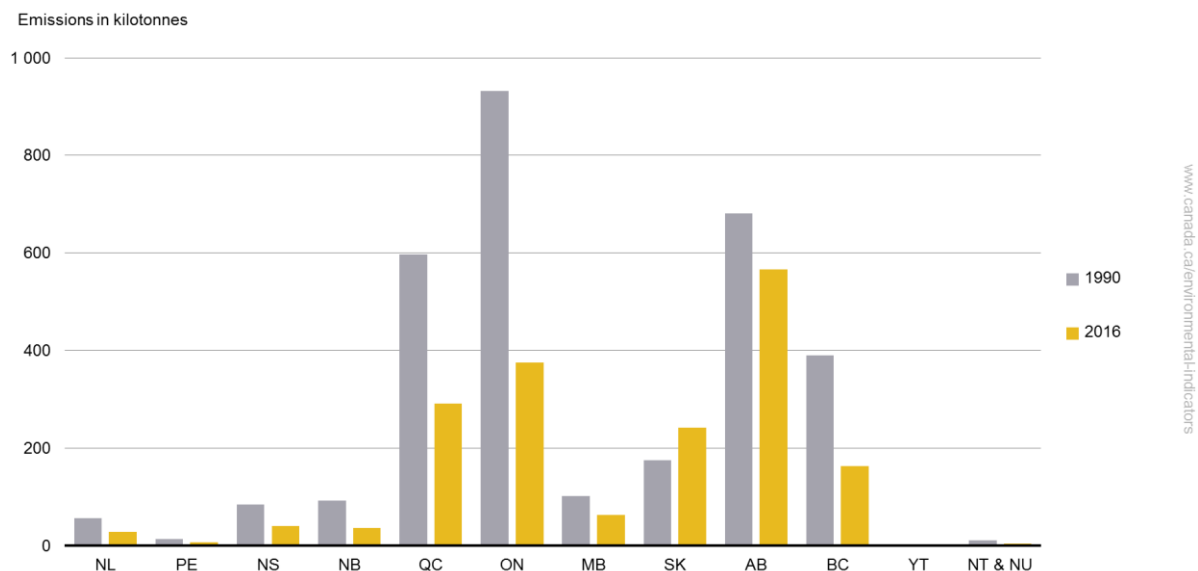
The only source with significant emissions growth over the 1990 to 2016 period was the oil and gas industry with an increase of 42 kt (7%).

Volatile organic compound emissions by province and territory

Key results

- Alberta emitted the highest proportion of VOCs in 2016. The province represented 31% (567 kt) of national emissions
- Between 1990 and 2016, Ontario experienced the largest reduction in VOC emissions. Emissions in the province decreased by 60% (556 kt)
- Saskatchewan is the only province that experienced an increase in VOC emissions of 37% (66 kt) between 1990 and 2016

Figure 9. Volatile organic compound emissions by province and territory, Canada, 1990 and 2016



[Data for Figure 9](#)

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emissions Inventory](#).

Alberta was the highest emitting province of VOCs in 2016 (567 kt), with the oil and gas industry as the main source, contributing 72% (407 kt) of the province's emissions.

Ontario was the second-highest emitter of VOCs, accounting for 21% (376 kt) of total national emissions in 2016. The main emission sources are paints and solvents, home firewood burning and off-road vehicles and mobile equipment. Ontario also experienced the largest reduction in emissions, with 556 kt (60%) between 1990 and 2016, mainly as a result of emission reductions from the closure of coal-fired power plants and from off-road vehicles and mobile equipment.

Quebec was the third largest emitter, with 16% (291 kt) of total national emissions, where home firewood burning and paints and solvents accounted for 61% of the emissions in that province.

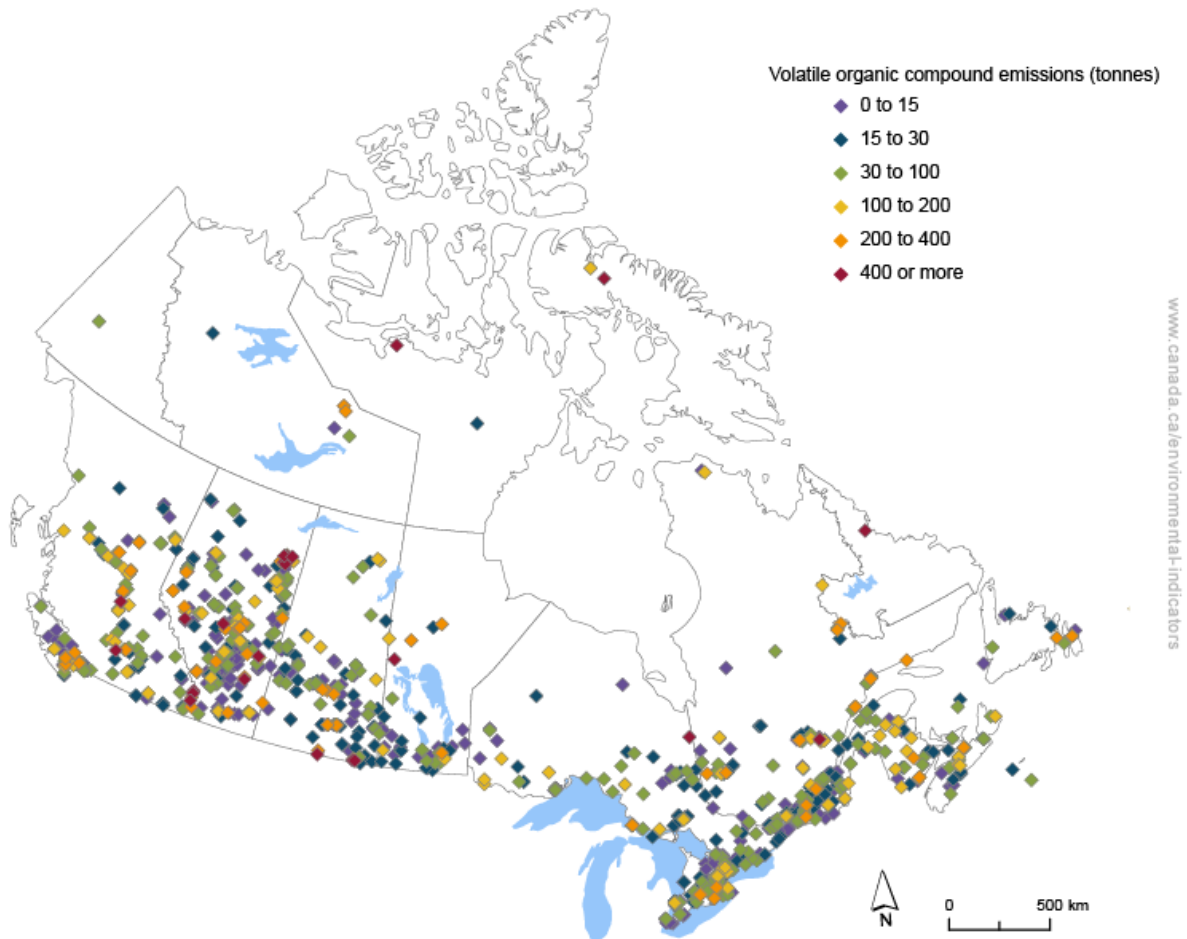
Most provinces and territories experienced reductions in emissions of more than 35% between 1990 and 2016 with the exception of Alberta (a 17% reduction in emissions due to an increase in the oil and gas industry) and Saskatchewan, where emissions increased 37% over the period. The oil and gas industry is responsible for the increase in emissions in Saskatchewan.

Volatile organic compound emissions by facilities

Environment and Climate Change Canada's National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities.

The Canadian Environmental Sustainability Indicators provide this information through an interactive map. With the interactive map, you can drill down to the VOC emissions at specific reporting facilities.

Volatile organic compound emissions by reporting facilities, Canada, 2016



Source: Environment and Climate Change Canada (2018) [National Pollutant Release Inventory Data search - facility reported data](#).

Navigate data using the [interactive map](#)

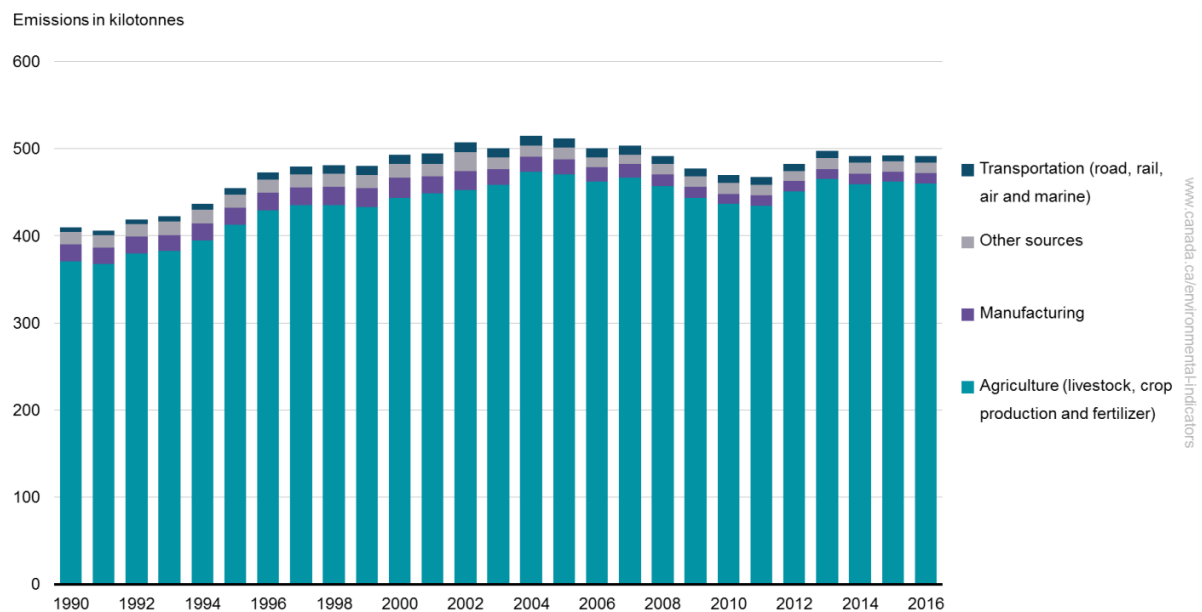
Ammonia emissions by source

[Ammonia](#) (NH₃) 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 2016, NH₃ emissions were 492 kilotonnes (kt). This is 20% higher than in 1990
- Agriculture (livestock, crop production and fertilizer) was the main source of NH₃ emissions in 2016. Emissions from this source accounted for more than 94% (460 kt) of total national emissions

Figure 10. Total ammonia emissions by source, Canada, 1990 to 2016



[Data for Figure 10](#)

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emissions Inventory](#).

Between 1990 and 2016, agriculture (livestock, crop production and fertilizer) experienced the largest increase (24% or 90 kt) in NH₃ emissions. It also remained the key source of NH₃ emissions throughout that period. Emissions from manufacturing and other sources each represented 2% (12 kt) of national emissions in 2016. Transportation (road, rail, air and marine) followed representing 1.5% (8 kt) of national emissions.

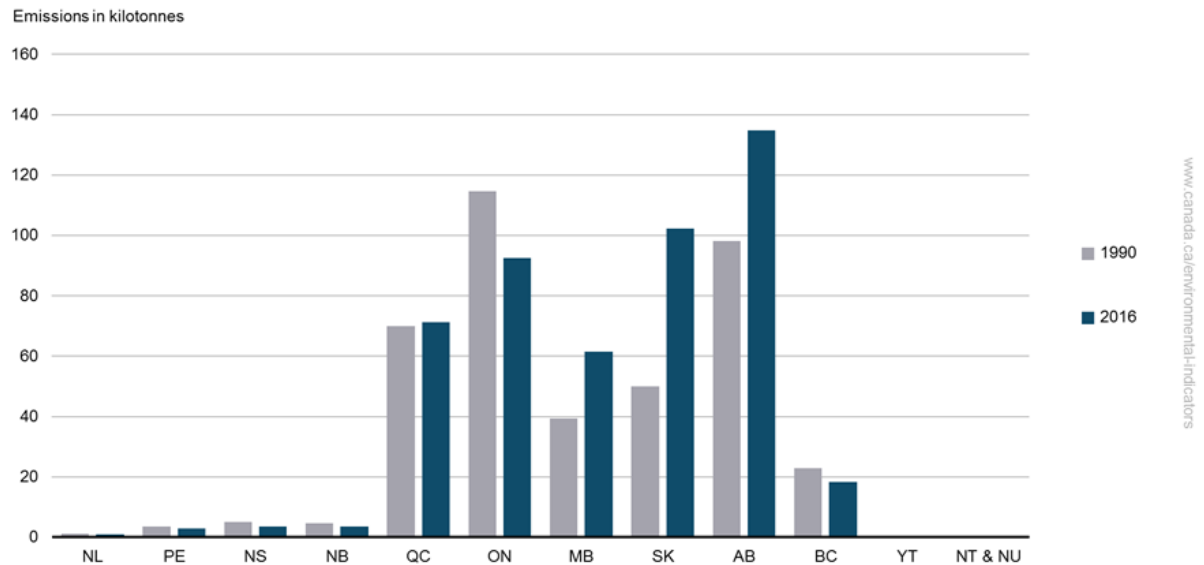
The growth in NH₃ emissions from agriculture (livestock, crop production and fertilizer) between 1990 and 2016 is mainly due to the increased use of synthetic nitrogen fertilizers and, up to 2005, larger livestock populations.

Ammonia emissions by province and territory

Key results

- In 2016, Alberta and Saskatchewan accounted for half (237 kt) of national NH₃ emissions
- Between 1990 and 2016, Ontario experienced the largest emissions reduction. Emissions in the province decreased by 22 kt (19%)

Figure 11. Ammonia emissions by province and territory, Canada, 1990 and 2016



[Data for Figure 11](#)

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emissions Inventory](#).

In 2016, Alberta emitted the most NH₃ of all the provinces and territories, accounting for 27% (135 kt) of total national emissions. Saskatchewan contributed the second-largest proportion of NH₃, representing 21% (102 kt).

Ontario and Quebec followed with 19% and 14% (92 kt and 71 kt) of total national emissions, respectively. For all provinces, livestock farms and the application of fertilizers were the most important sources of NH₃ emissions.

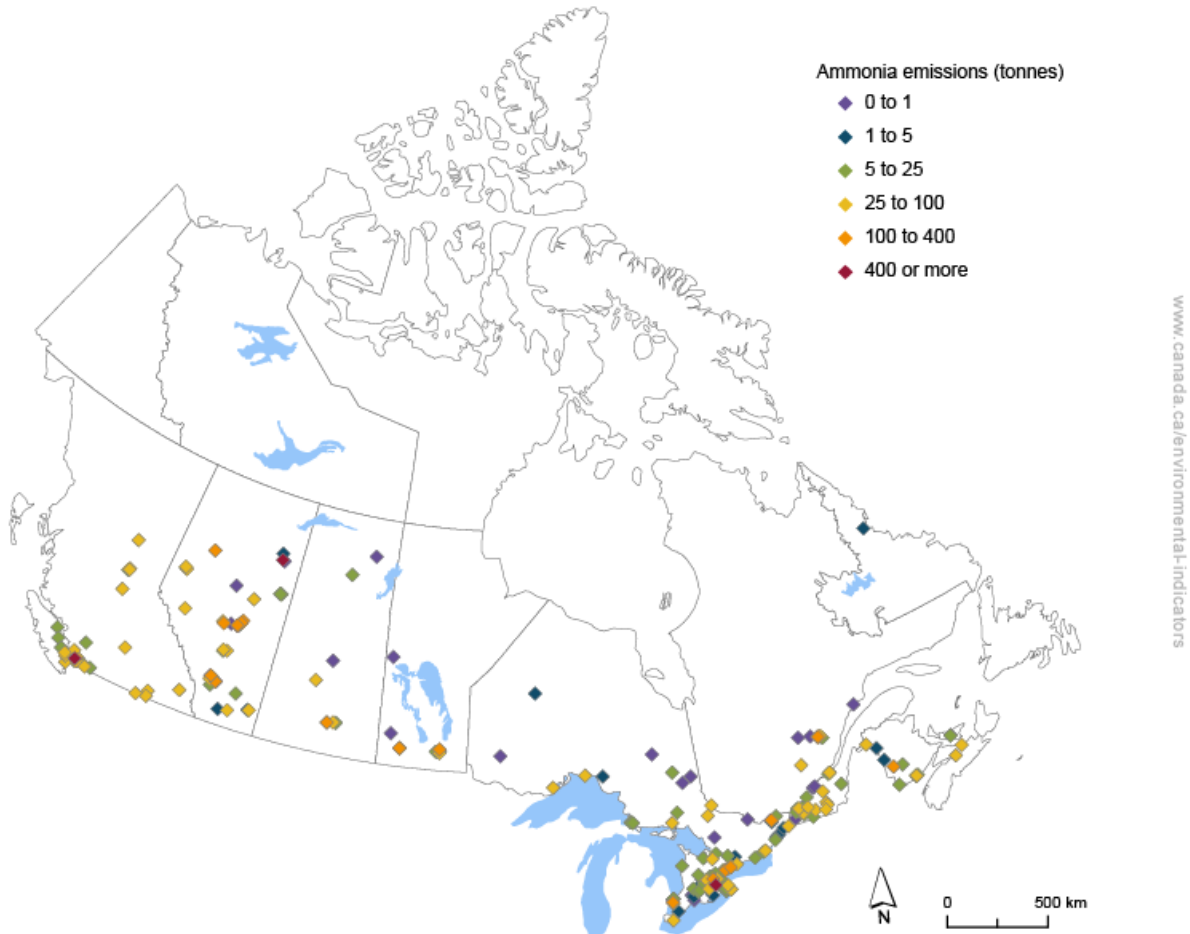
Almost all of the increase in emissions between 1990 and 2016 took place in Saskatchewan, Manitoba and Alberta.

Ammonia emissions by facilities

Environment and Climate Change Canada's National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities.

The Canadian Environmental Sustainability Indicators provide this information through an interactive map. With the interactive map, you can drill down to the NH₃ emissions at specific reporting facilities.

Ammonia emissions by reporting facilities, Canada, 2016



Source: Environment and Climate Change Canada (2018) [National Pollutant Release Inventory Data search - facility reported data](#).

Navigate data using the [interactive map](#)

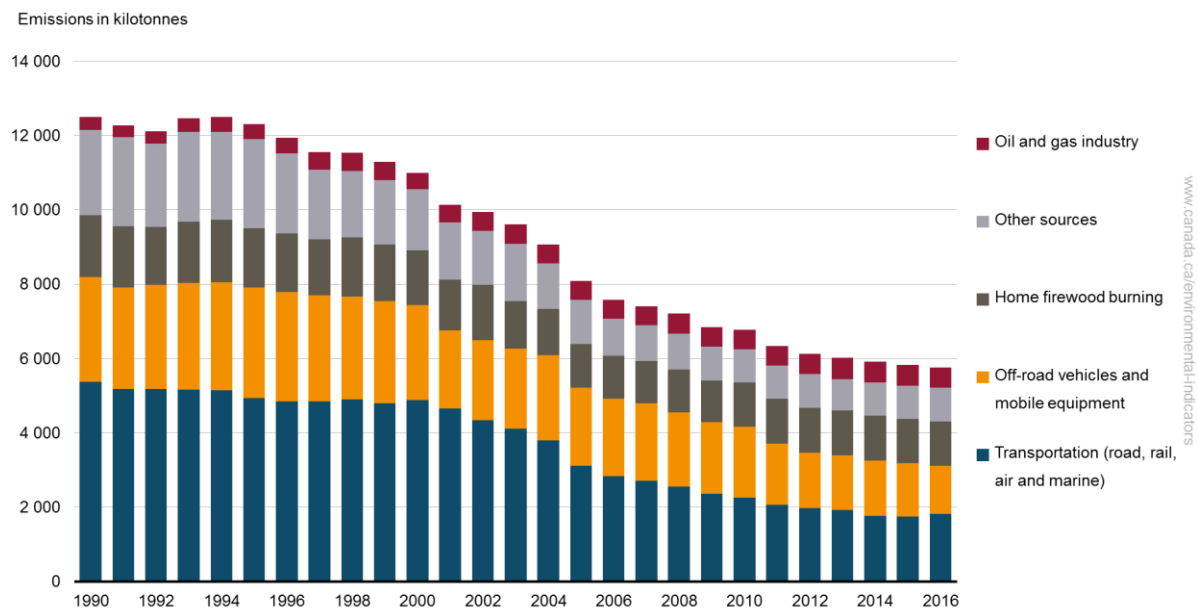
Carbon monoxide emissions by source

[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 2016, CO emissions in Canada were 5 770 kilotonnes (kt), a decrease of 54% from 1990 levels
- Transportation (road, rail, air and marine) was the largest source of CO emissions in Canada. In 2016, the sector represented 31% (1 815 kt) of total emissions

Figure 12. Total carbon monoxide emissions by source, Canada, 1990 to 2016



[Data for Figure 12](#)

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emissions Inventory](#).

In 2016, [transportation](#), [off-road vehicles and mobile equipment](#), and home firewood burning were the 3 most important sources of CO. These sources combined represented 75% (4 310 kt) of national emissions.

The largest reduction in emissions between 1990 and 2016 occurred in transportation (road, rail, air and marine) with an emission decrease of 3 566 kt (66%).

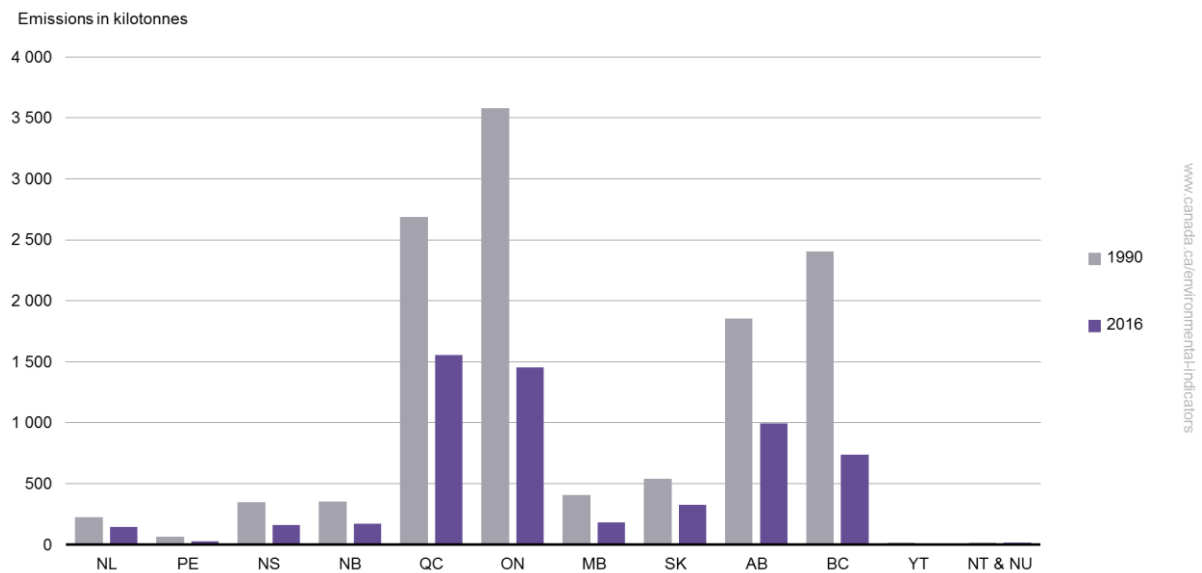
The decline in CO emissions between 1990 and 2016 is mainly due to the progressive introduction of cleaner and more efficient technology in vehicles (for example, catalytic converters).

Carbon monoxide emissions by province and territory

Key results

- In 2016, Ontario and Quebec accounted for more than 52% (3 007 kt) of national CO emissions
- Between 1990 and 2016, all provinces and territories experienced significant reductions in emissions. The largest reductions occurred in Ontario (by 2 126 kt or 59%), British Columbia (by 1 666 kt or 69%) and Quebec (by 1 134 kt or 42%)

Figure 13. Carbon monoxide emissions by province and territory, Canada, 1990 and 2016



[Data for Figure 13](#)

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emissions Inventory](#).

In 2016, Quebec emitted the most CO of all the provinces and territories, representing 27% (1 555 kt) of the total national emissions. Home firewood burning was the most important source of CO emissions for Quebec.

The province of Ontario ranked second, with 25% (1 452 kt) of total national emissions in 2016, with 34% of those emissions from off-road vehicles and mobile equipment.

Alberta, the third largest CO emitter, accounted for 17% (993 kt) of total national emissions. The oil and gas industry accounted for 42% of the province's CO emissions.

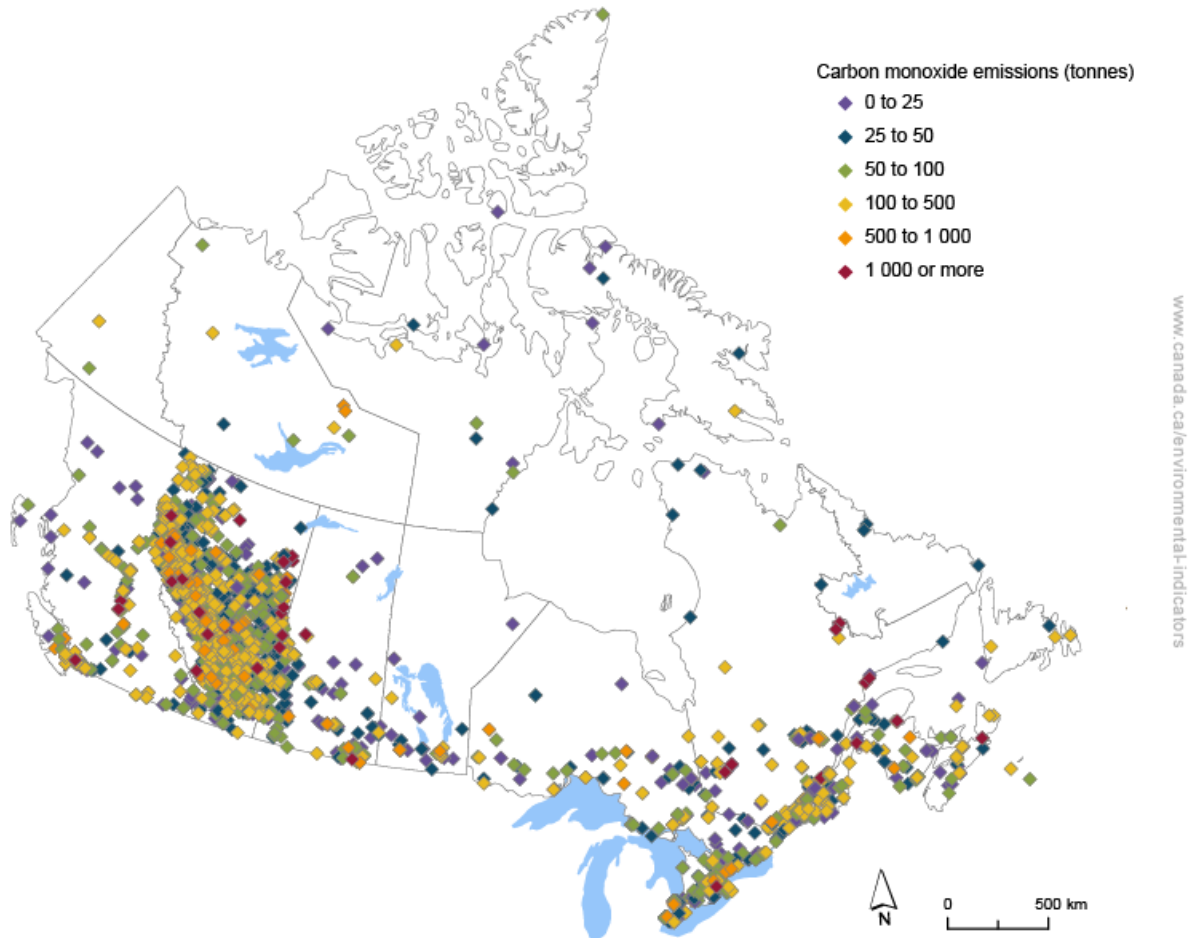
The sharp decrease in emissions between 1990 and 2016 in all provinces is mainly attributable to emission reductions from transportation (road, rail, air and marine).

Carbon monoxide emissions by facilities

Environment and Climate Change Canada's National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities.

The Canadian Environmental Sustainability Indicators provide this information through an interactive map. With the interactive map, you can drill down to the CO emissions at specific reporting facilities.

Carbon monoxide emissions by reporting facilities, Canada, 2016



Source: Environment and Climate Change Canada (2018) [National Pollutant Release Inventory Data search - facility reported data](#).

Navigate data using the [interactive map](#)

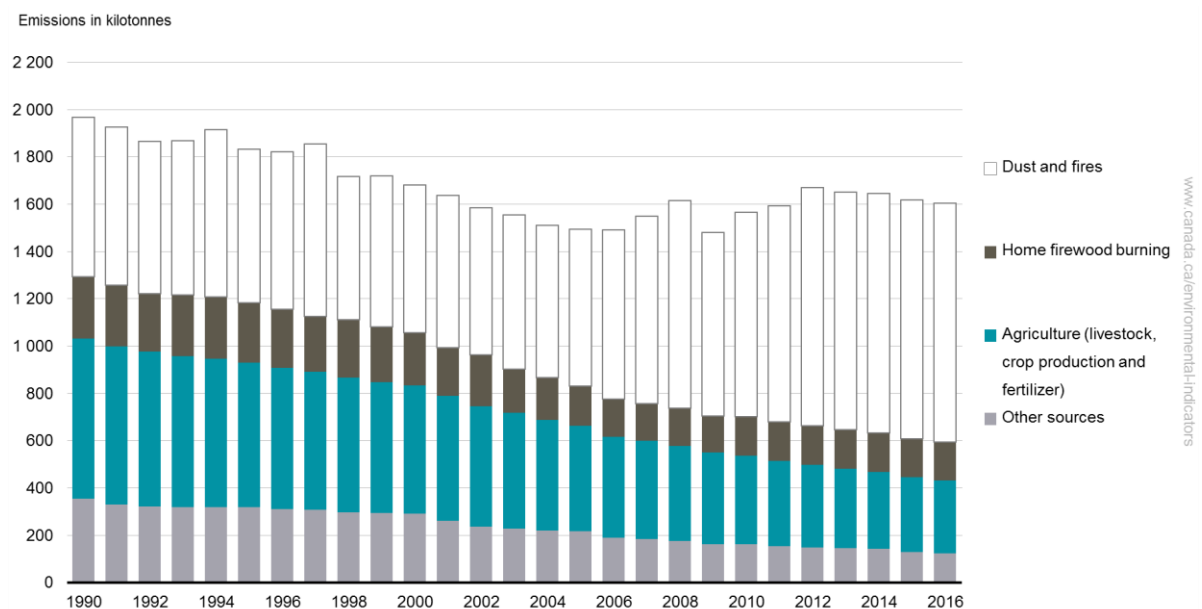
Fine particulate matter emissions by source

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. 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 2016, PM_{2.5} emissions were 1 606 kilotonnes (kt). This is 18% lower than in 1990
- Emissions from dust and fires (for example, road dust and prescribed forest burning) accounted for the majority of PM_{2.5} emissions, reaching 63% (1 010 kt) of total national emissions in 2016. These emissions increased by 50% (336 kt) between 1990 and 2016

Figure 14. Total fine particulate matter emissions by source, Canada, 1990 to 2016



[Data for Figure 14](#)

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emissions Inventory](#).

In 2016, 82% of PM_{2.5} emissions came from open source emissions, such as dust and fires, and agriculture (livestock, 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 18% of PM_{2.5} emissions in 2016 came from home firewood burning (163 kt or 10%) and other sources, including:

- ore and mineral industries, representing 2% (33 kt) of the emissions
- transportation (road, rail, air and marine), representing 1% (22 kt)
- manufacturing (18 kt) and off-road vehicles and mobile equipment (15 kt), each representing about 1% of emissions
- miscellaneous sources, such as emissions from cigarette smoking, representing 1% (16 kt)
- the oil and gas industry, representing less than 1% (11 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 2016 are mainly attributable to emission reductions from agriculture (livestock, crop production and fertilizer) 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.

Table 1. Source emissions changes between 1990 and 2016

Source	PM _{2.5} (change in kilotonnes from 1990 to 2016)	PM _{2.5} (percentage change from 1990 to 2016)
Dust and fires	336.2	49.9
Miscellaneous	0.8	5.6
Building heating and energy generation	0.04	0.8
Paints and solvents	0.009	249.2
Oil and gas industry	-1.2	-9.5
Incineration and waste	-2.3	-46.2
Transportation (road, rail, air and marine)	-18.8	-46.4
Ore and mineral industries	-25.8	-43.9
Off-road vehicles and mobile equipment	-40.9	-73.6
Electric utilities	-45.2	-93.2
Manufacturing	-98.5	-84.9
Home firewood burning	-98.8	-37.7
Agriculture (livestock, crop production and fertilizer)	-368.6	-54.5
Total	-363.2	-18.4

Note: The changes have been calculated using source data that are not rounded.

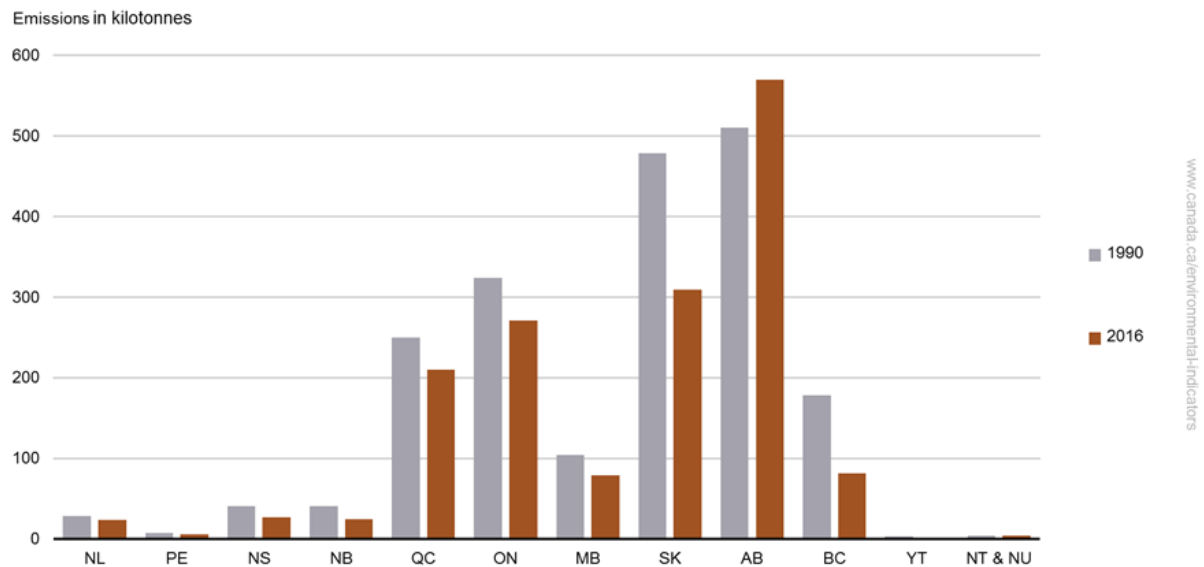
Source: Environment and Climate Change Canada (2018) [Air Pollutant Emissions Inventory](#).

Fine particulate matter emissions by province and territory

Key results

- In 2016, Alberta emitted the most PM_{2.5}. The province represented 35% (570 kt) of total national emissions
- Between 1990 and 2016, all provinces, with the exception of Alberta, decreased their emissions. The largest decrease was observed in Saskatchewan with 170 kt (35%)

Figure 15. Fine particulate matter emissions by province and territory, Canada, 1990 and 2016



[Data for Figure 15](#)

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emissions Inventory](#).

Dust and fires (for example, road dust and prescribed forest burning) were the largest sources of PM_{2.5} emissions in Alberta, the highest emitting province in 2016, accounting for 80% (454 kt) of total national emissions in 2016 in this province.

Saskatchewan ranked second in 2016, with 19% (309 kt) of PM_{2.5} emissions. Agriculture (livestock, crop production and fertilizer) was the largest source, with dust and fires being the second-largest source of PM_{2.5}.

Ontario ranked third, with 17% (271 kt), and Quebec ranked fourth with 13% (210 kt). For both provinces, dust and fires were the largest sources of emissions, with home firewood burning (for example, woodstoves and fireplaces) being the second-largest source.

The increase in emissions in Alberta between 1990 and 2016 can be attributed to growth in construction operations for the oil and gas industries.

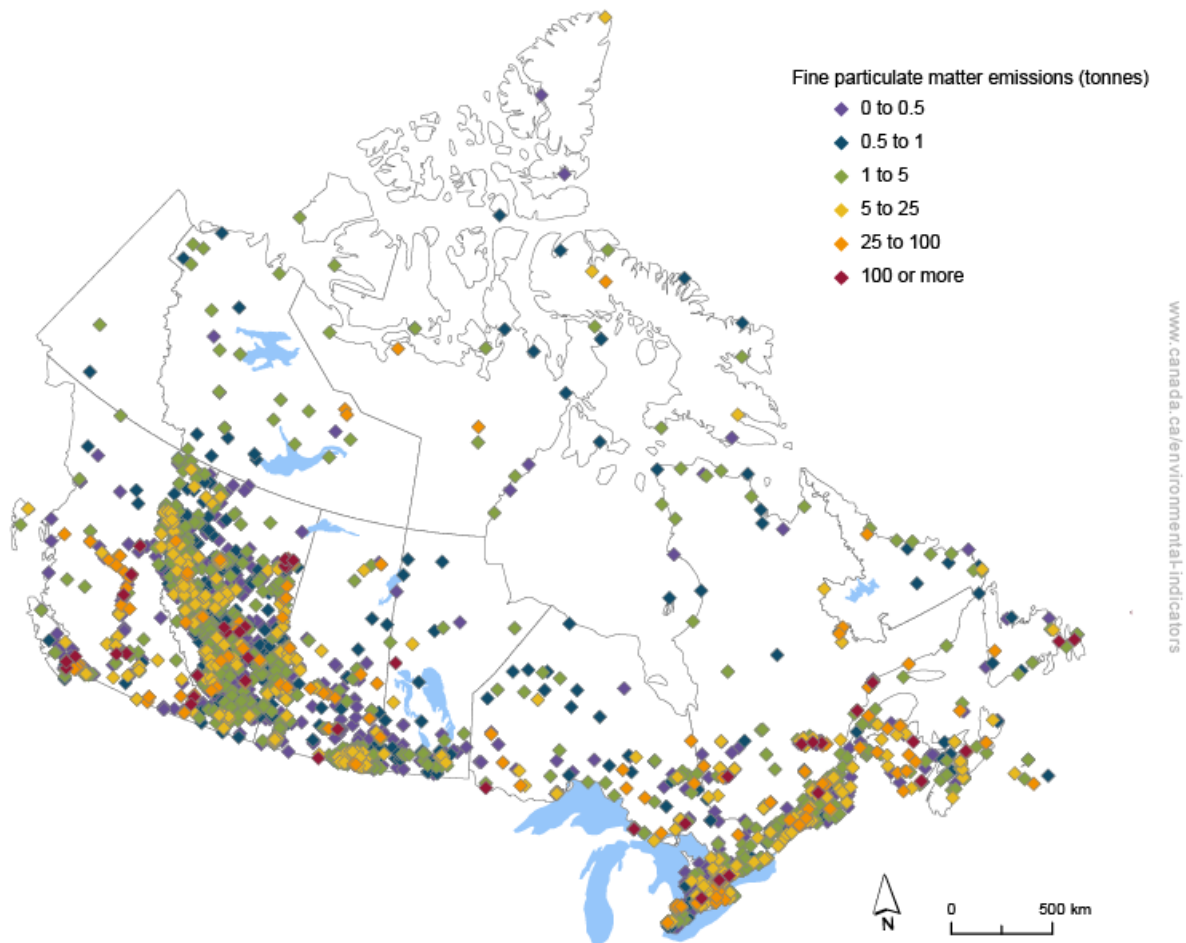
The exclusion of emissions from dust and fires and agriculture (livestock, crop production and fertilizer) provides a different breakdown of PM_{2.5} emissions in each province and territory. With these emissions removed, Quebec becomes the largest emitting province of PM_{2.5} in 2016, representing 33% (97 kt) of total emissions (288 kt). Ontario ranks second with 25% (72 kt) of emissions. British Columbia and Alberta rank third and fourth, both representing about 11% (32 kt and 30 kt, respectively) of emissions. Between 1990 and 2016, all of the provinces and territories experienced emissions reductions between 71% (British Columbia) and 18% (Northwest Territories and Nunavut).

Fine particulate matter emissions by facilities

Environment and Climate Change Canada's National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities.

The Canadian Environmental Sustainability Indicators provide this information through an interactive map. With the interactive map, you can drill down to the PM_{2.5} emissions at specific reporting facilities.

Fine particulate matter by reporting facilities, Canada, 2016



Source: Environment and Climate Change Canada (2018) [National Pollutant Release Inventory Data search - facility reported data](#).

Navigate data using the [interactive map](#)

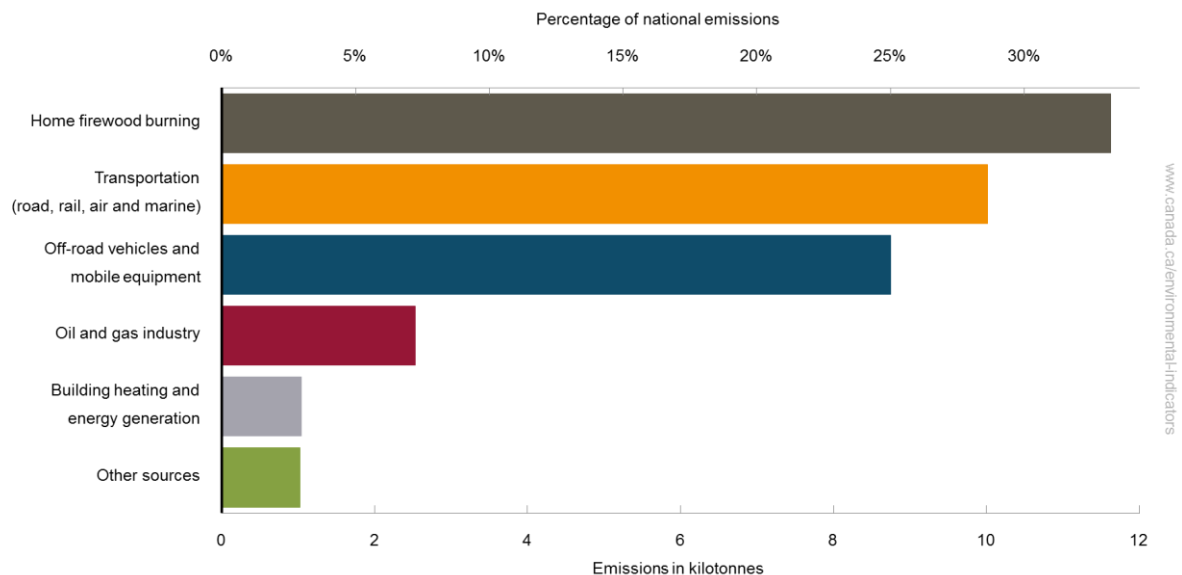
Black carbon emissions by source

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 35 kt in 2016
- In 2016, 3 sectors accounted for 87% of national black carbon emissions:
 - home firewood burning
 - off-road vehicles and mobile equipment
 - transportation (road, rail, air and marine)

Figure 16. Total black carbon emissions by source, Canada, 2016



[Data for Figure 16](#)

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Canada's Black Carbon Emissions Inventory](#).

In 2016, home firewood burning and transportation (road, rail, air and marine) accounted for the largest proportions of total national emissions, representing 33% (11.6 kt) and 29% (10 kt) respectively. Off-road vehicles and mobile equipment (for example, lawn and garden equipment, recreational vehicles, excavators, graders) was also a large contributor, representing about 25% (8.7 kt) of total national emissions. The remaining 13% of emissions came from the oil and gas industry, other sources (such as ore and mineral industries) and building heating and energy generation.

For both transportation and off-road vehicles and mobile equipment, the use of diesel engines was the main source of black carbon emissions. The same was true of the oil and gas industry where the use of stationary diesel engines for fuel extraction accounted for the largest share of emissions.

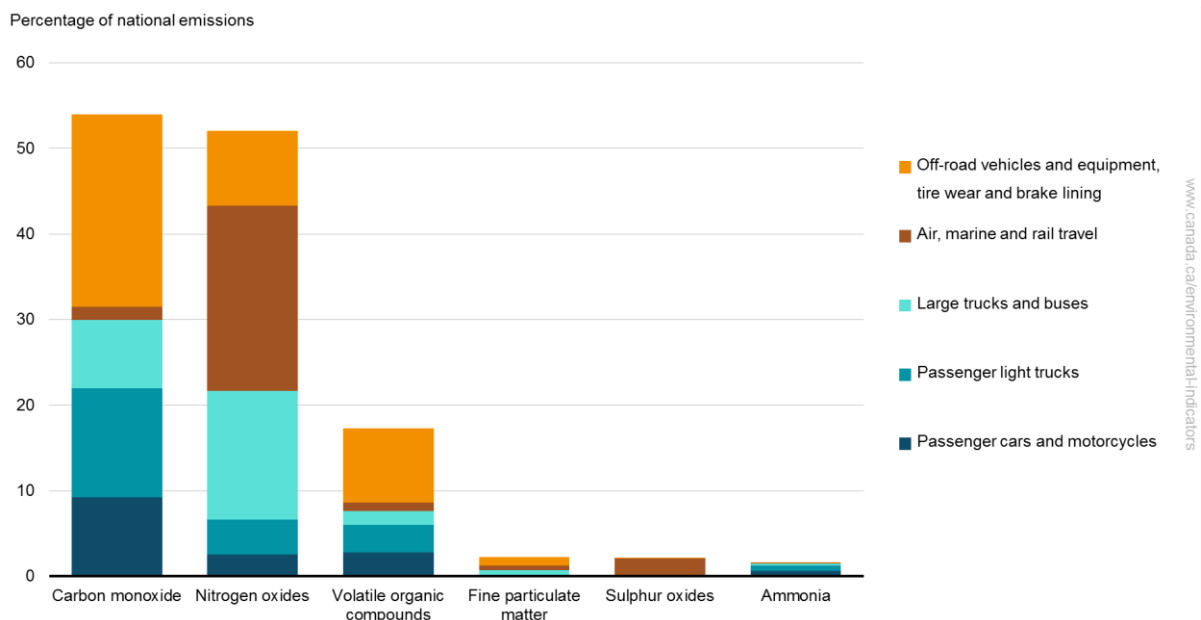
Air pollutant emissions from transportation, off-road vehicles and mobile equipment

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 2016, transportation, off-road vehicles and mobile equipment accounted for more than half of total national emissions of [carbon monoxide](#) (CO) and [nitrogen oxides](#) (NO_x) and 18% 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](#) (NH₃), the sectors represented less than 5% of total national emissions of these other pollutants

Figure 17. Contribution of transportation, off-road vehicles and mobile equipment to air pollutant emissions by transportation mode, Canada, 2016



[Data for Figure 17](#)

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 (2018) [Air Pollutant Emissions Inventory](#).

The mix of fuels used explains in large part the contribution of each transportation mode to emissions of different air pollutants.

[Large trucks and buses](#), and [rail and marine](#) mostly rely on diesel fuel. Aviation relies on aviation turbo fuel. These transportation modes are the largest sources of NO_x transportation-related emissions accounting for 37% (666 kilotonnes [kt]) of total NO_x emissions.

[Passenger cars and light trucks](#) mostly use gasoline and are a main source of pollutants, especially in urban centres. In 2016, emissions from passenger cars, motorcycles and light trucks amounted to

1 268 kt of CO, 120 kt of NO_x and 110 kt of VOCs. These emissions represented 22%, 7% and 6% of all emissions of these pollutants respectively.

Other sources (mainly composed of off-road vehicles and equipment)⁶ are also a significant source of pollution. Their combined emissions make up 23%, 9% and 9% of the total emissions of CO, NO_x and VOCs, respectively. Emissions mostly come from household use of gasoline- or diesel-powered recreational and lawn and garden equipment and from the operation of agricultural, construction and mining equipment.

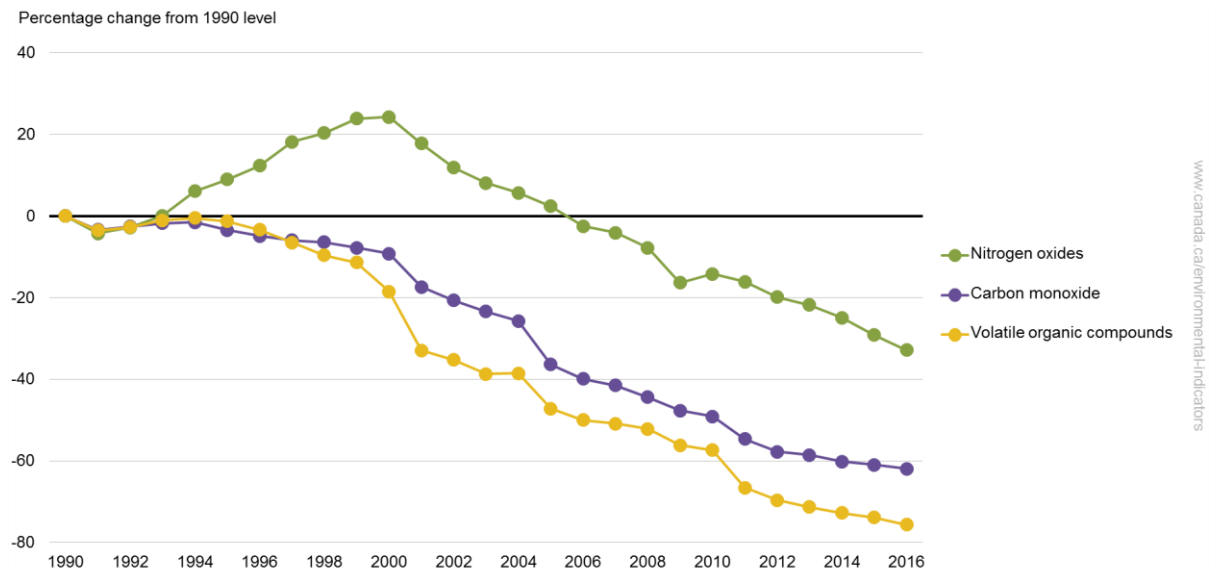
The largest source of sulphur oxide (SO_x) emissions in the transportation sector is marine vessels. Emissions of SO_x from marine vessels decreased by 87% between 2014 and 2016 due to the introduction of more stringent regulations.

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

Key results

- Between 1990 and 2016, total emissions of NO_x, CO and VOCs from transportation, off-road vehicles and mobile equipment decreased by 33%, 62% and 76%, respectively
- Since 2000, all pollutants demonstrated the same downward trend in their emissions level

Figure 18. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2016



[Data for Figure 18](#)

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the chart due to their low share ($\leq 5\%$) of total emissions in 2016.

Source: Environment and Climate Change Canada (2018) [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 2016. This decrease is mainly attributable to the

⁶ 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](#).

adoption of new regulations that lead to the gradual introduction of technologies and clean fuel for vehicles.

Between 1990 and 2000, NO_x emissions increased by 24%. It includes the increase in emissions of large trucks and buses (45%), marine (34%) and air (25%) transportation. From 2000 to 2016, new regulations contributed to a 48% decrease in emissions from large trucks and buses, while emissions from air and marine travel continued to increase by 21% and 11%, respectively. Emissions from air, marine and rail travel represented 22% of national emissions of NO_x in 2016.

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.

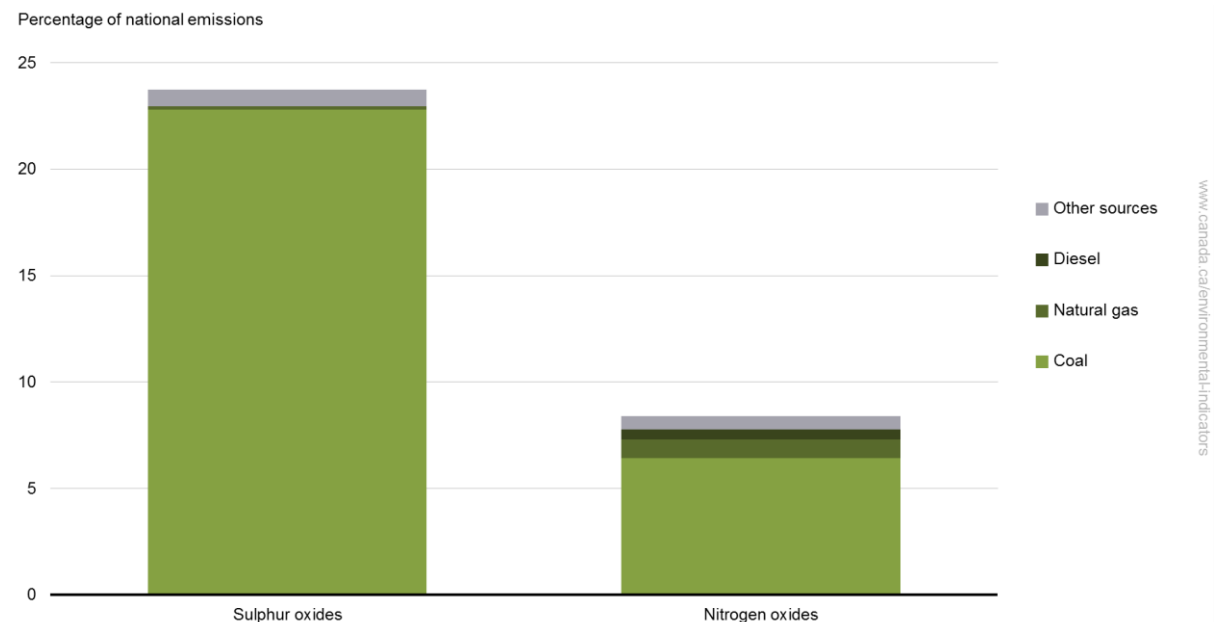
Air pollutant emissions from the electric utilities

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 2016, electric utilities were the source of 24% 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](#) (NH₃) emissions. However, they account for less than 1% of the total national emissions of these pollutants

Figure 19. Contribution of electric utilities to air pollutant emissions by fuel source, Canada, 2016



[Data for Figure 19](#)

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016. 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 (2018) [Air Pollutant Emissions Inventory](#).

In 2016, 96% of SO_x and 77% 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:

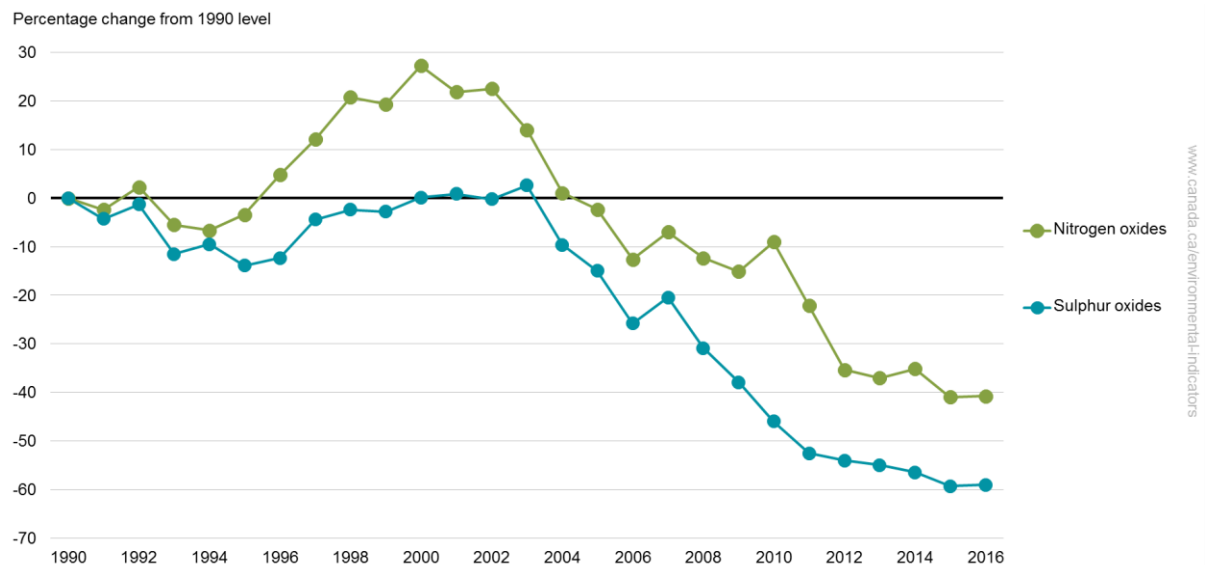
- 59% of electricity comes from hydro
- 16% comes from nuclear power plants
- 5% comes from non-hydro renewable sources, such as wind, solar, tidal power and biomass⁷

Changes in emissions from the electric utilities

Key results

- Emissions of SO_x and NO_x from electric utilities declined by 59% and 41%, respectively, between 1990 and 2016
- Most of that decline occurred from 2005 onward

Figure 20. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2016



[Data for Figure 20](#)

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016. 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 (2018) [Air Pollutant Emissions Inventory](#).

Between 2005 and 2016, emissions of NO_x and SO_x from electric utilities decreased by 39% and 52%, respectively. Over the same period, the share of electricity that came from burning fossil fuels

⁷ Natural Resources Canada (2016) [About electricity](#). Retrieved on May 18, 2018.

fell from 26% to 21%. This decline was mostly the result of a gradual drop in electricity generation from coal power plants.⁸

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

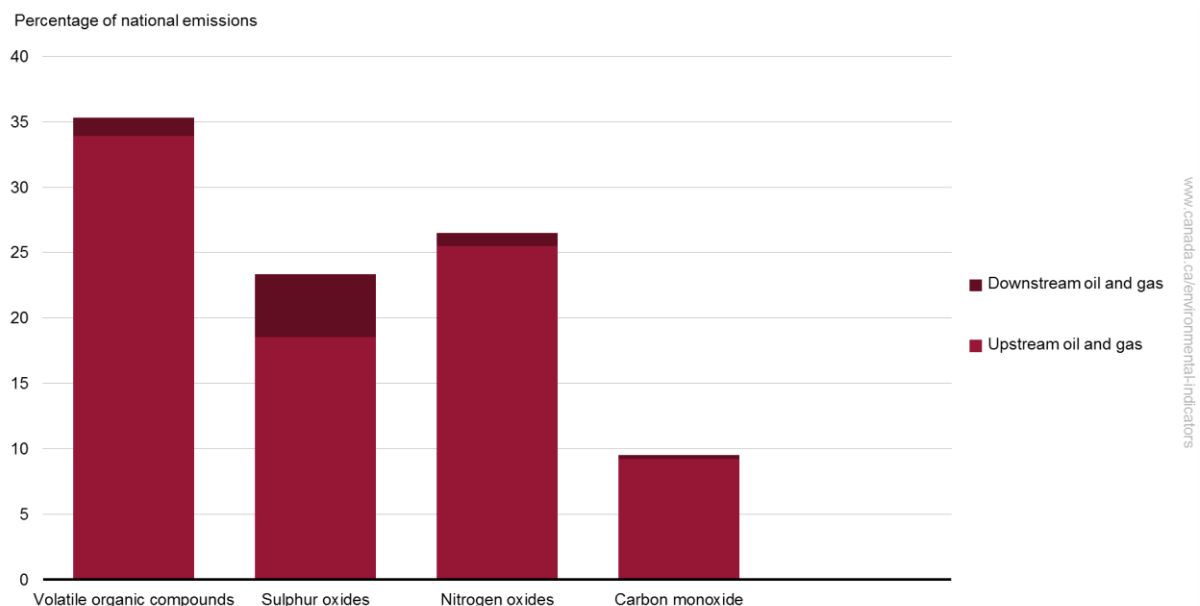
Air pollutant emissions from the oil and gas industry

The oil and gas sector is an important contributor to air pollutant emissions. Air pollutants are responsible for the formation of fine particulate matter (PM_{2.5}), ozone (O₃), smog and acid rain. They also adversely affect human health, the environment, and the economy. Most emissions from the oil and gas sector come from activities such as exploration, drilling, production and field processing.

Key results

- In 2016, the oil and gas industry was a major contributor to total national emissions of [volatile organic compounds](#) (VOCs) (35%), [sulphur oxides](#) (SO_x) (23%), [nitrogen oxides](#) (NO_x) (26%) and [carbon monoxide](#) (CO) (10%)
- The oil and gas industry is also a source of emissions of [fine particulate matter](#) (PM_{2.5}) and [ammonia](#) (NH₃). However, in 2016, it made up less than 1% of the total emissions of these pollutants

Figure 21. Contribution of the oil and gas industry to air pollutant emissions by activity type, Canada, 2016



[Data for Figure 21](#)

⁸ Statistics Canada (2016) [CANSIM Table 127-0007 - Electric power generation, by class of electricity producer, annual \(megawatt hour\)](#). Retrieved on December 20, 2016.

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016.
Source: Environment and Climate Change Canada (2018) [Air Pollutant Emissions Inventory](#).

In 2016, the oil and gas industry was the sector contributing the most to total national emissions of VOCs. It was also the second-largest contributor to emissions of NO_x and the third-largest contributor to emissions of SO_x and CO.

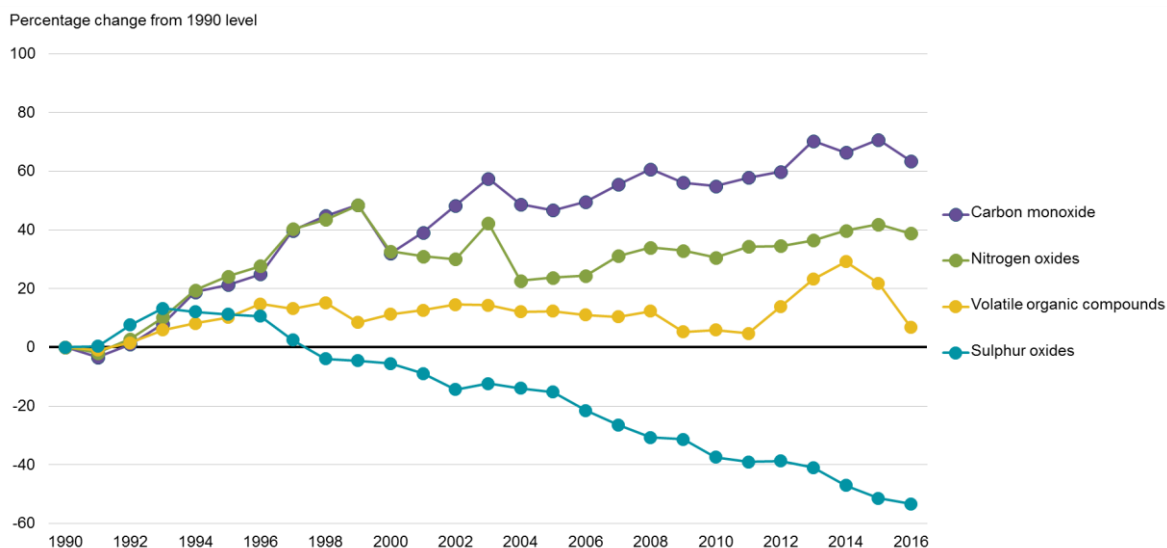
Most of emissions from the oil and gas industry came from upstream activities (exploration, drilling, production and field processing) compared to downstream activities (refining, storage and distribution). In 2016 96% of VOC, 79% of SO_x , 96% of NO_x and 97% of CO emissions from the oil and gas sector were from upstream activities.

Changes in emissions from the oil and gas industry

Key results

- Emissions of CO, NO_x and VOCs increased by 63%, 39% and 7%, respectively, between 1990 and 2016
- SO_x emissions decreased (53%) over that period

Figure 22. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2016



[Data for Figure 22](#)

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016.
Source: Environment and Climate Change Canada (2018) [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 during that period. This increase is in part explained by the fact that crude oil production had 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](#) (NH₃), [carbon monoxide](#) (CO) and [fine particulate matter](#) (PM_{2.5}). [Black carbon](#), which is a component of PM_{2.5}, is also reported.⁹ 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.¹⁰

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 (O₃) 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 [NO₂]) and VOCs are the main contributors to the formation of O₃. Nitrogen oxides, SO_x (such as sulphur dioxide [SO₂]), NH₃ 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. The indicators support the measurement of progress towards the goals and targets of the [2016–2019 Federal Sustainable Development Strategy](#).

Related indicators

The [International comparison of air pollutant emissions](#) indicators track air pollutant emissions for Canada and other member countries of the Organisation for Economic Co-operation and Development for which emissions data are available.

The [Air quality](#) indicators track ambient concentrations of PM_{2.5}, O₃, SO₂, NO₂, and VOCs at the national and regional level and at local monitoring stations.

⁹ 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 (2018) [Canada's Black Carbon Emissions Inventory](#). Retrieved on June 14, 2018.

¹⁰ Only facilities that had air pollutant emissions over a certain reporting threshold were included in the National Pollutant Releases Inventory (NPRI) reported data.

The [Greenhouse gas emissions](#) indicators report trends on Canada's GHG emissions nationally, by province and territory, per person and per unit gross domestic product, by economic sector and from [large facilities](#).



Safe and healthy communities

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

Data sources and methods

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](#) (NH₃), [carbon monoxide](#) (CO) and [fine particulate matter](#) (PM_{2.5}). The emissions data used are from Canada's [Air Pollutant Emission Inventory for the years 1990 to 2016](#).

Data for the black carbon indicator, a component of PM_{2.5}, come from Canada's [Black Carbon Emissions Inventory](#) and are reported for 2016 by source at the national level.

Facility data for local air pollutant emissions reported in [interactive maps](#) come from the [National Pollutant Release Inventory](#) and are available for the years 2006 to 2016.

More information

The Air Pollutant Emission Inventory and the Black Carbon Emissions Inventory provide data and estimates on releases of air pollutants from human activities. These pollutants contribute to the issues of smog, acid rain, reduced air quality and climate change. Improvements to data 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 Emission Inventory fulfills many of Canada's international pollution levels reporting obligations. It is a comprehensive inventory of 17 air pollutants,¹¹ 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, 2018, and cover the period from 1990 to 2016. Emissions data are reported in the inventory approximately one year after data collection, validation, calculation and interpretation have been completed. The indicators are reported following the public release of the inventory data.

¹¹ 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.

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 Emission Inventory is compiled using PM_{2.5} emissions data from combustion-related sources from the Air Pollutant Emission Inventory. Black carbon estimates are published separately from the Air Pollutant Emission Inventory. The data are current as of June 13, 2018.

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 (CO₂) (which can persist in the atmosphere for thousands of years) and other longer-lived greenhouse gases (GHGs). Although their life spans are short, short-lived climate pollutants are potent global warmers contributing to warming of the Earth's surface.¹² For black carbon, the pollutant has the ability to absorb solar radiation 460 to 1 500 times more than CO₂.¹³ 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.¹⁴

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 2016 are current as of September 14, 2017.

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 Emission 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

¹² Environment and Climate Change Canada (2017) [Short-lived climate pollutants](#). Retrieved on April 15, 2018.

¹³ Climate and Clean Air Coalition (2017) [Science: Black carbon](#). Retrieved on April 9, 2018.

¹⁴ Environment and Climate Change Canada (2018). [Canada's Black Carbon Inventory 2018: Executive summary](#). Retrieved on June 13, 2018.

The Air Pollutant Emission 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 [Annex 2](#) of the Air Pollutant Emission 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.

Facility-reported data from the National Pollutant Release Inventory are used in the Air Pollutant Emission 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 Emission Inventory uses in-house estimates for the following emission sources:

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

In general, in-house emission estimates are calculated from activity data and emission factors.¹⁵ Activity data usually comprise statistical production or process data at the provincial, territorial or national level. This information is typically provided by provincial/territorial agencies, federal government departments, industry associations, etc.

¹⁵ The United States Environmental Protection Agency defines an emission factor as "...a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant (for example, kilograms of particulate emitted per megagram of coal burned)."

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 Emission Inventory are therefore generally consistent with those used in the United States or those recommended in the emission inventory guidebook.¹⁶

The Air Pollutant Emission 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 Emission 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 A2-5 of Annex 2](#) of the Air Pollutant Emission Inventory Report). The parameters in both models were modified to take into account variations in the Canadian vehicle fleet, emission control technologies, types of fuels, vehicle standards, and types of equipment engines and their application in various industries. The emission estimates for civil and international aviation, railways and navigation are estimated using detailed vehicle movement statistics coupled with fuel consumption, engine information, and emission rates by vehicle types.

Calculation of black carbon emissions

Emissions of black carbon are calculated by applying factors to estimate the fraction of black carbon in PM_{2.5} emissions from combustion-related sources, with 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 profiles¹⁷ of air pollution sources. [Annex B](#) of Canada's Black Carbon Emission 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 emission inventory. The Air Pollutant Emission 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 2](#) of the Air Pollutant Emission 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 Emission 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

¹⁶ 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.

¹⁷ 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 (2018) [Canada's Black Carbon Emission Inventory](#). Retrieved on July 21, 2017.

the reconciliation process is provided in [Annex 2](#) of the Air Pollutant Emission Inventory Report.

Temporal coverage

Historical data are provided at the national level for the period from 1990 to 2016. For the regional indicators (provincial/territorial), emissions are presented for 1990 and 2016. Facility level emissions information are available from 2006 to 2016.

Air pollutant emissions by source classification

For the purpose of reporting the indicators, calculated emissions data from the Air Pollutant Emission 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
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 Emission Inventory/Black Carbon Emissions Inventory

Sources in the indicators	Sources and sectors in the Air Pollutant Emission Inventory and Black Carbon Emission 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

Sources in the indicators	Sources and sectors in the Air Pollutant Emission Inventory and Black Carbon Emission Inventory
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 forest 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 sources: Crematoriums
Incineration and waste	Incineration and waste sources: Waste incineration
Incineration and waste	Incineration and waste sources: Waste treatment and disposal
Incineration and waste	Incineration and waste sources: Waste (landfills, residential waste burning, treatment and disposal, water and sewage treatment)
Incineration and waste	Incineration and waste sources: Other incineration and utilities
Manufacturing	Manufacturing: Abrasives manufacture
Manufacturing	Manufacturing: Bakeries
Manufacturing	Manufacturing: Biofuel production
Manufacturing	Manufacturing: Chemicals industry
Manufacturing	Manufacturing: Electronics
Manufacturing	Manufacturing: Food preparation

Sources in the indicators	Sources and sectors in the Air Pollutant Emission Inventory and Black Carbon Emission Inventory
Manufacturing	Manufacturing: Glass manufacture
Manufacturing	Manufacturing: Grain industries
Manufacturing	Manufacturing: Metal fabrication
Manufacturing	Manufacturing: Plastics manufacture
Manufacturing	Manufacturing: Pulp and paper industry
Manufacturing	Manufacturing: Textiles
Manufacturing	Manufacturing: Vehicle manufacture (engines, parts, assembly, painting)
Manufacturing	Manufacturing: Wood products
Manufacturing	Manufacturing: Other industries
Miscellaneous	Commercial/Residential/Institutional: Cigarette smoking
Miscellaneous	Commercial/Residential/Institutional: Commercial cooking
Miscellaneous	Commercial/Residential/Institutional: Human ^[B]
Miscellaneous	Commercial/Residential/Institutional: Marine cargo handling
Miscellaneous	Commercial/Residential/Institutional: Other miscellaneous sources
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 / compressed 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

Sources in the indicators	Sources and sectors in the Air Pollutant Emission Inventory and Black Carbon Emission Inventory
Ore and mineral industries	Ore and mineral industries: Iron and steel industries
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 mining and smelting industry ^[C]
Use of paints and solvents	Paints and solvents: Dry cleaning
Use of paints and solvents	Paints and solvents: General solvent use
Use of paints and solvents	Paints and solvents: Printing
Use of paints and solvents	Paints and solvents: Surface coatings
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Air transportation
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: Marine transportation

Sources in the indicators	Sources and sectors in the Air Pollutant Emission Inventory and Black Carbon Emission Inventory
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 Emission 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 Emission 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 2016. They also provide information about emissions of selected pollutant, by sector, for the period from 1990 to 2016.

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 Emission Inventory/Black Carbon Emissions

Air pollutant emissions from transportation, off-road vehicles and mobile equipment	Sources and sectors in the Air Pollutant Emission Inventory and Black Carbon Emission Inventory
Air, marine and rail travel	Air transportation
Air, marine and rail travel	Marine transportation
Air, marine and rail travel	Rail transportation
Large trucks and buses	Heavy-duty diesel vehicles
Large trucks and buses	Heavy-duty gasoline vehicles
Large trucks and buses	Heavy-duty liquefied petroleum gas / natural gas vehicles
Off-road vehicles and equipment, tire wear and brake lining	Off-road diesel vehicles and equipment

Air pollutant emissions from transportation, off-road vehicles and mobile equipment	Sources and sectors in the Air Pollutant Emission Inventory and Black Carbon Emission Inventory
Off-road vehicles and equipment, tire wear and brake lining	Off-road gasoline / liquefied petroleum gas / compressed natural gas vehicles and equipment
Off-road vehicles and equipment, tire wear and brake lining	Tire wear and brake lining
Passenger cars and motorcycles	Light-duty diesel vehicles
Passenger cars and motorcycles	Light-duty gasoline vehicles
Passenger cars and motorcycles	Light-duty liquefied petroleum gas / natural gas vehicles
Passenger cars and motorcycles	Motorcycles
Passenger light trucks	Light-duty diesel trucks
Passenger light trucks	Light-duty gasoline trucks
Passenger light trucks	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 Emission Inventory/Black Carbon Emissions

Air pollutant emissions from electric utilities	Sources and sectors in the Air Pollutant Emission Inventory and Black Carbon Emission Inventory
Coal	Coal
Diesel	Diesel
Natural gas	Natural gas
Other	Waste materials ^[A]
Other	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 Emission Inventory/Black Carbon Emissions

Air pollutant emissions from the oil and gas industry	Sources and sectors in the Air Pollutant Emission Inventory and Black Carbon Emission Inventory
Downstream oil and gas	Downstream oil and gas industry
Downstream oil and gas	Petroleum product transportation and distribution
Upstream oil and gas	Upstream oil and gas industry

Recent changes

The emission estimates reported in the Air Pollutant Emission Inventory used in the indicators have undergone a number of significant recalculations. Specifically, the sector emissions for ore and mineral industries, oil and gas industry, manufacturing, transportation, agriculture, commercial/residential/institutional, incineration and waste sources, paints and solvents, dust, and fires, following the implementation of improved quantification methods. For more information about these recent changes, consult [Annex 2.3](#) of the Air Pollutant Emission 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 2.10](#) of Canada's Black Carbon Emission 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 Emission 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 2016 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 (2015) were used.

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

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 87% of the national anthropogenic black carbon emissions.

Resources

References

Environment and Climate Change Canada (2017) [Climate and Clean Air Coalition](#). Retrieved on April 15, 2018.

Environment and Climate Change Canada (2017) [Using and interpreting data from the National Pollutant Release Inventory](#). Retrieved on April 15, 2018.

Environment and Climate Change Canada (2018) [Access data from the National Pollutant Release Inventory \(NPRI\)](#). September 14, 2017 version. Retrieved on April 15, 2018.

Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory report - 2018](#). Retrieved on April 15, 2018.

Environment and Climate Change Canada (2018) [Canada's Black Carbon Inventory 2018](#). Retrieved on June 13, 2018.

Environment and Climate Change Canada (2018) [Tools and resources for the National Pollutant Release Inventory data](#). Retrieved on April 15, 2018.

Related information

[Air pollution: drivers and impacts](#)

[Air Pollutant Emissions Inventory: overview](#)

[Air Pollutant Emissions Inventory online search](#)

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 2016

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	-2
1992	-11	-2	-2	2	-3	-5
1993	-14	0	1	3	0	-5
1994	-21	5	2	7	0	-3
1995	-16	8	2	11	-1	-7
1996	-16	11	1	15	-4	-7
1997	-18	17	-1	17	-8	-6
1998	-19	19	-1	17	-8	-13
1999	-22	22	-3	17	-10	-13
2000	-22	21	-6	20	-12	-15
2001	-22	15	-14	21	-19	-17
2002	-24	13	-14	24	-20	-19
2003	-26	11	-17	22	-23	-21
2004	-27	5	-19	26	-27	-23
2005	-29	2	-23	25	-35	-24
2006	-35	-4	-27	22	-39	-24
2007	-37	-3	-28	23	-41	-21
2008	-43	-7	-30	20	-42	-18
2009	-52	-13	-35	16	-45	-25
2010	-55	-11	-34	15	-46	-20

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)
2011	-58	-13	-39	14	-49	-19
2012	-58	-17	-38	18	-51	-15
2013	-58	-18	-37	21	-52	-16
2014	-60	-19	-36	20	-53	-16
2015	-65	-22	-39	20	-53	-18
2016	-65	-25	-42	20	-54	-18

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.2. Data for Figure 2. Distribution of air pollutant emissions by source, Canada, 2016

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	23.4	26.5	35.3	0.5	9.5	0.7
Manufacturing	4.0	3.9	6.4	2.5	2.3	1.1
Ore and mineral industries	45.1	4.3	0.7	0.3	9.7	2.1
Transportation (road, rail, air and marine)	2.1	43.3	8.6	1.5	31.5	1.4
Off-road vehicles and mobile equipment	<0.1	8.7	8.6	<0.1	22.5	0.9
Building heating and energy generation	0.5	3.2	0.2	0.1	0.5	0.3
Electric utilities	23.7	8.4	<0.1	<0.1	0.6	0.2
Home firewood burning	0.3	1.1	12.7	0.4	20.7	10.2

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)
Incineration and waste	0.3	0.3	0.6	0.9	0.3	0.2
Paints and solvents	<0.1	<0.1	17.9	<0.1	<0.1	<0.1
Agriculture (livestock, crop production and fertilizer)	0.6	0.2	5.4	93.6	<0.1	19.2
Dust and fires	<0.1	<0.1	0.3	<0.1	2.1	62.9
Miscellaneous	<0.1	<0.1	3.2	0.1	0.1	1.0

Note: The indicator reports air pollutant emissions from human activities only. The percentages have been rounded off and their sum may not add up to 100.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.3. Data for Figure 3. Distribution of air pollutant emissions by province and territory, Canada, 2016

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	2.5	3.3	1.6	0.2	2.5	1.5
Prince Edward Island	<0.1	0.3	0.4	0.6	0.5	0.4
Nova Scotia	6.2	3.7	2.3	0.7	2.8	1.7
New Brunswick	2.0	1.9	2.0	0.7	2.9	1.5
Quebec	10.7	11.7	16.0	14.5	27.0	13.1
Ontario	23.7	16.6	20.7	18.8	25.2	16.9
Manitoba	13.6	2.4	3.5	12.5	3.1	4.9
Saskatchewan	11.2	7.9	13.3	20.8	5.6	19.3
Alberta	22.3	34.6	31.2	27.4	17.2	35.5

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)
British Columbia	7.2	15.9	8.9	3.7	12.8	5.1
Yukon	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
Northwest Territories and Nunavut	<0.1	0.8	0.1	<0.1	0.1	0.1

Note: The indicator reports air pollutant emissions from human activities only. The percentages have been rounded off and their sum may not add up to 100.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.4. Data for Figure 4. Total sulphur oxide emissions by source, Canada, 1990 to 2016

Year	Ore and mineral industries (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	1 483.8	618.4	533.9	430.7	3 066.8
1991	1 335.3	592.1	535.6	382.5	2 845.5
1992	1 169.7	610.7	574.9	368.1	2 723.4
1993	1 112.6	547.2	605.0	374.5	2 639.3
1994	891.9	559.8	598.5	376.8	2 427.1
1995	1 105.9	532.7	593.9	331.8	2 564.4
1996	1 089.1	542.2	590.8	351.5	2 573.6
1997	1 032.1	591.4	547.3	355.5	2 526.3
1998	1 019.4	603.6	513.4	354.3	2 490.7
1999	925.3	601.1	509.5	360.0	2 395.9
2000	915.9	619.2	504.7	361.7	2 401.5
2001	912.8	624.0	486.6	356.8	2 380.0
2002	906.5	617.2	457.2	351.3	2 332.2
2003	812.5	635.0	468.1	359.0	2 274.6
2004	867.4	559.0	459.5	359.9	2 245.8

Year	Ore and mineral industries (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2005	859.0	525.9	452.5	336.4	2 173.7
2006	830.9	458.9	418.8	270.5	1 979.1
2007	781.5	491.9	392.6	258.4	1 924.4
2008	717.7	427.5	369.8	225.7	1 740.7
2009	524.9	384.1	366.8	202.0	1 477.7
2010	503.7	334.0	334.2	197.4	1 369.3
2011	469.1	293.2	325.3	198.6	1 286.3
2012	478.2	284.2	327.3	191.7	1 281.5
2013	492.1	278.2	315.3	187.3	1 272.9
2014	487.2	269.1	282.9	192.0	1 231.3
2015	482.9	251.5	259.5	89.3	1 083.2
2016	481.3	253.1	249.2	83.0	1 066.6

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.5. Data for Figure 5. Sulphur oxide emissions by province and territory, Canada, 1990 and 2016

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)
Newfoundland and Labrador	76.0	26.5
Prince Edward Island	3.7	0.3
Nova Scotia	213.8	66.4
New Brunswick	109.7	21.5
Quebec	260.8	113.8
Ontario	1 130.9	252.5
Manitoba	509.3	145.3

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)
Saskatchewan	97.1	119.8
Alberta	516.6	238.1
British Columbia	129.8	77.3
Yukon	0.7	<0.1
Northwest Territories and Nunavut	18.6	5.1

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.6. Data for Figure 6. Total nitrogen oxide emissions by source, Canada, 1990 to 2016

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	1 018.0	346.0	397.5	388.1	257.0	2 406.5
1991	967.3	339.3	382.2	378.4	250.9	2 318.2
1992	979.1	355.9	374.4	387.8	262.9	2 360.1
1993	993.2	381.4	382.9	413.6	243.0	2 414.1
1994	1 044.1	413.2	389.8	447.4	240.0	2 534.5
1995	1 049.9	429.8	388.6	482.1	248.3	2 598.7
1996	1 105.2	441.8	385.6	473.5	269.3	2 675.4
1997	1 191.3	485.5	384.3	470.6	288.1	2 819.9
1998	1 267.6	496.4	371.4	423.8	310.5	2 869.7
1999	1 340.2	513.6	374.3	401.1	306.8	2 936.0
2000	1 353.4	459.1	376.9	394.2	327.1	2 910.7
2001	1 317.3	453.2	355.7	338.7	313.3	2 778.1
2002	1 246.8	449.8	378.2	326.1	315.0	2 716.0
2003	1 177.1	492.4	372.0	342.1	293.2	2 676.7
2004	1 142.2	424.5	361.7	343.8	259.8	2 532.1
2005	1 130.0	428.2	339.0	309.5	251.1	2 457.7

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)
2006	1 083.9	430.3	296.7	286.7	224.5	2 322.2
2007	1 060.7	453.5	283.1	287.3	239.0	2 323.6
2008	1 019.7	463.8	262.1	277.1	225.3	2 247.9
2009	914.1	460.0	234.6	262.2	218.2	2 089.0
2010	926.4	451.8	243.3	280.2	233.8	2 135.4
2011	927.6	464.8	250.8	251.3	200.0	2 094.6
2012	905.4	465.3	249.2	221.1	166.2	2 007.2
2013	886.9	472.1	243.2	213.0	161.7	1 976.8
2014	852.2	483.7	246.8	203.0	166.6	1 952.3
2015	795.6	490.8	242.1	199.7	151.8	1 880.1
2016	786.1	480.4	236.9	158.2	152.2	1 813.7

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.7. Data for Figure 7. Nitrogen oxide emissions by province and territory, Canada, 1990 and 2016

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)
Newfoundland and Labrador	63.0	59.9
Prince Edward Island	7.6	4.7
Nova Scotia	99.4	66.8
New Brunswick	79.0	34.2
Quebec	340.2	211.9
Ontario	616.3	301.5
Manitoba	74.4	44.0
Saskatchewan	144.9	143.0

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)
Alberta	646.3	627.9
British Columbia	316.0	287.9
Yukon	3.8	2.1
Northwest Territories and Nunavut	15.5	30.0

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

- Table A.8. Data for

Figure 8. Total volatile organic compound emissions by source, Canada, 1990 to 2016

Year	Oil and gas industry (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	599.9	357.5	356.5	271.5	909.9	380.9	260.5	3 136.7
1991	594.5	350.0	351.4	270.8	879.6	365.4	257.4	3 069.3
1992	608.8	352.2	335.9	256.4	890.3	364.9	257.7	3 066.3
1993	635.5	351.4	352.1	278.7	913.6	363.6	275.0	3 169.9
1994	648.7	362.1	358.4	276.4	919.8	365.0	276.6	3 207.1
1995	660.7	375.2	342.1	274.6	920.8	353.5	269.3	3 196.1
1996	688.6	373.0	338.4	265.0	899.1	347.7	270.2	3 182.0
1997	678.6	374.9	322.6	255.4	857.5	348.8	265.0	3 102.8
1998	691.1	377.5	342.0	257.0	815.0	351.6	271.4	3 105.6
1999	650.7	389.5	325.0	252.4	795.4	348.4	270.2	3 031.6
2000	667.5	395.9	313.6	249.1	711.3	340.8	265.7	2 943.8
2001	675.5	375.7	289.7	244.5	533.5	331.9	243.2	2 694.0
2002	687.5	368.4	313.2	240.3	522.8	312.7	242.6	2 687.5
2003	686.1	370.0	269.5	252.8	497.9	293.6	223.8	2 593.7
2004	672.6	366.4	261.5	244.9	513.9	279.3	206.7	2 545.3

Year	Oil and gas industry (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2005	673.8	365.9	246.3	241.8	429.9	251.0	197.6	2 406.3
2006	666.1	351.0	237.7	211.4	411.0	233.9	172.9	2 284.0
2007	662.0	348.9	234.9	206.0	403.0	231.1	158.5	2 244.5
2008	674.0	339.9	235.3	200.3	376.9	240.2	143.2	2 209.7
2009	631.6	309.6	224.3	198.1	361.9	203.7	122.7	2 051.8
2010	635.4	316.4	235.9	195.9	350.9	199.3	127.5	2 061.2
2011	628.4	304.4	235.2	195.4	245.0	186.0	124.8	1 919.2
2012	683.4	309.2	234.4	191.8	213.9	178.2	124.5	1 935.5
2013	739.2	313.6	233.0	186.1	197.7	172.0	123.7	1 965.3
2014	775.2	322.8	231.5	192.9	191.9	159.9	118.3	1 992.4
2015	730.9	325.7	230.0	190.1	183.4	153.6	114.9	1 928.6
2016	641.4	326.1	231.3	188.6	156.8	157.2	116.2	1 817.5

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.9. Data for Figure 9. Volatile organic compound emissions by province and territory, Canada, 1990 and 2016

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)
Newfoundland and Labrador	56.7	28.5
Prince Edward Island	13.1	7.1
Nova Scotia	84.0	40.9
New Brunswick	92.0	36.1
Quebec	597.1	290.7
Ontario	931.8	375.5

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)
Manitoba	101.8	62.8
Saskatchewan	175.7	241.5
Alberta	681.4	566.9
British Columbia	390.0	162.6
Yukon	2.2	0.9
Northwest Territories and Nunavut	10.7	3.9

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.10. Data for Figure 10. Total ammonia emissions by source, Canada, 1990 to 2016

Year	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	370.3	20.0	14.4	5.1	409.8
1991	367.5	19.1	14.4	5.2	406.2
1992	380.0	19.0	14.3	5.6	418.9
1993	382.4	18.5	15.2	6.0	422.1
1994	394.4	20.0	15.3	6.8	436.4
1995	412.9	19.0	15.0	7.5	454.4
1996	429.1	20.7	14.8	8.2	472.8
1997	434.9	20.9	15.0	9.1	479.8
1998	435.0	20.8	15.1	10.0	480.9
1999	433.3	21.5	14.7	10.8	480.3
2000	443.8	23.2	15.3	11.1	493.4
2001	448.4	19.9	14.5	11.7	494.5
2002	452.5	21.7	22.0	11.3	507.6
2003	458.5	17.7	13.5	11.1	500.9
2004	473.5	17.6	12.7	10.8	514.6

Year	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2005	470.6	17.0	13.7	10.5	511.8
2006	462.4	16.1	11.8	10.0	500.3
2007	466.4	16.1	10.9	9.9	503.3
2008	456.8	13.6	12.2	9.3	491.9
2009	443.6	12.6	11.9	8.9	476.9
2010	436.8	11.5	12.8	8.8	469.8
2011	434.5	11.8	12.3	8.5	467.2
2012	450.9	12.0	11.6	8.1	482.5
2013	465.3	11.3	12.6	8.0	497.2
2014	459.6	11.4	12.9	7.5	491.4
2015	461.9	11.7	11.7	7.4	492.6
2016	460.0	12.1	11.9	7.6	491.6

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.11. Data for Figure 11. Ammonia emissions by province and territory, Canada, 1990 and 2016

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)
Newfoundland and Labrador	1.1	1.0
Prince Edward Island	3.6	2.8
Nova Scotia	5.1	3.5
New Brunswick	4.7	3.6
Quebec	70.0	71.3
Ontario	114.7	92.4
Manitoba	39.4	61.6

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)
Saskatchewan	50.0	102.2
Alberta	98.2	134.8
British Columbia	23.0	18.4
Yukon	<0.1	<0.1
Northwest Territories and Nunavut	<0.1	<0.1

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.12. Data for Figure 12. Total carbon monoxide emissions by source, Canada, 1990 to 2016

Year	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	5 380.7	2 813.4	1 660.4	2 306.7	336.3	12 497.4
1991	5 181.4	2 736.7	1 636.4	2 403.1	324.8	12 282.4
1992	5 181.8	2 802.7	1 564.8	2 230.0	339.6	12 118.9
1993	5 167.7	2 878.4	1 637.9	2 421.7	363.1	12 468.7
1994	5 149.3	2 915.2	1 668.5	2 368.4	399.4	12 500.9
1995	4 942.9	2 964.9	1 593.1	2 405.9	407.9	12 314.7
1996	4 851.5	2 941.7	1 573.8	2 149.1	420.0	11 936.0
1997	4 860.0	2 844.4	1 502.7	1 882.0	469.8	11 558.9
1998	4 901.5	2 763.0	1 597.0	1 794.2	486.9	11 542.6
1999	4 801.8	2 751.3	1 521.8	1 722.3	499.3	11 296.6
2000	4 885.8	2 554.8	1 472.7	1 647.6	443.7	11 004.6
2001	4 660.6	2 105.9	1 364.1	1 536.8	467.8	10 135.2
2002	4 339.1	2 160.0	1 482.7	1 460.6	498.7	9 941.1
2003	4 119.4	2 157.1	1 278.9	1 534.8	529.5	9 619.6
2004	3 796.0	2 290.0	1 247.9	1 232.3	500.2	9 066.4

Year	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2005	3 124.7	2 087.6	1 180.0	1 199.2	493.4	8 084.8
2006	2 829.7	2 096.6	1 144.8	1 010.6	503.0	7 584.7
2007	2 708.3	2 083.7	1 146.8	953.0	522.6	7 414.4
2008	2 565.2	1 988.5	1 161.2	963.4	540.4	7 218.7
2009	2 370.4	1 915.0	1 121.1	917.0	524.9	6 848.5
2010	2 266.1	1 899.9	1 193.9	896.5	520.9	6 777.3
2011	2 068.2	1 647.7	1 204.2	890.0	530.5	6 340.6
2012	1 973.5	1 488.4	1 213.9	917.6	537.3	6 130.7
2013	1 931.2	1 463.9	1 206.3	852.8	572.7	6 026.8
2014	1 775.5	1 486.5	1 198.2	906.2	559.2	5 925.6
2015	1 750.1	1 443.9	1 190.3	881.1	574.0	5 839.4
2016	1 815.2	1 299.9	1 195.1	910.3	549.5	5 770.1

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.13. Data for Figure 13. Carbon monoxide emissions by province and territory, Canada, 1990 and 2016

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)
Newfoundland and Labrador	224.5	145.2
Prince Edward Island	64.1	29.0
Nova Scotia	348.1	162.4
New Brunswick	352.7	169.2
Quebec	2 689.3	1 555.2
Ontario	3 578.2	1 452.3
Manitoba	406.1	181.1

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)
Saskatchewan	541.1	325.6
Alberta	1 854.5	992.6
British Columbia	2 405.1	739.2
Yukon	15.7	4.2
Northwest Territories and Nunavut	18.0	14.1

Note: The indicator reports air pollutant emissions from human activities only.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.14A. Data for Figure 14. Total fine particulate matter emissions by source, Canada, 1990 to 2016

Year	Dust and fires (emissions in kilotonnes)	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	673.6	676.8	262.1	356.5	1 969.0
1991	670.0	669.6	258.4	330.1	1 928.2
1992	643.4	654.9	247.0	321.7	1 867.0
1993	651.8	640.6	258.5	319.3	1 870.1
1994	707.3	626.0	263.1	320.4	1 916.8
1995	650.8	611.4	251.2	320.4	1 833.8
1996	665.6	597.0	248.0	311.4	1 822.0
1997	729.6	582.9	234.8	308.3	1 855.6
1998	605.2	569.1	247.0	297.6	1 718.8
1999	638.0	555.5	232.9	294.4	1 720.7
2000	625.4	541.9	223.2	292.8	1 683.3
2001	642.6	528.6	204.2	262.1	1 637.5
2002	621.7	508.6	219.2	237.6	1 587.0
2003	652.1	488.3	186.4	230.2	1 557.0
2004	644.6	467.8	179.2	221.0	1 512.6
2005	663.5	447.9	166.8	217.4	1 495.6

Year	Dust and fires (emissions in kilotonnes)	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2006	716.8	427.7	158.8	190.5	1 493.9
2007	791.5	414.3	158.5	186.1	1 550.4
2008	876.8	400.9	160.3	177.6	1 615.7
2009	775.8	387.8	154.4	162.9	1 480.8
2010	863.2	374.7	163.8	164.1	1 565.8
2011	913.5	361.4	164.8	154.8	1 594.5
2012	1 008.3	348.9	165.8	149.8	1 672.8
2013	1 003.6	336.8	164.7	146.3	1 651.3
2014	1 013.1	325.9	163.6	143.8	1 646.4
2015	1 012.0	316.5	162.5	129.5	1 620.5
2016	1 009.9	308.1	163.3	124.6	1 605.8

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.15B. Data for Figure 14. Total fine particulate matter emissions by source, Canada, 1990 to 2016

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	58.8	40.6	116.0	55.7	14.8	12.4	4.6	48.5	5.1	<0.1
1991	55.7	37.9	104.7	53.3	13.0	12.3	4.6	43.5	5.1	<0.1
1992	53.1	37.3	101.6	53.5	13.0	12.5	4.7	40.7	5.1	<0.1
1993	52.8	37.2	102.4	57.7	13.3	13.2	4.9	32.6	5.2	<0.1
1994	54.5	37.8	102.7	62.4	13.7	13.9	4.9	25.0	5.5	<0.1
1995	54.7	37.0	103.6	65.2	14.2	14.5	4.9	20.9	5.4	<0.1
1996	56.0	37.6	95.6	64.3	14.2	14.4	5.2	19.1	5.2	<0.1
1997	57.6	39.3	87.8	64.0	14.6	14.8	5.0	20.2	5.0	<0.1
1998	54.1	40.7	83.2	58.8	15.3	16.1	4.6	19.9	4.8	<0.1
1999	52.4	41.8	83.2	56.1	15.9	13.9	4.8	21.6	4.7	<0.1
2000	54.9	42.8	78.5	54.0	16.3	13.4	5.3	23.2	4.5	<0.1
2001	51.3	42.4	65.1	44.6	16.5	13.3	5.0	19.4	4.4	<0.1
2002	41.8	41.1	56.3	42.7	16.7	14.1	5.2	15.2	4.4	<0.1
2003	40.2	41.2	55.7	43.1	17.0	12.6	5.5	11.0	3.9	<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)
2004	39.2	41.3	50.1	42.6	17.5	11.9	5.3	9.3	3.8	<0.1
2005	44.5	43.7	44.3	36.8	17.8	12.4	5.3	9.0	3.8	<0.1
2006	43.1	42.0	28.0	33.8	17.9	11.7	4.9	6.0	3.1	<0.1
2007	40.8	40.4	26.8	33.5	17.9	11.3	5.2	7.0	3.1	<0.1
2008	39.0	39.2	23.9	32.3	18.3	9.9	5.1	6.8	3.1	<0.1
2009	33.1	35.8	21.8	30.4	18.4	9.2	5.0	6.1	3.1	<0.1
2010	35.9	35.7	19.9	31.8	18.1	9.1	4.7	5.7	3.1	<0.1
2011	34.5	34.7	20.9	25.4	17.3	9.6	5.0	4.3	2.9	<0.1
2012	35.7	33.6	20.4	21.9	17.4	10.1	4.8	3.2	2.7	<0.1
2013	32.9	32.8	20.8	20.5	17.2	11.1	5.0	3.2	2.7	<0.1
2014	32.7	31.7	19.1	19.3	16.6	12.9	5.2	3.5	2.7	<0.1
2015	31.7	21.8	18.6	18.6	15.6	12.1	4.9	3.4	2.7	<0.1
2016	33.0	21.7	17.5	14.7	15.7	11.2	4.6	3.3	2.7	<0.1

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.16. Data for Figure 15. Fine particulate matter emissions by province and territory, Canada, 1990 and 2016

Province or territory	1990 (emissions in kilotonnes)	2016 (emissions in kilotonnes)	1990, excluding open sources ^[A] (emissions in kilotonnes)	2016, excluding open sources ^[A] (emissions in kilotonnes)
Newfoundland and Labrador	28.4	23.4	24.1	9.9
Prince Edward Island	7.2	5.9	3.3	2.5
Nova Scotia	40.6	26.9	25.5	13.1
New Brunswick	40.5	24.8	24.1	9.9
Quebec	249.8	209.9	159.7	96.7
Ontario	323.7	271.2	156.1	71.9
Manitoba	104.1	79.1	16.8	7.7
Saskatchewan	478.7	309.2	25.1	12.2
Alberta	510.3	569.6	77.8	30.1
British Columbia	178.3	81.5	108.7	32.0
Yukon	3.1	0.8	0.3	0.1
Northwest Territories and Nunavut	4.2	3.6	1.7	1.4

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.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.17. Data for Figure 16. Total black carbon emissions by source, Canada, 2016

Source	2016 (emissions in kilotonnes)	2016 (percentage of national emissions)
Home firewood burning	11.6	33.2
Transportation (road, rail, air and marine)	10.0	28.6
Off-road vehicles and mobile equipment	8.7	25.0
Oil and gas industry	2.5	7.2
Building heating and energy generation	1.0	3.0
Other sources	1.0	2.9

Note: The indicator reports air pollutant emissions from human activities only. 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 (2018) [Canada's Black Carbon Emission Inventory](#).

Table A.18. Data for Figure 17. Contribution of transportation, off-road vehicles and mobile equipment to air pollutant emissions by transportation mode, Canada, 2016

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	9.2	2.6	2.8	< 0.1	< 0.1	0.6
Passenger light trucks	12.8	4.0	3.2	< 0.1	< 0.1	0.6
Large trucks and buses	8.0	15.0	1.6	0.6	< 0.1	0.2
Air, marine and rail travel	1.5	21.7	1.0	0.5	1.9	< 0.1
Off-road vehicles and equipment, tire wear and brake lining	22.5	8.7	8.6	1.0	< 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.19. Data for Figure 17. Contribution of transportation, off-road vehicles and mobile equipment to air pollutant emissions by transportation mode, Canada, 2016
Emissions of air pollutants from transportation, off-road vehicles and mobile equipment by transportation mode, Canada, 2016

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	532.2	47.1	51.0	1.2	0.5	3.0
Passenger light trucks	736.3	72.7	58.7	1.3	0.7	3.1
Large trucks and buses	459.3	272.6	28.8	9.5	0.3	1.1
Air, marine and rail travel	87.3	393.8	18.7	8.2	20.6	0.4
Off-road vehicles and equipment, tire wear and brake lining	1 299.9	158.2	156.8	16.2	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 (2018) [Air Pollutant Emission Inventory](#).

Table A.20. Data for Figure 18. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2016

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	-4	-3	-4
1992	-3	-3	-3
1993	0	-2	-1
1994	6	-2	0
1995	9	-3	-1
1996	12	-5	-3
1997	18	-6	-7
1998	20	-6	-10
1999	24	-8	-11
2000	24	-9	-18
2001	18	-17	-33
2002	12	-21	-35
2003	8	-23	-39
2004	6	-26	-39
2005	2	-36	-47
2006	-3	-40	-50
2007	-4	-42	-51
2008	-8	-44	-52
2009	-16	-48	-56
2010	-14	-49	-57
2011	-16	-55	-67

Year	Nitrogen oxides (percentage change from 1990 level)	Carbon monoxide (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)
2012	-20	-58	-70
2013	-22	-59	-71
2014	-25	-60	-73
2015	-29	-61	-74
2016	-33	-62	-76

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the chart due to their low share ($\leq 5\%$) of total emissions in 2016.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.21. Data for Figure 18. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2016

Year	Nitrogen oxides (emissions in kilotonnes)	Carbon monoxide (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)
1990	1 406.1	8 194.1	1 290.8
1991	1 345.7	7 918.1	1 245.1
1992	1 366.9	7 984.5	1 255.3
1993	1 406.8	8 046.0	1 277.2
1994	1 491.5	8 064.5	1 284.8
1995	1 532.0	7 907.7	1 274.3
1996	1 578.7	7 793.1	1 246.8
1997	1 661.9	7 704.4	1 206.3
1998	1 691.5	7 664.5	1 166.6
1999	1 741.2	7 553.2	1 143.8
2000	1 747.6	7 440.6	1 052.0
2001	1 656.0	6 766.5	865.4
2002	1 572.9	6 499.1	835.6
2003	1 519.1	6 276.5	791.5
2004	1 486.1	6 086.0	793.2
2005	1 439.5	5 212.3	681.0

Year	Nitrogen oxides (emissions in kilotonnes)	Carbon monoxide (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)
2006	1 370.6	4 926.4	644.9
2007	1 348.0	4 792.0	634.1
2008	1 296.8	4 553.7	617.1
2009	1 176.3	4 285.5	565.6
2010	1 206.5	4 166.0	550.1
2011	1 178.9	3 715.9	431.0
2012	1 126.4	3 461.9	392.1
2013	1 099.8	3 395.1	369.7
2014	1 055.2	3 262.0	351.7
2015	995.4	3 194.0	337.0
2016	944.3	3 115.1	313.9

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the chart due to their low share ($\leq 5\%$) of total emissions in 2016.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.22. Data for Figure 19. Contribution of electric utilities to air pollutant emissions by fuel source, Canada, 2016

Fuel source	Sulphur oxides (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Ammonia (percentage of national emissions)
Coal	22.8	6.4	0.3	0.1	<0.1	<0.1
Natural gas	0.2	0.9	0.2	<0.1	<0.1	<0.1
Diesel	<0.1	0.5	<0.1	<0.1	0	0
Other sources	0.8	0.6	0.1	<0.1	<0.1	<0.1

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.23. Data for Figure 19. Contribution of electric utilities to air pollutant emissions by fuel source, Canada, 2016

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	243.0	116.8	15.9	2.2	0.4	0.2
Natural gas	1.7	16.0	11.2	0.4	0.6	0.1
Diesel	0.2	8.4	1.3	0.2	0.1	0.0
Other sources	8.2	11.0	8.1	0.5	0.2	0.1

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.24. Data for Figure 20. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2016

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	0	23
2003	3	14
2004	-10	1

Year	Sulphur oxides (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)
2005	-15	-2
2006	-26	-13
2007	-20	-7
2008	-31	-12
2009	-38	-15
2010	-46	-9
2011	-53	-22
2012	-54	-35
2013	-55	-37
2014	-56	-35
2015	-59	-41
2016	-59	-41

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.25. Data for Figure 20. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2016

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	532.7	248.3
1996	542.2	269.3
1997	591.4	288.1
1998	603.6	310.5

Year	Sulphur oxides (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)
1999	601.1	306.8
2000	619.2	327.1
2001	624.0	313.3
2002	617.2	315.0
2003	635.0	293.2
2004	559.0	259.8
2005	525.9	251.1
2006	458.9	224.5
2007	491.9	239.0
2008	427.5	225.3
2009	384.1	218.2
2010	334.0	233.8
2011	293.2	200.0
2012	284.2	166.2
2013	278.2	161.7
2014	269.1	166.6
2015	251.5	151.8
2016	253.1	152.2

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016. 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 (2018) [Air Pollutant Emission Inventory](#).

Table A.26. Data for Figure 21. Contribution of the oil and gas industry to air pollutant emissions by activity type, Canada, 2016

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	33.9	18.5	25.5	9.2	0.6	0.5

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)
Downstream oil and gas	1.4	4.8	1.0	0.3	0.1	<0.1

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.27. Data for Figure 21. Contribution of the oil and gas industry to air pollutant emissions by activity type, Canada, 2016

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	616.5	197.7	462.6	533.4	9.7	2.3
Downstream oil and gas	24.8	51.5	17.7	16.1	1.5	0.1

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.28. Data for Figure 22. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2016

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	0
1992	1	3	1	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	3
1998	45	43	15	-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)
1999	48	48	8	-5
2000	32	33	11	-5
2001	39	31	13	-9
2002	48	30	15	-14
2003	57	42	14	-12
2004	49	23	12	-14
2005	47	24	12	-15
2006	50	24	11	-22
2007	55	31	10	-26
2008	61	34	12	-31
2009	56	33	5	-31
2010	55	31	6	-37
2011	58	34	5	-39
2012	60	34	14	-39
2013	70	36	23	-41
2014	66	40	29	-47
2015	71	42	22	-51
2016	63	39	7	-53

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Table A.292B. Data for Figure 22. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2016

Year	Carbon monoxide (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Sulphur oxides (emissions in kilotonnes)
1990	336.3	346.0	599.9	533.9
1991	324.8	339.3	594.5	535.6
1992	339.6	355.9	608.8	574.9
1993	363.1	381.4	635.5	605.0
1994	399.4	413.2	648.7	598.5
1995	407.9	429.8	660.7	593.9
1996	420.0	441.8	688.6	590.8
1997	469.8	485.5	678.6	547.3
1998	486.9	496.4	691.1	513.4
1999	499.3	513.6	650.7	509.5
2000	443.7	459.1	667.5	504.7
2001	467.8	453.2	675.5	486.6
2002	498.7	449.8	687.5	457.2
2003	529.5	492.4	686.1	468.1
2004	500.2	424.5	672.6	459.5
2005	493.4	428.2	673.8	452.5
2006	503.0	430.3	666.1	418.8
2007	522.6	453.5	662.0	392.6
2008	540.4	463.8	674.0	369.8
2009	524.9	460.0	631.6	366.8
2010	520.9	451.8	635.4	334.2
2011	530.5	464.8	628.4	325.3
2012	537.3	465.3	683.4	327.3
2013	572.7	472.1	739.2	315.3
2014	559.2	483.7	775.2	282.9

Year	Carbon monoxide (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Sulphur oxides (emissions in kilotonnes)
2015	574.0	490.8	730.9	259.5
2016	549.5	480.4	641.4	249.2

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share ($\leq 1\%$) of total emissions in 2016.

Source: Environment and Climate Change Canada (2018) [Air Pollutant Emission Inventory](#).

Additional information can be obtained at:

Environment and Climate Change Canada

Public Inquiries Centre

12th Floor, Fontaine Building

200 Sacré-Coeur boul.

Gatineau, QC K1A 0H3

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

Fax: 819-938-3318

Email: ec.enviroinfo.ec@canada.ca