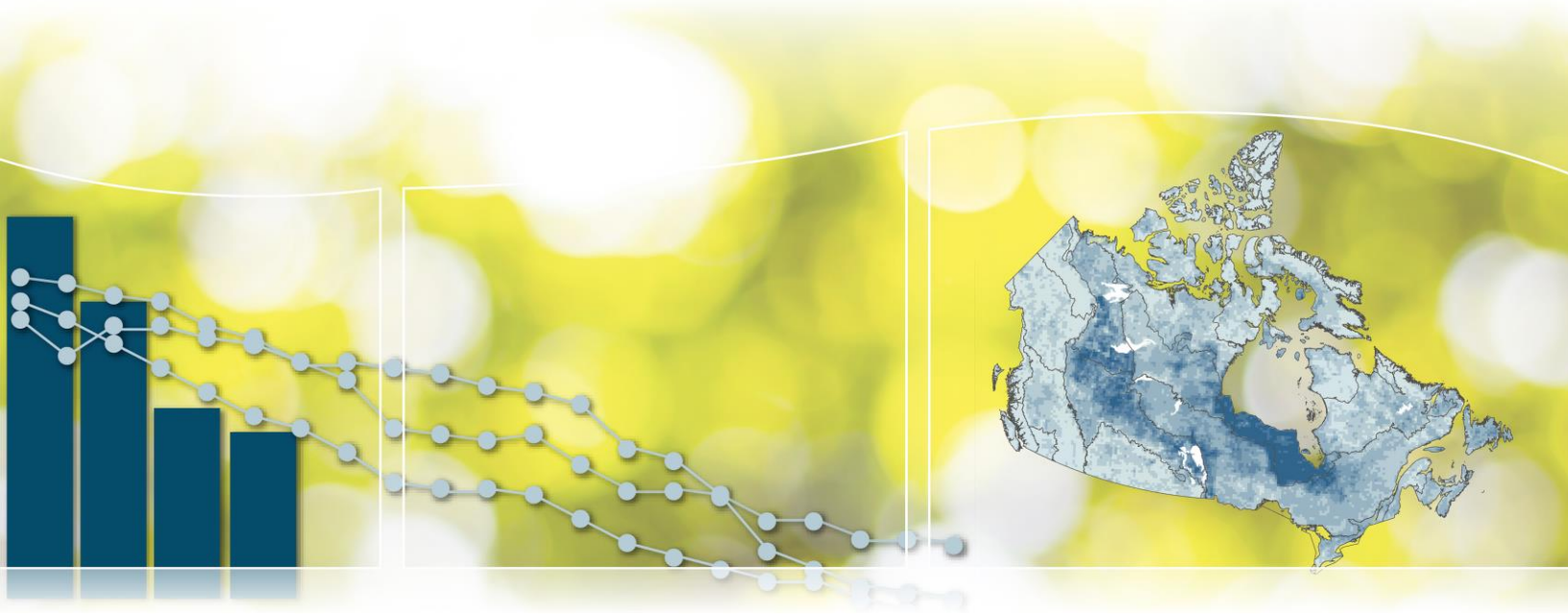
Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canadian Environmental Sustainability Indicators

International Comparison of Air Pollutant Emissions



Canada

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Canadian Environmental Sustainability Indicators

International Comparison of Air Pollutant Emissions

May 2016

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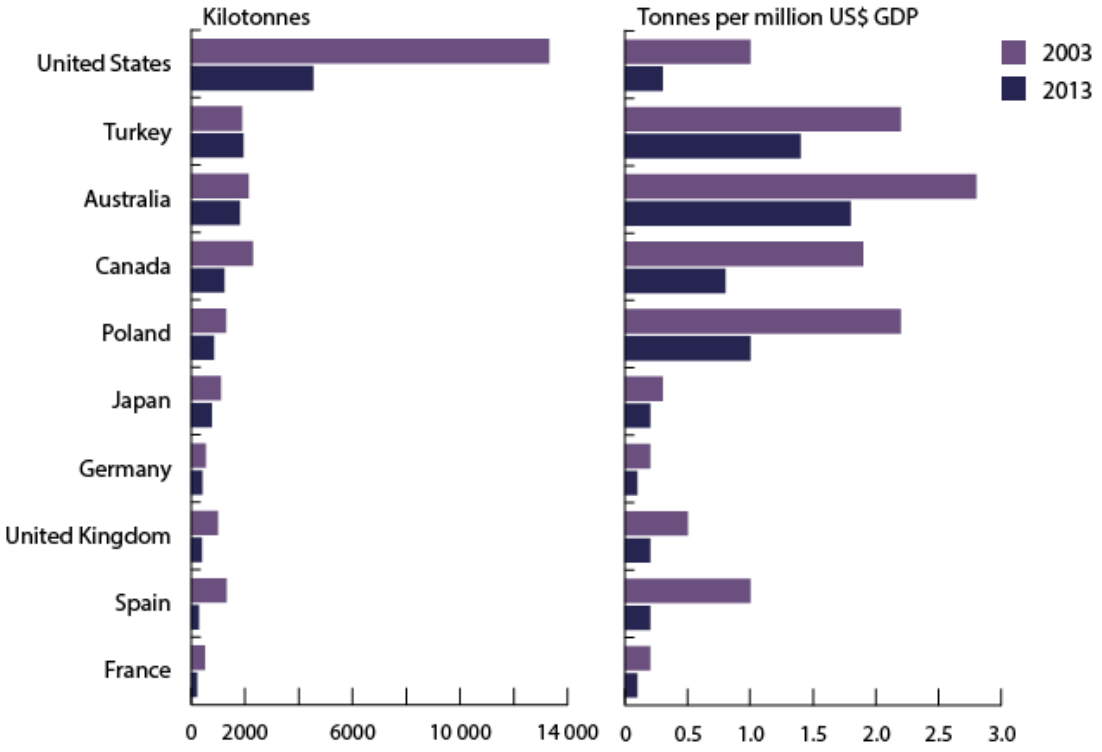
Part 1. International Comparison of Air Pollutant Emissions Indicators

Canada's air pollutant emissions[1] are compared with those of member countries[2] of the Organisation for Economic Co-operation and Development (OECD) for 2003 and 2013, with a focus on the top 10 emitting countries for each air pollutant examined. The air pollutant emissions and ratio of emissions to gross domestic product (GDP)[3] are provided for sulphur oxides (SO_X), nitrogen oxides (NO_X), volatile organic compounds (VOCs), carbon monoxide (CO) and fine particulate matter ($PM_{2.5}$).

Sulphur oxides

Although Canada's SO_X emissions declined by 47% in 2013 from 2003 levels, Canada ranked fourth in SO_X emissions among OECD member countries in 2013 behind the United States, Turkey and Australia and also had the fourth largest ratio of emissions to GDP among the top 10 emitting OECD member countries.

Figure 1. Sulphur oxide emissions by selected country, 2003 and 2013



Data for Figure 1

[1] Emissions reported for Canada may be slightly different than the emissions reported in the Canadian Environmental Sustainability Indicators (CESI) Air Pollutant Emissions indicators which are based on data from Canada's Air Pollutant Emission Inventory. Corrections can occur to Canada's national totals after final submission to international organizations which may result in slight differences in the values reported.

[2] For the indicators, the countries selected are the top 10 among OECD member countries in terms of total emissions in 2013.

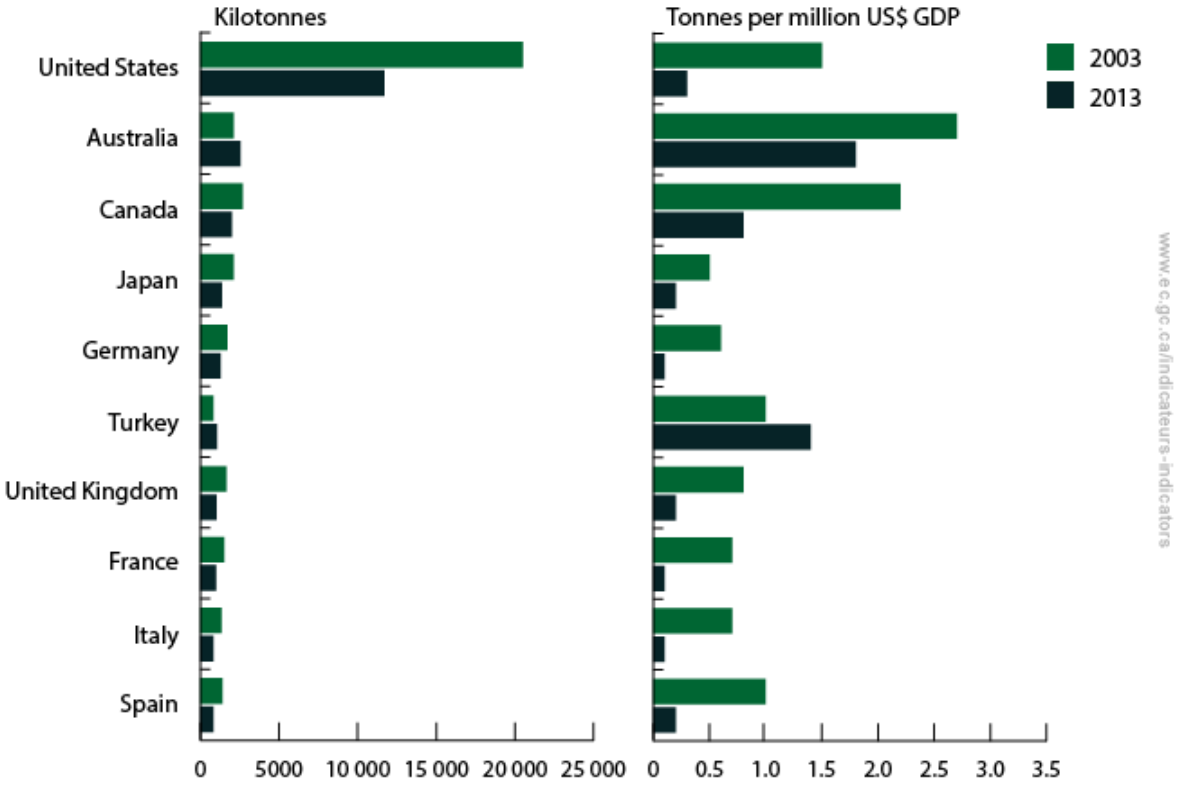
[3] Gross domestic product values are expressed in millions of constant U.S. dollars (US$) at constant purchasing power parity (PPP) for the base year of 2010. The use of PPP facilitates international comparison of GDP by creating an equivalent purchasing power basis for each country compared.

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant US$, constant purchasing power parity, for the base year of 2010.
Source: European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions; United Nations Framework Convention on Climate Change (UNFCCC) (2015) National Inventory Submissions 2015; Organisation for Economic Co-operation and Development (OECD) (2015) OECD.Stat.

Nitrogen oxides

In 2013, Canada's NO_X emissions were 25% lower than 2003 emissions. Canada ranked third in 2013 for NO_X emissions among the OECD member countries behind the United States and Australia. In terms of the ratio of emissions to GDP, Canada also ranked third for NO_X among the top 10 emitting OECD member countries, behind Australia and Turkey.

Figure 2. Nitrogen oxide emissions by selected country, 2003 and 2013



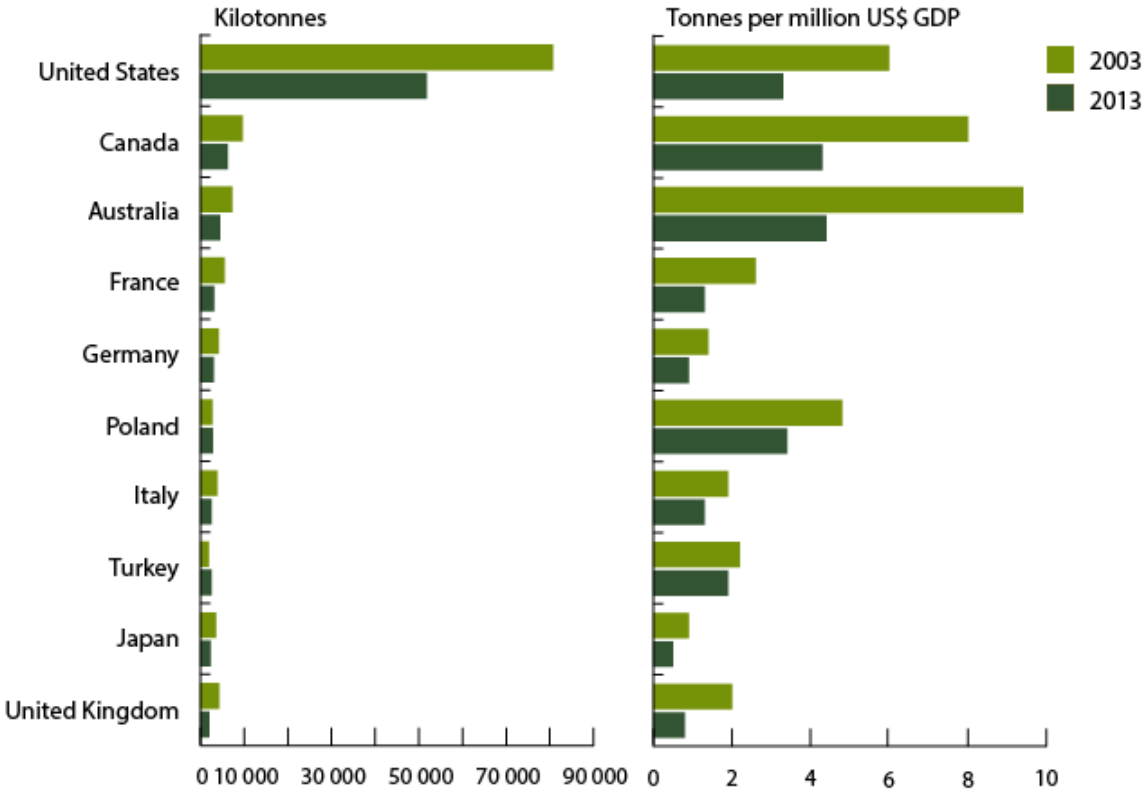
Data for Figure 2

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant US$, constant purchasing power parity, for the base year of 2010.
Source: European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions; United Nations Framework Convention on Climate Change (UNFCCC) (2015) National Inventory Submissions 2015; Organisation for Economic Co-operation and Development (OECD) (2015) OECD.Stat.

Carbon monoxide

In 2013, Canada's CO emissions were 35% lower than 2003 emissions. Canada ranked second for CO emissions among the OECD member countries behind the United States. In terms of the ratio of emissions to GDP, Canada also ranked second for CO among the top 10 emitting OECD member countries.

Figure 3. Carbon monoxide emissions by selected country, 2003 and 2013



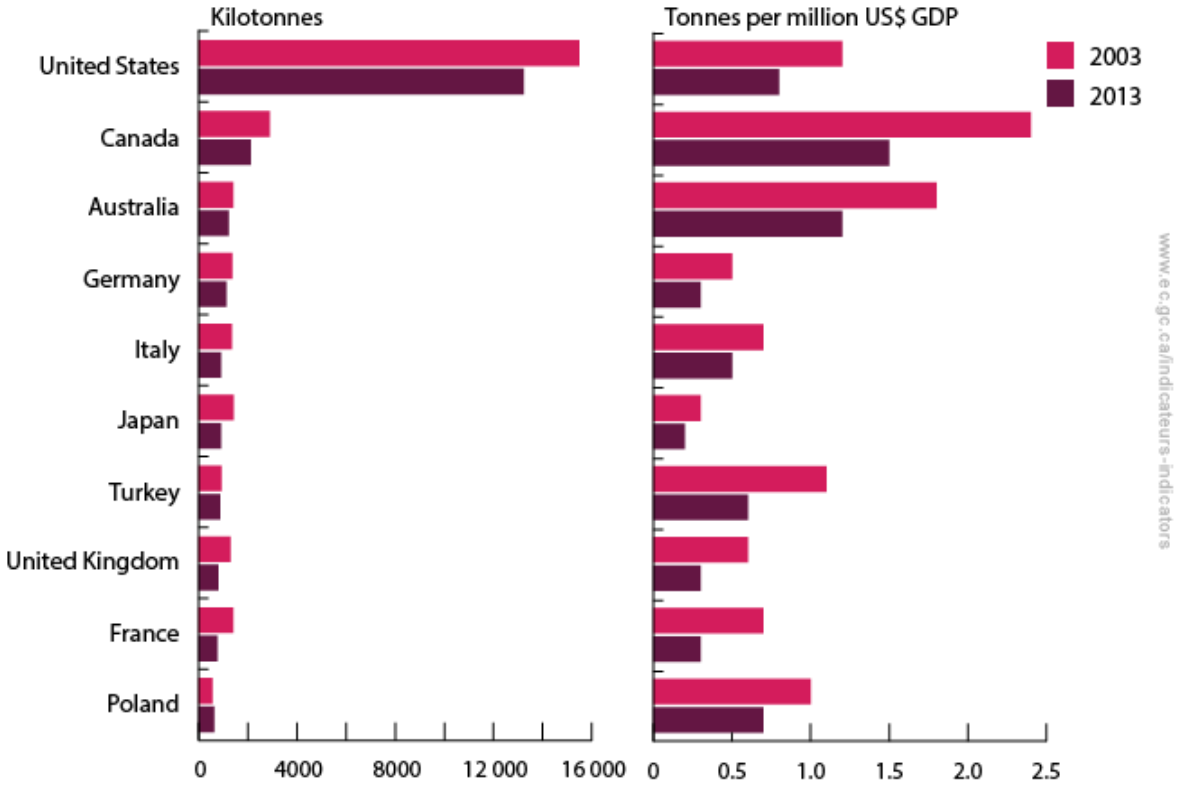
Data for Figure 3

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant US$, constant purchasing power parity, for the base year of 2010.
Source: European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions; United Nations Framework Convention on Climate Change (UNFCCC) (2015) National Inventory Submissions 2015; Organisation for Economic Co-operation and Development (OECD) (2015) OECD.Stat.

Volatile organic compounds

In 2013, Canada's VOC emissions were 26% lower than 2003 emissions. Canada ranked second for total VOC emissions in 2013 among the OECD member countries behind the United States. However, in terms of the ratio of emissions to GDP, Canada ranked highest for VOCs among these countries.

Figure 4. Volatile organic compound emissions by selected country, 2003 and 2013



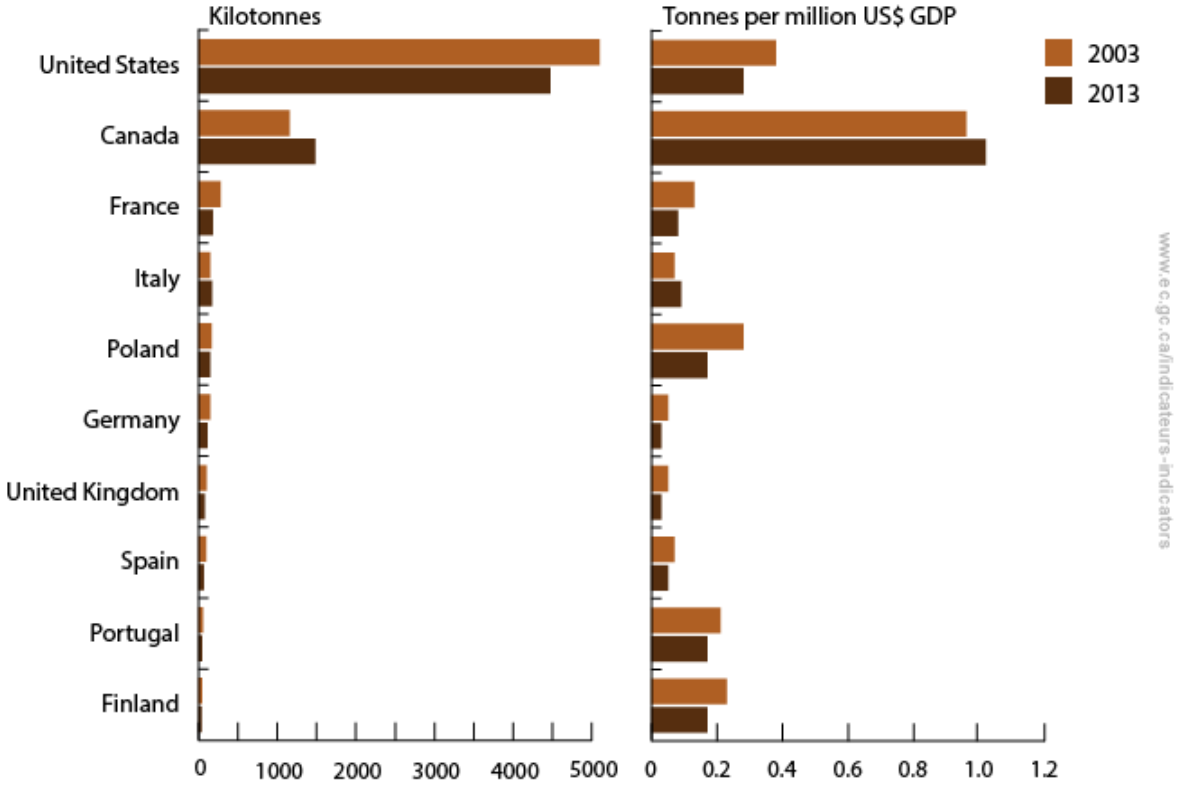
Data for Figure 4

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant US$, constant purchasing power parity, for the base year of 2010.
Source: European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions; United Nations Framework Convention on Climate Change (UNFCCC) (2015) National Inventory Submissions 2015; Organisation for Economic Co-operation and Development (OECD) (2015) OECD.Stat.

Fine particulate matter

In 2013, Canada's $PM_{2.5}$ emissions were 28% higher than 2003 emissions. Canada ranked second for total $PM_{2.5}$ emissions among the OECD member countries behind the United States. However, in terms of the ratio of emissions to GDP, Canada ranked highest for $PM_{2.5}$ among these countries. It is important to note that the United States and Canada are including open sources[4] such as dust from roads, agriculture and construction. These sources are not always reported by the other OECD member countries.

Figure 5. Fine particulate matter emissions by selected country, 2003 and 2013



Data for Figure 5

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant US$, constant purchasing power parity, for the base year of 2010.
Source: European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions; United Nations Framework Convention on Climate Change (UNFCCC) (2015) National Inventory Submissions 2015; Organisation for Economic Co-operation and Development (OECD) (2015) OECD.Stat.

[4] In 2013, open sources accounted for 1178 kilotonnes (kt) (79%) of Canada's national total of $PM_{2.5}$ and were largely emitted by activities associated with construction operations and dust from paved and unpaved roads. The remaining 306 kt (21%) came from other sources such as home firewood burning and industrial activities.

Part 2. Data Sources and Methods for the International Comparison of Air Pollutant Emissions Indicators

Introduction

The International Comparison of Air Pollutant Emissions indicators are part of the Canadian Environmental Sustainability Indicators (CESI) program, which provides data and information to track Canada's performance on key environmental sustainability issues.

Description and rationale of the international comparison of air pollutant emissions indicators

Description

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 (OECD) for which emissions data were available. Five pollutants were selected for these indicators: sulphur oxides (SO_X), nitrogen oxides (NO_X), carbon monoxide (CO), volatile organic compounds (VOC) and fine particulate matter ($PM_{2.5}$). Emissions are reported in kilotonnes.

Countries' air pollutant emissions intensities for the same five pollutants were also provided in terms of total tonnes of emissions per unit of gross domestic product (GDP). The GDP figures used are expressed in United States (U.S.) dollars, at constant prices and constant purchasing power parity (PPP) for the base year of 2010. The use of PPP facilitates international comparison of GDP by creating an equivalent purchasing power basis for each country compared.

Rationale

These indicators help to inform Canadians about how Canada's emissions compare to those of other countries. The indicators report on key air pollutants that contribute to smog and acid rain and help the government to identify priorities, track progress, and develop strategies and policies for reducing or controlling air pollution. The emissions data for Canada used for these indicators are also used to fulfill Canada's international and domestic commitments and reporting obligations.[5]

Recent changes to the indicators

The indicators previously used the OECD.Stat database for countries emissions information. However, 2013 emissions data were not available from the OECD.Stat at the time of this update. Therefore, emissions from each OECD member country were compiled using data from countries' inventory submissions to the Centre on Emission Inventories and Projections (CEIP) database of the Convention on Long-Range Transboundary Air Pollution, or, when CEIP data was unavailable, from National Inventory Submissions to the United Nations Framework Convention on Climate Change (UNFCCC). When both CEIP and UNFCCC data were unavailable, data from previous years were compiled from the OECD.Stat database.

[5] Convention on Long-Range Transboundary Air Pollution (CLRTAP).

Data

Data source

The air pollutant emissions data used to calculate the International Comparison of Air Pollutant Emissions indicators are directly retrieved from the Centre on Emission Inventories and Projections database of the Convention on Long-Range Transboundary Air Pollution (CLRTAP). For Australia, Greece, New Zealand and Japan 2003 and 2013 emissions data were not available from the CLRTAP database but taken from the National Inventory Submissions 2015 of the United Nations Framework Convention on Climate Change (UNFCCC).

For Chile, Israel and Korea, data were not available from either the CLRTAP or the UNFCCC. Only 2003 data, taken from the Organisation for Economic Co-operation and Development (OECD) .Stat database, are presented. Data for Mexico were not available from any of the data sources used and were not reported in the indicators. For fine particulate matter ($PM_{2.5}$), emissions data for both 2003 and 2013 were also unavailable for: Australia, Chile, Greece, Israel, Japan, Korea, New Zealand and Turkey.

Annex B includes the list of data sources for each OECD member country by pollutant for the years reported in the indicators (2003 and 2013).

Gross domestic product statistics were obtained through the national accounts of the OECD.Stat database.

Spatial coverage

These indicators cover the OECD member countries. For the complete list of countries included, please consult Table 1 in the methods section.

Temporal coverage

Two years are used to compare these countries: 2013, which is the year with the latest available information at the release time of these indicators, and 2003 (10 years prior).

Data completeness

Only those countries that submitted emissions are found in the indicators.

Data timeliness

The data is current up to the end of 2013. The International Comparison of Air Pollutant Emissions indicators are reported two to three years after data collection.

Methods

International comparison of air pollutant emissions indicators

Each country compiles and estimates its emissions, generally using a combination of top-down and bottom-up approaches. Top-down approaches involve the multiplication of sector activity levels by emissions factors. Bottom-up approaches are based on facility emissions. The emissions are collated, verified, validated and grouped into the format required by the international organizations, specifically the Centre on Emission Inventories and Projections (CEIP), United Nations Framework Convention on Climate Change (UNFCCC) and the Organisation for Economic Co-operation and Development (OECD).

The emissions are estimated or measured using one of the following methods:

- Continuous emission monitoring systems
- Predictive emission monitoring
- Source testing
- Mass balance
- Site-specific emission factors
- Published emission factors
- Engineering estimates
- Special studies

Canada's data are derived from the annual Convention on Long-Range Transboundary Air Pollution (CLRTAP) submission to the CEIP database. The submitted air pollutant emission data is based on Canada's Air Pollutant Emission Inventory. This includes information reported by facilities to the National Pollutant Release Inventory (NPRI) as well as emission estimates that are compiled for other sources such as motor vehicles.

International air pollution emissions per unit gross domestic product indicators

These indicators are obtained by dividing the countries' emissions by the gross domestic product (GDP) data from the OECD. The emission intensities are expressed in tonnes per million U.S. dollars using constant GDP at purchasing power parity (PPP) and the 2010 base year. The PPPs are weighted averages of the relative prices, quoted in national currency, of comparable items between countries. The use of PPPs facilitates international comparison of GDP by creating an equivalent purchasing power basis for each country compared.

Countries included in the comparison

Table 1. Coverage of OECD member countries in the indicators

Country	Sulphur oxides, nitrogen oxides, carbon monoxide and volatile organic compounds	Fine particulate matter
Australia	x	n/a
Austria	x	x
Belgium	x	x
Canada	x	x
Chile	A	n/a
Czech Republic	x	A
Denmark	x	x
Estonia	x	x
Finland	x	x
France	x	x
Germany	x	x
Greece	x	n/a
Hungary	x	x
Iceland	x	x
Ireland	x	x

Country	Sulphur oxides, nitrogen oxides, carbon monoxide and volatile organic compounds	Fine particulate matter
Israel	A	n/a
Italy	x	x
Japan	x	n/a
Korea	A	n/a
Luxembourg	x	x
Mexico	n/a	n/a
Netherlands	x	x
New Zealand	x	n/a
Norway	x	x
Poland	x	x
Portugal	x	x
Slovak Republic	x	x
Slovenia	x	x
Spain	x	x
Sweden	x	x
Switzerland	x	x
Turkey	x	n/a
United Kingdom	x	x
United States	x	x

Note: x = data available for 2003 and 2013. A = data for 2003 only. n/a = not available.

Air emissions not included in the comparison

In general, for the emissions data retrieved from the CLRTAP submission to the CEIP database, national emission totals (line 134 of the Nomenclature For Reporting tables from a country's national submission) exclude international aviation (landing and take-off) [1 A 3 a I (i) line 36] and shipping international inland waterways [1 A 3 d i (ii) line 45].

While the indicators generally exclude non man-made emissions (natural sources) and emissions from international bunker fuels (aviation and maritime transport) Canada's values include international emissions from aviation and marine since the estimation methodologies used by Canada cannot permit the separation of the international components from the domestic values. Emissions from open sources such as dust from roads, agriculture and construction are also included in Canada's values. These sources are not always reported by the other OECD member countries.

Caveats and limitations

Air pollutant emissions inventories from different countries are being estimated with the best data, measurements and methodologies available. Although the national emissions inventories used for these comparisons follow a reporting structure such as the Centre on Emission Inventories and Projections (CEIP) database, users should be cautious when comparing the data as emissions estimation methodologies and coverage among countries may differ.

Emissions reported for Canada in the CEIP database may be slightly different than the emissions reported in the Canadian Environmental Sustainability Indicators' National Air Pollutant Emissions indicators which are based on data from Canada's Air Pollutant Emission Inventory. Corrections can occur to Canada's national totals after final submission to CEIP which may result in slight differences in the values reported.

Part 3. Annexes

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

Table A.1. Data for Figure 1. Sulphur oxide emissions by selected country, 2003 and 2013

Countries	2003 sulphur oxide emissions (kilotonnes)	2013 sulphur oxide emissions (kilotonnes)	2003 sulphur oxide emissions intensity (tonnes per million US$ GDP)	2013 sulphur oxide emissions intensity (tonnes per million US$ GDP)
Sulphur oxide emissions of top ten emitting OECD member countries in 2013				
United States	13 307	4538	0.99	0.29
Turkey	1888	1939	2.24	1.43
Australia	2134	1805	2.77	1.77
Canada	2291	1225	1.91	0.84
Poland	1287	847	2.22	0.99
Japan	1101	758	0.27	0.17
Germany	534	416	0.18	0.12
United Kingdom	989	393	0.47	0.17
Spain	1307	287	0.98	0.20
France	507	219	0.24	0.09
Sulphur oxide emissions of other OECD member countries				
Italy	524	145	0.26	0.07
Greece	556	141	1.79	0.54
Czech Republic	215	138	0.96	0.48
Iceland	37	73	3.69	5.51
New Zealand	84	69	0.70	0.48
Slovak Republic	105	53	1.13	0.38
Finland	100	47	0.54	0.23
Belgium	154	46	0.41	0.10
Portugal	176	42	0.65	0.16
Estonia	100	37	4.07	1.13

Countries	2003 sulphur oxide emissions (kilotonnes)	2013 sulphur oxide emissions (kilotonnes)	2003 sulphur oxide emissions intensity (tonnes per million US$ GDP)	2013 sulphur oxide emissions intensity (tonnes per million US$ GDP)
Netherlands	64	30	0.10	0.04
Hungary	246	29	1.24	0.13
Sweden	41	27	0.12	0.07
Ireland	81	25	0.48	0.12
Austria	32	17	0.10	0.05
Norway	23	17	0.09	0.06
Denmark	35	14	0.16	0.06
Slovenia	62	11	1.29	0.21
Switzerland	15	10	0.04	0.02
Luxembourg	3	2	0.08	0.03
Chile	741	n/a	3.26	n/a
Israel	282	n/a	1.73	n/a
Korea	469	n/a	0.42	n/a
Mexico	n/a	n/a	n/a	n/a

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant US$, constant purchasing power parity, for the base year of 2010. n/a = not available.
Source: European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions; United Nations Framework Convention on Climate Change (UNFCCC) (2015) National Inventory Submissions 2015; Organisation for Economic Co-operation and Development (OECD) (2015) OECD.Stat.

Table A.2. Data for Figure 2. Nitrogen oxide emissions by selected country, 2003 and 2013

Countries	2003 nitrogen oxide emissions (kilotonnes)	2013 nitrogen oxide emissions (kilotonnes)	2003 nitrogen oxide emissions intensity (tonnes per million US$ GDP)	2013 nitrogen oxide emissions intensity (tonnes per million US$ GDP)
Nitrogen oxide emissions of top ten emitting OECD member countries in 2013				
United States	20 493	11 691	1.53	0.29
Australia	2104	2554	2.73	1.77
Canada	2671	1992	2.22	0.84
Japan	2117	1361	0.52	0.17
Germany	1715	1269	0.57	0.12

Countries	2003 nitrogen oxide emissions (kilotonnes)	2013 nitrogen oxide emissions (kilotonnes)	2003 nitrogen oxide emissions intensity (tonnes per million US$ GDP)	2013 nitrogen oxide emissions intensity (tonnes per million US$ GDP)
Turkey	818	1047	0.97	1.43
United Kingdom	1661	1020	0.79	0.17
France	1503	990	0.70	0.09
Italy	1348	821	0.66	0.07
Spain	1402	812	1.05	0.20
Nitrogen oxide emissions of other OECD member countries				
Poland	828	798	1.43	0.99
Greece	398	249	1.28	0.54
Netherlands	369	240	0.55	0.04
Belgium	294	208	0.78	0.10
Czech Republic	288	181	1.28	0.48
Austria	235	162	0.75	0.05
Portugal	245	161	0.91	0.16
New Zealand	160	157	1.34	0.48
Norway	195	154	0.76	0.06
Finland	215	145	1.16	0.23
Sweden	186	126	0.55	0.07
Denmark	226	124	1.03	0.06
Hungary	207	121	1.04	0.13
Slovak Republic	98	80	1.05	0.38
Ireland	131	79	0.77	0.12
Switzerland	96	72	0.28	0.02
Slovenia	52	43	1.09	0.21
Luxembourg	47	31	1.35	0.03
Estonia	42	30	1.69	1.13
Iceland	27	21	2.71	5.51
Chile	267	n/a	1.17	n/a
Israel	209	n/a	1.29	n/a

Countries	2003 nitrogen oxide emissions (kilotonnes)	2013 nitrogen oxide emissions (kilotonnes)	2003 nitrogen oxide emissions intensity (tonnes per million US$ GDP)	2013 nitrogen oxide emissions intensity (tonnes per million US$ GDP)
Korea	1362	n/a	1.21	n/a
Mexico	n/a	n/a	n/a	n/a

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant US$, constant purchasing power parity, for the base year of 2010. n/a = not available.
Source: European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions; United Nations Framework Convention on Climate Change (UNFCCC) (2015) National Inventory Submissions 2015; Organisation for Economic Co-operation and Development (OECD) (2015) OECD.Stat.

Table A.3. Data for Figure 3. Carbon monoxide emissions by selected country, 2003 and 2013

Countries	2003 carbon monoxide emissions (kilotonnes)	2013 carbon monoxide emissions (kilotonnes)	2003 carbon monoxide emissions intensity (tonnes per million US$ GDP)	2013 carbon monoxide emissions intensity (tonnes per million US$ GDP)
Carbon monoxide emissions of top ten emitting OECD member countries in 2013				
United States	80 730	51 762	6.01	3.28
Canada	9661	6288	8.04	4.31
Australia	7238	4508	9.39	4.42
France	5560	3196	2.59	1.33
Germany	4146	3089	1.39	0.91
Poland	2758	2876	4.76	3.35
Italy	3831	2571	1.88	1.30
Turkey	1884	2541	2.24	1.88
Japan	3577	2372	0.87	0.53
United Kingdom	4249	1971	2.03	0.83
Carbon monoxide emissions of other OECD member countries				
Spain	2450	1709	1.83	1.20
New Zealand	732	703	6.13	4.87
Netherlands	732	621	1.09	0.83
Austria	730	582	2.33	1.60

Countries	2003 carbon monoxide emissions (kilotonnes)	2013 carbon monoxide emissions (kilotonnes)	2003 carbon monoxide emissions intensity (tonnes per million US$ GDP)	2013 carbon monoxide emissions intensity (tonnes per million US$ GDP)
Sweden	753	562	2.23	1.38
Belgium	821	533	2.18	1.22
Czech Republic	717	524	3.19	1.84
Greece	815	463	2.63	1.76
Finland	578	369	3.13	1.80
Denmark	472	339	2.14	1.45
Hungary	666	326	3.35	1.48
Portugal	533	288	1.98	1.09
Norway	444	259	1.73	0.86
Slovak Republic	292	218	3.12	1.56
Switzerland	365	216	1.08	0.51
Estonia	174	158	7.09	4.89
Slovenia	198	155	4.15	2.84
Ireland	223	123	1.31	0.60
Luxembourg	48	30	1.38	0.66
Iceland	22	16	2.17	1.21
Chile	1569	n/a	6.89	n/a
Israel	284	n/a	1.74	n/a
Korea	805	n/a	0.71	n/a
Mexico	n/a	n/a	n/a	n/a

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant US$, constant purchasing power parity, for the base year of 2010. n/a = not available.
Source: European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions; United Nations Framework Convention on Climate Change (UNFCCC) (2015) National Inventory Submissions 2015; Organisation for Economic Co-operation and Development (OECD) (2015) OECD.Stat.

Table A.4. Data for Figure 4. Volatile organic compound emissions by selected country, 2003 and 2013

Countries	2003 volatile organic compounds (kilotonnes)	2013 volatile organic compounds (kilotonnes)	2003 volatile organic compound emissions intensity (tonnes per million US$ GDP)	2013 volatile organic compound emissions intensity (tonnes per million US$ GDP)
Volatile organic compound emissions of top ten emitting OECD member countries in 2013				
United States	15 491	13 227	1.15	0.84
Canada	2898	2131	2.41	1.46
Australia	1403	1216	1.82	1.19
Germany	1361	1138	0.46	0.34
Italy	1349	906	0.66	0.46
Japan	1418	903	0.35	0.20
Turkey	923	868	1.10	0.64
United Kingdom	1292	803	0.62	0.34
France	1406	758	0.65	0.32
Poland	562	636	0.97	0.74
Volatile organic compound emissions of other OECD member countries				
Spain	898	551	0.67	0.39
Sweden	209	174	0.62	0.43
Portugal	224	170	0.83	0.64
New Zealand	165	168	1.39	1.16
Netherlands	185	150	0.28	0.20
Czech Republic	227	149	1.01	0.52
Belgium	157	137	0.42	0.32
Norway	300	134	1.16	0.44
Austria	167	126	0.53	0.35
Hungary	178	120	0.89	0.55
Greece	194	124	0.63	0.47
Denmark	156	114	0.71	0.49
Finland	153	95	0.83	0.46

Countries	2003 volatile organic compounds (kilotonnes)	2013 volatile organic compounds (kilotonnes)	2003 volatile organic compound emissions intensity (tonnes per million US$ GDP)	2013 volatile organic compound emissions intensity (tonnes per million US$ GDP)
Ireland	107	90	0.63	0.44
Switzerland	116	84	0.34	0.20
Slovak Republic	71	63	0.76	0.45
Slovenia	50	33	1.04	0.61
Estonia	43	33	1.76	1.02
Luxembourg	12	8	0.36	0.17
Iceland	7	5	0.71	0.41
Chile	501	n/a	2.20	n/a
Israel	247	n/a	1.52	n/a
Korea	732	n/a	0.65	n/a
Mexico	n/a	n/a	n/a	n/a

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant US$, constant purchasing power parity, for the base year of 2010. n/a = not available.
Source: European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions; United Nations Framework Convention on Climate Change (UNFCCC) (2015) National Inventory Submissions 2015; Organisation for Economic Co-operation and Development (OECD) (2015) OECD.Stat.

Table A.5. Data for Figure 5. Fine particulate matter emissions by selected country, 2003 and 2013

Countries	2003 fine particulate matter emissions (kilotonnes)	2013 fine particulate matter emissions (kilotonnes)	2003 fine particulate matter emissions intensity (tonnes per million US$ GDP)	2013 fine particulate matter emissions intensity (tonnes per million US$ GDP)
Fine particulate matter emissions of top ten emitting OECD member countries in 2013				
United States	5101	4473	0.38	0.28
Canada	1156	1483	0.96	1.02
France	278	181	0.13	0.08
Italy	146	168	0.07	0.09

Countries	2003 fine particulate matter emissions (kilotonnes)	2013 fine particulate matter emissions (kilotonnes)	2003 fine particulate matter emissions intensity (tonnes per million US$ GDP)	2013 fine particulate matter emissions intensity (tonnes per million US$ GDP)
Poland	165	145	0.28	0.17
Germany	144	113	0.05	0.03
United Kingdom	100	80	0.05	0.03
Spain	97	67	0.07	0.05
Portugal	56	44	0.21	0.17
Finland	42	35	0.23	0.17
Fine particulate matter emissions of other OECD member countries				
Belgium	38	33	0.10	0.08
Norway	40	30	0.15	0.10
Hungary	40	30	0.20	0.13
Slovak Republic	28	29	0.30	0.21
Czech Republic	38	26	0.17	0.09
Sweden	26	22	0.08	0.05
Denmark	25	20	0.11	0.08
Estonia	21	20	0.87	0.61
Austria	23	18	0.07	0.05
Ireland	19	16	0.11	0.08
Netherlands	22	13	0.03	0.02
Slovenia	12	12	0.26	0.22
Switzerland	10	8	0.03	0.02
Luxembourg	3	2	0.08	0.05
Iceland	<0.1	<0.1	0.03	0.02
Australia	n/a	n/a	n/a	n/a
Chile	n/a	n/a	n/a	n/a
Greece	n/a	n/a	n/a	n/a
Israel	n/a	n/a	n/a	n/a
Japan	n/a	n/a	n/a	n/a
Korea	n/a	n/a	n/a	n/a

Countries	2003 fine particulate matter emissions (kilotonnes)	2013 fine particulate matter emissions (kilotonnes)	2003 fine particulate matter emissions intensity (tonnes per million US$ GDP)	2013 fine particulate matter emissions intensity (tonnes per million US$ GDP)
Mexico	n/a	n/a	n/a	n/a
New Zealand	n/a	n/a	n/a	n/a
Turkey	n/a	n/a	n/a	n/a

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant US$, constant purchasing power parity, for the base year of 2010. n/a = not available.
Source: European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions; United Nations Framework Convention on Climate Change (UNFCCC) (2015) National Inventory Submissions 2015; Organisation for Economic Co-operation and Development (OECD) (2015) OECD.Stat.

Annex B. Data sources by country, pollutants and years

UNFCCC: Data were retrieved from the National Inventory Submissions 2015 of the United Nations Framework Convention on Climate Change (UNFCCC).

CLRTAP: Data were retrieved from the 2015 submission of the Centre on Emission Inventories and Projections (CEIP) database of the Convention on Long-Range Transboundary Air Pollution (CLRTAP).

OECD: Data from the 2015 Organisation for Economic Co-operation and Development (OECD) "Emission of air pollutant" section of the "Environment (Air and Climate)" grouping from the OECD.Stat. database.

Table B.1. Data sources by country, pollutants and years: sulphur oxides, nitrogen oxides and carbon monoxide

Countries	Sulphur oxides 2003	Sulphur oxides 2013	Nitrogen oxides 2003	Nitrogen oxides 2013	Carbon monoxide 2003	Carbon monoxide 2013
Australia	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
Austria	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Belgium	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Canada	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Chile	OECD	n/a	OECD	n/a	OECD	n/a
Czech Republic	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Denmark	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Estonia	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Finland	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
France	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Germany	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Greece	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
Hungary	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Iceland	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Ireland	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Israel	OECD	n/a	OECD	n/a	OECD	n/a
Italy	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Japan	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
Korea	OECD	n/a	OECD	n/a	OECD	n/a
Luxembourg	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Mexico	n/a	n/a	n/a	n/a	n/a	n/a
Netherlands	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP

Countries	Sulphur oxides 2003	Sulphur oxides 2013	Nitrogen oxides 2003	Nitrogen oxides 2013	Carbon monoxide 2003	Carbon monoxide 2013
New Zealand	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
Norway	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Poland	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Portugal	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Slovak Republic	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Slovenia	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Spain	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Sweden	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Switzerland	CLRTAP	CLRTAP	CLRTAP	CLRTAP	OCDE	OCDE
Turkey	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
United Kingdom	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
United States	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP

Note: n/a = not available.

Table B.2. Data sources by country, pollutants and years: volatile organic compounds and fine particulate matter

Countries	Volatile organic compounds 2003	Volatile organic compounds 2013	Fine particulate matter 2003	Fine particulate matter 2013
Australia	UNFCCC	UNFCCC	n/a	n/a
Austria	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Belgium	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Canada	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Chile	OECD	n/a	n/a	n/a
Czech Republic	CLRTAP	CLRTAP	n/a	CLRTAP
Denmark	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Estonia	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Finland	CLRTAP	CLRTAP	CLRTAP	CLRTAP
France	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Germany	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Greece	UNFCCC	UNFCCC	n/a	n/a

Countries	Volatile organic compounds 2003	Volatile organic compounds 2013	Fine particulate matter 2003	Fine particulate matter 2013
Hungary	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Iceland	CLRTAP	CLRTAP	n/a	n/a
Ireland	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Israel	OECD	n/a	n/a	n/a
Italy	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Japan	UNFCCC	UNFCCC	n/a	n/a
Korea	OECD	n/a	n/a	n/a
Luxembourg	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Mexico	n/a	n/a	n/a	n/a
Netherlands	CLRTAP	CLRTAP	CLRTAP	CLRTAP
New Zealand	UNFCCC	UNFCCC	n/a	n/a
Norway	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Poland	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Portugal	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Slovak Republic	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Slovenia	CLRTAP	UNFCCC	CLRTAP	CLRTAP
Spain	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Sweden	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Switzerland	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Turkey	CLRTAP	CLRTAP	n/a	n/a
United Kingdom	CLRTAP	CLRTAP	CLRTAP	CLRTAP
United States	CLRTAP	CLRTAP	CLRTAP	CLRTAP

Note: n/a = not available.

Annex C. References and additional information

References and further reading

Centre on Emission Inventories and Projections European Monitoring and Evaluation Programme (2015) Centre on Emission Inventories and Projections 2015 submissions. Retrieved on January 21, 2016.

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Organisation for Economic Co-operation and Development (2015) OECD.Stat. Retrieved on January 21, 2016.

United Nations Framework Convention on Climate Change (2015) GHG Emissions Inventory – National Inventory Submissions 2015. Retrieved on January 21, 2016.

Related information

Air Pollutant Emissions

Drivers and Impacts of Air Pollution

www.ec.gc.ca

Additional information can be obtained at:

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