

**CANADIAN INVENTORY OF SO_x, PM_{2.5} AND
PM₁₀ EMISSIONS RESULTING FROM THE
COMBUSTION OF FUEL OILS**

**Lorri Thompson
Fuels Division
Oil, Gas and Energy Branch
Environment Canada**

**and Melanie White
Co-op Student
Ottawa University**

October 2002

TABLE OF CONTENTS

1. INTRODUCTION.....	1
2. BACKGROUND.....	1
2.1 ENVIRONMENT CANADA’S EMISSIONS DATABASE	1
2.2 ENVIRONMENT CANADA’S CRITERIA AIR CONTAMINANT INVENTORY	2
3. METHODOLOGY	2
4. INVENTORY OF CANADIAN EMISSIONS FROM THE USE OF HEAVY FUEL OILS	3
4.1 SULPHUR OXIDE EMISSIONS (HFO)	3
4.2 PM ₁₀ EMISSIONS (HFO).....	8
4.3 PM _{2.5} EMISSIONS (HFO).....	12
5. INVENTORY OF CANADIAN EMISSIONS FROM THE USE OF LIGHT FUEL OILS.....	16
5.1 SULPHUR OXIDE EMISSIONS (LFO).....	16
5.2 PM ₁₀ EMISSIONS (LFO)	20
5.3 PM _{2.5} EMISSIONS (LFO).....	23
6. CONCLUSIONS.....	26
7. APPENDIX 1.....	28
8. APPENDIX 2.....	32
9. APPENDIX 3.....	36

LIST OF TABLES AND FIGURES

FIGURES

Figure 4.1 - 1995 Canadian Estimated Annual SO_x Emissions from HFO use by Sector	6
Figure 4.2 - 1995 Canadian Estimated Annual SO_x Emissions from HFO use by Province.....	7
Figure 4.3 - Sectoral Contribution to the Eastern Provinces Estimated 1995 Annual SO_x Emissions from HFO use.....	8
Figure 4.4 - 1995 Canadian Estimated Annual PM₁₀ from HFO use by Sector.....	10
Figure 4.5 - 1995 Canadian Estimated Annual PM₁₀ Emissions from HFO use by Province.....	11
Figure 4.6 - Sectoral Contribution to the Eastern Provinces Estimated 1995 Annual PM₁₀ Emissions from HFO use.....	12
Figure 4.7 - 1995 Canadian Estimated Annual PM_{2.5} Emissions from HFO use by Sector.....	14
Figure 4.8 - 1995 Canadian Estimated Annual PM_{2.5} Emissions from HFO use by Province.....	15
Figure 4.9 - Sectoral Contribution to the Eastern Provinces Estimated 1995 Annual PM_{2.5} Emissions from HFO use.....	16
Figure 5.1 - 1995 Canadian Estimated Annual SO_x Emissions from LFO use by Sector.....	18
Figure 5.2 - 1995 Canadian Estimated Annual SO_x Emissions from LFO use by Province.....	19
Figure 5.3 - Sectoral Contribution to the Eastern Provinces Estimated 1995 Annual SO_x Emissions from LFO use.....	20
Figure 5.4 - 1995 Canadian Estimated Annual PM₁₀ Emissions from LFO use by Sector.....	22
Figure 5.5 - 1995 Canadian Estimated Annual PM₁₀ Emissions from LFO use by Province.....	23
Figure 5.6 - 1995 Canadian Estimated Annual PM_{2.5} Emissions from LFO use by Sector.....	25
Figure 5.7 - 1995 Canadian Estimated Annual PM_{2.5} Emissions from LFO use by Province.....	26

TABLES

Table A1.1 - Environment Canada's CAC Inventory - 1995 Sulphur Oxides (SOx) Emissions by Province (Tonnes).....	29
Table A1.2 - Environment Canada's CAC Inventory - 1995 Fine Particulate (PM10) Emissions by Province (Tonnes).....	30
Table A1.3 - Environment Canada's CAC Inventory - 1995 Fine Particulate (PM2.5) Emissions by Province (Tonnes).....	31
Table A2.1 - 1995 SOx Emissions from the Combustion of HFO by Province (Tonnes).....	33
Table A2.2 - 1995 PM10 Emissions by Province (Tonnes) from HFO Combustion.....	34
Table A2.3 - 1995 PM2.5 Emissions by Province (Tonnes) from HFO Combustion.....	35
Table A3.1 - 1995 SOx Emissions from the Combustion of LFO by Province (Tonnes).....	37
Table A3.2 - 1995 PM10 Emissions by Province (Tonnes) from LFO Combustion.....	38
Table A3.3 - 1995 PM2.5 Emissions by Province (Tonnes) from LFO Combustion.....	39

1. Introduction

In the “Action on Future Standards for Fuel Oils” as described in *the Federal Agenda on Cleaner Vehicles, Engines and Fuels*¹, Environment Canada indicated its intention to study the benefits and costs of reducing sulphur in fuel oils. To provide background information on this issue, an analysis of the existing emissions of sulphur oxides (SO_x) and particulate matter (PM₁₀ and PM_{2.5}) from the use of fuel oils in Canada was performed.

2. Background

2.1 Environment Canada’s Emissions Database²

The data used for the analysis was provided by the Pollution Data Branch of Environment Canada (EC). Since 1970, EC has measured, solicited, or estimated emissions from many major and minor sources in Canada. Emissions are collated, reconciled, and subsequently reported as comprehensive emissions inventories. Emissions inventories are used to support Canada’s obligations under various domestic and international agreements, protocols and conventions.

Environment Canada’s Residual Discharge Information System (RDIS) database is used to compile and store emissions inventory information consisting primarily of Criteria Air Contaminants (CAC) for the various regions and provinces in Canada. Criteria air contaminants are: Total Particulate Matter (TPM), Particulate Matter less than or equal to 10 Microns (PM₁₀), Particulate Matter less than or equal to 2.5 Microns (PM_{2.5}), Sulphur Oxides (SO_x), Nitrogen Oxides (NO_x), Volatile Organic Compounds (VOC), and Carbon Monoxide (CO).

Assembly of the data archived in RDIS requires the collaborative effort of federal and provincial/territorial governments, with input from private industry, and other non-governmental organizations. The most recent inventory of CAC emissions available is for the year 1995, although the RDIS database has since undergone revision to update emissions factors and estimation methodologies in consultation with stakeholders.

¹ Minister of Environment. A Federal Agenda for Cleaner Vehicles, Engines and Fuels. *Canada Gazette, Part I*, February 17, 2001, pp. 452-457.

² Residual Discharge Information System II 1995 database, version 2, Unpublished, Environment Canada, Pollution Data Branch, Ottawa, ON, May 2002.

RDIS was designed to store information from all point, area, mobile and biogenic (emissions produced by the actions of living organisms) Canadian emission sources, both anthropogenic (caused by human activity) and natural in origin. When source data on specific sources or pollutants is not available, emission factors and statistics are used to estimate the emission levels and are called area sources. The factors used by EC indicate the rate at which a contaminant is released into the environment as the result of a given activity.

The database contains estimates of the mass of substances released from sources based on emission factors and facility data supplied by the individual facilities to the provincial and territorial government bodies. Estimates of PM₁₀ and PM_{2.5} are calculated based on TPM values obtained from provincial and territorial authorities and accepted emission factors applicable to each industrial process type.

2.2 Environment Canada's Criteria Air Contaminant Inventory

Environment Canada publishes comprehensive emissions inventories of criteria air contaminants³ that attempt to account for all the emissions across Canada. Emissions originate from a number of sources, including industrial production, fuel combustion, transportation vehicles, incineration, paved and unpaved roads, forest fires, etc. The published inventories report emissions based on the following categories:

- Industrial Sources;
- Non Industrial Fuel Combustion;
- Transportation;
- Incineration;
- Miscellaneous;
- Open Sources; and
- Biogenic Sources.

3. Methodology

For the purposes of this paper, emissions data was extracted from the RDIS for SO_x, PM₁₀ and PM_{2.5} resulting from the combustion of both light and heavy fuel oils in Canada from point and area sources. Estimates of the mass of contaminants (SO_x, PM₁₀ and PM_{2.5}) released over a one year period were obtained from the database according to source, location, industrial sector (grouped according to *Standard Industrial Classification* code), fuel type and industrial process. These

³ Environment Canada's Criteria Air Contaminant Inventories are published on the Green Lane, Environment Canada's Website at: http://www.ec.gc.ca/pdb/ape/cape_home_e.cfm.

emissions estimates were compiled at the national and provincial levels according to categories used by Environment Canada for reporting purposes. These estimates were then compared with Environment Canada's published CAC Inventories, which can be found in Appendix 1.

4. Inventory of Canadian Emissions from the Use of Heavy Fuel Oils

4.1 Sulphur Oxide Emissions (HFO)

Total annual emissions of sulphur oxides from the use of HFO are estimated to be 206.1 kilotonnes (kt) nationwide, for 1995. This represents 5% of Canada's national Criteria Air Contaminants (CAC) inventory for SO_x, excluding transportation, open and miscellaneous sources. The estimated annual SO_x emissions from HFO use in the various sectors in Canada are presented in Figure 4.1.

Provincial inventories of SO_x emissions from the combustion of HFO can be found in Table A2.1 of Appendix 2. Figure 4.2 presents the portion of the SO_x inventory from HFO use that is attributed to each province. The western provinces (Manitoba, Saskatchewan, Alberta and British Columbia) and the territories account for 3% of emissions while the remaining 97% of SO_x emissions are emitted in the eastern provinces (Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland).

Within the eastern provinces, an estimated 200.8 kt of SO_x are emitted during the combustion of HFO, representing 16% of the eastern provinces' CAC inventory of SO_x emissions, excluding transportation, open and miscellaneous sources. Figure 4.3 presents the portion of the eastern provinces' SO_x inventory from HFO use that is attributed to the various sectors. The largest emitters, accounting for approximately 73% of the HFO inventory in the eastern provinces are the electric power generation⁴, petroleum refining, and pulp and paper sectors⁵.

⁴ Since 1995, two oil-fired plants (approx. 2500 MW or 50% of the total oil-fired capacity) have had their boilers converted to dual-fuel capability. These two plants can burn either natural gas or heavy fuel oil. A third unit (100 MW) has been re-powered to a gas turbine operation fueled with natural gas. Sulphur dioxide emissions from these plants are nearly zero when the plants are fired on natural gas. A fourth oil-fired plant (1050 MW) is in the planning stages of being modified to fire on Orimulsion. The plans are to have this plant equipped with stack gas scrubber for the removal of sulphur dioxide from the flue gas. In total, about 3700 MW (or 75%) of the total oil-fired capacity have, or are about to have, means to reduce sulphur emissions.

⁵ Since 1995, HFO consumption in the pulp and paper industry has declined approximately 7-9%. This decline in consumption is most likely attributed to fuel switching to natural gas due to new availability,

In the western provinces, 43% of emissions from the combustion of HFO is from the following sectors: pulp and paper, commercial fuel combustion and mining and rock quarrying.

The RDIS database reports 548 facilities using HFO. The 10 largest emitters of SO_x, nation wide, represent 39% of all emissions from the combustion of HFO. The 100 largest emitting facilities represent 72% of all emissions of SO_x from the combustion of HFO.

reduction in the energy intensity of production and varying economic conditions. This decrease is not interpreted as a downward trend, but as a specific response to the economic conditions of those periods.

Figure 4.1: Canadian Estimated Annual SOx Emissions from HFO Use by Sector

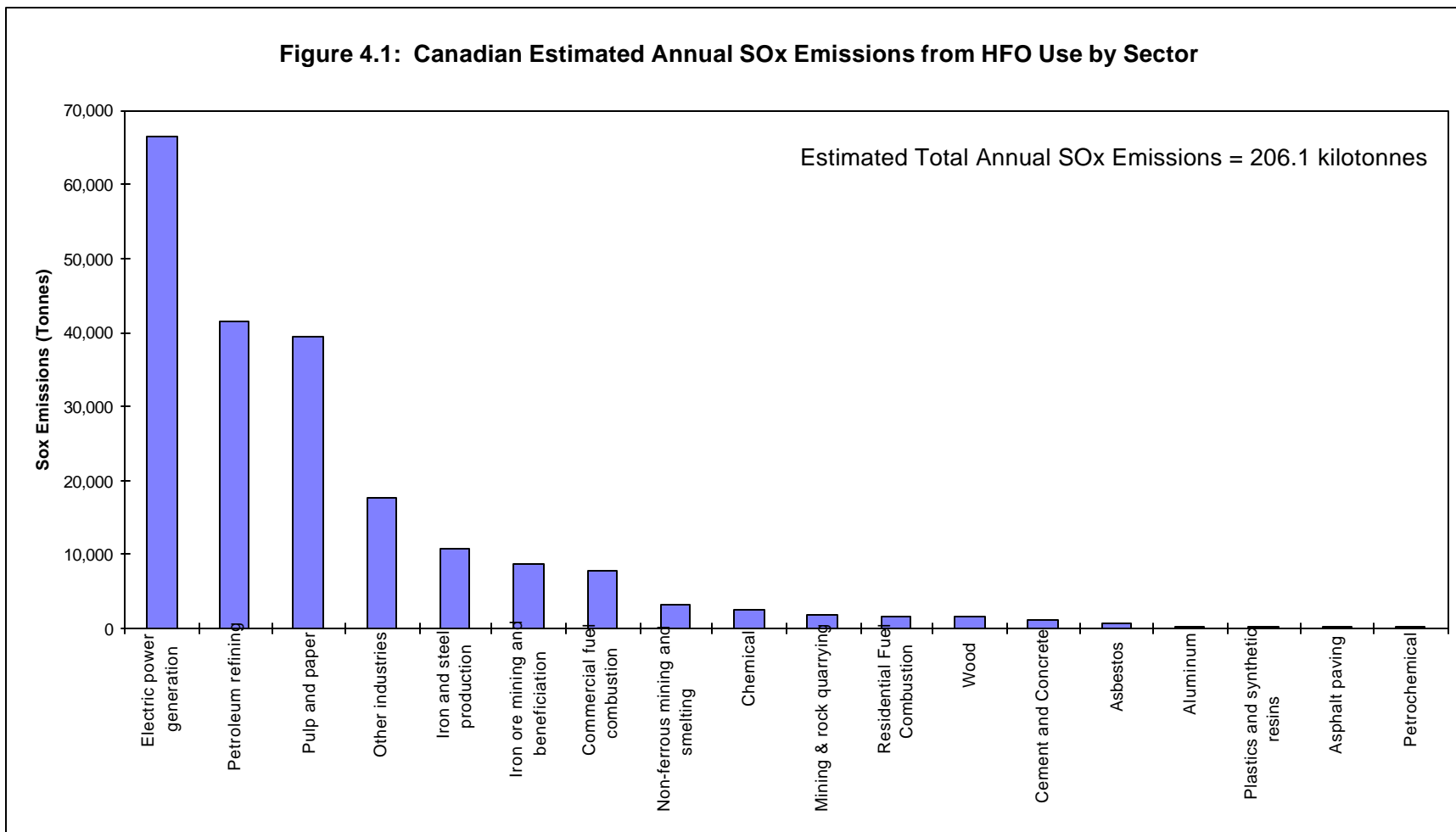
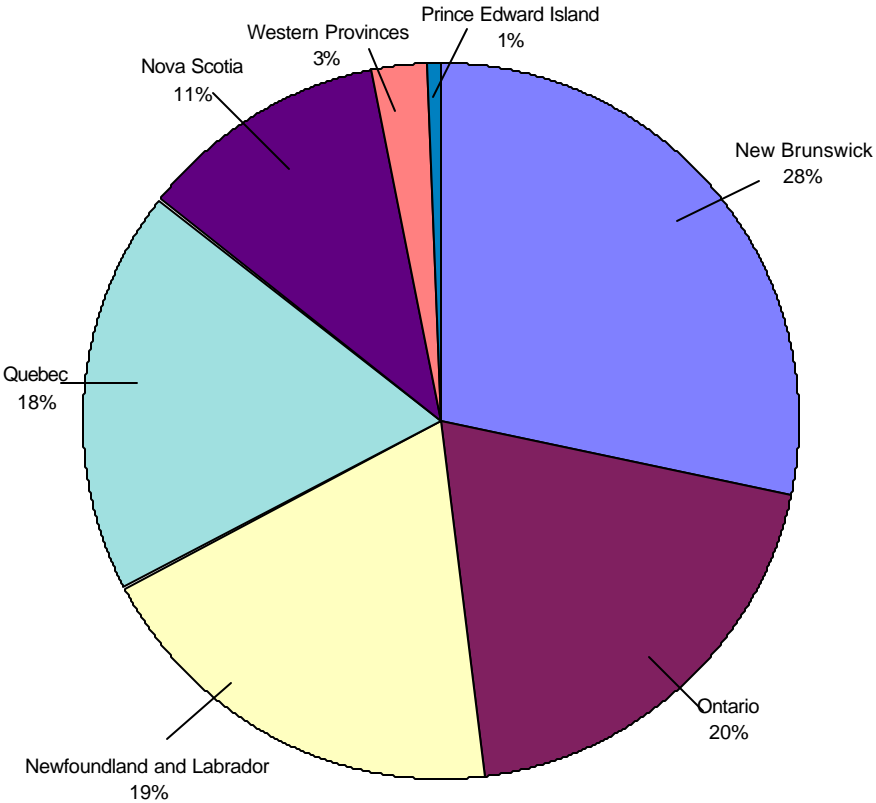
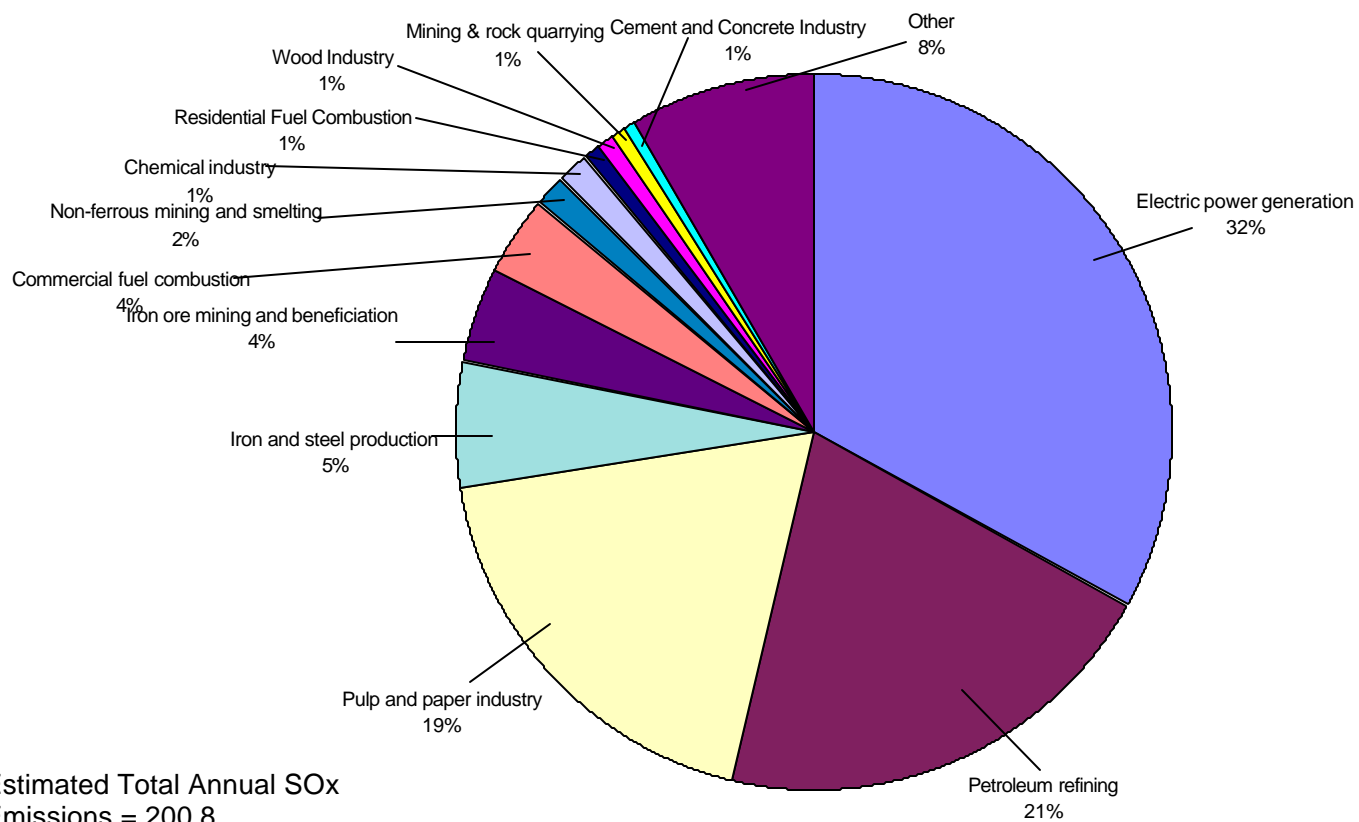


Figure 4.2: Canadian Estimated Annual SOx Emissions from HFO Use by Province



Estimated Total Annual PM10 Emissions = 206.1 kilotonnes

Figure 4.3: Estimated Emissions of SOx in the Eastern Provinces from HFO Use



Estimated Total Annual SOx Emissions = 200.8

4.2 PM₁₀ Emissions (HFO)

Total annual emissions of PM₁₀ from the combustion of HFO are estimated to be 10,951 tonnes nation wide. This represents 3% of Canada's national CAC inventory for PM₁₀, excluding transportation, open and miscellaneous sources. The estimated annual PM₁₀ emissions from HFO use in the various sectors in Canada are presented in Figure 4.4.

Provincial inventories of PM₁₀ emissions from the combustion of HFO can be found in Table A2.2 of Appendix 2. The portion of the PM₁₀ inventory that is attributed to each province is presented in Figure 4.5. The western provinces account for 3% of emissions, while the remaining 97% is in the eastern provinces.

Within the eastern provinces, an estimated 10,630 tonnes of PM₁₀ are emitted annually during the combustion of HFO. This represents 4% of the eastern provinces' CAC inventory for PM₁₀, excluding transportation, open and miscellaneous sources. Figure 4.6 presents the sectors in eastern provinces that emit PM₁₀ from the combustion of HFO, of which approximately 72% comes from the pulp and paper⁶, electric power and petroleum refining sectors.

The western provinces emit an estimated 321 tonnes of PM₁₀ annually from a variety of sources.

Of the 548 facilities in the RDIS database that report the use of HFO, the 10 largest emitters of PM₁₀ represent 47% of the total PM₁₀ inventory from the combustion of HFO. The 100 largest emitting facilities represent 79% of all emissions .

⁶ The large percentage of PM emissions reported from the combustion of HFO in the pulp and paper sector can be attributed to the inclusion of other process variables in the facility data reported to provincial/territorial authorities. These emissions are considered to be caused by either the primary fuel source, such as the combustion of wood waste in power boilers, or process losses in lime kilns from the calcination process.

Figure 4.4: Canadian Estimated Annual PM10 Emissions from HFO Use by Sector

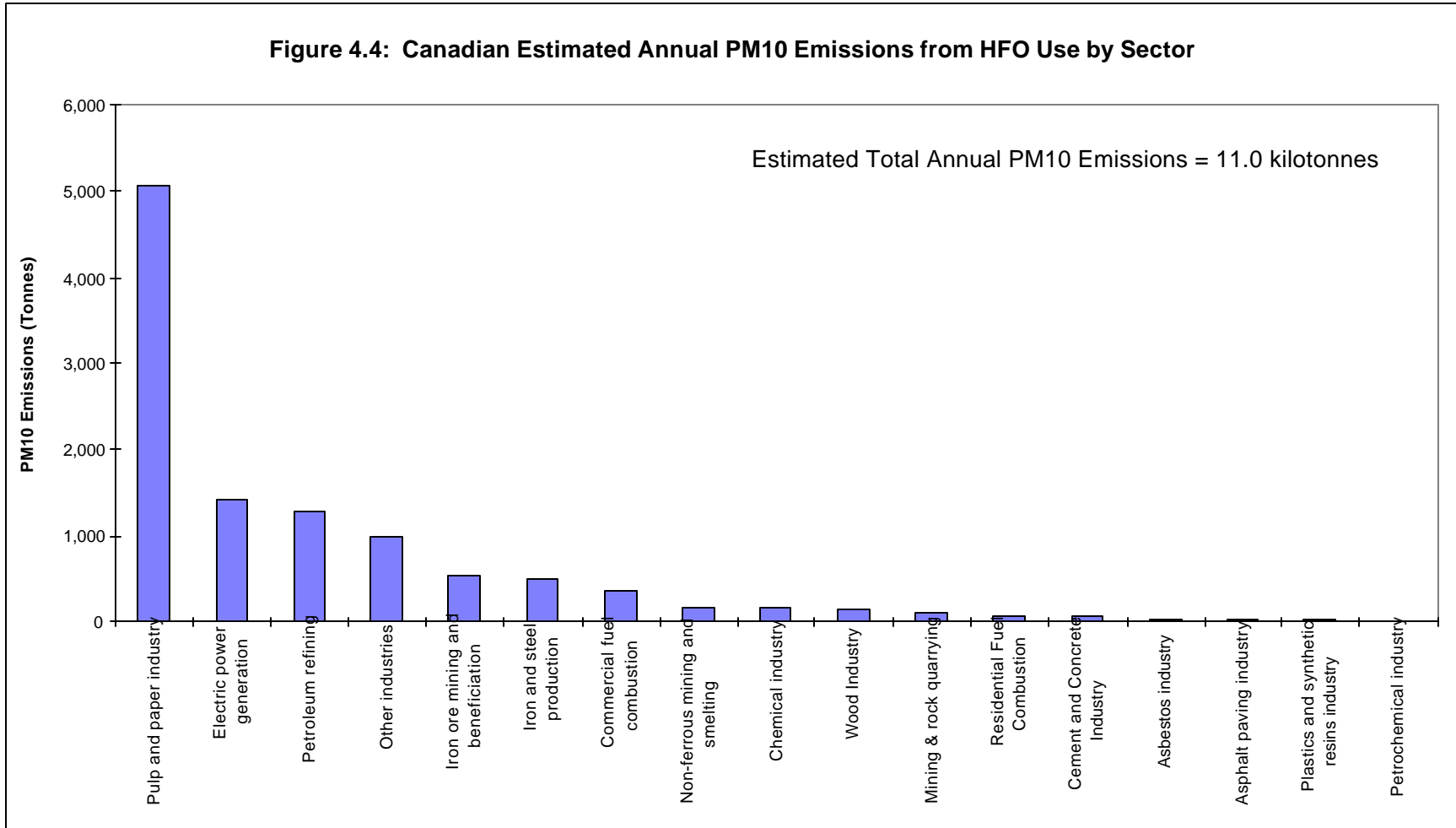
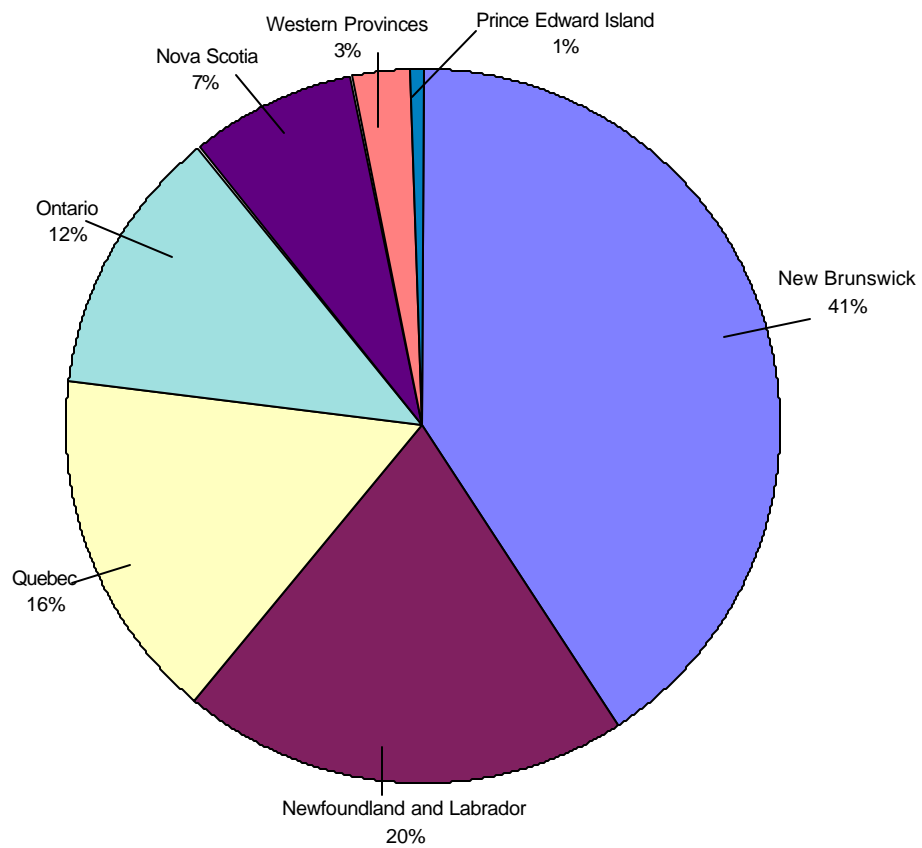
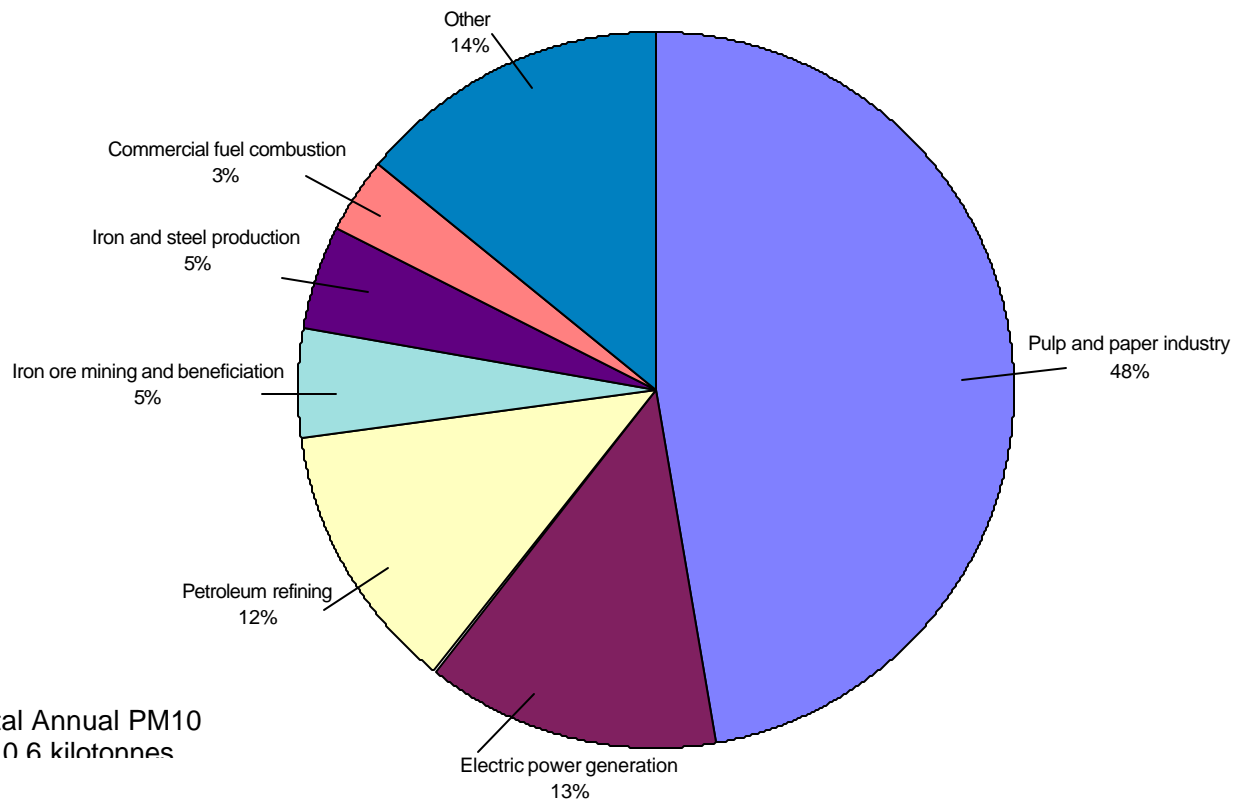


Figure 4.5: Canadian Estimated Annual PM10 Emissions from HFO Use by Province



Estimated Total Annual PM10 Emissions = 11.0 kilotonnes

Figure 4.6: Sectoral Contribution to the Eastern Provinces Estimated Annual PM10 Emissions from HFO Use



Estimated Total Annual PM10 Emissions = 10.6 kilotonnes

4.3 $PM_{2.5}$ Emissions (HFO)

Total annual emissions of $PM_{2.5}$ from the combustion of HFO are estimated to be 6,924 tonnes nation wide. This represents 3% of Canada's national CAC inventory for $PM_{2.5}$, excluding transportation, open and miscellaneous sources. The estimated annual $PM_{2.5}$ emissions from HFO use in the various sectors in Canada are presented in Figure 4.7.

Provincial inventories of $PM_{2.5}$ emissions from the combustion of HFO can be found in Table A2.3 of Appendix 2. Figure 4.8 presents the provincial breakdown of $PM_{2.5}$ emissions from HFO use. The western provinces account for 2% of emissions. The remaining 98% of $PM_{2.5}$ emissions are in the eastern provinces.

Within the eastern provinces, an estimated 6,745 tonnes of $PM_{2.5}$ are emitted annually during the combustion of HFO, representing 4% of the eastern provinces' CAC inventory for $PM_{2.5}$, excluding transportation, open and miscellaneous sources. The breakdown of the various sectors in the eastern provinces emitting $PM_{2.5}$ inventory from HFO use is presented in Figure 4.9. Approximately 73% of these emissions comes from the pulp and paper, electric power and petroleum refining sectors.

Within the western provinces, an estimated 178 tonnes from a variety of sources.

Of the 548 facilities in the RDIS database that report the use of HFO, the 10 largest emitters of $PM_{2.5}$ represent 48% of the total $PM_{2.5}$ inventory from the combustion of HFO. The 100 largest emitting facilities represent 80% of all emissions .

Figure 4.7: Canadian Estimated Annual PM2.5 Emissions from HFO Use by Sector

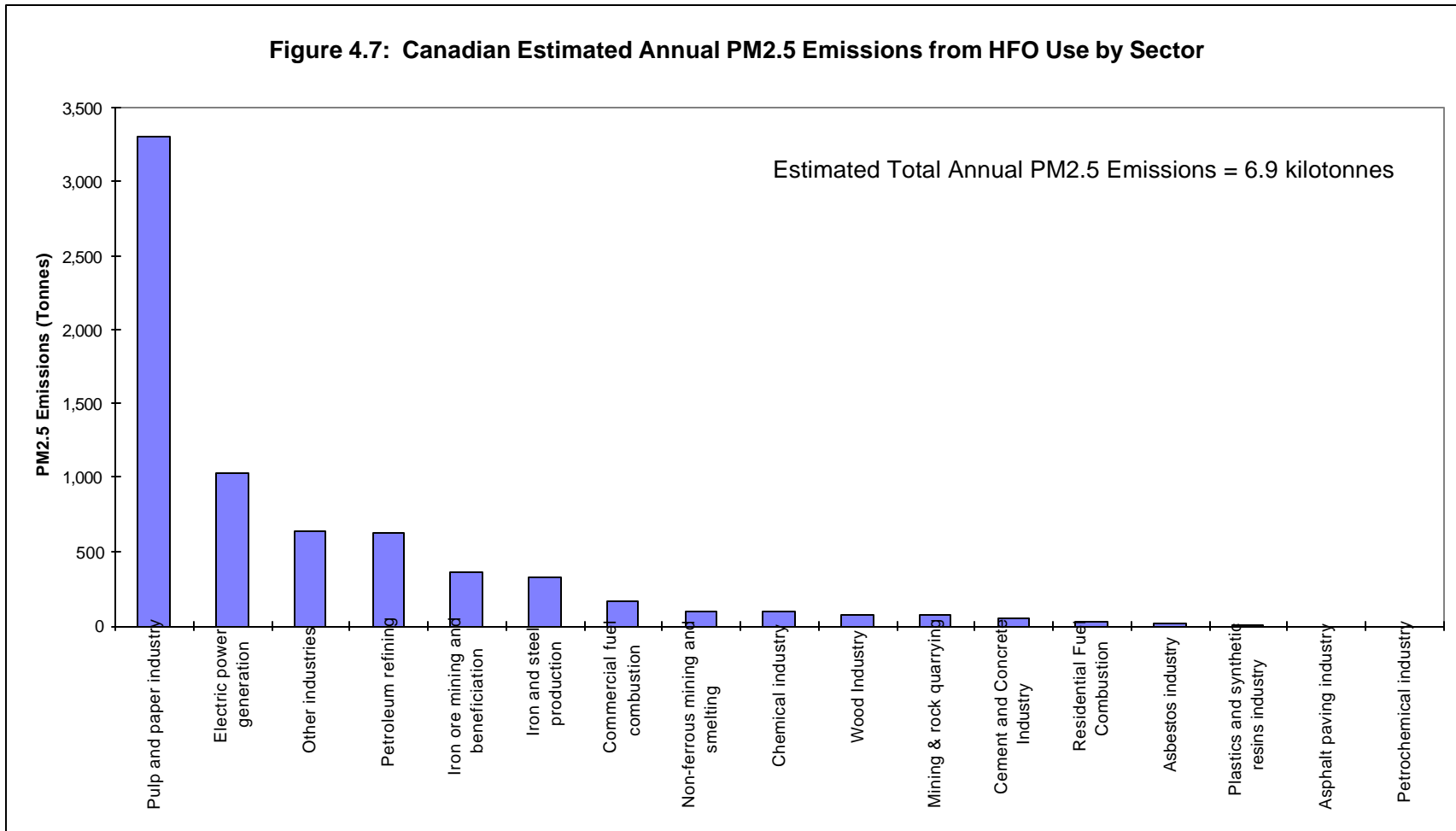
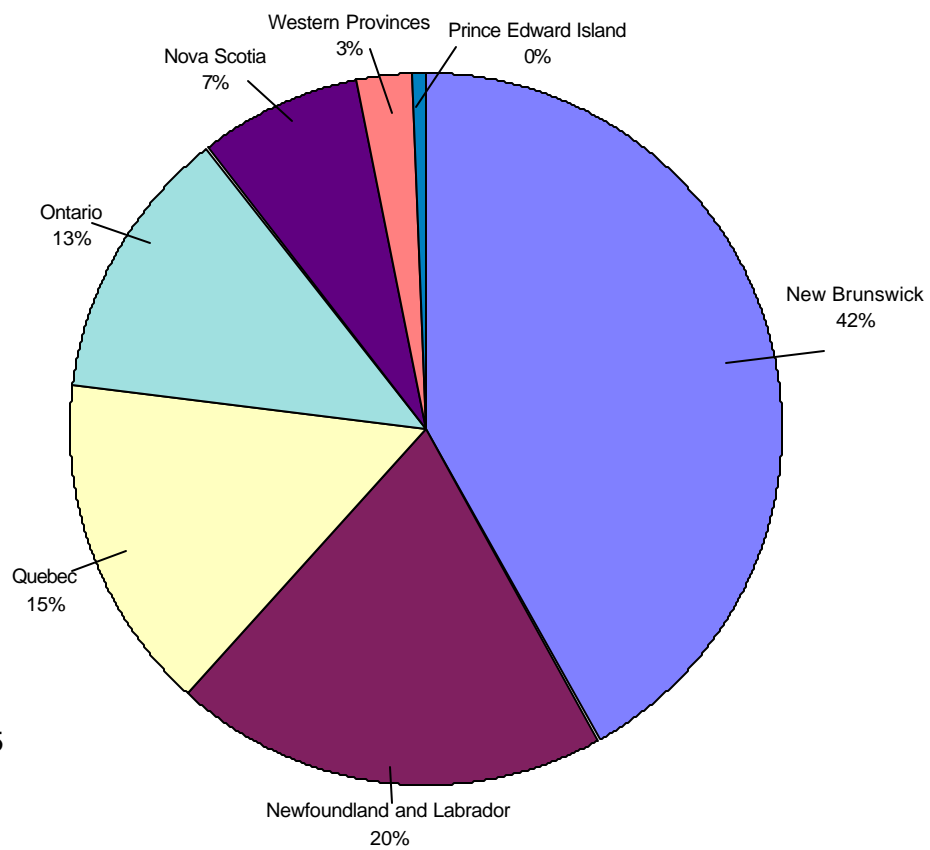
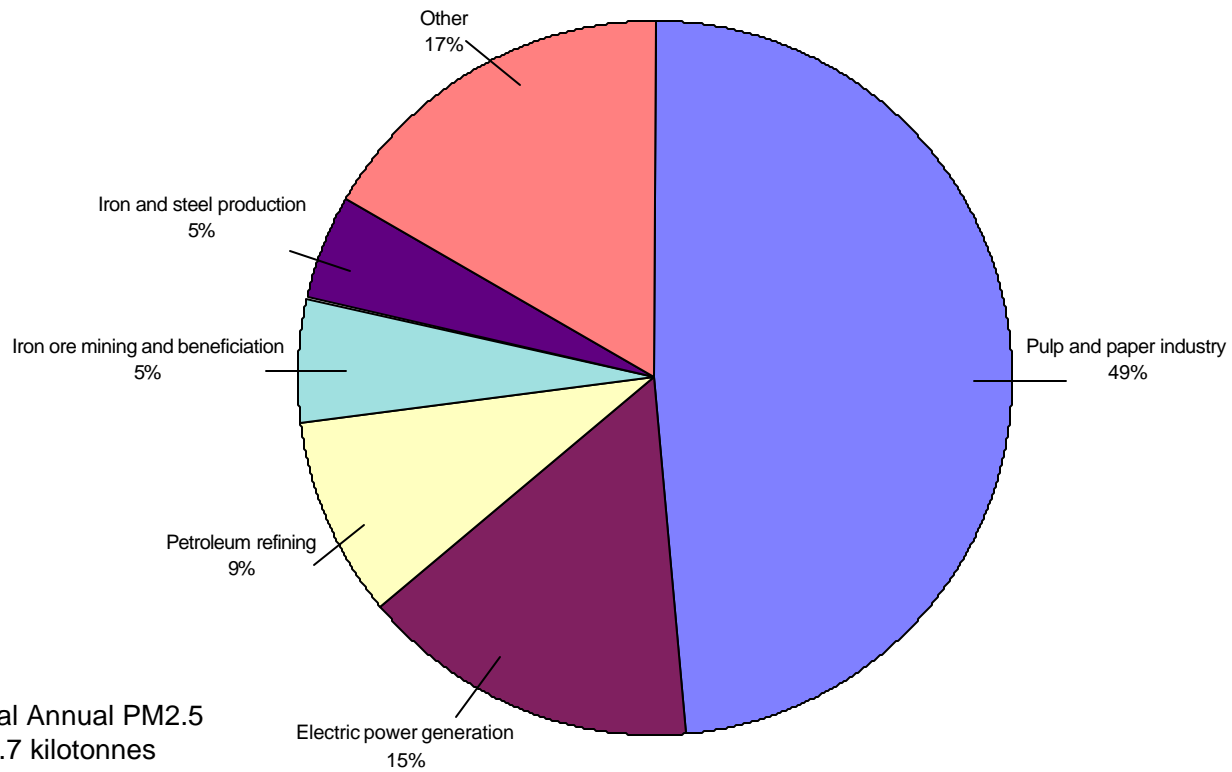


Figure 4.8: Canadian Estimated Annual PM2.5 Emissions from HFO Use by Province



Estimated Total Annual PM2.5 Emissions = 6.9 kilotonnes

Figure 4.9: Estimated Emissions of PM2.5 in the Eastern Provinces from HFO Use



Estimated Total Annual PM2.5 Emissions = 6.7 kilotonnes

5. Inventory of Canadian Emissions from the Use of Light Fuel Oils

5.1 Sulphur Oxide Emissions (LFO)

Total annual emissions of sulphur oxides from the use of LFO are estimated to be 21,435 tonnes nationwide, representing 1% of Canada's national CAC inventory for SO_x, excluding transportation, open and miscellaneous sources. The estimated annual SO_x emissions from LFO use in the various sectors in Canada are presented in Figure 5.1.

Provincial inventories of SO_x emissions from the combustion of LFO can be found in Table A3.1 of Appendix 3. Figure 5.2 presents the portion of the SO_x inventory from LFO use that is attributed to each province. The western provinces account for 6% of SO_x emissions while the remaining 94% are emitted in the eastern provinces.

Within the eastern provinces, an estimated 20,171 tonnes of SO_x are emitted during the combustion of LFO. This represents 2% of the eastern provinces' CAC inventory of SO_x emissions, excluding transportation, open and miscellaneous sources. The portion of the eastern provinces' SO_x inventory from LFO use that is attributed to the various sectors is presented in Figure 5.3. The residential fuel combustion, commercial fuel combustion and pulp and paper sectors contribute approximately 90% of the LFO SO_x inventory for these provinces.

In the western provinces, the largest emitter of SO_x from the combustion of LFO is the commercial and residential. These sectors accounts for 45% of the national LFO inventory of SO_x emissions.

The RDIS database reports 647 facilities using LFO. The 10 largest emitters of SO_x, nation wide, represent 24% of all emissions from the combustion of LFO. The 100 largest emitting facilities represent 28% of all emissions of SO_x from the combustion of LFO.

Figure 5.1: Canadian Estimated Annual SOx Emissions from LFO Use by Sector

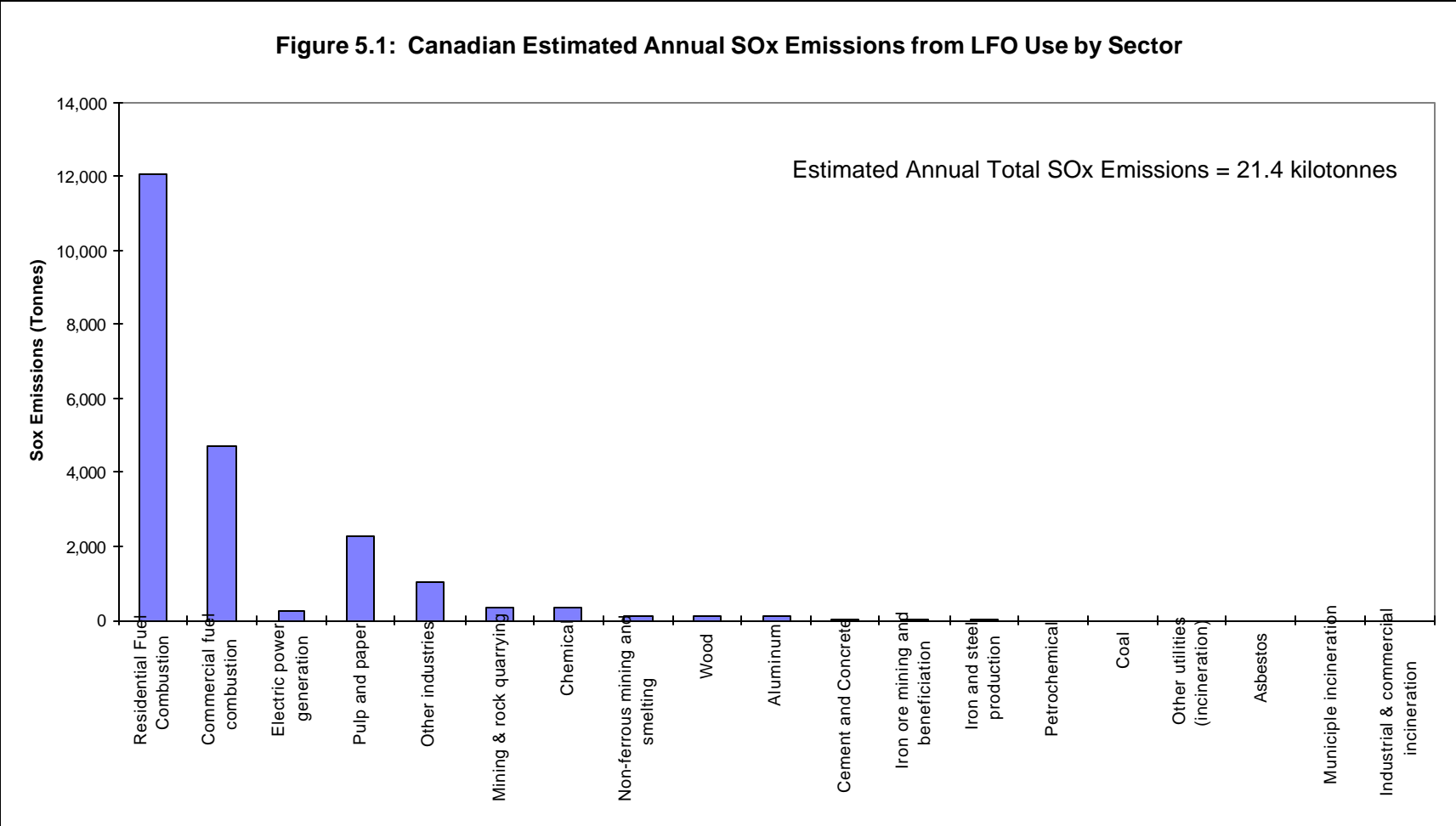
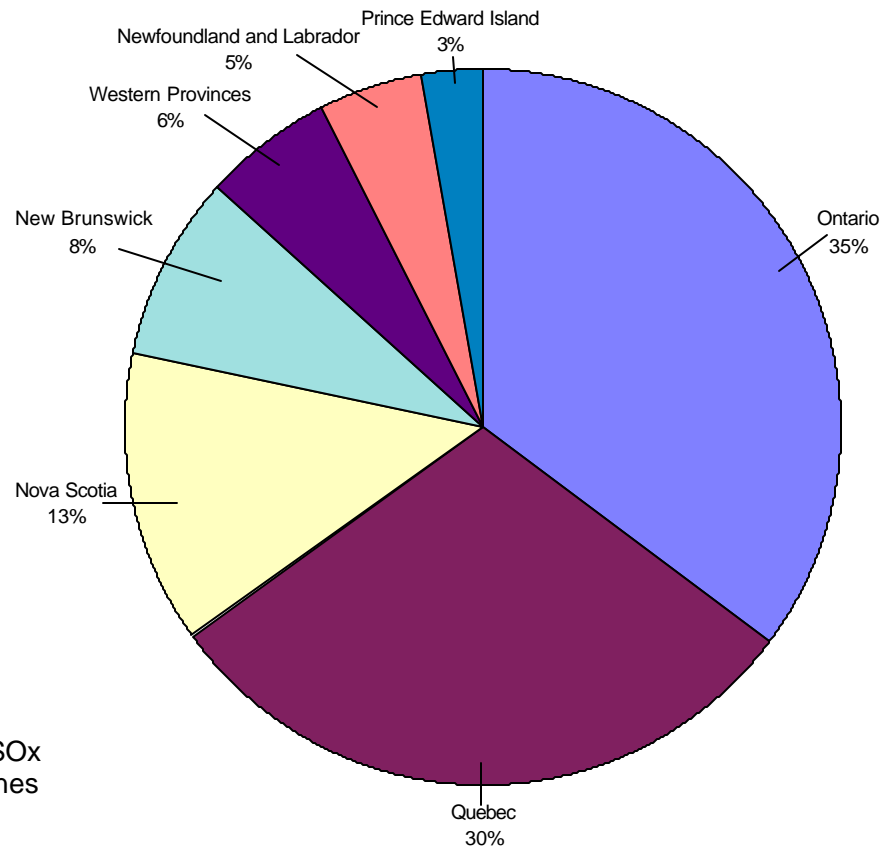
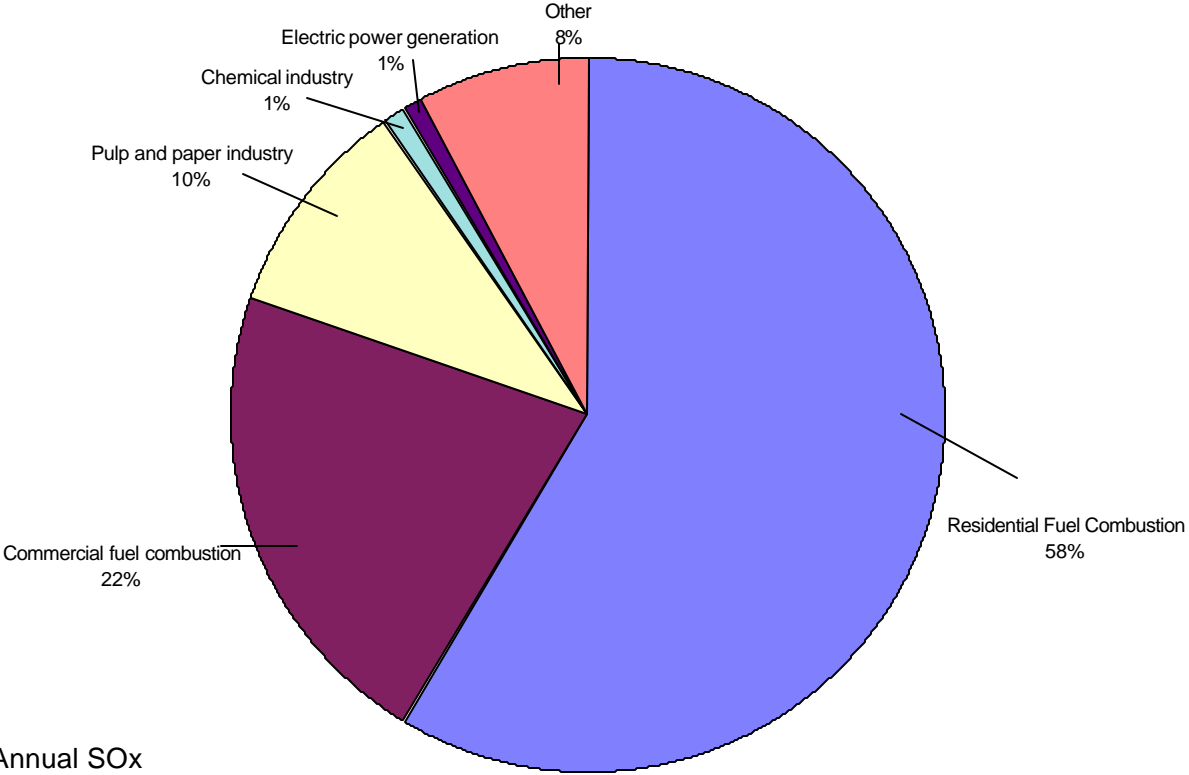


Figure 5.2: Canadian Estimated Annual SO_x Emissions from LFO Use by Province



Estimated Total Annual SO_x Emissions = 21.4 kilotonnes

Figure 5.3: Estimated Emissions of SOx in the Eastern Provinces from LFO Use



Estimated Total Annual SOx Emissions = 20.2 kilotonnes

5.2 PM_{10} Emissions (LFO)

Total annual emissions of PM_{10} from the combustion of LFO are estimated to be 933 tonnes nation wide, representing 0.2% of Canada's national CAC inventory for PM_{10} , excluding transportation, open and miscellaneous sources. The estimated annual PM_{10} emissions from LFO use in the various sectors in Canada are presented in Figure 5.4.

Provincial inventories of PM_{10} emissions from LFO use can be found in Table A3.2 of Appendix 3. The portion of the PM_{10} inventory that is attributed to each province is presented in Figure 5.5.

Within the eastern provinces, an estimated 647 tonnes of PM_{10} are emitted annually during the combustion of LFO. The largest emitters of PM_{10} in the eastern provinces are the residential fuels combustion and commercial fuel combustion sectors. They contribute 94% of the eastern PM_{10} inventory for LFO.

The western provinces emit an estimated 286 tonnes of PM_{10} annually, with the pulp and paper sector being the largest emitter. This sector contribute 87% of the western PM_{10} inventory for LFO.

Of the 647 facilities in the RDIS database that report the use of LFO, the 10 largest emitters of PM_{10} represent 15% of the total PM_{10} inventory from the combustion of LFO. The 100 largest emitting facilities emitting PM_{10} represent 25% of all emissions .

Figure 5.4: Canadian Estimated Annual PM10 Emissions from LFO Use by Sector

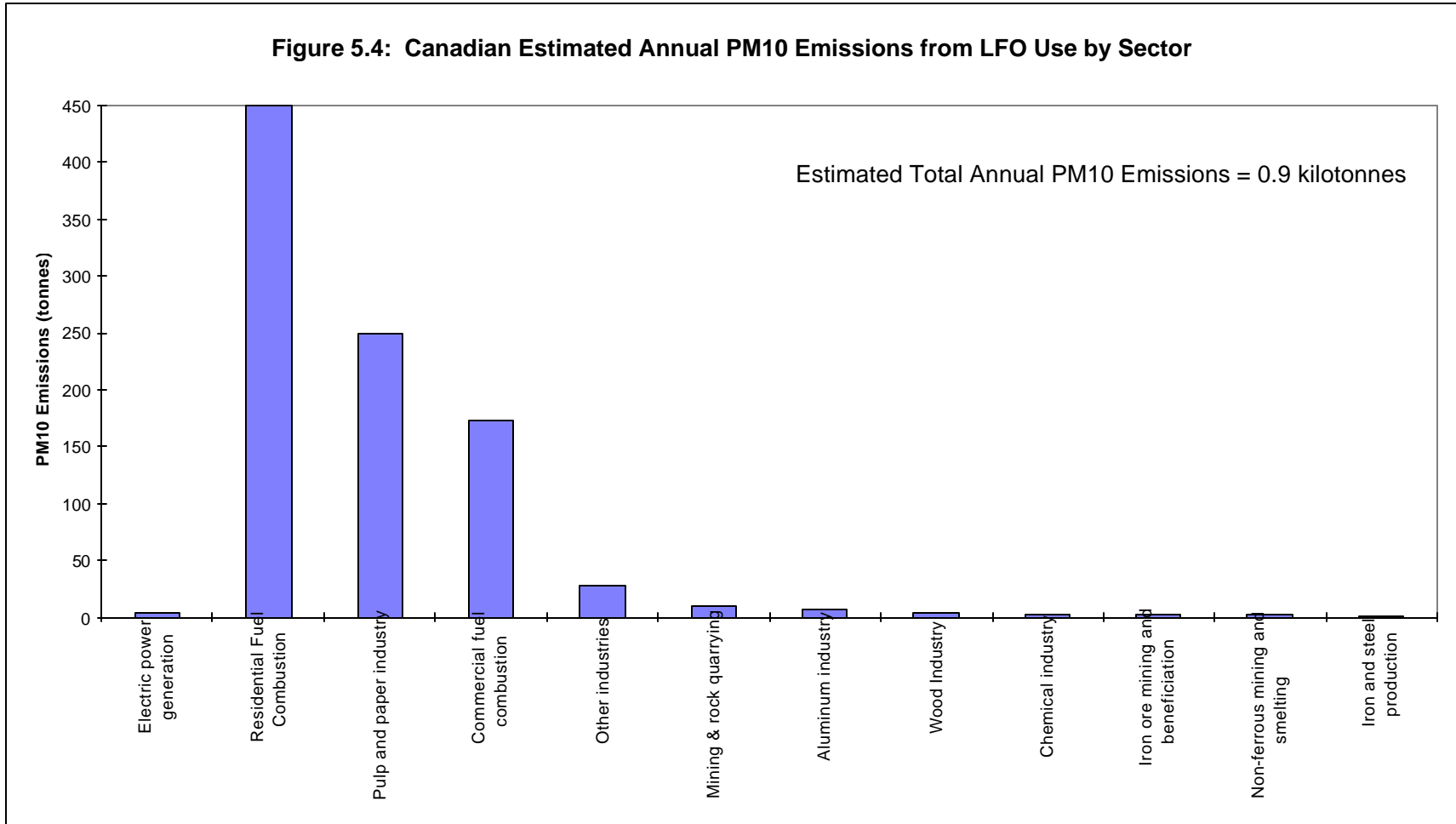
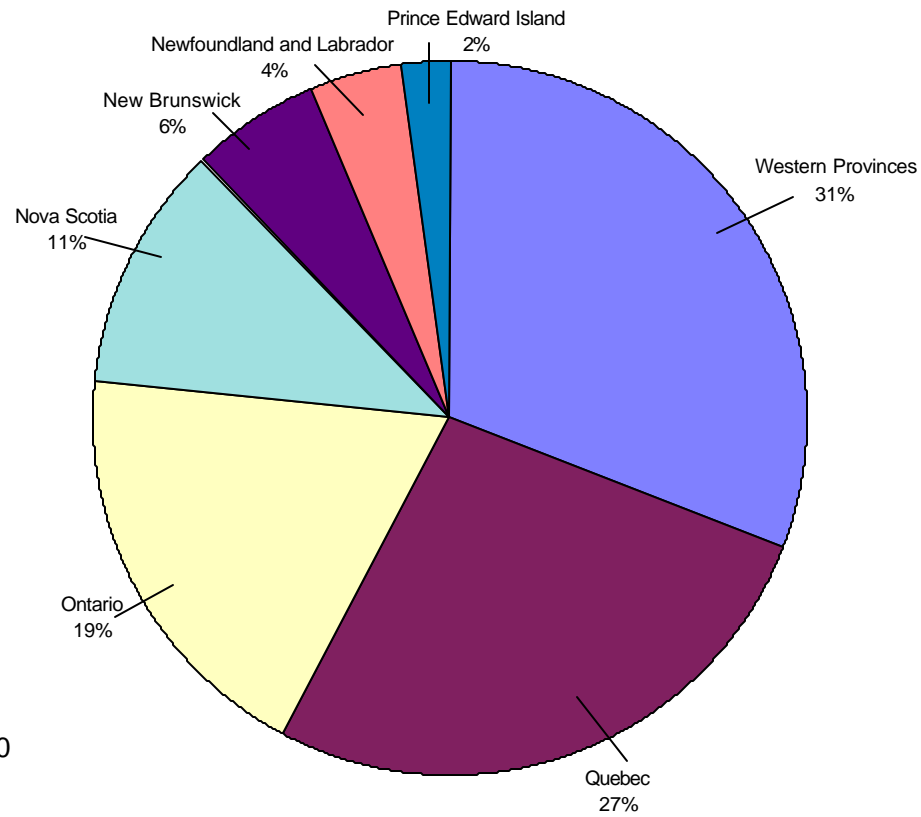


Figure 5.5: Canadian Estimated Annual PM10 Emissions from LFO Use by Province



Estimated Total Annual PM10
Emissions = 0.9 kilotonnes

5.3 $PM_{2.5}$ Emissions (LFO)

Total annual emissions of $PM_{2.5}$ from the combustion of LFO are estimated to be 560 tonnes nation wide. This represents 1.6% of Canada's national CAC inventory for $PM_{2.5}$, excluding transportation, open and miscellaneous sources. The estimated annual $PM_{2.5}$ emissions from LFO use in the various sectors in Canada are presented in Figure 5.6.

Provincial inventories of $PM_{2.5}$ emissions from the combustion of LFO can be found in Table A3.3 of Appendix 3. The portion of the LFO inventory that is attributed to each province is presented in Figure 5.7. The western provinces account for 85% of emissions and the eastern provinces account for the remaining 15%.

Within the eastern provinces, an estimated 478 tonnes of $PM_{2.5}$ are emitted annually during the combustion of LFO. The largest emitters of $PM_{2.5}$ are the residential fuels combustion and commercial fuel combustion sectors. They contribute 97% of the eastern $PM_{2.5}$ inventory for LFO.

The western provinces emit an estimated 81 tonnes of $PM_{2.5}$ annually, with the pulp and paper sector being the largest emitter. This sector contribute 73% of the western $PM_{2.5}$ inventory for LFO.

Of the 647 facilities in the RDIS database that report the use of LFO, the 10 largest emitters of $PM_{2.5}$ represent 15% of the total PM_{10} inventory from the combustion of LFO. The 100 largest emitting facilities emitting PM_{10} represent 25% of all emissions .

Figure 5.6: Canadian Estimated Annual PM2.5 Emissions from LFO Use by Sector

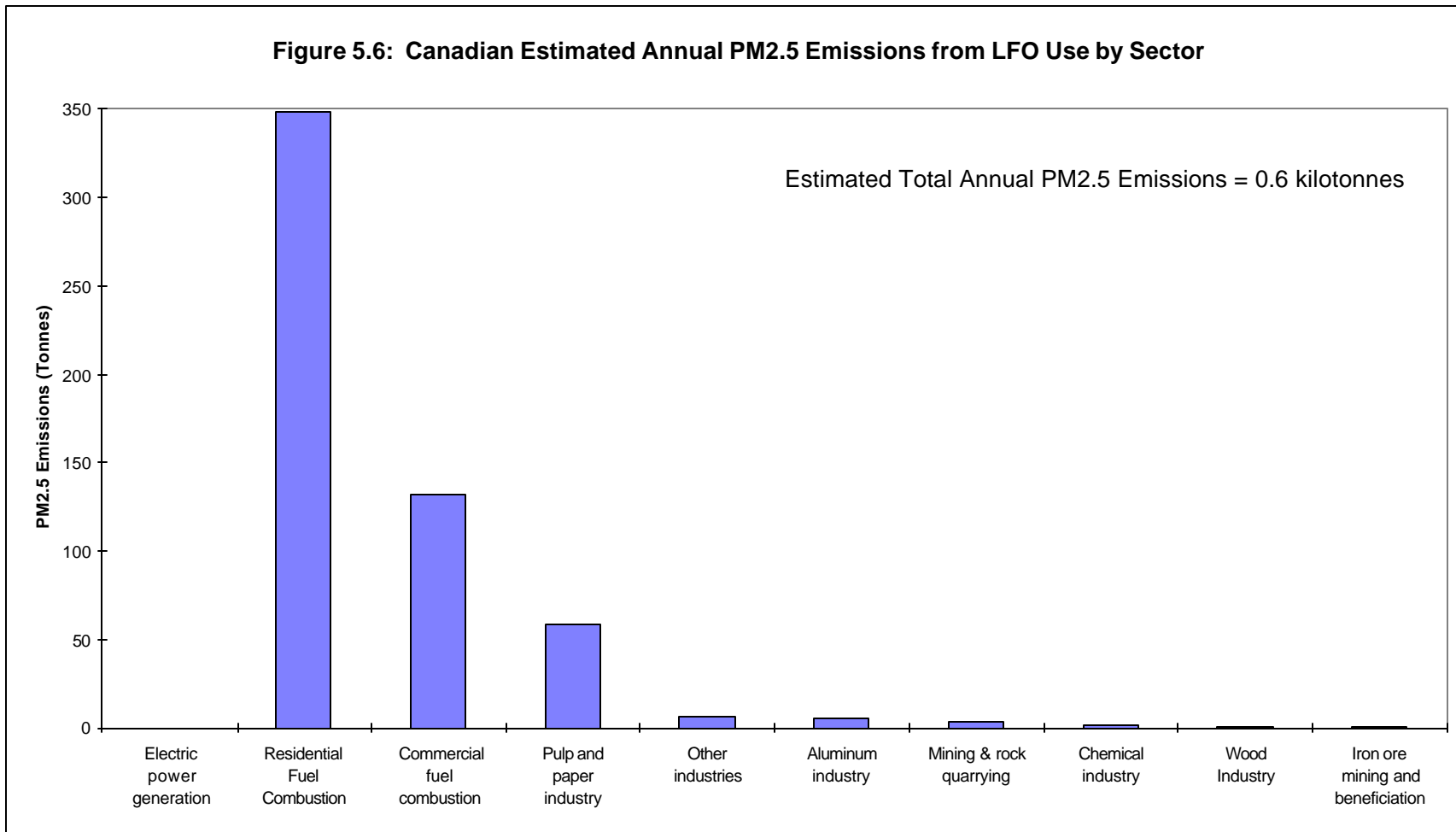
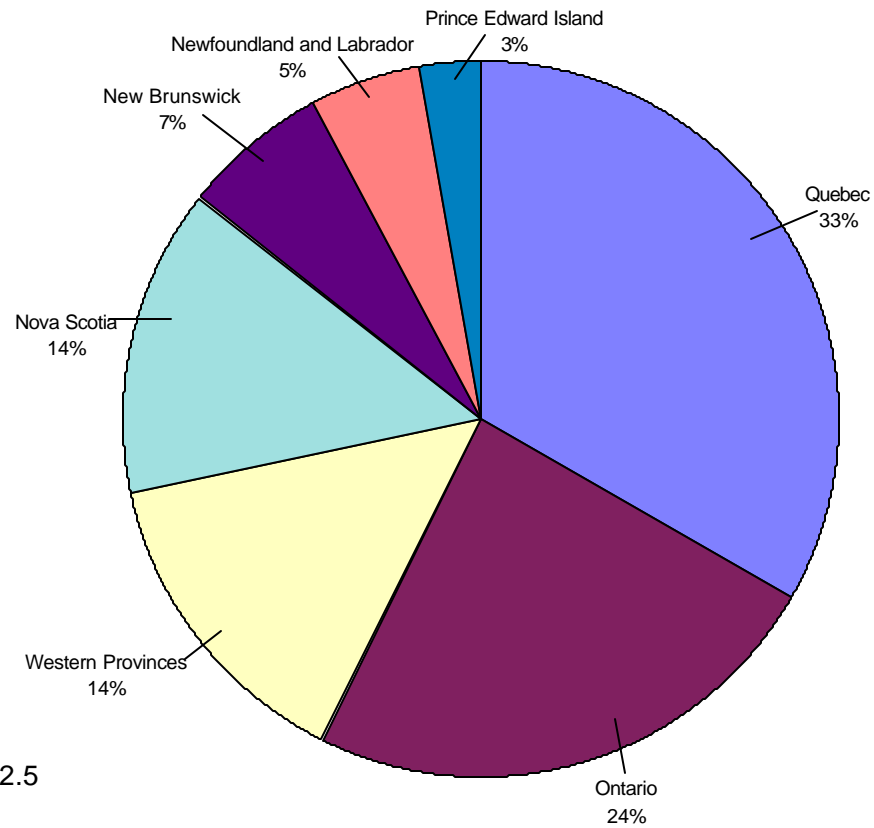


Figure 5.7: Canadian Estimated Annual PM2.5 Emissions from LFO Use by Province



Estimated Total Annual PM2.5
Emissions = 0.6 kilotonnes

6. Conclusions

National emissions of sulphur oxides from the combustion of HFO are estimated to be 206.1 kt per year and 21.4 kt per year from the combustion of LFO. The majority of these emissions, 97% of HFO and 94% of LFO, are concentrated in the eastern provinces of Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland.

Excluding transportation, open and miscellaneous sources, the combustion of fuel oils in the eastern provinces accounts for 16% of all eastern SO_x emissions. The sectors having a significant contribution to SO_x emissions from the use of HFO in eastern Canada are the electric power generation, petroleum refining and pulp and paper sectors. These three sectors combined account for 73% of the eastern SO_x inventory from HFO use. They are also the largest emitters of PM₁₀ and PM_{2.5} attributed to the combustion of HFO in the east.

Most of the SO_x, PM₁₀ and PM_{2.5} emissions from the combustion of LFO in the eastern provinces is from residential and commercial use. Residential and commercial use are responsible for a combined 80% of the SO_x inventory in the east from LFO use. In Western Canada, most PM₁₀ and PM_{2.5} emissions attributed to the combustion of LFO are found in Alberta and are attributed to the pulp and paper sector.

Appendix 1

Environment Canada's 1995 Published Criteria Air Contaminant Inventories for SO_x, PM₁₀ and PM_{2.5}

Table A1.1: Environment Canada's CAC Inventory - 1995 Sulphur Oxides (SOx) Emissions by Province (Tonnes)

CATEGORY / SECTOR / PROVINCES	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC	YUK	NWT	CANADA
INDUSTRIAL SOURCES													
Abrasives Manufacture					2,807	20							2,827
Aluminum Industry					42,102	1			2,419	1,713			46,236
Asbestos Industry					763								763
Asphalt Paving Industry				540		150				1,694			2,384
Bakeries													
Cement and Concrete Industry	31				8,424	20,838		486	3,094	1,112			33,984
Chemicals Industry				56	328	3,794	34	1	1,890	327			6,430
Clay Products Industry						3		31					34
Coal Mining Industry			146						2,336	2,839			5,321
Ferrous Foundries					1,623	50							1,673
Grain Industries											1		1
Iron and Steel Industries					15,015	47,645	53		81	6			62,801
Iron Ore Mining Industry	10,650					44,000							54,650
Mining and Rock Quarrying			80	1,060	63	1,680	138	24	447	2,483	5	14,790	20,770
Non-Ferrous Mining and Smelting Industry				13,749	217,543	287,521	357,766			15,141			891,720
Oil Sands									160,948				160,948
Other Petroleum and Coal Products Industry						96		482					578
Paint & Varnish Manufacturing													
Petrochemical Industry					120	706	178		271				1,275
Petroleum Refining	28,934		7,056	16,943	61,595		4,562	15,232	6,764				141,086
Plastics & Synthetic Resins Fabrication				159	109					4			272
Pulp and Paper Industry	3,070		7,283	12,258	21,756	11,647	2,504	47	3,840	14,624			77,030
Upstream Oil and Gas Industry								10,908	276,477	99,876			387,261
Wood Industry			251	798	635	310	57	7	1	561			2,621
Other Industries	471	916	12,962	5,177	8,091	18,055	530	1,820	234	604	5	87	48,953
TOTAL INDUSTRIAL SOURCES	43,156	916	20,722	40,695	336,373	498,220	361,261	18,368	467,270	147,750	10	14,877	1,949,617
NON INDUSTRIAL FUEL COMBUSTION													
Commercial Fuel Combustion	940	198	3,359	2,348	2,283	2,734	65	151	389	248	74	225	13,014
Electric Power Generation (Utilities)	15,704	294	134,883	67,330	283	74,730	1,361	108,536	130,471	369	46	317	534,323
Residential Fuel Combustion	715	372	4,368	1,399	4,938	4,502	76	93	317	432	25	32	17,270
Residential Fuel Wood Combustion	149	23	187	170	554	346	64	52	108	175	3	7	1,837
TOTAL NON INDUSTRIAL FUEL COMBUSTION	17,507	887	142,798	71,247	8,058	82,312	1,566	108,833	131,285	1,224	147	580	566,445
TRANSPORTATION													
TOTAL TRANSPORTATION	4,319	712	3,449	3,590	28,696	51,777	2,568	3,797	9,453	26,948	239	138	135,686
INCINERATION													
Crematorium					1	2							3
Industrial & Commercial Incineration	20	26	30		332	188			7				603
Municipal Incineration	7	6	71		162	57				131		23	457
Wood Waste Incineration	4		1	11		13	1	1	10				42
Other Incineration & Utilities		1			3	142				3			149
TOTAL INCINERATION	31	32	103	11	498	403	1	1	17	133	0	23	1,253
MISCELLANEOUS													
Cigarette Smoking													
Dry Cleaning													
Fuel Marketing										2			2
General Solvent Use													
Marine Cargo Handling Industry													
Meat Cooking													
Pesticides and Fertilizer Application													
Printing													
Structural Fires													
Surface Coatings													
TOTAL MISCELLANEOUS	0	0	0	0	0	0	0	0	0	2	0	0	2
OPEN SOURCES													
Agriculture (Animals)													
Agriculture Tilling and Wind Erosion													
Construction Operations													
Dust from Paved Roads**													
Dust from Unpaved Roads**													
Forest Fires					22	41	79	102	32	14	16	172	478
Landfills Sites													
Mine Tailings													
Prescribed Burning	1					9			43	39			92
TOTAL OPEN SOURCES	1	0	0	0	22	50	79	102	75	53	16	172	569
PROVINCIAL TOTAL													
TOTAL WITH OPEN SOURCES	65,014	2,547	167,071	115,542	373,647	632,762	365,475	131,100	608,100	176,111	412	15,791	2,653,571
TOTAL WITHOUT OPEN SOURCES	65,014	2,547	167,071	115,542	373,625	632,712	365,396	130,999	608,025	176,057	396	15,619	2,653,002

Notes:

1. Numbers may not add to totals, due to rounding.
2. The 1995 emissions inventory was compiled with the latest technical and statistical information available, only the Sulphur Oxides emissions can be compared to previous emissions inventories.
3. The Ontario estimates include the emissions from propane vehicles.

Table A1.2: Environment Canada's CAC Inventory - 1995 Fine Particulate (PM10) Emissions by Province (Tonnes)

CATEGORY / SECTOR / PROVINCES	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC	YUK	NWT	CANADA
INDUSTRIAL SOURCES													
Abrasives Manufacture					336	25							361
Aluminum Industry					5,553	120				2,114			7,787
Asbestos Industry					43					5			48
Asphalt Paving Industry	59	126	421	1,275	314	1,664	241	436	426	438	56	3	5,460
Bakeries													
Cement and Concrete Industry	633	4		27	1,059	4,058	144	1,351	465	739	2	5	8,486
Chemicals Industry				3	25	1,104	142	166	874	297			2,611
Clay Products Industry	3		16		57	14		371	22	139			622
Coal Mining Industry			229	17		420	657	1,480	4,048	1,999			8,849
Ferrous Foundries		1	3	24	315	27			70	9			448
Grain Industries			41	25	1,083	3,087	1,191	3,724	2,328	249			11,729
Iron and Steel Industries					2,663	7,971	26		6	146			10,813
Iron Ore Mining Industry	21,122					168							21,290
Mining and Rock Quarrying	56		633	539	1,701	6,037	289	325	194	1,365	105	264	11,508
Non-Ferrous Mining and Smelting Industry				83	1,633	7,808	2,101			1,535			13,159
Oil Sands									1,787				1,787
Other Petroleum and Coal Products Industry								121					121
Paint & Varnish Manufacturing						93				6			99
Petrochemical Industry					37	434			188				660
Petroleum Refining	516			317	818	2,176		119	832	235			5,012
Plastics & Synthetic Resins Fabrication					28	60				1			90
Pulp and Paper Industry	494		2,138	5,199	8,403	9,438	2,281	473	1,874	20,534			50,835
Upstream Oil and Gas Industry			0					18	1,162	825			2,005
Wood Industry	67	124	797	2,085	12,071	7,219	284	844	15,517	46,995			86,002
Other Industries	2,167	51	3,017	746	2,761	15,281	772	1,368	8,683	2,493	29	108	37,477
TOTAL INDUSTRIAL SOURCES	25,116	305	7,296	10,338	38,902	67,203	8,129	10,796	38,478	80,123	192	380	287,258
NON INDUSTRIAL FUEL COMBUSTION													
Commercial Fuel Combustion	50	8	165	237	441	961	151	129	520	311	4	28	3,004
Electric Power Generation (Utilities)	897	15	458	174	30	1,680	421	21,669	8,973	454	10	93	34,874
Residential Fuel Combustion	29	14	145	56	350	1,754	137	223	904	375	1	8	3,996
Residential Fuel Wood Combustion	11,162	1,655	14,071	12,759	40,220	28,025	4,665	3,786	7,525	12,693	222	484	137,268
TOTAL NON INDUSTRIAL FUEL COMBUSTION	12,138	1,693	14,838	13,227	41,041	32,419	5,375	25,807	17,922	13,833	237	613	179,141
TRANSPORTATION													
TOTAL TRANSPORTATION	1,743	473	2,009	2,241	19,019	22,528	3,592	5,921	13,023	24,631	204	140	95,524
INCINERATION													
Crematorium						2							2
Industrial & Commercial Incineration		3	1		17	14			16				51
Municipal Incineration			12		10	1				347			370
Wood Waste Incineration	138		46	336		421	36	38					1,015
Other Incineration & Utilities					1	34				3			38
TOTAL INCINERATION	138	3	59	336	28	472	36	38	16	350	0	0	1,476
MISCELLANEOUS													
Cigarette Smoking	14	4	24	19	208	230	24	20	57	360	1	2	962
Dry Cleaning													
Fuel Marketing										30			30
General Solvent Use													
Marine Cargo Handling Industry										1,385			1,385
Meat Cooking	23	5	37	30	292	442	45	40	110	564	1	3	1,594
Pesticides and Fertilizer Application	4	70	41	57	462	833	923	1,322	1,174	258	4	4	5,153
Printing													
Structural Fires	60	48	205	178	1,108	2,087	618	273	597	29	24	19	5,244
Surface Coatings													
TOTAL MISCELLANEOUS	102	127	308	284	2,070	3,592	1,610	1,655	1,937	2,626	30	27	14,368
OPEN SOURCES													
Agriculture (Animals)	74	841	1,129	954	13,335	20,651	14,600	28,966	60,386	101	3		141,041
Agriculture Tilling and Wind Erosion	37	2,178	1,742	1,879	31,409	67,065	118,978	368,621	247,931	8,553	15		848,408
Construction Operations	25,779	5,560	10,213	19,287	84,280	134,306	22,111	34,658	183,035	61	4,877	4,281	528,449
Dust from Paved Roads**	15,633	5,437	29,698	30,304	120,121	177,780	29,356	10,936	36,343	54,250	1,102	199	511,159
Dust from Unpaved Roads**	20,989	7,691	47,449	45,517	264,333	454,815	88,346	98,328	921,577	66,974	3,409	1,235	2,020,663
Forest Fires	82	6	58	67	31,310	59,121	114,671	146,853	46,177	35,752	22,777	249,221	706,095
Landfills Sites	7	1	10	9	96	124	19	17	41	54		1	379
Mine Tailings	87		5	47	538	807	398	1,283	148		104	331	3,749
Prescribed Burning	265					3,630	90	2	13,457	15,541			32,986
TOTAL OPEN SOURCES	62,952	21,714	90,303	98,063	545,424	918,300	388,569	689,666	1,509,094	181,286	32,287	255,268	4,792,926
PROVINCIAL TOTAL													
TOTAL WITH OPEN SOURCES	102,189	24,315	114,813	124,488	646,483	1,044,515	407,311	733,883	1,580,470	302,850	32,949	256,427	5,370,694
TOTAL WITHOUT OPEN SOURCES	39,237	2,601	24,510	26,425	101,059	126,215	18,741	44,217	71,376	121,564	662	1,160	577,768

Notes:

1. Numbers may not add to totals, due to rounding.
2. The 1995 emissions inventory was compiled with the latest technical and statistical information available, only the Sulphur Oxides emissions can be compared to previous emissions inventories.
3. The Ontario estimates include the emissions from propane vehicles.

Table A1.3: Environment Canada's CAC Inventory - 1995 Fine Particulate (PM2.5) Emissions by Province (Tonnes)

CATEGORY / SECTOR / PROVINCES	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC	YUK	NWT	CANADA
INDUSTRIAL SOURCES													
Abrasives Manufacture					237	18							254
Aluminum Industry					3,517	89				1,725			5,331
Asbestos Industry					22					3			25
Asphalt Paving Industry	20	42	140	469	105	647	80	145	142	141	19	1	1,950
Bakeries													
Cement and Concrete Industry	254	1		8	424	2,214	49	394	124	298	1	1	3,769
Chemicals Industry				2	15	645	76	53	414	186			1,391
Clay Products Industry					2	2			123	54			181
Coal Mining Industry			167	12		386	604	1,219	3,067	810			6,265
Ferrous Foundries		1	3	22	237	26				65			362
Grain Industries			10	6	227	476	148	475	319	81			1,742
Iron and Steel Industries					1,667	5,241	25			6	146		7,085
Iron Ore Mining Industry	7,567					58							7,625
Mining and Rock Quarrying	7		86	93	215	1,656	40	229	49	804	12	31	3,223
Non-Ferrous Mining and Smelting Industry				57	1,180	6,381	929			1,299			9,845
Oil Sands									1,407				1,407
Other Petroleum and Coal Products Industry								57					57
Paint & Varnish Manufacturing						33				2			35
Petrochemical Industry					31	211			23				265
Petroleum Refining	191			193	527	1,314		68	832	144			3,268
Plastics & Synthetic Resins Fabrication					21	39				1			62
Pulp and Paper Industry	381		1,936	3,695	7,013	6,430	1,768	293	1,770	16,051			39,337
Upstream Oil and Gas Industry								18	1,147	773			1,938
Wood Industry	22	41	296	785	5,499	2,482	95	337	10,029	33,010			52,594
Other Industries	1,756	22	1,334	392	1,384	9,936	409	744	6,543	1,274	9	33	23,835
TOTAL INDUSTRIAL SOURCES	10,198	106	3,972	5,733	22,322	38,284	4,223	4,154	25,939	56,812	40	66	171,849
NON INDUSTRIAL FUEL COMBUSTION													
Commercial Fuel Combustion	23	6	95	168	407	910	150	125	510	299	3	25	2,720
Electric Power Generation (Utilities)	656	12	281	120	24	719	210	7,309	8,777	427	9	90	18,633
Residential Fuel Combustion	22	11	101	35	292	1,704	136	222	835	364	1	7	3,730
Residential Fuel Wood Combustion	10,604	1,572	13,367	12,121	38,209	28,025	4,432	3,597	7,149	12,050	211	460	131,797
TOTAL NON INDUSTRIAL FUEL COMBUSTION	11,306	1,601	13,844	12,444	38,932	31,358	4,928	11,253	17,270	13,140	224	581	156,881
TRANSPORTATION													
TOTAL TRANSPORTATION	1,528	411	1,716	1,929	16,331	18,972	3,120	5,251	11,420	22,297	179	122	83,276
INCINERATION													
Crematorium					0	1							1
Industrial & Commercial Incineration		3			12	13			11				38
Municipal Incineration			8		9					338			355
Wood Waste Incineration	101		34	244		306	26	28					738
Other Incineration & Utilities						14				2			16
TOTAL INCINERATION	101	3	41	244	21	334	26	28	11	340	0	0	1,149
MISCELLANEOUS													
Cigarette Smoking	14	4	24	19	208	230	24	20	57	360	1	2	962
Dry Cleaning													
Fuel Marketing										30			30
General Solvent Use													
Marine Cargo Handling Industry										416			416
Meat Cooking	23	5	37	30	292	442	45	40	110	553	1	3	1,583
Pesticides and Fertilizer Application	1	20	12	16	132	238	264	378	335	74	1	1	1,472
Printing													
Structural Fires	55	43	187	161	1,007	1,897	561	248	542	27	22	17	4,768
Surface Coatings													
TOTAL MISCELLANEOUS	93	73	260	227	1,640	2,807	894	686	1,045	1,461	25	22	9,232
OPEN SOURCES													
Agriculture (Animals)	12	134	179	151	2,149	3,293	2,314	4,546	9,478	24	1		22,280
Agriculture Tilling and Wind Erosion	1	45	36	39	645	1,381	2,444	7,634	5,107	3,332			20,664
Construction Operations	522	113	207	390	1,706	2,718	448	701	3,705	12	99	87	10,707
Dust from Paved Roads**	3,738	1,300	7,102	7,247	28,725	42,513	7,020	2,615	8,691	20,256	264	48	129,517
Dust from Unpaved Roads**	3,087	1,132	7,161	6,695	38,885	66,897	12,997	14,465	138,803	9,839	502	182	300,644
Forest Fires	67	5	47	55	25,785	48,688	94,435	120,938	38,028	33,002	18,757	205,241	585,048
Landfills Sites	2		2	2	24	31	5	4	10	13			94
Mine Tailings	22		1	12	135	202	100	321	37		26	83	937
Prescribed Burning	186					2,541	63	1	9,420	14,661			26,872
TOTAL OPEN SOURCES	7,636	2,728	14,736	14,591	98,053	168,265	119,824	151,226	213,278	81,139	19,648	205,640	1,096,763
PROVINCIAL TOTAL													
TOTAL WITH OPEN SOURCES	30,861	4,921	34,569	35,167	177,298	260,020	133,016	172,598	268,963	175,188	20,116	206,432	1,519,149
TOTAL WITHOUT OPEN SOURCES	23,225	2,193	19,833	20,576	79,245	91,755	13,192	21,372	55,685	94,049	468	792	422,386

Notes:

1. Numbers may not add to totals, due to rounding.
2. The 1995 emissions inventory was compiled with the latest technical and statistical information available, only the Sulphur Oxides emissions can be compared to previous emissions inventories.
3. The Ontario estimates Include the emissions from propane vehicles.

Appendix 2

1995 Inventory of SO_x, PM₁₀ and PM_{2.5} Emissions from the Use of Heavy Fuel Oils

Table A2.1 -- 1995 SOx Emissions from the combustion of HFO by Province (Tonnes)

CATEGORY / SECTOR / PROVINCES	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC	YUK	NWT	TERRITORIES	CANADA	Eastern Provinces	Western Provinces
INDUSTRIAL SOURCES																
Abrasives Manufacture														0	0	0
Aluminum Industry					180									180	180	0
Asbestos Industry					762									762	762	0
Asphalt Paving Industry										155				155	0	155
Bakeries														0	0	0
Cement and Concrete Industry	25		53		213	879								1,169	1,169	0
Chemicals Industry			286	55	268	1,991			14					2,612	2,599	14
Clay Products Industry														0	0	0
Coal Mining Industry														0	0	0
Ferrous Foundries														0	0	0
Grain Industries														0	0	0
Iron and Steel Industries			788		1,310	8,786								10,883	10,883	0
Iron Ore Mining Industry	8,677					188								8,865	8,865	0
Mining and Rock Quarrying			4	1,024		263	135	9	382					1,817	1,291	526
Non-Ferrous Mining and Smelting Industry				1,170	1,988	20								3,178	3,178	0
Oil Sands														0	0	0
Other Petroleum and Coal Products Industry														0	0	0
Paint & Varnish Manufacturing														0	0	0
Petrochemical Industry					114									114	114	0
Petroleum Refining	10,990		671	2,631	9,366	17,860								41,518	41,518	0
Plastics & Synthetic Resins Fabrication					159	8								167	167	0
Pulp and Paper Industry	3,072		2,535	11,834	17,421	3,263	1,197	0	20					39,342	38,124	1,218
Upstream Oil and Gas Industry														0	0	0
Wood Industry			251	763	453		57	7		7				1,538	1,467	71
Other Industries	411	900	3,109	4,841	3,946	2,318	365	1,741	81	70		61	61	17,843	15,525	2,318
TOTAL INDUSTRIAL SOURCES	23,174	900	7,695	22,317	36,178	35,576	1,755	1,757	497	232	0	61	61	130,141	125,840	4,301
NON INDUSTRIAL FUEL COMBUSTION																
Commercial Fuel Combustion	691		2,561	1,933	781	1,217	27	132	348		19		19	7,708	7,182	526
Electric Power Generation (Utilities)	15,694	289	13,224	33,570	207	3,148	389	57	47					66,625	66,132	493
Residential Fuel Combustion			7	492	434	719								1,652	1,652	0
Residential Fuel Wood Combustion																
TOTAL NON INDUSTRIAL FUEL COMBUSTION	16,384	289	15,792	35,996	1,421	5,084	416	189	395	0	19	0	19	75,985	74,966	1,019
TRANSPORTATION																
TOTAL TRANSPORTATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCINERATION																
Crematorium														0	0	0
Industrial & Commercial Incineration					10									10	10	0
Municipal Incineration														0	0	0
Wood Waste Incineration														0	0	0
Other Incineration & Utilities														0	0	0
TOTAL INCINERATION	0	0	0	0	10	0	0	0	0	0	0	0	0	10	10	0
MISCELLANEOUS																
Cigarette Smoking																
Dry Cleaning																
Fuel Marketing										2						
General Solvent Use																
Marine Cargo Handling Industry																
Meat Cooking																
Pesticides and Fertilizer Application																
Printing																
Structural Fires																
Surface Coatings																
TOTAL MISCELLANEOUS	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
OPEN SOURCES																
Agriculture (Animals)																
Agriculture Tilling and Wind Erosion																
Construction Operations																
Dust from Paved Roads**																
Dust from Unpaved Roads**																
Forest Fires																
Landfills Sites																
Mine Tailings																
Prescribed Burning																
TOTAL OPEN SOURCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROVINCIAL TOTAL	39,558	1,189	23,487	58,313	37,609	40,659	2,170	1,946	892	234	19	61	80	206,137	200,815	5,322

- Notes:
1. Numbers may not add to totals, due to rounding.
 2. The Eastern Provinces include Ontario, Quebec and Atlantic Canada.
 3. The Western Provinces include Manitoba, Saskatchewan, Alberta, British Columbia and the Territories

Table A2.2 -- 1995 PM10 Emissions by Province (Tonnes) from HFO Combustion

CATEGORY / SECTOR / PROVINCES	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC	YUK	NWT	TERRITORIES	CANADA	Eastern	Western
INDUSTRIAL SOURCES																
Abrasives Manufacture														0	0	0
Aluminum Industry														0	0	0
Asbestos Industry					33									33	33	0
Asphalt Paving Industry										14				14	0	14
Bakeries														0	0	0
Cement and Concrete Industry	15		4		0	52								71	71	0
Chemicals Industry			18	3	16	111			1					150	149	1
Clay Products Industry														0	0	0
Coal Mining Industry														0	0	0
Ferrous Foundries														0	0	0
Grain Industries														0	0	0
Iron and Steel Industries			48		79	375								502	502	0
Iron Ore Mining Industry	540													540	540	0
Mining and Rock Quarrying			0	61		16	8	2	23					109	77	33
Non-Ferrous Mining and Smelting Industry				67	83	1								151	151	0
Oil Sands														0	0	0
Other Petroleum and Coal Products Industry														0	0	0
Paint & Varnish Manufacturing														0	0	0
Petrochemical Industry					7									7	7	0
Petroleum Refining	517		19	143	421	199								1,299	1,299	0
Plastics & Synthetic Resins Fabrication					10									10	10	0
Pulp and Paper Industry	188		146	3,656	742	303	30	1	1					5,066	5,034	32
Upstream Oil and Gas Industry														0	0	0
Wood Industry			18	42	27		4	0		54				145	87	58
Other Industries	26	41	184	236	238	132	22	105	5	1		4	4	993	857	136
TOTAL INDUSTRIAL SOURCES	1,286	41	437	4,207	1,656	1,189	64	107	30	69	0	4	4	9,089	8,815	274
NON INDUSTRIAL FUEL COMBUSTION																
Commercial Fuel Combustion	39		130	93	41	46	1	6	15		1			371	348	23
Electric Power Generation (Utilities)	888	14	229	154	8	100	19	3	2					1,419	1,395	25
Residential Fuel Combustion			0	21	19	30								71	71	0
Residential Fuel Wood Combustion																
TOTAL NON INDUSTRIAL FUEL COMBUSTION	927	14	360	268	68	176	21	9	17	0	1	0	1	1,861	1,814	47
TRANSPORTATION																
TOTAL TRANSPORTATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCINERATION																
Crematorium														0	0	0
Industrial & Commercial Incineration					0									0	0	0
Municipal Incineration														0	0	0
Wood Waste Incineration														0	0	0
Other Incineration & Utilities														0	0	0
TOTAL INCINERATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS																
Cigarette Smoking																
Dry Cleaning																
Fuel Marketing																
General Solvent Use																
Marine Cargo Handling Industry																
Meat Cooking																
Pesticides and Fertilizer Application																
Printing																
Structural Fires																
Surface Coatings																
TOTAL MISCELLANEOUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEN SOURCES																
Agriculture (Animals)																
Agriculture Tilling and Wind Erosion																
Construction Operations																
Dust from Paved Roads**																
Dust from Unpaved Roads**																
Forest Fires																
Landfills Sites																
Mine Tailings																
Prescribed Burning																
TOTAL OPEN SOURCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROVINCIAL TOTAL	2,213	55	796	4,476	1,724	1,365	84	116	47	69	1	4	5	10,951	10,630	321

Notes:

1. Numbers may not add to totals, due to rounding.
2. The Eastern Provinces include Ontario, Quebec and Atlantic Canada.
3. The Western Provinces include Manitoba, Saskatchewan, Alberta, British Columbia and the Territories

Table A2.3 -- 1995 PM2.5 Emissions by Province (Tonnes) from HFO Combustion

CATEGORY / SECTOR / PROVINCES	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC	TERRITORIES	CANADA	Eastern	Western
INDUSTRIAL SOURCES														
Abrasives Manufacture												0	0	0
Aluminum Industry												0	0	0
Asbestos Industry					16							16	16	0
Asphalt Paving Industry										5		5	0	5
Bakeries												0	0	0
Cement and Concrete Industry	10		2		0	34						46	46	0
Chemicals Industry			12	2	11	73			1			97	97	1
Clay Products Industry												0	0	0
Coal Mining Industry												0	0	0
Ferrous Foundries												0	0	0
Grain Industries												0	0	0
Iron and Steel Industries			31		52	244						328	328	0
Iron Ore Mining Industry	366											366	366	0
Mining and Rock Quarrying			0	40		10	5	1	15			71	50	21
Non-Ferrous Mining and Smelting Industry				44	54	1						99	99	0
Oil Sands												0	0	0
Other Petroleum and Coal Products Industry												0	0	0
Paint & Varnish Manufacturing												0	0	0
Petrochemical Industry					5							5	5	0
Petroleum Refining	192		7	93	212	128						632	632	0
Plastics & Synthetic Resins Fabrication					6							6	6	0
Pulp and Paper Industry	122		96	2,381	490	197	20	0	1			3,308	3,287	21
Upstream Oil and Gas Industry												0	0	0
Wood Industry			12	27	17		2	0		13		72	56	16
Other Industries	17	19	120	154	155	86	14	68	3	1	2	638	550	89
TOTAL INDUSTRIAL SOURCES	707	19	280	2,741	1,018	773	42	70	19	19	2	5,689	5,537	152
NON INDUSTRIAL FUEL COMBUSTION														
Commercial Fuel Combustion	15		67	47	22	17	0	2	6		0	176	168	8
Electric Power Generation (Utilities)	648	10	169	112	3	74	14	2	2			1,032	1,015	18
Residential Fuel Combustion			0	8	7	11						27	27	0
Residential Fuel Wood Combustion														
TOTAL NON INDUSTRIAL FUEL COMBUSTION	662	10	236	167	32	102	15	4	7	0	0	1,235	1,209	26
TRANSPORTATION														
TOTAL TRANSPORTATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCINERATION														
Crematorium												0	0	0
Industrial & Commercial Incineration					0							0	0	0
Municipal Incineration												0	0	0
Wood Waste Incineration												0	0	0
Other Incineration & Utilities												0	0	0
TOTAL INCINERATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS														
Cigarette Smoking														
Dry Cleaning														
Fuel Marketing														
General Solvent Use														
Marine Cargo Handling Industry														
Meat Cooking														
Pesticides and Fertilizer Application														
Printing														
Structural Fires														
Surface Coatings														
TOTAL MISCELLANEOUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEN SOURCES														
Agriculture (Animals)														
Agriculture Tilling and Wind Erosion														
Construction Operations														
Dust from Paved Roads**														
Dust from Unpaved Roads**														
Forest Fires														
Landfills Sites														
Mine Tailings														
Prescribed Burning														
TOTAL OPEN SOURCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROVINCIAL TOTAL	1,369	29	516	2,907	1,050	875	56	74	27	19	3	6,924	6,746	178

- Notes:
1. Numbers may not add to totals, due to rounding.
 2. The Eastern Provinces include Ontario, Quebec and Atlantic Canada.
 3. The Western Provinces include Manitoba, Saskatchewan, Alberta, British Columbia and the Territories.

Appendix 3

1995 Inventory of SO_x, PM₁₀ and PM_{2.5} Emissions from the Use of Light Fuel Oils

Table A3.1 -- 1995 SOx Emissions from the combustion of LFO by Province (Tonnes)

CATEGORY / SECTOR / PROVINCES	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC	TERRITORIES	CANADA	Eastern	Western
INDUSTRIAL SOURCES														
Abrasives Manufacture												0	0	0
Aluminum Industry					118							118	118	0
Asbestos Industry					2							2	2	0
Asphalt Paving Industry										0		0	0	0
Bakeries												0	0	0
Cement and Concrete Industry			3		2	40				2		47	45	2
Chemicals Industry			0	1	17	226				78		322	244	78
Clay Products Industry												0	0	0
Coal Mining Industry			7									7	7	0
Ferrous Foundries												0	0	0
Grain Industries												0	0	0
Iron and Steel Industries			12		15	5						32	32	0
Iron Ore Mining Industry	39					0						39	39	0
Mining and Rock Quarrying			5	36	57	50	3	0	63	11	92	317	148	169
Non-Ferrous Mining and Smelting Industry				110	13	18						141	141	0
Oil Sands												0	0	0
Other Petroleum and Coal Products Industry												0	0	0
Paint & Varnish Manufacturing												0	0	0
Petrochemical Industry					5	6						10	10	0
Petroleum Refining												0	0	0
Plastics & Synthetic Resins Fabrication					0							0	0	0
Pulp and Paper Industry					40	1,971			1	248		2,260	2,010	249
Upstream Oil and Gas Industry												0	0	0
Wood Industry			0	36	93	5						134	134	0
Other Industries	55	17	136	324	178	163	29	6	65	21	29	1,023	874	149
TOTAL INDUSTRIAL SOURCES	94	17	164	509	538	2,483	32	6	129	361	120	4,452	3,804	647
NON INDUSTRIAL FUEL COMBUSTION														
Commercial Fuel Combustion	239	194	745	413	1,431	1,345	30	13	8		269	4,688	4,368	320
Electric Power Generation (Utilities)		0	12			166	2	5	0	41		226	178	48
Residential Fuel Combustion	674	360	1,947	890	4,368	3,571	68	81	46		55	12,060	11,810	249
Residential Fuel Wood Combustion														
TOTAL NON INDUSTRIAL FUEL COMBUSTION	914	555	2,704	1,303	5,800	5,083	99	98	54	41	325	16,974	16,357	617
TRANSPORTATION														
TOTAL TRANSPORTATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCINERATION														
Crematorium												0	0	0
Industrial & Commercial Incineration		2			0							2	2	0
Municipal Incineration					2							2	2	0
Wood Waste Incineration												0	0	0
Other Incineration & Utilities		1				6						7	7	0
TOTAL INCINERATION	0	2	0	0	2	6	0	0	0	0	0	10	3	0
MISCELLANEOUS														
Cigarette Smoking														
Dry Cleaning														
Fuel Marketing														
General Solvent Use														
Marine Cargo Handling Industry														
Meat Cooking														
Pesticides and Fertilizer Application														
Printing					0									
Structural Fires														
Surface Coatings														
TOTAL MISCELLANEOUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEN SOURCES														
Agriculture (Animals)														
Agriculture Tilling and Wind Erosion														
Construction Operations														
Dust from Paved Roads**														
Dust from Unpaved Roads**														
Forest Fires														
Landfills Sites														
Mine Tailings														
Prescribed Burning														
TOTAL OPEN SOURCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROVINCIAL TOTAL	1,007	574	2,868	1,811	6,339	7,572	131	104	183	401	445	21,436	20,172	1,264

- Notes:
1. Numbers may not add to totals, due to rounding.
 2. The Eastern Provinces include Ontario, Quebec and Atlantic Canada.
 3. The Western Provinces include Manitoba, Saskatchewan, Alberta, British Columbia and the Territories.

Table A3.2 -- 1995 PM10 Emissions by Province (Tonnes) from LFO Combustion

CATEGORY / SECTOR / PROVINCES	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC	TERRITORIES	CANADA	Eastern	Western
INDUSTRIAL SOURCES														
Abrasives Manufacture												0	0	0
Aluminum Industry					6							6	6	0
Asbestos Industry												0	0	0
Asphalt Paving Industry												0	0	0
Bakeries												0	0	0
Cement and Concrete Industry			0		0							0	0	0
Chemicals Industry					0	0				3		3	1	3
Clay Products Industry												0	0	0
Coal Mining Industry			0									0	0	0
Ferrous Foundries												0	0	0
Grain Industries												0	0	0
Iron and Steel Industries			1		1							1	1	0
Iron Ore Mining Industry	3											3	3	0
Mining and Rock Quarrying			0	1	2	2	0		2	1	3	11	5	6
Non-Ferrous Mining and Smelting Industry				2	0	0						2	2	0
Oil Sands												0	0	0
Other Petroleum and Coal Products Industry												0	0	0
Paint & Varnish Manufacturing												0	0	0
Petrochemical Industry					0							0	0	0
Petroleum Refining												0	0	0
Plastics & Synthetic Resins Fabrication												0	0	0
Pulp and Paper Industry					0	1				249		250	1	249
Upstream Oil and Gas Industry												0	0	0
Wood Industry				1	3	0						4	4	0
Other Industries	2	1	5	5	6	2	1	0	2	3	1	27	20	7
TOTAL INDUSTRIAL SOURCES	4	1	6	9	18	5	1	0	4	255	4	307	43	265
NON INDUSTRIAL FUEL COMBUSTION														
Commercial Fuel Combustion	9	7	27	14	58	46	1	1	0		10	172	160	12
Electric Power Generation (Utilities)			0			0		3	0	1		4	1	4
Residential Fuel Combustion	25	13	71	33	176	126	3		2		2	450	443	6
Residential Fuel Wood Combustion														
TOTAL NON INDUSTRIAL FUEL COMBUSTION	34	20	99	47	233	172	4	4	2	1	12	626	604	22
TRANSPORTATION														
TOTAL TRANSPORTATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCINERATION														
Crematorium												0	0	0
Industrial & Commercial Incineration		0										0	0	0
Municipal Incineration												0	0	0
Wood Waste Incineration												0	0	0
Other Incineration & Utilities												0	0	0
TOTAL INCINERATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS														
Cigarette Smoking														
Dry Cleaning														
Fuel Marketing														
General Solvent Use														
Marine Cargo Handling Industry														
Meat Cooking														
Pesticides and Fertilizer Application														
Printing														
Structural Fires														
Surface Coatings														
TOTAL MISCELLANEOUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEN SOURCES														
Agriculture (Animals)														
Agriculture Tilling and Wind Erosion														
Construction Operations														
Dust from Paved Roads**														
Dust from Unpaved Roads**														
Forest Fires														
Landfills Sites														
Mine Tailings														
Prescribed Burning														
TOTAL OPEN SOURCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROVINCIAL TOTAL	38	21	104	55	252	176	5	4	6	256	16	933	647	287

- Notes:
1. Numbers may not add to totals, due to rounding.
 2. The Eastern Provinces include Ontario, Quebec and Atlantic Canada.
 3. The Western Provinces include Manitoba, Saskatchewan, Alberta, British Columbia and the Territories.

Table A3.3 -- 1995 PM2.5 Emissions by Province (Tonnes) from LFO Combustion

CATEGORY / SECTOR / PROVINCES	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC	TERRITORIES	CANADA	Eastern	Western
INDUSTRIAL SOURCES														
Abrasives Manufacture												0	0	0
Aluminum Industry					5							5	5	0
Asbestos Industry												0	0	0
Asphalt Paving Industry												0	0	0
Bakeries												0	0	0
Cement and Concrete Industry												0	0	0
Chemicals Industry					0	0				2		2	0	2
Clay Products Industry												0	0	0
Coal Mining Industry			0									0	0	0
Ferrous Foundries												0	0	0
Grain Industries												0	0	0
Iron and Steel Industries			0		0							0	0	0
Iron Ore Mining Industry	1											1	1	0
Mining and Rock Quarrying				0	1	0			1	0	1	3	1	2
Non-Ferrous Mining and Smelting Industry				0		0						1	1	0
Oil Sands												0	0	0
Other Petroleum and Coal Products Industry												0	0	0
Paint & Varnish Manufacturing												0	0	0
Petrochemical Industry												0	0	0
Petroleum Refining												0	0	0
Plastics & Synthetic Resins Fabrication												0	0	0
Pulp and Paper Industry					0	0				59		59	0	59
Upstream Oil and Gas Industry												0	0	0
Wood Industry				1	1							1	1	0
Other Industries	1	0	1	1	2	1	0	0	1	1	0	7	5	2
TOTAL INDUSTRIAL SOURCES	1	0	1	3	8	1	0	0	1	62	1	79	14	64
NON INDUSTRIAL FUEL COMBUSTION														
Commercial Fuel Combustion	7	6	21	11	44	35	1	0	0		8	132	123	9
Electric Power Generation (Utilities)			0						0	0		0	0	0
Residential Fuel Combustion	19	10	55	25	135	97	2	2	1		2	348	341	7
Residential Fuel Wood Combustion														
TOTAL NON INDUSTRIAL FUEL COMBUSTION	26	16	75	36	180	132	3	3	2	0	9	480	464	17
TRANSPORTATION														
TOTAL TRANSPORTATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCINERATION														
Crematorium												0	0	0
Industrial & Commercial Incineration		0										0	0	0
Municipal Incineration												0	0	0
Wood Waste Incineration												0	0	0
Other Incineration & Utilities												0	0	0
TOTAL INCINERATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS														
Cigarette Smoking														
Dry Cleaning														
Fuel Marketing														
General Solvent Use														
Marine Cargo Handling Industry														
Meat Cooking														
Pesticides and Fertilizer Application														
Printing														
Structural Fires														
Surface Coatings														
TOTAL MISCELLANEOUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEN SOURCES														
Agriculture (Animals)														
Agriculture Tilling and Wind Erosion														
Construction Operations														
Dust from Paved Roads**														
Dust from Unpaved Roads**														
Forest Fires														
Landfills Sites														
Mine Tailings														
Prescribed Burning														
TOTAL OPEN SOURCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROVINCIAL TOTAL	27	16	77	38	187	133	3	3	3	62	10	559	478	81

- Notes:
1. Numbers may not add to totals, due to rounding.
 2. The Eastern Provinces include Ontario, Quebec and Atlantic Canada.
 3. The Western Provinces include Manitoba, Saskatchewan, Alberta, British Columbia and the Territories.