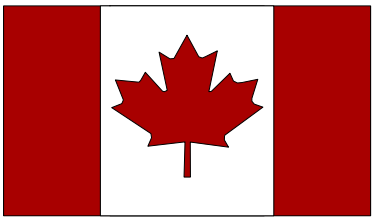

Environment Canada
Environmental Protection Service

Environnement Canada
Service de la protection de l'environnement

Sulphur in Liquid Fuels

1999

by Mark Tushingham
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April 2000

Environment Canada

Sulphur in Liquid Fuels

1999

Notice

The information contained in this report is compiled from data submitted by the producers and importers of liquid fuels in Canada pursuant to the requirements of the Federal *Fuels Information Regulations, No. 1*. Submissions have been verified for reasonableness but are subject to potential errors made at the source.

Any comments concerning the content of this report should be directed to:

Oil, Gas, and Energy Branch
Air Pollution Prevention Directorate
Environmental Protection Service
Environment Canada
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Ottawa, Ontario
K1A 0H3
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Appendices

1.0 Summary

This report summarizes data concerning the sulphur content in liquid fuels for the year 1999. The information used in the elaboration of this report was provided

pursuant to the *Fuels Information Regulations, No.1* of the *Canadian Environmental Protection Act*.

An in-depth analysis of the results reveals that the sulphur content varies widely among the different types of liquid fuels as well as among the regions. Gasoline constitutes 47.3 % of the reported volume of liquid fuels produced or imported in Canada, and accounts for 5.2 % of the sulphur mass in liquid fuels. Heavy fuel oil constitutes only 8.7 % by volume of liquid fuels, but contains 73.3 % of the total sulphur mass. The three regions of the Atlantic provinces, Quebec and Ontario account for 89.9% of the total mass of sulphur present in fuel in Canada.

The following table represents a national summary of the data compiled from Form 1 of the *Fuels Information Regulations, No.1*, "Report on Sulphur Content" required to be submitted to Environment Canada by petroleum refineries and importing companies.

TABLE 1.1 :
Fuel Production / Imports and Sulphur Content
National Summary for
1999

Type of Fuel	Fuel Production/Imports (m^3)	Sulphur Mass (tonnes)	Average Sulphur Content (%wt.)	Distribution of Sulphur in Products (%)
Aviation Turbo Fuel	5,796,803	2,579	0.055	1.5
Motor/Aviation Gasoline	38,473,561	8,898	0.032	5.2
Kerosene/Stove oil	1,588,974	583	0.045	0.3
Low-Sulphur Diesel Fuel	18,742,708	5,140	0.032	3.0
Diesel Fuel	3,958,012	7,780	0.230	4.5
Light Fuel Oil	4,288,089	7,485	0.203	4.4
Heavy Fuel Oil	7,103,971	125,548	1.771	73.3
Plant Consumption	795,801	13,199	1.668	7.7
TOTAL	80,747,919	171,212	0.222	100.0

2.0 Introduction

2.1 Fuels Information Regulations, No.1

The *Fuels Information Regulations, No.1* (see Appendix 1) was adopted in 1977 to provide Environment Canada with information regarding liquid fuel composition, particularly concerning sulphur dioxide (SO_2) emissions from their combustion. These Regulations require annual reporting on sulphur levels in fuels and one-time reporting of non-lead fuel additive content (plus when there are changes). They apply to all fuels[1] in liquid form that originate from crude oils, coal or bituminous sands.

The Regulations require all producers and importers handling more than 400 cubic meters (m^3) of fuels, intended for consumption in Canada within a calendar year, to report the volume of fuels produced or imported, the fuel density and the fuel sulphur content for each quarter of the calendar year (see Appendix 2). Environment Canada uses the reported values to estimate the amount of sulphur (tonnes) in Canadian fuels. The definition for each type of liquid fuel can be found on the last page of Form 1 in Appendix 2. The Regulations also require all producers and importers who supply more than 400 m^3 of a fuel to report all the additives other than lead or lead compounds in fuels.

A new category was added to the reporting form in 1995 to account for the production of low sulphur diesel fuel. This addition is a follow-up to the non-regulatory program agreed upon by the petroleum marketing industry to make available only diesel fuel with a sulphur content not exceeding 0.05% by weight at all service stations, truck stops and on-road cardlocks and keylocks in Canada. This program commenced on October 1, 1994. Information on low sulphur diesel is included in this report. Effective January 1, 1998, low sulphur diesel has been mandated for on-road vehicles by the federal *Diesel Fuel Regulations*. (see section 2.2)

2.2 Regulations Controlling Sulphur Levels in Fuels

On January 1, 1998, the federal *Diesel Fuel Regulations* came into effect. The regulations require all on-road diesel to have a sulphur level not exceeding 0.05% (500 ppm) by weight.

[1] Throughout this document, the word "fuel(s)" applies only to those fuels which are in liquid form and petroleum-based.

On June 23,1999, the *Sulphur in Gasoline Regulations* were published in Part 2 of the *Canada Gazette.* These regulations will limit the sulphur content in gasoline to an average of 30 ppm with a maximum of 80 ppm. The requirements will be phased in. The first stage begins on July 1, 2002 limiting the average sulphur content of gasoline to 150 ppm. On January 1, 2005 the sulphur content will be further limited to a 30 ppm average with a maximum of 80 ppm.

The Canadian General Standards Board (CGSB) has standards for fuels, which some provinces have adopted in their regulations. Depending on the type of fuel, these standards establish a range of 0.04 % to 3.50% (400 ppm to 35 000 ppm) of sulphur by weight (see Appendix 4). CGSB standards are revised periodically to reflect developments in product, usage and manufacturing technology.

2.3 Period covered

This report covers the period from January 1 to December 31, 1999. Petroleum refineries and importing companies are required to submit information for each calendar quarter to the regional office of Environment Canada before January 31 of the following year. Failure to submit the data on time, incomplete data or unsigned forms are offenses under the Canadian Environmental Protection Act and are punishable by fines and imprisonment.

2.4 Access to Information Act

In 1997 to 1999, there were a number of requests, under the federal *Access to Information Act*, for the forms submitted by Canadian refiners to Environment Canada. These requests involved the forms submitted by refiners for the years 1992 to 1998. Six of the fourteen companies involved objected to its release and filed with federal court to prevent the release of the forms. Between mid 1999 and early 2000, all six companies discontinued their court cases, and the data was released to the requesters and is in the public domain. Appendix 3 presents data on the annual volume weighted sulphur content (in parts per million by weight) for gasoline, diesel and fuel oil during the period of 1994 to 1998 for each Canadian refinery. The data for 1999 submitted by Canadian refiners and for 1998 and 1999 submitted by importers has been requested but has not yet been through the process required by the *Access to Information Act*.

2.5 Reporting Petroleum Refineries and Importing Companies

The following petroleum refineries and upgrading plants reported, under the regulation, information pertaining to volume, production, and fuel sulphur content for 1999:

Chevron Canada Limited (Burnaby, B.C)
Consumers' Co-operative Refineries Ltd. (Regina, Sask.)
Husky Oil Operations Limited (Prince George Refinery, Prince George, B.C)
Imperial Oil Limited (Dartmouth Refinery, Dartmouth, Nova Scotia)
Imperial Oil Limited (Nanticoke Refinery, Jarvis, Ontario)
Imperial Oil Limited (Sarnia Refinery, Sarnia, Ontario)
Imperial Oil Limited (Strathcona Refinery, Strathcona, Alberta)
Irving Oil Limited (Irving Oil Refinery, Saint John, New Brunswick)
North Atlantic Refining Limited (Come By Chance Refinery, Come By Chance, Nfld.)
NOVA Chemicals Limited (Corunna Plant, Sarnia, Ontario)
Parkland Refining Limited (Bowden Refinery, Innisfail, Alberta)
Petro-Canada Lubricants (Mississauga, Ontario)
Petro-Canada Products Limited (Montreal Refinery, Montreal, Quebec)
Petro-Canada Products Limited (Edmonton Refinery, Edmonton, Alberta)
Petro-Canada Products Limited (Lake Ontario Refinery, Oakville Plant, Ontario)
Shell Canada Limited (Montréal-Est Refinery, Montréal-Est, Québec)
Shell Canada Products Limited (Sarnia Manufacturing Center, Corunna, Ontario)
Shell Canada Products Limited (Scotford Refinery, Fort Saskatchewan, Alberta)
Suncor Inc. (Fort McMurray, Alberta)
Sunoco Inc. (Sarnia Refinery, Sarnia, Ontario)
Syncrude Canada Inc.(Fort McMurray, Alberta)
Ultramar Canada Inc. (St. Romuald Refinery, St. Romuald, Québec)

The following petroleum importers reported, under the regulation, information pertaining to volume, production, and fuel sulphur content for 1999:

ARCO Products Company (Blaine, Washington, USA)
Delta Western Fuel Canada Inc. (Whitehorse, Yukon)
Imperial Oil Limited (Depot Usine de Montreal Est, Montreal, Quebec)
Kildair Services Limited (Montreal and Tracy, Québec)
Mackenzie Petroleum Limited (Dawson City, Yukon)
Murphy Oil USA Inc. (Superior, Wisconsin)
New Brunswick Power Corporation (Fredericton, NB)
Newfoundland and Labrador Hydro (Holyrood, Nfld.)
North 60 Petro Ltd. (Whitehorse, Yukon)
Nova Scotia Power Inc. (Halifax, Nova Scotia)
Olco Petroleum Group Inc. (Hamilton, Ontario)
Olco Petroleum Group Inc. (Beauport, Quebec)
Olco Petroleum Group Inc. (Montreal, Quebec)
PaceSetter Enterprises (Whitehorse, Yukon)
Pétroles Norcan Inc. (Montreal, Quebec)
TransCanada Energy Limited (Calgary, Alberta)

3.0 Volumes of Liquid Fuels Produced / Imported

In order to verify the accuracy of the sulphur content in fuel reports submitted to Environment Canada, the reported volumes of produced fuels were compared to Statistics Canada figures for 1999 (see Table 3.1). The "plant consumption" volumes of oil sand processing plants are included in the Environment Canada numbers but are not included in the Statistics Canada numbers.

TABLE 3.1 : Volumes of Liquid Fuels Produced / Imported for Sale in Canada

Statistics Canada and Environment Canada Reportings for 1999

Type of Fuel	Statistics Canada (m^3)*	Environment Canada (m^3)
Aviation Turbo Fuel	5,819,047	5,794,265
Motor/Aviation Gasoline	38,420,283	38,473,561
Kerosene/Stove oil **	399,263	1,588,974
Low-Sulphur Diesel Fuel	-	18,735,659
Diesel Fuel	21,736,088	3,958,012
Light Fuel Oil	4,315,585	4,288,089
Heavy Fuel Oil	9,260,769	7,103,971
Plant Consumption***	889,559	795,801
TOTAL	80,840,594	80,738,332

* Statistics Canada Data are compiled for the period July 1998 to June 1999.

** According to Statistics Canada, approximately 75-80% of refinery-produced kerosene and stove oil are later transferred to diesel and light fuel oils.

*** Plant consumption fuel is assumed to be mostly heavy fuel oil.

Source: Statistics Canada, Catalogue 45-004 Monthly, June 1999

Note: Volumes reported to Environment Canada mostly reflect production at the various refineries while Statistics Canada considers opening and closing inventories and inter-product transfers.

4.0 Volumes of Liquid Fuels Produced / Imported and Fuel Sulphur Content

4.1 National and Regional Summaries

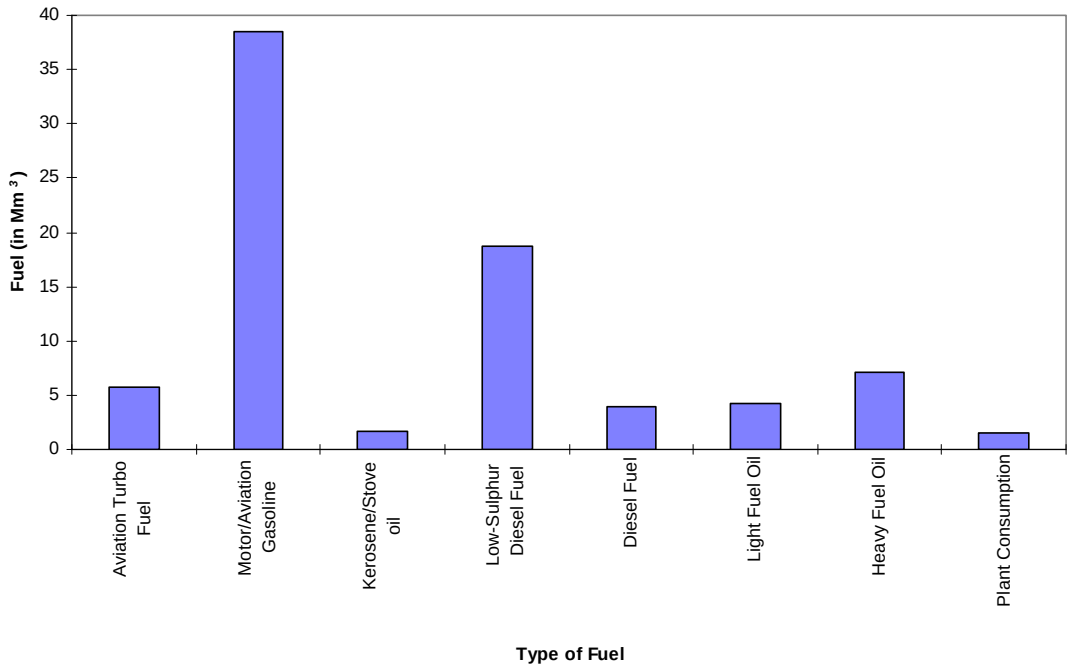
The following graphs and tables summarize the data compiled from reports pursuant to the regulation for 1999:

- National Data: Table 4.1, Graphs 4.1 and 4.2
- Regional Data: Tables 4.2A-F, Graphs 4.3, 4.4, 4.5
- Refinery Data for Gasoline: Graph 4.6
- Regional Data for Gasoline: Graph 4.7
- Refinery Data for Diesel Fuel: Graph 4.8
- Historical Trends (National): Graphs 4.9 to 4.14

TABLE 4.1 :
Fuel Production / Imports
National Summary for
1999

Type of Fuel	Fuel Production/Imports		Average Sulphur Content (%wt.)	Distribution of Sulphur in Products (%)
	(in m^3)	(in %)		
Aviation Turbo Fuel	5,796,803	7.2	0.055	1.5
Motor/Aviation Gasoline	38,473,561	47.6	0.032	5.2
Kerosene/Stove oil	1,588,974	2.0	0.045	0.3
Low-Sulphur Diesel Fuel	18,742,708	23.2	0.032	3.0
Diesel Fuel	3,958,012	4.9	0.230	4.5
Light Fuel Oil	4,288,089	5.3	0.203	4.4
Heavy Fuel Oil	7,103,971	8.8	1.771	73.3
Plant Consumption	795,801	1.0	1.668	7.7
TOTAL	80,747,919	100.0	0.222	100.0

Graph 4.1 National Liquid Fuel Production / Imports



Graph 4.2 : Tonnage of Sulphur in Liquid Fuels

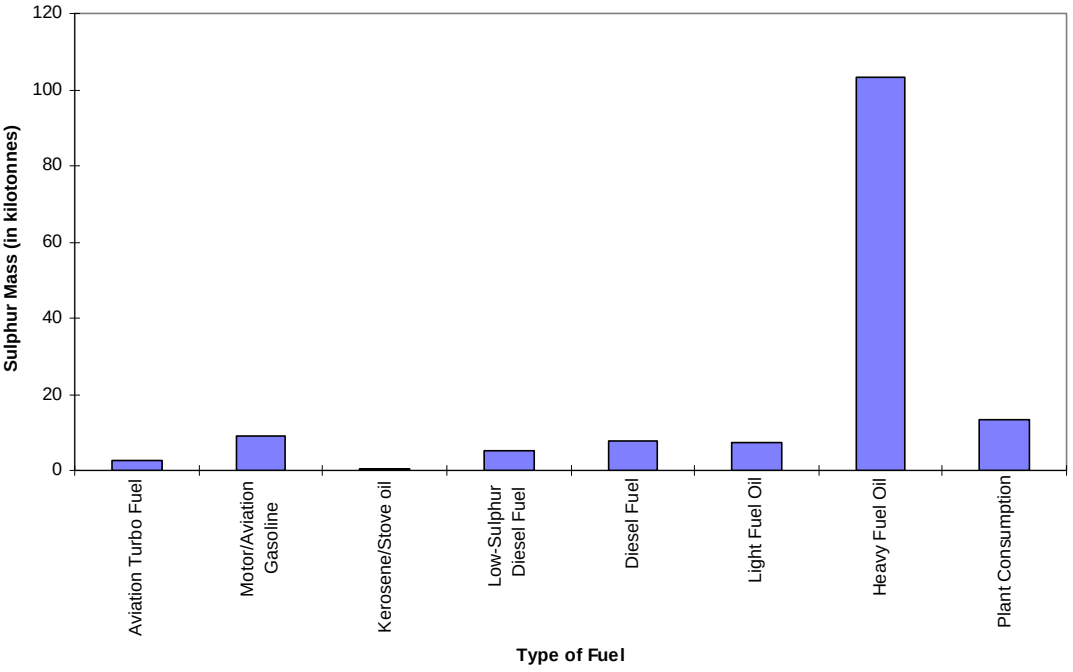


Table 4.2A : Fuel Production/Imports and Sulphur Content for 1999

Atlantic Region				
Type of Fuel	Fuel Production/Imports (m^3)	Sulphur Mass (tonnes)	Average Sulphur Content (%wt.)	Distribution of Sulphur in Products (%)
Aviation Turbo Fuel	459,112	472	0.130	0.6
Motor/Aviation Gasoline	2,711,194	452	0.023	0.6
Kerosene/Stove oil	95,800	18	0.023	0.0
Low-Sulphur Diesel Fuel	1,719,547	569	0.039	0.7
Diesel Fuel	719,402	704	0.115	0.9
Light Fuel Oil	1,403,764	1,570	0.132	2.0
Heavy Fuel Oil	2,957,464	63,413	2.148	82.4
Plant Consumption	367,150	9,760	2.615	12.7
TOTAL	10,433,433	76,958	0.745	100.0

Table 4.2B : Fuel Production/Imports and Sulphur Content for 1999

Quebec Region				
Type of Fuel	Fuel Production/Imports (m^3)	Sulphur Mass (tonnes)	Average Sulphur Content (%wt.)	Distribution of Sulphur in Products (%)
Aviation Turbo Fuel	1,093,872	221	0.025	0.6
Motor/Aviation Gasoline	9,523,386	1,943	0.028	5.5
Kerosene/Stove oil	1,228,719	477	0.047	1.3
Low-Sulphur Diesel Fuel	4,255,034	1,451	0.041	4.1
Diesel Fuel	299,918	909	0.356	2.6
Light Fuel Oil	1,606,889	3,472	0.252	9.8
Heavy Fuel Oil	2,117,041	26,079	1.241	73.3
Plant Consumption	81,033	1,008	1.461	2.8
TOTAL	20,205,892	35,561	0.187	100.0

Table 4.2C : Fuel Production/Imports and Sulphur Content for 1999

Ontario Region				
Type of Fuel	Fuel Production/Imports (m^3)	Sulphur Mass (tonnes)	Average Sulphur Content (%wt.)	Distribution of Sulphur in Products (%)
Aviation Turbo Fuel	1,897,217	1,082	0.070	2.6
Motor/Aviation Gasoline	12,379,959	4,225	0.046	10.2
Kerosene/Stove oil	176,974	62	0.042	0.2
Low-Sulphur Diesel Fuel	3,640,527	1,111	0.036	2.7
Diesel Fuel	842,669	2,343	0.328	5.7
Light Fuel Oil	1,258,855	2,432	0.223	5.9
Heavy Fuel Oil	1,439,655	27,751	1.939	67.1
Plant Consumption	138,161	2,339	1.717	5.7
TOTAL	21,774,017	41,346	0.204	100.0

Table 4.2D : Fuel Production/Imports and Sulphur Content for 1999

Prairies and Northern Region				
Type of Fuel	Fuel Production/Imports (m^3)	Sulphur Mass (tonnes)	Average Sulphur Content (%wt.)	Distribution of Sulphur in Products (%)
Aviation Turbo Fuel	1,590,649	260	0.020	1.9
Motor/Aviation Gasoline	11,750,303	1,984	0.023	14.2
Kerosene/Stove oil	4,750	0	0.001	0.0
Low-Sulphur Diesel Fuel	8,369,054	1,798	0.025	12.9
Diesel Fuel	1,828,773	2,892	0.185	20.7
Light Fuel Oil	0	0	0.000	0.0
Heavy Fuel Oil	513,790	6,963	1.324	50.0
Plant Consumption	177,718	40	0.025	0.3
TOTAL	24,235,036	13,936	0.064	100.0

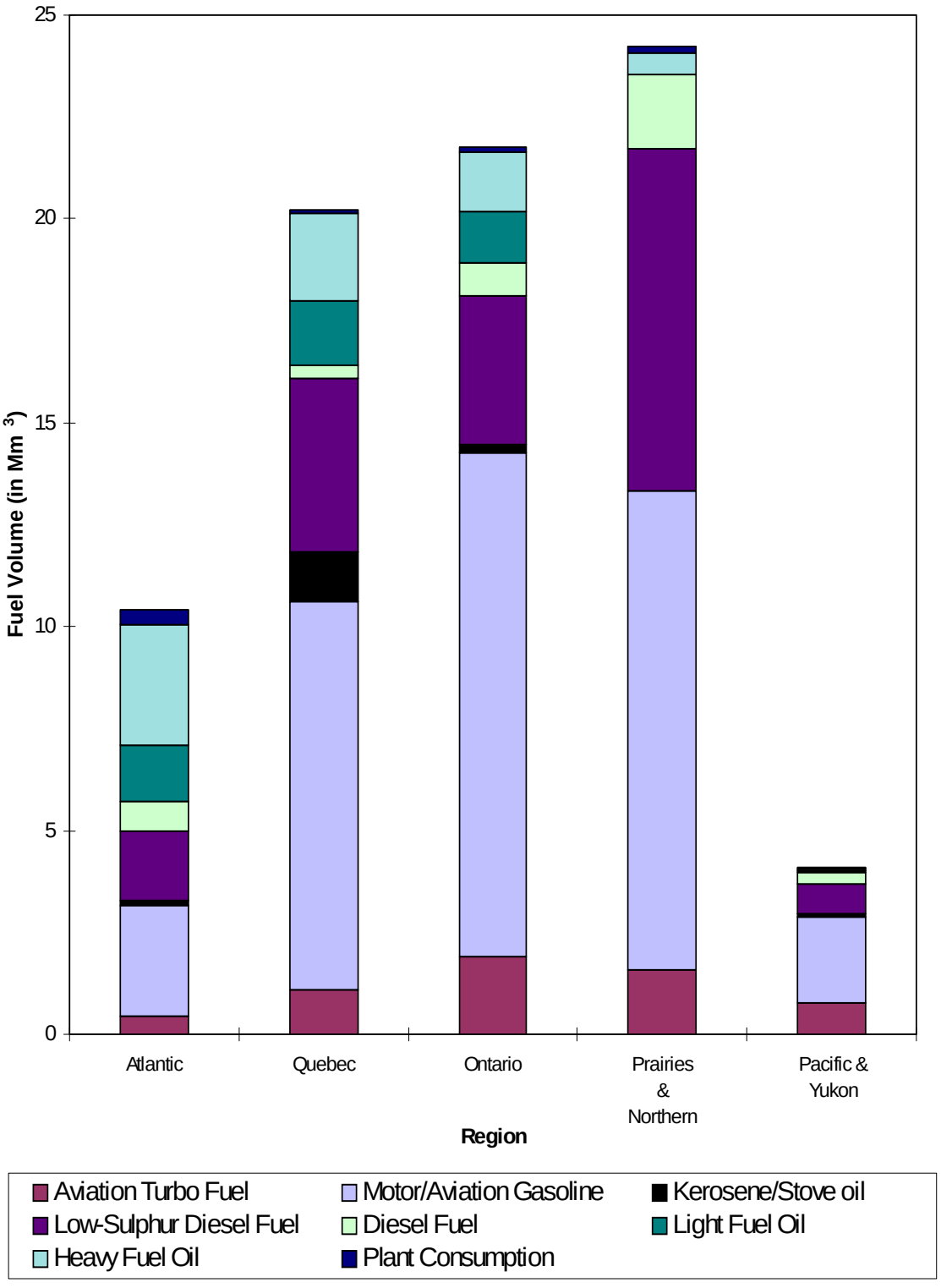
Table 4.2E : Fuel Production/Imports and Sulphur Content for 1999

Pacific and Yukon Region				
Type of Fuel	Fuel Production/Imports (m^3)	Sulphur Mass (tonnes)	Average Sulphur Content (%wt.)	Distribution of Sulphur in Products (%)
Aviation Turbo Fuel	755,953	544	0.088	16.0
Motor/Aviation Gasoline	2,108,720	293	0.019	8.6
Kerosene/Stove oil	82,731	26	0.038	0.8
Low-Sulphur Diesel Fuel	758,546	211	0.033	6.2
Diesel Fuel	267,250	931	0.403	27.3
Light Fuel Oil	18,581	10	0.065	0.3
Heavy Fuel Oil	76,021	1,343	1.726	39.4
Plant Consumption	31,740	52	0.242	1.5
TOTAL	4,099,542	3,411	0.093	100.0

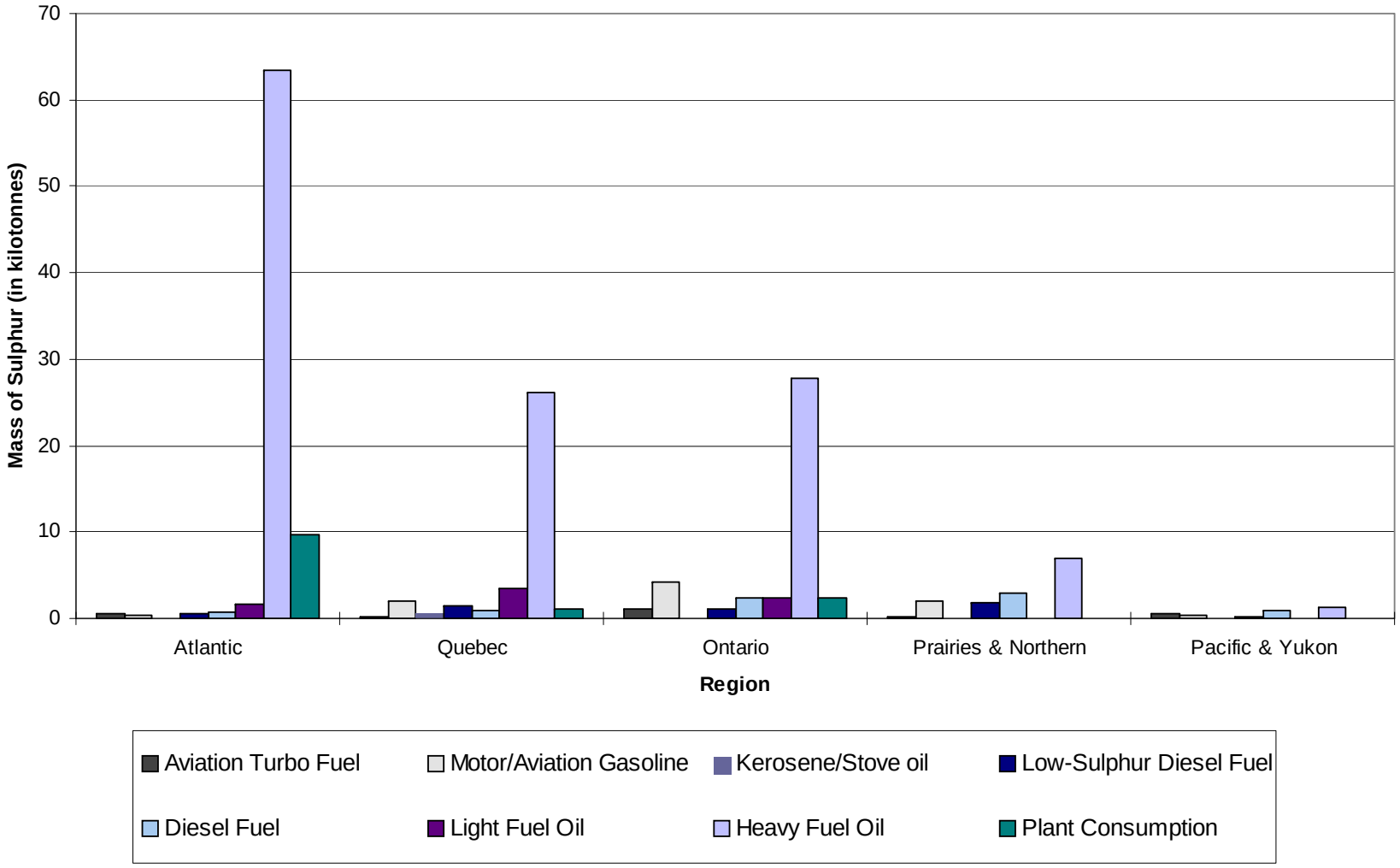
Table 4.2F : Regional and National Averages of the Density of Fuels Produced/Imported (in kg/m^3)

	Atlantic	Quebec	Ontario	Praries and North	Pacific and Yukon	Canada
Aviation Turbo Fuel	795.4	811.5	814.8	812.3	813.5	811.8
Motor & Aviation Gasoline	737.6	733.1	736.2	723.1	731.6	731.3
Kerosene/Stove Oil	822.0	823.1	837.9	810.1	845.5	825.8
Low-Sulphur Diesel Fuel	842.9	837.8	851.7	849.5	845.9	846.5
Diesel Fuel	849.7	853.5	848.3	857.5	864.1	854.3
Light Fuel Oil	847.3	861.6	866.1	-	843.9	858.2
Heavy Fuel Oil	996.2	989.7	990.6	1,019.0	1,011.2	994.9
Plant Consumption	922.1	810.4	983.8	838.7	755.0	755.7

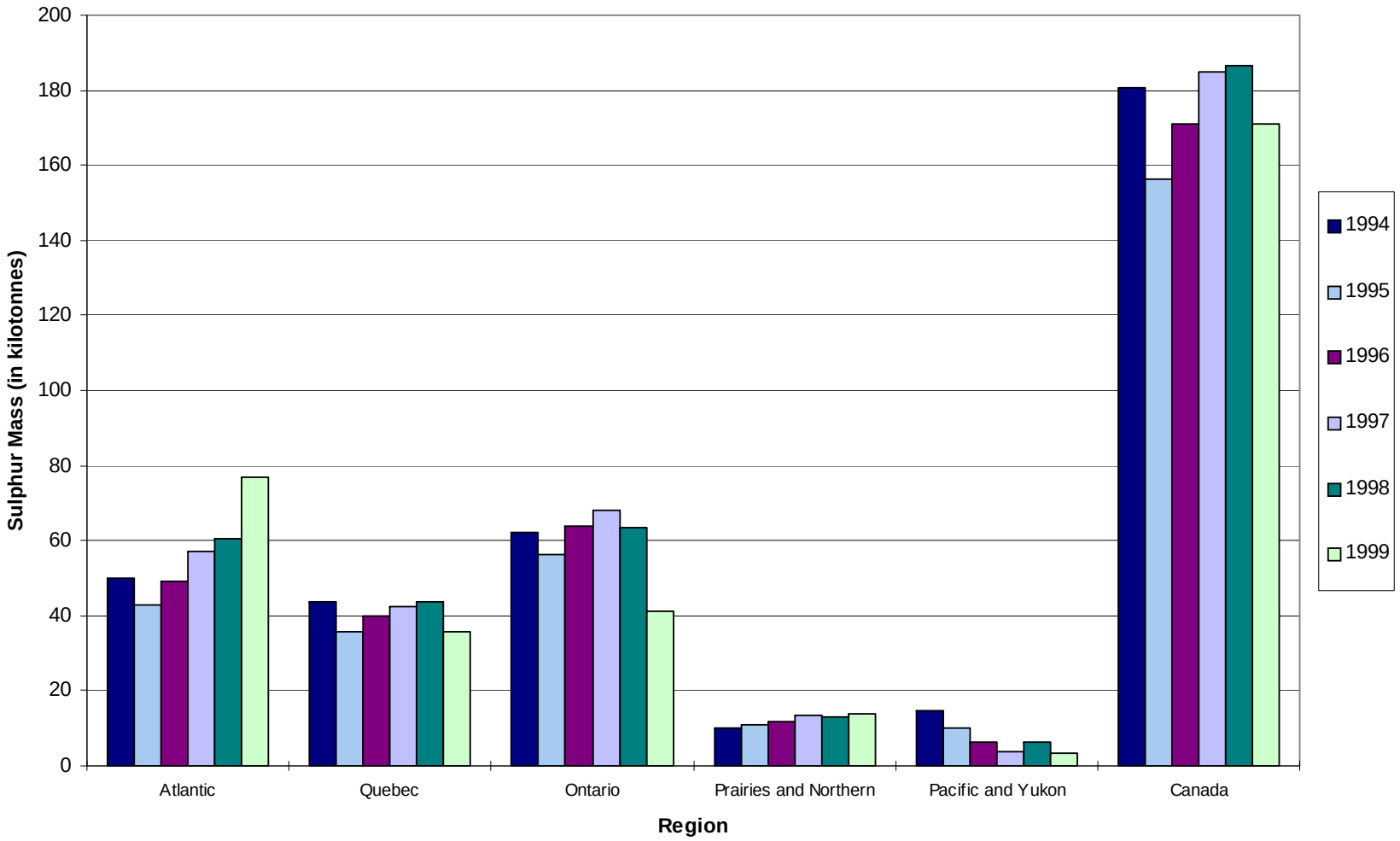
Graph 4.3 : Volumes of Liquid Fuels Produced / Imported



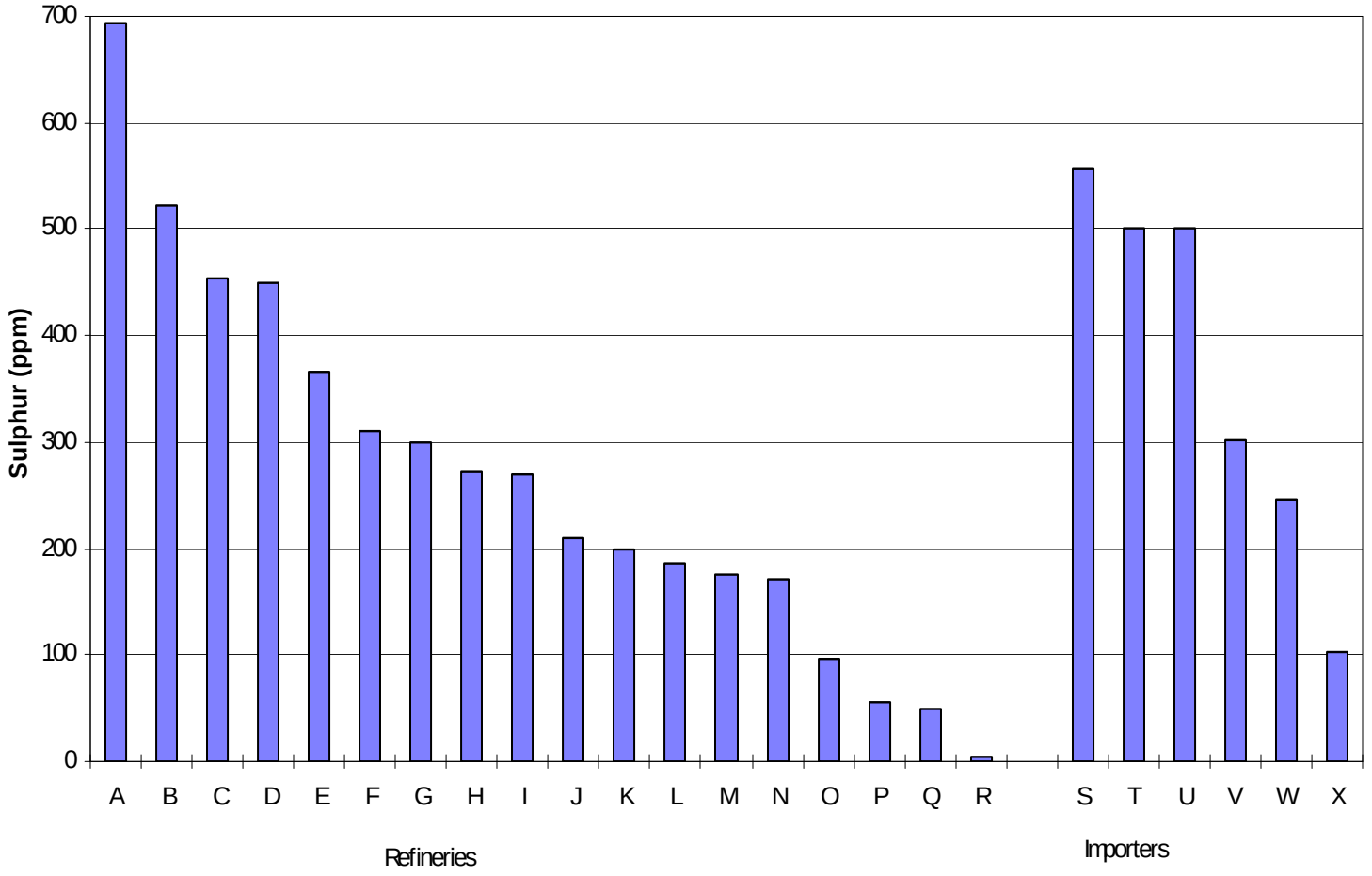
Graph 4.4 : Mass of Sulphur in Liquid Fuels Produced or Imported



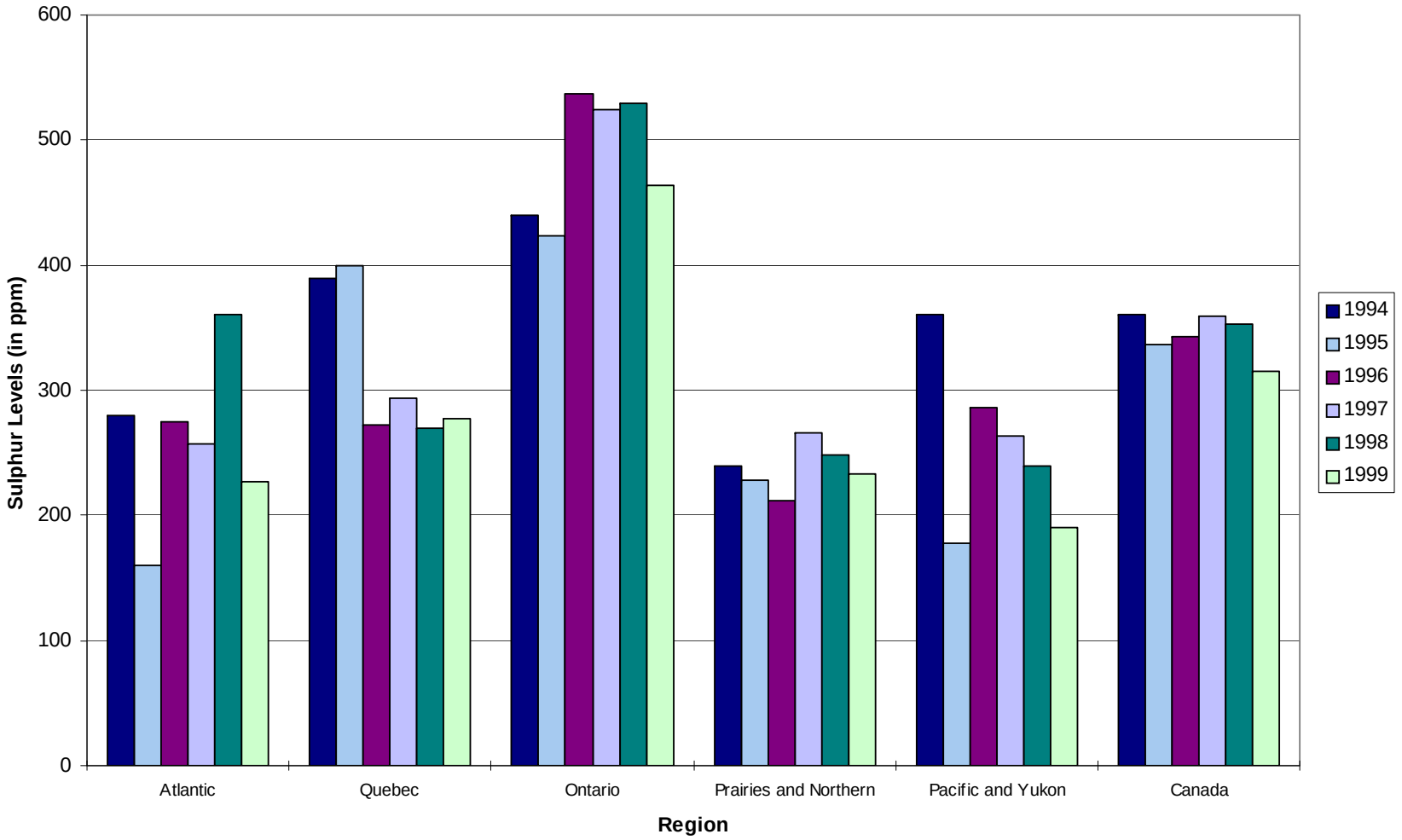
Graph 4.5 : Sulphur Mass in Liquid Fuels by Region

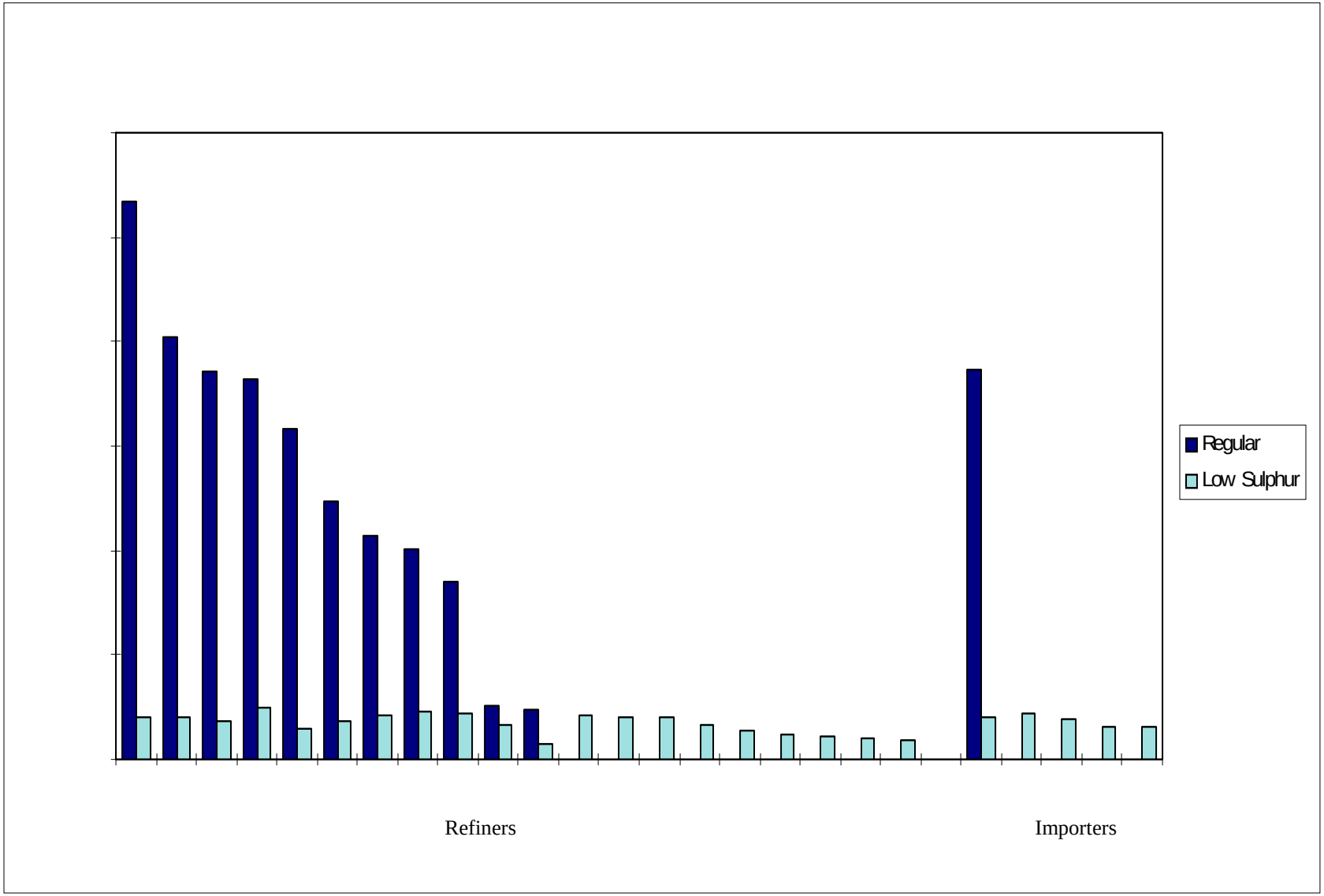


Graph 4.6 : Sulphur Levels in Gasoline by Refinery / Importer - 1999

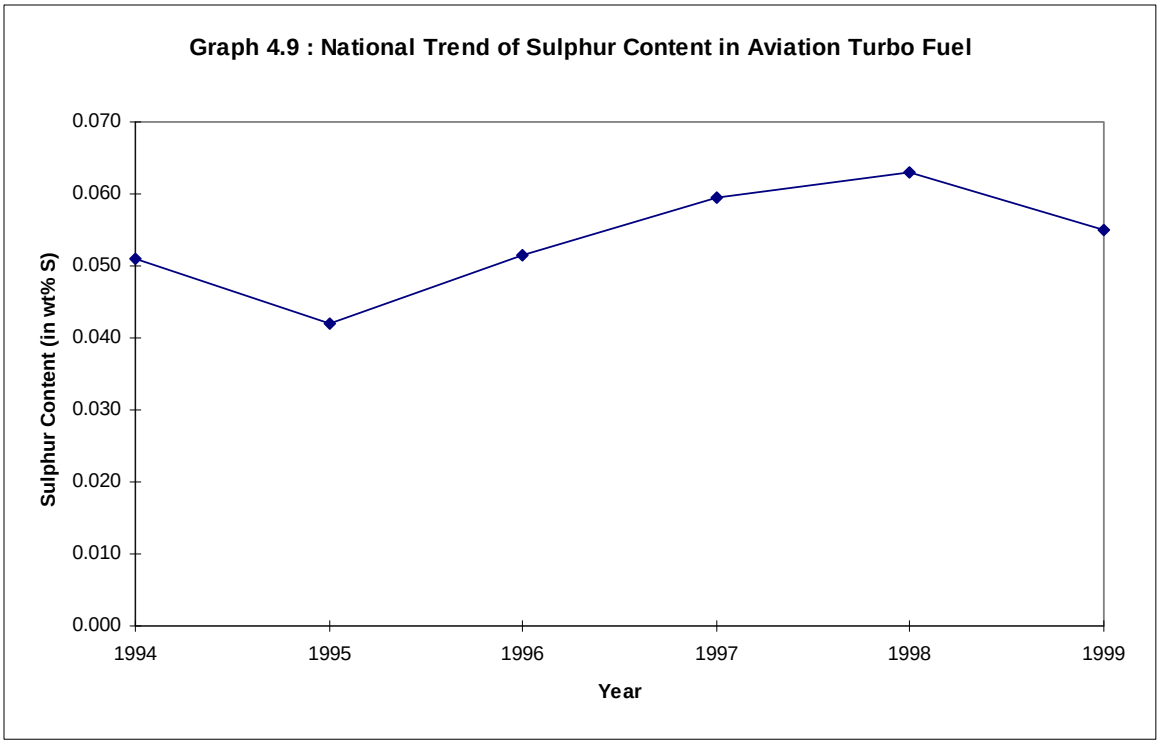


Graph 4.7 : Sulphur Levels in Gasoline by Region

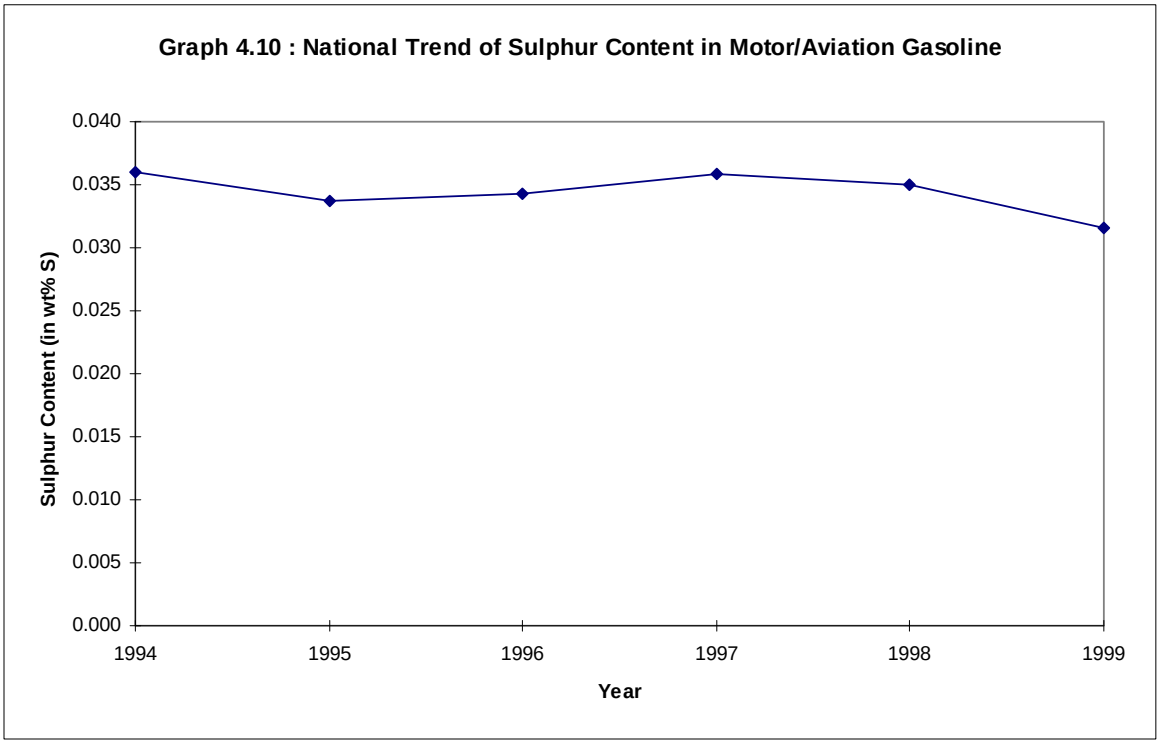



Regular
Low Sulphur
Refiners
Importers

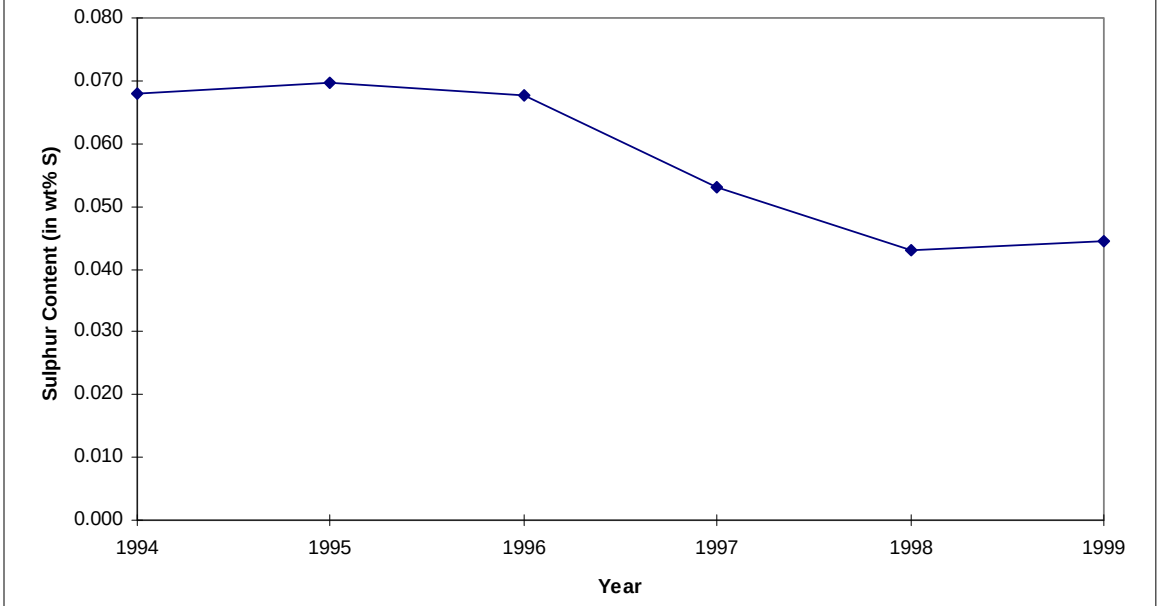
Graph 4.9 : National Trend of Sulphur Content in Aviation Turbo Fuel



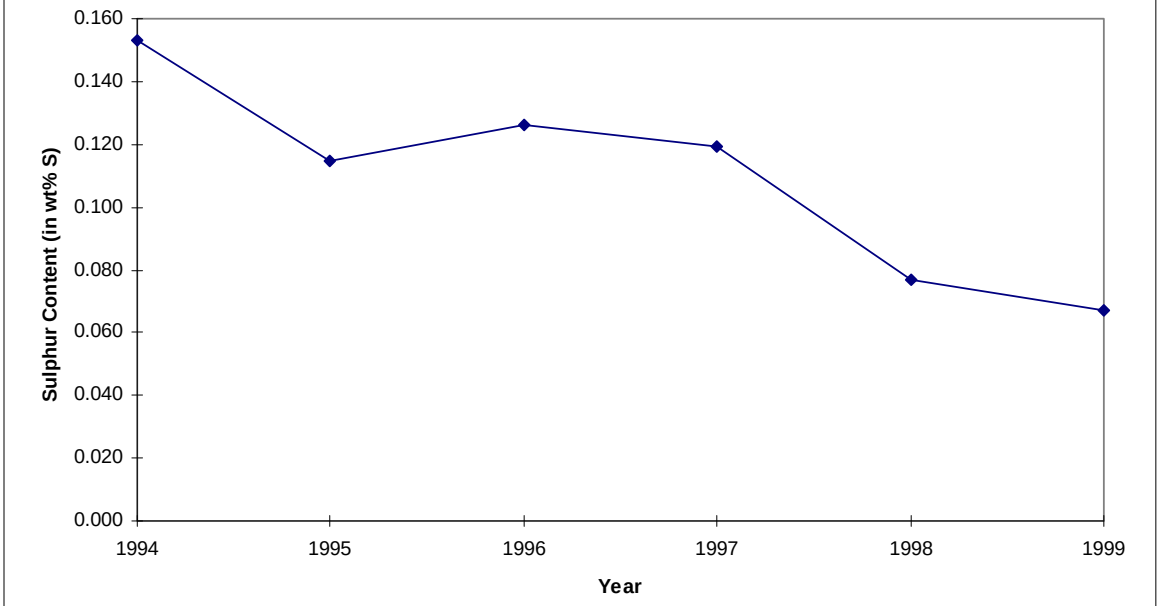
Graph 4.10 : National Trend of Sulphur Content in Motor/Aviation Gasoline



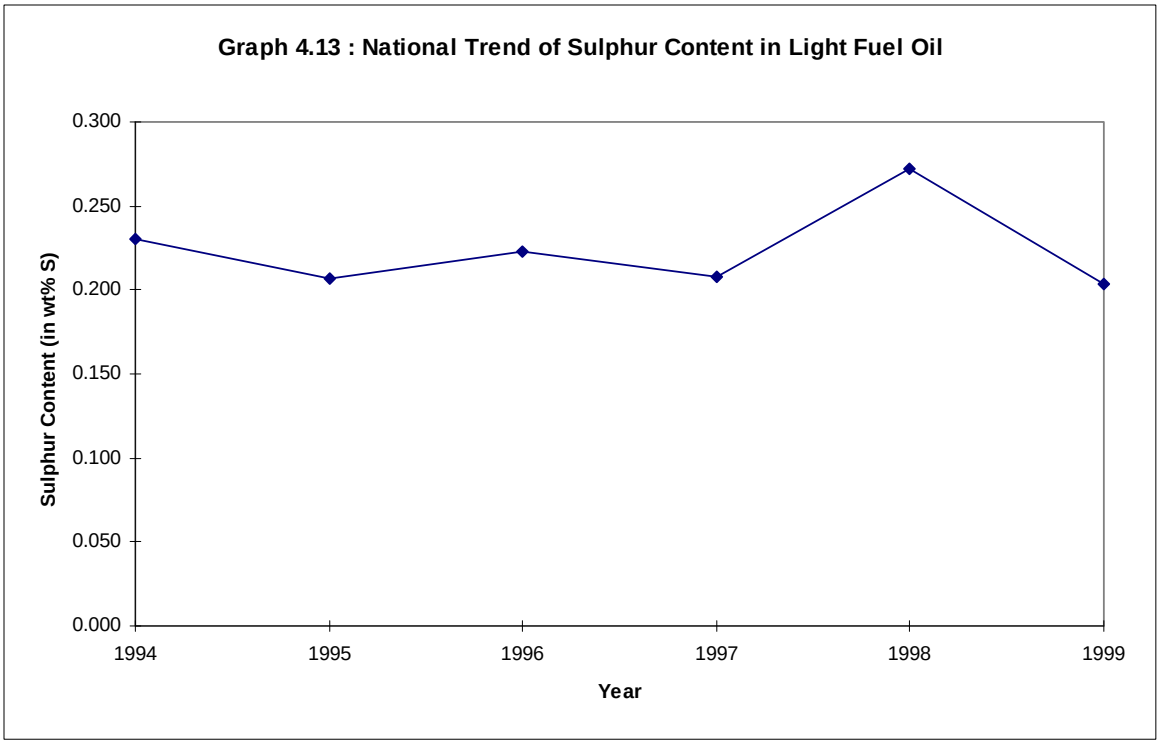
Graph 4.11 : National Trend of Sulphur Content in Kerosene/Stove Oil



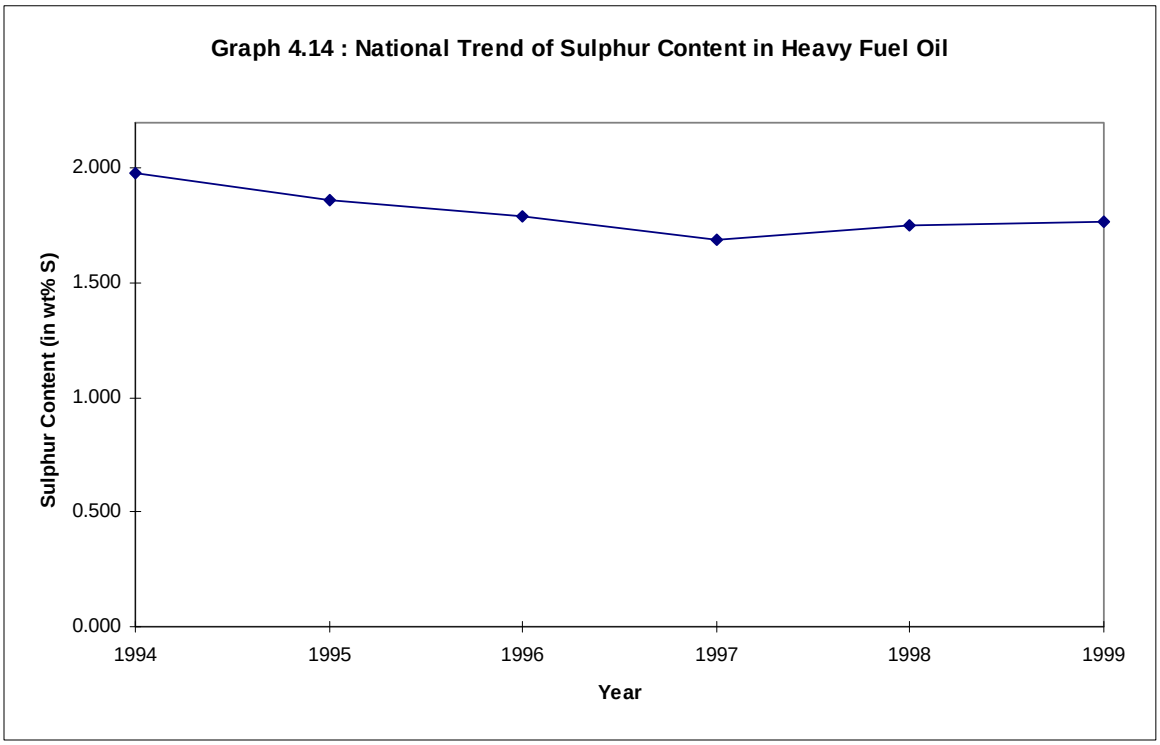
Graph 4.12 : National Trend of Sulphur Content in Diesel Fuel (Total Pool)



Graph 4.13 : National Trend of Sulphur Content in Light Fuel Oil



Graph 4.14 : National Trend of Sulphur Content in Heavy Fuel Oil



Appendix 1

Fuels Information Regulation, No. 1

Fuels Information Regulations, No. 1

1. Short Title. These Regulations may be cited as the *Fuels Information Regulations, No. 1*.

2. Interpretation. In these Regulations, **"Minister"** means the Minister of the Environment.

3. Application. These Regulations apply to fuels in liquid form that originate from crude oils, coal or bituminous sands.

Information. (1) Every person who produces in Canada or imports into Canada more than 400 cubic meters of a fuel named in an item of Form 1 of the schedule shall submit to the Minister, for each quarter of the calendar year during which the fuel was produced or imported, the information required by that Form.

(2) Information submitted pursuant to subsection (1) shall be submitted on or before January 31 following the end of the calendar year during which the fuel was produced or imported.

5. (1) Every person who produces in Canada or imports into Canada a fuel that contains any additive other than lead or lead compounds shall submit to the Minister, in respect of each additive not previously reported to the Minister under these Regulations, the information required by Form 2 of the schedule within sixty days of selling a cumulative total of 400 cubic meters of the fuel containing that additive within a calendar year.

(2) Where any change occurs in the information submitted by a person required by section 1, 2 or 4 of Form 2 of the schedule, that person shall, within sixty days of the change, report the change to the Minister.

SCHEDULE

Form 1 - Report on Sulphur Content

Reporting Period_____
Company Name _____
Facility Name_____Telephone_____
Facility Address _____

Fuels Produced or Imported for use or Sale in Canada

Name of Fuel	Quantity Refined, Produced or Imported (cubic meters)	API Gravity	Sulphur Content (Weight %) Highest	Lowest	Weighted Average
1. Aviation Turbo Fuel					
2. Motor Gasoline					
a) lead free					
b) regular					
c) premium					
3. Kerosene and Stove Oil					

4. Diesel Oil (by type)

5. No. 2 Light Fuel Oil

6. Heavy Fuel Oil
   a) No. 4
   b) No. 5
   c) No. 6

7. Synthetic Crude (sold as fuel)

8. A fuel other than the fuels named in items 1 to 5

_____(Signature of Authorized Company Official)
_____ (Title)
_____ (Date signed)

Form 2 - Liquid Fuel Additive Report

(To be submitted once for each fuel additive)

Fuel Manufacturer / Importer_____
Telephone_____
Address _____
Additive Manufacturer_____
Telephone_____
Address_____

1. Type of Fuel _____
   Brand Name of Additive _____
   Purpose of Additive _____
   Quantity Used Annually _____

2. Fuel Additive Concentration (mg/L)

Highest	Lowest	Weighted Average
_____	_____	_____

3. Composition of Fuel Additive

Complete either paragraph (a) or (b) or attach a copy of a letter from the fuel additive manufacturer attesting to the fact that the information required by paragraph (a) or (b) has been forwarded to Environment Canada.

(a) Chemical name of each Constituent — Approx. % by weight

(b) Element — Approx. % by weight
   Carbon
   Hydrogen
   Oxygen

(list other elements that individually account for more than 0.1% of the additive weight)

Appendix 2

Sample of Form 1,
“Report on Sulphur Content in Liquid Fuels”

Environment Canada Environnement Canada

REPORT ON SULPHUR CONTENT OF LIQUID FUELS

QUARTER: _____ YEAR: _____

This report should be submitted:

a) by January 31st for each quarter separately of the preceding calendar year, **unless** per notice below.
b) by every person who during the calendar year has produced or imported over 400 cubic meters of petroleum fuels for use in Canada.
(No minimum for diesel fuel)
c) for the purpose of informing the Minister of Environment Canada.
d) to:

Notice: 30 days after the last day of each quarter if this form includes information scheduled under section 4(1) of the Diesel Fuel Regulations.

This form is provided for your convenience. Please refer to the Canadian Environmental Protection Act, Fuels Information Regulation No.1, Diesel Fuel Regulations for information on compliance with the requirements for reporting on sulphur content of liquid fuels.

FUELS PRODUCED OR IMPORTED FOR USE OR SALE IN CANADA

Company									
Facility Name:									
Facility Address:									
Type of Liquid Fuel		Volume (m^3)				Density (Kg/m^3) or API Gravity	Sulphur Content (weight %)		
		Produced		Imported			Min.	Max.	Volume Weighted Avg.
1 Aviation Turbo Fuel	1.1 Jet A								
	1.2 Jet B								
2 Gasoline	2.1 Regular								
	2.2 Mid-Grade								
	2.3 Premium								
	2.4 Aviation								
3 Kerosene and Stove Oil									
4 Diesel Fuel		Produced	Sold	Imported	Sold				
	4.1 S < 0.05 wt%								
	4.2 S > 0.05 wt%								
5 Light Fuel Oil									
6 Heavy Fuel Oil	6.1 Number 4								
	6.2 Number 5								
	6.3 Number 6								
7 Other: specify (including Plant Consumption and Synthetic Crude used as a fuel)									
Authorized Company Official: (Please Print)		Title:				Signature:			
Telephone Number:		Fax Number:				Date:			

Revised : March 2000

REPORT ON SULPHUR CONTENT OF LIQUID FUELS

INSTRUCTIONS

1. Please use this form only and do not create or substitute another. If additional space is required for fuel information, make extra copies of the form.

2. For the column headings: "Volume (m^3) - Produced, Imported", enter the number for the gross production of the liquid fuel. Do not include inter-product transfers of the liquid fuel.

LIQUID FUEL DEFINITIONS

Aviation Turbo Fuel

All kerosene-type (Jet A) and naphtha/wide-cut type (Jet B) fuels for turbo-jet or straight-jet type aircraft engines.

Gasoline

All gasoline-type fuels for internal combustion engines including aviation gasoline.

Kerosene and Stove Oil

Kerosene, mineral lamp oil, stove oil, type 1 fuel oil including all fuels intended for atomizing burners.

Diesel Fuel

All grades of distillate fuel suitable for diesel engines.

No. 2 Light Fuel Oil

Distillate fuel intended for use in most atomizing-type burner applications.

Heavy Fuel Oil

Fuel oils are heating fuel oil - type 4,5,and 6 containing residual components and include bunker C.

Other:
-plant consumption: liquid fuels used onsite or in company operations and not accounted for in items 1 to 6. Data should be provided for each fuel type using the definitions listed above.
-synthetic crude used as a fuel
-does not include gases

Appendix 3

Volume Weighted Annual Sulphur
Levels by Refiner for 1994 to 1998

Table A3.1 : Volume Weighted Annual Sulphur Level in Gasoline

		Sulphur Levels (parts per million by weight)				
Name	City	1994	1995	1996	1997	1998
Atlantic						
Imperial Oil	Dartmouth	377	365	419	374	491
Irving Oil Limited	Saint-John	148	71	35	43	129
North Atlantic Refining Ltd.	Come-by-Chance	100	38	75	118	76
Quebec						
Petro-Canada	Montreal	580	472	356	387	318
Shell	Montreal	468	392	319	333	312
Ultramar	St-Romuald	225	219	174	186	170
Ontario						
Imperial Oil	Sarnia	590	728	787	712	792
Shell	Sarnia	508	553	579	582	567
Imperial Oil	Nanticoke	278	340	506	530	528
Nova	Sarnia	-	-	-	-	-
Petro-Canada Lubricants	Mississauga	-	-	-	-	-
Petro-Canada	Oakville	586	528	489	519	520
Sunoco	Sarnia	273	368	276	298	301
Prarie and Northern Region						
Petro-Canada	Edmonton	420	360	380	394	377
Imperial Oil	Strathcona	223	239	243	346	297
Consumer's Co-op	Regina	85	97	179	103	148
Shell	Scotford	15	50	50	50	50
Syncrude	Fort McMurray	-	-	-	-	-
Suncor	Fort McMurray	-	-	-	-	-
Parkland	Bowden	10	0	1	1	1
Pacific and Yukon Region						
Husky Oil	Prince George	158	183	261	225	282
Chevron	Burnaby	215	215	273	294	246
National Average		350	345	340	360	354

Table A3.2 : Volume Weighted Annual Sulphur Level in Low-Sulphur Diesel

		Sulphur Levels (parts per million by weight)				
Name	City	1994	1995	1996	1997	1998
Atlantic						
Imperial Oil	Dartmouth	-	340	360	390	400
Irving Oil Limited	Saint-John	450	400	400	440	450
North Atlantic Refining Ltd.	Come-by-Chance	-	-	-	490	130
Quebec						
Petro-Canada	Montreal	400	340	420	330	400
Shell	Montreal	-	390	370	210	280
Ultramar	St-Romuald	-	450	380	400	410
Ontario						
Imperial Oil	Sarnia	-	-	-	420	290
Shell	Sarnia	300	330	340	360	360
Imperial Oil	Nanticoke	-	-	-	160	290
Nova	Sarnia	-	-	-	-	-
Petro-Canada Lubricants	Mississauga	10	10	20	20	20
Petro-Canada	Oakville	-	-	-	170	320
Sunoco	Sarnia	460	340	300	370	460
Prarie and Northern Region						
Petro-Canada	Edmonton	260	190	220	210	230
Imperial Oil	Strathcona	300	290	400	410	380
Consumer's Co-op	Regina	270	200	270	250	230
Shell	Scotford	40	50	80	100	210
Syncrude *	Fort McMurray	-	-	-	-	-
Suncor	Fort McMurray	80	70	90	140	160
Parkland	Bowden	-	-	-	-	-
Pacific and Yukon Region						
Husky Oil	Prince George	140	140	200	200	210
Chevron	Burnaby	320	350	390	380	400
National Average		190	210	260	270	310

*Report Plant Consumption only

Table A3.3 : Volume Weighted Annual Sulphur Level in Regular Diesel

		Sulphur Levels (parts per million by weight)				
Name	City	1994	1995	1996	1997	1998
Atlantic						
Imperial Oil	Dartmouth	1,560	2,010	1,460	1,840	890
Irving Oil Limited	Saint-John	2,360	1,820	1,840	1,750	2,150
North Atlantic Refining Ltd.	Come-by-Chance	2,280	2,320	1,270	1,100	4,220
Quebec						
Petro-Canada	Montreal	3,240	2,910	3,720	3,540	2,430
Shell	Montreal	1,850	2,060	2,230	1,900	3,020
Ultramar	St-Romuald	880	800	760	860	-
Ontario						
Imperial Oil	Sarnia	1,390	660	690	-	-
Shell	Sarnia	3,750	4,050	4,040	4,200	4,090
Imperial Oil	Nanticoke	3,000	3,480	3,880	4,300	-
Nova	Sarnia	-	-	-	-	-
Petro-Canada Lubricants	Mississauga	-	-	-	-	-
Petro-Canada	Oakville	3,260	3,570	3,500	3,810	3,720
Sunoco	Sarnia	1,620	1,290	1,620	2,370	2,650
Prarie and Northern Region						
Petro-Canada	Edmonton	-	-	-	-	-
Imperial Oil	Strathcona	2,150	1,820	2,100	1,980	2,100
Consumer's Co-op	Regina	-	-	-	-	-
Shell	Scotford	-	-	-	270	-
Syncrude	Fort McMurray	-	-	-	-	-
Suncor	Fort McMurray	-	-	-	-	-
Parkland	Bowden	4,410	5,650	5,680	4,620	4,730
Pacific and Yukon Region						
Husky Oil	Prince George	600	570	580	-	-
Chevron	Burnaby	1,490	1,680	2,670	4,140	3,750
National Average		2,050	2,150	2,360	2,580	2,990

Table A3.4 : Volume Weighted Annual Sulphur Level in Light Fuel Oil

		Sulphur Levels (parts per million by weight)				
Name	City	1994	1995	1996	1997	1998
Atlantic						
Imperial Oil	Dartmouth	2,452	2,125	2,004	1,928	1,360
Irving Oil Limited	Saint-John	1,860	-	-	1,731	2,080
North Atlantic Refining Ltd.	Come-by-Chance	-	-	-	-	-
Quebec						
Petro-Canada	Montreal	2,000	2,577	3,591	2,753	3,336
Shell	Montreal	1,949	2,357	2,256	2,784	2,837
Ultramar	St-Romuald	1,390	1,120	1,281	1,355	2,231
Ontario						
Imperial Oil	Sarnia	3,138	1,668	1,803	1,417	2,260
Shell	Sarnia	4,070	3,000	-	-	-
Imperial Oil	Nanticoke	4,301	2,950	3,189	3,327	1,791
Nova	Sarnia	1,590	1,520	1,450	1,550	1,850
Petro-Canada Lubricants	Mississauga	-	-	-	-	-
Petro-Canada	Oakville	3,442	3,642	4,069	3,663	4,253
Sunoco	Sarnia	2,141	1,591	1,758	2,144	2,578
Prarie and Northern Region						
Petro-Canada	Edmonton	-	-	-	-	-
Imperial Oil	Strathcona	-	-	-	-	-
Consumer's Co-op	Regina	-	-	-	-	-
Shell	Scotford	-	-	-	-	-
Syncrude	Fort McMurray	-	-	-	-	-
Suncor	Fort McMurray	-	-	-	-	-
Parkland	Bowden	-	-	-	-	-
Pacific and Yukon Region						
Husky Oil	Prince George	-	-	-	514	599
Chevron	Burnaby	-	-	-	-	-
National Average		2,180	1,980	2,150	2,000	2,270

Table A3.5 : Volume Weighted Annual Sulphur Level in Heavy Fuel Oil

		Sulphur Levels (parts per million by weight)				
Name	City	1994	1995	1996	1997	1998
Atlantic						
Imperial Oil	Dartmouth	18,190	14,698	13,590	12,664	15,820
Irving Oil Limited	Saint-John	22,637	20,850	18,612	18,396	18,409
North Atlantic Refining Ltd.	Come-by-Chance	23,069	17,876	22,302	28,323	26,460
Quebec						
Petro-Canada	Montreal	25,950	20,644	22,130	21,072	19,730
Shell	Montreal	19,820	17,723	19,447	18,230	17,679
Ultramar	St-Romuald	9,329	8,324	10,070	11,361	11,440
Ontario						
Imperial Oil	Sarnia	19,804	21,970	20,153	21,840	22,530
Shell	Sarnia	27,317	25,835	27,398	28,326	26,485
Imperial Oil	Nanticoke	21,306	23,022	23,325	25,815	27,319
Nova	Sarnia	11,960	11,840	11,990	13,520	14,690
Petro-Canada Lubricants	Mississauga	-	-	-	-	-
Petro-Canada	Oakville	14,381	14,702	15,029	15,848	16,099
Sunoco	Sarnia	21,678	17,317	18,351	20,169	20,539
Prarie and Northern Region						
Petro-Canada	Edmonton	21,705	23,009	26,568	25,890	23,736
Imperial Oil	Strathcona	16,150	15,302	15,080	15,493	13,697
Consumer's Co-op	Regina	7,763	8,313	12,315	11,207	8,986
Shell	Scotford	-	-	-	-	-
Syncrude	Fort McMurray	-	-	-	-	-
Suncor	Fort McMurray	-	-	-	-	-
Parkland	Bowden	-	-	-	-	-
Pacific and Yukon Region						
Husky Oil	Prince George	19,388	26,300	16,636	13,800	19,549
Chevron	Burnaby	10,807	14,663	17,832	15,153	15,107
National Average		17,775	16,761	17,300	17,250	17,320

Appendix 4

Canadian General Standards Board Standards for
Sulphur Content in Fuels

Appendix 4: Canadian General Standards Board Standards for Sulphur Content in Fuels

Specification Number	Fuel Category	Maximum Sulphur Content (% mass)
	Gasoline	
CAN/CGSB-3.5-94	Unleaded, Automotive	0.10
CAN/CGSB-3.25-94	Aviation	0.05
	Aviation Turbo Fuel	
CAN/CGSB-3.23-93	Kerosene Type (Jet A, A-1, F-34)	0.30
CAN/CGSB-3.22-93	Wide Cut Type (Jet b, F-40)	0.40
	Kerosene	
CAN/CGSB-3.3-M89	Type No. 1-K	0.04
	Type No. 2-K	0.13
	Diesel Fuel	
CAN/CGSB-3.6-M90	Type A	0.30
	Type B	0.50
CAN/CGSB-3.517-93	Low Sulphur Automotive	0.05
	Diesel Fuel Mining	
CAN/CGSB-3.16-M88	Special	0.25
	Regular	0.50
	Fuel Oil, Heating Type	
CAN/CGSB-3.2-M89	Type 00	0.20
	Type 0	0.50
	Type 1	0.70
	Type 2	0.70
	Type 4	no limit
	Type 5	no limit
	Type 6	no limit
	Fuel, Naval Distillate	
3-GP-11Mb (1989)	-6^{o} C Pour Point	1.00
3-GP-15Mb (1989)	-18^{o} C Pour Point	1.00
3-GP-12Ma	**Fuel Oil, Marine Boiler**	3.50
	Naphtha Fuel	
CAN/CGSB-3.27-M89	Type 1	5 mg/kg
	Type 2	500 mg/kg
	Aviation Fuel	
3-GP-24c (1989)	High Flash Type	0.40

Appendix 5

Maximum Sulphur Content in Fuel Oils
Provincial Regulations and By-Laws

Appendix 5: Maximum Sulphur Content in Fuel Oils
Provincial Regulations and By-Laws

Province	Regulation/By-Law	Regulation Adoption	Maximum Sulphur Content (% mass)
Canada	Diesel Fuel Regulations Sulphur in Gasoline Regulation	1998 1999	0.05 0.015 avg/0.03cap(2002-04)[1] 0.003 avg/0.008cap(2005)[1]
New Brunswick	Clean Environment Act, Air Quality Regulation	1983, amended 1990	#1 - 0.5 #2 - 0.5 #4 - 1.5 #5 - 2.0 #6b - 3.0 #6c - 3.0
Quebec	Use of Petroleum Products Act Petroleum Products Regulation	1991, amended 1996	Gasoline: Grades 1,2,3,4 - 0.15 Diesel: Type AA - 0.2 Types A,B,C,D,E - 0.5 Heating Oil: Type 00 - 0.2 Types 0,1,2 - 0.5
	By-Law 90, Montreal Urban Community	1987	1.0-1.5
Ontario	Environmental Protection Act, Regulation 361, Sulphur Content in Fuels	1970, amended 1980, amended 1990 -effective in Metro Toronto only	#1 - 0.5 #2 - 0.5 #4 - 1.5 #5 - 1.5 #6b - 1.5 #6c - 1.5
	Environmental Protection Act, Regulation Made Under the Environmental Protection Act, Boilers	1986	1.0
British Columbia	Waste Management Act, Sulphur Content in Fuel Regulation	1989	1.1
	Diesel Fuel Regulation	1994 -effective for on-road diesel only	0.05
	Cleaner Gasoline Regulation	1995 -effective 1999 Southwest B.C. -effective 2000 for the rest of B.C.	0.015[2] 0.020[2]

[1] Has various options - see regulation for details.

[2] Annual limit, also can use the U.S. Complex Model to provide equivalent emission levels.

Appendix 6

Comparison of Average Fuel Sulphur Content in the Liquid Fuels Report With the Limits Set Forth by the Canadian General Standards Board and the Provincial Regulations

Appendix 6: Average Sulphur Content in the Liquid Fuels Report With the Limits Set Forth by the Canadian General Standards Board and the Provincial Regulations

1) Average Sulphur Content (%) in the Liquid Fuels Report Versus the Limits Set Forth by the CGSB

Type of Fuel	Sulphur Content (%) in Liquid Fuels Report (1999)	CGSB (%)
Aviation Turbo Fuel	0.055	0.3 - Jet A 0.4 - Jet B
Motor And Aviation Gasoline	0.032	0.10 - Leaded/Unleaded 0.05 - Aviation
Kerosene/Stove Oil	0.045	0.04 - Type No. 1-K 0.13 - Type No. 2-K
Low Sulphur Diesel Fuel	0.032	0.05
Diesel Fuel	0.230	0.30 - Type A 0.50 - Type B
Light Fuel Oil	0.203	0.70
Heavy Fuel Oil	1.771	No Limits

2) Average Sulphur Content (%) in the Liquid Fuels Report for Heavy Fuel Oil Versus the Limits Set Forth by Provincial Regulations

		Provincial Regulations	
Region	**Sulphur Content (%) in Liquid Fuels Report (1999)**	**Province**	**Sulphur Content Limit (%)**
Atlantic	2.148	New Brunswick	1.5 - Type 4 2.0 - Type 5 3.0 - Type 6
Quebec	1.241	Quebec	2.0 1.0/1.5 - Montreal
Ontario	1.939	Ontario	1.0 - Boilers 1.5 - All Types - Toronto
Prairie and Northern	1.324	---	---
Pacific and Yukon	1.726	B.C.	1.1 - All Types