Environment Canada Environnement Canada

Benzene in Canadian Gasoline:

Effect of the *Benzene in Gasoline Regulations*

2009 Annual Report

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Notice

The information contained in this report is compiled from data as of June 21, 2010, submitted by the producers and importers of gasoline in Canada pursuant to the requirements of the *Benzene in Gasoline Regulations* under the *Canadian Environmental Protection Act, 1999*. Information submitted to Environment Canada has been reviewed for reasonableness but may be subject to errors made at the source.

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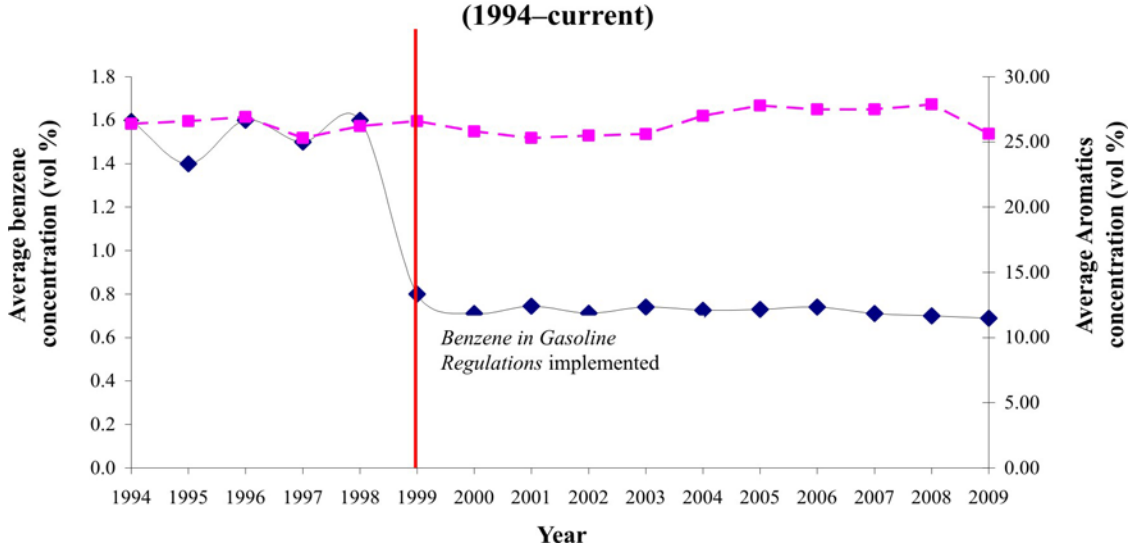
1.0 Summary

This report reviews how primary suppliers have responded to the *Benzene in Gasoline Regulations* of the *Canadian Environmental Protection Act, 1999* (CEPA 1999). The *Benzene in Gasoline Regulations* came into effect on July 1, 1999, fulfilling a recommendation of the federal-provincial Task Force on Cleaner Vehicles and Fuels. In 1995, the Task Force recommended to the Canadian Council of Ministers of the Environment (CCME) that benzene in gasoline be reduced through a federal regulation to 1% by volume and that aromatics (or equivalent benzene tailpipe emissions) be frozen at 1994 levels. The CCME endorsed this recommendation. Consequently, the federal government passed the federal *Benzene in Gasoline Regulations* on November 26, 1997.

The *Benzene in Gasoline Regulations* have been successful in achieving both of the recommendations of the Task Force: reported benzene levels have been significantly reduced and reported aromatic levels are about the same as they were in 1994. Figure 1.1 shows how benzene and aromatics levels have changed since the coming into force of the regulations.

Figure 1.1: Average Benzene and Aromatics Content of Canadian Gasoline (1994–current)



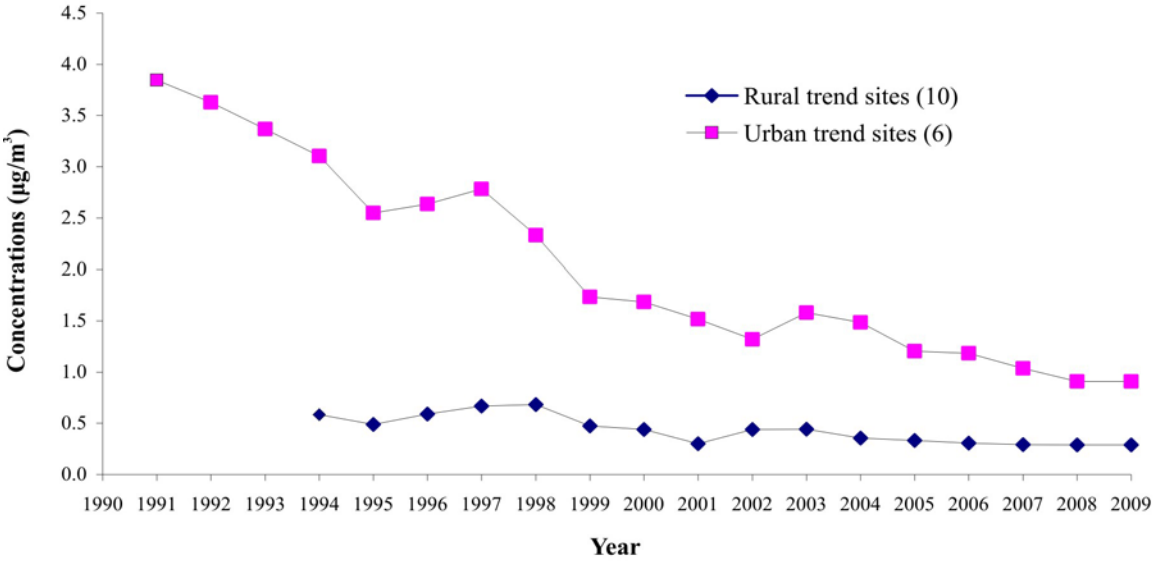
All primary suppliers must submit reports annually to Environment Canada reporting on the composition of the gasoline they supplied in that year (quarterly reports were required until the end of 2002). For the 2009 reporting year all but one primary supplier reported that their gasoline met the regulated requirements with respect to benzene concentration and benzene emissions number (BEN). The one supplier that did not meet the requirements exceeded the maximum benzene concentration level. Details on the exceptions can be found in Section 3.3: Reported Exceedances of Regulated Limits.

Independent audits are required for those primary suppliers that elected to be on a yearly pool average and must be submitted to Environment Canada by May 31 of the year following the reporting period. This report includes analysis of the independent audits conducted for the 2009 reporting period. Those audits found seventeen instances of non-

compliance with administrative requirements involving sampling and reporting requirements. Six primary suppliers outlined the corrective actions that they took to address these issues.

Figure 1.2 presents the annual benzene levels in urban and rural Canada from 1991 to 2009.

Figure 1.2: Average Mean Ambient Benzene Levels (1991–current)



Source of data: Claire Austin (Environment Canada), NAPS Annual Benzene Report (1991–2009), July 11, 2011.

Figure 1.2 has been produced on the basis of a raw NAPS dataset that has not been fully validated. The dataset, sources of uncertainty and detection limits are currently under review (July 2011).

NAPS is Canada's "National Air Pollution Surveillance" program conducted on the basis of a Memorandum of Understanding (MOU) between the federal government and the provinces and territories. Data collected at "designated" air monitoring sites identified in the MOU and at other "non-designated" sites are reported in NAPS datasets.

Benzene is one of a suite of volatile organic compounds (VOCs) that were measured in 50 050 electropolished stainless steel canister (Summa™) samples collected at 90 air monitoring sites across Canada from 1989–2009. There were 55 sites operational in 2009 collecting a total of 3552 samples for that year. Summa canister samples were analyzed at Environment Canada's Air Quality Research Division, Analysis and Air Quality Section, 335 River Road, Ottawa.

Based on data availability, urban trend sites were selected covering the period 1991–2009 and rural trend sites were selected covering the period 1999–2009. An annual and seasonal (summer and winter) data completeness criterion of 75% was applied over the respective times periods. All trend sites had at least 75% data completeness in 2009.

These criteria were met for only 10 urban sites across Quebec, Ontario, Manitoba, Alberta and British Columbia for the period 1991–2009, and for six rural sites across Nova

Scotia, Quebec and Ontario for the period 1999–2009. Although all 10 urban trend sites were "designated" NAPS sites, one of them is now closed. Five of the six rural trend sites were "non-designated" sites.

Spatially, the urban and rural trend sites are not distributed equally across the country. Because of this, and because of the limited number of trend sites, these data are not necessarily representative of an overall national trend in benzene concentrations. Also, urban and rural benzene levels are not easily comparable because the former are based on 24-hr integrated samples, while the latter are based on 4-hr integrated samples collected during the middle of the day.

Annual means were calculated for the urban and rural trend sites based on all of the data collected during the year—including summer, winter, spring and fall seasons. All sites were weighted equally. There was considerable variability in the data, especially during the 1990s. Outliers were not removed from the dataset. There was no interpolation of missing data. No special statistical or analysis techniques were used.

Urban annual mean benzene concentrations decreased by approximately 0.2 µg/m^3 per year at 10 NAPS urban trend sites, from 4.5 µg/m^3 in 1991 to 0.9 µg/m^3 in 2009 (Figure 1.2). There was no statistically significant trend observed in ambient benzene levels measured at the six NAPS rural trend sites, annual mean concentrations remaining steady at approximately 0.3 µg/m^3 during the period 1999–2009.

2.0 Overview of *Benzene in Gasoline Regulations*

This report reviews the compliance of primary suppliers' (refiners, importers and blenders) gasoline with the *Benzene in Gasoline Regulations*,[1] and summarizes levels of various parameters in Canadian gasoline. The information used for this report was provided by primary suppliers, as required under the Regulations.

2.1 Benzene in Gasoline Regulations

The *Benzene in Gasoline Regulations* were passed in November 1997 in order to reduce emissions of benzene from gasoline-powered vehicles. The regulations limit the level of benzene and the benzene emission number (BEN)[2] of Canadian gasoline and require reporting on the composition of gasoline that is produced, imported or blended.[3] The Regulations apply to all types of gasoline for sale or use in Canada, except gasoline for use in aircraft, competition vehicles or scientific research.

All primary suppliers of gasoline must submit reports annually on the levels of various parameters of their gasoline to Environment Canada (quarterly reports were required until the end of 2002). Importers must notify Environment Canada at least 12 hours in advance of their intention to import:

[1] SOR/97-493, as amended by SOR/99-204, SOR/2000-102, SOR/2003-318 and SOR/2004-252; a copy of the Regulations can be found at www.ec.gc.ca/CEPARegistry/regulations.

[2] BEN: The Benzene Emission Number relates gasoline composition to the estimated emissions of benzene from vehicles. It is a number calculated using various gasoline parameters and relates gasoline composition to emissions of benzene from a "typical" 1990 vehicle (see Schedule 1 of the Regulations).

[3] The definition of "blend" in the Regulations excludes the mixing of complying gasoline or the adding of only additives, commercially-pure butane or oxygenate to complying gasoline.

- more than 100 m^3 of gasoline at any one time;
- any amount of gasoline-like blendstock; or
- into a province, more than 1000 m^3 of gasoline within any one day.

The *Benzene in Gasoline Regulations* introduced a new approach to controlling fuel composition by allowing regulatees the option to elect to use a yearly pool average as the basis for compliance. This option is selected separately for each refining, blending facility and import pool, and provides regulatees considerable flexibility in meeting the requirements of the regulations. The Regulations are mainly focused on primary suppliers (refiners, blenders and importers) who can affect the composition of gasoline. There is also a per-litre limit for benzene at the point of sale. In addition to setting a limit for gasoline benzene content, the Regulations also set a limit for the benzene emission number (BEN) of gasoline, a number that relates gasoline composition to estimated emissions of benzene from vehicles.

The regulated limits apply to individual refineries, blending facilities and imports into a province from outside Canada. Primary suppliers are subject to flat limits for each of their refineries, blending facilities or import pools unless they have elected for yearly pool average limits. The yearly pool average is the volume-weighted average of benzene or BEN of the gasoline supplied by the primary supplier during a year and may be selected for either benzene, BEN or both. Independent audits must be submitted to Environment Canada by primary suppliers who elect to be on a yearly pool average.

Since July 1, 1999, primary suppliers have been subject to limits on the level of benzene and the BEN in the gasoline they produce, blend or import. Table 2.1 summarizes the regulated limits for benzene and the BEN.

Table 2.1: Regulated Limits for Benzene and the BEN

Supplier Activity	Type of Limit	Benzene % by volume	BEN*	
			Summer	Winter
Production, Blending and Imports	Flat	1.0	71	92
	Yearly-Pool Average	0.95	59.5 (annual average)	
	Not-to-be-exceeded cap	1.5	102	132
Sales	Flat	1.5	N/A	N/A

* Four refineries use alternative (higher) limits for BEN pursuant to subsection 17(2) of the Regulations (refer to Appendix 2 for further information).

2.2 Alternative Limits for the BEN

Under subsection 17(2) of the Regulations, a primary supplier may have elected before December 1, 1998, to use alternative (higher) limits for the BEN. Petro-Canada and Shell elected to use alternative (higher) limits for the BEN at their Ontario and Quebec refineries. Their alternative limits were set out in a Notice published by the Minister of the Environment in the *Canada Gazette* on September 4, 1999 (see Appendix 2). The Petro-Canada refinery in Oakville has since been closed.

These alternative limits were based on the historical composition of the primary supplier's gasoline, thereby reflecting its historical BEN number. These limits can be found in Appendix 2 (CGI, Vol. 133, No. 36). There is no expiry date for alternative BEN limits, although a primary supplier may rescind the alternative limit at any time. A supplier rescinding its alternative limit would then be subject to the normal limits for BEN.

3.0 Compliance with the Regulations

3.1 Primary Suppliers and the Options to Meet Requirements

Primary suppliers are required to register with Environment Canada using the Registration Form for a Manufacturer, Blender or Importer of Gasoline (see Appendix 1). Table 3.1 shows the primary suppliers who were registered with Environment Canada[4] and reported supplying gasoline during 2009 indicating their choice for either a "Flat" (flat per-litre limit) or "YPA" (yearly pool average) as the basis of compliance with the benzene and BEN limits.

Table 3.1: Primary Suppliers Reporting on Gasoline Composition (2009)

	Name	Facility or Import Location	Benzene Limit	BEN Limit
Refiners	Chevron Canada Ltd.	Burnaby, BC	YPA	YPA
	Consumer's Cooperative	Regina, SK	YPA	Flat
	Husky Oil Operations Ltd.	Prince George, BC	YPA	YPA
	Imperial Oil Ltd.	Dartmouth, NS	YPA	Flat
	Imperial Oil Ltd.	Sarnia, ON	YPA	Flat
	Imperial Oil Ltd.	Strathcona, AB	YPA	Flat
	Imperial Oil Ltd.	Nanticoke, ON	YPA	Flat
	Irving Oil Ltd.	St. John, NB	YPA	YPA
	North Atlantic Refining Ltd.	Come-By-Chance, NL	Flat	Flat
	Shell Canada Products	Montréal, QC	YPA	YPA
	Shell Canada Products	Scotford, AB	YPA	YPA
	Shell Canada Products	Sarnia, ON	YPA	YPA
	Suncor Energy Products Inc.	Montréal, QC	YPA	YPA
	Suncor Energy Products Inc.	Edmonton, AB	YPA	YPA
	Suncor Energy Products Inc.	Sarnia, ON	YPA	YPA
	Ultramar Ltee.	St-Romuald, QC	YPA	YPA
Blenders	Ultramar Ltee.	Montréal, QC	YPA	Flat
Importers	Honda	Alliston, ON	Flat	Flat
	Imperial Oil Ltd.	Burrard, BC	Flat	Flat
	Larry Penner Enterprises	Emerson, MB	Flat	Flat
	Pétroles Norcan Inc	Notre-Dame Est, QC	Flat	Flat
	Shell Trading Canada	British Columbia	Flat	Flat
	Suncor Energy Products Inc.	Burrard, BC	YPA	YPA

[4] See *Registration Form for a Manufacturer, Blender or Importer of Gasoline* in Appendix 1.

As indicated in Table 3.1, refineries tend to prefer yearly pool average limits for the benzene concentration and BEN respectively, whereas blenders and importers often opt for flat per-litre limits.

3.2 Information Reported

Under section 8 of the regulations, primary suppliers must provide the information set out on the form entitled *Report on the Composition of Gasoline* (see Appendix 1) before February 15 of the following year. Prior to 2003, the reports were submitted quarterly. After 2003, it was mandatory that reports be submitted before February 15 of the following year.

In addition to the volume of gasoline supplied (m^3), the number of batches supplied and the names of any oxygenates added, the regulations require that primary suppliers also report the maximum and year-to-date average values[5] for the following parameters:

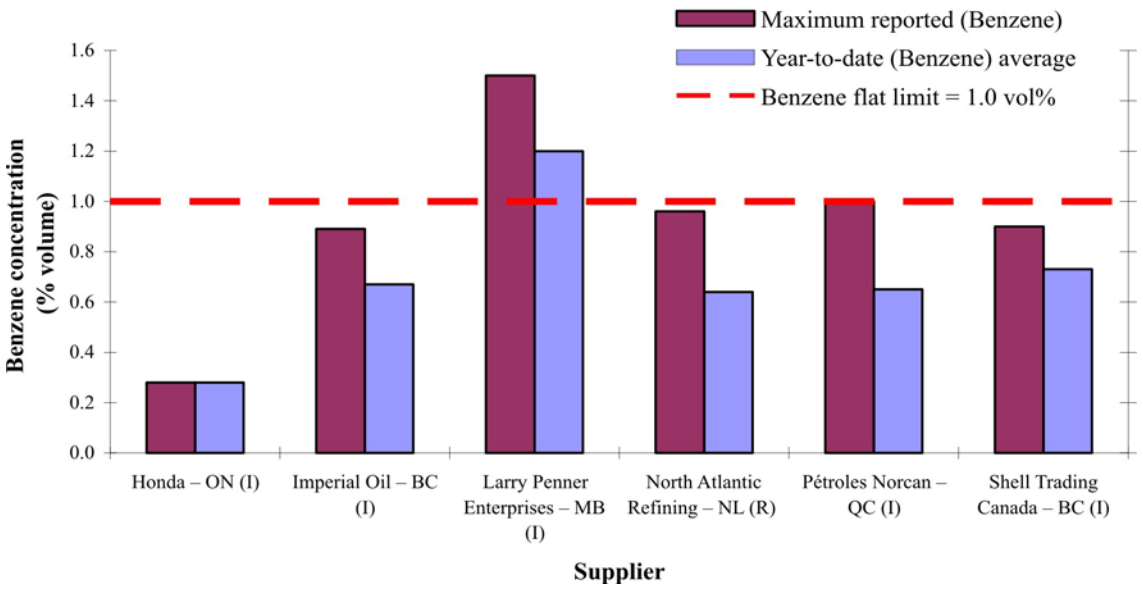
- concentration of benzene (% by volume),
- value of BEN,
- concentration of aromatics (% by volume),
- concentration of olefins (% by volume),
- concentration of sulphur (mg/kg),
- concentration of oxygen (% by weight),
- vapour pressure at 37.8°C (100°F) (kPa),
- evaporation fraction at 93.3°C (200°F – E200) (% by volume), and
- evaporation fraction at 148.9°C (30°F – E300) (% by volume).

3.3 Reported Exceedances of Regulated Limits

For primary suppliers using flat limits (R = refiner, I = importer, B = blender), Figure 3.1 shows the reported maximum and average benzene level and Figure 3.2 shows the reported maximum and average BEN.

[5] Prior to 2002, the quarterly volume-weighted average values were required.

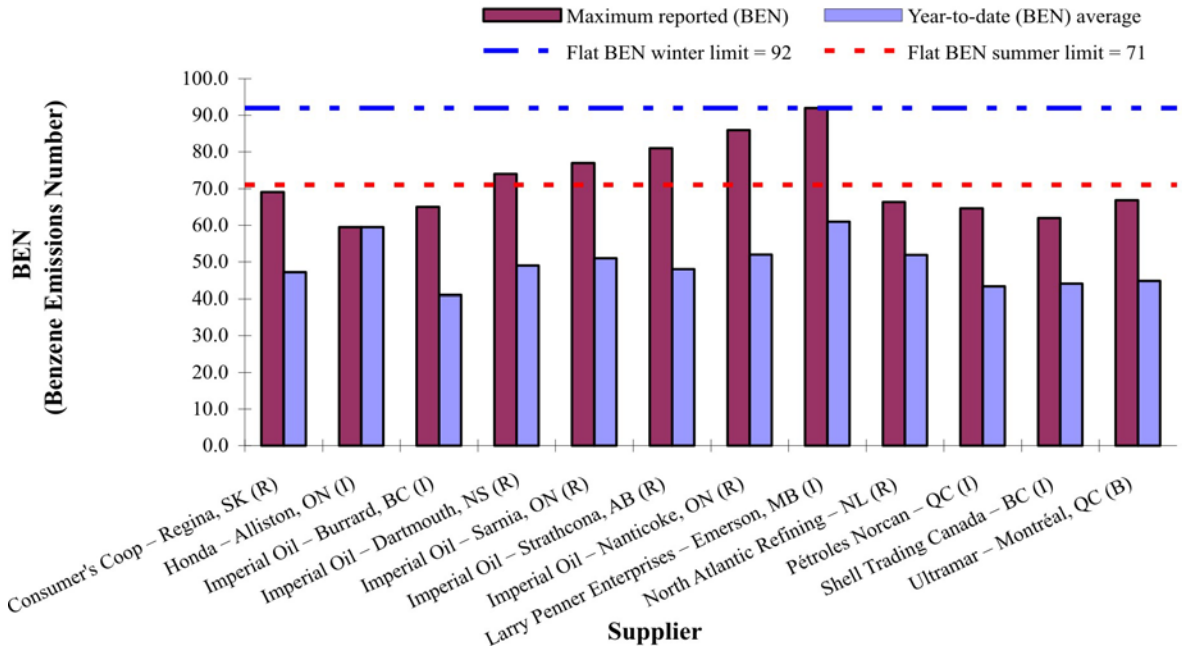
Figure 3.1: Reported Benzene Levels (Maximum and Average) for Suppliers on a Flat Limit, 2009



As shown in Figure 3.1 there was one reported exceedance of the benzene flat limit of 1.0% by an importer, Larry Penner Enterprises Inc., in Manitoba.

Environment Canada's Enforcement Branch is responsible for the enforcement of regulations created under CEPA 1999, including the *Benzene in Gasoline Regulations.* As part of its enforcement activities, Enforcement Branch reviews data reported by regulatees under the *Benzene in Gasoline Regulations.* All CEPA 1999 regulations are enforced in accordance with the Compliance and Enforcement Policy for the Canadian Environmental Protection Act, 1999, available on Environment Canada's website at www.ec.gc.ca/lcpe-cepa.

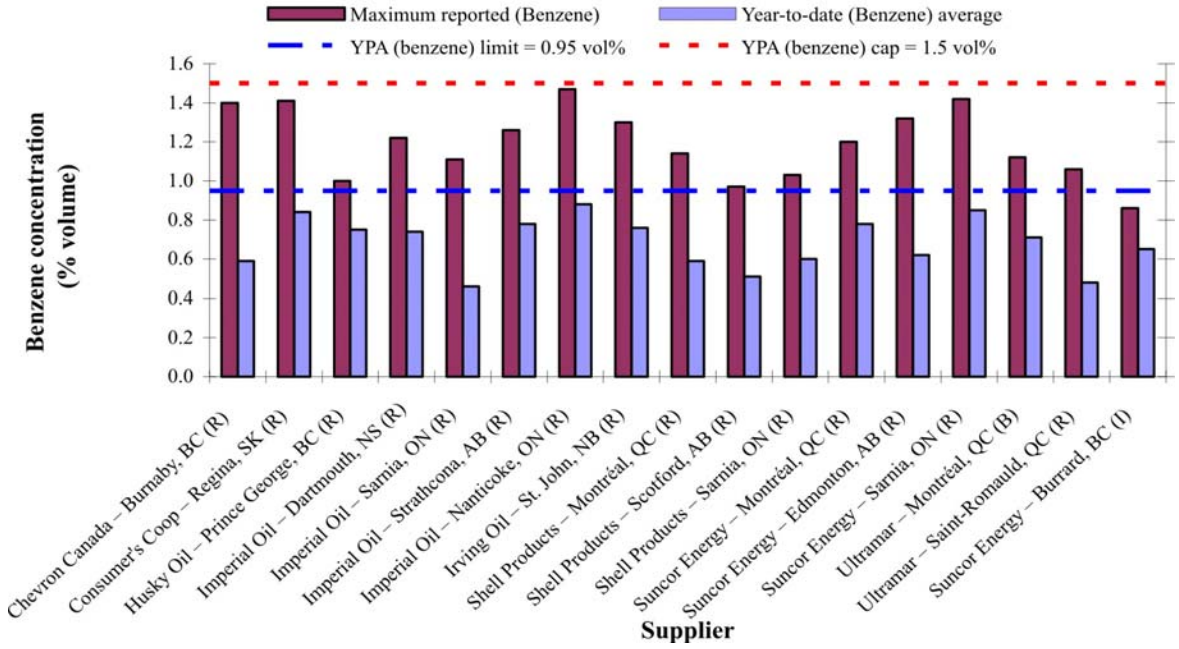
Figure 3.2: Reported BEN (Maximum and Average) for Suppliers on a Flat Limit, 2009



As shown in Figure 3.2, there were no exceedances of the seasonal BEN limits by a flat-limit supplier in the year 2009.

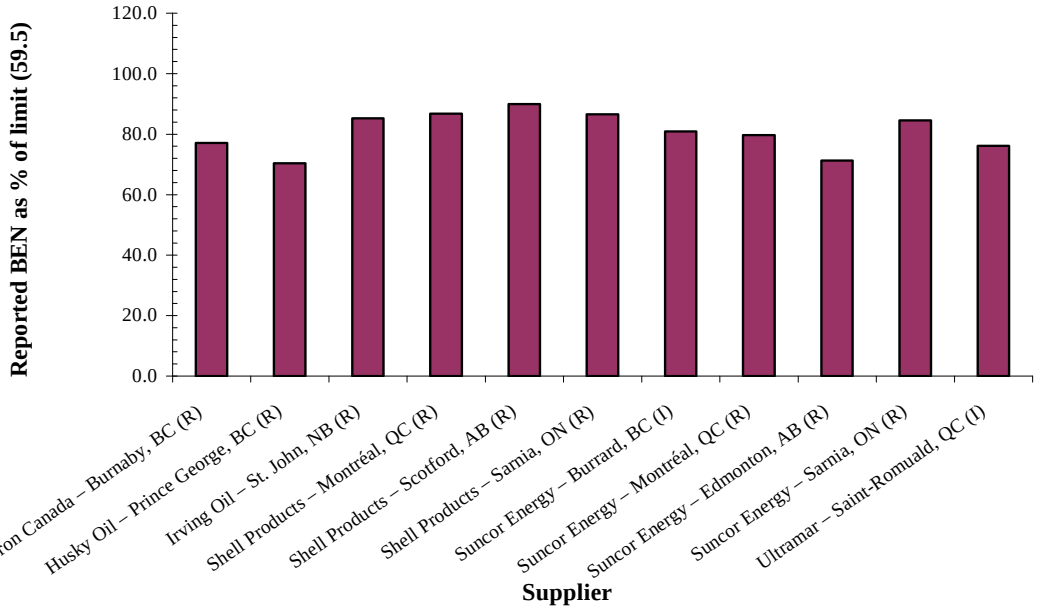
For primary suppliers using YPA limits, Figure 3.3 shows the reported average and maximum benzene levels and Figure 3.4 shows the reported average BEN as a percentage of the regulated limit (59.5 YPA). The yearly pool average data from Figures 3.3 and 3.4 represent the volume weighted average for all gasoline from a given primary supplier during the year.

Figure 3.3: Reported Benzene Levels (Maximum and Average) for Suppliers on a Yearly Pool Average Limit, 2009



No annual reports received by Environment Canada reported maximum benzene levels that exceeded the benzene limit of 1.5% (never-to-be-exceeded-cap) as shown in Figure 3.3.

Figure 3.4: Reported BEN Average (% of Limit) for Suppliers on a Yearly Pool Average Limit, 2009



As indicated in Figure 3.4, all primary suppliers were compliant with the yearly pool average limit of 59.5 for BEN in 2009 as prescribed by the Regulations.

3.4 Summary of 2009 Independent Audits

Under section 22 of the Regulations, a primary supplier that has elected to use a yearly pool average as its basis for compliance must have an independent auditor perform an audit of the primary supplier's systems, practices and procedures and its compliance with the Regulations.

The auditor's report must be submitted to Environment Canada by May 31 of the year following the reporting period. Environment Canada views the audits as a crucial component of the enforcement provisions of the Regulations and, to be effective, the auditing process must be independent and thorough. The concept of a yearly pool average relies on the maintenance of complete records and reports. The audits are intended to provide Environment Canada assurance that the yearly pool averages are being correctly reported. This section contains the analysis of the independent audits submitted for the 2009 reporting period.

For the 2009 reporting year, 16 audits were submitted by 8 companies in regard to 14 refineries and 3 importers. Fourteen of these audits were combined audits capturing the audit requirements for both the *Benzene in Gasoline Regulations* and the *Sulphur in Gasoline Regulations*. The audits were conducted by four audit companies.

Paragraph 22(3)(*e*) of the Regulations requires that the audit contain "an assessment by the auditor of the extent to which the primary supplier has complied with these Regulations throughout the year of the audit." The 2009 audits indicate that all primary suppliers subject to audits met the regulated limits for benzene concentration and BEN.

Eight audit reports identified one or more instances of minor non-compliance with the administrative requirements of the regulations, for a total of 10 instances of non-compliance. Six companies accompanied the audit report with a list of corrective actions that have been taken by the primary supplier, covering 8 of the 10 instances of non-compliance.

Instances of minor non-compliance involved sampling and reporting requirements. With respect to sampling, instances of non-compliance included:

- Benzene in gasoline concentration test method was not fully compliant with the CAN/CGSB 3.0 No. 14.3.99.
- Storage of samples was not in compliance due to lack of sample volume stored.

With respect to the annual reports required by the regulations, instances of non-compliance included:

- In the annual reports, numbers were entered incorrectly or were missing from report.
- Exported gasoline data was included in annual report.
- Inconsistency in data on Excel spreadsheet used to calculate benzene YPA with data from the Laboratory Information System.
- Inaccuracy found in Report on Composition of Gasoline (Sch. 3) where BEN was incorrectly checked on the yearly pool average election.
- Q3 and Q4 data were incorrectly calculated from the Excel spreadsheet.

Several recommendations for improvements were made by auditors in one of the evaluation reports. These recommendations were made relating to:

- procedures for updating compliance plans,
- documentation and procedures for sampling,
- procedures for updating and clarifying test methods,
- creating a succession plan to ensure information and processes are not lost.

4.0 Canadian Gasoline Composition

This section reviews the composition of gasoline in Canada during 2009, based on data reported by primary suppliers pursuant to the Regulations. The Regulations require that the following parameters are reported:

- the concentration of benzene,
- the value of BEN,
- the concentration of aromatics,
- the concentration of olefins,
- the concentration of sulphur,
- the concentration of oxygen,
- the vapour pressure,
- the evaporation fraction at 93.3°C (200°F – E200),
- the evaporation fraction at 148.9°C (300°F – E300).

Appendix 3 shows the regional and national concentrations for all parameters. Appendix 4 shows the parameters reported by individual companies.

4.1 Volume of Gasoline

The number of batches and volume of gasoline (excluding exports) reported are summarized in Table 4.1.

Table 4.1: Regional Volumetric Data (2009)

Region	Total Volume (m^3)	Number of Batches
Atlantic	3 133 810	400
Quebec/Ontario	23 495 864	2 276
West/North	13 482 520	2 432
National	40 112 194	5 108

4.2 Regulated Parameters: Benzene and BEN

Data reported on benzene and BEN levels for 2009 are summarized in Table 4.2. The national trend for benzene is shown graphically in Figure 4.1.

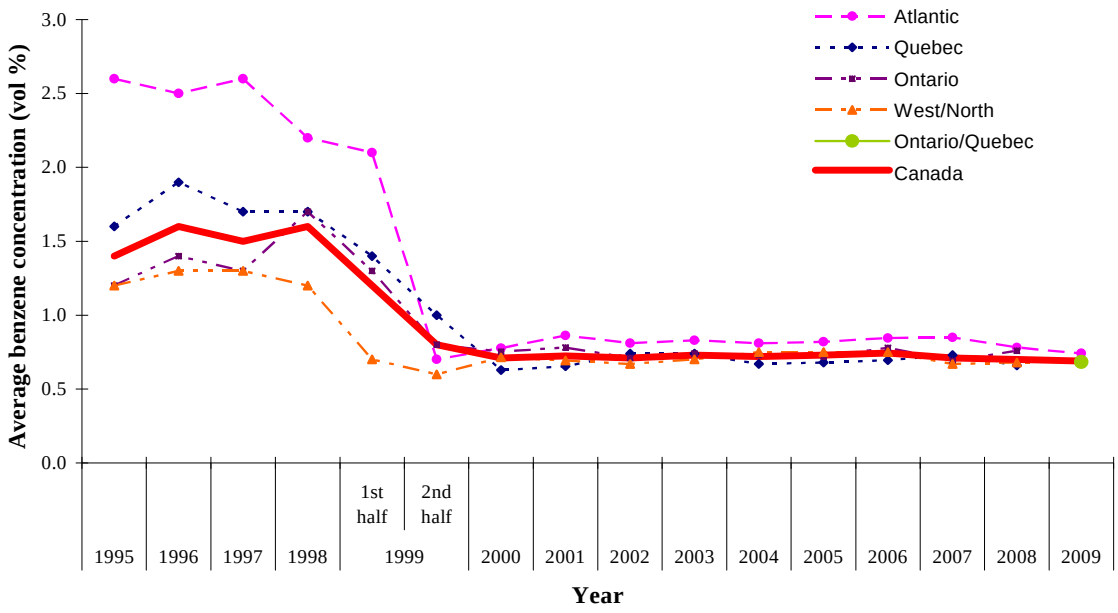
Table 4.2: Benzene Concentration and BEN (2009)

Year	Reported Volume Weighted Averages					
	Benzene (% Volume)			BEN		
	Minimum	Maximum	Canadian Volume Weighted Average	Minimum	Maximum	Canadian Volume Weighted Average*
2009	0.28	1.20	0.69	41.0	61.0	48.2

* Includes primary suppliers on alternative limits.

Figure 4.1 shows the graphical trend in benzene levels between 1995 and 2009 for Canada, both nationally and by region.[6] As the Regulations took effect mid-1999, the data for the year 1999 is presented separately for the first and second half of the year. Nationally, benzene levels in 2009 were half of those between 1995 and 1998.

Figure 4.1: Average Benzene Content of Canadian Gasoline by Region (1995–current)



[6] The data for 1995 to 1998 were collected from primary suppliers under a voluntary survey of benzene, aromatics and olefins in gasoline. All refiners and a number of importers participated in the survey. Annual reports on the survey were published by Environment Canada.

Figures 4.2 and 4.3 show the regional and national average values for benzene concentrations and BEN, respectively.

Figure 4.2: Average Benzene Concentration of Canadian Gasoline (2009)

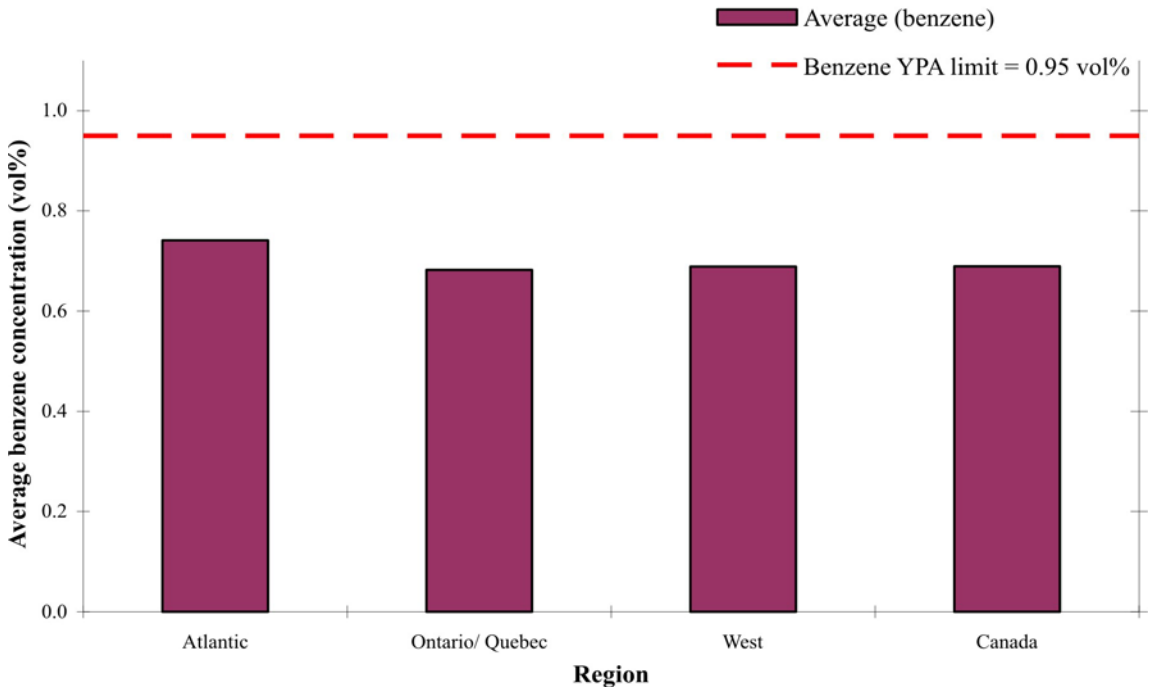
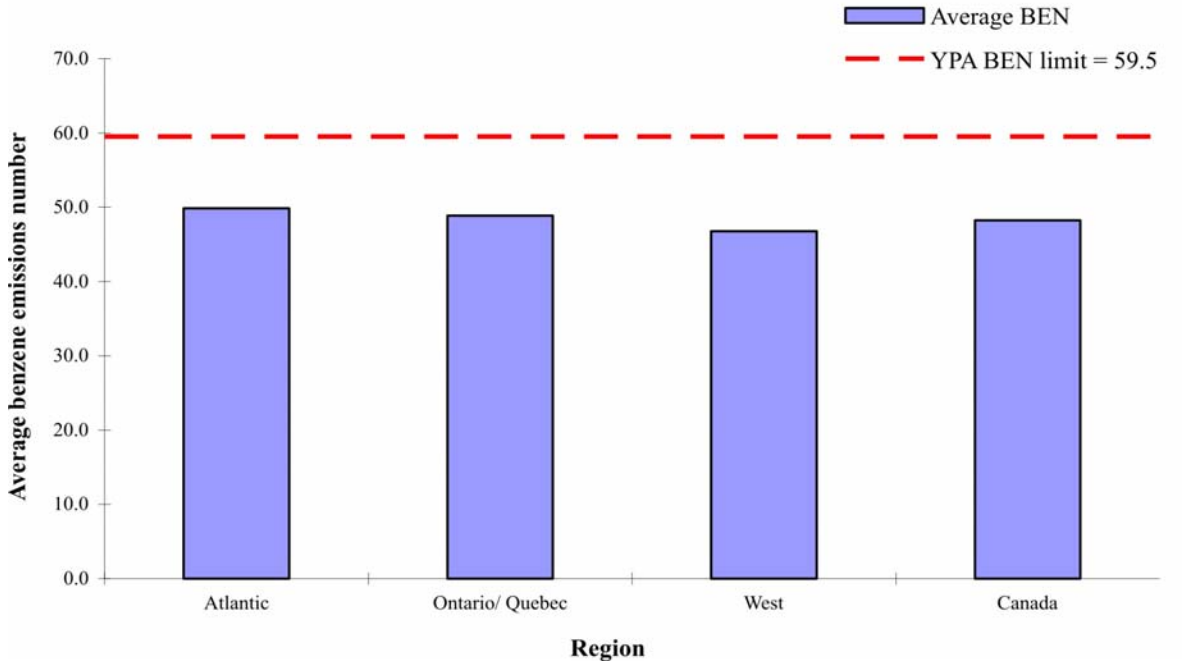


Figure 4.3: Average BEN of Canadian Gasoline (2009)



4.3 Reported Oxygen Concentration

Primary suppliers are required to report the type of oxygenate that they use and the oxygen concentration of the gasoline produced or imported. Tables 4.3 and 4.4 summarize the concentrations of MTBE and ethanol, respectively, based on the reported oxygen concentrations and type of oxygenate. Since 2000, the average level of MTBE reported in gasoline produced and imported has decreased to negligible amounts. The average concentration of ethanol in gasoline that was reported for 2009 showed an approximate 13% decrease from 2008 levels. The data presented here does not include oxygenates that are blended downstream of the refinery or point of import. As a result, these values are likely to be underestimates of the usage of oxygenates in Canadian gasoline.

Table 4.3: Average and Maximum Concentrations of MTBE Reported

Region	Average Concentration of MTBE Based on All Volumes of Gasoline Reported (% vol)									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Atlantic	0.85	1.13	0.14	0.08	0.06	0.11	0.02	0.00	0.00	0.00
Quebec	0.02	0.08	0.04	0.06	0.22	0.07	0.17	0.10	0.04	0.03
Ontario	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
West	0.21	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Canada	0.14	0.11	0.02	0.02	0.06	0.03	0.06	0.00	0.00	0.01
Region	**Maximum Concentration of MTBE Based on All Volumes of Gasoline Containing MTBE (% vol)**									
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Atlantic	14.89	15.39	14.83	14.67	14.72	14.39	0.61	0.00	0.00	0.00
Quebec	3.00	7.11	2.22	9.44	9.27	7.90	13.94	13.56	10.89	9.67
Ontario	11.44	12.22	0.28	11.06	2.78	6.11	0.00	0.00	10.94	
West	15.56	0.00	3.33	8.33	1.11	0.00	0.00	0.00	0.00	0.00
Canada	15.56	15.39	14.83	14.67	14.72	14.39	13.94	13.56	10.94	9.67

* 15 % MTBE by volume = approximately 2.7 wt % oxygen.

Table 4.4: Average and Maximum Concentrations of Ethanol Reported

Region	Average Concentration of Ethanol Based on All Volumes of Gasoline Reported (% vol)									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quebec	0.04	0.00	0.01	0.19	0.29	0.10	0.03	1.62	1.71	0.38
Ontario	1.43	1.69	1.81	2.02	1.80	1.98	2.02	0.00	0.00	
West	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.24	0.59	0.65
Canada	0.46	0.60	0.61	0.60	0.67	0.57	0.52	0.64	0.79	0.44
Region	**Maximum Concentration of Ethanol Based on All Volumes of Gasoline Containing Ethanol (% vol)**									
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quebec	10.00	10.00	10.00	10.00	10.00	10.00	10.00	25.84	25.68	9.46
Ontario	10.00	10.00	10.00	9.73	10.00	75.95	71.89	9.19	0.00	
West	0.57	0.00	10.00	10.00	10.81	10.00	10.54	10.54	10.81	10.54
Canada	10.00	10.00	10.00	10.00	10.81	75.95	71.89	25.84	25.68	10.54

* 10 % ethanol by volume = approximately 3.7 wt % oxygen.

4.4 Trends of Aromatics and Olefins

From 1994 to 1998, data on the benzene, aromatic and olefin concentrations in gasoline were collected by Environment Canada under a voluntary survey. Olefin concentrations were added to this survey in 1997. When gasoline is combusted in the vehicle's engine, aromatics in the gasoline can form benzene (a known human carcinogen), while olefins can form 1,3-butadiene (a probable human carcinogen).

Trends for aromatics and olefins content are shown in Tables 4.5 and 4.6, respectively.[7] These data show that 2009 national reported levels of aromatics have slightly decreased since 2008. Similarly, levels of olefins have slightly decreased since 2008 and remain among the lowest reported levels since 1997.

Table 4.5: Average Aromatics Content of Canadian Gasoline 1995–current

Region	Volume-Weighted Average Aromatics (volume %)															
	1995	1996	1997	1998	1999		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					1st half	2nd half										
Atlantic	31.6	29.4	30.3	31.5	30.8	28.3	28.0	25.9	26.4	26.4	27.8	27.2	28.0	27.2	27.2	27.7
Quebec	28.5	27.3	24.8	22.0	26.1	27.4	25.4	25.4	26.0	25.5	26.8	28.8	27.9	28.8	29.4	28.7
Ontario	26.3	28.5	28.1	30.2	27.9	29.0	28.3	27.6	27.0	25.9	29.6	29.8	30.9	30.0	30.3	
West	24.6	24.5	23.1	24.1	23.9	23.4	23.6	23.5	23.3	24.5	24.6	25.3	25.2	24.3	24.8	25.6
Canada	26.6	26.9	25.3	26.2	26.2	26.6	25.8	25.5	25.5	25.3	27.0	27.8	27.7	27.5	27.9	27.6

Table 4.6: Average Olefins Content of Canadian Gasoline 1997–current

Region	Volume-Weighted Average Aromatics (volume %)													
	1997	1998	1999		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
			1st half	2nd half										
Atlantic	8.7	13.6	11.7	14.1	15.1	17.4	17.7	16.2	14.7	13.8	15.2	13.9	13.6	13.2
Quebec	14.1	12.5	13.3	14.2	13.6	14.1	13.4	13.4	11.8	11.5	13.3	11.7	12.3	9.6
Ontario	10.2	9.4	10.8	9.7	10.3	10.4	9.5	8.7	8.4	7.5	7.0	7.6	7.5	
West	10.9	9.8	9.4	10.2	10.1	10.9	10.7	11.1	10.1	9.5	9.1	9.1	8.4	9.3
Canada	11.2	10.6	11.0	11.4	11.4	12.1	11.5	11.4	10.3	9.4	10.5	9.9	9.9	9.8

[7] The data for 1995 to 1998 were collected from primary suppliers under a voluntary survey of benzene, aromatics and olefins in gasoline. All refiners and a number of importers participated in the survey. Annual reports on the survey were published by Environment Canada.

4.5 Comparison of Imported vs. Domestic Gasoline

Table 4.7 compares the data provided by refiners and importers. As was shown in Table 3.1, flat limits were selected by the majority of importers while the YPA option was selected by the majority of refiners. As shown in Table 4.7, importers reported lower maximum values for all parameters except for the distillation parameter E300.

Table 4.7: Comparison of Importers and Refiners Reported Maximum and Average Values (for All Reported Parameters in 2009)

Parameter	Reported Maxima		Calculated Volume Weighted Average	
	Importers	Refiners	Importers	Refiners
Oxygen (wt %)	3.60	3.90	0.07	0.18
Sulphur (mg/kg)	52.00	79.00	13.30	17.72
Vapour Pressure (kPa)	106.10	116.70	68.55	80.93
E200 (vol %)	88.20	93.80	50.55	47.89
E300 (vol %)	100.00	96.70	86.28	84.64
Aromatics (vol %)	46.60	55.40	24.39	27.91
Olefins (vol %)	33.30	38.20	12.07	9.59
Benzene (vol %)	1.50	1.47	0.67	0.69
BEN	92.00	97.40	44.14	48.58

5.0 Other Gasoline Quality Information

5.1 Gasoline Regulations

The *Gasoline Regulations*[8] limit the concentration of lead in gasoline that is produced, imported, sold or offered for sale in Canada and limit the concentration of phosphorus in unleaded gasoline. The maximum concentration of lead produced, imported, sold or offered for sale in Canada is 5 mg/L and limit the concentration of phosphorus in unleaded gasoline to 1.3 mg/L. Gasoline for use in aircraft is exempt from the Regulations and gasoline for use in competition vehicles is not subject to the lead concentration restrictions.

Since 1990, the Regulations have significantly reduced lead emissions from gasoline, with 99.8% of gasoline now lead-free. The Regulations were passed in response to the 1986 Royal Society of Canada Commission on Lead in the Environment, which recommended to the Government of Canada that "Public health and environmental policy should be to reduce blood lead to its lowest possible level". Of particular concern were emissions of lead particles to the atmosphere, of which the largest source was gasoline

[8] SOR/90-247, as amended by SOR/92-587, SOR/94-355, SOR/97-147, SOR/98-217, SOR/2000-104, and SOR/2003-106; a copy of the Regulations can be found at www.ec.gc.ca/CEPARegistry/regulations.

lead particulates from the combustion of tetraethyl lead and tetramethyl lead, antiknock additives that were commonly used in gasoline.

The original regulations, and subsequent amendments, have provided exemptions for specific, limited uses of leaded gasoline, when a transition to non-leaded fuels was not technically and economically feasible. An exemption of indeterminate length was therefore provided for aircraft, and temporary exemptions have been provided for competition vehicles since 1994. The latest temporary exemption for competition vehicles expired on December 31, 2009.

The *Regulations Amending the Gasoline Regulations,*[9] published in July 2010, provide an exemption for the production, import and sale of leaded gasoline in Canada for use in competition vehicles for an indeterminate period. Record-keeping and reporting requirements for producers, importers and sellers of leaded gasoline remain in effect.

Although the dependence of the racing sector on leaded gasoline appears to be decreasing, a transition to non-leaded fuels remains infeasible for large Canadian events that are organized by U.S. racing associations that sanction the use of leaded gasoline.

In keeping with the broader policy goal of reducing lead emissions from gasoline, the government will work with international stakeholders, including the U.S. Environmental Protection Agency (EPA), to encourage a continued transition to non-leaded fuels by U.S. racing associations, will initiate a dialog with domestic stakeholders to promote a transition by Canadian competitors, and will review the decision to exempt within five years. This review will assess any new U.S. policies on this issue, industry progress towards reduced leaded gasoline use, new developments on the technical feasibility of a transition to non-leaded fuels, and any new information regarding the health impacts of lead exposure at Canadian race tracks. The willingness of industry stakeholders to work proactively toward a transition to non-leaded fuels will be a factor in the review.

Under the *Gasoline Regulations*, producers, importers or sellers of leaded gasoline must submit reports (see Appendix 1) to the Minister of the Environment as follows:

- Every person who produces, imports or sells (or offers for sale) in Canada leaded gasoline for use in competition vehicles is required to make and maintain records, which must be submitted annually to the Minister of the Environment, on or before March 31 of the year following the year the activity occurred. These records must include:
    - the brand name of the gasoline;
    - the octane rating and the method used for determining the octane rating of the gasoline;
    - the average yearly lead concentration in milligrams per litre (mg/L) of the gasoline for each brand name;
    - if the gasoline was sold for resale or distribution, the name and address of the re-seller or distributor;
    - if the gasoline was sold at a track or event location, the name and address of the track or event location where the gasoline was used; and
    - quantities of leaded gasoline produced, imported, sold or offered for sale.

[9] www.ec.gc.ca/lcpe-cepa/eng/Regulations/DetailReg.cfm?intReg=184

For the 2009 reporting period, eight companies submitted records of imports of leaded gasoline for use in competition vehicles totaling 827 639 litres. Eight companies submitted records of leaded gasoline sales. The reported average lead concentrations of that gasoline ranged from 8 mg/L to 2 134 mg/L.

APPENDIX 1

Annual Compliance Package with Sample Reporting Forms for the *Benzene in Gasoline Regulations* and *Gasoline Regulations*

Current package available at:
http://ec.gc.ca/energie-energy/default.asp?lang=Fr&n=48F8FEEC-1

Benzene in Gasoline Regulations

NOTE: Information contained in this page is for compliance promotional purposes and has NO legal status. For requirements under the Regulations, refer to the actual regulations.

These regulations apply to importers, manufacturers and blenders of gasoline. They also apply to anyone that sells gasoline or offers it for sale.

The Regulations prohibit the production or import of gasoline with a benzene content exceeding 1.0% by volume. They also restrict the Benzene Emissions Number (BEN), a calculated parameter that relates gasoline composition to predicted emissions of benzene from vehicle tailpipes to a maximum of 71 in the summer and 92 in the winter. Companies may elect to meet annual pooled averages for benzene and BEN, in place of the above limits.

The Regulations also prohibit the sale of gasoline with more than 1.5% by volume of benzene.

Various reporting and record-keeping requirements are specified in different sections of the Regulations. For instance:

- Section 6 requires that information on alternative sampling or analysis methods be submitted 60 days prior to use.
- Section 7 specifies that registration as per Schedule 2 is required with Environment Canada 15 days prior to commencing operations for new refiners, importers or blenders (a copy of Schedule 2 is attached for your convenience).
- Section 8 requires every primary supplier to submit gasoline composition reports due annually on February 15. A copy of Schedule 3 is attached for your convenience.
- Section 12 specifies additional reporting requirements for importers. A page summarizing the reporting requirements is attached for your convenience.
- Subsection 21(2) requires that a compliance plan be signed by an authorized official of the primary supplier and sent to the Minister by registered mail or courier at least 150 days before the beginning of the first year (i.e. by August 4) for which the primary supplier has elected to meet a requirement on the basis of a yearly pool average. Any changes to the compliance plan require at least 45 days notice to the Minister as per subsection 21(3).
- Subsection 22(3) requires that auditor's reports for those on a yearly pool average be submitted each year by May 31.

REGISTRATION FORM
FOR A MANUFACTURER, BLENDER OR IMPORTER OF GASOLINE (Sch. 2)
***BENZENE IN GASOLINE REGULATIONS* (s. 7)**

Please mail to the **appropriate regional office** (please refer to the "Headquarter and Regional Offices" list at section "Contacts List" of the CD for the appropriate address).

This form is provided for your convenience. Please refer to the *Benzene in Gasoline Regulations* for information on requirements.

1. Company Name: _____

   Company Address: _____

Type of primary supplier (check one or more): Manufacturer [ ] Blender [ ] Importer [ ]

2. Name and location of each refinery and typical annual volume, in m^3, of each type of gasoline manufactured at each refinery:
   _____
   _____
   _____

3. Name and location of each blending facility, typical blending material(s) and typical annual volume, in m^3, of each type of gasoline blended at each facility: (For cargo tankers, railway cars, boats, marine vessels or other mobile blending facilities, indicate only the type and number of mobile facilities and the province of operation.)
   _____
   _____
   _____

4. Each usual point and mode of importation and typical annual volume, in m^3, of each type of gasoline imported:
   _____
   _____

5. Authorized Official: _____ Telephone No. (_____) _____-_____
   Title: _____ Fax No. (_____) _____-_____

   Signature: _____ Date: _____

REPORT ON COMPOSITION OF GASOLINE (Sch. 3)
BENZENE IN GASOLINE REGULATIONS (s. 8)

This report should be:

a) submitted by every primary supplier as defined in the Regulations;
b) submitted on or before February 15 of each year (annual reporting);
c) mailed to the **appropriate regional office** of Environment Canada (please refer to the "Headquarter and Regional Offices" list at section "Contacts List" of the CD for the appropriate address).

This form is provided for your convenience. Please refer to the *Benzene in Gasoline Regulations* for information on requirements.

Registration Number:	Year:
Company Name:	
Company Address:	

Type of primary supplier (check one or more): [ ] Manufacturer [ ] Blender [ ] Importer

Has a yearly pool average been elected for this year? [ ] Yes [ ] No

If yes, for which parameters? [ ] Benzene [ ] Benzene Emissions Number (BEN)

If yes, has your compliance plan been updated during the reporting period?

[ ] Yes [ ] No

Note: Updated compliance plans must be submitted to the Minister pursuant to subsection 21(3) of the *Benzene in Gasoline Regulations.*

Name and location of the refinery, blending facility or points of importation in the province, covered by this report: (Refer to Notes A) and B) on the next page.)

_____

_____

_____

_____

Composition of gasoline supplied during this reporting period.

Volume of gasoline supplied, in m^3	Number of batches supplied	Name of any oxygenates added

	Column 1	**Column 2**	**Column 3**
Item	**Parameter**	**Maximum Value**	**Year-to-date volume-weighted average value**
1.	Oxygen Concentration (% by weight)		
2.	Sulphur Concentration (mg/kg)		
3.	Vapor pressure at 37.8ºC (100ºF) (kPa)		
4.	Evaporative fraction at 93.3ºC (200ºF)		
5.	Evaporative fraction at 148.9ºC (300ºF)		
6.	Aromatics concentration (% by volume)		
7.	Olefins concentration (% by volume)		
8.	Benzene concentration (% by volume)		
9.	Benzene Emissions Number		

Authorized Official*	Telephone No. ( ) -
Title	Fax No. ( ) -
Signature	Date

* Refer to note (F) on next page.

NOTES – *BENZENE IN GASOLINE REGULATIONS*

A) This Report on Composition of Gasoline must be submitted separately for each refinery, blending facility and province of importation, or any combination of them described under section 18 of the *Benzene in Gasoline Regulations*.

B) For Note A, the name and location for cargo tankers, railway cars, boats, marine vessels or other mobile blending facilities are replaced by the type of mobile facilities, their number and the province of operation, or the name and location of the non-mobile facility with which they are grouped.

C) The average benzene emissions number is the volume-weighted average of the benzene emissions numbers for each batch; it is not calculated from the average model parameters.

D) Under subsection 13(2) of *the Benzene in Gasoline Regulations*, for each batch of gasoline-like blendstock dispatched or imported by the primary supplier during the period covered by this Report, the primary supplier must report to the Minister, in an annex to this Report, the name and address of the purchaser or receiver, the date of dispatch or importation and the volume.

E) Under subsection 2(2) of Schedule 1 to the *Benzene in Gasoline Regulations*, the primary supplier must report to the Minister, in an annex to this Report, each occurrence of a model parameter that is outside the acceptable range, the reason for each occurrence, and the volume of gasoline affected.

F) Authorized official is a defined term (refer to subsection 1(1) of the *Benzene in Gasoline Regulations*).

Additional Requirements for Importers as per Section 12 of the *Benzene in Gasoline Regulations*

NOTE: Information contained in this page is for compliance promotional purposes and has no legal status. For requirements under the Regulations, refer to the actual regulations.

Subsection 12(1). Every importer must notify the Minister, at least 12 hours before the time of importation, of the importer's intention to import:

a) at any one time more than 100 m^3 of gasoline identified under subsection 9(1) or (2) as complying gasoline, US reformulated gasoline, California gasoline or northern winter complying gasoline; or

b) at any one time, any amount of gasoline identified under subsection 9(1) as gasoline-like blendstock; or

c) into a province and within any one day, more than 1,000 m^3 of gasoline identified under subsection 9(1) or (2) as complying gasoline, U.S. reformulated gasoline, California gasoline or northern winter complying gasoline (amended 2003).

Subsection 12(2). The notice required by subsection (1) must include:

a) the name and registration number of the importer;

b) the type of gasoline identified under subsection 9(1), unless it is complying gasoline;

c) the volume of the gasoline that is scheduled to be imported;

d) the point of entry of the gasoline into Canada and the estimated date and time* that it will enter Canada;

e) the address of the first storage facility or refueling facility to which the gasoline is to be delivered and the estimated date and time of its delivery there; and

f) the name and telephone number of a representative of the importer through whom sampling arrangements can be made.

* Provide the best estimated date and time with your notice; revise when more accurate date and time become available.

Subsection 12(3). No importer shall import gasoline by cargo tanker, railway car, boat, marine vessel or aircraft unless the gasoline is accompanied at the point of entry into Canada and at the point of delivery, and everywhere between those points, by a record that shows:

a) the name, address and registration number of the importer;

b) the name and address of the person to whom the gasoline is to be sold or ownership transferred;

c) the address of the first storage facility or refueling facility to which the gasoline is to be delivered;

d) the volume of the gasoline; and

e) the type of gasoline identified under subsection 9(1), unless it is complying gasoline.

12-HOUR NOTIFICATION OF IMPORTS
BENZENE IN GASOLINE REGULATIONS (s. 12)

This additional requirement under section 12 of these regulations is addressed to importers intending to import at any one time more than 100 m^3 of gasoline or more than 1000 m^3 into a province in one day. Note no minimum for gasoline-like blendstock.

This notification should be sent via fax at least 12 hours before the time of importation to the **appropriate regional office** of Environment Canada (please refer to the "Headquarter and Regional Offices" list at section "Contacts List" of the CD for the appropriate fax number).

This form is provided for your convenience. Please refer to the *Benzene in Gasoline Regulations* for information on requirements.

a) Importer Name: _____

Importer Registration Number: _____

Batch Number (Optional): _____

b) Type of gasoline identified under Section 9, check or mark "x" below:

Complying gasoline [ ] California gasoline [ ] Gasoline-like blendstock [ ]
Northern winter complying gasoline [ ] US reformulated gasoline [ ]

c) Scheduled volume of gasoline (m^3):

d) Point of entry into Canada:
_____

Estimated date _____ and time of entry _____

e) Address of first storage facility or refueling facility to whom gasoline is to be delivered:
_____

Estimated date of delivery _____ and time of delivery _____

f) Importer's representative through whom sampling may be arranged:

Name (print): _____ Telephone: _____

Following to be Completed by Environment Canada (please print):

Environment Canada official receiving or reviewing information:

Name: _____ Signature: _____

Date: _____ Telephone: (_____) _____- _____

Gasoline Regulations

NOTE: Information contained in this page is for compliance promotional purposes and has no legal status. For requirements under the Regulations, refer to the actual regulations.

NOTE: The current exemption for gasoline used in competition vehicles is valid until January 1, 2010.

These regulations limit the lead and phosphorus content in gasoline that is produced, imported or sold in Canada to 5 mg/L and 1.3 mg/L, respectively. Gasoline for use in aircraft is exempted. Until January 1, 2010, these regulations did not apply to gasoline for use in competition vehicles, as defined by the Regulations, except for the record and reporting requirements of section 11.

Leaded Gasoline Used in Competition Vehicles Reporting

For leaded gasoline used in competition vehicles, annual detailed reports indicating, among other things, quantities imported, produced and distributed, as well as the lead concentrations, must be submitted to the Minister of the Environment by March 31 of the year following the year in which the activity occurred. Records detailing these activities must be kept in Canada for a period of five years after the date the record is made. Example templates in paper form for company identification and record keeping (for leaded gasoline import, production, sales, re-sales and distribution information) are attached for your convenience. Electronic versions of the templates (in Excel) are also available.

Leaded Gasoline For Competition Vehicles
Annual Reporting for *Gasoline Regulations*
Canadian Environmental Protection Act, 1999

Company Identification and Declaration

Company Information

Company Name:_____

_____

Address:_____

City: _____ Prov.: _____

Postal Code:_____

Phone: (_____) _____-_____

Fax: (_____) _____-_____

Contact Information

Name:_____

Title:_____

Address:_____

City:_____ Prov.:_____

Postal Code:_____

Phone: (_____) _____-_____

Fax: (_____) _____-_____

(to be completed if contact address differs from company address)

Calendar year: ____

Non Involvement

☐ In the above indicated calendar year, I did not produce, import, distribute, re-sell, sell or offer for sale leaded gasoline for use in competition vehicles. In this case, please complete this form and return it to the address listed below.

Involvement

☐ In the above indicated calendar year, I produced, imported, distributed, re-sold, sold or offered for sale leaded gasoline for use in competition vehicles. The reports for these activities are attached.

Confidential

☐ Pursuant to subsection 313(1) of the *Canadian Environmental Protection Act, 1999*, I request that the following information for the above calendar year be treated as confidential (please specify your reasons).

Not Confidential

☐ I do not request the following information be treated as confidential and I consent to it being released without restriction.

_____ _____

Signature Name *(please print)*

_____ _____

Title Place and Date

Please complete this form, including your records, and send it to the appropriate regional office (please refer to the "Headquarter and Regional Offices" list at section "Contacts List" of the CD for the appropriate address).

Leaded Gasoline For Competition Vehicles
Record Keeping for *Gasoline Regulations*
Canadian Environmental Protection Act, 1999

Leaded Gasoline Import/Production Information

Date	Brand Name	Octane Rating/ Analysis Method[1]	Average Lead Concentration (mg/L)	Quantity Imported (Litres)	Quantity Produced (Litres)

1. Please indicate for Octane Rating and Analysis Method: R – Research Octane Number; M – Motor Octane Number; or, A – Anti-Knock Index.

APPENDIX 2

Alternative Limits under the *Benzene in Gasoline Regulations*

http://canadagazette.gc.ca/archives/p1/1999/1999-09-04/pdf/g1-13336.pdf#page=4

Canada Gazette, Part I, Vol. 133, No. 36
September 4, 1999

GOVERNMENT NOTICES

DEPARTMENT OF THE ENVIRONMENT

Alternative Limits under the *Benzene in Gasoline Regulations*

This notice provides information on alternative limits that have been approved by the Minister of the Environment under the federal *Benzene in Gasoline Regulations.*

The federal *Benzene in Gasoline Regulations* set limits for the level of benzene in gasoline and for a parameter called the benzene emissions number (BEN). The BEN relates gasoline composition to the estimated emissions of benzene from vehicles. The limits under the Regulations came into effect on July 1, 1999.

Under subsection 17(2) of the *Benzene in Gasoline Regulations*, primary suppliers of gasoline (refiners, blenders and importers) could elect to be subject to alternative limits for the BEN, based on their historical gasoline composition. Under subsection 16(2), primary suppliers unable to meet the July 1, 1999, implementation date could also apply to be subject to temporary (higher) limits for both benzene and the BEN for up to six months.

Temporary Limits under Subsection 16(2)

Under subsection 16(2) of the Regulations, primary suppliers may apply for temporary alternative limits for benzene and the BEN if, for reasons beyond their control, they cannot meet the implementation date of July 1, 1999. Primary suppliers may only use the temporary limits until December 31, 1999. Under subsection 16(4) of the Regulations, the Minister of the Environment approves these applications only if:

- the primary supplier has made all reasonable efforts to meet the implementation date of July 1, 1999; and
- that non-authorization of the temporary limits would:
  - have a significant effect on the supply of gasoline or other petroleum products in the region,
  - require the primary supplier to significantly curtail operations or cease operating for a period of time and thereby result in financial hardship, or
  - result in the primary supplier going out of business.

In the Regulatory Impact Analysis Statement that accompanied amendments to the *Benzene in Gasoline Regulations*, published in the *Canada Gazette*, Part II, on May 26, 1999, the Minister of the Environment announced her intention to "publish a notice in *Canada Gazette* Part I identifying the company, its alternative limits, and the period that the limits apply". Pursuant to that intention, the following tables show the temporary alternative limits for benzene and the

BEN that have been applied for and approved. It should be noted that under the Regulations, companies can elect to meet the requirements on the basis of yearly pool average limits with associated never-to-be-exceeded caps, rather than meeting "flat" never-to-be-exceeded limits.

Temporary Limits for Primary Suppliers Having Elected to Use Yearly Pool Averages

Company	**Refinery or province of importation**	**Temporary yearly pool average limits (all expire on Dec. 31, 1999)**	**Temporary never-to-be-exceeded caps**	**Expiry date for temporary never-to-be-exceeded caps**
		Benzene (% vol.) *BEN*	*Benzene (% vol.)* *BEN*	
Petro-Canada	Montréal refinery	1.28% 76.4	4.61% 156.8/198.1	November 15, 1999
Shell	Montréal refinery	2.0% 86.8	4.7% 117.8/220.0	November 15, 1999
Ultramar	Québec refinery and Montréal terminal	1.2% –	3.55% –/134.8	November 15, 1999
Pétroles Norcan	Imports into Quebec	1.54% 66.68	3.0% –	November 15, 1999
Petro-Canada	Oakville refinery	1.75% 80.4	4.29% 140.6/–	September 15, 1999
Standard limits under subsections 16(1) and 17(1)				
Standard limits	Benzene BEN	0.95% 59.5	1.5% 102/132	

Temporary Limits for Primary Suppliers Subject to "Flat" Limits

Company	**Refinery or province of importation**	**Temporary flat (per-litre) limit**		**Expiry date for temporary flat limit**
		Benzene (% vol.)	*BEN*	
Olco/Neste	Imports into Quebec and Ontario	3.00%	–	November 15, 1999
Spur/Murphy	Imports into Ontario	2.06%	–	September 15, 1999
Parkland	Bowden refinery	1.50%	–	December 31, 1999
Standard limits under subsection 3(1) and section 4				
Standard limits		1.00%	71/92	

Notes:

1. There are different seasonal per-litre limits for the BEN: summer (1st number) and winter (2nd number).
2. Temporary average limits, which expire on December 31, 1999, take into account gasoline produced/imported before and after the expiry date for the temporary per-litre limits. After the expiry dates, regular limits apply.
3. "–" indicates that no temporary limit was applied for by the primary supplier.

Under paragraph 3(2)(*b*) of the Regulations, the areas where gasoline sold is subject to temporary alternative limits are:

- Quebec, except that portion of the province that is in the northern supply area (as defined by the Regulations);
- all of Ontario; and
- southern Alberta and south-eastern British Columbia (roughly the towns of Provost, Leduc, Drayton Valley and Revelstoke, and all other locations in Alberta and British Columbia south and east of those towns).

In the above areas, the prohibition on selling (as opposed to manufacturing, blending or importing) gasoline containing benzene at a concentration that exceeds 1.5% by volume is deferred from October 1, 1999, to April 1, 2000.

Alternative Limits for BEN under Subsection 17(2)

Under subsection 17(2) of the Regulations, primary suppliers may elect for alternative limits for the BEN based on the historical composition of their gasoline. There is no expiry date for alternative BEN limits.

In the Regulatory Impact Analysis Statement that accompanied the *Benzene in Gasoline Regulations*, published in the *Canada Gazette*, Part II, on November 26, 1997, the Minister of the Environment announced her intention that the alternative limits "will be publicly available and will be published by Environment Canada". Pursuant to that intention, the following alternative limits for the BEN have been applied for and approved:

Alternative Limits for BEN

Company	Refinery	Benzene Emissions Number	
		Alternative yearly pool average limit	**Alternative never-to-be-exceeded cap (summer/winter)**
Petro-Canada	Montréal	67.9	115.0/151.0
Shell	Montréal	65.3	110.5/144.7
Petro-Canada	Oakville	65.3	117.1/141.4
Shell	Sarnia	65.0	106.0/147.8
Standard limits under subsection 17(1)			
Standard limits		59.5	102/132

Contact Bruce McEwen, Oil, Gas and Energy Branch, Air Pollution Prevention Directorate, Environment Canada, 819-953-4673.

* This contact information was included in this *Canada Gazette* Part I notice (September 1999). For the most current contact information, please refer to the contributing authors of this report.

APPENDIX 3
Regional and National Data for All Parameters

Table A3.1: Averages (Total, Maximum and Minimum) and Maximum Values of Reported Gasoline Parameters (2009)

		Atlantic	Ontario/ Quebec	West	Canada
Volume (m^3)		3 133 810	23 495 864	13 482 520	40 112 194
[Benzene] (vol %)	*Volume-weighted average*	0.74	0.68	0.69	0.69
	Maximum YTD average	0.76	0.88	1.20	1.20
	Minimum YTD average	0.64	0.28	0.51	0.28
	Maximum value reported	1.30	1.47	1.50	1.50
BEN (Benzene Emissions Number)	*Volume-weighted average*	49.90	48.90	46.80	48.20
	Maximum YTD average	51.90	59.50	61.00	61.00
	Minimum YTD average	49.00	43.30	41.00	41.00
	Maximum value reported	74.00	97.40	92.00	97.40
[Sulphur] (mg/kg)	*Volume-weighted average*	22.80	17.00	16.70	15.70
	Maximum YTD average	25.70	30.00	36.00	36.00
	Minimum YTD average	19.00	2.80	8.00	2.80
	Maximum value reported	41.00	71.00	78.90	78.90
[Olefin] (vol%)	*Volume-weighted average*	13.20	9.60	9.30	9.80
	Maximum YTD average	16.30	13.30	14.60	16.30
	Minimum YTD average	0.80	0.10	0.90	0.10
	Maximum value reported	25.30	33.30	38.20	38.20
[Aromatics] (vol%)	*Volume-weighted average*	27.70	28.70	25.60	27.60
	Maximum YTD average	39.10	34.10	36.60	39.10
	Minimum YTD average	26.00	22.30	20.10	20.10
	Maximum value reported	48.70	55.40	54.30	55.40
E200 (vol%)	*Volume-weighted average*	44.80	49.90	45.90	48.20
	Maximum YTD average	45.10	57.30	54.70	57.30
	Minimum YTD average	44.60	39.90	43.70	39.90
	Maximum value reported	93.80	88.30	89.10	93.80
E300 (vol%)	*Volume-weighted average*	85.10	84.90	84.60	84.80
	Maximum YTD average	86.00	89.00	90.00	90.00
	Minimum YTD average	83.70	81.90	80.00	80.00
	Maximum value reported	95.00	100.00	96.70	100.00
Vapour Pressure (kPa)	*Volume-weighted average*	85.50	78.80	80.90	80.00
	Maximum YTD average	87.90	85.80	87.10	87.90
	Minimum YTD average	82.10	62.70	58.70	58.70
	Maximum value reported	107.00	108.70	116.70	116.70
[Oxygen] (wt%)	*Volume-weighted average*	0.00	0.10	0.20	0.20
	Maximum YTD average	0.00	0.80	3.60	3.60
	Minimum YTD average	0.00	0.00	0.00	0.00
	Maximum value reported	0.00	3.50	3.90	3.90

Figure A3.1: Average, Maximum Average and Maximum Value for Benzene Concentration of Canadian Gasoline (2009)

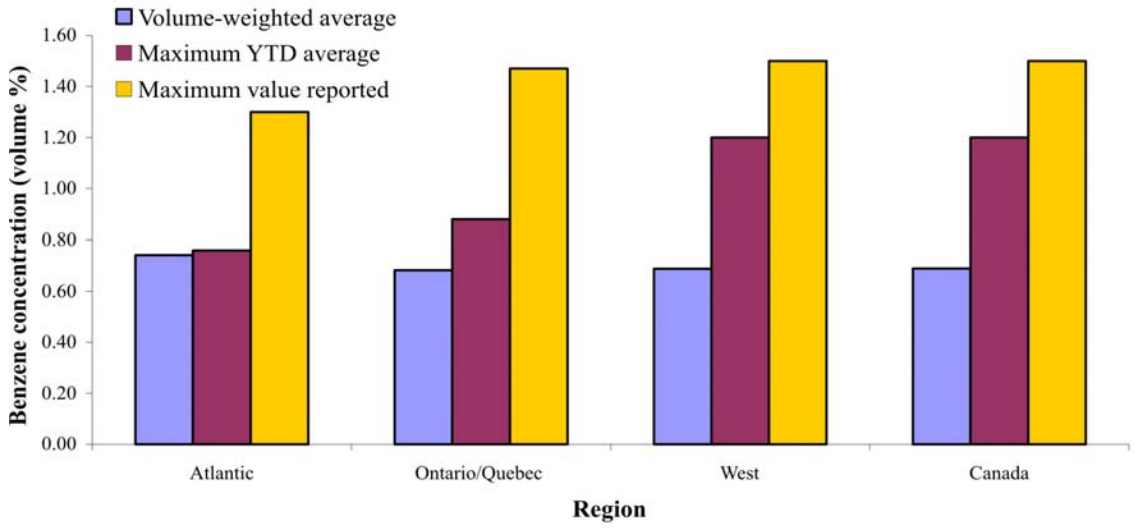


Figure A3.2: Average, Maximum Average and Maximum Value for BEN of Canadian Gasoline (2009)

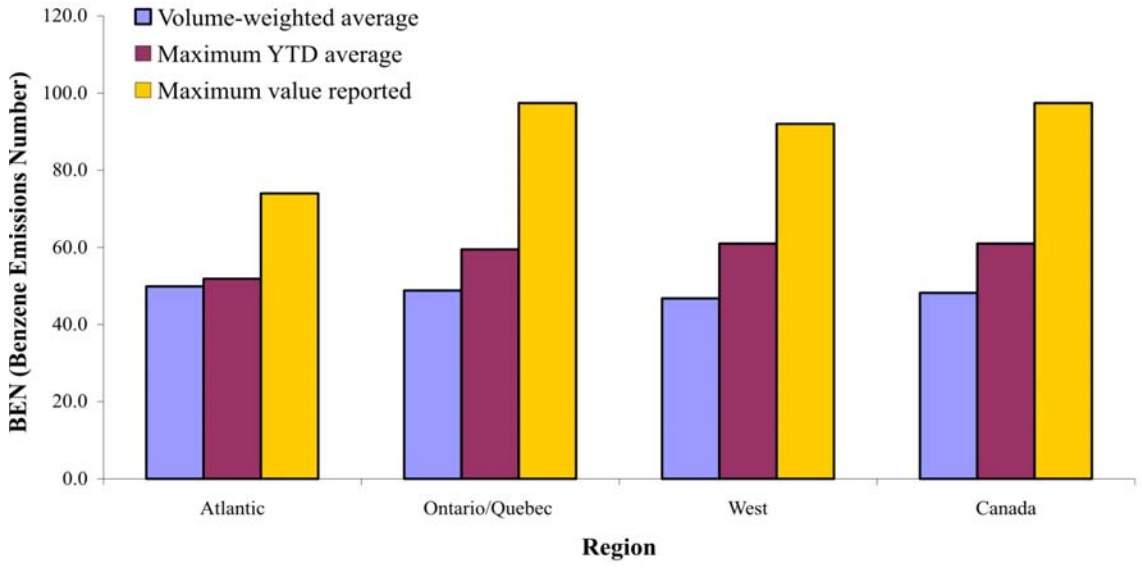


Figure A3.3: Average, Maximum Average and Maximum Value for Sulphur Concentration of Canadian Gasoline (2009)

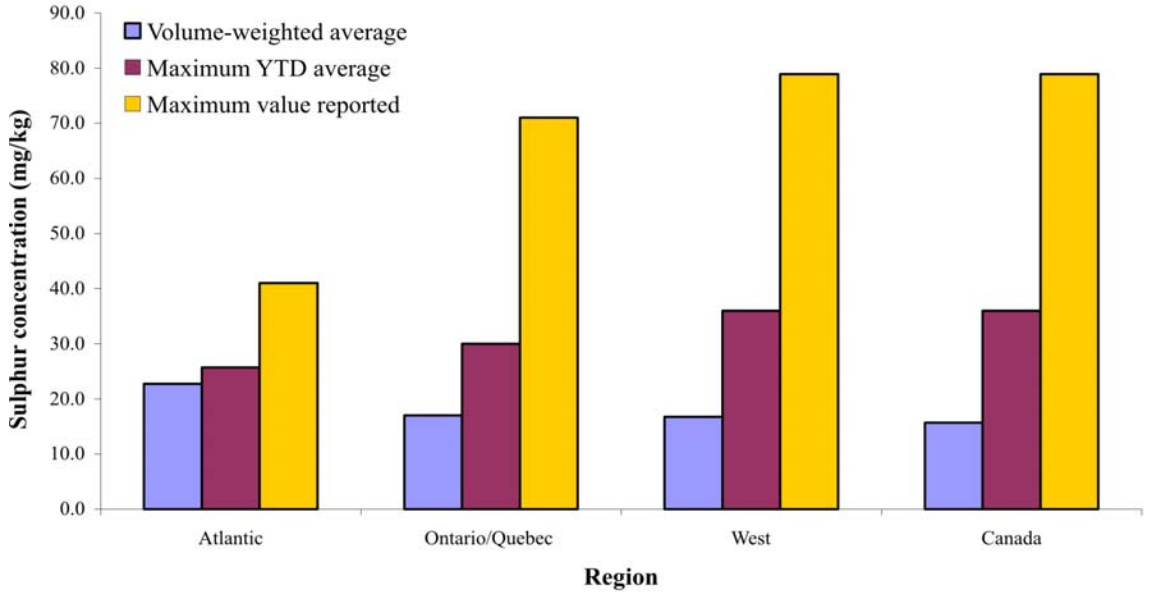


Figure A3.4: Average, Maximum Average and Maximum Value for Olefin Concentration of Canadian Gasoline (2009)

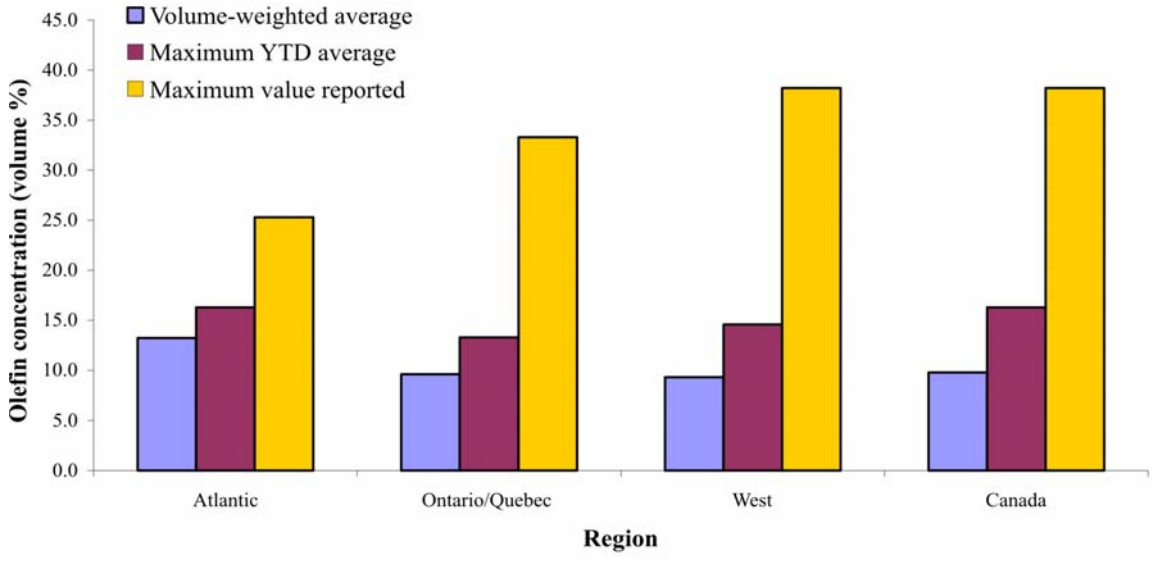


Figure A3.5: Average, Maximum Average and Maximum Value for Aromatics Concentration of Canadian Gasoline (2009)

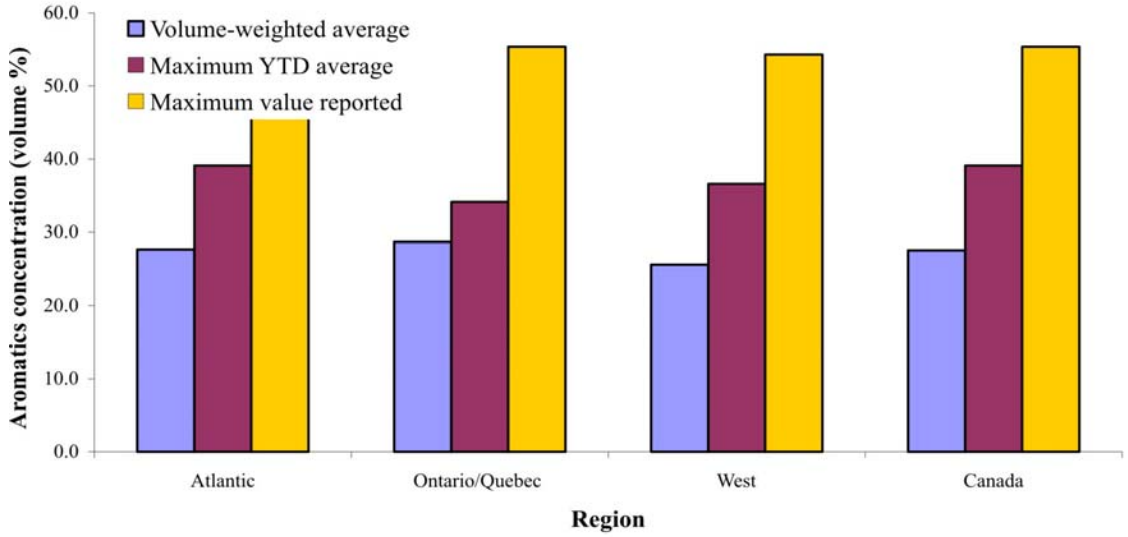


Figure A3.6: Average, Maximum Average and Maximum Value for Vapour Pressure of Canadian Gasoline (2009)

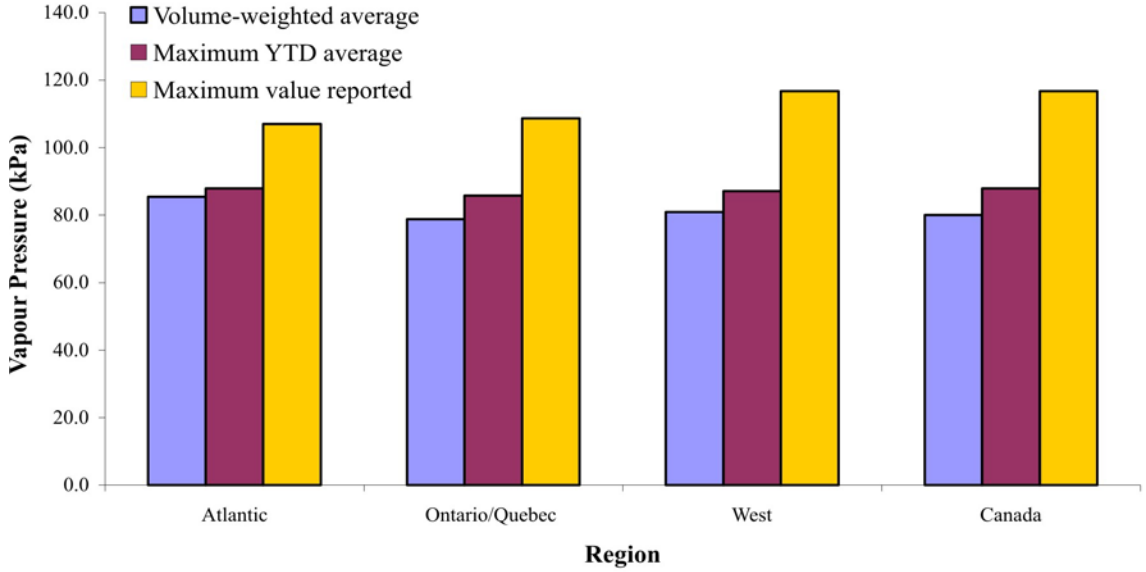


Figure A3.7: Average, Maximum Average and Maximum Value for Average E200 of Canadian Gasoline (2009)

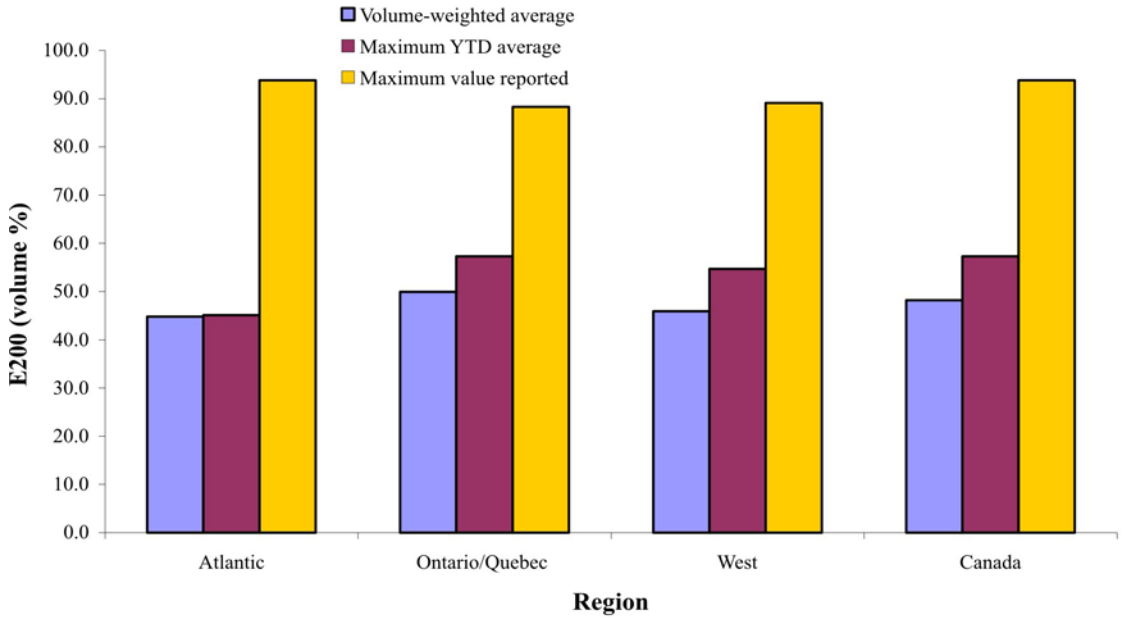


Figure A3.8: Average, Maximum Average and Maximum Value for Average E300 of Canadian Gasoline (2009)

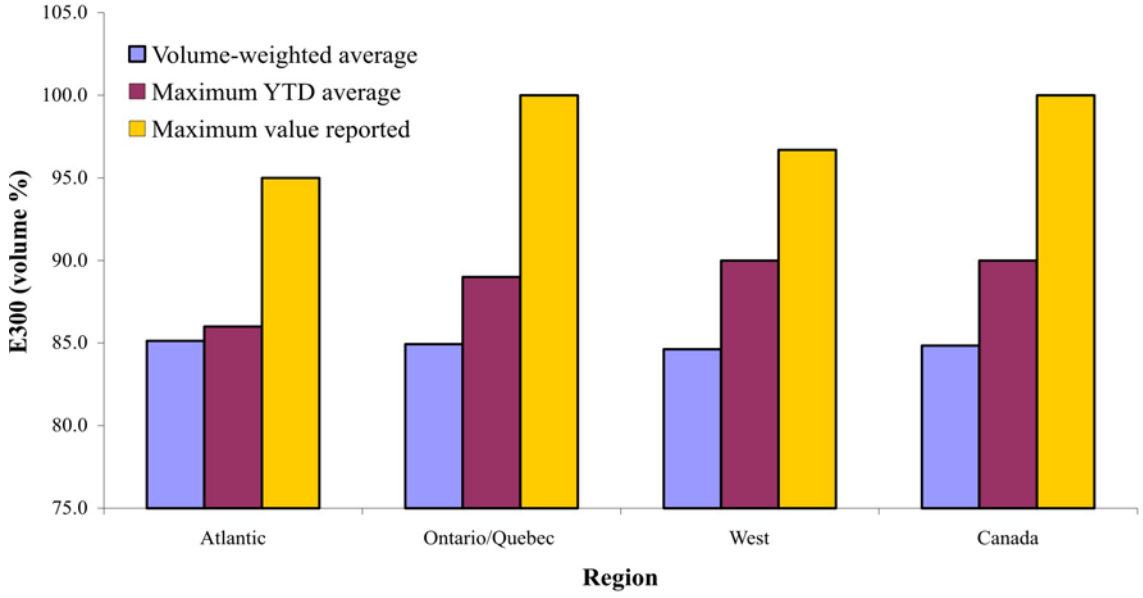
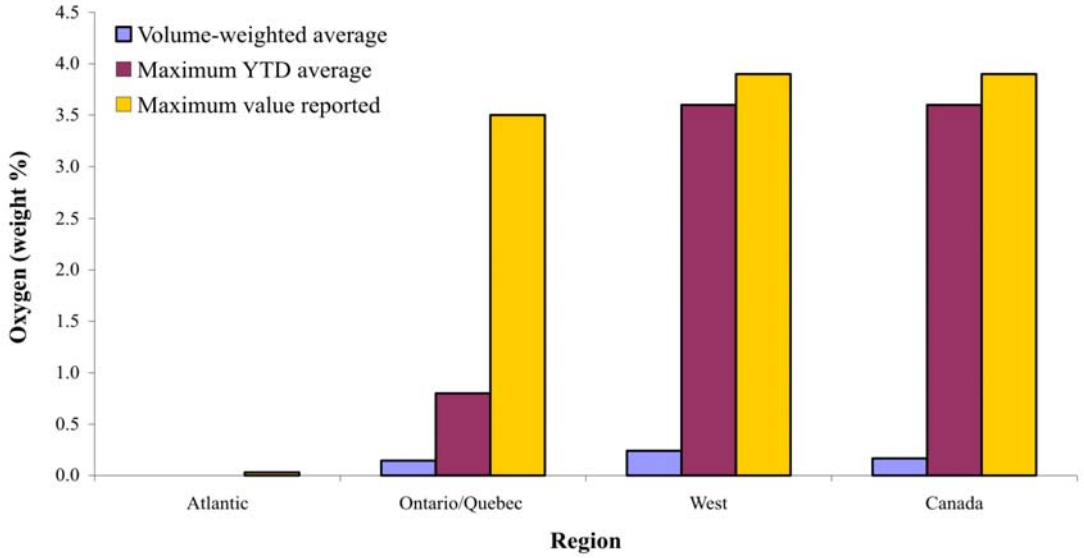


Figure A3.9: Average, Maximum Average and Maximum Value for Average Oxygen concentration of Canadian Gasoline (2009)



APPENDIX 4
Company Reported Data

Table A4.1a: Averages and Maxima Reported for Gasoline Parameters (2009)

		[Benzene] (%vol)		BEN		[Aromatics] (% vol)		[Olefins] (%vol)	
Type	**Facility Name (Location)**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**
R	Chevron Canada (Burnaby, BC)	0.59	1.40	45.9	77.3	26.4	47.2	10.7	25.8
R	Consumer's Co-op (Regina, SK)	0.84	1.41	47.2	69.1	25.5	34.0	10.0	20.0
R	Husky Oil (Prince George, BC)	0.75	1.00	41.9	54.7	20.1	32.2	14.2	27.2
R	Imperial Oil (Dartmouth, NS)	0.74	1.22	49.0	74.0	27.5	46.0	16.3	25.3
R	Imperial Oil (Sarnia, ON)	0.46	1.11	51.0	77.0	33.5	45.4	2.2	7.0
R	Imperial Oil (Strathcona, AB)	0.78	1.26	48.0	81.0	22.8	39.6	9.1	16.1
R	Imperial Oil (Nanticoke, ON)	0.88	1.47	52.0	86.0	29.9	45.0	8.2	29.2
R	Irving Oil (St. John, NB)	0.76	1.30	50.7	66.4	26.0	38.0	11.0	20.0
R	North Atlantic Refining (NL)	0.64	0.96	51.9	66.3	39.1	48.7	0.8	3.3
R	Shell Canada (Montréal, QC)	0.59	1.14	51.6	83.5	32.3	46.6	7.6	18.4
R	Shell Canada (Scotford, AB)	0.51	0.97	53.5	90.6	36.6	54.3	0.9	1.9
R	Shell Canada (Sarnia, ON)	0.60	1.03	51.5	83.1	33.0	55.0	10.0	16.0
R	Suncor Energy (Montréal, QC)	0.78	1.20	47.4	91.3	29.0	55.4	13.1	27.0
R	Suncor Energy (Edmonton, AB)	0.62	1.32	42.4	62.1	22.5	32.8	11.8	38.2
R	Suncor Energy (Sarnia, ON)	0.85	1.42	50.3	97.4	26.1	54.6	3.9	11.4
R	Ultramar (St-Romauld, QC)	0.48	1.06	45.3	75.4	26.0	55.0	13.3	25.1
B	Ultramar (Montréal, QC)	0.71	1.12	44.8	66.8	23.2	40.1	12.3	20.6
I	Honda (Queenston, ON)	0.28	0.28	59.5	59.5	34.1	34.1	0.1	0.1
I	Imperial Oil (Burrard, BC)	0.67	0.89	41.0	65.0	24.4	42.5	14.6	26.5
I	Larry Penner (MB)	1.20	1.50	61.0	92.0	27.1	27.1	10.7	10.7
I	Pétroles Norcan (Montréal, QC)	0.65	1.00	43.3	64.6	22.3	38.8	11.2	33.3
I	Shell Trading Canada (BC)	0.73	0.90	44.1	62.0	23.0	34.4	10.2	16.4
I	Suncor Energy (Burrard, BC)	0.65	0.86	48.2	66.6	28.9	46.6	12.6	26.8

Type: R = refiner, B = blender, I = importer

Table A4.1b: Averages and Maxima Reported for Gasoline Parameters (2009)

		[Sulphur] (mg/kg)		[Oxygen] (%wt)		Vapour Pressure (kPa)		E200 (% vol)		E300 (% vol)	
Type	**Facility Name (Location)**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**
R	Chevron Canada (Burnaby, BC)	23.1	78.9	0.00	0.00	78.2	106.8	47.4	89.1	84.4	95.0
R	Consumer's Co-op (Regina, SK)	16.7	36.6	1.43	3.77	80.5	107.1	46.3	79.3	80.0	87.2
R	Husky Oil (Prince George, BC)	12.0	35.0	0.72	3.90	75.0	107.0	52.0	67.0	90.0	94.0
R	Imperial Oil (Dartmouth, NS)	25.7	39.5	0.00	0.00	87.5	106.4	44.6	93.8	84.7	91.8
R	Imperial Oil (Sarnia, ON)	2.8	19.6	0.00	0.00	76.0	105.0	50.0	63.0	89.0	94.0
R	Imperial Oil (Strathcona, AB)	16.0	33.0	0.00	0.00	87.1	116.7	46.5	66.1	86.8	96.7
R	Imperial Oil (Nanticoke, ON)	21.0	71.0	0.00	0.00	77.6	106.6	48.2	65.4	81.9	93.4
R	Irving Oil (St. John, NB)	19.0	41.0	0.00	0.03	82.1	106.0	45.0	60.0	86.0	95.0
R	North Atlantic Refining (NL)	20.3	28.8	0.00	0.00	87.9	107.0	45.1	56.3	83.7	90.0
R	Shell Canada (Montréal, QC)	15.0	27.0	0.00	0.00	80.8	105.0	49.3	60.3	85.5	93.4
R	Shell Canada (Scotford, AB)	8.0	32.0	0.00	0.00	80.3	107.0	44.0	56.9	82.1	92.2
R	Shell Canada (Sarnia, ON)	22.0	35.0	0.00	0.00	78.3	107.4	48.0	56.0	82.0	91.0
R	Suncor Energy (Montréal, QC)	19.4	40.0	0.80	3.50	76.4	108.7	50.5	88.3	84.0	94.8
R	Suncor Energy (Edmonton, AB)	21.0	64.0	0.00	0.00	82.7	122.0	44.6	57.6	86.5	93.0
R	Suncor Energy (Sarnia, ON)	19.0	34.0	0.00	0.00	76.5	107.0	44.8	59.0	84.0	95.0
R	Ultramar (St-Romauld, QC)	16.0	33.0	0.00	0.00	85.8	106.4	52.8	70.3	86.8	94.8
B	Ultramar (Montréal, QC)	13.6	33.0	0.00	0.00	71.9	102.0	52.8	72.1	88.4	97.3
I	Honda (Queenston, ON)	30.0	30.0	0.00	0.00	62.7	62.7	39.9	39.9	86.6	86.6
I	Imperial Oil (Burrard, BC)	14.0	23.0	0.00	0.00	63.4	88.4	46.2	52.9	82.9	91.2
I	Larry Penner (MB)	36.0	36.0	3.60	3.60	74.0	90.0	54.7	54.7	80.5	80.5
I	Pétroles Norcan (Montréal, QC)	12.3	52.0	0.14	1.74	75.7	100.0	57.3	88.2	88.7	100.0
I	Shell Trading Canada (BC)	21.0	39.0	0.00	0.00	58.7	91.6	43.7	49.2	85.5	88.0
I	Suncor Energy (Burrard, BC)	9.4	24.0	0.00	0.00	66.6	106.1	46.8	54.9	85.5	94.6

Type: R = refiner, B = blender, I = importer

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