



**The Canada-wide standards
for particulate matter and ozone**

Québec five-year progress report (2001-2005)



June 2007

PRODUCTION TEAM

Authors André Grondin, Eng., Service de la qualité de l'atmosphère
 René Bougie, Chem., Service de la qualité de l'atmosphère
 Michel Bisson, Geo., Service de l'information sur le milieu atmosphérique

Revision Michel Goulet, Head, Service de la qualité de l'atmosphère
 France Delisle, Head, Service de l'information sur le milieu atmosphérique

Photos taken from the 31st floor of the Marie-Guyart building in Québec: looking east

Left: A day of summer smog in Québec, September 10, 2002 – 3:32 p.m.

Right: A clear day in Québec, September 24, 2002 – 3:45 p.m.

Source: Roger Lemire, MDDEP

Reference: GRONDIN, André, Michel BISSON and René BOUGIE, 2007. *The Canada-wide standards for particulate matter and ozone : Québec five-year progress report*, Ministère du Développement durable, de l'Environnement et des Parcs du Québec, Direction des politiques de l'air, ISBN 978-2-550-50051-3 (PDF), 19 p.

Legal deposit – Bibliothèque et Archives nationales du Québec, 2007

ISBN 978-2-550-50051-3 (PDF)

© Government of Québec, 2007

CONTENTS

1. Introduction	1
The Canada-wide standards	1
2. Description of territory	2
3. Overview of ambient air results relative to the Canada-wide standards (CWS)	2
Ozone.....	2
Fine particles (FP).....	3
4. Overview of atmospheric emissions.....	4
5. Elements of intervention	7
Ambient air monitoring network.....	7
Air quality indexing and forecasting programs (AQI and Info-Smog)	7
Current and future reductions of atmospheric emissions of fine particles and precursors of ozone and fine particles	8
6. Conclusion and next steps	10
Ambient milieu.....	10
Reduction of emissions	10
 Appendix 1: Maps of the six census metropolitan areas (CMAs) and reporting sub-areas (RSAs) with populations¹	 11
Appendix 2: Census metropolitan areas and sub-areas subject to the Canada-wide standards for ozone and fine particles¹	12
Appendix 3: Cartographic representation of the Canada-wide standards	13
Appendix 4: Canada-wide standards – Ozone	15
Appendix 5: Canada-wide standards – Fine particles.....	16
Appendix 6: Detailed atmospheric emissions for 2002 in Québec.....	17

1. Introduction

In June 2000, the federal, provincial and territorial governments, with the exception of Québec, adopted the *Canada-wide Standards for Particulate Matter (PM) and Ozone*. The standard for particles concerns the fine fraction of the total particles (TP, also called PM), namely the fine particles (FP) with a diameter of less than 2.5 microns, also called PM_{2.5}. To comply with these standards, the governments committed to take steps to reduce concentrations of these pollutants in the ambient air by year 2010. Though it is not a signatory to the Canada-wide environmental standards sub-agreement, the Government of Québec acts in harmony with the other jurisdictions with regard to these air quality standards.

Ozone (O₃) and fine particles are two of the main pollutants responsible for smog. Extensive scientific studies reveal that they have significant effects not only on health (causing chronic bronchitis, asthma and premature death), but also on the environment. Ozone also causes damage to crops and increases vulnerability to disease among certain species of trees. In addition, fine particles reduce visibility in the air.

Ozone is formed through chemical reactions among nitrogen oxides (NO_x) and volatile organic compounds (VOCs), especially in summer when the weather is warm and sunny. Fine particles in the atmosphere are distinguished by their origin: primary fine particles are emitted directly into the atmosphere, while secondary fine particles are formed through chemical reactions involving sulphur dioxide (SO₂), nitrogen oxides, volatile organic compounds and ammonia (NH₃).

Recognition of the Canada-wide standards is a step toward minimizing the risks of these pollutants to human health and the environment. As management objectives, the CWS represent a balance between, on the one hand, seeking the best possible protection for health and the environment, and on the other, the feasibility and costs of reducing pollutant emissions into the atmosphere.

The Canada-wide standards

The Canada-wide standards for particulate matter and ozone are defined as follows ⁽¹⁾:

- for particles:
 - a Canada-wide standard for fine particles of 30 µg/m³, in a 24-hour averaging period, by year 2010. Achievement of this target will be determined based on the 98th percentile annual ambient measurement, averaged over three consecutive years;
- for ozone (O₃):
 - a Canada-wide standard of 65 ppb, in an 8-hour averaging period, by year 2010. Achievement of this target will be determined based on the 4th-highest annual ambient measurement, averaged over three consecutive years.

(1) Source: CCME (www.ccme.ca/assets/pdf/pmozone_standard_e.pdf)

2. Description of territory

As part of their implementation of the Canada-wide standards, specifically the verification of compliance with these standards, the governments must report on the compliance of urban agglomerations of over 100 000 inhabitants. In Québec, six census metropolitan areas (CMAs) are concerned: Montréal, Québec, Gatineau, Saguenay, Sherbrooke and Trois-Rivières. According to the 2006 census these urban agglomerations include two-thirds of the population of Québec.

CMAs of over 500 000 inhabitants are subdivided into reporting sub-areas (RSAs). Montréal has nine of these sub-areas, Québec city has five, and Gatineau, two (Ottawa-Gatineau has over 500 000 inhabitants). The areas and sub-areas are presented in the maps in Appendix 1. The monitoring stations associated with each area and sub-area, together with the pollutants measured there in 2005, are presented in appendix 2.

The determination of the census areas and sub-areas, and the methodology used in the calculation of indicators and the establishment of statistics, follow the directives in the *Guidance document on achievement determination of the Canada-wide standards* (http://www.ccme.ca/assets/pdf/gdad_eng_oct4.pdf).

3. Overview of ambient air results relative to the Canada-wide standards (CWS)

For Québec, the present report constitutes the first assessment of the methodology proposed for evaluating achievement of the Canada-wide standards. An overview of the results is presented in maps 1 and 2 in appendix 3.

These results are the combined effect of local emissions and a variable contribution from the transboundary transport of fine particles and ozone and their precursors. It should be noted that the percentage of the contribution from local emissions tends to increase with the duration of smog episodes.

Ozone

The 2005 results (the average of data from 2003, 2004 and 2005) show that in four of the six CMAs (Montréal, Gatineau, Sherbrooke and Trois-Rivières) ozone indicators are over the standard of 65 ppb, the target set for 2010. Most of the RSAs in Montréal are over the standard. Only the CMAs of Québec and Saguenay meet the ozone standard set for 2010. Figure 1 illustrates from west to east the value of this indicator; a slight decrease is noted as moving away from Ontario border. The detailed data are presented in appendix 4.

Transboundary flow from the United-States and Ontario contributes significantly to the rise in concentrations of ozone from may to september for areas in south-western Québec that are near the borders. Generally speaking, from 25 to 30% of the ozone originates in the United-States, while 30 to 60% is from Ontario. In contrast, the

contribution from local emissions of ozone precursors varies by area, from 15% in the Outaouais area to 65% in the Québec area.

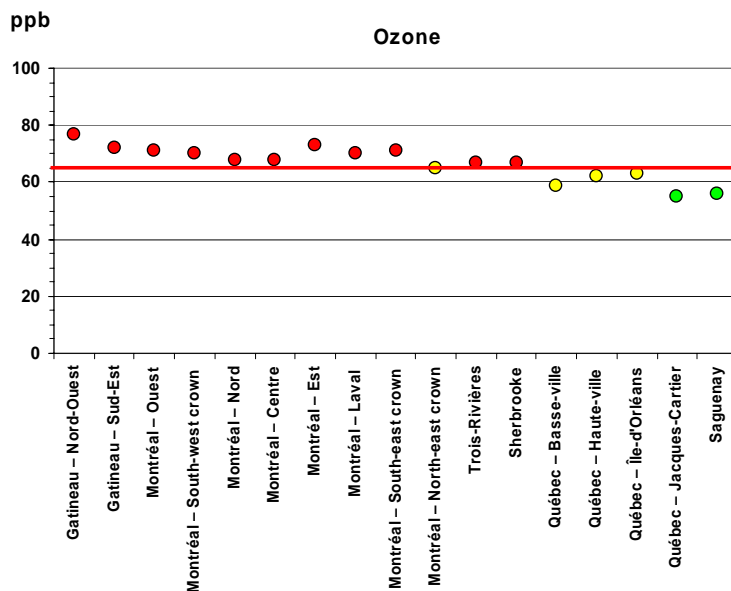


Figure 1: Value of the CWS indicator for ozone in 2005

Note: The CWS indicator for ozone in 2005 represents the 4th-highest value in the daily maximums of running 8-hour average concentrations (ppb) averaged over the years 2003, 2004 and 2005.

Fine particles (FP)

The measurement of fine particles, unlike this of ozone, is done in general only since 2003. The results for 2005 (the average of data from 2003, 2004 and 2005) show that in the CMA of Montréal, for five of the six RSAs where data were available, fine particle indicators are over the 2010 standard, with values ranging from 32 to 40 $\mu\text{g}/\text{m}^3$. For Québec, Trois-Rivières, Sherbrooke, Gatineau and Saguenay, the value of the indicator is under 30 $\mu\text{g}/\text{m}^3$, varying from 24 to 29 $\mu\text{g}/\text{m}^3$ (Figure 2). The detailed data are presented in appendix 5.

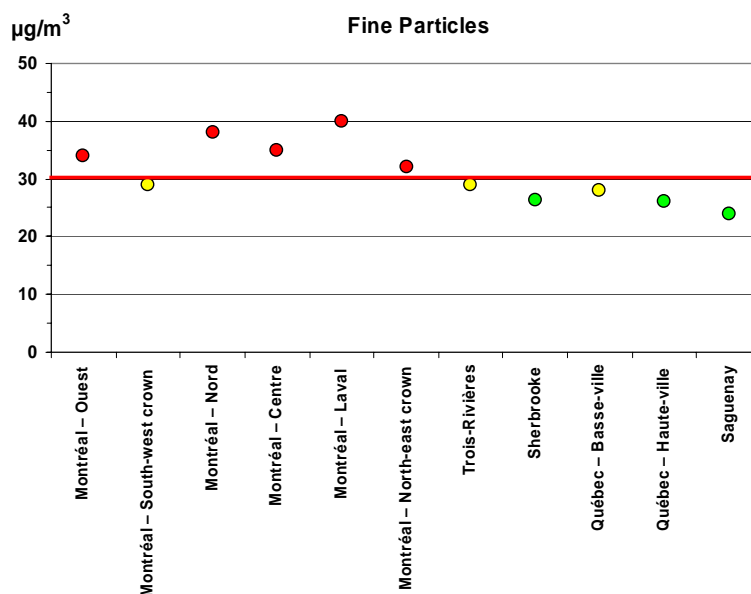


Figure 2: Value of the CWS indicator for fine particles in 2005

Note: The CWS indicator for fine particles in 2005 represents the 98th percentile of daily data on 24-hour average concentrations ($\mu\text{g}/\text{m}^3$) averaged over the years 2003, 2004 and 2005.

Transboundary transport of fine particles and precursors can also have an impact on the concentrations measured, both in summer and winter.

4. Overview of atmospheric emissions

The high concentrations of ozone and fine particles that are sometimes observed can be caused by emission sources located both in and outside of Québec.

Table 1 presents Québec emissions for the year 2002 of fine particles (primary FPs) and ozone and secondary FP precursors. Figures 3 to 7 show the distribution of 2002 emissions among the main emitters, with trends from 1990 to 2010.

Table 1: Atmospheric emissions of FP and of ozone and FP precursors for the year 2002 (in tons)

Pollutants	Industry	Transportation	Wood heating	Other sources	Total
FP	32 136	11 637	32 928	647	77 348
SO₂	197 717	14 387	475	11 871	224 450
NO_x	40 014	247 074	3 322	16 966	307 376
VOC	77 694	146 177	48 032	97 169	369 072

Source: Ministère du Développement durable, de l'Environnement et des Parcs, Direction des politiques de l'air, december 2006; detailed data in appendix 6.

Note to the reader: Detailed data by sub-sectors for these pollutants in 2002 are presented in Appendix 6. Certain data may differ from other publications predating the establishment of new emission factors. For example, in the case of the transportation sector, a new, more representative calculation model was recently developed.

Fine particles

Fine particle emissions have been inventoried in Québec since 2002. Emissions of total particles (TP) are used to express the trend since 1990. Assuming that the trend for fine particles is similar to that for total particles, one notes a decline up to the early 2000s, followed by a slight rise due to the increase in economic activity.

Residential wood heating and the industrial sector are the main contributors of fine particles emissions.

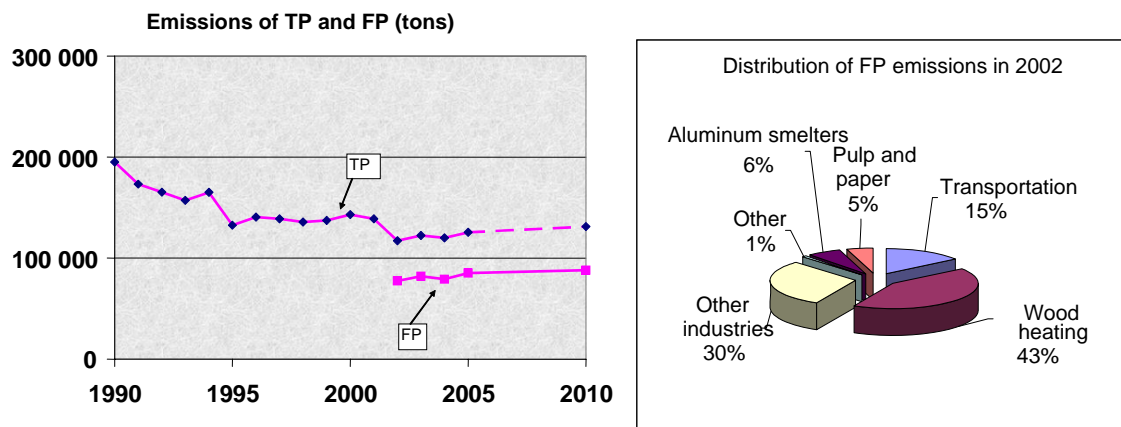


Figure 3: 1990-2010 trends and the 2002 distribution of fine particles emissions

Sulphur dioxide

For sulphur dioxide (SO₂), continuous reductions have occurred over the last 15 years, primarily in the industrial sector of non-ferrous metal extraction (copper). One also notes sustained reductions for the pulp and paper industry and the transportation sector. This is excellent performance, considering the increase in emissions from aluminum smelters due to the expansion of this industry in Québec over the last two decades. Further reductions are expected in future, but at a slower rate.

Nearly 90% of sulphur dioxide emissions are from the industrial sector. The sub-sectors of non-ferrous metal extraction and aluminum smelters are the main contributors.

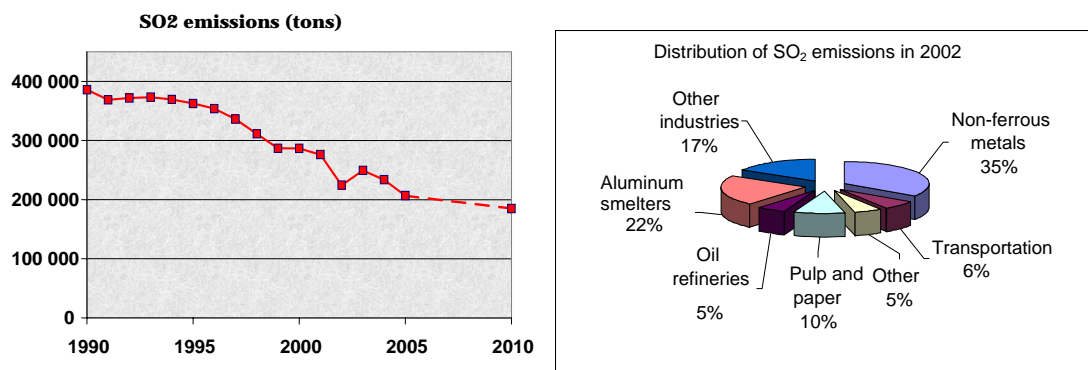


Figure 4: 1990-2010 trend and the 2002 distribution of SO₂ emissions

Nitrogen oxides

With regard to nitrogen oxides (NO_x), the trend shows a weak but steady reduction due essentially to the transportation sector, which at 80% is by far the most important contributor. In the other sectors, weak reductions observed in one area are cancelled out by increases in others. However, future reductions can be expected through the gradual replacement of cars and trucks by models that are much less polluting.

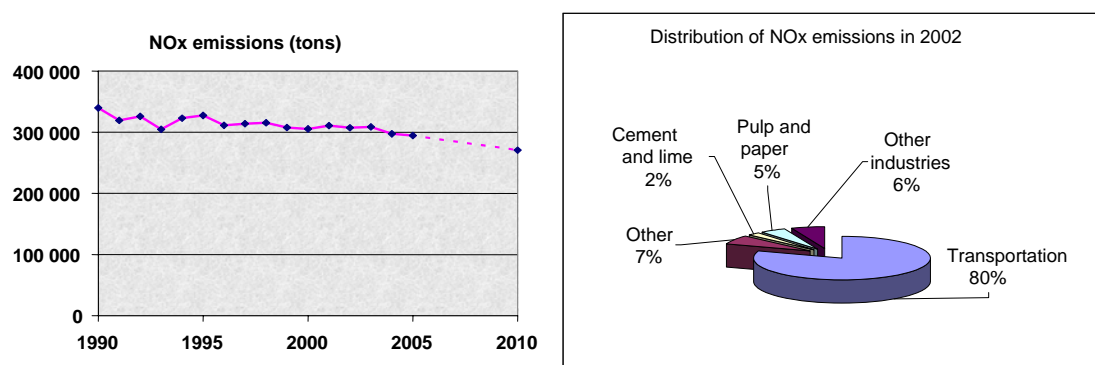


Figure 5: 1990-2010 trend and the 2002 distribution of NO_x emissions

Volatile organic compounds

With regard to volatile organic compounds (VOCs), the trend shows a weak but steady decline in emissions that should continue in future. The decrease is primarily due to the reduction of emissions from gas-powered road vehicles.

Aside from transportation, which contributed 40% of emissions in 2002, the major contributor to emissions is the use of solvents, primarily in the sectors shown as “Other” and “Other industries”.

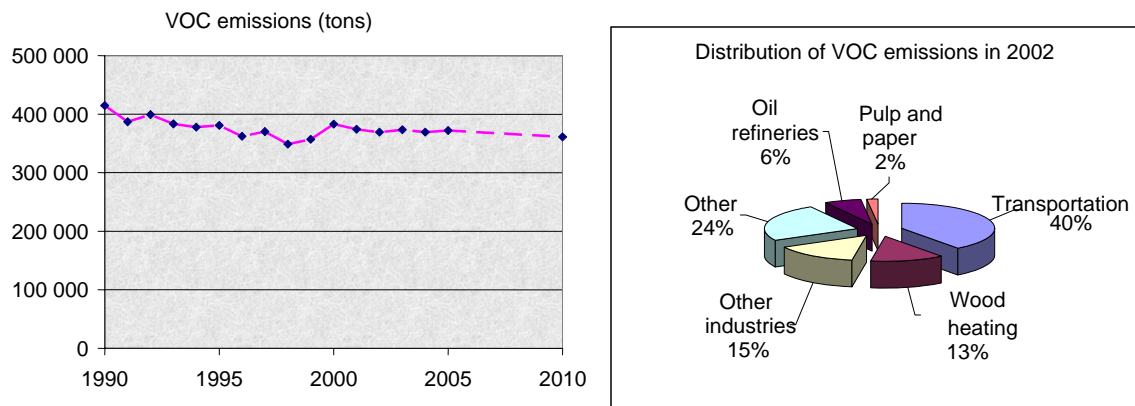


Figure 6: 1990-2010 trend and 2002 distribution of VOC emissions

5. Elements of intervention

Ambient air monitoring network

In December 2005, 23 ozone analyzers and 18 fine particle analyzers were in operation, in the territory defined in section 2, to monitor the Canada-wide standards. In the coming years it will be important to maintain and strengthen this monitoring network, as much as possible, to complete its territorial coverage and improve the knowledge on the impact of atmospheric transport on smog, be it transboundary or not.

Air quality indexing and forecasting programs (AQI and Info-Smog)

Since February 2004 the Québec Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP), in collaboration with Environment Canada, the City of Montréal and the Québec Ministère de la Santé et des Services Sociaux, has published an air quality index (AQI) applicable to the whole of Québec except the island of Montréal. Continuing work begun under the former Montréal Urban Community, the City of Montréal publishes a similar index based on monitoring stations it operates on its territory. The air quality index provides the public with information about the quality of the air, updated hourly.

For Québec: (http://www.mddep.gouv.qc.ca/air/iqa/index_en.htm)

For Montréal: (<http://www.rsqa.gc.ca/framville.asp?url=framrsqf.asp>)

In collaboration with the same partners, the Ministère participates in the air quality forecasting program (Info-Smog). Environment Canada publishes air quality forecasts and advance warnings when poor air quality is expected. Like the air quality index, this program both informs the public and raises awareness about the problem of smog and related issues. As of the summer of 2006, Info-Smog covers the same territory as the air quality index, all year round. This territory extends over a large part of southern Québec.

Current and future reductions of atmospheric emissions of fine particles and precursors of ozone and fine particles

Industry

The interventions of the Québec government are primarily aimed at reducing industrial emissions. Examples include the overhaul of the Regulation respecting the Quality of the Atmosphere (RQA) in the form of the Draft air quality regulation (DAQR), and the depollution attestations (operating permits) applicable to large industry under the Industrial waste reduction program (IWRP). These interventions are also intended to extend what is known about fine particles emissions and precursors and about the precursors of ozone.

Reduction of fine particle emissions: The tightening of standards for many industrial sources will bring about a reduction in emissions of fine particles, since currently available reduction technologies are highly effective at removing fine particles. For example, relative to 2000 levels, FP reductions are expected on the order of 600 tons/year in atmospheric emissions from biomass boilers, and 400 tons/year from wood panelboard mills.

Reduction of sulphur dioxide emissions (fine particle precursors): The maximum sulphur content of heavy oil will be lowered from 2.0% to 1.5%, and improved recovery of incoming sulphur at copper extraction facility will be required.

Reduction of nitrogen oxides emissions (ozone and fine particle precursors): An annual emission limit of 2100 tons will be set for the Tracy station, and low-NO_x models will be required when fossil fuel burners are replaced.

Reduction of volatile organic compounds emissions (ozone precursors): Emission limits will be set for printing and dry-cleaning facilities; an ambient air standard will be applied for formaldehyde from wood panelboard mills and for styrene from the manufacture of composite materials (fibreglass and resins).

Meanwhile, depollution attestations have been issued under the Industrial waste reduction program in the pulp and paper sector, and the issuing process is currently underway for the mining and metallurgy sectors. Exhaustive measurement campaigns of emissions of fine particles, nitrogen oxides and volatile organic compounds were

carried out by the pulp and paper industry as part of these attestations. Analysis of the data is in progress.

Residential wood heating

With regard to wood heating appliances (stoves and fireplaces), Québec participates in public information and awareness programs on the impact of wood heating on air quality and health, and on recommended practices to adopt. For example, during the winter season the Info-Smog forecasting program notifies citizens in most of southern Québec when conditions are unfavourable for the use of these appliances.

A draft regulation is being prepared to restrict the manufacture, purchase, sale and installation of residential wood heating appliances to those possessing EPA or CSA B-415.1 certification.

Transportation

The implementation of measures set forth in the Québec action plans on Climate Change (the 2000-2002 and the 2006-2012 action plans) has had, or will have, a not insignificant impact on air quality. Specific measures include increased investment in public transportation infrastructures (extension of the subway to Laval, addition of two commuter train lines serving St-Jérôme-Blainville and Mascouche-Repentigny-Montréal, reserved bus lanes, etc.) and programs to encourage carpooling and increase access to mass transit.

The heavy-duty vehicle inspection and maintenance program, approved by Cabinet on february 18, 2004, was put in place in june 2006. This program will bring about a reduction in emissions of 450 tons/year, essentially of fine particles.

Other interventions

In order to minimize emission increases and avoid any significant deterioration of air quality, when authorizing new facilities the Ministère du Développement durable, de l'Environnement et des Parcs will continue to ensure that the best production and emission treatment technologies are used.

Furthermore, additional reductions will be obtained through the implementation of certain interdepartmental initiatives, including the 2006-2012 Québec action plan on climate change, the Québec policy on public transportation (2006), and energy efficiency measures proposed in the Québec energy strategy (2006).

Lastly, the Government of Québec is committed to hydroelectricity and wind power, avoiding the emissions of nitrogen oxides and greenhouse gases that come with thermal power plants.

6. Conclusion and next steps

This first assessment of the Canada-wide standards shows that the 2005 indicators do not meet the targets set for 2010. However, there is every reason to believe that the setting up of emission reduction measures by the Ministère du Développement durable, de l'Environnement et des Parcs, in concert with other departments and levels of government, will indeed allow Québec to meet these objectives by 2010.

Here are the next steps being envisaged:

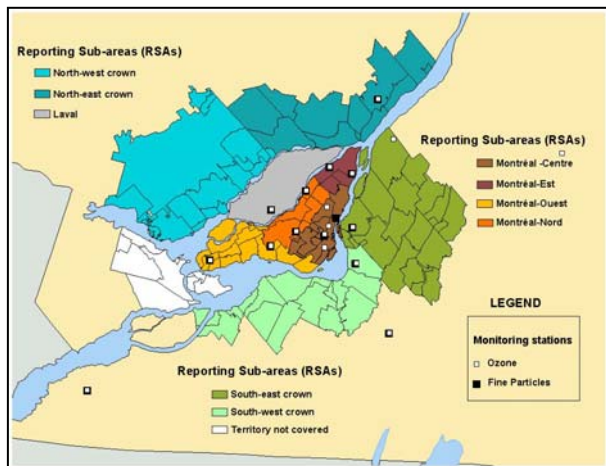
Ambient milieu

- Maintain and upgrade the monitoring network for ozone and fine particles.
- Improve public awareness of the air quality index and produce various reports on air quality in Québec.
- Continue research on the impact of atmospheric transport on smog, both transboundary and other.
- Keep in step with the evolution of fine particle measurement technology in the coming years, adjusting the value of indicators as needed.
- Improve the evaluation of the influence of transboundary flow of pollutants and precursors, the influence of background levels, and the impact of natural events, so as to consider them in future annual and five-year appraisals of the degree of achievement of the Canada-wide standards.

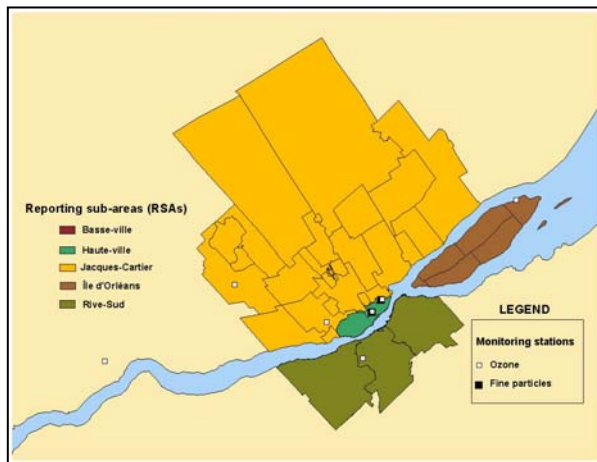
Reduction of emissions

- Extend the characterization of fine particles and precursors to other industrial sectors and examine the opportunities for reduction of these pollutants.
- Finish the project to overhaul the Regulation respecting the quality of the atmosphere.
- Set up measures to lower emissions from residential wood heating:
 - finish the draft regulation on wood heating appliances;
 - continue efforts to raise public awareness on the subject.
- Continue work toward setting up an inspection and maintenance program for light vehicles.
- Continue the implementation of other measures in the transportation, energy and climate change sectors.

Appendix 1: Maps of the six census metropolitan areas (CMAs) and reporting sub-areas (RSAs) with populations¹



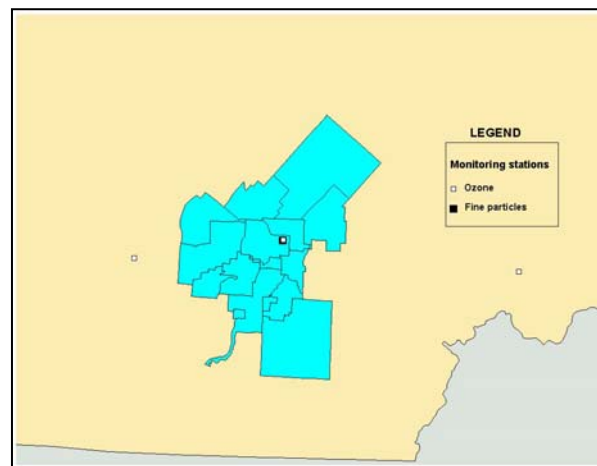
Montréal and its reporting sub-areas, 3 635 700 inhabitants



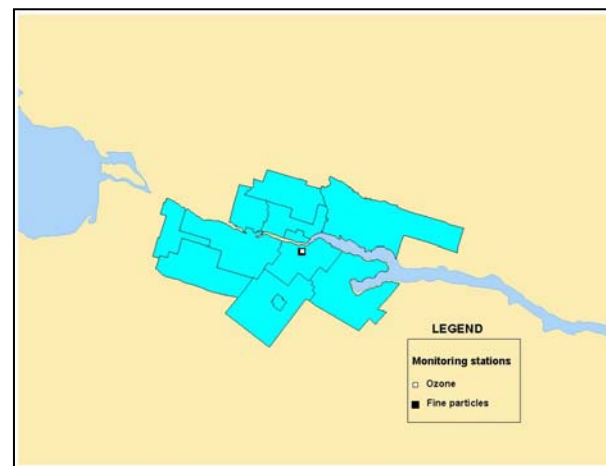
Québec and its reporting sub-areas, 716 600 inhabitants



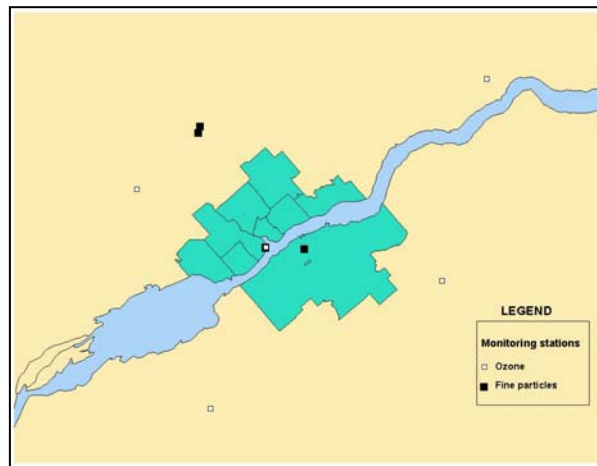
Gatineau and its reporting sub-areas, 267 800 inhabitants



Sherbrooke, 163 700 inhabitants



Saguenay, 153 000 inhabitants



Trois-Rivières, 142 200 inhabitants

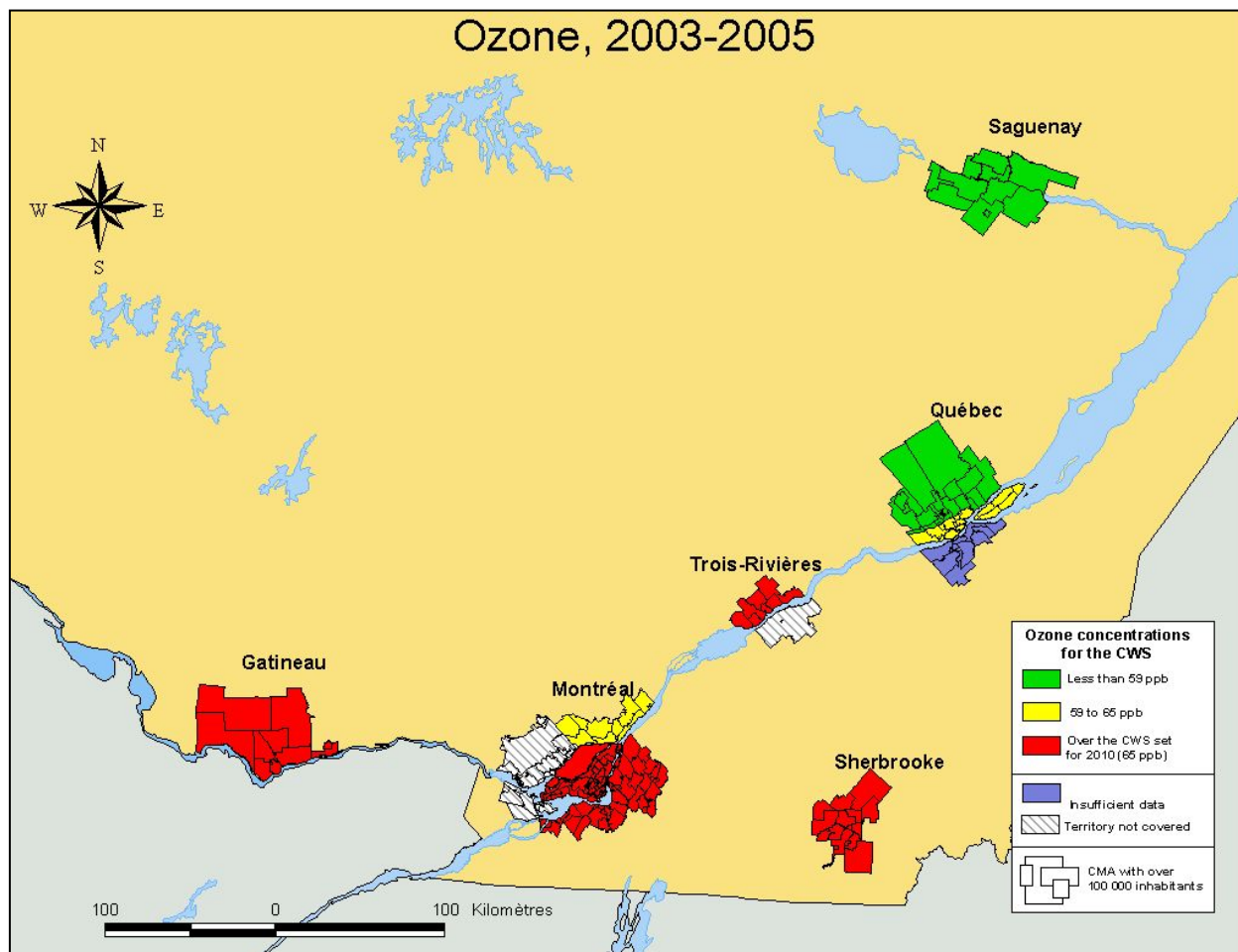
¹ According to Statistics Canada estimates for 2005

Appendix 2: Census metropolitan areas and sub-areas subject to the Canada-wide standards for ozone and fine particles¹

Spatial reference units		Reference stations		Pollutants measured	
Census metropolitan area (CMA)	Reporting sub-area (RSA)	Name	Station No.	Ozone	Fine particles
Montréal	Montréal-Centre	Jardin botanique	06001	x	
		Ontario	06012	x	
		Drummond	06013		x
		Hochelaga – Maisonneuve	06054		x
		De Maisonneuve	06061	x	
		Usine de filtration	06068	x	
	Montréal-Ouest	Aéroport de Montréal 1	06066	x	x
		Saint-Anne-de-Bellevue	06099	x	x
	Montréal-Nord	Duncan	06028	x	x
		Parc-Pilon	06029	x	x
	Montréal-Est	Saint-Jean-Baptiste	06003	x	x
		Rivière-des-Prairies	06055	x	x
	Laval	Chomedey	06205	x	x
	North-east crown	L'Assomption	06500	x	x
	South-east crown	Bourassa	06600	x	x
		Varenes 1	06613	x	
South-west crown	Parc Océanie	06760	x	x	
Québec	Basse-ville	Des Sables	03006	x	x
		Parc Primevère	03021	x	---
	Haute-ville	Saint-Charles-Garnier	03028	x	x
	Jacques-Cartier	Catherine	03712	x	---
	Ile-d'Orléans	François	03712	x	
	Rive-Sud	Charny	03061	x	---
Trois-Rivières		Ursulines	04019	x	x
Sherbrooke		Parc Cambron	05018	x	x
Saguenay		Université Chicoutimi	02022	x	x
Gatineau	Sud-Est	Hull	07002	x	x
	Nord-Ouest	La Pêche	07400	x	---

¹ The selection of territory to be covered by the Canada-wide Standards was done in accordance with directives in the *Guidance Document on Achievement Determination of the Canada-wide Standards*.

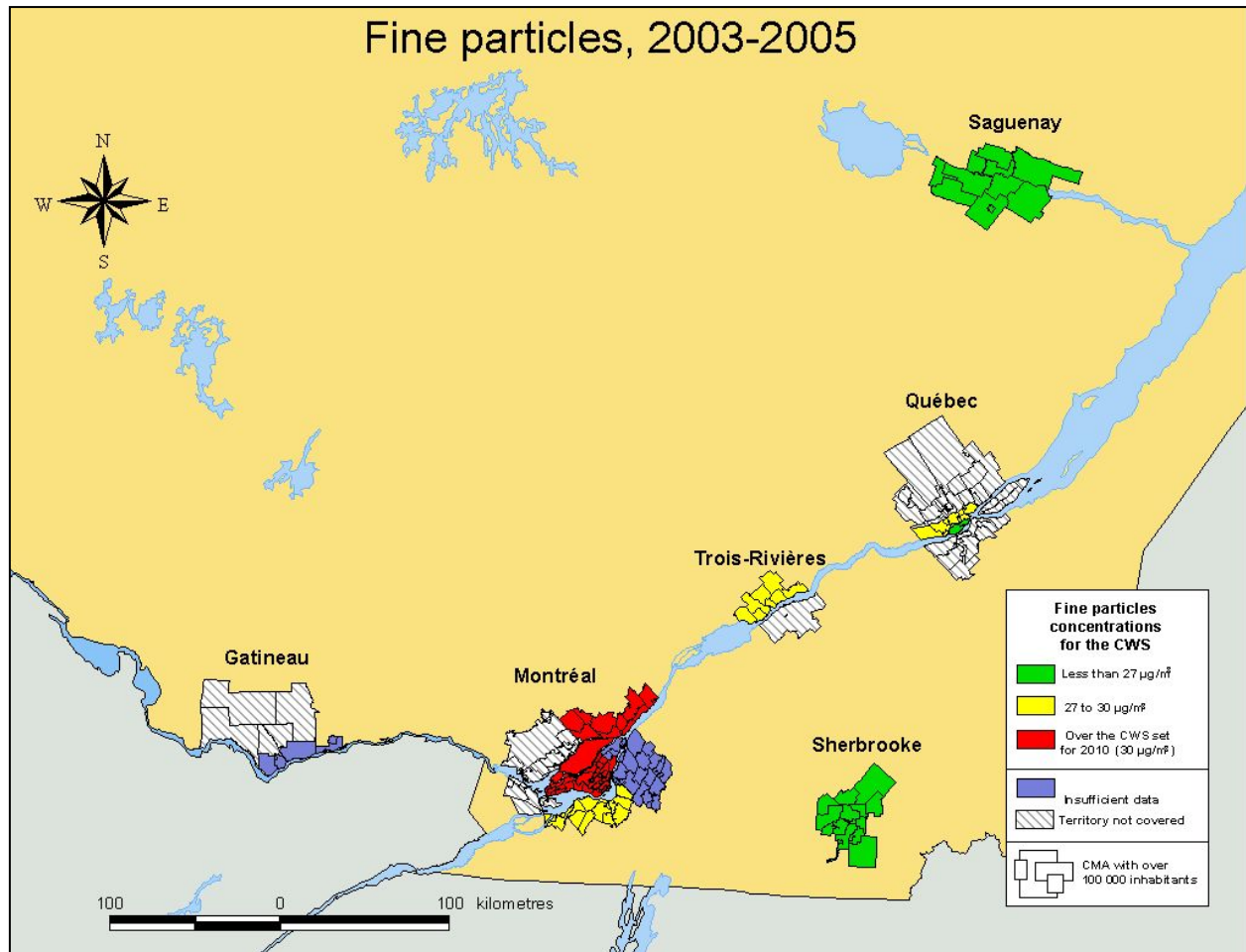
Appendix 3: Cartographic representation of the Canada-wide standards



Map 1: Value of the CWS indicator for ozone in 2005

Note: The CWS indicator for ozone in 2005 represents the 4th-highest value in the daily maximums of running 8-hour average concentrations (ppb) averaged over the years 2003, 2004 and 2005.

Appendix 3: Cartographic representation of the Canada-wide standards (cont.)



Map 2: Value of the CWS indicator for fine particles in 2005

Note: The CWS indicator for fine particles in 2005 represents the 98th percentile of daily data on 24-hour average concentrations (µg/m³) averaged over the years 2003, 2004 and 2005.

Appendix 4: Canada-wide standards – Ozone

Spatial reference units		4th-highest value of daily maximums of 8-hour running averages (ppb) ¹			3-year average
		2003	2004	2005	
Census metropolitan area (CMA)	Reporting sub-area (RSA)	2003	2004	2005	CWS indicator in 2005
Montréal	Montréal-Centre (4 stations)	72.4	64.4	66.3	68
	Montréal-Ouest (2 stations)	77.1	63.6	70.8	71
	Montréal-Nord (2 stations)	74.1	60.0	69.5	68
	Montréal-Est (2 stations)	80.4	64.5	73.9	73
	Laval (1 station)	79.0	60.5	69.0	70
	North-east crown (1 station)	72.0	53.8	70.6	65
	South-west crown (1 station)	77.3	65.1	67.6	70
	South-east crown (2 stations)	76.8	62.7	74.0	71
Québec	Basse-ville (2 stations)	64.8	49.0	63.3	59
	Haute-ville (1 station)	69.6	54.3	61.3	62
	Jacques-Cartier (1 station)	61.3	50.9	53.3	55
	Île-d'Orléans (1 station)	67.3	53.9	67.0	63
	Rive-Sud (1 station)	Nil	— ²	61.5	Insuff.
Trois-Rivières	(1 station)	73.8	57.3	69.8	67
Sherbrooke	(1 station)	— ²	64.1	70.1	67 ³
Saguenay	(1 station)	61.9	48.0	57.4	56
Gatineau	Sud-Est (1 station)	76.1	64.7	75.9	72
	Nord-Ouest (1 station)	78.9	70.7	80.3	77

¹ The 4th-highest value is reported if there is at least 75% data completeness for the period from April 1 to September 30.

² The value for this year cannot be used in calculating the three-year average because it does not meet completeness criteria, i.e. the amount of data is insufficient to produce the indicator.

³ The value of the indicator may be under-estimated due to the absence of data for 2003, a year in which the 4th-highest values were generally higher than in 2004 and 2005.

Note: The calculation of indicators was carried out in accordance with directives in the *Guidance Document on Achievement Determination of the Canada-wide Standards*.

Appendix 5: Canada-wide standards – Fine particles

Spatial units of reference		98th percentile of daily data over 24 hours ($\mu\text{g}/\text{m}^3$) ¹			3-year average
Census metropolitan area (CMA)	Reporting sub-area (RSA)	2003	2004	2005	CWS indicator in 2005
Montréal	Montréal-Centre (2 stations)	34.1	28.7	41.1	35
	Montréal-Ouest (2 stations)	38.9	26.2	37.3	34
	Montréal-Nord (2 stations)	37.8	31.1 ³	44.5 ³	38
	Montréal-Est (2 stations)	In suff.	In suff.	41.6	In suff.
	Laval (1 station)	48.6 ³	26.5	44.8	40 ⁴
	North-east crown (1 station)	33.4	24.3	36.8	32
	South-west crown (1 station)	32.6 ³	23.3	31.5	29
	South-east crown (1 station)	Nil	— ²	40.8	In suff.
Québec	Basse-ville (2 stations)	28.2	23.2	32.3	28
	Haute-ville (1 station)	— ²	23.8	29.1	26 ⁵
Trois-Rivières	(1 station)	30.5	24.2	30.9	29
Sherbrooke	(1 station)	— ²	25.1	26.5	26 ⁵
Saguenay	(1 station)	30.0	20.9	20.5	24
Gatineau	Sud-Est (1 station)	— ²	— ²	39.1	In suff.

¹ The value of the 98th percentile is reported if there is at least 75% data completeness over four quarters.

² The value for this year cannot be used in calculating the three-year average because it does not meet data completeness criteria, i.e. the amount of data available is insufficient to produce the indicator.

³ Despite the fact that the amount of data available does not meet data completeness criteria, the value of the 98th percentile can be used in calculating the three-year average because it is greater than or equal to $30.0 \mu\text{g}/\text{m}^3$.

⁴ The indicator value may be over-estimated due to the small amount of data available in 2003.

⁵ The indicator value may be under-estimated due to the absence of data for the winter of 2003.

Note: The calculation of indicators was carried out in accordance with directives in the *Guidance Document on Achievement Determination of the Canada-wide Standards*.

Appendix 6: Detailed atmospheric emissions for 2002 in Québec

Sector	Pollutants (tons)				
	SO ₂	VOC	NO _x	TP	FP
Pulp and Paper	21 682	6 770	14 325	5 784	3 902
Wood Transformation	484	8 430	2 262	5 633	2 937
SAWMILLS	307	5 413	1 020	2 447	1 484
PARTICLE BOARD	177	3 017	1 243	3 186	1 453
Iron & Steel Industry	17 003	772	3 973	4 518	2 741
METALLURGY	9 124	338	620	3 029	1 767
IRON AND STEEL FOUNDRIES	46	14	78	166	136
IRON ORE PELLETIZING	6 592	9	3 090	983	639
FERRO-ALLOYS	1 242	412	185	339	199
Aluminum Smelters	49 636	1 350	694	9 318	4 877
Chemicals	6 110	1 124	1 750	854	230
ORGANIC CHEMICALS	39	168	23	12	6
INORGANIC CHEMICALS	6 053	121	1 227	809	195
PETROCHEMICALS	18	835	500	34	29
Oil and Gasoline	12 108	23 681	4 663	911	618
OIL REFINERIES	12 108	4 083	4 660	911	618
GAS STATIONS	0	19 598	3	0	0
Cement and Lime Plants	10 129	65	6 717	1 111	493
CEMENT	7 909	61	5 990	993	487
LIME	2 220	3	727	119	6
Zinc Extraction	5 341	1	21	155	73
Copper Extraction	71 698	3	129	717	652
Other	3 526	42 268	5 480	38 438	15 613
PLASTIC PRODUCTS	0	6 152	69	4	4
RUBBER PRODUCTS	5	2 855	66	30	15
INDUSTRY CAUSING AREA EMISSIONS	1 381	30 468	2 005	35 508	14 553
ABRASIVES	0	0	0	0	0
REFRACTORY PRODUCTS	0	1	24	30	9
CLAY PRODUCTS	164	0	8	14	8
CARBON ELECTRODES	145	0	7	38	34
FOOD AND BEVERAGES	20	1 434	620	181	84
UNCLASSIFIED INDUSTRIES (INVSRC)	1 403	509	2 217	1 468	819

Sector	Pollutants (tons)				
	SO ₂	VOC	NO _x	TP	FP
ASBESTOS MINING AND MILLING	404	1	117	53	15
LANDFILL SITES	1	840	208	1 073	40
EXTRACTION OF MAGNESIUM etc.	4	8	140	39	34
Solvent Use	10	89 627	159	10	9
PRINTING	0	8 950	53	2	2
ADHESIVES	0	4 354	5	0	0
INDUSTRIAL SURFACE COATING	8	17 618	99	7	6
DRY CLEANING	0	172	0	0	0
NON-INDUSTRIAL USE OF SOLVENTS	0	57 735	0	0	0
PAINTS AND COATINGS	1	799	2	0	0
Incinerators	189	239	762	76	58
C.E.R.S./Longueuil	58	2	6	7	6
C.T.D. Îles-de-la-Madeleine	13	3	1	0	0
CREMATORIUM	0	0	0	0	0
WASTEWATER TREATMENT PLANT/Montréal	1	15	403	9	8
INCINERATOR/Québec	108	198	269	18	17
RIVE-SUD/Lévis	0	18	46	3	2
SAFETY-KLEEN/Mercier	10	4	37	40	24
Thermal Generating Plants	1 362	104	5 419	246	160
HYDRO-QUÉBEC THERMAL PLANTS	1 269	47	4 869	100	65
BIOMASS COGENERATION PLANTS	93	57	550	146	95
Non-industrial Combustion	10 786	48 462	13 949	35 808	33 348
PUBLIC ADMINISTRATION	163	6	185	15	8
AGRICULTURE	45	8	325	12	10
C.C.U.M./Montréal	191	2	88	15	5
WOOD HEATING	475	48059	3 322	34 786	32892
BUSINESS AND INSTITUTIONS	6 376	227	6 139	630	291
RESIDENTIAL	3 536	161	3 889	350	143
Transportation	14 387	146 177	247 074	13 600	11 637
AIRCRAFT	593	1377	9697	321	125
AUTOMOBILES, DIESEL	43	190	630	63	58
OTHER DIESEL	2196	6551	56845	5825	5470
OTHER TRANSPORTATION				1051	
BOATS	6946	2552	28257	1589	1462
HEAVY TRUCKS, DIESEL	1471	2659	65493	2094	1935
HEAVY TRUCKS, GAS	79	958	3404	47	37
LIGHT TRUCKS, DIESEL	84	362	876	107	99
LIGHT TRUCKS, GAS	872	25641	22443	174	145
RAILWAYS	480	524	11092	248	212
OFF-ROAD, GAS	182	62883	9667	1865	1717

Sector	Pollutants (tons)				
	SO ₂	VOC	NO _x	TP	FP
MOTORCYCLES	7	685	361	6	4
AUTOMOBILES, GAS	1435	41797	38311	210	192
TOTALS	224 450	369 072	307 376	117 179	77 348