Direction de
l'environnement et du
développement durable

2009

RSQA · Réseau de surveillance de la qualité de l'air
www.rsqa.qc.ca

Environmental Assessment Report

Air Quality in Montréal

Highlights

Reducing smog

Carpooling, walking, cycling, avoiding letting one's vehicle motor run uselessly and complying with posted speed limits are as many simple actions that help at all times improve the air quality.

- Fine particules responsible for 67 of the 68 poor air quality days in Montréal in 2009.
- Sulfur dioxide responsible for just two days of poor air quality.
- Regional issue: 32 days of smog.
- Local issue: 36 days of poor air quality.
- Summer smog and high concentrations of sulphates.
- Winter smog and high concentrations of chlorides.
- Solid-fuel-burning equipment: regulation adopted.
- Benzene: downward trend.

Montréal

Number of poor air quality days

A poor air quality day is deemed to be a day during which the air quality index is "**poor**" in at least one monitoring station and this, for at least one hour. This indicator includes both those smog days occurring at the regional level and those days where poor air quality is observed locally over a short period of time.

In 2009, all poor air quality days recorded on the Montréal territory were due to high concentrations of fine particles ($PM_{2.5}$), except for two occurring in the month of March. One of these days was caused by a concentration of sulfur dioxide (SO_2) exceeding the acceptable Air Quality Index (AQI) value and the other, by an overrun of the acceptable AQI values for both the $PM_{2.5}$ and SO_2 pollutants.

Number of poor air quality days		
Total	Regional issue	Local issue
68	32	36

Regional issue: smog days and episodes

A "**smog day**" is a day during which atmospheric emissions and weather conditions result, over many hours, in the formation or accumulation of high concentrations of fine particles or ozone over a vast area of the territory. For the Montréal region, the Air Quality Index needs to be poor in at least three of the four sub-regions identified, namely the East, West, North and Downtown and this, simultaneously.

Three criteria[1] are used to determine smog days:

1. **Intensity**: the concentrations of fine particles (average over 3 hours) or ozone (hourly average) must respectively exceed 35 µg/m^3 and 160 µg/m^3.
2. **Duration**: the high concentrations must be observed for at least three hours.
3. **Range**: the high concentrations must be representative of the administrative region.

On the other hand, "**smog episode**" refers to a day or group of days during which the presence of smog is continuous.

1. www.mddep.gouv.qc.ca/air/info-smog/portrait/index.htm

According to observations, there were 32 poor air quality days in Montréal in at least three sub-regions simultaneously, corresponding to the criteria defining smog days. Of this number, 29 days were distributed over the months of January, February, March, November and December, whereas the three remaining days were all observed in the month of August. Very few of these days occurred in the summertime, since the conditions favourable to the formation of smog were not present in that period. Indeed, according to Environment Canada, the month of July was one of the least sunny in recent years and the first dog days of summer only occurred in August. During a regional smog episode, such as the one observed in August, pollutants of regions as far away as Ontario and the United States play a significant role as they can travel over great distances, pollution being oblivious to borders.

Local issues

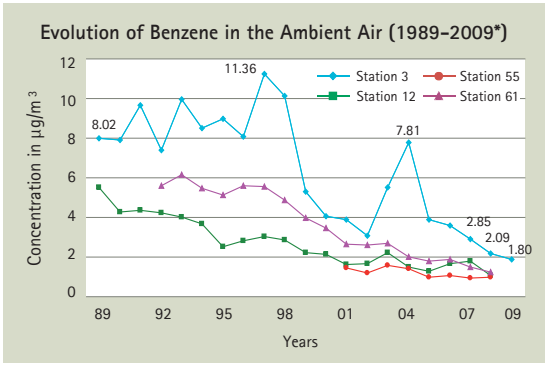
The poor air quality days recorded in at least one monitoring station measuring the effects of a more local source are distributed as follows:

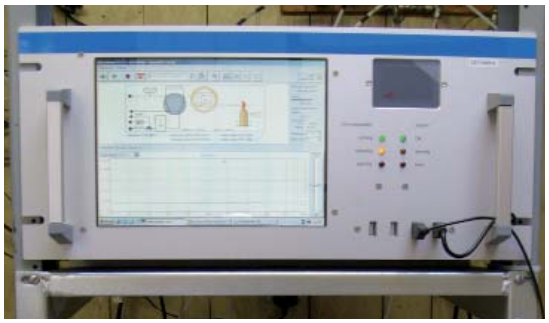
- 17 poor air quality days observed over a period of months in the Downtown region are directly related to a wood burning stove in that sector (stations 13 and 61);
- 1 poor air quality day in August owing to the fireworks (station 50);
- 1 poor air quality day in April owing to a fire (station 3);
- 1 poor air quality day in March due to a high concentration of SO_2 in the East (station 3);
- 16 poor air quality days related to human activities such as traffic, wood heating and industry.

All in all, there were 68 poor air quality days observed in 2009, one more than in 2008.

Benzene: still a downward trend

In 2009, the mean concentration of benzene measured at station 3, located on Saint-Jean-Baptiste Blvd. in the borough of Rivière-des-Prairies–Pointe-aux-Trembles, dipped under the 2.00 µg/m³ mark. Indeed, the mean value of 1.80 µg/m³ recorded in 2009 results in a reduction of about 14% of this pollutant compared to the concentration measured in 2008. This concentration is fast approaching the values observed in the other stations on the Island of Montréal. Since the closure of station 12, the analysis of benzene and other non polar VOC are conducted at station 80, located at 2580 Saint-Joseph St. East and commissioned at the beginning of 2009.

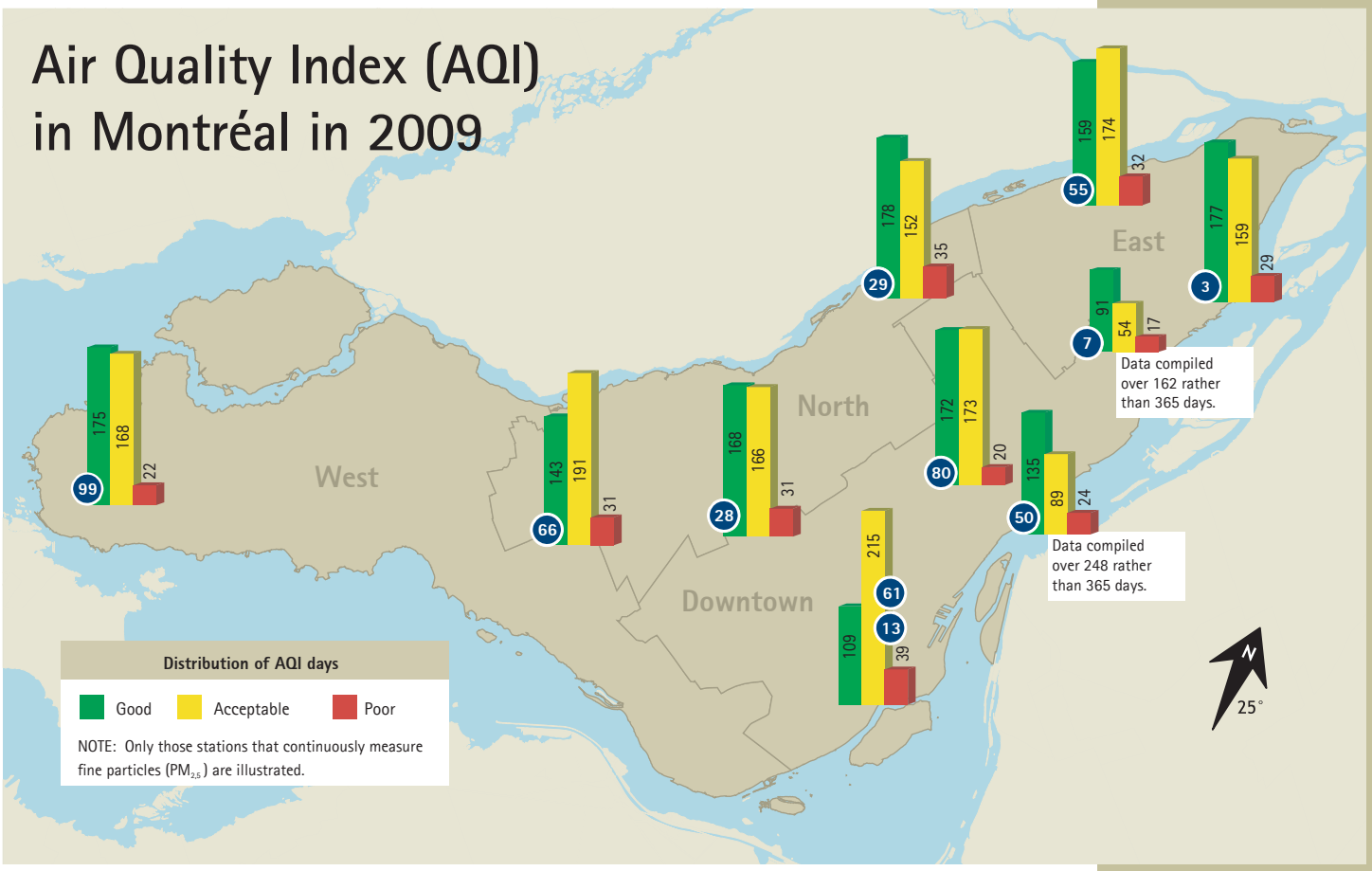




Technical improvement

In August, a benzene flow injection analyser was installed at station 3. In the long term, the analysis of the data obtained will provide information on releases of this pollutant on an hourly, weekly and seasonal basis. It is worthwhile mentioning that the results obtained to date with this method are comparable to those obtained with the traditional TO-14 monitoring method.

The analysis of benzene for stations 55, 61 and 80 had not yet been completed when we went to press. Consequently, it was impossible to produce a schedule comparing the data for the various stations. This data will eventually be available in the **Documents section** of our Web site.



Special dossier on particles

The science of particles

Particles or particulate matter (PM) represent a set of very small airborne substances. They exist in a solid or liquid form and come in different sizes. These particles are released directly into the atmosphere through various human or natural activities, in which case they are called primary particles, or yet again formed in the atmosphere from precursor pollutants, for those designated as secondary particles. Particles are complex pollutants as they are composed of a multitude of chemical species. When present in great concentrations in the ambient air, visibility is impaired. Particles are associated with smog episodes both in the winter and summertime.

Particles that are continuously monitored by the monitors of the city's network are those fine particles or $PM_{2.5}$ with a diameter of 2.5 µm or less. Other particles, notably those with a diameter less or equal to 10 µm, PM_{10}, are also subject to regular monitoring, their in-laboratory analysis revealing the chemical nature of the substances that compose them. The data collected help to identify the potential sources of airborne particles, in order to implement the corrective measures necessary to diminish their presence.

Many years of monitoring have allowed us to identify and resolve certain total airborne particle issues related, among others, to the industrial sector. The data collected over the years have also been sourced to establish trend lines that allow us to track the evolution of air quality in the various areas of the island. These trend lines are available at www.rsqa.qc.ca in the **Historique et tendance section**.

Winter smog: presence of chlorides in the air

In the wintertime, the application of abrasive materials on our roadways is common practice in order to provide for the safe circulation of motor vehicles. The de-icing salts generally used are **sodium** and **calcium chlorides**. An analysis of certain total suspended particulate matter samples conducted before, during and after poor air quality episodes in the months of January, February and December 2009 revealed strong concentrations of chlorides at two monitoring stations located near important roadways, namely station 6-Châteauneuf located at the junction of Highways 25 and 40 and station 13-Drummond located at the intersection of Drummond St. and René-Lévesque Blvd. West. As indicated in the table below, winter concentations of chlorides are very high compared to those observed at other times of the year.

Chloride concentrations in µg/m³

RESULTS	Station 6	Station 13
Summer ave.	0.25	0.18
Winter ave.	9.56	2.95
Annual ave.	4.66	1.49

Summer average: May to October
Winter average: January to April, November and December

At 51.06 µg/m³, the maximum concentration of chlorides for the year 2009 was reached on December 21st at station 06-Châteauneuf, after a smog episode, when the average temperature recorded was -14 °C. That day was also one of the eight days of intense cold recorded by Environment Canada in December. Few data are available regarding chloride concentrations in the ambient air. However, the average annual concentration in Canada is believed to be in the 1.2 µg/m³ range.[1] According to these observations, the average is not respected in these two locations.

1. www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/chloride-chlorure/index-fra.php

Special dossier on particles

Summer smog: sulphates take to the air!

The month of August featured a 3-day regional smog episode (August 16-18). The concentrations of $PM_{2.5}$ measured exceeded the AQI value of 35 µg/m³ both in Montréal and in the stations of the Greater Metropolitan Region operated by the Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP). Furthermore, an analysis of the chemical composition of the particles measured on August 17th at four monitoring stations located in the West (99), the East (3 and 6) and Downtown (13) yielded a concentration of sulphates (SO_4^{2-}) some eight times greater than the annual average and this, both in Montréal and outside of the Montréal region. These days were also characterized by warm temperatures and a high level of humidity.

Although sulphate concentrations have been rather stable since 2008, a comparison with the concentrations of prior years points to a downward trend for this pollutant. It is noteworthy that the maximum concentrations fo each of the years 2005 to 2009 were obtained during the summer, when temperatures and humidity levels were quite high and the dominant winds were mainly from the South and South-West. For each of these days, the air quality was poor, owing to strong concentrations of fine particles. However, strong concentrations of ozone were also present.

Results of the average concentrations of sulphates (µg/m³) for four monitoring stations

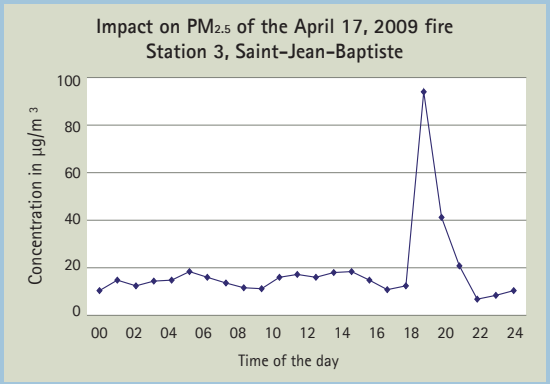
	2009	2008	2007	2006	2005
Average annual concentration µg/m³					
TSP	2.93	2.74	3.24	3.60	4.59
PM_{10}	2.10	2.08	2.27	2.50	3.39
Maximum concentration recorded µg/m³					
	Aug 17	Apr 17	May 24	Jul 10	Sept 13
TSP	16.62	9.74	15.02	15.42	22.70
PM_{10}	16.40	8.43	10.41	14.17	23.50
Weather conditions					
Temp. °C	33	13	22	24	24
Winds (direction)	West	Calm winds	South-West	South	South-West
Humidity (%)	66	40	57	65	72
Overview	Clear	Clear	Clear	Clear	Dry mist and Clear

Origin of sulphates

Most sulfur products are released as sulfur dioxide (SO_2) by industrial processes and the combustion of fossil fuels. They are oxidized by the oxygen in the air and, following some complex reactions, they then form sulphuric anhydride (SO_3), sulfuric acid (H_2SO_4) and sulphates (SO_4^{2-}). Depending on the wind conditions, SO_2 can travel great distances and originate from sources as far away from Montréal as Ontario and the United States. Indeed, this is exactly what happens with episodes of regional smog.

A fire in Montréal's East end

A fire broke out during the evening of April 17, 2009 in the East end of Montréal, corner of Sherbrooke St. East and 14th Avenue. Two industrial facilities were wasted by the fire, the first a concrete plant and the second, a roofing company. Monitoring station 3, located on Saint-Jean-Baptiste Blvd., informed us about the concentrations of pollutants released during this event, notably in terms of fine particles.



Special dossier on particles

Fine particles and wood heating

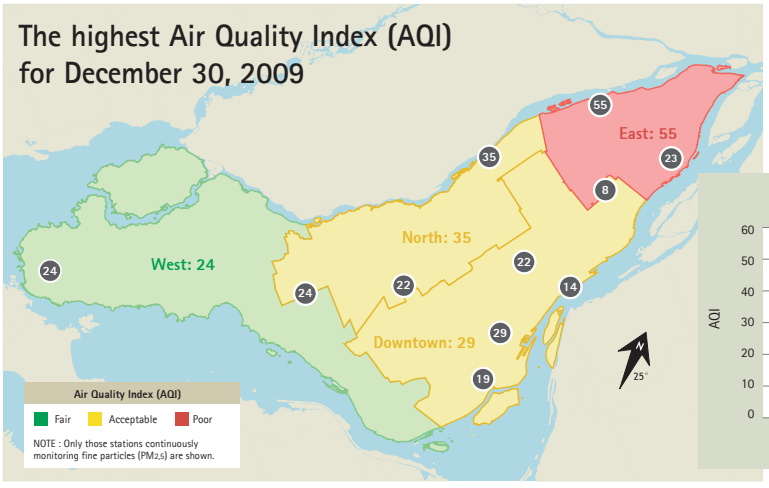
The main sources of fine particles have been identified as industries, transportation and wood heating. For many years now, on the Island of Montréal, industries have been closely monitored, as they are subject to regulations according to their sector of activity. A transportation plan has been developed by the city to reduce the total emissions released by motor vehicles. Also, various federal and provincial regulations apply to different levels of the transportation industry.

The increase of wood burning in heavily populated urban settings contributes to the deterioration of the ambient air quality and may prove harmful to the health of the exposed populations.

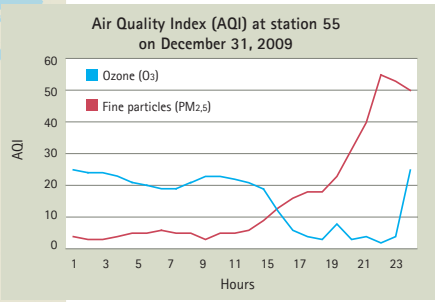
Measures taken in residential districts show that PM concentrations often exceed 30 µg/m^3, the threshold established in the Canada-wide standards. An overview of these results is presented in page 7 of this report. The Canadian Council of the Ministers of the Environment, in preparing these standards, had raised the issue of emissions released by wood heating equipment and had then supported the preparation of a document intended for municipalities wishing to legislate.

Consequently, it is in full consideration of the adverse effects of fine particles on the environment and the health of its citizens, that the Council adopted in April 2009, the **Bylaw 09-012 concerning solid-fuel-burning equipment**. The Bylaw prohibits the installation, within a new or existing construction, of a solid-fuel-burning equipment, with the exception of an EPA or CAN/CSA-B415.1 pellet-burning certified stove. However, gas, electrical or oil fueled equipment are allowed.

The adoption of this Bylaw, that limits the growth in the number of solid-fuel-burning equipment, is a key step toward improving the quality of air in Montréal. The municipal administration has also called upon the federal and provincial governments to implement a program to replace wood burning equipment with equipment that relies on cleaner fuels. Following the adoption of this regulation, an awareness and information campaign on the adverse effects of wood heating on our health and environment was conducted among the Montréal population.



In the graph below, the increase in $PM_{2.5}$ at station 55 is clearly visible in the middle of the evening in a residential district.



Canada-wide standards: 2nd reference year

Preoccupied by the high concentrations of fine particles and ozone in the ambient air and their adverse effects on the health of citizens and the environment, the Canadian Council of the Ministers of the Environment adopted **Canada-wide standards** in June 2000. These standards are target concentrations to be attained by the year 2010.

For **ozone**, the standard of 127 µg/m^3 (the maximum daily 8-hour moving average) is determined based on the average of the greatest 4th annual maximums, calculated over three consecutive years. For **fine particles** ($PM_{2.5}$), the standard of 30 µg/m^3 (the daily maximum over 24 hours) is determined on the basis of the annual average of the value of the 98th percentile, also calculated over three consecutive years. Given that the year 2010 was established as the deadline for the assessment of these pollutants in the ambient air, the results of the year 2009 constitute the second reference year.

The schedules opposite compare the results obtained in the various monitoring stations to the objectives set out in the Canada-wide standards. However, this comparison is made without having followed all of the instructions in the federal guidelines, as these require an exercise that is more complex and exceeds the framework of this report.

The summer of 2009 did not break any records except for those related to gloomy weather. Indeed, according to Environment Canada data, July 2009, with only 212 hours of sunshine for the Montréal region, was the least sunny month in recent years. This explains why ozone concentrations, a pollutant released by precursors reacting to sun rays and warm temperatures, were well below the standard of 127 µg/m^3.

On the other hand, concentrations of fine particles are less influenced by the level of sunshine. The results for the year 2009 exceed the Canada-wide standards in all RSQA monitoring stations, in addition to revealing a slight increase compared to the year 2008. These results for $PM_{2.5}$ clearly indicate that corrective measures, to curb this pollutant's release at the source, need to be implemented to attain the objectives set for 2010. Some of these measures will be defined in the next edition of *Montréal's Strategic Plan for Sustainable Development*.

Fine particles ($PM_{2,5}$)

Threshold: 30 µg/m^3

STATION	Annual value of 98th percentile 24 hrs			3-year average
	2008	2009	2010	
3	31	37		34
7	31	38		35
13	33	39		36
28	35	37		36
29	31	39		35
50	31	38		35
55	32	39		36
66	34	37		36
80*	--	32		32
99*	--	32		32

* Incomplete data for the year 2008

Ozone (O_3)

Threshold: 127 µg/m^3

STATION	4th highest daily maximum 8-hr moving average			3-year average
	2008	2009	2010	
3	115	108		112
28	100	93		97
29	117	109		113
55	124	114		119
61	92	100		96
66	119	111		115
68	115	105		110
80*	--	112		112
99	124	109		117

* Incomplete data for the year 2008

Production
Service des infrastructures, transport et environnement
Direction de l'environnement et du développement durable

Information
514 280-4368
dianeboulet@ville.montreal.qc.ca

Web Site
www.rsqa.qc.ca

Coordination
Service des communications et des relations avec les citoyens

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A continuous presence on the Island of Montréal

Air pollution is one of the major factors contributing to the deterioration of the quality of life of citizens living in an urban setting. That is why monitoring the ambient air quality has always been a priority for the Ville de Montréal. The first measures of air quality in Montréal were conducted back in the 60s. Over the years, the growing complexity of air pollution has made it necessary to implement a very sophisticated system. Where are we today and what can be done to improve the situation?

Seventeen monitoring stations located throughout the Island of Montréal now compose the Réseau de surveillance de la qualité de l'air (RSQA), part of the National Air Pollution Surveillance Network (NAPS), whose objective it is to provide accurate, standardized and long-term data on air quality in Canada. Of this number, 11 stations measure airborne pollutants continuously, 24 hours a day. The RSQA measures the impact on the quality of ambient air of commercial, industrial and residential activities on the island. This data may give rise to corrective measures (notably regulatory) in order to protect the health of Montrealers and the quality of their environment. The RSQA is also a partner of the Info-SMOG program, which broadcasts smog alerts when the conditions for a SMOG episode, whether in the summer or winter, are present.

One can verify at all times the air quality on the Montréal territory by consulting the www.rsqa.qc.ca Web site which broadcasts the Air Quality Index (AQI) on an hourly basis.

Monitoring Stations on the Island of Montréal