

Environmental Assessment Report

Air Quality in Montréal

Highlights

Slight Decrease in the Number of Poor Air Quality Days

In 2007, there were 44 days of poor air quality, a slight decrease (6%) from 2006. This result is due to initiatives implemented to improve the air quality in Montréal's East End industrial sector. However, in Rivière-des-Prairies, a residential neighbourhood, the situation has deteriorated, with a total of 23 poor air quality days compared to 13 in 2006. Of these 23 days, 15 were recorded during the winter due to the local impact of residential wood heating.

Particulate Matter: Always a Problem

Particulate matter ($PM_{2.5}$), emitted by multiple local and regional sources, is a recurrent cause of most poor air quality days in Montréal, i.e. 35 of the 44 recorded days in 2007. Once again, the greatest hourly concentrations were recorded in Mercier-Hochelaga-Maisonneuve during fireworks at La Ronde.

Marked Improvement in the Air Quality of Montréal's East End

The two typical and representative ambient air pollutants emitted by Montréal's East End petrochemical sector were seriously curtailed in 2007. Indeed concentrations of sulphur dioxide and benzene recorded at Station 3 on Saint-Jean-Baptiste Boulevard fell by 38% and 20% respectively. The RSQA (Réseau de surveillance de la qualité de l'air) has never recorded such a low annual average for these two pollutants. Needless to say, we will

pursue our collaborative efforts with local industries to further improve the situation.

A Record: 14 Smog Warnings Issued during Summer 2007

Fourteen smog warnings were issued during the summer of 2007, the greatest number since 2000. Such a high figure indicates that the summer's meteorological conditions favoured the formation of seasonal smog, of which ozone is an important component. Summer 2007 weather conditions are one of the factors that explain an 11% increase in the average ozone concentrations recorded in all RSQA monitoring stations.



The City Monitors Air Quality For Your Benefit!

Concerned about the quality of its ambient air, the City of Montréal, over the last 40 years, has maintained a comprehensive surveillance network. Under Montréal's Direction de l'environnement et du développement durable, the RSQA manages 17 monitoring stations, 13 of which operate on a continuous basis. In addition to measuring and monitoring the pollutants common to large urban centres, the RSQA monitors more than 170 volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC). Thanks to Environment Canada's National Air Pollution Surveillance (NAPS) Network, the RSQA is able to draw on leading-edge technology.

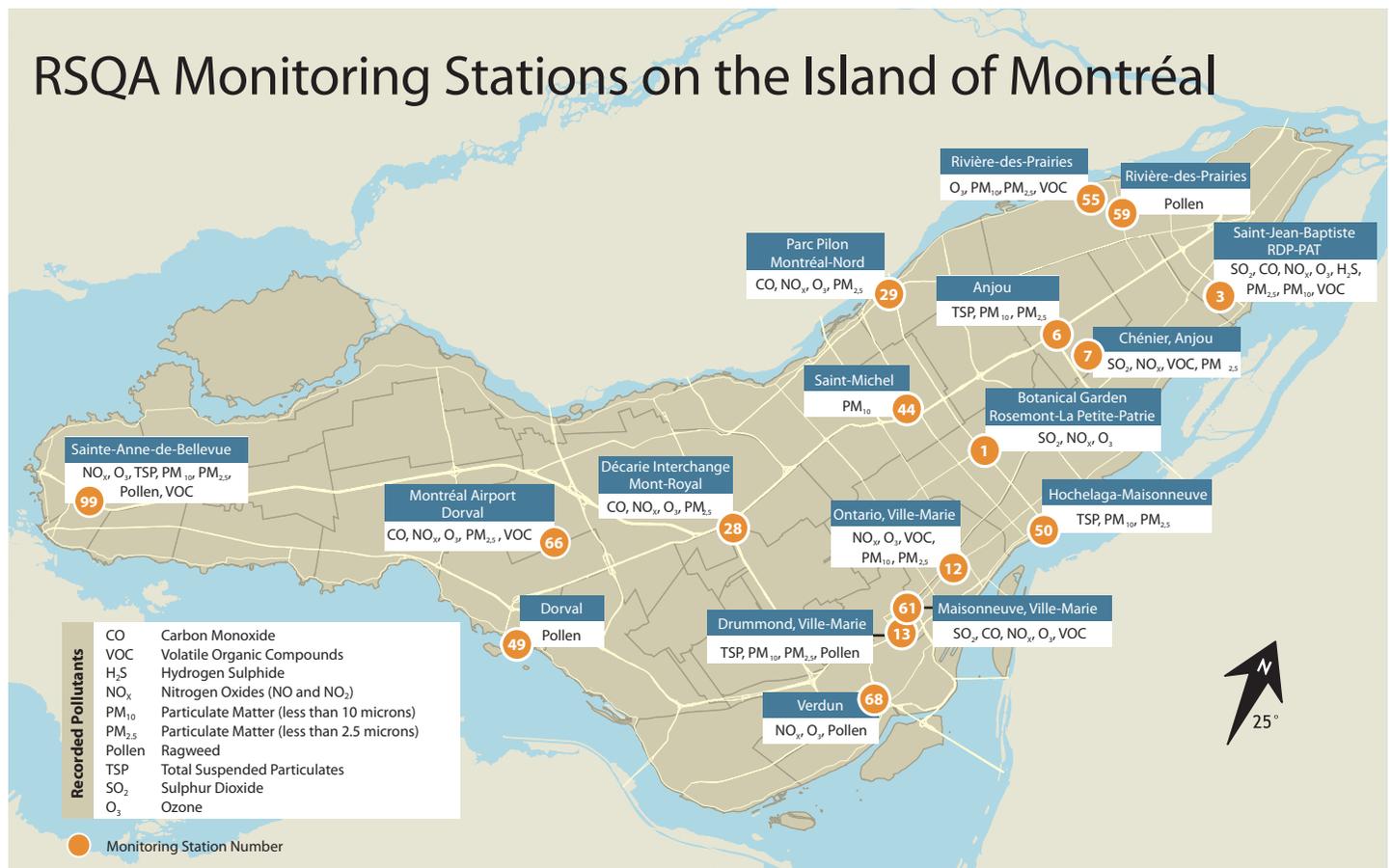
In 2007, in cooperation with NAPS and the Borough of Anjou, the RSQA added a temporary monitoring station located near Chénier Arena. Its purpose is to monitor concentrations of airborne sulphur dioxide (SO₂) and benzene and to assess the impacts of Montréal's East End industrial sector on air quality.

Communicating air quality information to Montréal citizens is also an important mandate of the RSQA. Some of the means that are presently used by the City to inform the population at

large about air quality include the RSQA's Web site at www.rsqa.qc.ca, communicating the air quality index (AQI) to metro users thanks to a partnership with Métrovision and participating in Québec's INFO-SMOG program, on air quality forecasts.



Station 7: Chénier Arena, Anjou

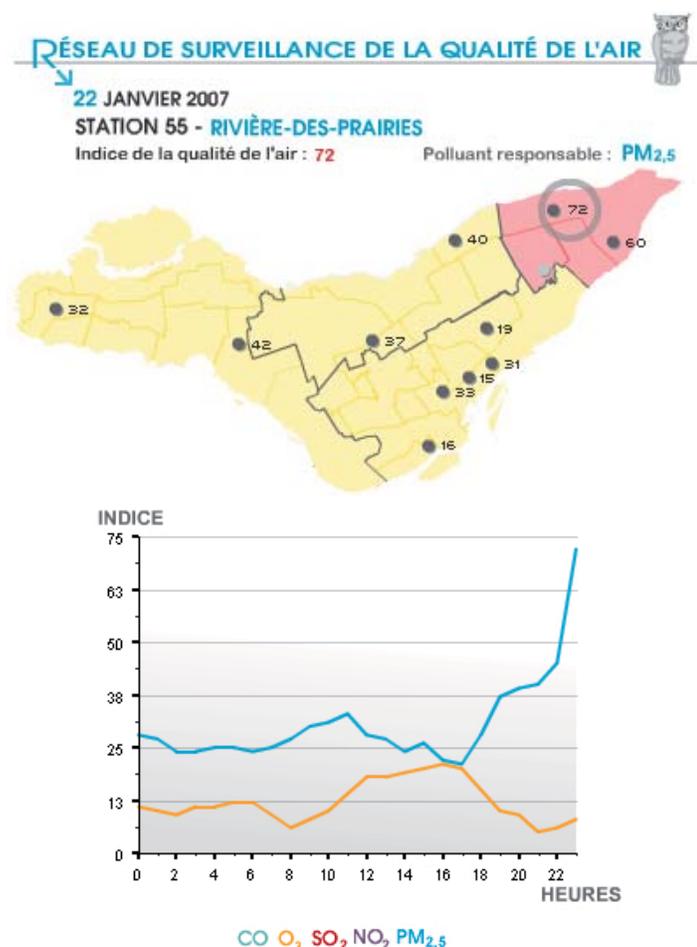


Particulate Matter and Wood Heating

For many generations, wood burning, as an auxiliary heating source or simply for enjoyment, has been a lifestyle choice of many Quebecers. Despite its innocent appearance, wood smoke contains numerous toxins, notably particulate matter (PM_{2.5}), carbon monoxide (CO), nitrogen oxides (NO_x), formaldehyde, VOC, polycyclic aromatic hydrocarbons (PAH), as well as dioxins and furans. Health specialists confirm that exposure to wood smoke is often associated with respiratory problems.

High concentrations of particulate matter, emitted by wood burning, contribute to winter smog. The surveillance conducted by the RSQA has determined that specific problems were associated with the presence of local sources of pollution thereby confirming that wood burning is a serious issue in terms of air quality in a densely populated area such as Montréal.

During the wintertime, there have been occurrences where Montréal's overall air quality was rated as good or acceptable, except in those residential areas where wood burning was a factor. The figure below clearly indicates what has been



NOTE: This is an image captured from the French-only RSQA Web site.

observed at Station 55 (Rivière-des-Prairies), the only station located in this type of neighbourhood. Indeed, the effects of PM_{2.5}, when viewed in real time on RSQA's Web site, reveal high concentrations of particulate matter in the evenings.

During the winter of 2007, the number of Rivière-des-Prairies' poor air quality days owing to PM_{2.5} was nearly five times greater than in the downtown core and 1.5 times greater than in the refineries sector of Montréal-Est. During the summer, the same comparison results in the opposite conclusion, thereby clearly revealing the negative impacts of wood burning in the Rivière-des-Prairies area.

Number of Poor Air Quality Days in Winter Due to Particulate Matter

Station 55 Rivière-des-Prairies	Station 3 Saint-Jean-Baptiste	Station 50 Downtown
15	9	3

Number of Poor Air Quality Days in Summer Due to Particulate Matter

Station 55 Rivière-des-Prairies	Station 3 Saint-Jean-Baptiste	Station 50 Downtown
8	0	14

For many years now, Montréal has conducted public awareness campaigns on best practices respecting wood burning. Unfortunately, no air quality improvement has been observed. Wood burning, even in an environmentally-certified stove, emits pollutants. Also, it is worthwhile mentioning that the United States Environmental Protection Agency's (EPA) emission standards have been established on the basis of averages obtained in ideal laboratory-controlled conditions. For comparative purposes, it should be noted that a traditional wood stove in use for nine hours discharges as many airborne particles as a certified wood stove during 60 hours or an automobile during a full year (18,000 km).

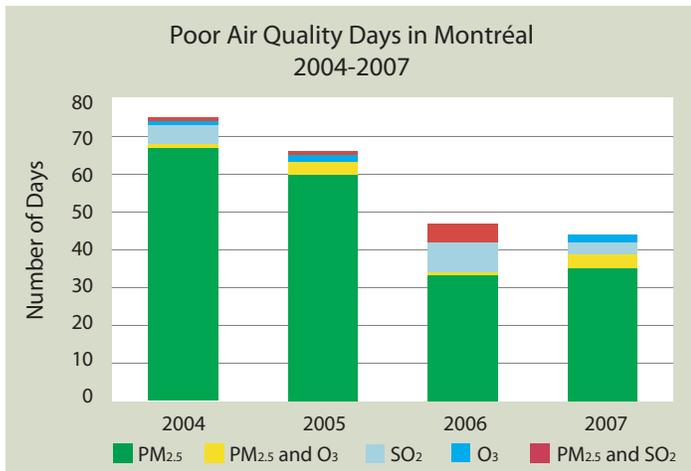
For all of these reasons, wood stove burning is one of the activities for which Montréal is considering the implementation of solutions to reduce airborne concentrations of particulate matter with the view of improving air quality.

Number of Poor Air Quality Days Decreasing!

Montréal's criteria for defining a poor air quality day were established in 2004. These criteria for SO₂, issued by the World Health Organization (WHO), have been part of the AQI since January 2004. Those for PM_{2.5}, from the same source, were adopted in January 2003, and are still valid today, thus allowing for a comparison of the frequency of poor air quality days from 2004 to 2007. The table below outlines the AQI criteria used to define air quality on an hourly basis.

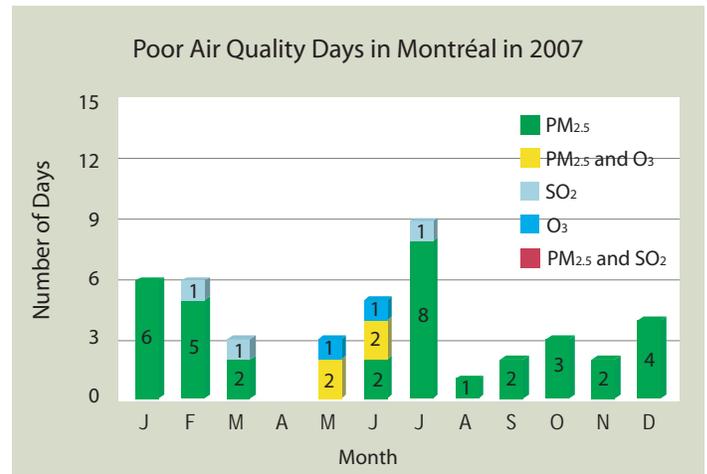
Pollutant	Type of Measurement	AQI Reference Value
Sulphur Dioxide (SO ₂)	10-minute moving ave.	500 µg/m ³
Ozone (O ₃)	Hourly average	160 µg/m ³
Nitrogen Dioxide (NO ₂)	Hourly average	400 µg/m ³
Carbon Monoxide (CO)	Hourly average	35 mg/m ³
Particulate Matter (PM _{2.5})	3-hour moving average	35 µg/m ³

In 2007, the RSQA only observed 44 poor air quality days in Montréal. Constantly improving since 2004, the decline represents a more than 40% decrease over the last four years. Still, PM_{2.5} are responsible for most of these poor air quality days. In 2007, this pollutant was responsible for 35 of these 44 days (80%), a figure similar to 2006. The key difference between 2006 and 2007 is the important reduction in SO₂ or



SO₂ / PM_{2.5} events. During 2006, these pollutants were responsible for 13 poor air quality days, compared to only three in 2007. This represents a major (77%) decrease.

As observed in most of the preceding years, with respect to the distribution of poor air quality days on a monthly basis, none occurred in April. However, May and June showed a total of six poor air quality days due to ozone, or a combination of O₃ / PM_{2.5}, compared to a single occurrence in 2006.



Number of Poor Air Quality Days Decreased by 41% in the Last Four Years!



August 14, 2007 at 11:15 am PM_{2.5}: 5.5 µg/m³

Distribution of the Air Quality Index (AQI) on the Island of Montréal

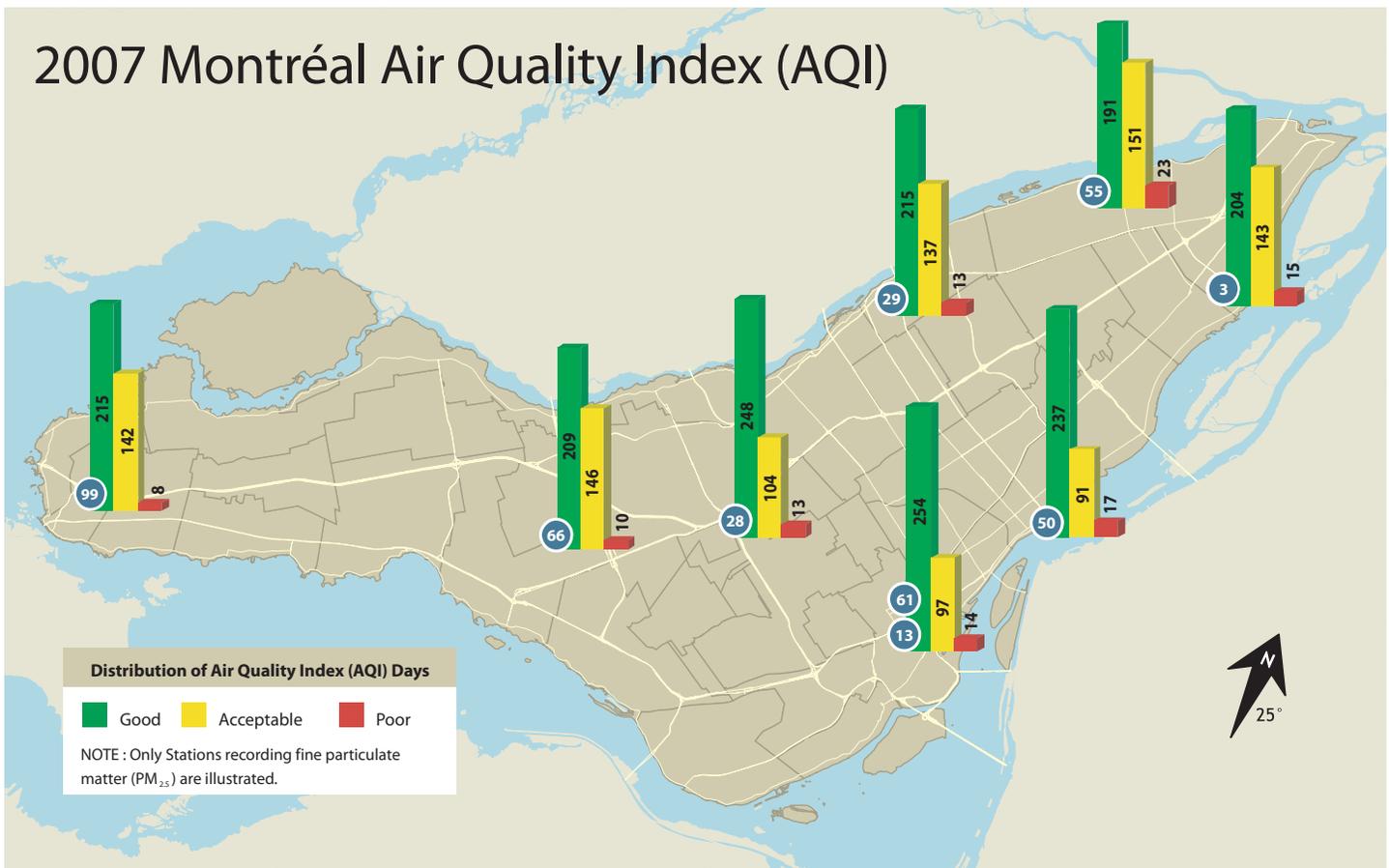
The Air Quality Index (AQI) is accounted for every hour based on five standard pollutants: SO₂, CO, O₃, NO₂ and PM_{2.5}. It indicates whether air quality is good, fair (acceptable) or poor. The whole day is qualified by the greatest hourly AIQ recorded for that day. The map below illustrates the annual distribution of the AQI for 2007. Since PM_{2.5} are generally responsible for poor air quality, the comparison only refers to the data sourced from the eight stations measuring this pollutant.

During 2007, 44 days of poor air quality were recorded in Montréal. Station 99 (Sainte-Anne-de-Bellevue) again recorded the lowest number of such days. Indeed, of the eight days recorded in 2007, seven occurred during summer episodes of smog, a mostly regional phenomenon. Such a low value is due to the absence of pollutant sources in the immediate vicinity of this station. Located on the western tip of the Island of Montréal, the environment of this station is hardly impacted by transportation, industry or residential wood burning activities.

The same cannot be said of Station 55 (Rivière-des-Prairies–Pointe-aux-Trembles). Heavily influenced by residential wood burning, the number of days with poor air quality rose from 13 in 2006 to 23 in 2007 (43%). This increase is mainly due to the 15 days of poor air quality recorded during the winter period, from November to March.

In the same borough, Station 3 (Saint-Jean-Baptiste Boulevard) has been credited with the greatest improvement: a reduction of 32% in the number of days with poor air quality. Compared to 22 days in 2006, only 15 such days were recorded during 2007. This significant decrease is mainly due to initiatives targeting SO₂ emissions.

32% Decrease In Days With Poor Air Quality In Montréal's East End Industrial Sector



Marked Air Quality Improvement in Montréal's East End

The Island of Montréal's East End is home to the greatest concentration of heavy industries, particularly those in the petroleum and petrochemical sector. Located on Saint-Jean-Baptiste Boulevard, downstream from the major industries with respect to western and southwestern prevailing winds, RSQA's Station 3 measures the airborne pollutants discharged by these industries.

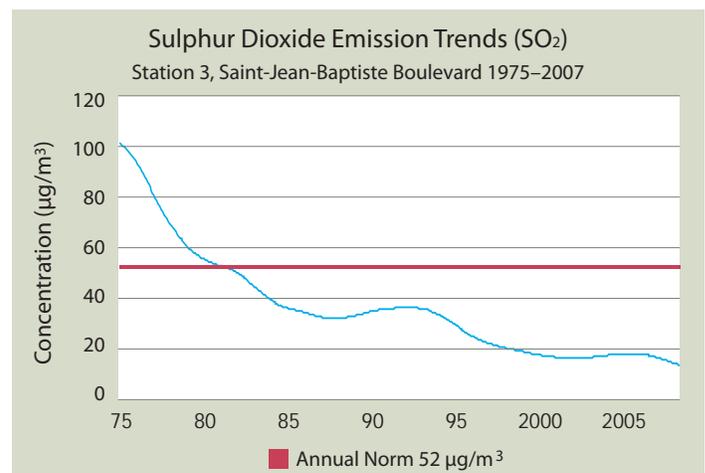
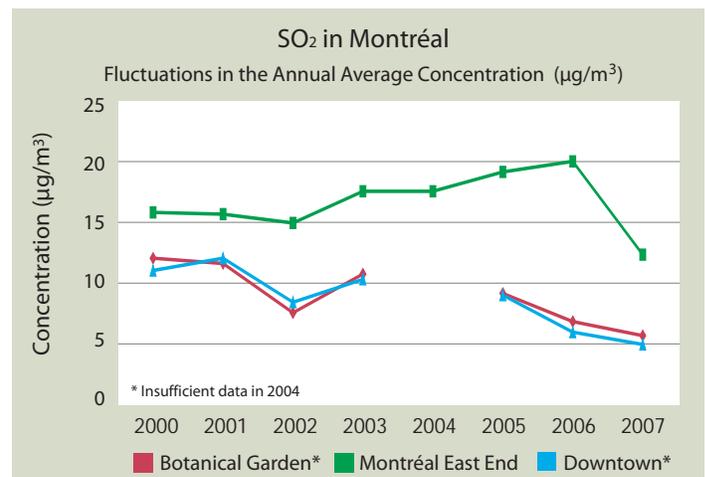
Among these pollutants, two products, namely SO₂ and benzene, are under close observation and monitoring. Over the years, high concentrations of SO₂ and benzene have required interventions from Montréal's Division du contrôle des rejets industriels of the Direction de l'environnement et du développement durable. In 2007, thanks to the efforts of these industries, the RSQA recorded a significant improvement in SO₂ and benzene emissions. Efforts are ongoing to ensure further progress.

A Very Significant Decrease of Sulphur Dioxide in 2007

In Montréal, 85% of atmospheric emissions of SO₂ come from the petroleum sector. Consequently, it is not surprising to find much greater concentrations of this pollutant in the East End of the Island compared to other areas. Also, even though concentrations of this pollutant have decreased almost everywhere in Montréal since 2000, they have increased in the East End of the Island. As shown in the next figure, a major deviation from this trend was established in 2007.

In point of fact, Station 3 recorded a 38% decrease in the annual average concentrations of SO₂, compared with 2006. This annual average (12.4 µg/m³) is the lowest ever recorded by the RSQA since this pollutant has been the subject of monitoring (30 years). The following figure presents the long-term trend of SO₂ concentrations, showing a recent decrease after having been relatively stable over the past seven years.

In 2007, high concentrations of SO₂ were responsible for only three days of poor air quality. This represents a major improvement compared to 2006 when 13 days of poor air quality due to this pollutant were recorded. Finally, it is interesting to observe that no bad air quality days have been observed between July 7, 2007 and the end of that year.



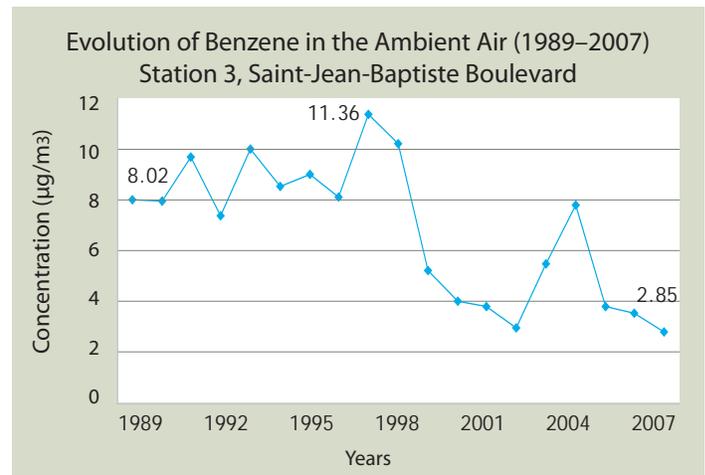


Lowest Concentrations of Benzene Since 1989

Montréal's Direction de l'environnement et du développement durable has long been concerned by high levels of benzene in the East End area, the greatest concentrations in Canada. However, over the past three years, the average annual concentrations of benzene have gradually declined.

In 2007, the RSQA finally recorded an annual average lower than $3 \mu\text{g}/\text{m}^3$, a first since benzene monitoring began in 1989. Owing to this 20% decrease from last year, the average concentration of benzene in 2007 is currently at $2.85 \mu\text{g}/\text{m}^3$, the lowest ever recorded at Station 3 located on Saint-Jean-Baptiste Boulevard. This successful result is due to a close collaboration between Montréal's Division du contrôle des rejets industriels and industry partners from Montréal's East End.

Mainly discharged into the atmosphere through gasoline manufacturing and distribution processes, benzene can be linked to a variety of sources often difficult to identify and control. In order to ensure best monitoring practices and better define the issues involved with the presence



of benzene, the RSQA has acquired a continuous benzene analyzer, to be installed and running in 2008. This instrument will provide hourly results, allowing for a timelier response. Above all, it will facilitate the identification of possible sources of benzene emissions.



Ambient Benzene Levels Have Decreased by 60% Since 2004

INFO-SMOG Program: Now Available Throughout the Year

Launched in 1994, through a four-way partnership between the City of Montréal, the Direction de la santé publique de Montréal-Centre, Québec's Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP) and Environment Canada, the Info-Smog Program is now available every day of the year.

Info-Smog is disseminated through various media and accessible on the Internet. The program serves two purposes: provide forecasts of air quality and warn the population about high smog levels. These warnings are accompanied by a message aiming to inform those at risk about the measures they should embrace to reduce their exposure to smog as well as to inform the population about ways in which it can contribute to reduce emissions of pollutants contributing to smog formation.

When the program was launched, it only covered the April 15th to September 30th period, the only pollutant considered being ozone. Since 2002, Info-Smog is available throughout the year, given that it now includes a daily forecast of PM_{2.5} levels, made possible by their continuous measurement. Since 2007, the air quality forecast is issued twice daily, in the morning and afternoon.

Annual Number of Smog Warnings

Outlined in the table below are the Info-Smog program official data for the Greater Montréal Area (GMA). A smog warning is a forecast of poor air quality issued specifically for the GMA and distinct from the forecast for other administrative regions in Québec. It's quite clear from the table that the

Total Number of Smog Warnings

Year	Summer	Winter	Total
2000	0	---	---
2001	13	---	---
2002	9	17	26
2003	3	17	20
2004	0	17	17
2005	10	14	24
2006	1	7	8
2007	14	12	26

number of smog warnings is relatively constant during the winter period, while it fluctuates significantly in the summer. This is due to meteorological conditions that can vary considerably from one summer to the other.

A Record: 14 Smog Warnings Issued in Summer 2007



June 27, 2007

PM_{2.5} : 45 µg/m³



June 29, 2007

PM_{2.5} : 3 µg/m³

As air quality is very closely related to weather conditions, these differences have an immediate impact on air quality. It seems that climatic variations from one season to the next have a stronger impact in summer than in winter. A rainy summer with mild temperatures noticeably decreases the formation of smog... as seen in 2000, 2004 and 2006.

The total number of smog warnings per year varies between 17 and 26 from 2002 to 2007 except for 2006. The number of warnings was exceptionally low in 2006, with only eight, while in 2007 it returned to normal with a total of 26. Indeed, there were 14 smog warnings for the summer of 2007, the greatest number since 2000.

RSQA Website Has a New Look

The RSQA launched its first website in 2000. Thanks to the AQI which is presented daily, citizens have an interactive tool at their disposal that systematically provides air quality updates. In 2007, several modifications were made to the RSQA website to make it even more dynamic and easier to consult.

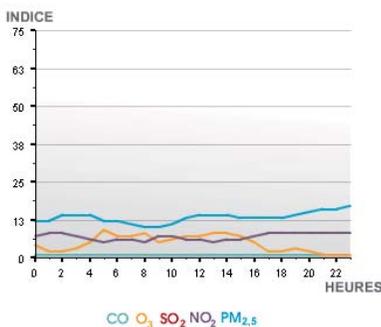
FOUR REGIONS: The Island of Montréal is divided into four regions, each with its own AQI. The region's AQI value reflects the greatest AQI and also the most representative of the monitoring stations in that area. Identifiable by black dots, each station posts an hourly updated AQI.

INFORMATION AT YOUR FINGERTIPS: By placing the cursor on the desired station, a circle appears and the information relating to that station appears above the map. Click on a station and a graphic illustrating the hourly fluctuations of measured pollutants appears beneath the map.



GRAPHIQUE | FICHE STATION | POLLUANTS | CALCUL IQA

Station 28 – Échangeur Décarie



TABS: To obtain a description of each monitoring station or a list of which pollutants are measured, after selecting a station, simply click on one of the tabs for further information.



AQI TABLE:

A table has been created in order to quickly obtain the hourly or daily AQI for each sector.

INDICE DE QUALITÉ DE L'AIR (IQA)*	
le plus élevé pour le 21 décembre 2007	
Nord : 21	Est : 24
Centre : 38	Ouest : 22
<ul style="list-style-type: none"> ■ Bon (1 à 25) ■ Acceptable (26 à 50) ■ Mauvais (51 et plus) ● Aucune donnée 	
*Données non-validées	

RECHERCHE DE DATES ANTERIEURES

2007 ▼ déc ▼ 21 ▼

RECHERCHER

PREVIOUS DATA: It is still possible to access data from preceding years and the number of available years has been increased to three.

INFO-SMOG FORECAST:

The air quality forecast is always available and is now updated twice daily.



NOTE: These are images captured from the French-only RSQA Web site.

Comparison with Canada-Wide Standards

The Canada-Wide Agreement on Environmental Harmonization, adopted in 1998 by the Canadian Council of Ministers of the Environment (CCME), has identified objectives to be attained by 2010. Less restrictive than the AQI, the Canada-wide standards related to ozone and PM_{2.5} have already been adopted. The results, presented in the two tables below, are indicative of the current data available, seeing as it is not yet possible to comply with all of the national guidelines, as this would require a complex exercise that exceeds the scope of this report.

The meteorological conditions of the summer of 2007 were favourable to ozone formation. Therefore, compared

Ozone (O₃) in µg/m³ Standard : 127 µg/m³

STATION	4 th Highest Daily Maximum 8-Hour Moving Average			Average Over 3 Year
	2005	2006	2007	
1	130.3	124.7	134.4	130
3	128.8	123.3	135.2	129
12	123.8	112.2	122.8	120
28	116.4	94.7	94.8	102
29	136.8	126.7	140.4	135
55	145.2	128.5	147.1	140
61	109.5	90.7	110.2	103
66	135.0	121.7	137.1	131
68	123.6	108.9	138.9	124
99	138.5	123.8	140.7	134

with the past two years, it is not surprising to observe that concentrations have increased this year in nearly all the monitoring stations on the Island of Montréal. Indeed, six RSQA monitoring stations show levels exceeding the Canada-wide standards for ozone.

However, the situation is the complete opposite for PM_{2.5}. The 98th percentile values in 2007 were as low in 2006, resulting in very minor fluctuations with respect to the average for the last three years. The Canada-wide standard was achieved at five RSQA monitoring stations.

Particulate Matter (PM_{2.5}) in µg/m³ Standard : 30 µg/m³

STATION	Annual Value of the 98 th Percentile Daily 24-Hour Average			Average Over 3 Year
	2005	2006	2007	
3	41	22		31.5
13	41	21	25	29.1
28	30	25	26	27.0
29	46	23	23	30.6
50	43	26	27	31.9
55	41	22	23	28.6
66	40	24	23	29.1
99	34	21	24	26.3

The Impact of Fireworks

During the International des feux Loto-Québec, from June 20 to July 28, 2007, two of the nine fireworks displays resulted in high concentrations of PM_{2.5} at Station 50, located in the Borough of Mercier-Hochelaga-Maisonneuve. South and southwesterly winds blew the particles emitted by the fireworks to the monitoring station, located 1.8 km from La Ronde.

In 2007, the maximum hourly concentrations of PM_{2.5} measured on the Island of Montréal varied from 50 to 98 µg/m³, except at Station 50, where hourly concentrations were much greater: 119 µg/m³ on July 25th and up to 154 µg/m³ on July 18th. During the evening of July 18th, even though it was only for a very short period of time, the station recorded an excessively high value of fine particles reaching 658 µg/m³ for a one minute concentration.

While the levels of fine particulate matter remain quite low at all RSQA stations, the impact of the fireworks at La Ronde is strongly felt at the Hochelaga Station when the wind blows from the south.





Pollutant Trends: Ozone on the Rise

The 14 smog warnings issued during the summer explain why greater ozone annual averages were registered in 2007. The high number of warnings indicates that the meteorological conditions for the summer were often favourable to smog formation, of which ozone is a major component.

In 2007, the 10 RSQA monitoring stations measuring ozone have, without exception, shown an increase in their annual average concentrations compared with the levels of 2006. The 11% overall average increase for the Island of Montréal varied from 3% at Station 3 on Saint-Jean-Baptiste Boulevard to just over 21% at Station 68 in Verdun.

2006–2007 Variations in Average Annual Ozone Concentrations

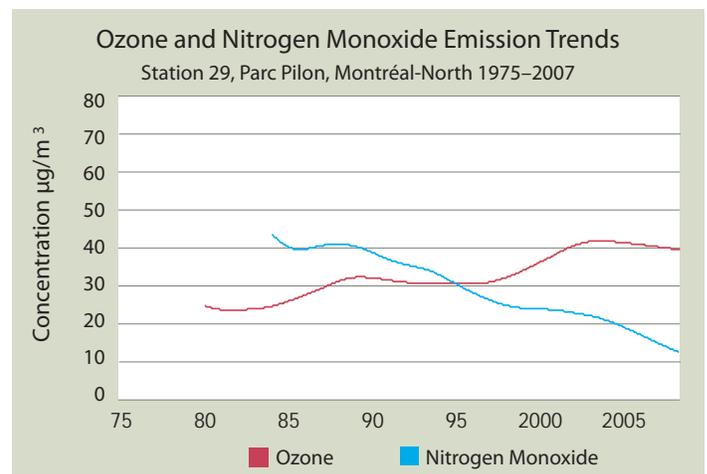
Station	Ozone (O ₃)	Nitrogen Monoxide (NO)
1	10%	-7.7%
3	3%	-5.2%
12	15%	-14.4%
28	10%	-17.2%
29	12%	-15.5%
55	10%	
61	16%	-13.9%
66	11%	-4.2%
68	21%	1.0%
99	6%	-15.4%

Whether due to or directly causing this ozone increase, the average concentration of NO continued to decline as recorded all over Montréal over the past 20 years. In 2007, eight of the nine RSQA stations where nitrogen oxides are recorded

revealed a 4% to 17% decrease in NO. This average decrease of 10% more or less corresponds to the increase recorded for ozone.

The link between these two major pollutants is well known and common to all large urban centres throughout the world. Ozone concentrations are typically higher at monitoring stations located far from downtown core areas and highways. The graphic showing the levels of these two pollutants recorded at Station 29, located in Montréal-Nord, clearly illustrates this relation. The 56% increase in ozone concentration since 1984 is due in part to a decrease in nitrogen monoxide of 72%.

All pollutant trends recorded at RSQA monitoring stations can be seen on the website (www.rsqa.qc.ca) in the “Historique” section, under “Tendance des polluants depuis 1975.”



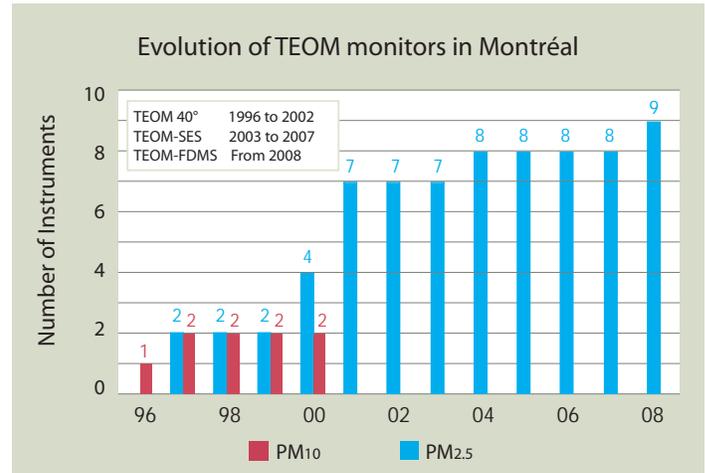
Impact of the Methods Used to Measure Particulate Matter

The RSQA started to measure particulate matter in 1985. Dichotomous air samplers were then used and allowed the measurement of concentrations of fine (PM_{10}) and very fine ($PM_{2.5}$) particles, i.e. particles of an average aerodynamic diameter of 10 and 2.5 microns. Sampling in a non continuous fashion, 24 hours at a time every six days, these instruments did not result in timely air quality data, as these were only made available after several weeks or months.

In 1996, in order to respond more quickly to poor air quality occurrences, the RSQA starting using TEOM (Tapered Element Oscillating Microbalance) continuous particulate monitors, which provided continuous measurements on an hourly basis.

In 1998, the AQI for $PM_{2.5}$ was calculated with a criteria of $25 \mu\text{g}/\text{m}^3$ for a 24-hour moving average. In an attempt to improve the AQI, in 2003, RSQA began to use, at the same time as the MDDEP, a three-hour moving average with an AQI criteria of $35 \mu\text{g}/\text{m}^3$.

Compared to the reference method, the first TEOM underestimated the concentrations of particulate matter, especially in the wintertime. The constant development of TEOM technology, and in particular the arrival of the



TEOM-FDMS version of the instrument, allowed the RSQA to obtain results much closer to the reference method. However, since the transition from TEOM-SES to TEOM-FDMS started in October 2007 but was only completed in 2008, it is only in 2008 that we will observe the impact of this upgrade. The transition from TEOM-SES to TEOM-FDMS will likely increase the concentrations of $PM_{2.5}$ and thus better reflect the reality of the situation.



Results More In Line With Reality



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