

Direction de  
l'environnement et du  
développement durable

2011



## Environmental Assessment Report Air Quality in Montréal

### Highlights

- A very rainy spring season, a summer characterized by extreme variations in temperatures and a very warm autumn were among the weather phenomena that marked the year 2011 and influenced air quality on the Island of Montréal.
- The total number of poor air quality days on the territory of the agglomeration of Montréal was 69.
- Of this number, 68 days were due to the presence of elevated concentrations of fine particles ( $PM_{2.5}$ ) and just one day to the presence of ozone.
- Smog accounted for 19 of these poor air quality days, the 50 other days having resulted from issues that were local in nature and related to human activities.
- Although ozone concentrations were generally on the rise, it is worthwhile mentioning that this pollutant is increasingly less responsible for those poor air quality days, fine particles now being responsible for the great majority of these days.
- Nitrogen oxide monitors have been replaced by the most technologically advanced instruments within an ongoing program to renew this equipment.



Irrespective of the weather, the Réseau de surveillance de la qualité de l'air team is there to monitor and maintain the equipment and, ultimately, the reliability of the measures.

## Pollutants under surveillance

As usual, the Réseau de surveillance de la qualité de l'air (RSQA) measured the concentrations of pollutants present in the ambient air throughout 2011.

Among the pollutants measured by our continuous monitors, 24 hours a day and 365 days per year, are carbon monoxide, nitrogen oxides, sulphur dioxide, ozone and fine particles. These measures allow the calculation of an air quality index which is posted on Ville de Montréal's Web site. Other more specific pollutants, such as volatile organic compounds, nitrates, sulphates and chlorides, to name just a few, are also monitored on a periodic basis.

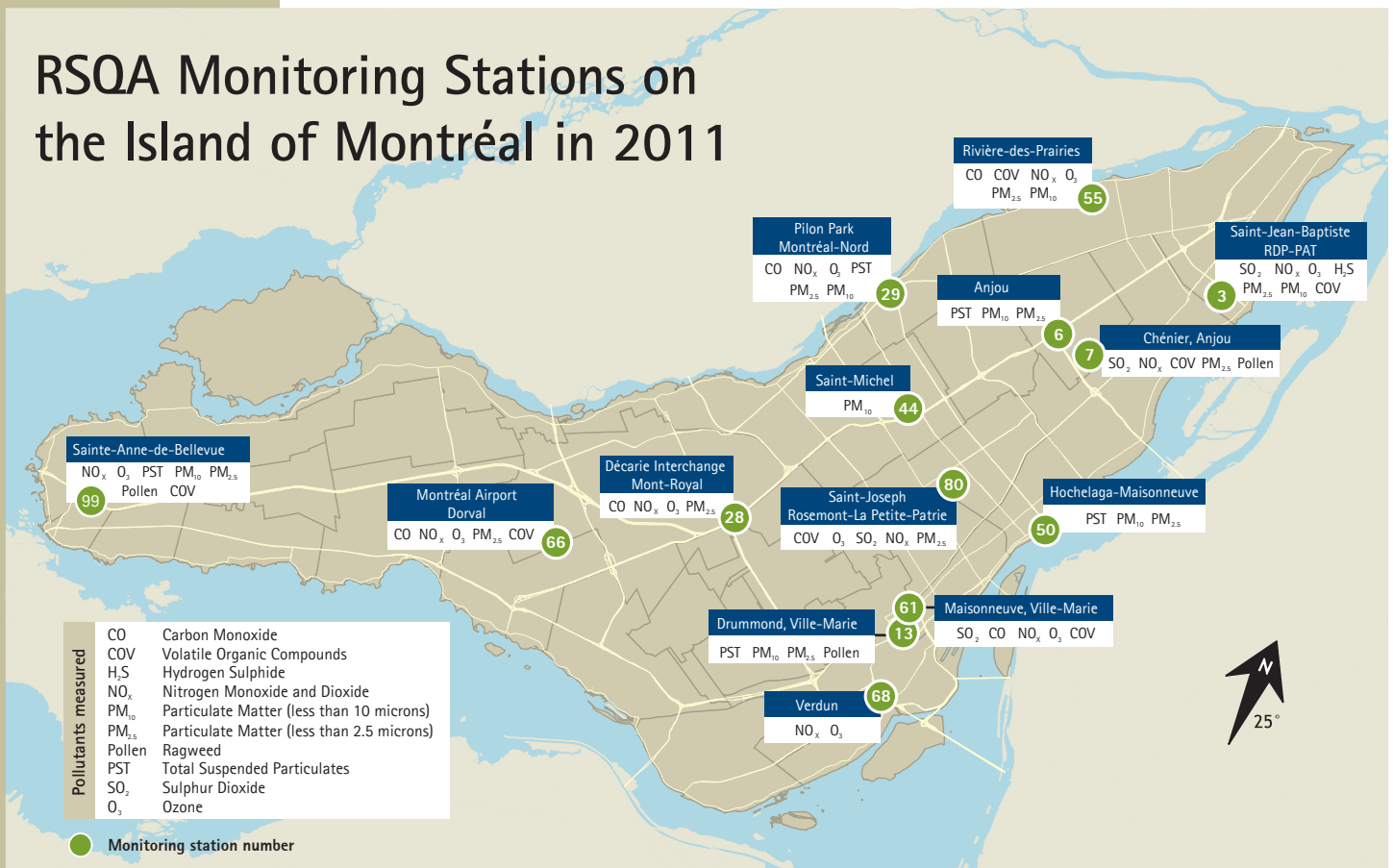
The data collected over the years allow the observation of various trends. These are also available on the Web site in the *Historique et tendances* (History and trends) section. In order to maintain the highest quality standards in this

field of expertise, the equipment is subjected to a rigorous maintenance and calibration program conducted by specialized technical staff. In 2011, according to a schedule prepared in collaboration with the National Air Pollution Surveillance Network (NAPS), the existing nitrogen oxide monitors were replaced by better performing equipment.



It is possible, at all times, to check the state of air quality on the territory of Montréal, by consulting the [rsqa.qc.ca](http://rsqa.qc.ca) Web site which posts these results on an hourly basis.

## RSQA Monitoring Stations on the Island of Montréal in 2011

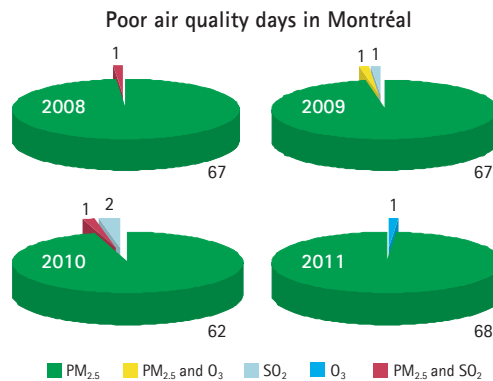


# Air quality in Montréal

In 2008, the apparatus used to measure fine particles (PM<sub>2.5</sub>) were replaced by equipment enabling the measurement of the more volatile component of these particles, in accordance with the method of reference used by the U.S. Environmental Protection Agency. This pollutant has become the main cause of the poor air quality days occurring annually on the territory of the agglomeration of Montréal. This technology has also highlighted the fact that, even if the high levels of ozone concentrations in the summer trigger smog episodes, it is the cascade of secondary chemical reactions activated by the oxidizing action of ozone on the pollutants present in the atmosphere that is the main culprit in the resulting increase in concentrations of fine particles.

Every year, the weather conditions influence the number of poor air quality days, thus making any comparisons difficult on a yearly basis. Despite this, the annual average over the last four years was approximately 67 days. The graph opposite shows the role played by fine particles in the episodes of poor air quality days recorded since 2008.

In 2011, the number of poor air quality days totalled 69. Of this number, 19 were smog days, whereas the remaining 50 days were attributable to local issues. This was the case notably for the only poor air quality day due to high concentrations of ozone recorded at station 3.



With the exception of stations 3 and 13, the trend indicated by the data points towards a decline in the number of poor air quality days. In this respect, station 99 located in Sainte-Anne-de-Bellevue serves as a bellwether for atmospheric contamination originating in Ontario and the United States. This station has the lowest number of poor air quality days. Over the years, many of the data recorded in other stations have tended to approximate those recorded at station 99. For others however, it is the opposite, an indication of the existence of yet to be controlled sectorial sources of emissions. In order to achieve measurable improvements, promoting behavioral changes among citizens is indispensable as well as the implementation of characterization programs of fine particles in specific sectors.

Smog days:  
19 days

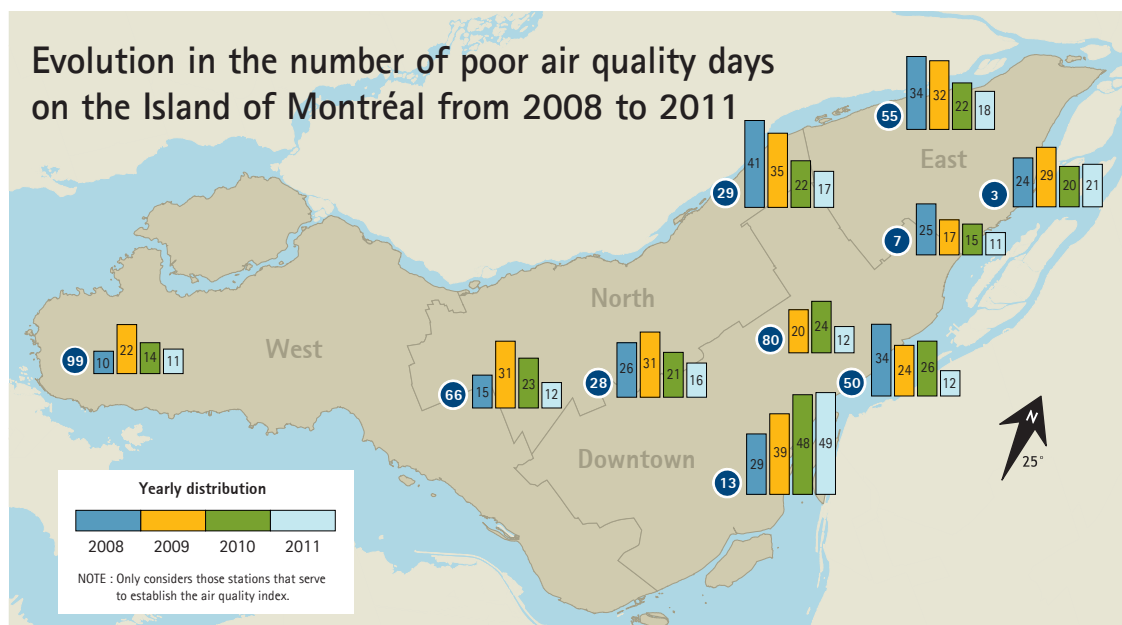
Intensity:  
PM<sub>2.5</sub> > 35 µg/m<sup>3</sup>  
during at least  
3 hours

Range:  
Montréal region

Local issues:  
50 days

PM<sub>2.5</sub> > 35 µg/m<sup>3</sup>  
Moving average  
3 hours

O<sub>3</sub> > 160 µg/m<sup>3</sup>  
Moving average  
1 hour



## History of monitoring in an urban area

The Saint-Michel neighbourhood, wedged between Papineau and Port-Royal streets, the 25<sup>th</sup> Avenue and the Metropolitan expressway, has a long industrial history that is well known to the population of Montréal.

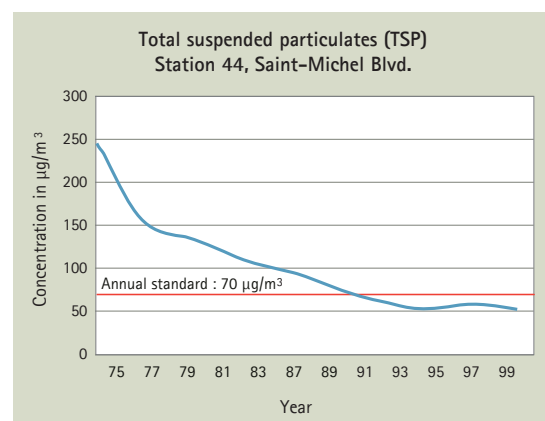
At the beginning of the last century, one of the signature activities of this sector was undoubtedly the large scale exploitation of the Francon and Miron quarries. In that era, the rock and limestone were crushed, collected and transformed into concrete. This processing activity which was pursued over 60 years had a profound impact on both the immediate and adjacent environment of this neighbourhood. Around 1968, the depletion of the raw materials resulted in a change in the quarry's activities, then transformed into an urban dump. For almost 20 years, 40 million tons of waste were landfilled there, one of the biggest urban landfill sites of this type in North America. The operations of such a site created numerous issues for the neighbouring population.

In 1970, coinciding with the adoption of Montréal Urban Community Bylaw 9 intended to prevent the harmful effects of air pollution on human health, vegetation, materials, the comfort and well-being of its citizens, monitoring station 44 was set up downstream of the quarry, at 8110 Saint-Michel Blvd., for the purpose of measuring concentrations of total suspended particulates (TSP).



Monitoring station 44 (Saint-Michel)

Among the 15 monitoring stations or so in operation that measured TSPs in the 1970s, station 44 recorded the greatest TSP values in Montréal as well as those showing the most frequent exceedances relative to the 150  $\mu\text{g}/\text{m}^3$  (24-hour average) standard. These results were heavily influenced by the traffic related to the activities of the quarry and dump.

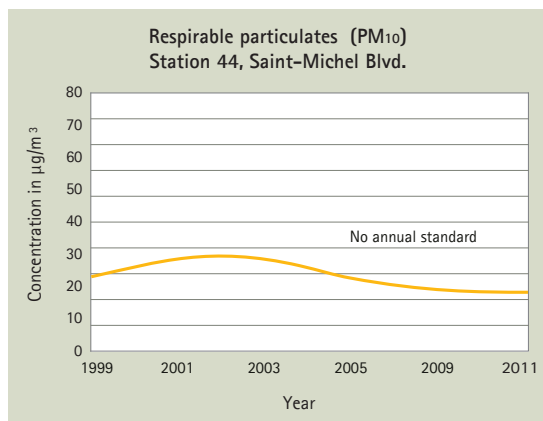


Nevertheless, about 15 years were needed before the average TSP concentrations fell below the 70  $\mu\text{g}/\text{m}^3$  threshold (annual standard). However, once these concentrations declined below the threshold, they stayed there in subsequent years. Many efforts were made in those years to mitigate the environmental impact of industrial activities in and around the quarry. The end of operations in the Francon and Miron quarries, respectively in 1986 and 1988, also contributed to these good results.

The sub-threshold concentrations of TSPs over a nine-year period and the fact that these concentrations were similar to those recorded in the seven other stations in operation on the territory, during that period, justified the termination of TSP measures by the station in 1999. It is worthwhile mentioning that the annual concentrations measured in 1999 amounted to 53  $\mu\text{g}/\text{m}^3$ , a 83% reduction of this pollutant in 30 years.

During this period, certain studies concluded that the presence of particles of a diameter inferior to 10  $\mu\text{m}$  ( $\text{PM}_{10}$ ) in the atmosphere could be harmful to human health. Consequently, it

was decided to replace the TSP measurement by one involving PM<sub>10</sub>. The installation of the new monitoring equipment was intended to measure the concentrations of this type of particles in the sector, thereby enhancing our knowledge of the sources liable to emit such particles. After peaking in 2002-2003, the annual average concentrations of PM<sub>10</sub> has been declining since that time.



Since 2005, PM<sub>10</sub> concentrations measured at station 44 no longer vary from those recorded at other stations, as was the case in 1969. Indeed, in the past five years, concentrations of this pollutant have been stable around the figure of 20 µg/m<sup>3</sup> in the monitoring stations exposed to urban activities, as indicated in the table below.

Year	Average annual concentration of PM <sub>10</sub> in µg/m <sup>3</sup>			
	Station 3	Station 13	Station 44	Station 50
1999	23.0	22.0	24.0	N/A*
2000	21.0	22.0	26.0	N/A*
2001	26.0	26.6	27.1	30.2
2002	25.1	28.3	31.3	27.3
2003	25.0	26.0	33.0	26.0
2004	20.0	21.9	24.5	21.0
2005	23.4	23.0	24.8	24.8
2006	18.9	20.6	18.9	21.5
2007	19.7	19.0	20.1	20.5
2008	18.7	18.4	19.5	18.2
2009	16.0	18.2	18.9	17.8
2010	18.3	18.8	18.9	20.2
2011	17.0	17.0	16.7	16.7

\* Station 50 was commissioned in 2001.

Although the number of exceedances of the threshold was slightly greater at station 44 in its first years of activity, the situation reverted to normal from 2006 onward, as indicated in the table below. Since then, the data have been similar for all stations.

Année	Number of exceedances per year of PM <sub>10</sub> Threshold: 50 µg/m <sup>3</sup> Average: 24 hours			
	Station 3	Station 13	Station 44	Station 50
1999	1	0	3	N/A*
2000	3	1	4	N/A*
2001	3	1	5	3
2002	3	5	7	5
2003	3	3	7	7
2004	2	0	4	2
2005	3	3	4	3
2006	1	1	0	1
2007	3	0	3	2
2008	0	1	1	1
2009	1	0	1	0
2010	0	0	0	0
2011	0	0	0	0

\* Station 50 was commissioned in 2001.

These observations allow us to conclude that the emission sources that led to the commissioning of station 44 are now well under control. Also, there is no reason to believe that the particulates measured at station 44 are of a different nature than those measured at the other stations.

Since the acquisition of the land hosting the old quarry by Ville de Montréal, the site has become the city's most important environmental rehabilitation project and is now designated as *Complexe environnemental de Saint-Michel (CESM)*. As witnessed by the results achieved, the issues associated with the activities related to the operations of a landfill site no longer exist in the area surrounding the CESM, thus calling into question the relevance of continuing to conduct any monitoring at that station. Citizens' use of the site, now a recreational area, will no longer result in any more particulate emissions than those found in any other of the city's parks. The collection of air samples to measure PM<sub>10</sub> concentrations at the Saint-Michel site was thus discontinued in December 2011, thereby resulting in the closing of the station.

*The CESM transformation into an urban park should be completed by 2020.*

## Fireworks

Some products, used in the manufacturing of pyrotechnics, become airborne after the fireworks go off and can prove harmful for the environment and human health. However, the ephemeral aspect of the event greatly reduces the exposure time to any emissions.

Last July 2, 2011, during the presentation of the International des Feux Loto-Québec at La Ronde, the winds' direction favored the dispersion of the pollutants emitted by the explosion of the coloured pyrotechnics towards two of the RSQA's monitoring stations. The high concentrations of fine particulates were thus measured by these stations located in the path of the smoke plume.

Between 9 and 10 p.m., the hourly concentration of fine particulates ( $PM_{2.5}$ ) measured at station 50, located in Hochelaga-Maisonneuve just 1.7 km away from the site of the fireworks, reached  $156 \mu\text{g}/\text{m}^3$ . In the following hour, the dispersion of the pollutants by light winds blowing in from the Southwest was such that the hourly concentration of these same particulates measured at station 7 in the Anjou sector, about 8.8 km from the site, reached  $89 \mu\text{g}/\text{m}^3$ . These concentrations were



respectively 4.5 and 2.5 times greater than the  $35 \mu\text{g}/\text{m}^3$  threshold used to establish the air quality index. These elevated concentrations of fine particles thus resulted in an episode of poor air quality.

Many chemical products enter into the manufacturing of fireworks in order to obtain vibrant colours and awe-inspiring visual effects. For instance, copper sulphate is responsible for the blue colouring, the green comes from the barium chloride whereas potassium nitrate is used to create sparkles and stars.

The laboratory analysis of sulphate, nitrate and chloride concentrations was conducted on samples of total suspended particulates (TSP) collected on the filters for July 2, 2011 at the stations identified above. The presence of these compounds was observed, but since the filters collect samples over a 24-hour period, it is difficult to ascertain whether the results obtained are truly representative of a situation which only lasted an hour over that period. Also, the concentrations measured approximated the generally observed seasonal averages. In order to confirm the fireworks' contribution to the presence of these chemical substances, we would have to be able to collect these emissions, during the holding of many such events, and also take samples representative of the duration of the event. Not a simple task, seeing as the winds must be blowing in the right direction, a situation that only Mother Nature can control.

### Distance between the fireworks' site and stations 50 and 7



## A better adapted space for station 3

Present in the Pointe-aux-Trembles sector since 1981, the monitoring station located on Saint-Jean-Baptiste Blvd. provides us information, among other things, on the airborne emissions of the industries located upstream. As part of the renovations carried out during the summer, a brick construction in harmony with the park's environment was specially erected to shelter the air quality measuring equipment. Offering a work space that is better adapted and state-of-the-art in terms of standards in the field, this construction confirms the permanent status of this station in the sector.



Station interior

This station is one the best equipped on the territory. It enables the continuous monitoring of hydrogen sulphide ( $H_2S$ ), ozone ( $O_3$ ), nitrogen oxides ( $NO$ ,  $NO_2$ ), sulphur dioxide ( $SO_2$ ), fine particulates ( $PM_{2.5}$ ) as well as the following organic compounds: benzene, toluene, ethylbenzene and xylene. On its roof, sequential air samplers consider the presence of particulates of a diameter of  $10\ \mu m$  ( $PM_{10}$ ) and total suspended particulates (TSP).

## From contemporary art to the Environment

The monitoring station, corner of Duncan Street and the service lane of the Décarie expressway, needed a paint job. The department, once again, called on [Café-Graffiti](#) to paint a mural on the side of the station that is most exposed to the view of motorists.

This initiative serves two purposes: the first, to encourage a not-for-profit organization that works towards the social reintegration of young people who are often cut off from mainstream society, and the second, to showcase this urban art form. This solution also results in proofing the building against graffitists. By featuring an owl, the theme of the mural illustrates the surveillance role assumed by the RSQA throughout the agglomeration of Montréal.



Monitoring station 28 (Décarie)

## NAPS 2011 annual meeting

The annual meeting of the National Air Pollution Surveillance Network (NAPS) managers was held in Victoria from May 3 to 5, 2011. This meeting allowed for the sharing of knowledge and issues encountered by the various interveners throughout the country. The RSQA presented a comparison of the results of the measures of particulates (PST, PM<sub>10</sub> and PM<sub>2.5</sub>) obtained in specific Montréal areas as well as its 2010 Annual report. Once again, the quality of the work performed by the RSQA was recognized by all.



The following provinces are not represented in the photograph: Saskatchewan, New-Brunswick, Newfoundland-and-Labrador and Nunavut. Credit: © Manon Therrien, MDDEP.

## Feu vert a harbinger of change

Wood heating is a major public health issue, as it is responsible for the emission of pollutants in the atmosphere. Indeed, fine particles are harmful to human health, given that they penetrate deeply into the lungs and then enter the bloodstream. In this manner, they contribute to the aggravation of certain medical conditions such as asthma, bronchitis, emphysema and heart diseases. In addition to fine particles, wood combustion also results in the emission of other toxic and irritating substances. Smoke from residential wood heating is harmful to everyone, but especially to young children, seniors and those suffering from respiratory or cardiac problems.

On the Island of Montréal, more than 85,000 homes are equipped with a wood stove or fireplace. These appliances have a significant impact on air quality and contribute to the phenomenon of winter smog.

Financed by the Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP) and managed by Équiterre, the *Feu vert* program specifically focuses on wood stoves and fireplaces. A financial incentive of up to \$900 is offered to Montréal Island residents who replace their old wood stove or fireplace with a less polluting electric, pellet-burning, gas or propane appliance. The *Feu vert* program also allows them to get rid of their old stove without replacing it.

Montréal Island residents have until December 31, 2012 to send their application to the *Feu vert* program. For further details on the eligibility criteria, the value of the financial incentives offered and the procedure, citizens are invited to visit the [feuver.org](http://feuver.org) site or call 514 871-VERT (8378).

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