Direction de l'environnement

2012

Environmental Assessment Report

Air Quality in Montréal

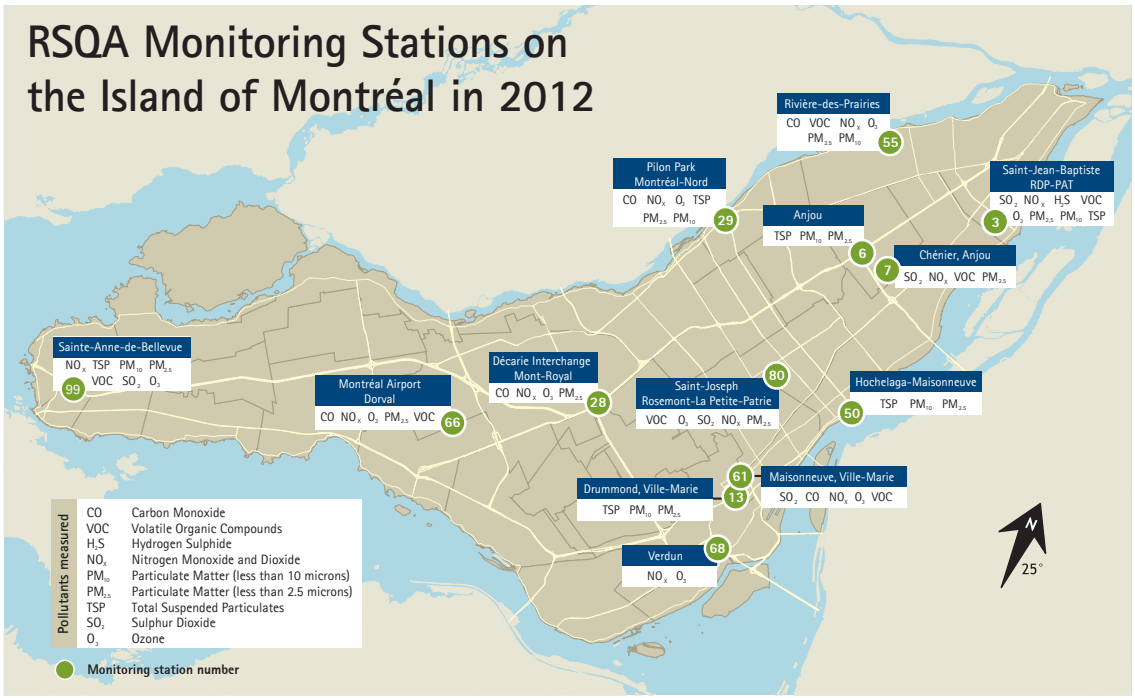
Highlights

- Only 49 poor air quality days, of which 15 were smoggy.
- No smog episode during the summer, despite particularly balmy and dry conditions.
- Air quality is improving in the east end of Montréal: sulphur dioxide, hydrogen sulphide and benzene are at their lowest levels in 12 years.
- The RSQA, a partner in applied research projects.
- Publication of an information leaflet on outdoor fires.
- Updating of the data acquisition system for all of the network's stations.

The Réseau de surveillance de la qualité de l'air (RSQA) constantly monitored pollutant concentrations in the ambient air throughout 2012. Monitors were strategically added to certain stations in order to obtain new information on specific pollutants.

A continuous sulphur dioxide (SO_2) analyzer was thus installed in station 99, to measure the concentrations of this pollutant originating in Ontario and the Northeastern United States. Station 55 was equipped with a carbon monoxide (CO) monitor to obtain data on this pollutant's concentrations generated by wood combustion, a type of heating that is popular in the area hosting this station. Station 3 was provided with a high volume sampler of total suspended particles and anion (chlorides, sulphates and nitrates) analyses were conducted on the filters collected every six days. This information will prove useful within the impact assessment study of the environment on the aging of metallic structure coatings (see page 6). Finally, station 29 had to be temporarily moved within Pilon Park, in order to accommodate the area that was required for the rehabilitation work on the Henri-Bourassa/Pie IX Blvd. interchange.

RSQA Monitoring Stations on the Island of Montréal in 2012



Montréal

Better air quality in Montréal

Smog days: 15 days

Intensity: $PM_{2.5}$ > 35 µg/m³ during at least 3 hours

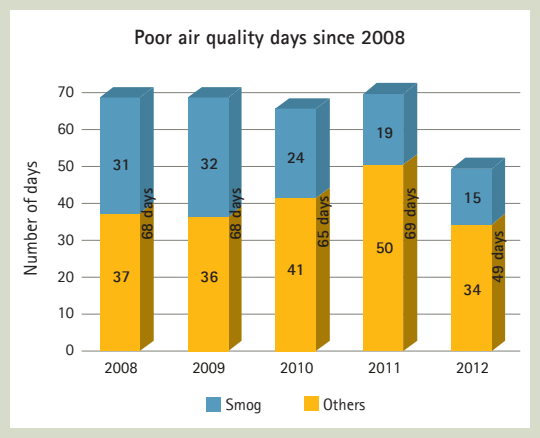
Range: Montréal region

Local issues: 34 days

$PM_{2.5}$ > 35 µg/m³ 3-hour rolling average

49 poor air quality days were recorded in 2012, all due to the presence of fine particles ($PM_{2.5}$) and of these, only 15 were smoggy days. This is the lowest number of poor air quality days on record since 2008. Indeed, the annual average since 2008, the year which witnessed a change in the measurement technology of fine particles, was around 67 days/year.

The graph below depicts the number of poor air quality days recorded in the past five years as well as the number of smog days for each. The results bear witness to a downward trend.

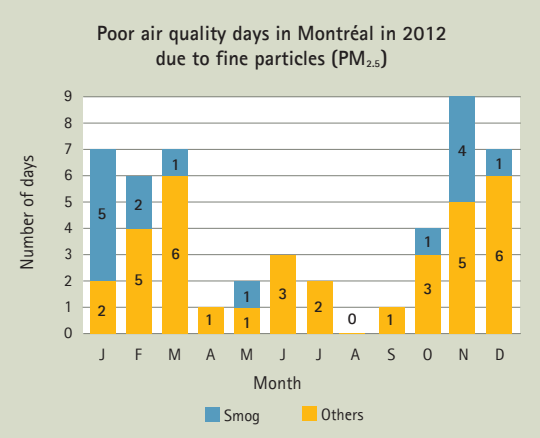


This trend is also confirmed by the results of the $PM_{2.5}$ concentrations obtained by carrying out the comparative exercise according to the method recommended for the calculation of Canadawide standards. The results for 2011 and 2012 are inferior to those observed for 2010.

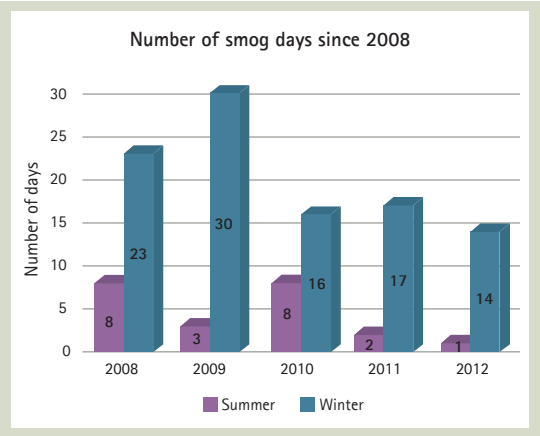
Fine particles ($PM_{2.5}$), threshold: 30 µg/m³

Station	Annual variation of $PM_{2.5}$ 98th percentile (µg/m³)			3-year average
	2010	2011	2012	
3	29	27	24	27
7	32	25	25	27
13	34	29	31	31
28	31	26	28	28
29	34	25	29	29
50	31	23	30	28
55	31	26	28	28
66	32	26	29	29
80	31	26	27	28
99	28	21	22	24
Annual average	**31**	**25**	**27**	**28**

The distribution of the number of poor air quality days on a monthly basis once again shows that the majority of these days occurred in the wintertime, from January to March and from October to December. The same observation holds true for each and every year since 2008.



The existing relationship between meteorological conditions, the presence of fine particles and air quality is very real. Wide temperature variations resulting in thermal inversions and stationary air masses are behind the smog episodes recorded, particularly during the winter season. In May, the forest fires which raged from the 25th to the 27th near the city of Timmins in Northeastern Ontario were felt as far as Montréal, resulting in the only smog days between the months of April and September. In the past five years, the summer of 2012 was the only one that was completely smog free, despite a warm season with a few heatwaves



between June and September. The presence of light but constantly blowing winds during this period was probably the factor that made the difference.

What are the factors that influenced the concentrations of fine particles in the ambient air in 2012? The following hypotheses provide partial answers to this question, without claiming to be the absolute truth.

Reduction of transboundary pollution

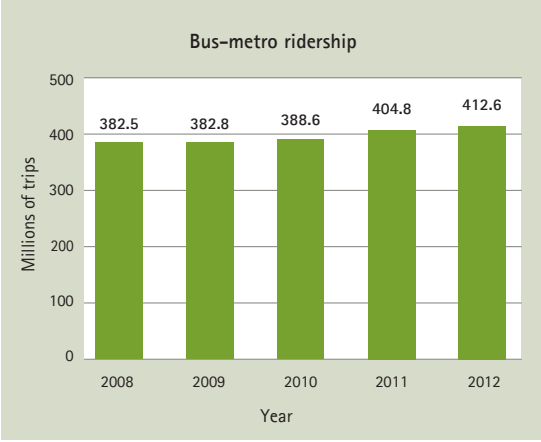
In August 2010, the United States Environmental Protection Agency (US EPA) under the *Clean Air Act* set new National Ambient Air Quality Standards (NAAQS) for SO_2. The lowering of acceptable concentrations of SO_2 in the ambient air directly leads to a drop in concentrations of sulphates, formed in the air and then transported in the guise of fine particles into the Montréal region by winds mainly blowing in a South-West direction. SO_2 emissions from the fuels used in thermal power plants and other industrial processes show a downward trend. Just recently, in December 2012, the US EPA lowered its threshold for acceptable concentrations of primary type fine particles. Even though it is still too soon to tell, the results of this change will likely be measurable in a few years' time.

Acting locally

After consulting the data provided by the Société de transport de Montréal (STM), one can only conclude that the number of passenger trips by bus and metro since 2010 is on the rise. Could it be that the many road repair sites on the Island of Montréal and its outskirts increased the frequency of public transportation at the expense of car commuting? It's possible, but no passenger vehicle counting survey is available at this time to validate this theory. However, as the *Car free day* experience has demonstrated on a number of occasions in the past, air quality improves as soon as the number of vehicles circulating in a given perimeter decreases or becomes nil, thus the importance of a diversified offering of alternate forms of transportation. In this regard, the increase in the number of cyclists, over the past few years, as well as the advent of the Bixi in 2009 can also have a positive impact on lowering $PM_{2.5}$ emissions. In its 2012 mid-year report, the Société de vélo en libre-service Bixi stated that the number of trips by users of this form of transportation had increased by 10% relative to 2011.

Finally, the adoption by Ville de Montréal, in 2009, of regulations intended to ban wood burning apparatus excluding pellet stoves, awareness campaigns regarding the pollution caused by this type of heating and the implementation of a program to replace these apparatus by equipment using cleaner fuels (**feuvert.org**) may also have had a positive impact, translating into smaller quantities of airborne fine particles. The extension of the *Feu vert* program until the end of 2013 and the launch of the *Changez d'air* program in September 2012, applying in all other Québec municipalities, will likely have an impact on the concentrations that will be measured in the future.

The strategies implemented, here and elsewhere, will certainly have long-term impacts, thus the importance of maintaining a highly effective air quality monitoring system.



Ridership is calculated by taking into account the number of passenger trips from the point of origin until the final destination (Source: STM).

Air quality report for the east end of Montréal

The curves showing the trend of the pollutants measured since the beginning of the RSQA are available on the rsqa.qc.ca site in the "Historique et tendances" section.

Air quality is a preoccupation for both Montréal and its citizens, and particularly for residents of the east end of the island, home to most chemical and petrochemical industries. Since its set-up, in 1989 in the park on Saint-Jean-Baptiste Blvd., monitoring station number 3 has continuously been measuring the presence of airborne pollutants in the sector.

Over the past 10 years, certain events have influenced the quantities of airborne pollutants in the area, notably the recommissioning in 2002 of Pétrochimie Coastal, now Chimie Parachem, the commissioning in 2003 of Interquisa, now Cepsa, the closing of Pétromont in 2008 and, more recently, the closing of the Shell refinery in 2010.

Over the years, the monitoring equipment has been improved and the station's tool set has been expanded, notably with the addition of a BTEX (benzene, toluene, ethylbenzene, xylenes) continuous analyser. An analysis of the results measured on an hourly basis allow for a much quicker intervention in the industry's activities than in the past, when a 24-hour sample was collected once every six days.

Has air quality improved over time?

As shown in the schedule of average 24-hour concentrations of the main pollutants emitted by industrial or transportation activities for the years 2000 to 2012, air quality has greatly improved in the east end of Montréal.

Station 3: Saint-Jean-Baptiste Blvd. Average 24-hour concentrations in µg/m³			
Pollutant	2000	2012	
SO_2	15.8	5.2	↓ 67%
H_2S	14.0	1.7	↓ 88%
NO_2	28.2	17.2	↓ 39%
NO	17.3	4.1	↓ 76%

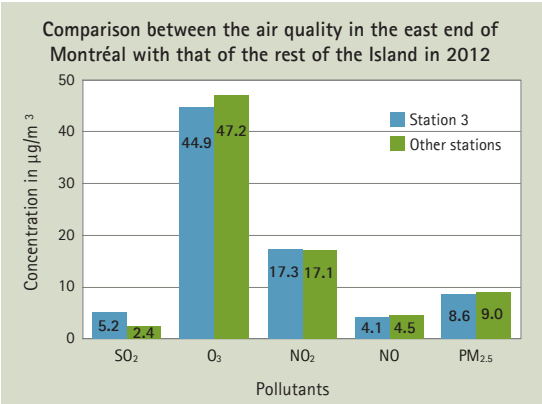
With respect to sulphur dioxide, the number of days where air quality was poor due to the presence of SO_2 fell from 13 days in 2006 to none in 2012, an indication of the effectiveness of the

Monitoring station #3 (Saint-Jean-Baptiste)

measures implemented to control their emissions. One can also observe a marked reduction in the presence of hydrogen sulphides, and in turn, a decrease in the odours characteristic of the presence of this pollutant. As far as nitrogen oxides are concerned, any decline in their numbers directly impacts the formation of ozone as they are the precursors of ozone.

How does air quality in the east end of Montréal compare with that of the rest of the island?

As shown in the comparative graph of 24-hour rolling averages, the concentrations of pollutants such as ozone, nitrogen oxides and fine particles are slightly lower or equal to those measured in other RSQA stations on the Island of Montréal. However, despite a 67% drop recorded for SO_2



Comparison between the annual 24-hour rolling averages recorded in station 3 and those of other comparable stations.

- Sulphur dioxide (SO_2): three stations 7, 61, 80
- Ozone (O_3): four stations 55, 66, 80, 99
- Nitrogen oxides (NO_2 and NO): five stations 7, 55, 66, 80, 99
- Fine particles ($PM_{2.5}$): eight stations 7, 28, 29, 50, 55, 66, 80, 99

during the 2000 to 2012 period, these results indicate that concentrations of this pollutant are still twice as high in the east end compared with the rest of the island.

Again this year, a decline in benzene concentrations was monitored in the Saint-Jean-Baptiste station. With a concentration of 1.28 µg/m^3, the benzene measured in the east end of Montréal is moving much closer to the concentrations recorded in the Island of Montréal's other stations, terrific news indeed.

Benzene concentrations	2009	2010	2011	2012
Station 3 1050 St-Jean-Baptiste	1.80	1.86	1.44	1,28
Station 61 1001 de Maisonneuve	1.12	1.09	1.00	TBD
Station 55 12400 Wilfrid Ouellette	0.67	0.58	0.58	TBD
Station 7 8200 Chénier	0.81	0.81	0.76	TBD
Station 80 2580 Saint-Joseph	0.80	0.63	0.59	TBD

TBD: The data from Environment Canada's laboratory are not yet available for these stations.

In conclusion

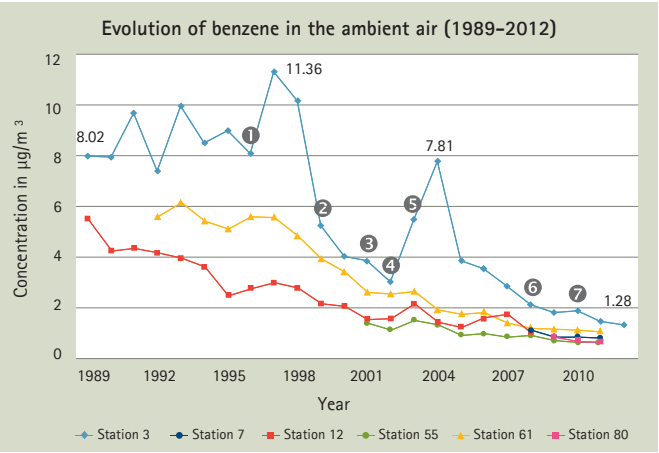
A comparative analysis of the results obtained in station 3 with those of other stations shows that:

- the situation has greatly improved for sulphur dioxide (reduction of 67%) and benzene (reduction of 84%), and that we need to continue in this vein in order to attain the levels observed elsewhere;
- the situation is similar to that in other stations as far as nitrogen oxides, ozone and fine particles are concerned.

Are the improvements observed due to the closing of the Shell refinery? The industries must control their emissions using anti-pollution systems or the most effective technologies, under the continous surveillance of the city's Direction de l'environnement. Despite all of the enforced controls, spills or equipment failures were always likely to produce emissions. Given that the refinery has been converted into an oil terminal, petroleum product transhipment and handling activities are still being conducted today on the site, and emissions are always possible. However, among the main airborne contaminants, only VOCs are still emitted by the terminal's activities. As the pollutants do not come with an originating address and are subject to the prevailing winds... one would be hard pressed to ascertain their origin beyond a reasonable doubt.

The refinery's closure likely had a positive impact on the area's air quality, but it is worthwhile mentioning that the remaining industries are cooperating by implementing new emission abatement measures, such as the installation of flooting roofs on wastewater treatment ponds or the recuperation of benzene at ships' loading docks.

84% decline in airborne benzene concentrations since 1989.



Events that influenced the quality of ambient air in the east end of Montréal

1. Recovery of oil vapours in 1996: Bylaw 90-3
2. Decrease of the benzene content in gasoline in 1999
3. Measurement and corrective measures for leaks (equipment) in 2001: Bylaw 90-6
4. Recommissioning in 2002 of Pétrochimie Coastal, now Chimie Parachem
5. Commissioning in 2003 of Interquisa, now Cepsa
6. Closure of Pétromont in 2008
7. Closure of the Shell refinery in 2010

A partner in various research projects

Environmental impacts on the aging of metallic structure coatings

Hydro-Québec has many metallic structures such as towers, power transformers and junction boxes that need to be protected against corrosion. Toward this end, a coating is applied on the structures. Nevertheless, these coatings are subjected to various conditions, including airborne pollutants, that result in the aging of the structures.

Witness plates

Sainte-Anne-de-Bellevue test bench with witness plates
Photo credit: IREQ (Hydro-Québec), 2012

In order to demonstrate the impacts of these pollutants on coatings, a research team from the Institut de recherche d'Hydro-Québec (IREQ) set up some test benches close to three RSQA monitoring stations, namely Sainte-Anne-de-Bellevue (control medium), Saint-Jean-Baptiste (industrial setting) and Chénier (urban setting influenced by road traffic).

Four different types of coatings were applied to the test benches installed during the summer of 2012. The follow-up, consisting in a characterization of materials, will be conducted over a four-year time span until 2016. The project aims to:

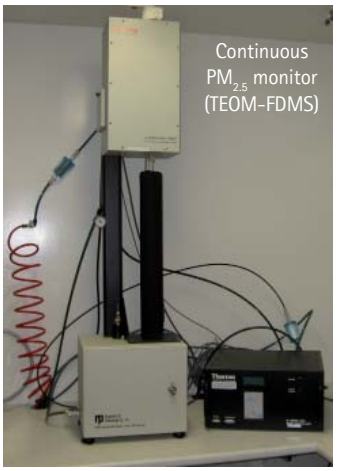
- improve Hydro-Québec's knowledge of the various atmospheric conditions where their facilities are found;
- lead to a greater understanding of the degradation and aging mechanisms of coatings under real operating conditions;
- optimize the choice of coatings according to the various atmospheric conditions.

Characterization of the oxidative potential of fine particles ($PM_{2.5}$)

Fine particles can result in adverse health effects, particularly among vulnerable segments of the population, such as seniors, children and persons suffering from chronic lung diseases. Preoccupied by this situation, Health Canada has launched a project to characterize the nature of $PM_{2.5}$ and identify their action mechanisms. The project's objectives are to:

- characterize the oxidative potential of $PM_{2.5}$ in many locations throughout Canada;
- examine their chemical composition;
- identify their main sources;
- improve the development of a tool in order to determine health risks.

Clean filter (left) and filter after monitoring (right)



Continuous $PM_{2.5}$ monitor (TEOM-FDMS)

In addition, as the composition of these particles is likely to vary according to the location where the sample has been collected (different sources of pollution), participation by the cities of Vancouver and Toronto was also solicited to check whether there existed significant regional variations. As a partner in the project, the RSQA will provide Health Canada the filters of the 10 $PM_{2.5}$ monitors in activity in its network, and this, for as long as required. The results may also be used for physiological studies on respiratory health and heart diseases.

Deployment of a mobile air quality laboratory in the streets of Montréal

The monitoring stations within an air quality network are generally fixed. However, it is possible to improve our understanding of the dispersion of pollutants in an urban setting, to better identify the emission sources as well as to obtain information on areas that are far away from these stations, by combining fixed measures with ad hoc and mobile measures. This is precisely what Jeff Brook, a researcher with Environment Canada, and his team have undertaken by driving the streets of Montréal at the wheel of their mobile laboratory baptized the Cruiser (*Canadian Regional and Urban Investigation System for Environmental Research*).

Over a 34-day period spanning three seasons (summer, fall, winter), airborne pollutants were measured by monitors, while the Cruiser traveled following predetermined trajectories. These mobile measures were then compared with the data collected by the RSQA monitoring stations. This approach allowed for the linkage of the two types of measures as well as to validate the data gathered by the mobile laboratory's instruments.

Environment Canada's Cruiser mobile laboratory

Many maps were then produced showing marked differences in the spatial distribution of various pollutants at a suburban level, namely the streets of a neighborhood. Consequently, there exist microenvironments where average pollution levels may vary considerably.

The study focuses on the complex relationships that exist between airborne pollutants, provides information to better identify certain sources of pollutants and will ultimately allow for a better assessment of the Montréal population's exposure to airborne pollution.

The results of the "Elucidating multipollutant exposure across a complex metropolitan area by systematic deployment of a mobile laboratory" study were published in the December 2012 issue of the Atmospheric Chemistry and Physics Discussion journal.

Outdoor fires forbidden

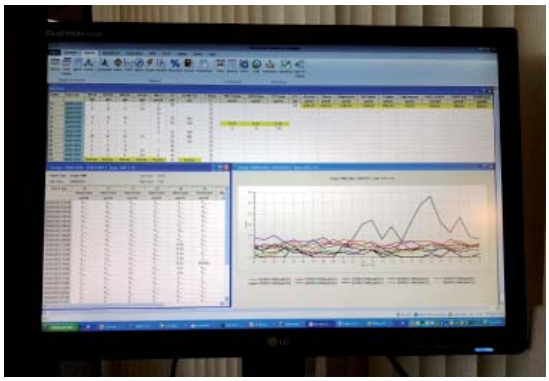
In terms of safety, outdoor fires are not risk-free. Apparently peaceful, romantic and inoffensive, outdoor fires are a source of emission of hundreds of different toxic substances. Certain of these substances are recognized as being carcinogenic. Others, for instance fine particles, can penetrate deeply into the lungs and result in health problems. Smoke can also provoke various immediate ailments, such as an irritation of the eyes and respiratory tract, headaches, bronchial congestion, while aggravating the symptoms of various medical conditions, affecting the health of persons with cardiovascular problems and being a source of nuisance for the neighborhood. Consequently, given that outdoor fires can result in serious outcomes for the safety and quality of life of citizens and for the environment, they are forbidden on the Island of Montréal, save in certain exceptional circumstances, where a permit is required.

In order to regulate this activity on the territory of the agglomeration of Montréal, the city's Service de sécurité incendie and Direction de l'environnement prepared an information document. Entitled *Les feux extérieurs dans l'agglomération de Montréal*, the leaflet explains the areas of responsibility of each department and the steps required to obtain a permit whenever event-related, commercial or industrial activities are planned. This communication tool is also used by inspectors to raise citizens' awareness and compliance with the regulations in force.

The leaflet on outdoor fires is available in French only at ville.montreal.qc.ca/chauffageaubois, in the 22 service counters of Bureau Accès Montréal and the 9 offices of the related cities.

Did you say DR DAS?

Since the beginning of the 80s, transmission of the RSQA's data to Ville de Montréal's central data base was conducted using a standard telephone line. The technology sourced was very limiting and did not allow, for instance, a remote access to the measurement apparatus. To correct this situation and with a view of improving work efficiency, an update of the data acquisition system was undertaken in 2010. After a test period over a few months, DR DAS was successfully implemented in December 2012.



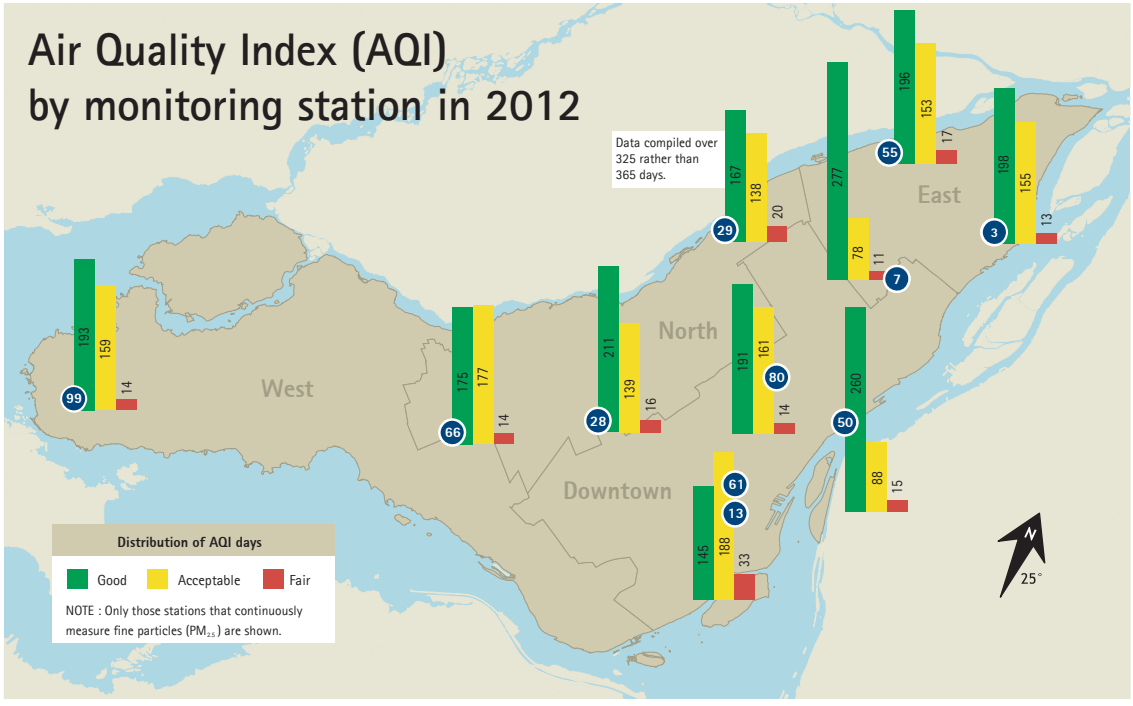
DR DAS in action

The choice of DR DAS and their *Envista Air Resources Manager* became obvious given the objective of standardizing our facilities with the surveillance networks in operation elsewhere in Canada, including the network operated by Québec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP).

This change now enables us to optimize the transfer of information by relying on a wireless technology. In addition to being able to transmit the data into the central data base, it is now possible to remotely diagnose the performance of all the apparatus in the stations and to carry out any follow-up actions. Quality assurance and data validation activities are thus simplified, given the possibility of using specific alerts. The many options available, accessible both in the monitoring stations themselves and remotely, permit the speedy creation of schedules and graphs.

This major project was made possible thanks to the support of Environment Canada.

Air quality portrait



Graphic design
Rachel Mallet

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

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

Web site
rsqa.qc.ca

Photographs
Ville de Montréal

Printed in Canada
ISSN 1925-685X (print)
ISSN 1925-6868 (PDF)

06 - 05 - 2013