

2016 Environmental Assessment Report

AIR QUALITY IN MONTRÉAL

Service de l'environnement

Montréal 

Highlights

PORTRAIT OF AIR QUALITY

- Improvement in air quality
- Concentrations of fine particulate matter on the wane
- Annual average of fine particulate matter under the threshold of $10 \mu\text{g}/\text{m}^3$ recommended by the World Health Organization (WHO)
- Annual hourly average of sulfur dioxide below the Canadian standard of 5 ppb

NOVELTIES

- Commissioning of station 31 downtown
- Closing of stations 13 and 61 downtown
- Upgrading of Website
- Accessibility of Website by mobile devices
- Participation in a research project

TURCOT PROJECT

- Commissioning of four new monitoring stations in January
- Total suspended particulates on the rise during the works
- Real-time data available on the Turcot project's Website

AMBIENT AIR QUALITY STANDARDS

- New standards for sulfur dioxide in force since October 3, 2016
- Comparison with Canadian standards of the results obtained on the territory of the agglomeration of Montréal for fine particles, ozone and sulfur dioxide
- Results for all parameters below the recommended threshold limits



The Network in short

Over the past year, the *Réseau de surveillance de la qualité de l'air* (RSQA) (the Network) of the *Service de l'environnement* pursued its activities throughout the territory of the agglomeration of Montréal. During this period, improvements were made to the Network. Among others, the fine particulate matter TEOM-FDMS analysers were replaced by SHARP 5030 models. This new technology, whose detection limit is greater than that of the TEOM-FDMS technology it replaces, allows for the monitoring of fine particulate matter concentrations by the minute, thereby offering a greater accuracy of hourly data averages.

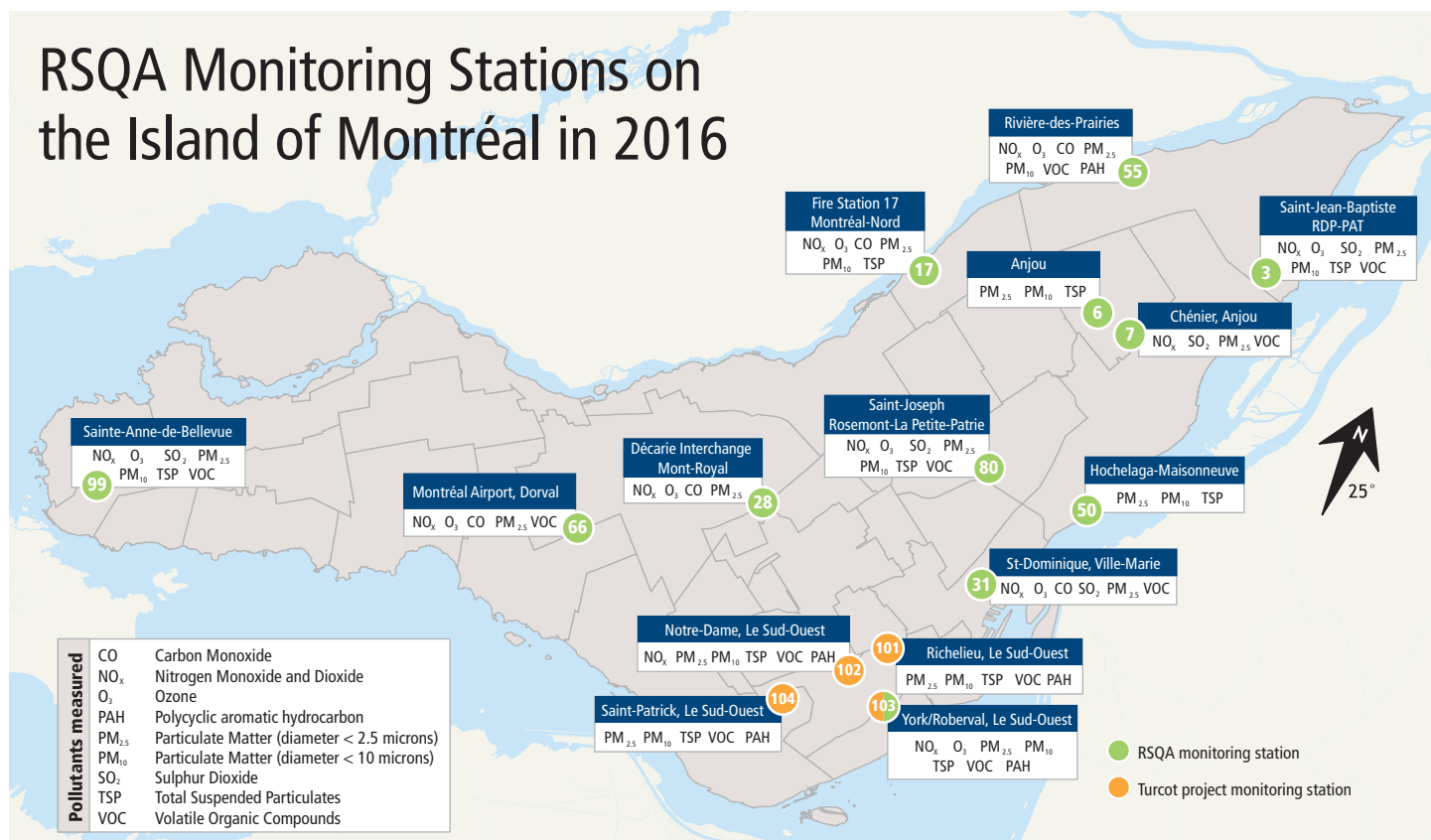
The number of stations also increased to 15 from 12 (after substracting station 68 closed in March 2015). The commissioning of the new stations was conducted within the air quality monitoring program implemented for the rebuilding of the Turcot Interchange. With respect to the posting of real-time air quality data, the RSQA's (rsqa.qc.ca) Website was rejuvenated and it is now accessible to mobile devices. In addition, the measurements taken by the Turcot project monitoring stations are also available in real-time on the Website of the *Ministère des Transports, de la Mobilité durable et de l'Électrification des transports* (www.turcot.transports.gouv.qc.ca/fr/travaux/qualitedelair).

What is a poor air quality day?

According to established criteria, as soon as fine particulate concentrations are greater than $35 \mu\text{g}/\text{m}^3$ for at least three hours in a given station, the day is deemed poor in terms of air quality. For a poor air quality day to be characterized as a smog day, $\text{PM}_{2.5}$ concentrations greater than $35 \mu\text{g}/\text{m}^3$ need to be measured during at least 3 hours over more than 75% of the territory of the agglomeration of Montréal. During a smog day, fine particulate concentrations generally remain high for 24 hours and sometimes longer.

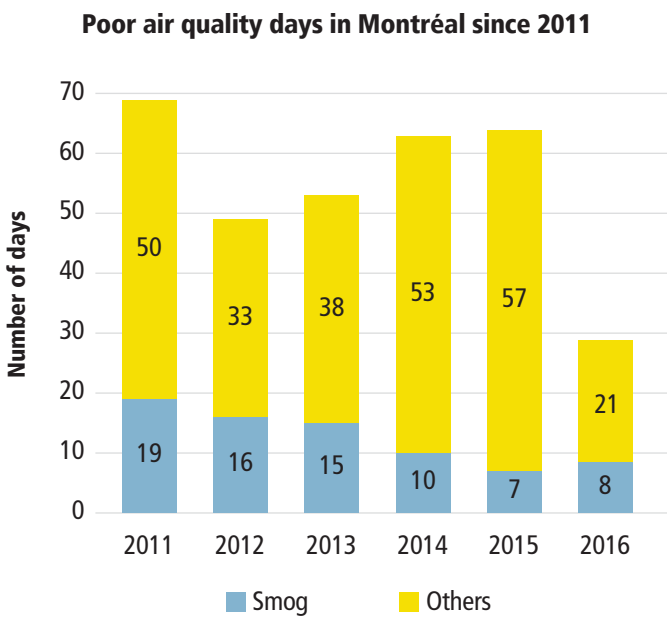
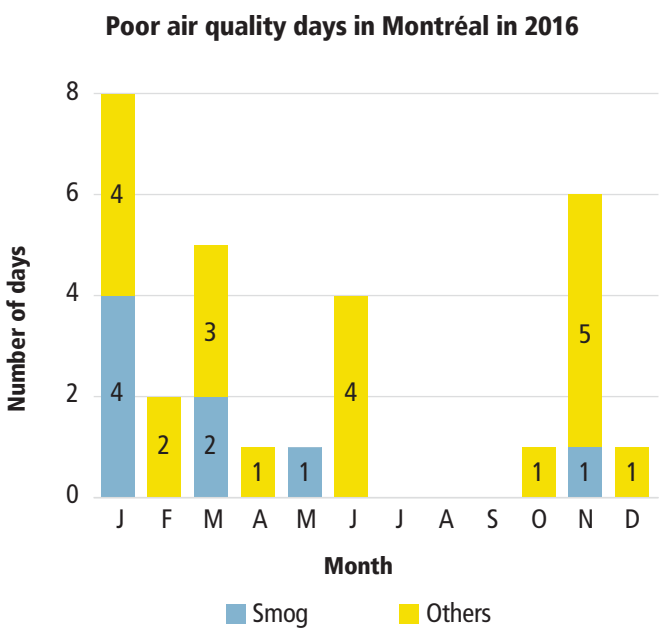
The efforts made by Ville de Montréal (the City) to oversee, through regulatory measures, activities such as wood burning, as well as the implementation of a transportation plan relying on the electrification of transportation as well as on active and public transportation, contribute to a reduction of pollutants at the source and an improvement in air quality. Other measures will need to be implemented in coming years to maintain the observed downward trend of air pollutant emissions over the past few years and to pursue, even intensify, efforts to improve the quality of the air that we breathe.

RSQA Monitoring Stations on the Island of Montréal in 2016



Portrait of air quality

In 2016, only 29 poor air quality days, of which 8 smog days, were recorded on the territory of Montréal. The pollutants responsible for these poor air quality days were fine particulate matter (28) and fine particulate matter and ozone (1). The smog days recorded were observed in January, March, May and November. The smog day recorded on May 24, 2016 was due to the combined presence of fine particulate matter and ozone. The afternoon high of 29 °C and light winds resulted in ozone concentrations exceeding the threshold of 82 ppb during a short interval at the end of the afternoon at station 55.



Modifications made to the Network

In downtown Montréal, station 13, located at 1212 Drummond St., was dedicated to the monitoring of fine particulate matter, whereas station 61, located at 1001 Maisonneuve West Blvd., was specialized in the measurement of gaseous pollutants. Owing to the proximity of the stations, their results were combined in a single dot on the Website. Due to the disrepair of the facilities and occupational safety issues, both stations were decommissioned and no activity was recorded in either one in 2016.

Why only 29 poor air quality days in 2016 compared to 64 in 2015?

Decommissioning of station 13 resulted in a major decrease in the number of poor air quality days, given that it was this station that, historically since 2009, recorded the greatest number of these days. This unenviable record was due to the emissions of fine particulate matter from a wood burning oven from the station's neighboring pizzeria, during peak hours, which made their way directly into the sample probe.

Number of poor air quality days at station 13 due to the combustion of the pizza oven						
2009	2010	2011	2012	2013	2014	2015
17	23	30	16	19	39	34

Total annual number of poor air quality days at station 13						
2009	2010	2011	2012	2013	2014	2015
39	48	49	33	32	54	42

The number of poor air quality days due to wood combustion was determined on the basis of the results obtained for each hour of the day, the winds' direction and through a comparison with the results obtained at the other stations of the Network. This exercise allows for a confirmation of the direct impact of a local source of pollution on the ambient air quality in a sector.

But what about air quality downtown?

In order to keep an air quality monitoring station in the downtown sector, a new station was inaugurated on January 28, 2016, about 2 km away from the previous stations. This station, which recuperated the equipment of the two closed stations, is identified as station 31 and is located on the top floor of the fire station at 75 Ontario St. East. The new station’s location will contribute to a more accurate picture of the air quality downtown, given that the old station’s proximity to the pizzeria with its wood burning oven unduly influenced the air quality results in that sector.

Good news for the agglomeration

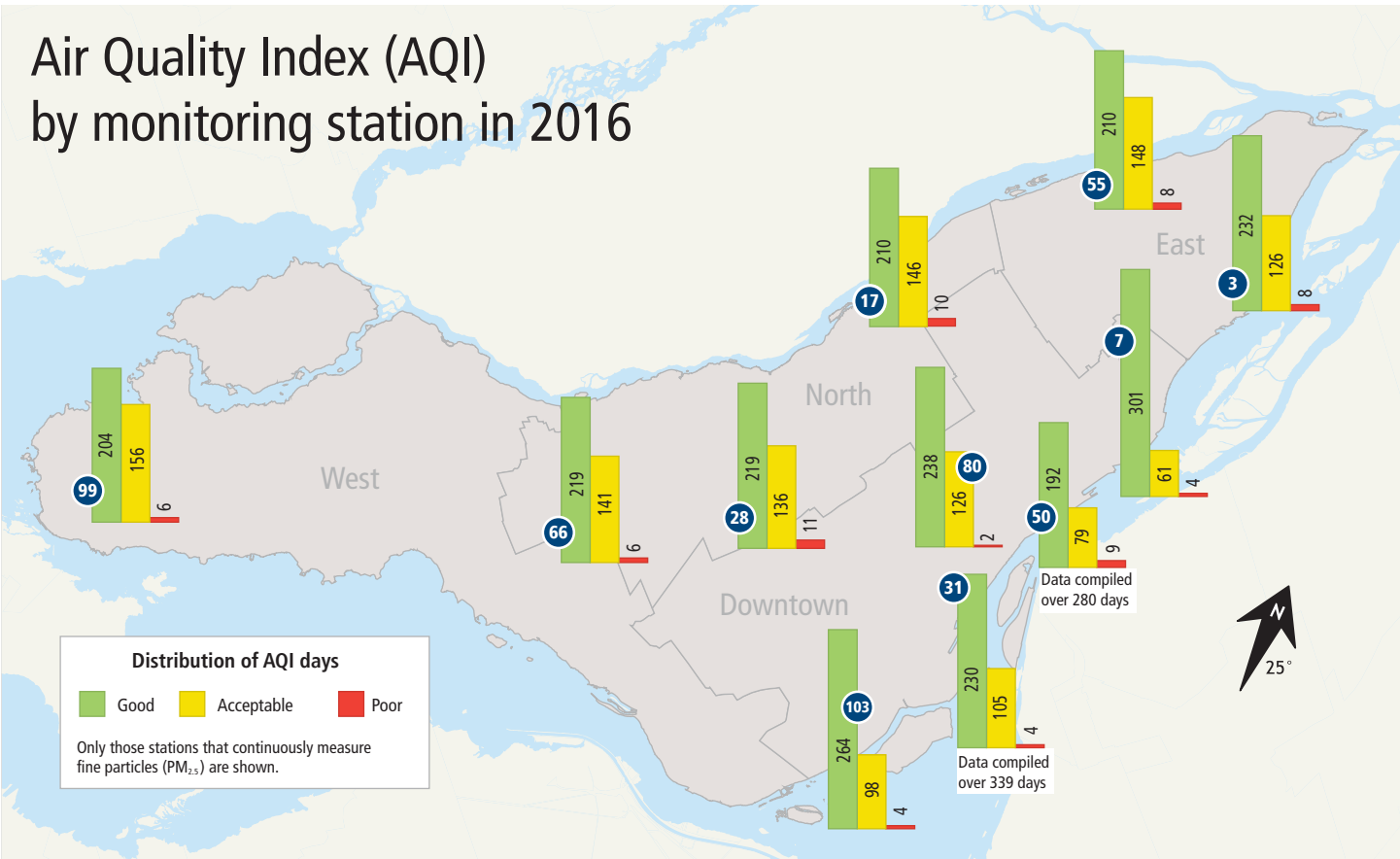
An analysis of the results obtained for fine particulate matter since 2009 reveals that concentrations are on the wane throughout the territory, which is good news for all Montréal citizens preoccupied by the impacts of air pollution on their health. Indeed, the average annual concentrations, since 2014, are below the standard of 10 µg/m³ set by the World Health

Organization (WHO). According to the WHO: “Particulate matter affects more people than any other pollutant”.* This conclusion challenges all of us to do better in order to diminish the emission sources of fine particulate matter. It also explains why the City has adopted a transportation plan, why it is efficient and innovative in its management of waste materials and why it is responsible for the application of various regulations in matters of urban affairs and construction.

Average annual concentrations in µg/m³ of fine particulate matter measured since 2009

2009	2010	2011	2012	2013	2014	2015	2016
11.4	10.6	9.7	9.3	10.2	9.3	8.7	7.0

* World Health Organization. “Ambient (outdoor) air quality and health”, Media Centre, [online]. [www.who.int/mediacentre/factsheets/fs313/en] (Page accessed in March 2017).



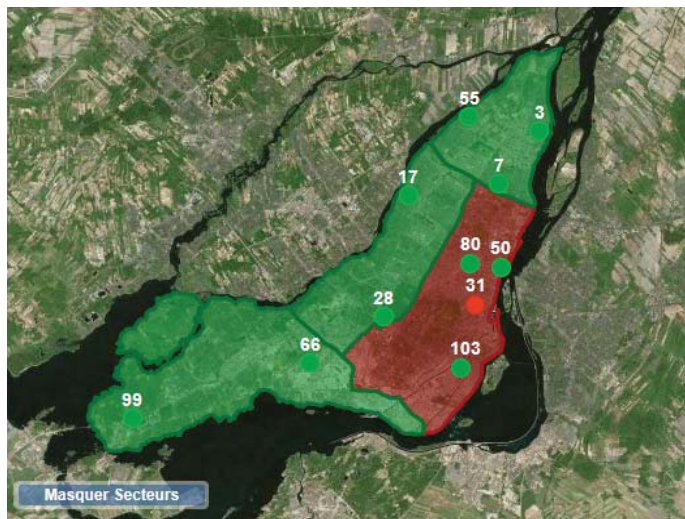
The new station proves its worth!

Some of you might remember the fire that broke out in an abandoned building located at 3464 Park Avenue on November 23, 2016 around 9 a.m. The results presented in the graph below were recorded at station 31 located less than 900 metres from the seat of the fire. The sector was rapidly engulfed by smoke whose vast plume was visible for several kilometres around. At the worst point of the blaze (around 11 a.m.), the average concentrations of fine particulate matter increased to $365 \mu\text{g}/\text{m}^3$. However, owing to the speedy intervention of firefighters, these concentrations quickly returned to more acceptable levels.

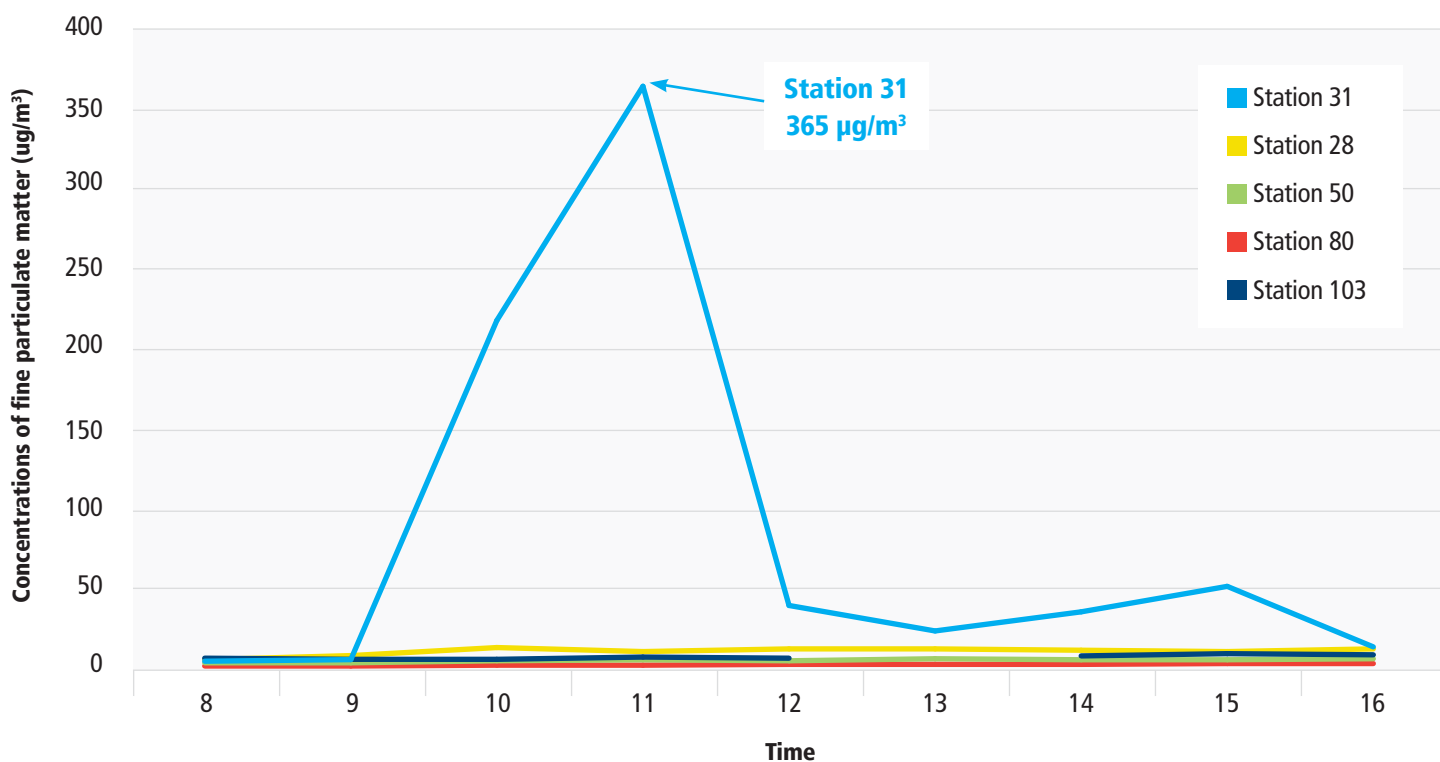
For comparison purposes, as evidenced in the literature, the hourly concentrations recorded by the City of Beijing, China, regularly exceed this value. Can you imagine living in a cloud of smoke and this, day after day, knowing the health impacts of $\text{PM}_{2.5}$?

This sudden increase in fine particulate matter was also visible on the RSQA's new Web application (see opposite picture) launched last fall. This application now lets users access real-time data on their mobile devices. Among the other changes implemented, users can zoom in on a station to find its location. To see these changes for yourself, please consult the Website at rsqa.qc.ca.

November 23, 2016



Average concentrations of fine particulate matter during a major fire on November 23, 2016



Special project

The RSQA is collaborating in a research project led by Professor Dr. Scott Weichenthal of McGill University, whose purpose is to assess the air quality impacts of the adoption of the By-law concerning solid-fuel-burning devices and fireplaces (15-069).

Launched in the fall of 2016, the project consists in monitoring fine particulate matter ($PM_{2.5}$) in various sectors of the City (eight locations were chosen) during the months of December to March for the winters of 2017, 2018 and probably 2019.

Dr. Weichenthal's and his team's research is focused on understanding the impact of the built environment on air pollution exposures in urban areas as well as the short and long-term health effects of air pollution exposures.

Stay tuned!



Mobile probe for fine particles



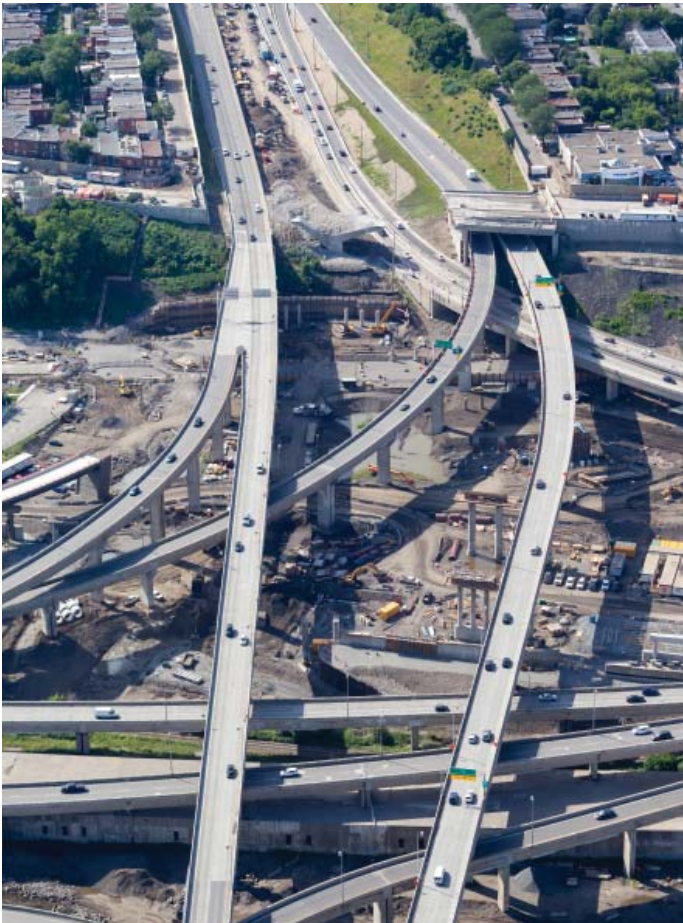
Analysis of BTEX in the ambient air

In the 1990s, benzene concentrations were high in the east end of Montréal. The industry's efforts to curtail volatile organic compound emissions in the atmosphere in order to comply with the By-law respecting atmospheric emissions (By-law 2001-10) were successful, the concentrations of benzene measured in the east end of Montréal being estimated at about $1.1 \mu\text{g}/\text{m}^3$ since 2014. This represents a tenfold decline relative to the maximum annual concentration of $11.4 \mu\text{g}/\text{m}^3$ measured in 1997. The continuous monitoring of BTEX (benzene, toluene, ethyl benzene, xylene) volatile organic compounds conducted at station 3 allows us to better assess the source activities of pollutants on a daily basis and can facilitate interventions, should they be required.

* Benzene is classified as a human carcinogen by the International Agency for Research on Cancer.

Turcot project

An integral part of the reconstruction of the Turcot Interchange, a continuous air quality monitoring program was launched in January 2016 with the commissioning of four monitoring stations within the area hosting the construction works. The City collects the data and analyses them by comparing the results obtained with the thresholds identified in the *Règlement sur l'assainissement de l'air* (By-law 2001-10) of the *Communauté métropolitaine de Montréal* in relation to total suspended particulates and, for fine particles, with the Clean Air Regulation (*Règlement sur l'assainissement de l'atmosphère* (RAA)) of Québec's *Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques*. This comparison is used to assess the effectiveness of the mitigation measures implemented to control dust emissions related to the Turcot project activities and to identify the interventions that are required on site.



Close view of the Turcot Interchange (July 22, 2016)
Credit: © FOTOimage Montréal / Shutterstock.com



Aerial view of the Turcot project (October 20, 2016)
Credit: © FOTOimage Montréal / Shutterstock.com

Although the RAA does not apply to the territory of the agglomeration of Montréal, the threshold of $30 \mu\text{g}/\text{m}^3$ that is recommended therein is used for reference purposes. That being said, there were 13 days during which average daily concentrations of $\text{PM}_{2.5}$ were greater than $30 \mu\text{g}/\text{m}^3$ at station 102. Of these, 3 were smog days, during which fine particulate matter readings were high in many locations on the Island, the 10 other days being due to the dust coming from the neighboring autoroute, project activities and other non-point sources. The results obtained at the other stations varied between 1 and 3 days where concentrations exceeded the threshold.

With respect to total suspended particulates, the picture is quite different given that the number of days during which average daily concentrations exceeded the threshold of $150 \mu\text{g}/\text{m}^3$ of

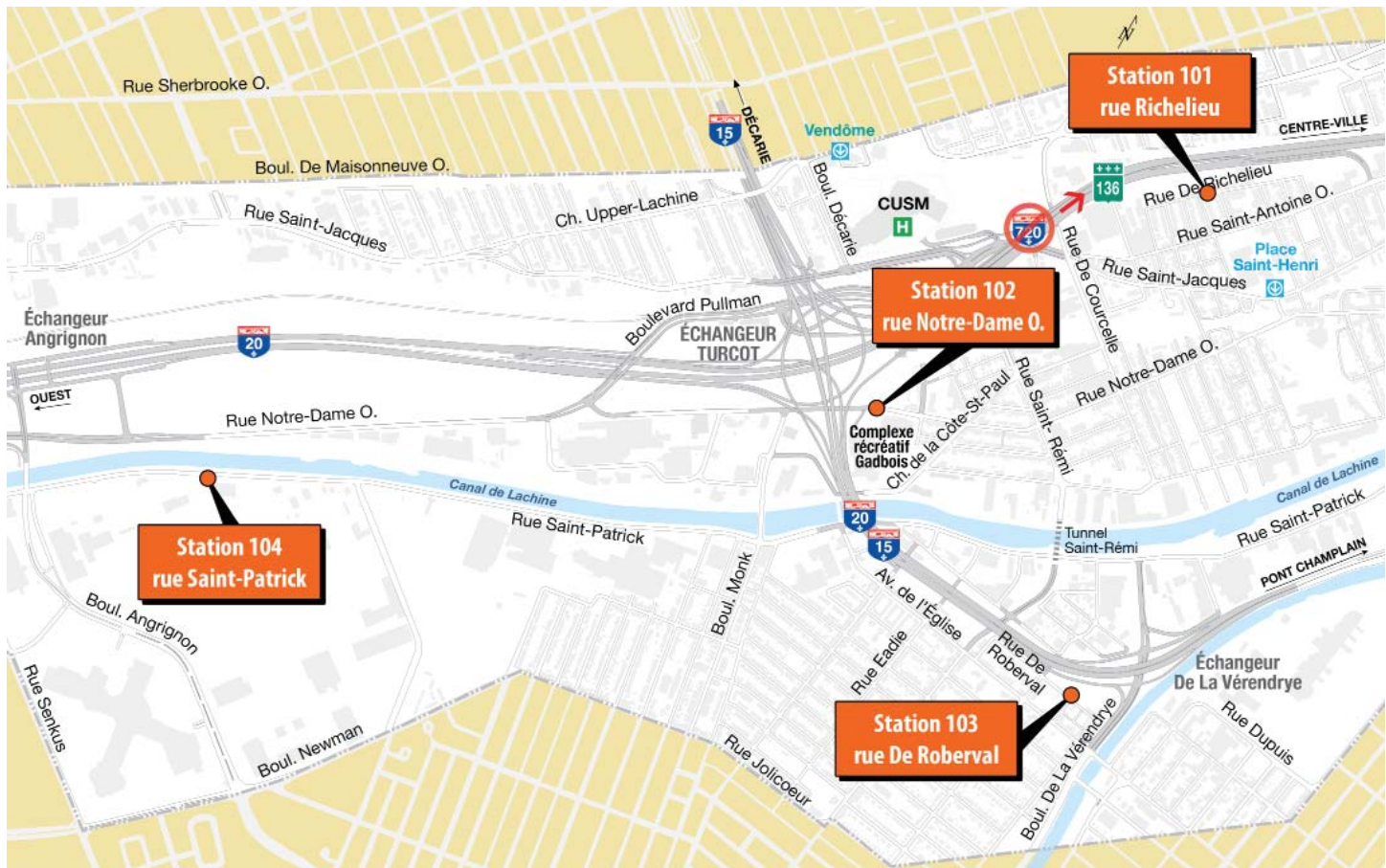
Bylaw 2001-10 totalled 144 at station 102 and less than half that number at the three other stations. Many of the exceedances cannot be directly attributed to the work site, the autoroute interchange itself being a significant source of coarse particles. It's also worthwhile mentioning that station 102 is located directly in the worksite and was thus impacted by the excavation and handling of soil activities that were conducted last summer, a phase of the project that is now terminated.

Nevertheless, the nuisance potential of coarse particles is very real for the citizens who live near the autoroute and work site. That is why the City participates in meetings of the Neighbourhood Committees with a view to informing citizens about the progress of the work, discussing their preoccupations and implementing solutions. The City has also urged KPH, the consortium responsible for the works, to adjust and implement additional on site

mitigation measures. The inspectors of the *Division du contrôle des rejets industriels* of the *Service de l'environnement* regularly visit the work site to ensure the effectiveness of the measures implemented to control dust emissions.

Since December, the data are available on line on the Website of the *Ministère des Transports, de la Mobilité durable et de l'Électrification des transports* (MTMDET). In addition to the graphs with their color code, you'll find the location of the different stations, the applicable standards, the mitigation measures that have been implemented, a report on exceedances of the thresholds and other analysis results. For further information, please consult the MTMDET's Website at seti-media.com/infopopulation/rsqa_turcot.

Location of Turcot project monitoring stations



Credit: © Ministère des Transports, de la Mobilité durable et de l'Électrification des transports

Canadian Air Quality Standards

Within the following comparative exercise, average measures are obtained using the data of all of the stations of the City's *Réseau de surveillance de la qualité de l'air*. The Canadian standards are used for reference purposes only.

Canadian standards

With a view to replacing Canadawide standards, new Canadian Ambient Air Quality Standards (CAAQS) have been developed for fine particulate matter (PM_{2.5}), ozone (O₃) and sulfur dioxide (SO₂). These new standards are at the heart of the Air Quality Management System (AQMS) put forward by the Canadian Council of Ministers of the Environment (CCME).

On October 11, 2012, the provincial governments, with the exception of Québec, agreed to implement the AQMS. Although Québec supports the general objectives of AQMS, it will not implement the System since it includes federal industrial emission requirements that duplicate Québec's Clean Air Regulation. However, Québec will collaborate with the other jurisdictions on developing other elements of the system, notably air zones and airsheds. Despite this particular situation, the proposed Canadian standards are an interesting referential basis, allowing for a benchmarking of the PM_{2.5}, O₃ and SO₂ results obtained for the Montréal agglomeration.

Situation in Montréal

Fine particulate matter (PM_{2.5})

An analysis of the results since 2010 shows a clear improvement in concentrations of fine particulate matter in Montréal's ambient air. Indeed, a decline of 7 µg/m³ is observed in the three-year average for the 2014-2016 period of the 98th annual percentile of daily average concentrations over 24 hours compared to the 2010-2012 average. This value of 21 µg/m³ is far less than the target standard of 27 µg/m³ for 2020. Such an observation is very significant, given that fine particulate matter is associated with many health problems and there exists no identifiable threshold below which PM_{2.5} has no impact on human health.

A decline in the 3-year average of annual average concentrations can also be observed. The value of 8.6 for 2014-2016 is compliant with the Canadian standard for 2020 and shows a decline of 1 µg/m³ relative to 2012-2014.

Canadian Ambient Air Quality Standards (CAAQS)

Pollutant	Averaging time	Standards			Metric
		2015	2020	2025	
PM _{2.5} *	24-hour (calendar day)	28 µg/m ³	27 µg/m ³	-	3-year average of the annual 98 th percentile of the daily 24-hour average concentrations
PM _{2.5} *	Annual (calendar year)	10 µg/m ³	8.8 µg/m ³	-	3-year average of the annual average concentrations
Ozone	8-hour	63 ppb	62 ppb	-	3-year average of the annual 4 th highest daily maximum 8-hour average concentrations
SO ₂ *	1-hour	-	70 ppb	65 ppb	3-year average of the annual 99 th percentile of the SO ₂ daily maximum 1-hour average concentrations
SO ₂ *	1 year (calendar year)	-	5.0 ppb	4.0 ppb	Arithmetic average over a single calendar year of all 1-hour average SO ₂ concentrations

* Canadian Council of Ministers of the Environment (CCME). "Air", *Resources*, [online]. [www.ccme.ca/en/resources/air/index.html] (Page accessed in March 2017).

Fine particulate matter concentrations expressed in µg/m³

3-year average of the annual 98 th percentile of the daily 24-hour average concentrations					
Standard = 28 in 2015 Standard = 27 in 2020					
2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	
28	26	25	24	21	

3-year average of annual average concentrations					
Standard = 10 in 2015 Standard = 8.8 in 2020					
2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	
9.9	9.7	9.6	9.4	8.6	

Ozone (O₃)

The recorded ozone concentrations are below the standard set for 2020. The trend is rather stable with 3-year averages varying between 55 and 58 ppb since 2010-2012.

Ozone concentrations expressed in ppb

3-year average of the annual 4 th highest daily maximum 8-hour average concentrations				
Standard = 63 in 2015			Standard = 62 in 2020	
2010-2012	2011-2013	2012-2014	2013-2015	2014-2016
58	57	55	55	56

Sulfur dioxide (SO₂)

In October 2016, new CAAQS were added for SO₂ to foster an improvement in air quality throughout Canada. The 2014-2016 value of 21 ppb for the 3-year average of the daily maximum concentrations of SO₂ over 1 hour is well below the standards established for 2020 and 2025 (70 and 65 ppb respectively). The average annual value shows a slight decline in 2016 compared to 2012, and is compliant with the Canadian standards set for 2020 and 2025.

SO₂ emissions are associated with respiratory problems, particularly among asthmatic children and adults, as well as environmental impacts, such as acid rain and smog. The main sources of SO₂ are the use of fossil fuels and industrial activities.

SO₂ concentrations expressed in ppb for all stations

3-year average of the annual 99 th percentile of the SO ₂ daily maximum 1-hour average concentrations				
Standard = 70 ppb in 2020			Standard = 65 ppb in 2025	
2010-2012	2011-2013	2012-2014	2013-2015	2014-2016
31	26	23	23	21

Arithmetic average over a single calendar year of all 1-hour average SO ₂ concentrations				
Standard = 5.0 ppb in 2020			Standard = 4.0 ppb in 2025	
2012	2013	2014	2015	2016
1.1	1.0	1.1	0.9	0.7

Influence of the industrial environment

Station 3 is located in the east end of the Island of Montréal in the heart of the chemical and petrochemical sector. Since its commissioning in 1989, in the park on Saint-Jean-Baptiste Blvd., the monitoring station has never ceased to measure the presence of air pollutants in the sector.

According to the statistics accumulated since then, the maximum number of poor air quality days due to SO₂ fell from 13 days in 2006 to just 2 days in 2010. And since 2011, no exceedances of the AQI value for SO₂ have been observed (10-minute moving average > 190 ppb or 500 µg/m³). The decline in concentrations of pollutants emitted in the ambient air can certainly be attributed to a change in activities, particularly the closing of many refineries since 1989. And although the refining activities have been substituted for other industrial activities, the latter have had no impact on SO₂ results in 2016.

The tables below present the averages of the CAAQS for SO₂ at station 3. Compared to the two previous tables, one immediately notices the influence of industrial emissions on the results. For 2010-2012, the average at station 3 was greater by about 30 ppb than the average for all other stations on the Island of Montréal. This variance declines to 20 ppb for the 2014-2016 average. Despite this situation, concentrations remain far below the standards established for 2020 and 2025. Average annual concentrations, for the past five years, have been slightly higher than those obtained for all RSQA stations. However, these values are very low and there has been a downward trend since 2013, a good omen for future years. Average annual concentrations are also below the Canadian standards for both 2020 and 2025.

SO₂ concentrations expressed in ppb at station 3

3-year average of the annual 99 th percentile of the SO ₂ daily maximum 1-hour average concentrations				
Standard = 70 ppb in 2020			Standard = 65 ppb in 2025	
2010-2012	2011-2013	2012-2014	2013-2015	2014-2016
59	52	50	49	40

Arithmetic average over a single calendar year of all 1-hour average SO ₂ concentrations				
Standard = 5.0 ppb in 2020			Standard = 4.0 ppb in 2025	
2012	2013	2014	2015	2016
2.0	2.1	1.8	1.7	1.3

