The background image shows an aerial view of the St. Lawrence River flowing through a park. The riverbank is lined with trees displaying vibrant autumn colors. A paved path runs parallel to the river, and a road with a few cars is visible. In the distance, the large geodesic dome of the Montreal Biosphère is prominent against a blue sky with scattered white clouds.

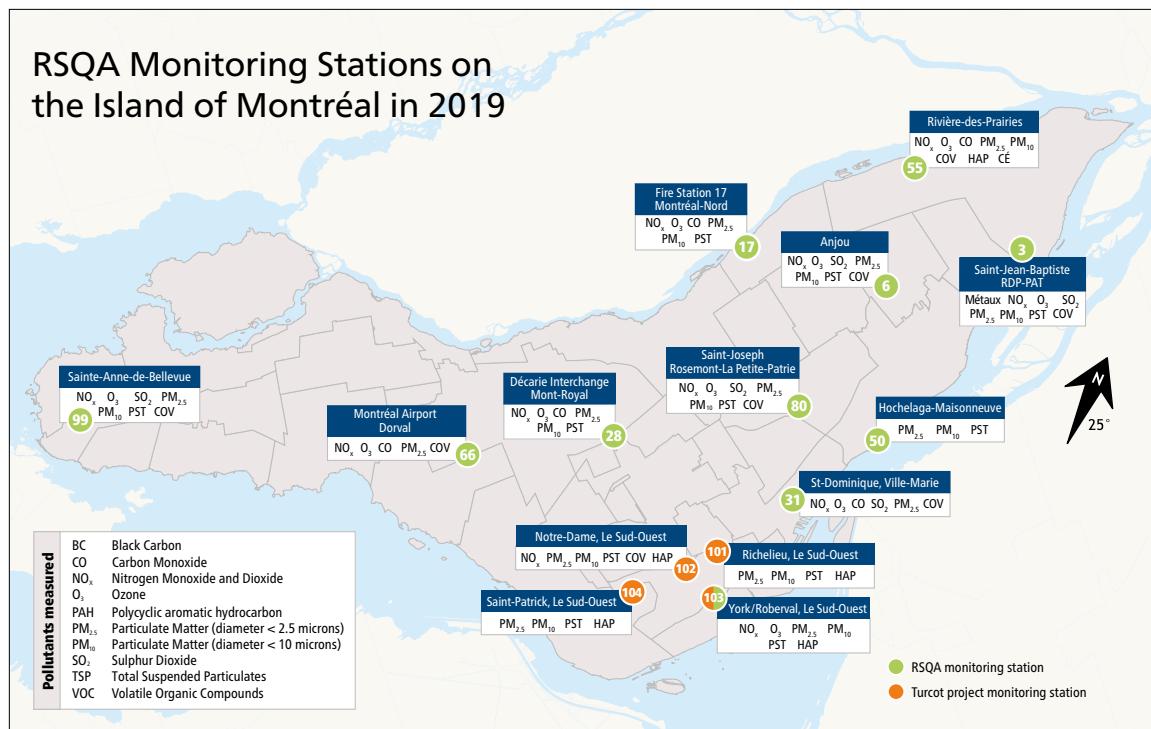
Environmental Assessment Report 2019

# Air quality in Montréal

Service de l'environnement



# Air Quality Monitoring



## The Network's Mission

In keeping with its mandate, the Réseau de surveillance de la qualité de l'air (RSQA) measures concentrations of pollutants in the ambient air in order to take stock of the situation on the territory of the agglomeration of Montréal. The results for fine particulate matter (PM<sub>2.5</sub>), ozone (O<sub>3</sub>), sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>) and carbon monoxide (CO) are available in real time and can be consulted on the RSQA's Web site at [rsqa.qc.ca](http://rsqa.qc.ca). Other measures and analyses are also conducted according to the sampling program of Environment and Climate Change Canada's (ECCC) National Air Pollution Surveillance (NAPS) Program, to which it belongs.

## Team

The RSQA team is comprised of nine persons who ensure themselves of the accuracy of the measures taken by the analyzers as well as the validation of the many results collected. The team combines the expertise of a section head, a chemist, a research officer, a technical officer and five environmental technicians. All participate in the Quality Assurance/Quality Control (QA/QC) program that will officially be validated in 2020 in order to comply with the new NAPS Program guidelines.

# The NAPS Program is 50 years old!

The NAPS Program celebrated its 50<sup>th</sup> anniversary in 2019. Since its inception in 1969, the NAPS Program has changed significantly, but its mandate remains the same: provide reliable long term data on ambient air quality in Canada that meet stringent quality standards. The data generated help support the regulations, programs and research dealing with air quality. The NAPS Program is comprised of some 260 stations throughout Canada managed by provincial and territorial governments. Did you know that Ville de Montréal and Metro Vancouver are the only entities that manage their own air quality monitoring networks? These innovative entities had taken responsibility for the monitoring of air quality on their territories before the provinces adopted legislation in this regard. The RSQA ensures that it complies with the NAPS Program guidelines on air quality monitoring in order to provide the population with reliable data.



## Equipment

In 2019, the number of air quality monitoring stations decreased to 14 with the closing of station 7. The renovations and redevelopment of the Chénier Arena property no longer allowed the station to pursue its activities on that site. In the fall, the instruments were transferred less than 2 km away, to station 6-Anjou, located at 7650 Châteauneuf Blvd. (see station 6 topo p.9).

These 14 monitoring stations are equipped with continuous analyzers and samplers to intermittently measure air pollutants. The data obtained are then subjected to a stringent validation process. Some of the samples are sent to the Ville de Montréal's laboratory (VOC polar, anions and metals) while others are sent to the ECCC's laboratory in Ottawa (VOC non polar, PAH, PM<sub>2.5</sub>). The RSQA processes a considerable number of results annually, approximately one million data, which explains why some of the results can only be made public a few months after being collected.

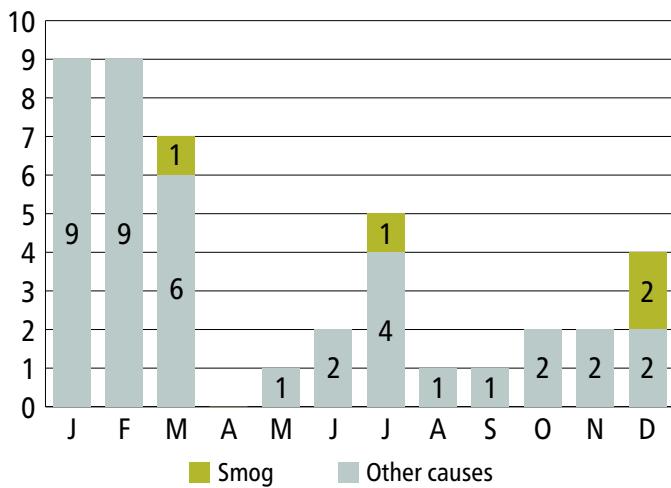


Type	Continuous analyzers	Intermittent samplers
Number	54	15
Data	Hourly	24 hrs (every 6 days)
Pollutants measured	NO <sub>x</sub> , O <sub>3</sub> , SO <sub>2</sub> , CO, PM <sub>2.5</sub> , PM <sub>10</sub> , TPM, VOC (BTEX), EC	VOC (polar and non polar), PAH, PM <sub>2.5</sub> , PM <sub>10</sub> , TPM, metals, anions
Number of annual data	Almost 1 million	Almost 100,000

# Portrait of Air Quality

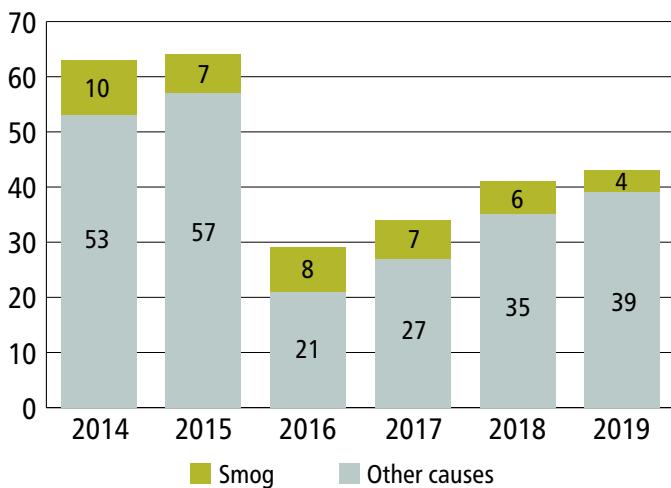
A total of 43 days of poor air quality were recorded in 2019, of which 4 smog days were identified. As was the case in 2018, fine particles were responsible for all the poor air quality days distributed over 11 months during the year. However, the greatest number of poor air quality days were observed in the months of January, February and March.

Poor air quality days by month in Montréal in 2019



The number of smog days has been declining since 2014, whereas the number of poor air quality days has been increasing in Montréal since 2016. A study published in 2019 has shown that fine particle pollution levels have increased by 5.5% from 2016 to 2018 due to the smoke of forest fires, a growing economy and the lax application of the *Clean Air Act*<sup>1</sup>. Given that the air knows no boundaries, this increase has had an impact on the concentrations observed in Montréal, which may partially explain the increase in fine particles observed since 2016.

Poor air quality days in Montréal by year since 2014



<sup>1</sup> Karen Clay and Nicholas Z. Muller. Recent Increases in Air Pollution: Evidence and Implications for Mortality. NBER Working Paper No. 26381, October 2019.  
<https://www.nber.org/papers/w26381>.

### **What is a poor air quality day?**

Based on established criteria, a day is deemed poor in terms of air quality as soon as fine particulate matter concentrations ( $\text{PM}_{2.5}$ ) exceed  $35 \mu\text{g}/\text{m}^3$  for at least 3 hours in a given station. A poor air quality day is characterized as a smog day when concentrations of  $\text{PM}_{2.5}$  exceed  $5 \mu\text{g}/\text{m}^3$  during at least 3 hours over more than 5% of the agglomeration's territory. During a smog day, concentrations of  $\text{PM}_{2.5}$  generally remain high for 24 hours and sometimes longer.

## **Air Quality Index (AQI)**

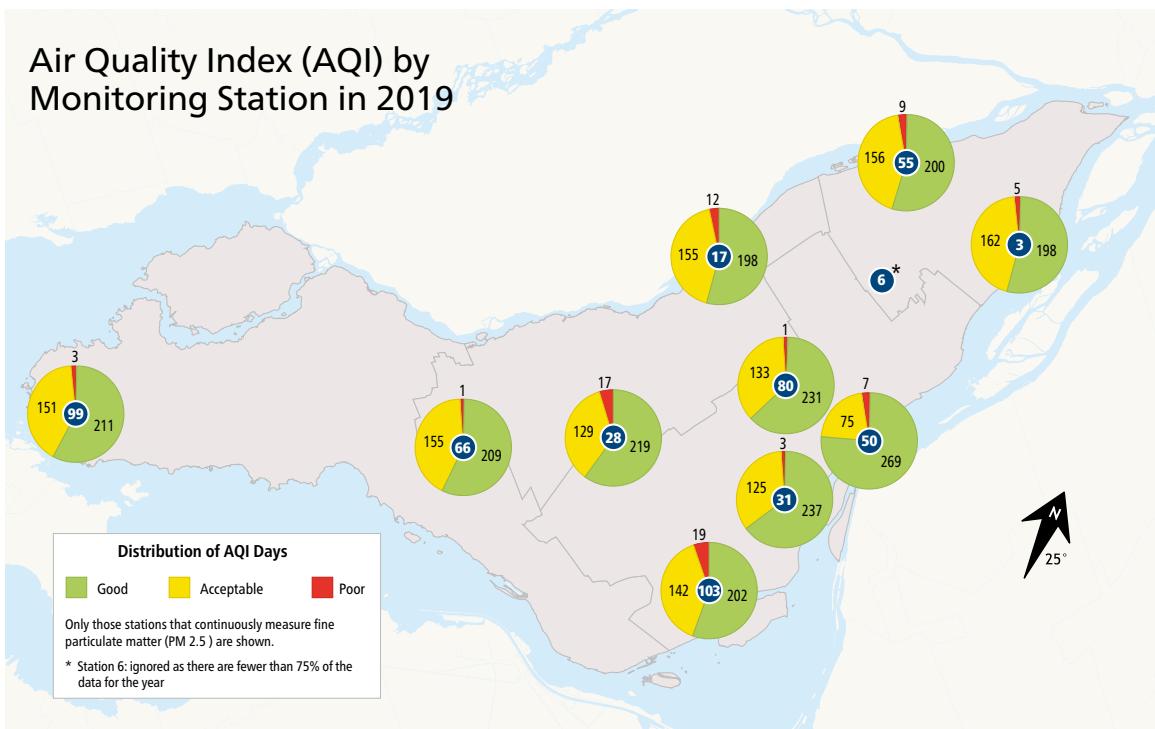
Ville de Montréal measures air quality using a numerical value called the "air quality index (AQI)". The value of 50 of this index is attributed to the upper limit acceptable for each of the pollutants measured. The hourly index that is posted is the greatest value of the sub-indices calculated for each of the five pollutants subjected to continuous monitoring in the RSQA stations.

The value of the index is defined as follows	
 Good	1 to 25
 Acceptable	26 to 50
 Poor	51 or more

The index is calculated using the following formula:  $\text{Index} = (\text{measure} / \text{standard or AQI value}^*) \times 50$   
The calculation is based on the following schedule:

Pollutant	Type of measure	Standard	AQI value*
Sulphur dioxide ( $\text{SO}_2$ )	10-minute moving average	-	$500 \mu\text{g}/\text{m}^3$
Carbon monoxide (CO)	Hourly	$35 \text{ mg}/\text{m}^3$	-
Ozone ( $\text{O}_3$ )	Hourly	$160 \mu\text{g}/\text{m}^3$	-
Nitrogen dioxide ( $\text{NO}_2$ )	Hourly	$400 \mu\text{g}/\text{m}^3$	-
Respirable particles ( $\text{PM}_{2.5}$ )	3-hour moving average	-	$35 \mu\text{g}/\text{m}^3$

\*Reference value used to calculate the air quality index.



In 2019, in addition to the smog days, the events responsible for the poor air quality days are mainly related to traffic (Décarie Exchange and Notre-Dame Street) and the construction work associated with the Turcot Project (20 days, stations 28, 50 and 103), the Loto-Québec fireworks (1 day, station 50) and other human activities with a local scope (18 days, all stations).

# Dossier on the East End of Montréal

## Station 3 - Saint-Jean-Baptiste

The air quality in the East End of Montréal is an issue that again preoccupied Montrealers in 2019. Since its commissioning in 1989 in the park on Saint-Jean-Baptiste Blvd., monitoring station 3 has never ceased measuring atmospheric pollutants in the sector. Over the years, the measuring equipment has improved and the station's apparatus was enhanced, notably with the addition of a continuous BTEX analyzer (benzene, toluene, ethylbenzene and xylene) and the monitoring of metals which was done every 5 years and is now done annually since 2018.

Measures at station 3	
Type of analysis	Pollutants measured
Continuous	NO <sub>x</sub> , O <sub>3</sub> , SO <sub>2</sub> , PM <sub>2.5</sub> , VOC (non polar: BTEX)
Intermittent	VOC (polar and non polar), PM <sub>10</sub> , TPM, metals, anions

## Evolution 2000-2019 of the Air Quality in the East End

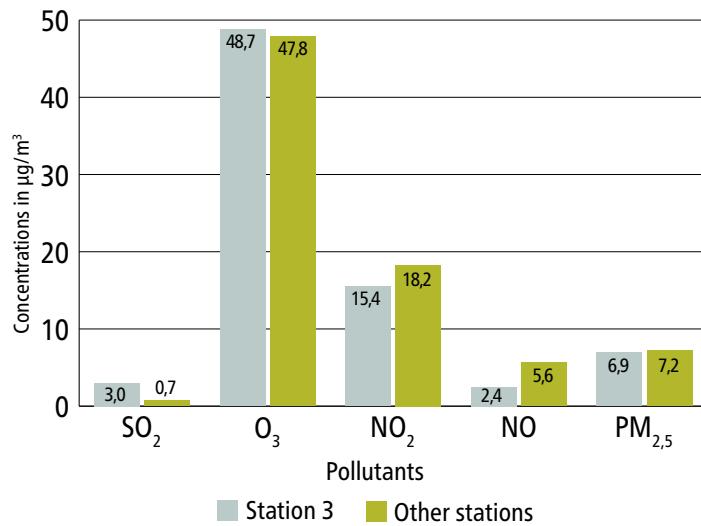
Station 3 - Saint-Jean-Baptiste Blvd. Annual concentrations (hourly averages) in µg/m <sup>3</sup>				
Pollutant	2000	2019	Evolution	
SO <sub>2</sub>	15.8	3.0	↓ 81%	
O <sub>3</sub>	38.2	48.8	↑ 28%	
NO <sub>2</sub>	28.1	15.5	↓ 45%	
NO	17.3	2.5	↓ 86%	
PM <sub>2.5</sub>	8.9	7.0	↓ 21%	

As shown in the schedule of annual concentrations for the years 2000 to 2019, the main pollutants emitted by industrial activities, wood burning and transportation, namely sulphur dioxide, nitrogen oxides and fine particles, have strongly declined, whereas ozone is on the increase. Ozone is a secondary pollutant whose formation is complex and influenced by the sun. As NO<sub>x</sub> decrease, a greater portion of radicals OH are available to react with VOCs, leading to a greater formation of ozone, which explains the increase observed.

Except for ozone, air quality greatly improved in the East End of Montréal. With respect to SO<sub>2</sub>, the number of poor air quality days due to the presence of that pollutant dropped from 13 days in 2006 to none since 2012, an indication of the effectiveness of the measures implemented to control their emissions. As far as PM<sub>2.5</sub> are concerned, a significant decline of 21% is observed. Any decrease in the ambient concentrations of that pollutant are a net gain for public health.

## Air Quality in the East End Compared to that in the Rest of the Island

Comparison of the air quality in the East End of Montréal with that in the rest of the Island



Comparison between the annual average (hourly data) recorded at station 3 and that of the other network stations.

- Sulphur dioxide ( $\text{SO}_2$ ): three stations 31, 80, 99
- Ozone ( $\text{O}_3$ ): eight stations 17, 28, 31, 55, 66, 80, 99, 103
- Nitrogen oxides ( $\text{NO}_2$  et NO): nine stations 17, 28, 31, 55, 66, 80, 99, 102, 103
- Fine particles ( $\text{PM}_{2,5}$ ): nine stations 17, 28, 31, 50, 55, 66, 80, 99, 103

As illustrated in the comparative graph of annual averages, the situation in the East End of Montréal is similar to that in the stations of the rest of the Island. The concentrations of nitrogen oxides and of fine particles are slightly lower than those measured in the other RSQA stations. The concentrations of ozone and of sulphur dioxide are a little higher at station 3 compared to the other stations. However, ozone concentrations are inter-related with those of nitrogen oxides. Consequently, given that the latter are lower at station 3, the quantity of ozone is more important.

Despite a drop of 81% in  $\text{SO}_2$  from 2000 to 2019, the results indicate that concentrations of this pollutant are still three times greater in the East End than in the rest of the Island. However, it needs to be said that their levels are very low (traces) and are close to the detection limit of the  $2.6 \mu\text{g}/\text{m}^3$  apparatus.

## And What About Arsenic?

In 2019, arsenic was the subject of many articles in the media. The measuring of metals is done on particles of a size smaller than 10 µm collected on filters over 24 hrs. The sources of arsenic in the ambient air are industrial activities, the incineration of waste and the use of fossil fuels. However, at the onset, arsenic is a chemical element naturally present in the environment. At station 3, the annual average of arsenic concentrations in 2019 was of 0.50 ng/m<sup>3</sup>, similar to the average recorded in the previous year (0.45 ng/m<sup>3</sup>).

In response to the recommendations of a notice by the Direction générale de la santé publique (DRSP) published in September 2018 on arsenic emissions by Glencore Canada Corporation's (CCR) copper refinery, the establishment now measures arsenic concentrations in its own three air quality monitoring stations. These measures are then forwarded to the DRSP in order to enable it to produce a new notice. It is worthwhile mentioning that the 2018 notice indicated that the arsenic concentrations measured and modeled in the sectors neighboring the refinery were too low for any health effects related to an environmental exposition to arsenic to be observed among the people living near by.

## Station 6 - Anjou

Station 6 located on the roof of Fire station 28 in Anjou was commissioned back in 1983. Analyses are still conducted over a period of 24 hours every 6 days by high flow samplers. Following the closure of station 7-Chénier, its continuous monitoring instruments were transferred to the Anjou station in the fall of 2019. Toward this end, the additional equipment required the complete renovation of an aedicule installed on its roof. PM<sub>10</sub> and VOC analyses were also added. The results for O<sub>3</sub>, NO<sub>x</sub>, SO<sub>2</sub> and PM<sub>2.5</sub> are available in real time on the [RSQA's Web site](#).



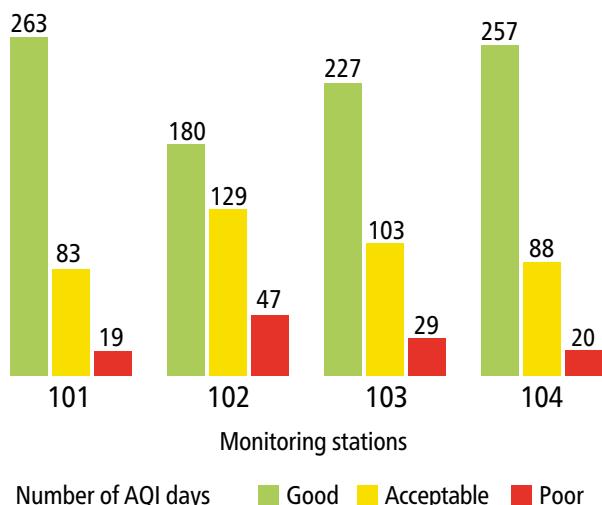
# Turcot Project

The monitoring of air quality within the framework of the Turcot Interchange project continued throughout the year. In 2019, average daily concentrations of fine particulate matter ( $\text{PM}_{2.5}$ ) exceeded the standard of  $30 \mu\text{g}/\text{m}^3$  set by the *Ministère de l'Environnement et de la Lutte aux changements climatiques* (MELCC) on only five occasions at station 102, compared to 7 in 2018. An improvement was also observed in all other stations.

Exceedances of the Standard for Fine Particulate Matter ( $\text{PM}_{2.5}$ )				
Stations	101	102	103	104
Total 2016	1	13	1	3
Total 2017	0	4	0	1
Total 2018	2	7	2	3
Total 2019	1	5	1	0

In 2019, the milestones were related to the dismantlement of the last infrastructures, the installation of the final beams and the progressive reopening of many sections of the Interchange. Although work is still ongoing in the vicinity of the stations, the work site is declining in intensity and is reaching the end, as shown in the lower results.

Air Quality Index (AQI) by Turcot Project Monitoring Station in 2019



The data are available online on the Web site of the *Ministère des Transports* (MTQ) at [seti-media.com/infopopulation/rsqa\\_turcot](http://seti-media.com/infopopulation/rsqa_turcot).

# Wood Burning By-Law



The By-law concerning solid fuel-burning devices and fireplaces (15–069), which entered into force on August 24, 2015, prohibited the use of any solid fuel burning device on the territory of Ville de Montréal during smog alerts. However, it is only since October 1, 2018 that the second part of the By-law entered into force, that part forbidding the use of any solid fuel device on the territory of Ville de Montréal, except for devices recognized by an organization identified in the Attachment of the By-law, within a certification process (CSA/B415.1-10 or EPA) confirming that it emits no more than 2.5 g/hr of particles in the atmosphere.

Since the complete entry into force of the By-law on October 1, 2018, Ville de Montréal has ensured a follow-up of complaints and reported cases on the 311 call line and conducted the inspections required. In cases of non-compliance, the City sends notices of infraction and may prosecute offenders.

# Canadian Ambient Air Quality Standards

Within the framework of the following comparative exercise, the averages are obtained by using the data of all RSQA stations. The Canadian ambient air quality standards (CAAQS) are used for reference purposes only. Since 2017, the CAAQS deal with fine particulate matter ( $PM_{2.5}$ ), ozone ( $O_3$ ), sulphur dioxide ( $SO_2$ ) and nitrogen dioxide ( $NO_2$ ). These standards are the core of the Air Quality Management System (AQMS) promoted by the Canadian Council of Ministers of the Environment. These data are presented in micrograms per cubic metre ( $\mu g/m^3$ ) or parts per billion (ppb).

Since 2013, an improvement in  $PM_{2.5}$  concentrations has been observed in Montréal's ambient air. The situation is similar to last year and the results are below the standards to be attained by 2020.

Fine Particulate Matter ( $PM_{2.5}$ ) Concentrations Expressed in $\mu g/m^3$				
3-year average of the annual 98 <sup>th</sup> percentile of the daily 24-hour average concentrations Canadian standard = 28 in 2015 and 27 in 2020				
2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
24	21	20	20	20

3-year average of the annual average concentrations Canadian standard = 10 in 2015 and 8.8 in 2020				
2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
9.4	8.6	7.5	7.4	7.4

The recorded concentrations of ozone are lower than the Canadian standard for 2020. The trend is stable with 3-year averages fluctuating between 55 and 58 ppb between 2013 and 2019.

Ozone ( $O_3$ ) Concentrations Expressed in ppb				
3-year average of the annual 4 <sup>th</sup> highest daily maximum 8-hour average concentrations Canadian standard = 63 in 2015 and 62 in 2020				
2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
55	56	58	57	55

Over the past 5 years, there has been an improvement in  $SO_2$  results. The concentrations of the two CAAQS are compliant with the 2020 standards and there has been little or no variation since the preceding year.

### Sulphur Dioxide (SO<sub>2</sub>) Concentrations Expressed in ppb

3-year average of the annual 99<sup>th</sup> percentile of the daily maximum 1-hour average concentrations  
 Canadian standard = 70 in 2020 and 65 in 2025

2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
23	21	18	17	17

Arithmetic average over a single calendar year of all 1-hour average concentrations  
 Canadian standard = 5.0 in 2020 and 4.0 in 2025

2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
0.9	0.7	0.8	0.6	0.5

The 3-year averages for NO<sub>2</sub> were stable between 2013 and 2019. The concentrations recorded in 2017-2019, i.e. 46 ppb, were far below the Canadian standard for 2020, but just above the 2025 standard (42 ppb). And as far as the annual average is concerned, it complies with the 2020 and 2025 standards. A slight decline in NO<sub>2</sub> concentrations in the atmosphere was observed in 2019.

### Nitrogen dioxide (NO<sub>2</sub>) Concentrations Expressed in ppb

3-year average of the annual 98<sup>th</sup> percentile of the daily maximum 1-hour average concentrations  
 Canadian standard = 60 in 2020 and 42 in 2025

2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
46	45	45	45	46

Arithmetic average over a single calendar year of all 1-hour average concentrations  
 Canadian standard = 17 in 2020 and 12 in 2025

2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
8.4	10.0	10.3	10.4	9.1

# Outreach

# Awareness-Raising

Awareness-raising is a core priority of the Service de l'environnement. In 2019, the members of the RSQA team were invited to participate in two public meetings on air quality in the East End of Montréal (February and August). During the meetings, citizens were able to share their preoccupations and ask their questions relative to air quality. The RSQA's Web site was also presented and its content explained in order to enhance the sharing of information.

In 2019, the RSQA Web site hosted 48,000 visitors and the month of July was the busiest (6,586 views).

Also, during the year, two groups of citizens were able to visit some of the monitoring stations of the network and see for themselves the equipment and the tasks accomplished by the RSOA's technical staff.

# Conferences



The RSQA was involved in many conferences in 2019. For instance, the RSQA was invited to a panel discussion entitled *La nouvelle bataille de l'air* on the occasion of the prestigious Americana conference held in March 2019.

Also, the RSQA gave a presentation during the "Santé et qualité de l'air – Enjeu de société majeur" conference organized by the Association pour la prévention de la contamination de l'air et du sol (APCAS), the Quebec chapter of the *Air & Waste Management Association* (AWMA).

The RSQA was also part of the organizing committee of the AWMA's 112<sup>th</sup> annual conference entitled "Winds of change: Environment, Energy & Health" held in Quebec City in June 2019. This event attracted a majority of the world's leading experts in air quality. It provided a forum for the exchange of information while affording an opportunity to enhance our knowledge in order to offer durable solutions to environmental issues. This was the very first time that the conference was held in Quebec. The RSQA co-chaired two technical sessions on air quality entitled "*Air quality monitoring: challenges and innovations PART I & II*". It presented the results of an analysis of elemental carbon at station 55 - Rivières-des-Prairies, strongly influenced by wood heating.

The RSQA was also involved in the planning of a professional development workshop for women. This workshop broached various subjects such as gender discrimination, raising awareness relative to mental health problems in order to combat stigma, work-family balance and women in science following the #MeToo movement. All of these events were highly successful and the conference was awarded the *2019 Event of the year* prize by the Québec City's Ambassador Club.

# Overview

## COVID-19: Impact of the Confinement on Air Quality

The RSQA continues to put its expertise to work for citizens by monitoring the quality of the air during the confinement episode brought about by the COVID-19 pandemic.

This analysis of the confinement on air quality is done on three levels by using the data provided by the RSQA:

- At the ECCC level: exploitation of the data for all of Canada by the NAPS Program in order to exploit and publish data at the national level.
- At the MELCC level: creation of a Web page that includes the evolution of NO<sub>2</sub> at the level of the Province of Québec.
- At the RSQA level: global exploitation (Island of Montréal) and fine exploitation (monitoring stations 3, 28 and 99) published on the Web site. The pollutants studied are: NO<sub>2</sub>, fine particulate matter and ozone. The period covered runs from March 16 (beginning of the confinement) to April 13 inclusively (beginning of the cleaning of streets). The analysis is available on the Web site at [rsqa.qc.ca](http://rsqa.qc.ca).

The confinement's impact on the air quality of the Agglomeration of Montréal is positive. A reduction in air pollution has been observed for the confinement period under review, i.e. from March 16 to April 13, 2020, inclusively. The overall result can be summarized as follows:

- The average air quality index (AQI) for the different years over the same period is "good" (AQI ≤ 25). However, an improvement of 10% during the confinement is observed for the AQI of 2020, compared to 2017-2019.
- An absence of poor air quality days in 2020, whereas for the same period, the average number of days varies historically between 1 and 8.
- A significant decrease in nitrogen dioxide (NO<sub>2</sub>) and fine particles (PM<sub>2.5</sub>), both of which are pollutants whose major source of emissions is transportation.
- Concentrations of ozone (O<sub>3</sub>), a secondary pollutant, have slightly risen. Indeed, ozone is formed under warm and sunny conditions owing to chemical reactions between nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOC), caused by strong road traffic density.

An improvement in air quality has come about through changes in our individual and collective practices. The confinement period provides evidence to that effect.

# Coming in 2020

The RSQA measures ambient air quality according to a well established sampling program and maintains standards of the highest quality. Certain novelties will be deployed shortly in the network:

- the introduction of continuous monitoring instruments for hydrogen sulfide ( $H_2S$ );
- the introduction of continuous monitoring instruments for ultrafine particles (UFP) or nanoparticles ( $\leq 0.1 \mu m$  in diameter);
- the introduction of metal analyses on filters of  $PM_{10}$  at 2 stations on a permanent basis.

## Production

Ville de Montréal

Service de l'environnement

Division du contrôle des rejets et suivi environnemental

Réseau de surveillance de la qualité de l'air (RSQA)

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