2023

AIR QUALITY MONITORING RESULTS

New Nouveau Brunswick

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2023 Air Quality Monitoring Results

Department of Environment and Local Government
Province of New Brunswick

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Introduction

New Brunswickers enjoy clean and healthy air, compared to many other parts of the world. Clean air is not something we can take for granted. In New Brunswick, the Department of Environment and Local Government (DELG) works to monitor, protect, and enhance the quality of our outdoor air.

The better we understand our air quality, the more we can do to safeguard and improve it. This report provides information about the quality of our outdoor air in 2023 and follows a series of annual reports dating back to 1996, when New Brunswick's *Clean Air Act* was introduced. It includes data from New Brunswick's ambient air quality monitoring network, information and analyses to help describe the current state of New Brunswick's air quality, as well as recent trends.

TIMELY REPORTING

Real-time air quality data, and information in between annual report publications, is available through the following provincial and federal resources:

Real-Time Air Quality Data Portal | *www.elgegl.gnb.ca/AirNB*

New Brunswick operates an online Air Quality Data Portal that provides access to today's hourly monitoring results at each of the provincially- and industry- operated monitoring stations. Results are updated automatically every hour at each monitoring station in the province. This data helps the public to manage their individual health risks in real-time.

Air Quality Health Index | *www.airhealth.ca*

The Air Quality Health Index (AQHI) was designed by Health Canada to help communicate air quality information. It converts air quality data for key air pollutants into a single number. New Brunswick shares its air quality data with Health Canada to allow them to calculate hourly AQHI values for New Brunswick. Health Canada also works with Environment and Climate Change Canada to generate AQHI forecasts and provides health-related messaging to accompany the AQHI values. This helps to describe what the numbers mean in terms of health risks, and how best to respond to those risks to avoid health problems.

AQHI values are updated every hour, and forecasts are issued daily.

Public Advisories | *www.gnb.ca* and *www.weather.gc.ca*

Air quality data and pollution forecasts are continually monitored by the federal and provincial government. Whenever air quality objectives are exceeded or are forecasted to be exceeded, advisories are issued by federal and provincial agencies to the media to share with the public. These notices include health-related messaging to advise at-risk groups about the level of risk and appropriate precautions that they should take.

Understanding Air Pollution

Air quality is constantly changing. It is affected by a wide variety of factors, including the weather, long range movements of air from other parts of the world, natural events, industry cycles, and other human activities.

Air pollution can cause a wide range of environmental and health impacts. It is particularly problematic for children, the elderly, and people with respiratory or heart problems. It can also impact visibility (haze), crop production, cause harm to forests, fish and wildlife, and alter the quality of our waterbodies and drinking water. Some air contaminants can also affect paints and sealants, which can reduce the lifespan of buildings and other infrastructure. Air pollutants may also cause nuisance issues that affect our comfort and well-being, such as excessive dust and odours.

Some of the more common air pollutants include:

- Carbon monoxide (CO)
- Fine particulate matter ($PM_{2.5}$)
- Ground level ozone (O_3)
- Hydrogen sulphide (H_2S)
- Nitrogen dioxide (NO_2)
- Sulphur dioxide (SO_2)
- Volatile organic compounds (VOC)

Additional information about the sources and effects of key air pollutants is provided in *An Introduction to Air Quality in New Brunswick (ISBN 978-1-4605-3080-1)*, which is available on the DELG website.

Air Quality Monitoring in New Brunswick

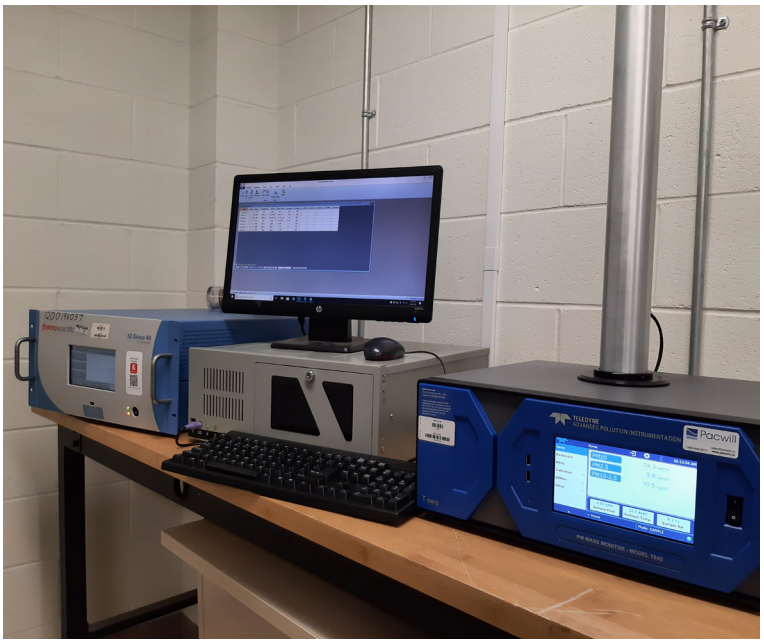
Air quality is determined through monitoring of the "ambient air". That is, the normal outdoor air that is available for use by people and the environment. This is different from emissions monitoring (i.e., determining how much pollution is coming from a smokestack) and indoor air quality monitoring. Ambient monitoring is conducted out in the community, and the results are intended to be representative of the outdoor air we breathe.
New Brunswick has an extensive network of ambient air quality monitoring stations that collect data continuously, year-round.

A COOPERATIVE APPROACH

Air quality monitoring in New Brunswick is a partnership between the federal and provincial government.
The Federal Government provides DELG with monitoring equipment and a centralized national database for the air quality information collected. DELG deploys and maintains the equipment, operates stations, performs necessary calibrations, and ensures that the data is accurate. The operators of large industrial facilities are also required to participate in air quality monitoring as a condition of regulatory approval under the *Clean Air Act.*

2023 NETWORK STATUS

8	DELG stations
26	Industry stations
2	Joint stations
36	Total stations
43	DELG monitors
48	Industry monitors
91	Total monitors



Air Quality Monitoring Equipment: An Ozone (O_3) Monitor (left) and a Particulate Matter Monitor ($PM_{2.5}$) (right)

Air Quality Monitoring Station (Bathurst)

DATA QUALITY ASSURANCE

Environment and Climate Change Canada plays an oversight role to ensure that DELG monitors are appropriately maintained, and data is accurate. Similarly, DELG checks and audits the industry-run stations to ensure the accuracy of their data. Data quality problems are rare, but when issues do occur, they are addressed immediately.

STATION LOCATIONS

Station sites and locations are selected based on several factors, including geography, population distribution, and the locations and types of major industrial emitters. Because of this, some areas of the province have more coverage than others, and some areas are not monitored.

A station location map is provided below. Detailed maps and a full inventory of pollutants monitored at each station are available in *Air Quality Monitoring Results - Supplementary Data 2023* available on the DELG web page.

NETWORK CHANGES

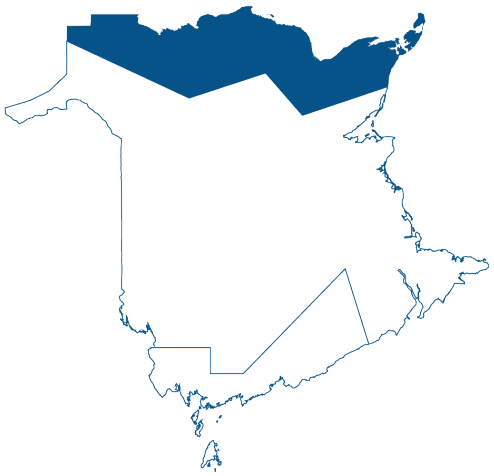
While air quality monitoring in New Brunswick relies on a relatively static network, sometimes changes are required to implement new technology, reallocate resources, or increase monitoring capacities.

In 2023, within the provincial air quality network, a meteorological monitoring tower was added to the Moncton, Thanet Street station. There were no changes within the industry-run monitoring network.

As previously reported in the 2022 Air Quality Monitoring Results Report, DELG also began converting the necessary climate control technology within its stations to ductless air-to-air heat pump systems. Ambient air quality monitoring stations have previously relied on electric baseboard heating paired with through-the-wall air conditioning units for climate control. In 2023, conversions were completed at an additional two stations.

Provincial Air Zones

New Brunswick has been separated into three “Air Zones”, which are geographic areas that have different air quality profiles and challenges. These zones help to guide management actions by highlighting regional issues and opportunities.



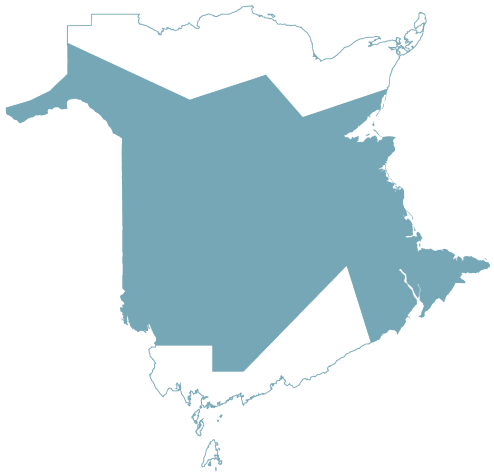
NORTHERN AIR ZONE

The northern air zone includes New Brunswick’s northern coastline and most of the province’s border with Quebec. The area is largely rural but contains many towns and villages. The largest community is Bathurst, with a population of approximately 12,000.

Because there are no major urban centers in the northern air zone, it does not experience many of the air quality issues associated with big cities, such as smog from heavy traffic.

The air zone is home to major industrial emitters in Atholville (AV Group Pulp Mill) and Belledune (NB Power Belledune Generating Station). These facilities emit a variety of air contaminants including sulphur dioxide, nitrogen dioxide, and fine particulate matter, which can impact air quality in nearby communities and the broader region. The NB Power Belledune Generating Station is currently New Brunswick’s second largest sulphur dioxide emitter.

Industry-run air quality monitoring stations operate in Atholville and Belledune and a DELG station operates in Bathurst, the zone’s largest population center.

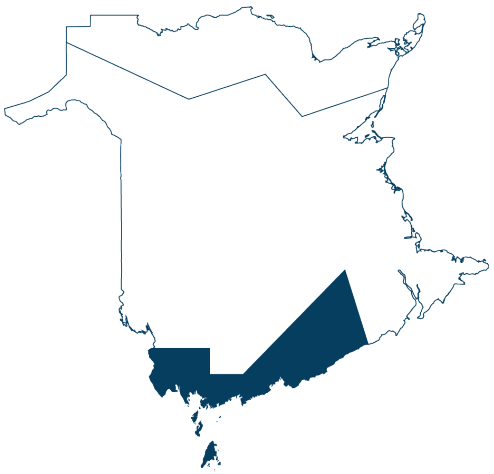


CENTRAL AIR ZONE

The central air zone is the largest of the three provincial air zones. It includes five major population centers: Moncton, Dieppe, Fredericton, Miramichi, and Edmundston. The largest of these is Moncton, with a population of approximately 79,000. These cities can experience air quality issues typical of those experienced in larger urban centers – such as the combined impact from vehicles, homes, businesses, etc.

There are several major emitters in this area, including the AV Group pulp mill in Nackawic, Twin Rivers Paper Company pulp mill in Edmundston, and the Arbec Forest Products oriented strand board mill in Miramichi. Emissions from these facilities can include sulphur dioxide, nitrogen dioxide, fine particulate matter, reduced sulphur compounds, and volatile organic compounds. These facilities can impact air quality at both the local and regional scale.

DELG monitoring stations operate in Moncton, Fredericton, Miramichi, and Edmundston to provide coverage to these major population centers. Industry-run stations operate in Edmundston, Nackawic, and Miramichi.



SOUTHERN AIR ZONE

The southern air zone includes a large portion of New Brunswick's southern coastline along the Bay of Fundy and borders the State of Maine in the west. It is home to the City of Saint John, the province's second largest city with a population of approximately 71,000.

The City of Saint John is a major industrial center for the province. It hosts a variety of industrial emitters, including the Irving Oil Ltd. refinery, the Irving Pulp and Paper Ltd. mill, and the Irving Paper Ltd. mill. The city also experiences air quality impacts from ship traffic via its active industrial port and its cruise ship terminal. Together, these sources emit fine particulates, sulphur dioxide, nitrogen dioxide, reduced sulphur compounds, and volatile organic compounds. The air zone is also impacted by J.D. Irving Ltd.'s Lake Utopia Paper mill and New Brunswick's largest sulphur dioxide emitter, the NB Power Coleson Cove Generating Station.

Air quality in the City of Saint John and the surrounding region is the most monitored in the province. The city is home to 12 air quality monitoring stations. Notably, two stations in the city include routine monitoring for volatile organic compounds due to the presence of the oil refinery and associated infrastructure and industries. Additional industry-run stations operate near the Coleson Cove generating station, and the J.D. Irving Ltd. paper mill in the Utopia area of Eastern Charlotte.

DELG also operates a station in Saint Andrews as a means of tracking contaminants at a location without large nearby emitters. It provides a point of comparison for other stations in the network. It also helps track the influence of pollution from other parts of the world on New Brunswick's air.

COMMON AIR QUALITY CHALLENGES

In addition to the impacts from major emitters, all New Brunswick air zones experience local scale air quality impacts from various smaller industrial and commercial emitters (e.g. fish plants, commercial boilers, pits and quarries, paint shops, etc.).

New Brunswick's large, forested areas can generate pollen events during warmer seasons, and are also vulnerable to forest fires. Both can impact air quality at the local and regional scale.

Smoke from wood burning for residential heat can result in air quality impacts during the colder seasons. Similarly, outdoor burning (e.g. campfires) in the summer months can affect local air quality.

All New Brunswick air zones receive long range pollutants (such as fine particulate matter and ozone) from other parts of the world.

THE PROVINCIAL AIR QUALITY MONITORING NETWORK NORTHERN AIR ZONE (2023)

JACQUET RIVER

STATION NAME	OPERATOR
Jacquet River	NB Power, Belledune Generating Station

BELLEDUNE

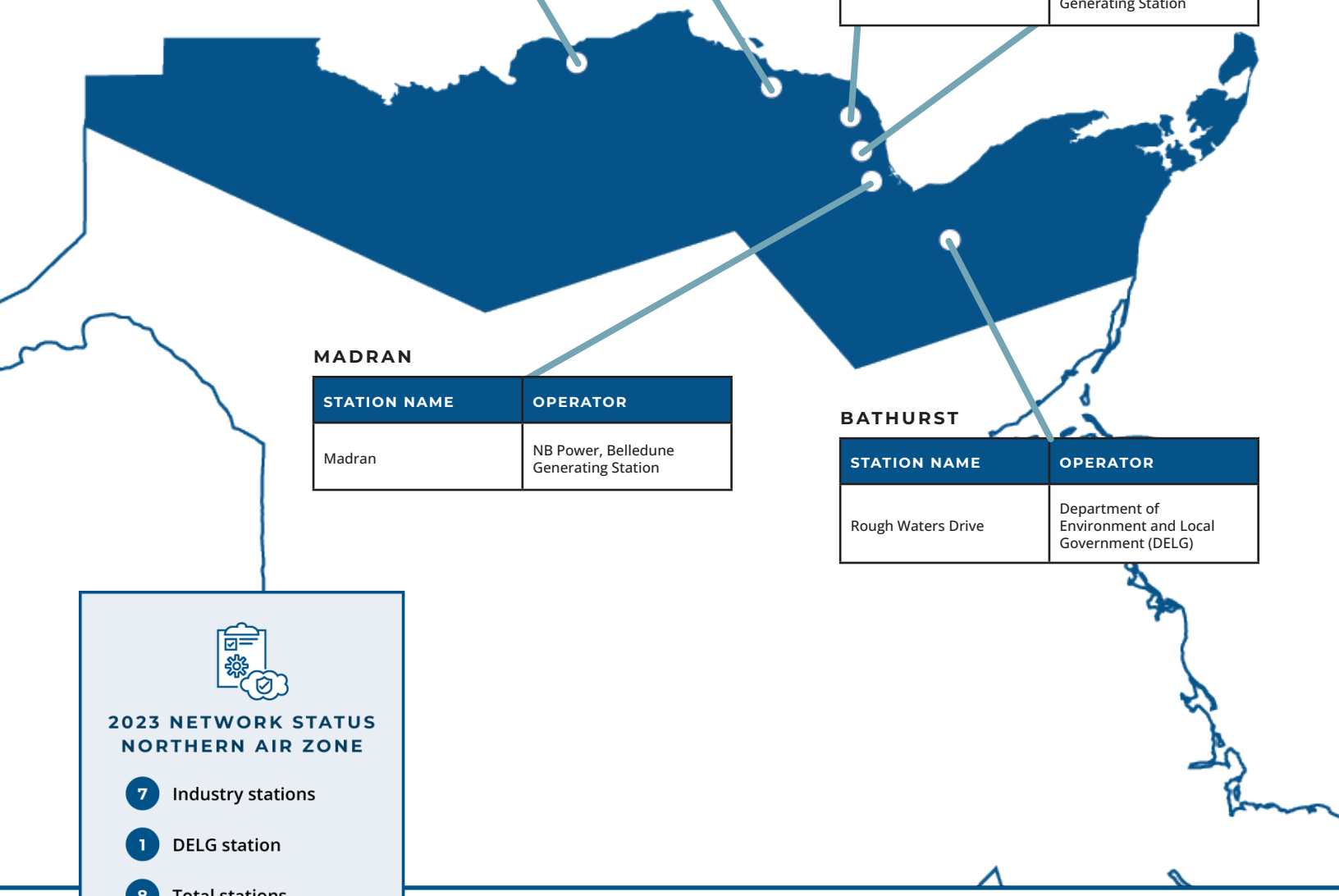
STATION NAME	OPERATOR
Belledune East	NB Power, Belledune Generating Station
Municipal Hall	NB Power, Belledune Generating Station

ATHOLVILLE

STATION NAME	OPERATOR
Beauvista	AV Group NB, Atholville Mill
Boom Road	AV Group NB, Atholville Mill

POINTE-VERTE

STATION NAME	OPERATOR
Pointe-Verte	NB Power, Belledune Generating Station



MADRAN

STATION NAME	OPERATOR
Madran	NB Power, Belledune Generating Station

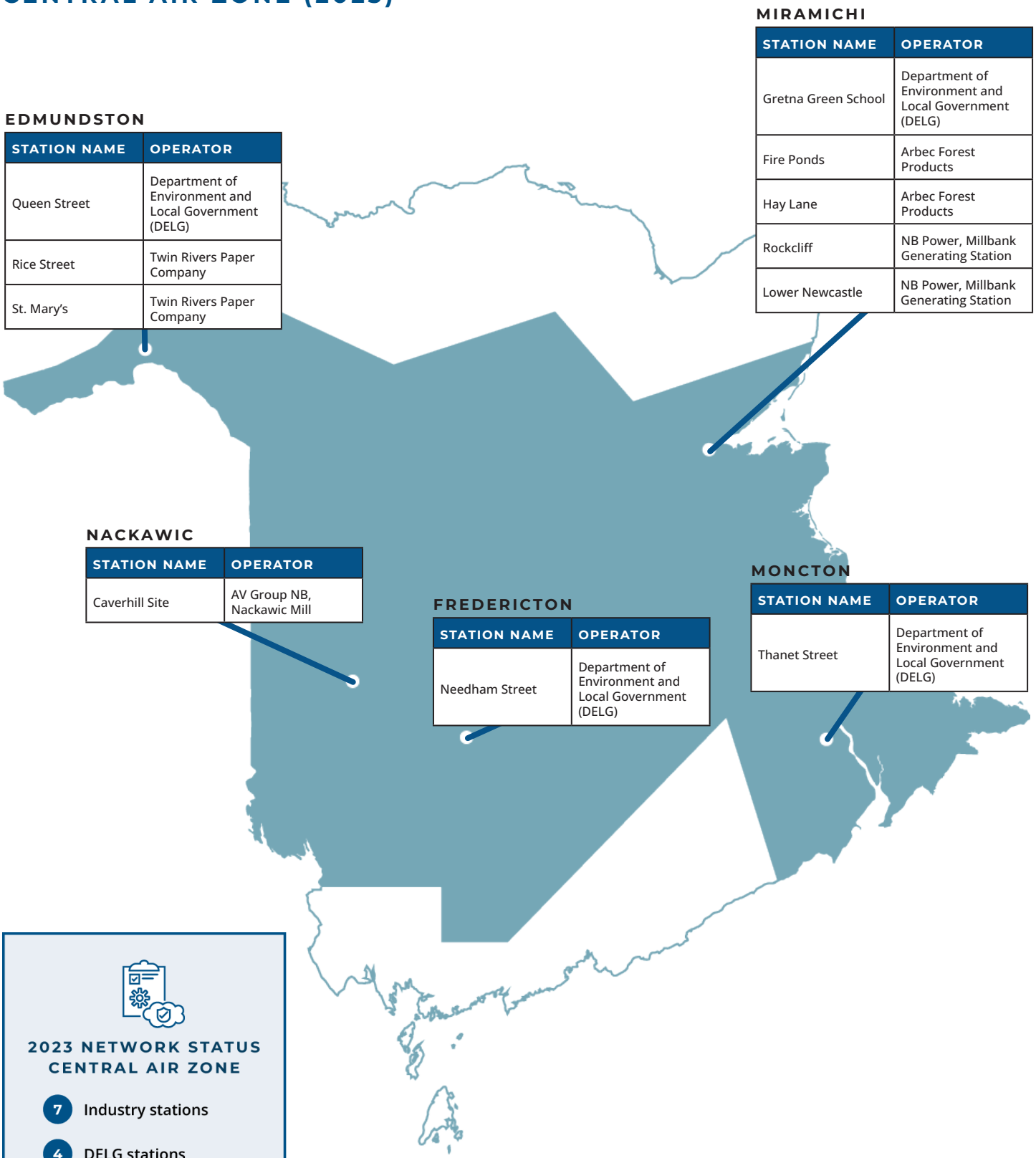
BATHURST

STATION NAME	OPERATOR
Rough Waters Drive	Department of Environment and Local Government (DELG)

2023 NETWORK STATUS NORTHERN AIR ZONE

- 7 Industry stations
- 1 DELG station
- 8 Total stations

THE PROVINCIAL AIR QUALITY MONITORING NETWORK CENTRAL AIR ZONE (2023)



EDMUNDSTON

STATION NAME	OPERATOR
Queen Street	Department of Environment and Local Government (DELG)
Rice Street	Twin Rivers Paper Company
St. Mary's	Twin Rivers Paper Company

MIRAMICHI

STATION NAME	OPERATOR
Gretna Green School	Department of Environment and Local Government (DELG)
Fire Ponds	Arbec Forest Products
Hay Lane	Arbec Forest Products
Rockcliff	NB Power, Millbank Generating Station
Lower Newcastle	NB Power, Millbank Generating Station

NACKAWIC

STATION NAME	OPERATOR
Caverhill Site	AV Group NB, Nackawic Mill

FREDERICTON

STATION NAME	OPERATOR
Needham Street	Department of Environment and Local Government (DELG)

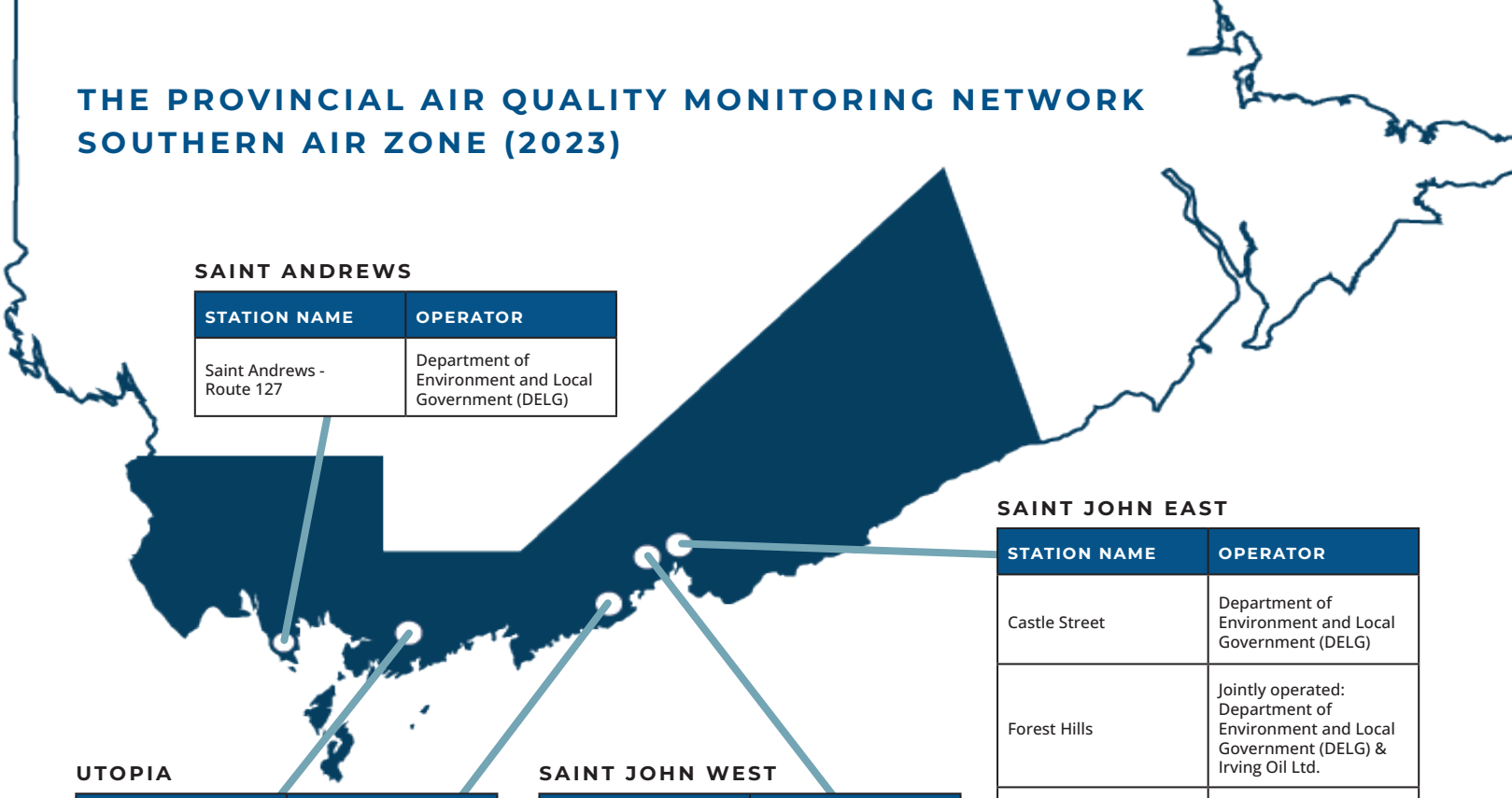
MONCTON

STATION NAME	OPERATOR
Thanet Street	Department of Environment and Local Government (DELG)

2023 NETWORK STATUS CENTRAL AIR ZONE

- **7** Industry stations
- **4** DELG stations
- **11** Total stations

THE PROVINCIAL AIR QUALITY MONITORING NETWORK SOUTHERN AIR ZONE (2023)



SAINT ANDREWS

STATION NAME	OPERATOR
Saint Andrews - Route 127	Department of Environment and Local Government (DELG)

SAINT JOHN EAST

STATION NAME	OPERATOR
Castle Street	Department of Environment and Local Government (DELG)
Forest Hills	Jointly operated: Department of Environment and Local Government (DELG) & Irving Oil Ltd.
Champlain Heights Elementary School	Jointly operated: Department of Environment and Local Government (DELG) & Irving Oil Ltd.
Expansion Avenue	Irving Oil Ltd.
Grandview West	Irving Oil Ltd.
Midwood	Irving Oil Ltd.
Silver Falls	Irving Oil Ltd.

UTOPIA

STATION NAME	OPERATOR
Lake Utopia Site	J.D. Irving, Ltd. – Lake Utopia Paper

SAINT JOHN WEST

STATION NAME	OPERATOR
West Side	Department of Environment and Local Government (DELG)
Saint John Street	American Iron & Metal Company
Bridge Street	Irving Pulp and Paper Ltd.
Sherbrook	Irving Pulp and Paper Ltd.
Milford	Irving Pulp and Paper Ltd.

LORNEVILLE

STATION NAME	OPERATOR
Musquash	NB Power, Coleson Cove Generating Station
Lorneville	NB Power, Coleson Cove Generating Station
Manawagonish Road	NB Power, Coleson Cove Generating Station

2023 NETWORK STATUS SOUTHERN AIR ZONE

- **12** Industry stations
- **3** DELG stations
- **2** Joint stations
- **17** Total stations

Air Quality Objectives and Standards

Air quality objectives and standards are put in place for pollutants to avoid potential impacts to the natural environment, to human health, or to avoid nuisance dust or odour.

New Brunswick has formally adopted and reports on air quality objectives for five pollutants. These are established as regulated "Maximum Permissible Ground Level Concentrations" under the authority of the *Clean Air Act.*

In addition to the provincial objectives, New Brunswick reports on four pollutants with respect to the Canadian Ambient Air Quality Standards (CAAQS). The CAAQS provide a common benchmark for air quality across Canada and have been adopted by the Canadian Council of Ministers of Environment as part of an overarching Air Quality Management System (AQMS) for Canada.

The CAAQS have been adopted in federal regulation under the *Canadian Environmental Protection Act (CEPA)* as non-binding standards. Although CAAQS compliance is not a regulated requirement in New Brunswick, the province continues to make efforts toward achievement.

The New Brunswick objectives and the CAAQS are listed in the table below.

NEW BRUNSWICK AIR QUALITY OBJECTIVES AND STANDARDS			
POLLUTANT	TYPE OF OBJECTIVE	CALCULATED STATISTIC	NUMERIC VALUE
Carbon Monoxide	Provincial	1 hour average	30 ppm
		8 hour average	13 ppm
Fine Particulate Matter	CAAQS	3-year average of daily maximum 24 hour average	27 µg/m³
		3-year average of annual averages	8.8 µg/m³
Ground Level Ozone	CAAQS	3-year average of 4th worst daily 8-hour maximum	62 ppb
Hydrogen Sulphide	Provincial	1 hour average	11 ppb
		24 hour average	3.5 ppb
Nitrogen Dioxide	Provincial	1 hour average	210 ppb
		24 hour average	105 ppb
		Annual average	52 ppb
	CAAQS	3-year average of 98th percentile daily 1-hour maximum	60 ppb
		Annual Average	17 ppb
Sulphur Dioxide	Provincial*	1 hour average	339 ppb
		24 hour average	113 ppb
		Annual Average	23 ppb
	CAAQS	3-year average of 99th percentile daily 1-hour maximum	70 ppb
		Annual Average	5 ppb
Total Suspended Particulate	Provincial	24 hour average	120 µg/m³
		Annual average	70 µg/m³

** The provincial objectives for sulphur dioxide are 50% lower (more strict) in Saint John, Charlotte, and Kings Counties.*

PROVINCIAL OBJECTIVES VS. CAAQS

As shown in the table above, some pollutants are covered by both the provincial objectives and the CAAQS. The provincial objectives and CAAQS are calculated differently, and serve different purposes.

Provincial objectives include short term averages, which makes them useful for real-time compliance monitoring. Achievement can be monitored hour-by-hour, which allows for immediate corrective actions to be taken (in response to real-time data).

In contrast, the CAAQS rely on calculations that are more complex, and their achievement can only be determined once per year. The strength of the CAAQS is in long-term air quality management and planning. They are designed to detect real changes in overall air quality, and to disregard the effects that unusual weather variations can have on monitoring results. The CAAQS also have the benefit of being comparable to calculations used in other jurisdictions like the United States of America.

Both the provincial objectives and the CAAQS share common goals of protecting human health, guiding regulatory decision-making, and informing long-term air quality planning decisions.

WHY ADOPT MORE THAN ONE OBJECTIVE FOR A POLLUTANT?

There is often more than one objective/standard for a given contaminant (e.g. an hourly objective and an annual objective). This is because most pollutants can cause more than one type of environmental or human health impact, which is primarily linked to length of exposure. Setting more than one objective ensures that the different exposure scenarios are addressed.

For example, a pollutant could cause lung irritation when people are briefly exposed to concentrations above a certain value. In this case a short-term exposure objective (e.g., 1-hour average concentration) might be established. The same contaminant could also be known to cause another type of health impact but only through constant exposure. In this case, the second impact might occur at a much lower concentration. In this case a second, long-term exposure objective, might be established (e.g., annual average concentration).

In this example, compliance with the first objective would be determined on an hour-by-hour basis. This means that there are 8,760 opportunities for compliance/exceedance each year (one for each hour of the year). However, compliance with the second objective can be determined only once per year.

Importantly, it would be possible to achieve the first objective in each of those 8,760 measurements, but still fail to meet the second objective. Similarly, it would be possible for the first objective to be exceeded many times throughout the year, but nevertheless meet the second objective. This is why it is important to have both.

CAAQS MANAGEMENT LEVELS

The AQMS provides a colour-coded “Management Level” system for grading air quality. These levels are shown below. Under the system, “green” is best, and indicative of pristine undeveloped areas. “Yellow” and “orange” are progressively poorer, and “red” (CAAQS exceedance) is worst. Generally, poorer air quality is intended to trigger more aggressive action to improve air quality. The colour-coded management levels are meant to encourage continuous improvement (toward “green” status) for all of Canada.

CANADIAN AMBIENT AIR QUALITY STANDARDS					
POLLUTANT	METRIC	MANAGEMENT LEVELS AND ASSOCIATED METRIC VALUES			
		Green Goal: Maintain "keep clean areas clean"	Yellow Goal: Prevent air quality deterioration	Orange Goal: Prevent CAAQS exceedance	Red Goal: Achieve the CAAQS
Fine Particulate Matter	Daily Maximum	0 to 10 µg/m³	11 to 19 µg/m³	20 to 27 µg/m³	> 27 µg/m³
	Annual Average	0 to 4 µg/m³	5 to 6.4 µg/m³	6.5 to 8.8 µg/m³	> 8.8 µg/m³
Ground Level Ozone	Daily 8-Hour Maximum	0 to 50 ppb	51 to 56 ppb	57 to 62 ppb	> 62 ppb
Nitrogen Dioxide	Daily 1-hour Maximum	0 to 20 ppb	21 to 31 ppb	32 to 60 ppb	> 60 ppb
		0 to 2.0 ppb	2.1 to 7.0 ppb	7.1 to 17.0 ppb	> 17.0 ppb
Sulphur Dioxide	Daily 1-hour Maximum	0 to 30 ppb	31 to 50 ppb	51 to 70 ppb	>70 ppb
	Annual Average	0 to 2.0 ppb	2.1 to 3.0 ppb	3.1 to 5.0 ppb	>5.0 ppb

For pollutants with more than one CAAQS metric (i.e., an annual and a daily metric), only one Management Level is determined, which is based on the poorer of the two calculated values.

CAAQS Achievement Versus Management Level

Some events that impact air quality, like the flow of pollution into our air zones from other parts of the world, or from forest fires, are beyond the ability of government or regulated industries to reasonably control. Nevertheless, from an environmental and human health impact perspective, these emissions are no different than any other pollution. This is why when CAAQS achievement is determined, it is based on all air quality measurements regardless of these possible events. However, when determining the CAAQS "Management Levels", the impacts from these exceptional events can be removed from the datasets, and adjustments made where appropriate. For this reason, the values calculated to determine CAAQS achievement can be different than the values calculated to determine a "Management Level".

In 2023, the management level calculations required adjustments to account for impacts from three forest fire events and one industrical fire event. However, as the calculated changes were very minor, this had no impact on the resulting management levels.

Air Zones & Management Levels

The AQMS also requires that each air zone in Canada is assigned an overall Management Level each year based on the Management Level for the "worst" monitoring station in that zone. This does not mean that air quality throughout an entire zone is represented by that colour, but rather signals the types of management actions that should be considered for the zone. Additional information about the CAAQS and AQMS are available via the CCME web site: *www.ccme.ca*

2023 Air Quality Monitoring Results

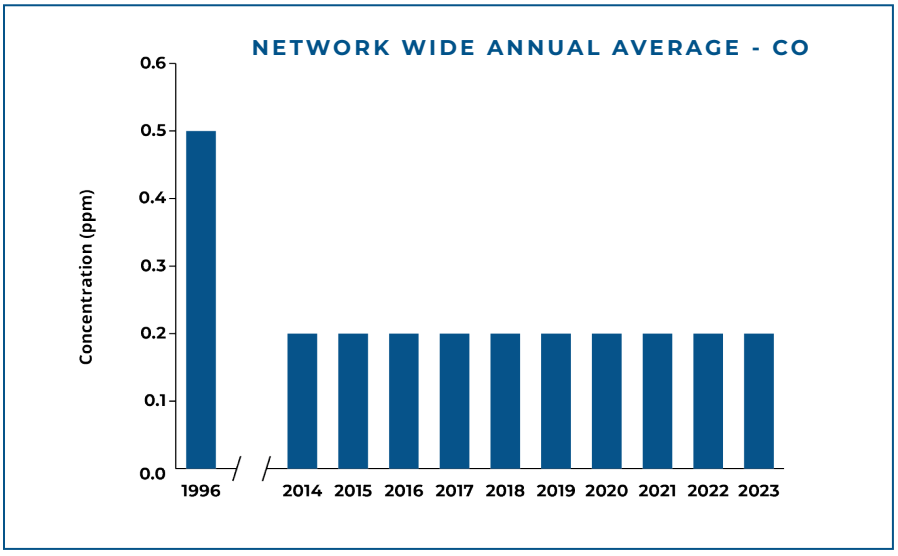
Achievement statistics with respect to the provincial air quality objectives, CAAQS, and Management Levels are provided in the charts and graphics that follow. Where exceedances are identified, discussion is also provided with respect to events and activities that caused or contributed to those results.

CARBON MONOXIDE

As indicated above, the objectives for CO concentration were achieved at both monitoring locations throughout 2023.

New Brunswick's CO objectives have been met every year since *Clean Air Act* reporting began in 1996. There has also been significant improvement in CO concentrations since that time, as reflected in the long-term trend graph below. The graph also shows that the current low levels of CO have remained stable over the past 10 years.

2023 PROVINCIAL CARBON MONOXIDE (CO) RESULTS	
STATION	PROVINCIAL OBJECTIVES COMPLIANCE (# OF EXCEEDANCE EVENTS)
Moncton, Thanet Street	0
Saint John, Castle Street	0



The number and location of sampling stations has varied throughout the period represented.

CARBON MONOXIDE LONG-TERM TREND

CO levels are primarily driven by the incomplete/inefficient combustion of fuels. As most combustion sources (automobiles in particular) have continued to improve in efficiency over the years, CO has become less of a concern in New Brunswick communities. This is reflected both in the long-term trend, and in the reduction in monitoring effort for this contaminant.

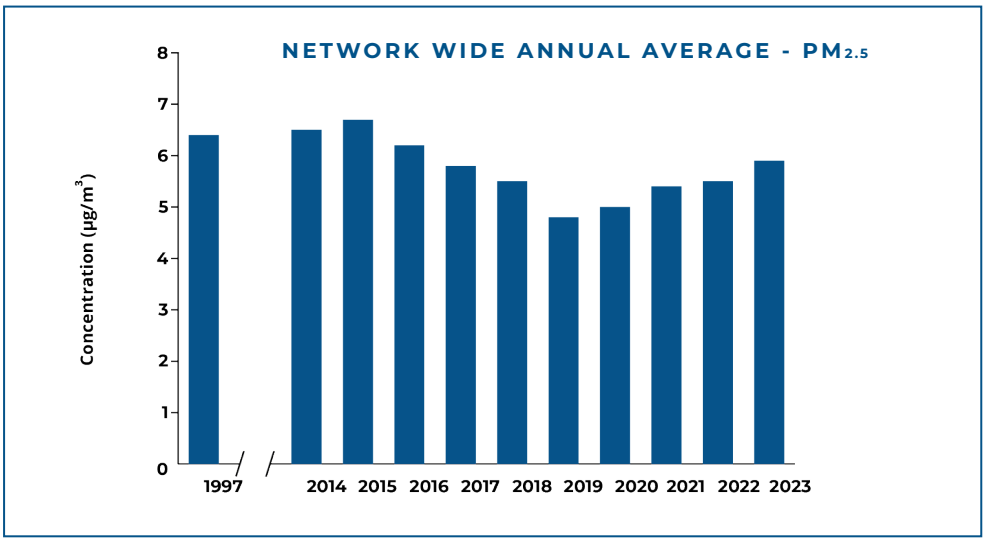
FINE PARTICULATE MATTER

2023 FINE PARTICULATE MATTER ($PM_{2.5}$) MONITORING RESULTS					
AIR ZONE	STATION	CAAQS		STATION MANAGEMENT LEVEL	AIR ZONE MANAGEMENT LEVEL
		Daily (Limit: 27 µg/m³)	Annual (Limit: 8.8 µg/m³)		
Northern	Bathurst, Rough Waters Drive	14	5.5	Yellow	**Yellow** The northern air zone was assigned a "Yellow Management Level" based on the level assigned at Bathurst, Rough Waters Drive.
	Belledune, East	13	4.7	Yellow	
	Belledune, Municipal Hall	13	4.9	Yellow	
Central	Edmundston, Queen Street	18	6.9	Orange	**Orange** The central air zone was assigned an "Orange Management Level" based on the level assigned at Edmundston, Rice St.
	Edmundston, Rice Street	21	8.4	Orange	
	Fredericton, Needham Street	15	5.9	Yellow	
	Miramichi, Fire Ponds	11	3.9	Yellow	
	Miramichi, Gretna Green School	11	4.6	Yellow	
	Miramichi, Hay Lane	11	5.9	Yellow	
	Moncton, Thanet Street	13	5.8	Yellow	
	Nackawic, Caverhill Site	11	5.4	Yellow	
Southern	Saint Andrews, Route 127	11	4.1	Yellow	**Orange** The southern air zone was assigned an "Orange Management Level" based on the level assigned at Saint John, Manawagonish.
	Saint John, Castle Street	14	5.4	Yellow	
	Saint John, Champlain Hts.	13	5	Yellow	
	Saint John, Forest Hills	14	5.6	Yellow	
	Saint John, Lorneville	14	6.5	Orange	
	Saint John, Manawagonish	16	7.9	Orange	
	Saint John, Saint John Street	10	3.1	Green	
	Saint John, West Side	13	5.5	Yellow	

The objectives (CAAQS) for $PM_{2.5}$ concentration were achieved at all monitoring locations throughout 2023. The northern air zone is in the yellow management level, while the central and southern air zones are in the orange management level. The levels of the two orange air zones are driven by results at two stations in each of those air zones. Most stations are in the yellow category.

New Brunswick has achieved the $PM_{2.5}$ CAAQS consistently since their introduction in 2012. The long-term trend for $PM_{2.5}$ in the province has been relatively flat. *Clean Air Act* reporting of $PM_{2.5}$ data began in 1997 (Note: *Clean Air Act* reporting started in 1996, but $PM_{2.5}$ monitoring was not introduced until 1997).
This trend is illustrated in the graph to the right.

FINE PARTICULATE MATTER LONG-TERM TREND



The number and location of sampling stations, as well as the monitoring technology, has varied throughout the period represented.

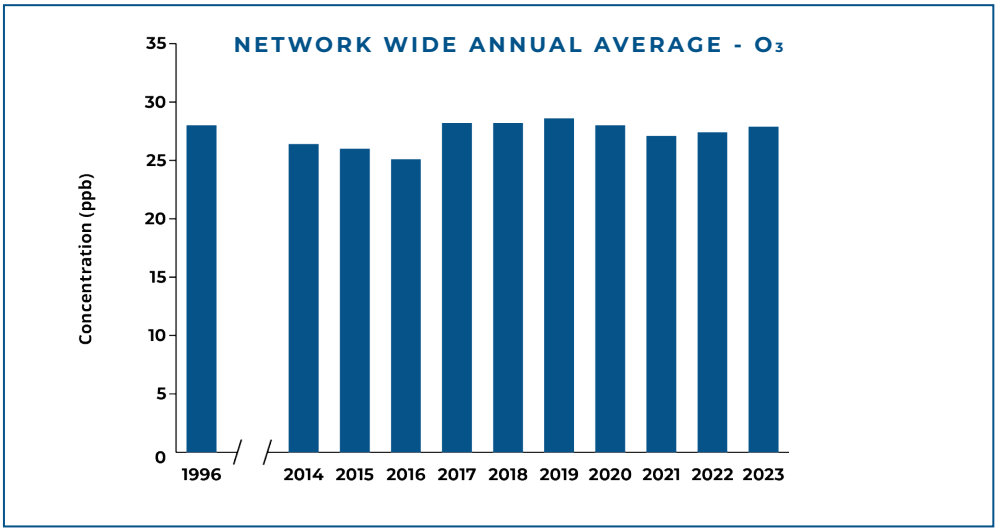
GROUND LEVEL OZONE

2023 GROUND LEVEL OZONE (O_3) MONITORING RESULTS				
AIR ZONE	STATION	CAAQS 8 Hour (limit: 62 ppb)	STATION MANAGEMENT LEVEL	AIR ZONE MANAGEMENT LEVEL
Northern	Bathurst, Rough Waters Drive	49	Green	**Green** The northern air zone was assigned a "Green Management Level" based on the level assigned at Bathurst, Rough Waters Drive.
Central	Edmundston, Queen Street	51	Yellow	**Yellow** The central air zone was assigned a "Yellow Management Level" based on the level assigned at Fredericton, Needham Street.
	Fredericton, Needham Street	55	Yellow	
	Miramichi, Gretna Green School	52	Yellow	
	Moncton, Thanet Street	52	Yellow	
Southern	Saint Andrews, Route 127	53	Yellow	**Yellow** The southern air zone was assigned a "Yellow Management Level" based on the level assigned at Saint John, Castle Street.
	Saint John, Castle Street	56	Yellow	
	Saint John, Forest Hills	52	Yellow	
	Saint John, West Side	51	Yellow	

The objectives (CAAQS) for O_3 concentration were achieved at all monitoring locations throughout 2023. The northern air zone is in the green management level, while the central and southern air zones are in the yellow management level.

GROUND LEVEL OZONE LONG-TERM TREND

New Brunswick has achieved the O_3 CAAQS consistently since their introduction in 2012 and the current results are very good. The long-term trend for O_3 concentration in the province has been relatively stable as seen in the chart to the right.



The number and location of sampling stations has varied throughout the period represented.

HYDROGEN SULPHIDE

The objectives for H_2S concentration were achieved at 6 of the 8 monitoring locations throughout 2023. The two remaining stations were in achievement greater than 99% of the time but recorded 6 brief exceedance events which are described below.

2023 HYDROGEN SULPHIDE (H_2S) PROVINCIAL RESULTS

STATION	PROVINCIAL OBJECTIVES COMPLIANCE (# OF EXCEEDANCE EVENTS)
Nackawic, Caverhill Site	1
Saint John, Bridge Street	0
Saint John, Champlain Heights	0
Saint John, Forest Hills	0
Saint John, Midwood Ave	5
Saint John, Milford	0
Saint John, Sherbrooke Street	0
Saint John, West Side	0

EXCEEDANCE EVENT DISCUSSION

Nackawic, Caverhill Site | *AV Group Nackawic Mill Station*

The one-hour objective was exceeded once on June 11. The event lasted one hour. Following an investigation, no operational issues were recorded at the AV Nackawic mill. Fugitive emissions from the facility's wastewater lagoon are the suspected cause, combined with poor dispersion (weather conditions).

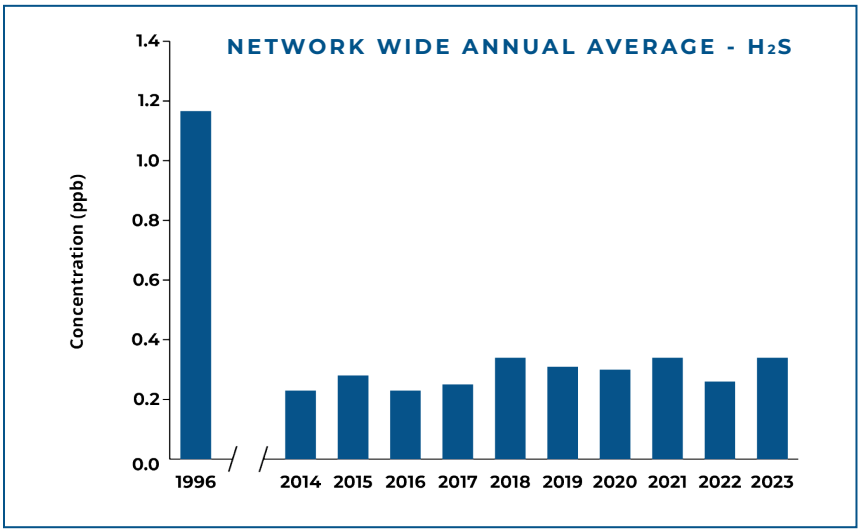
Saint John, Midwood Avenue | *Irving Oil Ltd. Station*

There were five exceedance events at Midwood Avenue. Two separate events on January 9th, one on January 12, one August 15th, and one September 1st. All one-hour objective exceedances were less than two hours, with the exception of the January 12 event which lasted 11 hours. The January 9 and 12 events also triggered exceedances of the 24-hour objective.

For the August 15 event, no operational issues were identified at the Irving Oil Refinery. Weather, wind, and tide information suggest that the primary source was fugitive emissions from a nearby municipal wastewater treatment lagoon and/or natural off gassing from nearby tidal flats.

For all other events, the elevated levels were related to refinery emissions. In each case the elevated levels were immediately addressed by optimizing flare operations to reduce emissions.

It should be noted that the objective for H_2S is odour-based. The exceedance events noted above were objectionable from an odour perspective, but the concentrations remained well below levels where human health impacts could occur. The recent trend (10 years) for H_2S levels in NB has been very consistent with significant improvement since 1996.



The number and location of sampling stations has varied throughout the period represented.

HYDROGEN SULPHIDE LONG-TERM TREND

As reflected in the current results and the historic trend, H_2S levels near emitting facilities are generally good, but are sometimes affected by brief episodes of high values. These are typically either due to "upset conditions" (i.e., accidents or equipment failures) at the emitting facilities, or unusual weather interfering with normal dispersion and trapping pollutants in place.

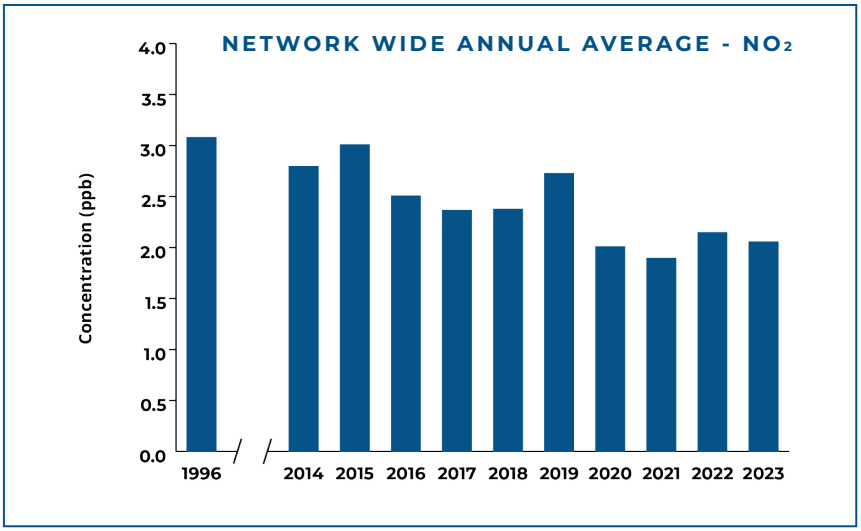
NITROGEN DIOXIDE

2023 NITROGEN DIOXIDE (NO_2) MONITORING RESULTS						
AIR ZONE	STATION	PROVINCIAL OBJECTIVES COMPLIANCE (# OF EXCEEDANCE EVENTS)	CAAQS		STATION MANAGEMENT LEVEL	AIR ZONE MANAGEMENT LEVEL
			1 hour daily (Limit: 60 ppb)	Annual (Limit: 17 ppb)		
Northern	Bathurst, Rough Waters Drive	0	16	1.1	Green	**Green** The northern air zone was assigned a "Green Management Level" based on the level assigned at Bathurst, Rough Waters Drive.
	Belledune, East	0	12	0.7	Green	
	Belledune, Municipal Hall	0	9	0.6	Green	
Central	Edmundston, Queen Street	0	30	4.3	Yellow	**Yellow** The central air zone was assigned a "Yellow Management Level" based on the level assigned at Edmundston, Queen Street.
	Fredericton, Needham Street	0	23	2.3	Yellow	
	Miramichi, Gretna Green School	0	8	0.8	Green	
	Miramichi, Lower Newcastle	0	6	n/a	Green	
	Miramichi, Rockcliff	0	8	0.5	Green	
	Moncton, Thanet Street	0	29	3.4	Yellow	
Southern	Saint Andrews, Route 127	0	4	n/a	Green	**Orange** The southern air zone was assigned an "Orange Management Level" based on the level assigned at Saint John, Castle Street.
	Saint John, Castle Street	0	32	4.1	Orange	
	Saint John, Forest Hills	0	26	3.0	Yellow	
	Saint John, Grandview West	0	27	3.6	Yellow	
	Saint John, West Side	0	25	3.1	Yellow	

All objectives (provincial and CAAQS) for NO_2 were achieved at all monitoring locations throughout 2023. The northern air zone is in the green management level, the central air zone in the yellow management level, and the southern air zone in the orange management level. Overall, results are very good. Locations with higher population density experienced higher values (but still very good relative to the objectives).

NITROGEN DIOXIDE LONG-TERM TREND

New Brunswick's NO_2 objectives have been met at all locations every year since *Clean Air Act* reporting began in 1996. Likewise, the NO_2 CAAQS have been achieved since their introduction in 2020. The 10-year trend for NO_2 concentration in the province has been towards consistent and gradual improvement.



The number and location of sampling stations has varied throughout the period represented.

SULPHUR DIOXIDE

2023 SULPHUR DIOXIDE (SO_2) MONITORING RESULTS

AIR ZONE	STATION	PROVINCIAL OBJECTIVES COMPLIANCE (# OF EXCEEDANCE EVENTS)	CAAQS		STATION MANAGEMENT LEVEL	AIR ZONE MANAGEMENT LEVEL
			1 hour daily (Limit: 70 ppb)	Annual (Limit: 5.0 ppb)		
Northern	Atholville, Beauvista	0	88	0.8	Red	Red The northern air zone was assigned a "Red Management Level" based on the level assigned at Atholville, Boom Road.
	Atholville, Boom Road	1	148	3.6	Red	
	Belledune, East	0	8	0.0	Green	
	Belledune, Jacquet River	0	7	0.0	Green	
	Belledune, Madran	0	9	0.1	Green	
	Belledune, Municipal Hall	0	7	0.0	Green	
	Belledune, Pointe-Verte	0	9	0.1	Green	

SULPHUR DIOXIDE - CONTINUED

2022 SULPHUR DIOXIDE (SO_2) MONITORING RESULTS						
AIR ZONE	STATION	PROVINCIAL OBJECTIVES COMPLIANCE (# OF EXCEEDANCE EVENTS)	CAAQS		STATION MANAGEMENT LEVEL	AIR ZONE MANAGEMENT LEVEL
			1 hour daily (Limit: 70 ppb)	Annual (Limit: 5.0 ppb)		
Central	Edmundston, Queen Street	0	92	2.0	Red	**Red** The central air zone was assigned a "Red Management Level" based on the level assigned at Edmundston, Rice Street.
	Edmundston, Rice Street	3	203	2.7	Red	
	Edmundston, St. Mary's	0	38	0.5	Yellow	
	Miramichi, Lower Newcastle	0	1	0.1	Green	
	Miramichi, Rockcliff	0	3	0.0	Green	
	Nackawic, Caverhill site	0	19	n/a	Green	
Southern	Lake Utopia	0	63	0.7	Orange	**Red** The southern air zone was assigned a "Red Management Level" based on the level assigned at Saint John, Grandview West.
	Saint John, Castle Street	0	20	0.5	Green	
	Saint John, Champlain Heights	0	53	0.6	Orange	
	Saint John, Lorneville	0	6	0.1	Green	
	Saint John, Expansion Ave	0	42	0.6	Yellow	
	Saint John, Forest Hills	0	72	1.5	Red	
	Saint John, Grandview West	0	105	0.9	Red	
	Saint John, Manawagonish	0	1	0.0	Green	
	Saint John, Midwood	0	25	0.6	Green	
	Saint John, Musquash	0	3	0.1	Green	
	Saint John, Silver Falls	0	27	0.2	Green	
	Saint John, West Side	0	46	0.5	Yellow	

The provincial objectives for SO_2 concentration were achieved at 23 of the 25 monitoring locations throughout 2023. The two remaining stations were in achievement greater than 99% of the time but recorded four brief exceedance events. These exceedances are described below.

EXCEEDANCE EVENT DISCUSSION

Edmundston, Rice Street | *Twin Rivers Paper Station*

The one-hour objective was exceeded three times, twice on January 15 and once on December 12. The events lasted one hour each. In each of these cases, the events were the result of brief equipment failures at the Twin Rivers Paper mill. The 24-hour objective was exceeded once on November 12, due to a fire within the sulphur storage tank at the mill. All issues were immediately addressed.

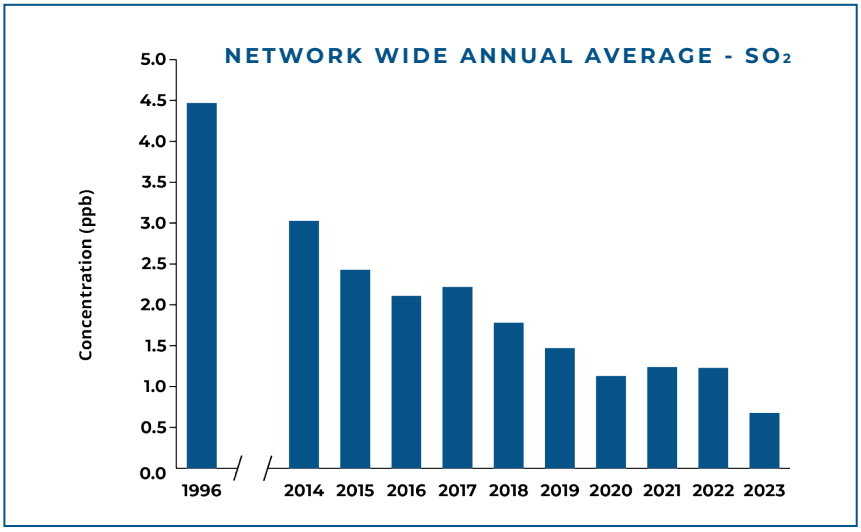
Atholville, Boom Road | *AV Groupe NB, Atholville Mill*

The one-hour objective was exceeded once on August 11 and lasted one hour. Upset conditions at the mill caused a brief release of gases containing SO_2. The issue was resolved immediately.

The CAAQS for SO_2 were not achieved at six locations, with two non-achieving locations in each air zone. The non-achieving stations have been identified in previous reports and planning efforts continue toward improving SO_2 levels in those areas. Work is now underway to identify opportunities to reduce emissions toward bringing the affected areas back into achievement.

Although challenges remain with respect to CAAQS achievement in some areas, the recent trend (10 years) and long-term trend for SO_2 levels in NB has shown improvement as reflected below.

SULPHUR DIOXIDE LONG-TERM TREND



The number and location of sampling stations has varied throughout the period represented.

As reflected in the current results, and the historic trend, SO_2 levels near emitting facilities are generally good, but are sometimes affected by episodes of high values. These are often associated with "upset conditions" (i.e., accidents or equipment failures) at the emitting facilities, or unusual weather interfering with normal dispersion and trapping pollutants in place.

TOTAL SUSPENDED PARTICULATE

The provincial objectives for TSP concentration were achieved at all three monitoring locations throughout 2023.

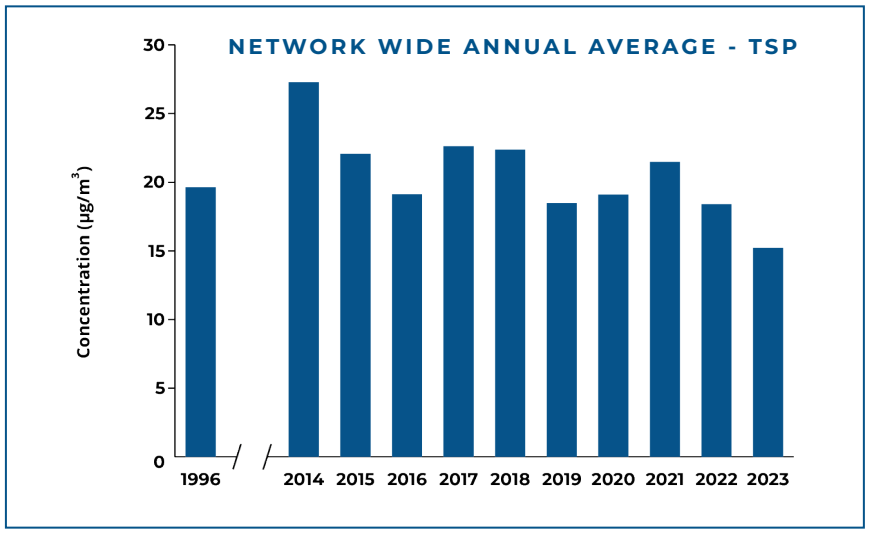
2023 PROVINCIAL TOTAL SUSPENDED PARTICULATE (TSP) RESULTS	
STATION	PROVINCIAL OBJECTIVES COMPLIANCE (# OF EXCEEDANCE EVENTS)
Miramichi, Fire Ponds	0
Miramichi, Hay Lane	0
Miramichi, Rockcliff	0

TOTAL SUSPENDED PARTICULATE LONG-TERM TREND

The long-term trend for TSP levels in NB has seen little change over the years. This is likely due to the large influence of natural sources (e.g., wind-blown dust, pollen, etc.) on these values.

Unlike most other parameters in the provincial network, TSP monitoring is not continuous, and data is not available in real-time. Samples are collected on filter media, which are collected and sent to a laboratory for measurement.

The TSP monitoring effort has also been gradually reduced over the years, with only three stations now remaining in NB's ambient network. This is because larger particles (which make up the majority of the particles in a TSP sample) are now known to be less relevant to health than smaller particles. Hence, TSP monitors are increasingly being replaced with $PM_{2.5}$ monitors (which measure only the smallest particles), both in NB and throughout the world.



The number and location of sampling stations has varied throughout the period represented.

VOLATILE ORGANIC COMPOUNDS

The term "Volatile Organic Compounds" (VOCs) encompasses a vast list of chemicals. DELG's monitoring efforts capture approximately 100 of them. Detailed results for these compounds are provided in the *Air Quality Monitoring Results - Supplementary Data 2023* companion document.

For many of the VOC compounds monitored, the primary interest is their impact on the formation of ground level ozone. However, some carry other environmental and human health risks.

2023 results for four key (or "marker") VOCs (those closely related to fuel burning, petrochemical storage, and refining) are provided below. These VOCs are collectively referred to as "BTEX", which stands for benzene, toluene, ethylbenzene, and xylene.

As there are no New Brunswick objectives or CAAQS for VOCs, results below are compared against air quality criteria from other Canadian jurisdictions. Please note that different jurisdictions are selected for each BTEX contaminant since no single jurisdiction has adopted objectives for all four.

ANNUAL AVERAGE BTEX CONCENTRATIONS				
PARAMETER	SAINT ANDREWS (BACKGROUND REFERENCE) [1]	FOREST HILLS [1]	CHAMPLAIN HEIGHTS [1]	COMPARABLE ANNUAL AIR QUALITY CRITERION [2]
Benzene	0.059 ppb	0.112 ppb	0.208 ppb	0.14 ppb (Ontario)
Ethylbenzene	0.003 ppb	0.027 ppb	0.122 ppb	45.4 ppb (Quebec)
Toluene	0.023 ppb	0.162 ppb	0.536 ppb	None
Xylene	0.008 ppb	0.108 ppb	0.483 ppb	4.5 ppb (Quebec)

[1] Annual averages are approximations based on data from limited sampling.
[2] The most stringent ambient air quality objective available from a Canadian jurisdiction.

Of the four BTEX contaminants, only benzene exceeded the annual guideline levels, which occurred at the Champlain Heights monitoring station.

24- HOUR AVERAGE BTEX CONCENTRATIONS (PERCENT OF SAMPLES EXCEEDING GUIDELINE)				
PARAMETER	SAINT ANDREWS (BACKGROUND REFERENCE) [2]	FOREST HILLS	CHAMPLAIN HEIGHTS	COMPARABLE AIR QUALITY CRITERION[1] 24-HOUR
Benzene	0 %	0 %	4 %	0.71 ppb (Ontario)
Ethylbenzene	0 %	0 %	0 %	227.2 ppb (Quebec)
Toluene	0 %	0 %	0 %	104.7 ppb (Alberta)
Xylene	0 %	0 %	0 %	159.1 ppb (Alberta)

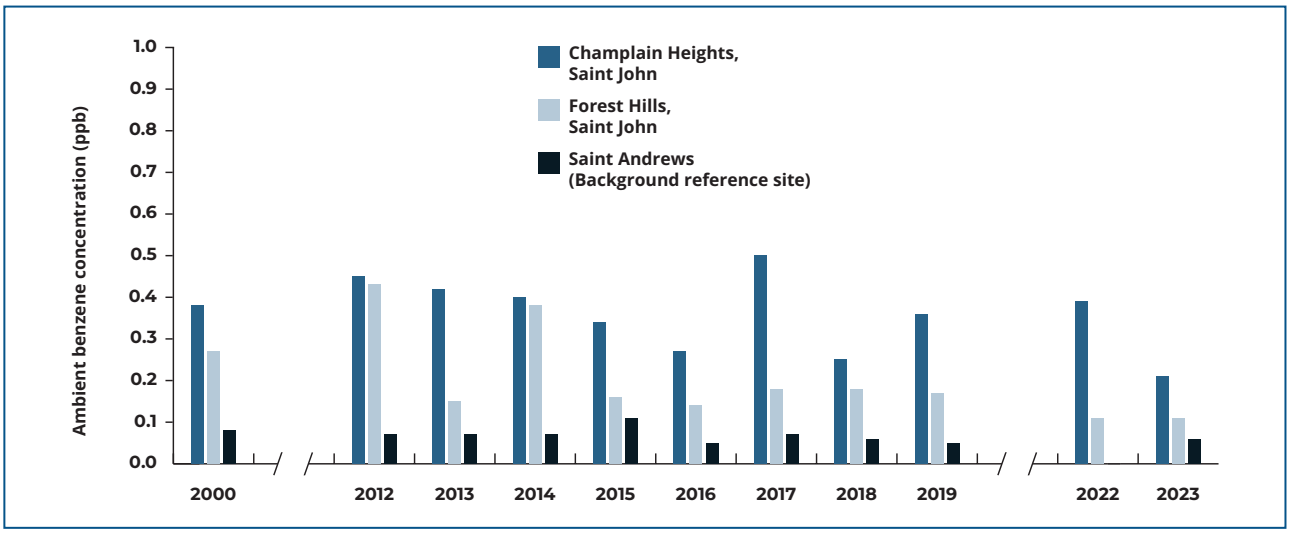
[1] The most stringent ambient air quality objective available from a Canadian jurisdiction.
[2] Sample draw time is only 8-hour, not 24-hour

VOC sample results for three of the four BTEX contaminants are well below the 24-hour guideline levels at all monitoring locations. Concentrations of the fourth, benzene, exceeded the guideline level at one Saint John location (Champlain Heights), with 4% of samples collected in exceedance of the comparable air quality criterion. The maximum 24-hour concentration detected at that location was 1.08 ppb, as compared to the 0.71 ppb guideline.

Of the BTEX contaminants, benzene receives special attention as it is recognized as cancer-causing by the World Health Organization and the United States Environmental Protection Agency. As such, it has been the target of emissions reduction efforts all over the world. As indicated below, benzene levels have remained within a consistent range (though with significant year-to-year variability) over the past 10 years, and since data for all three stations first became available in 2000.

ANNUAL AVERAGE BENZENE LEVELS IN SAINT JOHN, NB

VOC monitoring is limited to the Saint John area (and one background station) because it is home to a concentration of industries that are prone to VOC emissions. This includes a large oil refinery and its supporting facilities, which includes a marine terminal located at Canaport, and a marine loading and rail offloading terminal in east Saint John.



Prior to 2017, the data for the background reference site was collected at a station on the Point Lepreau peninsula. Sufficient VOC data is not available for 2020 and 2021 to calculate representative annual averages for those years. Annual averages are approximations based on data from limited sampling.

SUMMA canisters for sampling VOCs

Similar to TSP, VOCs are not monitored continuously, and results are not available in real-time. Rather, air samples are collected in stainless steel canisters, which are shipped to a laboratory for analysis. Results are returned later.

Acid Rain Monitoring

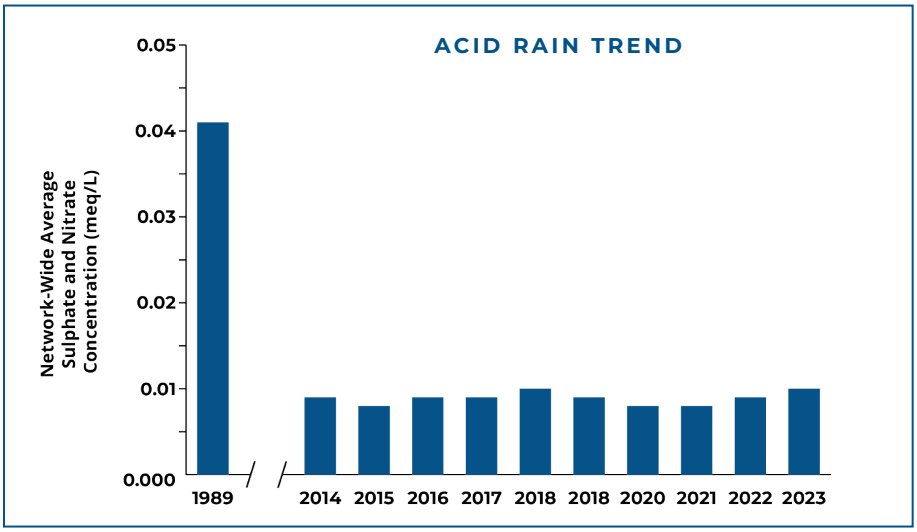
Acid Rain Sampling Equipment

Some air pollutants can be transformed in the atmosphere into acidic particles that ultimately fall out as acid rain (or snow, hail, etc.). The emissions that cause acid rain typically travel long distances, hundreds or even thousands of kilometers, before returning to the surface as rain or snow.

The adverse impacts of acid rain have been recognized since the early 1980s. Acid rain harms sensitive ecosystems by changing the chemistry of lakes, streams, and forest soils. It can also damage trees and agriculturally important plants. Infrastructure is also impacted by acid rain, as it can degrade paints and protective coatings, which accelerates corrosion.

Measures to reduce the emissions that contribute to acid rain have been undertaken in North America since the late 1980s. Most recently, this has included commitments to reduce emissions under the Canadian Council of Ministers of Environment's "Post-2000 Canada-wide Acid Rain Strategy". Over the past two decades, emissions from major sources within New Brunswick have been reduced significantly.

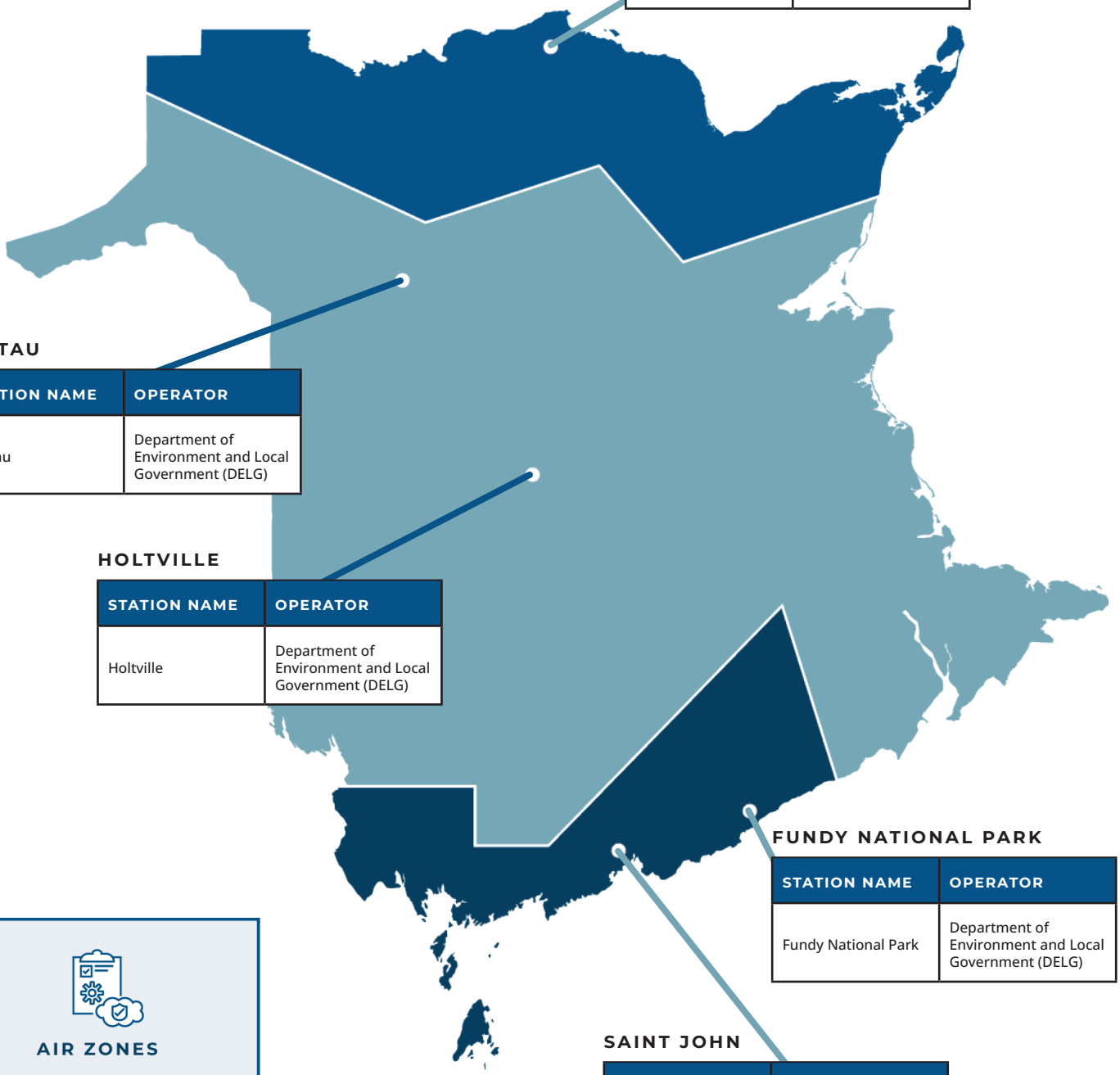
DELG has operated an acid precipitation (rain and snow) monitoring network since the early 1980s. The map on page 29 shows the location of the five acid precipitation monitoring sites in New Brunswick. Samples are collected at each of these sites by a local site operator every day and sent to the provincial laboratory for analysis. DELG staff coordinate the monitoring program, perform data quality assurance, and maintain the official data archive.



The key indicators for acid rain are sulphate and nitrate concentration. Each of these parameters has a slightly different effect on acidity but can be combined and expressed as "milliequivalents per litre" (meq/L). As reflected in the chart to the left, peak levels occurred in 1989. Emission reduction strategies have reduced sulphate and nitrate concentrations by approximately 77% since then.

Although levels have declined, acid rain monitoring remains important to ensure that our most sensitive lakes and rivers are provided with long-term protection from acid damage.

ACID RAIN MONITORING NETWORK



ST. MAURE

STATION NAME	OPERATOR
St. Maure	Department of Environment and Local Government (DELG)

NICTAU

STATION NAME	OPERATOR
Nictau	Department of Environment and Local Government (DELG)

HOLTVILLE

STATION NAME	OPERATOR
Holtville	Department of Environment and Local Government (DELG)

FUNDY NATIONAL PARK

STATION NAME	OPERATOR
Fundy National Park	Department of Environment and Local Government (DELG)

SAINT JOHN

STATION NAME	OPERATOR
Lakewood Heights	Department of Environment and Local Government (DELG)

AIR ZONES

- Northern Air Zone
- Central Air Zone
- Southern Air Zone

Special Project Monitoring

In addition to its network of permanent air quality monitoring stations, DELG also leads a variety of special air quality monitoring projects across the province using its mobile air quality monitoring unit (since 2001).

Special studies are typically used to:

- Assess air quality near pollution sources;
- Evaluate potential sites for permanent monitoring stations;
- Verify air quality modelling predictions; and
- Measure background (baseline) air quality levels prior to a development.

Results from special studies may be reported in separate stand-alone reports, which can be accessed at: *www.gnb.ca/environment*

DELG's Mobile Air Quality Monitoring Unit

Study Parameters

The DELG mobile air quality monitoring unit (pictured left) can be equipped with a wide variety of monitoring equipment, including all of the instrument types that are used in the regular monitoring network, but also specialized sampling equipment to address any site-specific issues that are being investigated.

Duration

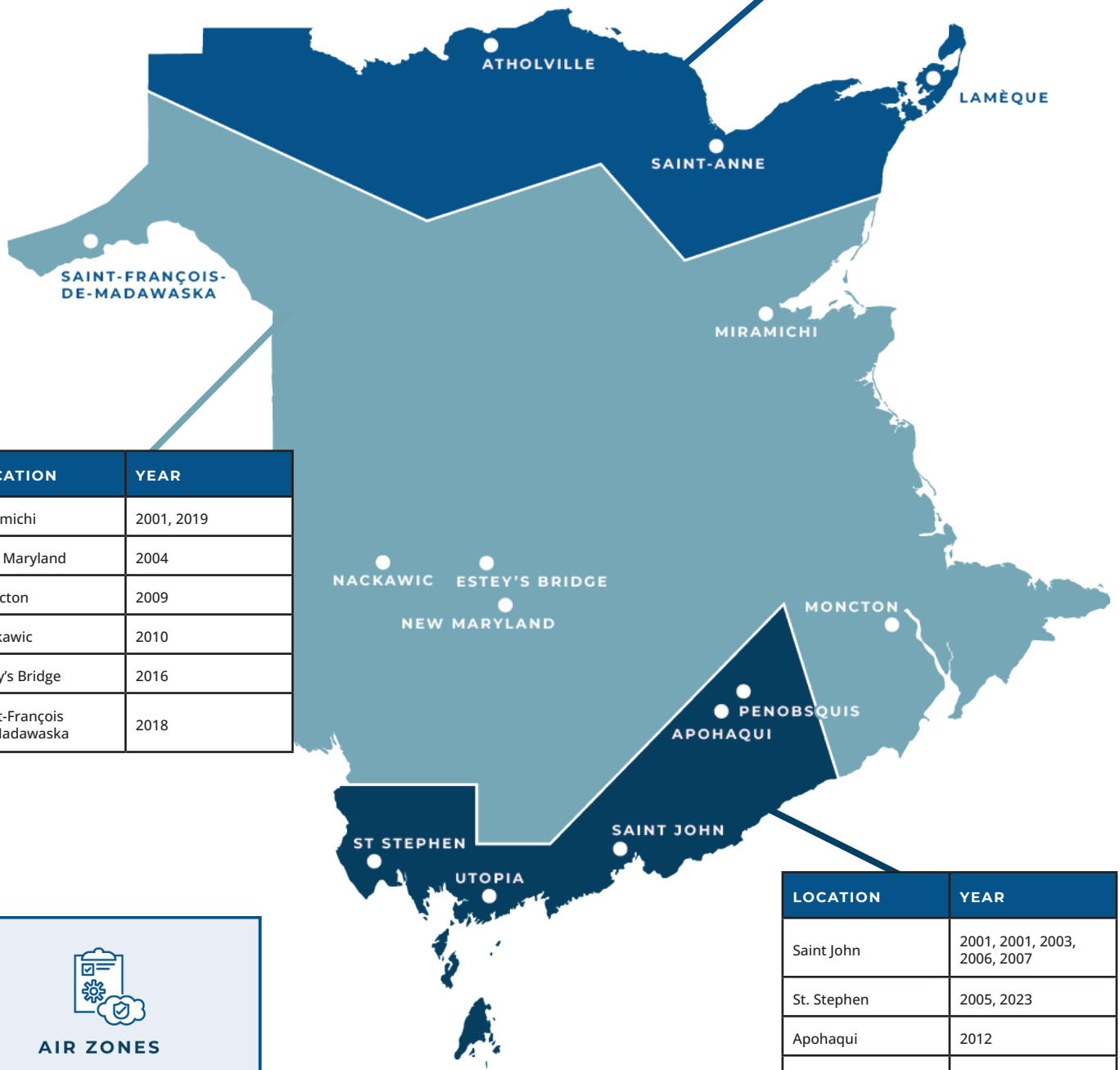
Due to day-to-day and seasonal variations in weather patterns and pollution emissions, to capture the full variety of air quality conditions at a project site, special projects typically last between 6 months and 2 years.

Status

During the 2023 monitoring year, the mobile air quality monitoring unit was in the St. Stephen area. Monitoring continued into the following year and summary results will be included in the next annual report.

HISTORY OF SPECIAL MONITORING PROJECTS

LOCATION	YEAR
Lamèque	2002, 2003, 2004
Atholville	2011
Saint-Anne	2015



LOCATION	YEAR
Miramichi	2001, 2019
New Maryland	2004
Moncton	2009
Nackawic	2010
Estey's Bridge	2016
Saint-François de Madawaska	2018

LOCATION	YEAR
Saint John	2001, 2001, 2003, 2006, 2007
St. Stephen	2005, 2023
Apohaqui	2012
Penobsquis	2014
Utopia	2021

AIR ZONES

- Northern Air Zone
- Central Air Zone
- Southern Air Zone

Air Quality Advisories

Four air quality advisories (in the form of “special air quality statements”) were issued in 2023 for New Brunswick. Three advisories were issued separately on June 25, September 5, and September 30, 2023, all due to forest fires in Quebec. Those advisories were issued for all of New Brunswick (except southern regions), Northwestern New Brunswick and the Edmundston and Madawaska regions, respectively. One advisory was also issued on September 14, 2023, for Saint John and County due to an industrial fire in downtown Saint John. All advisories ended the following day.

Conclusion

Air quality surveillance and comprehensive reporting of air quality information to New Brunswickers is a priority for DELG.

As reflected in this report, overall, air quality in New Brunswick is good relative to provincial standards. However, challenges remain with respect to achievement of the 2020 SO_2 CAAQS in some locations. DELG is committed to working towards improvements in these areas.

Ten-year trends indicate relatively stable levels for all measured contaminants, and longer-term trends indicate significant improvement for many. These results are driven by several key historic air quality policy initiatives.

These include:

- The National Air Pollution Surveillance Program (1969) and its associated federal-provincial Memorandum of Understanding (2004, and last renewed in 2019), which establishes a cooperative, partnered, approach for ambient air quality monitoring across Canada.
- The Canada - US Air Quality Agreement (1991), which required both countries to reduce sulphur dioxide, and nitrogen dioxide emissions, and also to work together to address the transboundary air pollutants that cause ground-level ozone formation.
- The Canada-wide Acid Rain Strategy for Post 2000 (1998), which provided an important policy road map for emissions reductions, data sharing, and public reporting of data across Canada.
- The Canadian Council of Ministers of Environment's Air Quality Management System (2012), which provides common goals for ambient air quality, a comprehensive public reporting framework, and regulated emissions limits for targeted industries across Canada.
- The Canadian Council of Ministers of Environment's adoption of CAAQS targets for SO_2 and NO_2 (2020).

For more complete site-specific monitoring results, visit the *Air Quality Monitoring Results - Supplementary Data 2023* companion document.

CONTACT

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Web: GNB.CA/Environment

List of Acronyms and Abbreviations

AQHI	Air Quality Health Index
AQMS	Air Quality Management System
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CCME	Canadian Council of Ministers of the Environment
CEPA	Canadian Environmental Protection Act
CAAQS	Canadian Ambient Air Quality Standards
CO	Carbon Monoxide
DELG	Department of Environment and Local Government

$PM_{2.5}$	Fine Particulate Matter (less than 2.5 microns)
GNB	Government of New Brunswick
H_2S	Hydrogen Sulphide
Met	Meteorology (Wind Speed, Wind Direction, Temperature, Relative Humidity, Barometric pressure)
$\mu g/m^3$	Micrograms per cubic meter
meq/L	Milliequivalents (molar equivalent acidity) per litre
mg/L	Milligrams per litre
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
O_3	Ground Level Ozone
ppb	Parts per billion
ppm	Parts per million
SO_2	Sulphur Dioxide
TRS	Total Reduced Sulphur
TSP	Total Suspended Particulate
VOC	Volatile Organic Compounds