New Nouveau Brunswick
Be...in this place • Être...ici on le peut

MacAleese Lane Air Quality Report

2009 Monitoring Program

Department of Environment

April 2010

MacAleese Lane Air Quality Report

2009 Monitoring Program

Introduction

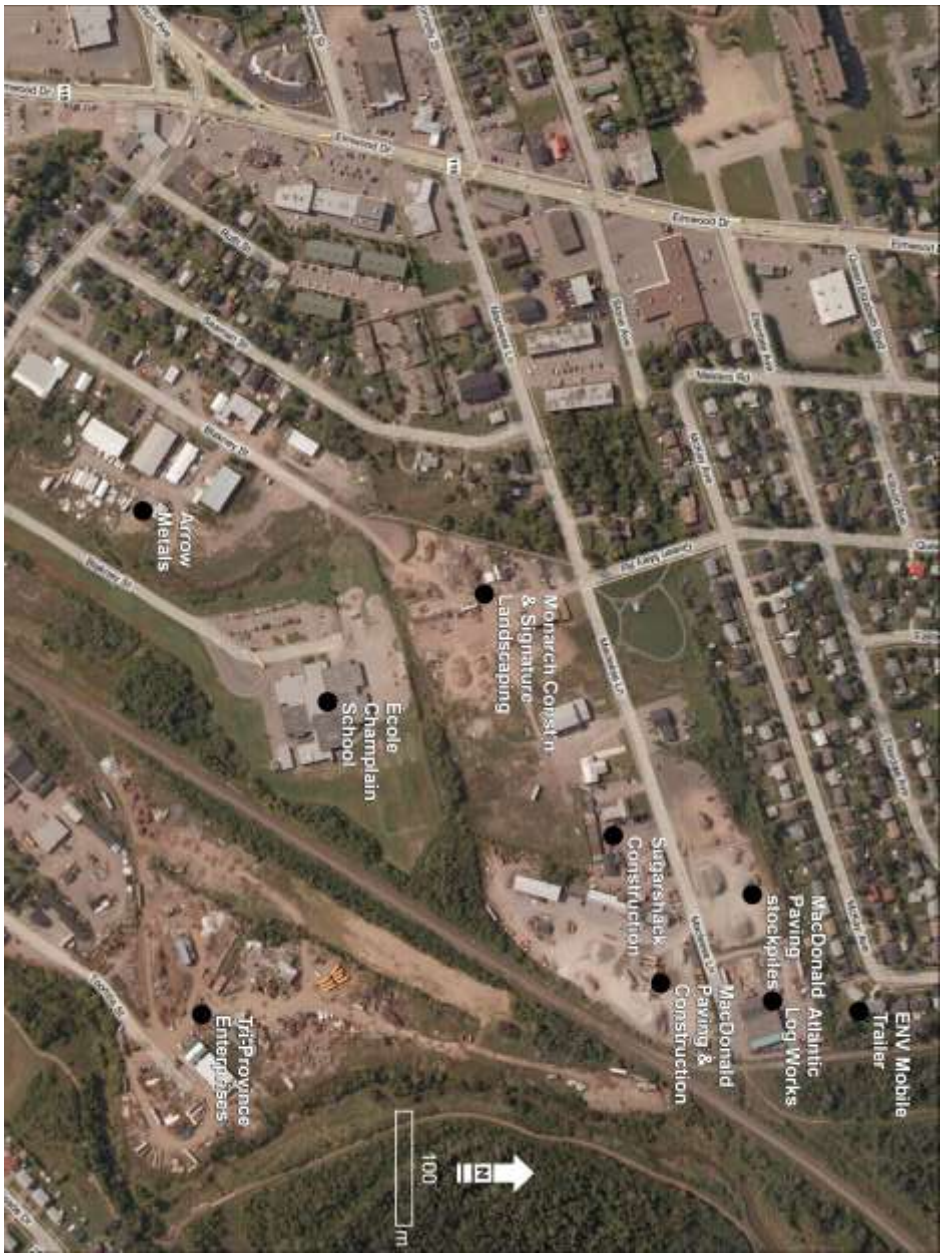
In February of 2009, the New Brunswick Department of Environment (ENV) began an air quality monitoring study in the vicinity of the light industrial park off MacAleese Lane in Moncton, New Brunswick. The study area is pictured in Figure 1.

Residents of the area have been concerned for some time about nuisance and possible health effects relating to air emissions from the various facilities operating within the park including an asphalt plant, dust from exposed stockpiles, and diesel truck emissions. Immediately adjacent to the park is the École Champlain School for kindergarten to Grade 5 with a school population of 555 students and 75 staff.

The Department's air quality monitoring mobile was used for the study. It was outfitted with air quality monitoring equipment to measure levels of a number of air pollutants including sulphur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ground level ozone (O_3), total reduced sulphur (TRS) and particulate matter. Added in March were instruments that gathered periodic 24-hour composite air samples for volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) that required lab analysis. The mobile was also outfitted with a meteorological tower for measuring wind speed and wind direction.

In selecting the location for the monitoring program, Department staff considered several factors including the location of local emission sources, prevailing seasonal winds, the operating season for the asphalt plant, access to power and security. Residents were particularly concerned about the emissions from the asphalt plant and its associated activities including exposed aggregate stockpiles and diesel truck movement. Asphalt paving is a warm season activity, when prevailing winds are typically from the southwest. A secure location with ready access to power was found at 141 McKay Avenue, lying north of the asphalt plant and separated by a distance of 160 meters. It was felt this site would be a good location to measure air quality conditions downwind of the asphalt plant.

Figure 1 Study Area



Methodology

Table 1 is excerpted from the National Air Pollution Surveillance (NAPS) Quality Assurance and Quality Control Guidelines (2004) and lists many of the measurement methods used in the study.

Common air pollutants were measured on a continuous basis and compared to New Brunswick Air Quality Objectives or, as in the case of ozone, National Air Quality Objectives. Particulate matter was measured for a range of particle sizes. Fine particulate ($PM_{2.5}$) was measured using Beta Attenuation Method (BAM) technology. Total suspended particulate (TSP) and inhalable particulate (PM_{10}) were measured using a field portable version of the BAM with interchangeable size-specific heads.

Table 1: Measurement Method and Operating Specifications of NAPS Network Analyzers[1]

Pollutant	Measurement Method	Monitor Type	Operating Range	Operating Temperature	Minimum Detection Limit
Ozone (O_3)	UV Absorption	Continuous Automated	1.0 ppm or 0.5 ppm	15-35°C	0.002 ppm
Carbon Monoxide (CO)	Infrared Gas Filter Correlation	Continuous Automated	50 ppm	15-35°C	0.1 ppm
Sulphur Dioxide (SO_2)	UV Fluorescence	Continuous Automated	1.0 ppm or 0.5 ppm	15-35°C	0.002 ppm
Nitrogen Oxides (NO_X)	Chemiluminescence	Continuous Automated	1.0 ppm or 0.5 ppm	15-35°C	0.002 ppm
Particulate Matter (PM_{10}, $PM_{2.5}$,)	Beta radiation attenuation	Continuous Automated		See NAPS QA/QC Guidelines	1.0 $\mu g/m^3$
Organic Compounds	Manual GC/MSD	Manual Canister	N/A	N/A	N/A

Source: Environment Canada, National Air Pollution Surveillance Network Quality Assurance and Quality Control Guidelines (2004)

Data was retrieved automatically on an hourly basis with the exception of PM_{10} and TSP data that was periodically downloaded manually at the monitoring site during scheduled visits.

VOC samples were collected in evacuated canisters and sent to the Environment Canada (EC) River Road lab in Ottawa for analysis for more than 150 individual VOC compounds.

Polyurethane foam (PUF) samplers were used to capture gas phase and particulate phase PAHs and analysis was performed at the EC Ottawa lab for 32 PAH compounds.

Monitoring of pollutants measured on a continuous basis began on February 25, 2009 and ended on December 15, 2009. The VOC sampling began on February 18 and ended on November 29th on a 1 in every 3rd day frequency, until mid-September when the sampling schedule was reduced to once every 6th day. Variance in this schedule occurred as a result of occasional problems with the timer activation of the sampling port on the scheduled sampling day, particularly after mid-September. In total, 59 VOC samples were collected and analyzed. The analysis included approximately 150 VOC compounds.

PAH sampling operated on a 1 in every 6th day schedule beginning on March 20 and ending on December 15. In total 38 PAH samples were collected and analyzed.

Results

Sulphur Dioxide (SO_2), Ozone (O_3), Nitrogen Dioxide (NO_2), Total Reduced Sulphur (TRS), Carbon Monoxide (CO)

Table 2 summarizes the monitoring results for common air pollutants that were measured at MacKay Ave. between February 25 and December 15, 2009. Results are reported on the basis of both 1 hour and 24 hour averaging periods. The maximum value recorded for each pollutant during that period can be compared to its respective air quality objective. The overall average pollutant concentration is also provided and the percent of time that data was available during the monitoring period. In all instances, the 1 hour and 24 hour maximum values recorded remained below, and for the most part well below, the air quality objective(s) for each pollutant. Average values for SO_2, NO_2, TRS and CO were also low. These results indicated there was no significant impact of these pollutants from emission sources in the area.

For comparison purposes, monitoring results from ENV's permanent monitoring site at Thanet St. in Moncton, adjacent to Wheeler Boulevard, for the same time period are presented in Table 3. The results suggest both sites had similar levels of air quality. SO_2 and TRS are not measured at the Thanet St. site.

Table 2: McKay Ave. Summary-Feb 25-Dec 15, 2009

141 McKay Ave. Moncton	SO_2	O_3	NO_2	TRS	CO
	ppb	ppb	ppb	ppb	ppm
1-hr Maximum	10	66	62	2	1.7
1-hr Objective	339	82	210	11*	30
24-hr Maximum	2	59	21	1	0.8
24-hr Objective	113	---	105	3.5*	---
Average	0	23	3	0	0.2
Data available [%]	100	100	97	100	100

Table 3: Thanet St. Summary-Feb 25-Dec 15, 2009

5 Thanet St., Moncton	SO_2	O_3	NO_2	TRS	CO
	ppb	ppb	ppb	ppb	ppm
1-hr Maximum	---	67	45	---	1.8
1-hr Objective	339	82	210	11*	30
24-hr Maximum	---	61	23	---	1.1
24-hr Objective	113	---	105	3.5*	---
Average	---	23	5	---	0.2
Data available [%]	---	100	98	---	82

* NB Air Quality Objective for Hydrogen Sulphide is used in the absence of Objective for TRS

Particulate Matter ($PM_{2.5}$, PM_{10}, TSP)

Measurements of suspended particulate at McKay Ave. are summarized in Table 4. From February 25 until August 26, 2009 continuous measurements of $PM_{2.5}$ and TSP were carried out. In late August the TSP instrument was converted to measurement of PM_{10} that began on August 28. This change was made at the request of the Department of Health since, like $PM_{2.5}$, exposure to PM_{10} is associated with health effects, whereas TSP is dominated by the coarse fraction of particulate material (e.g. dust) and not directly related to health effects.

Results for particulate are reported in terms of a 24 hour averaging period. $PM_{2.5}$ and PM_{10} values remained below the objectives with maximum values of 26 and 48 $\mu g/m^3$, respectively. The daily TSP objective of 120 $\mu g/m^3$ was exceeded on three occasions, May 14, May 21 and June 18, with a peak daily value of 308 $\mu g/m^3$ recorded on May 14. High TSP readings on these three days were associated with increasing afternoon wind speeds above 5 kilometers per hour blowing from the south west and west south west. It was also found that at peak hourly TSP

levels fine particulate ($PM_{2.5}$) was only 6-9% of TSP suggesting the TSP exceedances were caused by coarse wind-blown dust material, likely originating within the industrial park.

For comparison purposes, monitoring results for $PM_{2.5}$ at ENV's permanent monitoring site on Thanet St. in Moncton during the same time period are presented in Table 5. Average levels for $PM_{2.5}$ were identical at the two sites, namely 7 µg/m^3.TSP and PM_{10} are not monitored at the Thanet St. location.

Table 4: McKay Ave. Summary for Particulate-Feb 25-Dec 15, 2009

141 McKay Ave., Moncton	**$PM_{2.5}$**	**TSP**	**PM_{10}**
	µg/m^3	**µg/m^3**	**µg/m^3**
24-hr Maximum	26	308	48
24-hr Objective	30*	120	50**
Average	7	36	17
Data available [%]	100	59	26

Table 5: Thanet St. Summary for Particulate-Feb 25-Dec 15, 2009

5 Thanet St., Moncton	**$PM_{2.5}$**	**TSP**	**PM_{10}**
	µg/m^3	**µg/m^3**	**µg/m^3**
24-hr Maximum	33	---	---
24-hr Objective	30*	120	50**
Average	7	---	---
Data available [%]	98	---	---

* Level of the Canada-Wide Standard

** California Air Resources Board

Volatile Organic Compounds (VOCs)

Volatile organic compounds (VOCs) are organic chemical compounds with high vapour pressure and thus vaporize readily to the atmosphere. Some of the significant man-made emission sources of VOCs include oil refineries, gasoline distribution centres, motor vehicles, asphalt paving and solvent usage. VOCs are also released naturally from living forests and forest fires.

The analysis of the 59 daily VOC samples collected during the study is summarized in Table 6. Results are presented for Total VOCs and selected VOC compounds and compared to guidelines from different jurisdictions in Canada and abroad, where they exist. Results from the MacAlesse Lane study are also compared to 2008 measurements made at the Forest Hills site in Saint John (at the time of writing this report, 2008 was the most recent year a complete NAPS yearly dataset for this site was available). The 24-hour maximum and average levels of Total VOCs were lower at McKay Ave. compared to the Forest Hills site. Levels of many of the individual VOC compounds were similar or lower at McKay Ave. compared to results from the Saint John site in 2008. For the listed compounds none of the national or international air quality objectives were exceeded.

Table 6 Comparative VOC Concentrations

VOC	Max 24-h average (ppb)		24-h average guideline (ppb)	Annual average (ppb)		Annual average guideline (ppb)
	Forest Hills (2008)	McKay Ave (2009)		Forest Hills (2008)	McKay Ave (2009)	
Total VOC	104.80	42.91		27.42	6.8	
1,3 butadiene	0.09	0.03		0.02	0.01	1 (UK)
Benzene	0.69	0.19		0.20	0.10	1.5 ((Sweden)
Toluene	2.48	1.47	63 (WHO) 106 (AB) 24 (ON)	0.35	0.28	10-100 (Sweden)
Ethylbenzene	0.25	0.16	4464 (WHO) 227 (ON)	0.05	0.05	
Xylenes	0.75	0.73	1013 (WHO) 161 (AB) 522 (ON)	0.13	0.15	
Styrene	0.19	0.15	56 (WHO) 94 (MB) 93 (ON)	0.01	0.01	
Chloromethane	0.70	0.72	3344 (ON)	0.57	0.61	
Vinyl chloride	0.00	0.00	0.4 (ON)	0.00	0.00	
1,1 dichloroethylene	0.00	0.30		0.00	0.01	
Dichloromethane	0.08	0.12	792 (WHO) 62 (ON)	0.06	0.07	100-250 (Sweden)
1,2 dichloroethane	0.03	0.02	159 (WHO)	0.01	0.01	100-150 (Sweden)
Carbon tetrachloride	0.10	0.10	0.4 (ON)	0.09	0.09	
1,2 dichloropropane	0.01	0.00		0.00	0.00	
Trichloroethylene	0.01	0.01	21 (ON)	0.00	0.00	100-200 (Sweden)
1,1,2 trichloroethane	0.00	0.00		0.00	0.00	
Ethylene dibromide	0.00	0.00	0.4 (ON)	0.00	0.00	
Tetrachloroethylene	0.05	0.04	34 (WHO)	0.01	0.01	
1,1,2,2 tetrachloroethane	0.00	0.00		0.00	0.00	

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are ubiquitous in the environment and are released from both natural and man-made sources including transportation vehicles, wood stoves, fossil-fuel power plants, asphalt plants, wood preservation facilities, forest fires, volcanoes and open burning. Many of the man-made sources of PAHs are released to air as the result of the incomplete combustion of wood and fossil fuels such as coal and oil and being semi-volatile are often associated with fine particulate. PAHs were included in the monitoring program because of the potential for such emissions from the asphalt plant and from wood burning for home heating in the area.

Table 7 compares PAH results for the monitoring program in Moncton in 2009 against 2008 data for selected sites elsewhere in the country (at the time of writing, 2008 was the most recent year a complete NAPS yearly dataset for these sites was available).

There are no ambient air quality guidelines in existence for total PAH but we can compare values from other sites in Canada. The average Total PAH value at McKay Ave. during the study was 16.38 ng/m^3, as compared to other urban sites in eastern Canada that ranged from 6.15 ng/m^3 (Saint John) to 38.92 ng/m^3 (Hamilton) in 2008. The other monitoring site included for comparison is a rural, remote site at Kejimkujik National Park in Nova Scotia with an average Total PAH value of less than 1 ng/m^3.

Some PAHs are suspected or known carcinogens. Benzo(a)pyrene, abbreviated B(a)P, is a known carcinogen for which enough toxicity data is available that an air quality guideline has been developed in Ontario. At McKay Ave. in 2009 the 24 hour maximum value for B(a)P was 0.19 ng/m^3, well below the Ontario guideline objective of 1.1 ng/m^3. 24-hour maximum values of B(a)P ranged from 0.03 to 2.39 ng/m^3 for the sites represented in Table 7.

Table 7 Comparative PAH Results

	Total PAH		Benzo(a)pyrene*	
Location	Maximum 24-h average (ng/m^3)	Average (ng/m^3)	Maximum 24-h average (ng/m^3)	number of samples
McKay Ave, Moncton	77.58	16.38	0.19	38
Forest Hills, Saint John**	10.52	6.15	0.03	22
Corner Brook, NL**	113.29	18.41	2.39	19
Montreal, QC**	69.39	20.30	1.16	24
Hamilton, ON**	210.62	38.92	1.04	15
Kejimkujik, NS**	2.23	0.96	0.03	22

***** Ontario MOE guideline for benzo(a)pyrene is 1.1 ng/m^3, 24-h average

** 2008 NAPS data

Summary and Conclusions

In response to air quality concerns expressed by local residents, ENV conducted an air quality monitoring program using its mobile trailer in the area of MacAleese Lane in Moncton between late February and mid-December 2009. The area is home to a light industrial park, an elementary school and a residential community.

The monitoring program included continuous measurements of criteria air pollutants including sulphur dioxide, carbon monoxide, nitrogen dioxide, ground level ozone, total reduced sulphur and particulates (TSP, PM_{10}, $PM_{2.5}$). Periodic daily samples of volatile organic compounds and polycyclic aromatic hydrocarbons were also taken and analyzed.

No exceedances of health related air quality objectives for any of the pollutants measured were recorded during the monitoring program. Only the daily average value for total suspended particulate exceeded the air quality objective on three days during the study as a result of wind-blown dust.

Overall, air quality levels for common air pollutants in the MacAleese area were comparable to ENV's air quality monitoring site in Moncton.

VOC levels were well below available air quality guidelines and similar or lower in comparison to levels recorded at the Forest Hills site in Saint John in 2008.

Similarly PAH levels were well below available guidelines. The 24-hour maximum and average levels of Total PAH and B(a)P were higher in the MacAleese area than at Forest Hills in 2008 but similar or lower in comparison to other urban monitoring sites in eastern Canada.

Next Steps

A local working committee of Environment and Health officials, school administration officials, parents, and industry representatives was established in January 2010, to share information and to seek solutions to any outstanding air quality and other environmental quality related concerns in the area.

Further assessment of levels of particulate was begun in late March, 2010 by measuring levels of PM_{10} on École Champlain School property.

Glossary

SO_2	Sulphur dioxide
O_3	Ozone
NO_2	Nitrogen dioxide
TRS	Total reduced sulphur
CO	Carbon monoxide
TSP	Total suspended particulate
PM_{10}	Inhalable particulate, suspended particles up to 10 microns in diameter
$PM_{2.5}$	Fine particulate, suspended particles up to 2.5 microns in diameter
VOCs	Volatile organic compounds
PAHs	Polycyclic aromatic hydrocarbons
BAM	Beta attenuation method
NAPS	National Air Pollution Surveillance
ENV	New Brunswick Department of Environment
MOE	Ontario Ministry of Environment
EC	Environment Canada
ppm	parts per million
ppb	parts per billion
$\mu g/m^3$	micrograms per cubic meter
ng/m^3	nanograms per cubic meter

Report prepared by:

Randy Piercey
Environmental Evaluation and Reporting
Sate of the Environment Branch
New Brunswick Department of Environment

Date: April 29, 2010