DETROIT RIVER INTERNATIONAL CROSSING (DRIC)
2nd INTERIM AIR QUALITY MONITORING REPORT
JANUARY 1st, 2007 – MARCH 31st, 2007

Prepared for:

URS Canada Inc.
75 Commerce Valley Drive East
Markham, Ontario
L3T 7N9

Prepared by:

SENES Consultants Limited
121 Granton Drive, Unit 12
Richmond Hill, Ontario
L4B 3N4

June 2007

Printed on Recycled Paper Containing Post-Consumer Fibre

Executive Summary

As part of the Environmental Assessment, the Detroit River International Crossing (DRIC) team has established two ambient air monitoring stations in the Area of Continued Analysis (ACA), along the existing Huron Church/Highway 3 corridor. These monitoring stations have been collecting data on ambient concentrations of nitrogen oxides, fine particulate matter, VOCs, aldehydes, and local meteorology since October 1st, 2006 and this monitoring will continue until the end of September 2007. The information from this monitoring program will be used in establishing current baseline conditions in the area for use in the air dispersion modelling portion of the Environmental Assessment associated with the DRIC project. This report presents the results from the first half of the sampling period, from October 1st, 2006 to March 31st, 2007, with a focus on the second quarter, beginning January 1st, 2007. The main findings to date are as follows:

- There were no exceedances of the MOE AAQCs (1-hr and 24-hr) for NO_x at either station during the second quarter of sampling;
- The average NO_x concentrations at each station remained relatively unchanged;
- The guideline levels for VOCs (acrolein, benzene) and aldehydes (acetaldehyde, formaldehyde) were not exceeded at any point during the second quarter of sampling;
- The proposed Canada Wide Standard (24-hr) for $PM_{2.5}$ was exceeded at both stations (5 days at OPHL and 4 days at St. Clair College), bringing the total thus far in the sampling period to 18 exceedance days at OPHL and 12 at St. Clair College. This may be attributed to any number of local or transboundary sources. The results of the air dispersion modelling which is currently underway will clarify the actual impact of traffic on local concentrations;
- The average 24-hr $PM_{2.5}$ concentration at each monitoring station for the period thus-far remained relatively unchanged since the end of the first quarter;
- Average daily car and short truck traffic volumes for the second quarter decreased when compared to daily average volumes from the first quarter. The percentage decrease in daily average volumes of cars and short trucks from the end of the first quarter to the end of the second quarter were approximately 8.7% and 5.1%, respectively. Average daily long truck traffic volumes increased by approximately 7.4%.

TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1.0 Introduction

1.1 PURPOSE OF STUDY

As part of the Environmental Assessment, the Detroit River International Crossing (DRIC) team has established two ambient air monitoring stations in the Area of Continued Analysis (ACA), along the existing Huron Church/Highway 3 corridor. The purpose of the monitoring program is to collect data on the total pollutant concentrations that are routinely observed in the corridor, rather than specifically determine the fraction that originates from the roadway. This air contaminant concentration data is to be used in establishing baseline data in the air modelling assessment as it firmly establishes the air quality conditions in the study area. The monitoring stations were each operating by September 28th, 2006. The official beginning to the air monitoring program was considered to be October 1st, 2006, and it will continue until the end of September 2007. This report presents the results from the first half of the sampling period, from October 1st, 2006 to March 31st, 2007, with a focus on the second quarter, beginning January 1st, 2007.

The data collected during this study will be used to:

- Establish current conditions within the Huron Church Road/Hwy 3 corridor;
- Assist in determining background air concentrations of the pollutants being measured; and
- Benchmark the air dispersion modelling.

The measured concentrations will be compared to the relevant federal Canada Wide Standards (CWSs) and provincial Ambient Air Quality Criteria (AAQCs) and guidelines to assess whether they are presently within acceptable levels. In addition, the monitoring data will be used in combination with air dispersion modelling undertaken by the DRIC study team to determine the contribution from the roadway relative to upwind background sources in the area which may include Zug Island and other local industries. This background contribution will be added to all modelled results for the assessment of the Practical Alternatives. Also, the data will be used to validate the air dispersion modelling and contributions from upwind background sources. This will be done by modelling the existing conditions and comparing the model predicted concentrations (including background) with the measurements for each pollutant. A statistical analysis will then be completed to confirm the model accuracy is within acceptable levels. This is the second interim report released by the Study Team.

1.2 POLLUTANTS BEING MEASURED

Nitrogen oxides (NO_x) and fine particulate matter ($PM_{2.5}$) are generally the typical air pollutant indicator compounds with respect to transportation related vehicle emissions. Other criteria air pollutants such as sulphur dioxide (SO_2), carbon monoxide (CO) and various species of volatile compounds are also related to transportation sources, but generally are not problematic in terms of health and environmental effects. Four air toxics associated with transportation sources have been selected for monitoring. These are:

- Benzene
- Acrolein *
- Formaldehyde *
- Acetaldehyde *

While transportation sources are not the dominant contributor of the above VOCs to the ambient air (as they are each used widely in industry), they are considered to be characteristic compounds in vehicle exhaust. Benzene is present in the exhaust of gasoline-powered vehicles, as well as diesel-powered vehicles to a lesser extent. Acrolein, formaldehyde, and acetaldehyde (denoted with an asterisk) are typically associated with diesel-powered heavy trucks (more so than gasoline-powered vehicles), and are believed to be primarily responsible for the characteristic odour of diesel exhaust.

It should be noted that transportation sources are only one source of the pollutants included in this study, and all measured concentrations would be expected to have contributions from a variety of local, regional and transboundary sources (i.e., nearby industrial operations and other sources). The MOE operates two monitoring stations in the Windsor area (Windsor West and Windsor Downtown), which collect information on air concentrations, including those measured in the DRIC study. The MOE monitoring data for January to March 2007 was not available at the time this report was written, however preliminary information from the MOE stations for previous years are included in the discussion sections to provide some perspective on the results from the DRIC study.

In addition to the air pollutant concentrations, meteorological data is continuously collected at both stations, such that the data can be correlated with the meteorological conditions. The parameters being measured are:

- Wind speed and direction;
- Temperature; and
- Relative Humidity.

1.3 AMBIENT AIR QUALITY CRITERIA (AAQCS), CANADA WIDE STANDARDS (CWS) AND GUIDELINE LEVELS

The Ontario Ministry of the Environment (MOE) has set Ambient Air Quality Criteria (AAQCs) for a number of air pollutants of concern. Similar to AAQCs, the Canadian Council of Ministers of the Environment (CCME) has set Canada-Wide Standards (CWSs) for specific air pollutants – for $PM_{2.5}$ it is 30 $\mu g/m^3$ (24-hr average). Unlike regulatory standards that apply to fenceline (or Point of Impingement – POI) concentrations at industrial facilities, AAQCs are not legally enforceable unless included in a regulatory instrument (i.e. Certificate of Approval). Instead, these criteria represent the maximum concentration or level (based on potential effects) of contaminant that is desirable or considered acceptable in ambient air (MOE, 2005).

Similarly, the CWS for $PM_{2.5}$ represents a target concentration in ambient air that is to be achieved by 2010. According to the guidance documents provided by the CCME, CWS achievement will be based on community-oriented monitoring sites i.e., sites located where people live, work and play rather than at the expected maximum impact point for specific emission sources (CCME, 2000). Communities for which jurisdictions demonstrate (i) that continued exceedance of the CWS levels is primarily due to transboundary flow of PM and ozone or their precursor pollutants from the U.S. or from another province/territory, and (ii) that "best efforts" have been made to reduce contributions to the excess levels from pollution sources within the jurisdiction, will be identified in reporting as "transboundary influenced communities" that are unable to reach attainment of the CWSs until further reduction in transboundary air pollution flow occurs. Demonstration of transboundary flow influence will be a shared responsibility of the federal government and the affected province/territory, and demonstration of best efforts will include measures in both provincial/territorial and federal implementation plans. It is likely that when the CWS comes into force in 2010, Windsor will be designated as a "transboundary influenced community".

2.0 Monitoring Equipment and Methodology

The following section describes the equipment and methods used to collect samples of each of the contaminants presented in Section 1.0. The description will include information pertaining to whether the contaminant was collected on a continuous basis, or whether it was collected by a trained field technician operating on a pre-defined sampling schedule coinciding with the Environment Canada (EC) National Air Pollutant Surveillance (NAPS) network schedule. Each of the methods described below are either provided by, or approved by the U.S. Environmental Protection Agency (EPA) and Ontario Ministry of the Environment (MOE).

2.1 NITROGEN OXIDES (NO_X)

The levels of nitrogen oxides (NO_x) in the ambient air were measured using continuously sampling NO_x analysers that operate on the principle of chemiluminescence, which is a U.S. EPA and Ontario Ministry of the Environment (MOE) approved method. Ambient air is continuously drawn into the analyser where it is exposed to a steady supply of ozone (O_3), initiating a chemical reaction with the NO_x compounds that produces light (chemiluminescence). The intensity of this light is directly proportional to the amount of nitrogen oxide (NO) in the sample gas stream. Nitrogen dioxide (NO_2) that may also be present in the sample gas does not participate in this reaction; therefore a second stream of gas is also passed through a catalytic-reactive converter, which converts the NO_2 to NO such that chemiluminenscence may take place. The results from this second stream are reported as NO_x, and the NO_2 content is determined by difference, through subtracting the known NO content of the sample gas from the first stream.

2.2 FINE PARTICULATE MATTER ($PM_{2.5}$)

Samples of fine particulate matter with a diameter less than 2.5 micron ($PM_{2.5}$) are collected using MetOne Instruments BAM-1020 Particulate Monitors. This instrument uses the principle of beta ray attenuation through a filter tape to provide an hourly determination of mass concentration on a continuous basis. Each hour, the instrument performs a cycle consisting of four steps in order to produce an average hourly $PM_{2.5}$ concentration. Included in each cycle is an automatic calibration, which allows the instrument to provide highly accurate $PM_{2.5}$ concentrations each hour. Descriptions of each of the steps in the cycle are described in detail in Appendix A2.

2.3 VOC SAMPLING

The method applied to collect samples of volatile organic compounds (VOCs) was the US EPA Compendium Method TO-15: *Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters and Analysed by Gas Chromatography/Mass Spectrometry (GC/MS).*

VOCs are collected in polished stainless steel canisters (summa canisters) over a set time period. For the purposes of this study, samples were collected over a period of 24-hours. Summa canisters are stainless steel vessels that have had their internal surfaces made chemically inert through an electro-polishing and chemical deactivation process. These 6L canisters hold a high vacuum (~28 "Hg), and ambient air is sampled by opening a valve which draws air into the canister. Before sampling, a flow controller is attached to the canister to control the rate at which are is drawn into the canister, such that sampling occurs evenly over the course of the desired time period. This method of VOC sampling requires that a field technician place the canister in the selected location and manually open and close the valve at the beginning and end of each sampling period.

Following sample collection, the canisters are shipped to a laboratory for analysis for benzene and acrolein. Results are reported on a 24-hour average basis.

2.4 ALDEHYDE SAMPLING

The method applied to collect samples of aldehydes was the US EPA Compendium Method TO-11A: *Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC).* This method applies to the collection of formaldehyde, as well as other carbonyl compounds (aldehydes and ketones).

Samples of aldehydes are collected on sorbent tubes (glass tubes filled with material that easily absorb the target compounds), which meet the specifications of US EPA Method TO-11A for the determination of aldehydes in ambient air. These tubes are 6 mm OD x 110 mm long, and contain a 300 mg front sorbent section, and a 150 mg backup sorbent section. The sorbent is silica gel coated with 2,4-dinitrophenylhydrazine (DNPH). Ambient air is drawn through this sorbent tube by a personal pump at a flow rate of approximately 1 L/min for a period of 24-hours. This requires that a field technician calibrate the pump before and after each sampling period, and be present to switch the pump on and off.

After sampling, the tubes are sealed and kept refrigerated until they are packed in coolers and forwarded to the laboratory for analysis of formaldehyde and acetaldehyde.

2.3 MONITORING LOCATIONS

The DRIC team examined potential locations to site the monitoring stations within the Highway 3/Talbot Road/Huron Church corridor. In addition, suggested locations for each station were obtained from the DRIC Community Consultation Group (CCG). The final locations were selected based on the technical requirements / limitations of the available properties (i.e., site access, power availability, trees) and permissions from the property owners. Both stations are located within 45 m of the edge of the roadway, along Huron Church / Highway 3.

The first station was deployed in an open field adjacent to the Ontario Public Health Laboratory (OPHL), which is located at 3400 Huron Church Rd. (between Cabana Rd. and Pulford St.). The second station is located adjacent to 2015 Talbot Road (Highway 3), which is on the south side of the road, opposite the main entrance to St. Clair College. Both locations experience significant traffic. In addition, the station at St. Clair College will experience the effects of idling traffic, as vehicles queue at the intersection. In addition, a traffic counting station on Huron Church Road, located in the St. Clair College area provide continuous traffic counts to correlate with the measurements. Figures 2.1 and 2.2 illustrate the approximate locations of each monitoring station.

Figure 2.1
Ontario Public Health Laboratory Air Monitoring Station Location

Figure 2.2
St. Clair College Air Monitoring Station Location

3.0 Monitoring Results and Discussion

3.1 MONITORING RESULTS TO DATE

The following section outlines the monitoring results by contaminant, for the period from October 1st, 2006 – March 31st, 2007, with a specific focus on the second quarter (beginning January 1st, 2007). A discussion of the results presented below appears in Section 3.4.

3.1.1 Nitrogen Oxides

Nitrogen oxides are emitted to the air from combustion processes, and are largely comprised of nitric oxide (NO) and nitrogen dioxide (NO_2). Major sources include the transportation sector, utilities and other processes that involve the combustion of fossil fuels.

Nitrogen dioxide is a reddish brown gas with a pungent odour, which transforms in the atmosphere to form nitric acid and nitrates. It also plays a major role in atmospheric reactions that produce ground level ozone, which is a major component of smog. Nitrogen dioxide reacts to form organic nitrates, which contribute to the formation of fine particulate (i.e. $PM_{2.5}$).

Atmospheric concentrations of NO_x were measured continuously at both monitoring sites and averaged on an hourly basis, calculated on the hour. The resulting hourly concentrations and daily average concentrations were compared to MOE Ambient Air Quality Criteria (AAQCs) of 400 $\mu g/m^3$ and 200 $\mu g/m^3$, respectively. These AAQCs are outlined in the MOE document *Summary of O.Reg. 419/05 Standards and Point of Impingement Guidelines and Ambient Air Quality Criteria* (MOE, 2005). A summary of the hourly and daily maximum, minimum and average values separated by each month in the sampling period to-date are presented in Tables 3.1 and 3.2, respectively.

Table 3.1
Hourly Max/Min/Average NO_x Concentrations by Month
(October 2006 – March 2007)

Monitoring Station	Month	MOE AAQC (µg/m^3)	Maximum Measured Concentration (µg/m^3)	Minimum Measured Concentration (µg/m^3)	Average Concentration (µg/m^3)
Ontario Public Health Laboratory	Oct. 2006	400	319	0	30
	Nov. 2006		265	4	44
	Dec. 2006		231	2	33
	Quarter #1		**319**	**0**	**36**
	Jan. 2007		216	3	36
	Feb. 2007		297	0	38
	Mar. 2007		209	1	24
	Quarter #2		**297**	**0**	**32**
St. Clair College	Oct. 2006	400	191	0	14
	Nov. 2006		345	0	34
	Dec. 2006		223	2	21
	Quarter #1		**345**	**0**	**23**
	Jan. 2007		115	3	22
	Feb. 2007		237	4	24
	Mar. 2007		225	1	24
	Quarter #2		**237**	**1**	**23**

Table 3.2
Daily Max/Min/Average NO_x Concentrations by Month
(October 2006 – March 2007)

Monitoring Station	Month	MOE AAQC (µg/m^3)	Maximum Measured Concentration (µg/m^3)	Minimum Measured Concentration (µg/m^3)	Average Concentration (µg/m^3)
Ontario Public Health Laboratory	Oct. 2006	200	101	2	30
	Nov. 2006		144	8	44
	Dec. 2006		118	9	33
	Quarter #1		**144**	**2**	**36**
	Jan. 2007		74	8	36
	Feb. 2007		117	3	38
	Mar. 2007		73	2	24
	Quarter #2		**117**	**2**	**32**
St. Clair College	Oct. 2006	200	56	1	14
	Nov. 2006		149	7	34
	Dec. 2006		66	5	21
	Quarter #1		**149**	**1**	**23**
	Jan. 2007		47	6	22
	Feb. 2007		64	8	24
	Mar. 2007		66	3	24
	Quarter #2		**66**	**3**	**23**

Tables 3.1 and 3.2 illustrate that maximum recorded hourly and daily averages are well within the AAQC values. The following figures present the entire data set for the sampling period thus far in graphical format, in order to show fluctuations in the NO_x concentrations over the period. Figure 3.1 shows the hourly maximums over the sampling period, and Figure 3.2 shows the daily averages. Refer to Appendix A1 for a tabular summary of all NO_x concentrations collected over the sampling period.

Figure 3.1
Hourly NO_x Concentrations ($\mu g/m^3$)

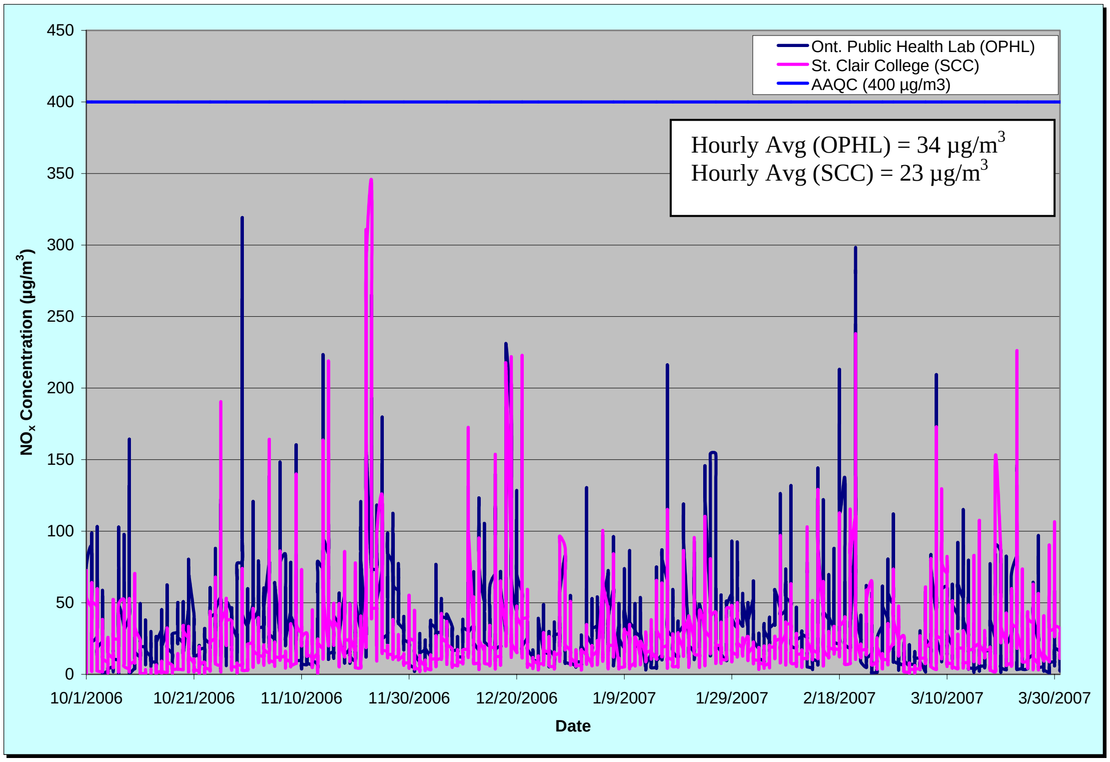
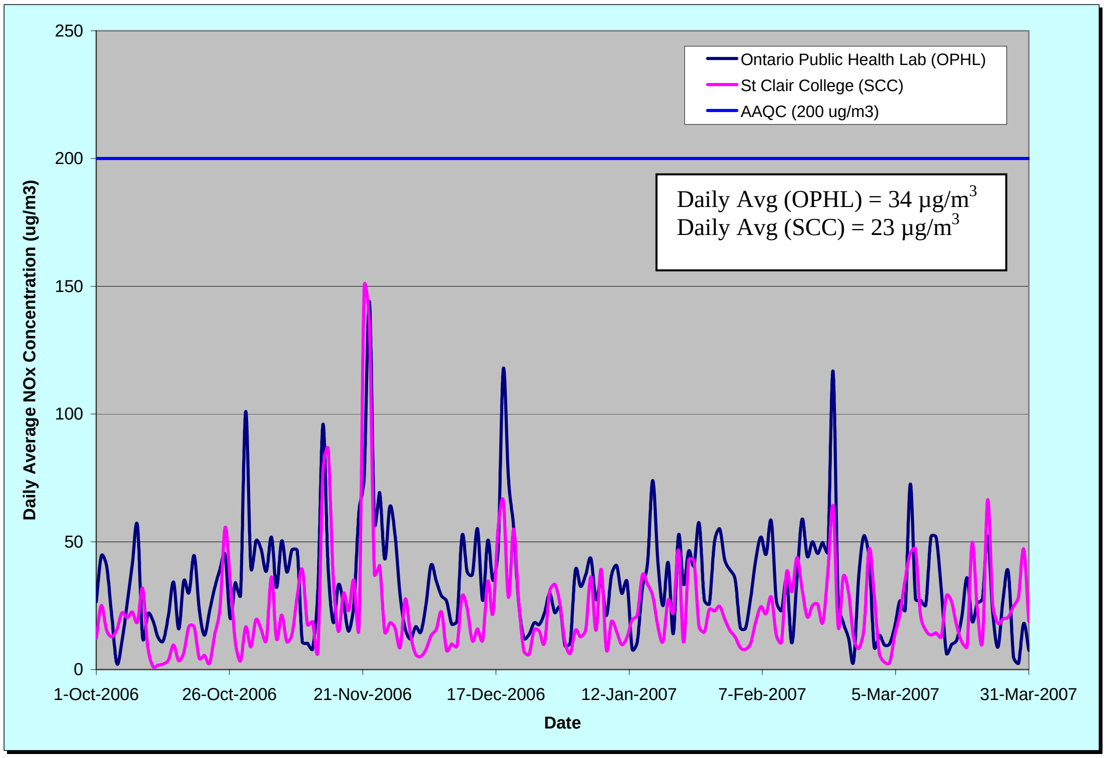


Figure 3.2
Daily Average NO_x Concentrations ($\mu g/m^3$)



3.1.2 $PM_{2.5}$

Particulate matter includes aerosols, smoke, fumes, dust, flyash and pollen. Its composition varies with origin, residence time in the atmosphere, time of year and environmental conditions. Fine particulate matter may be emitted directly to the atmosphere through fuel combustion (e.g., motor vehicles, smelters, power plants, industrial facilities, residential fireplaces and wood stoves, agricultural burning and forest fires) or formed indirectly in the atmosphere through a series of complex chemical reactions (MOE, 2006).

Ambient concentrations of $PM_{2.5}$ were collected continuously at each of the monitoring stations as hourly averages, calculated on the hour. The 24-hr average concentration of $PM_{2.5}$ for each day was compared to the proposed Canada Wide Standard (CWS) of 30 $\mu g/m^3$. The CWS for $PM_{2.5}$ will come into force in 2010, and achievement will be based on the 98th percentile annual ambient measurement, averaged over three consecutive years. A summary of the maximum, minimum, and average daily concentrations of $PM_{2.5}$ separated by month over the entire sampling period thus-far are presented in Table 3.3

.

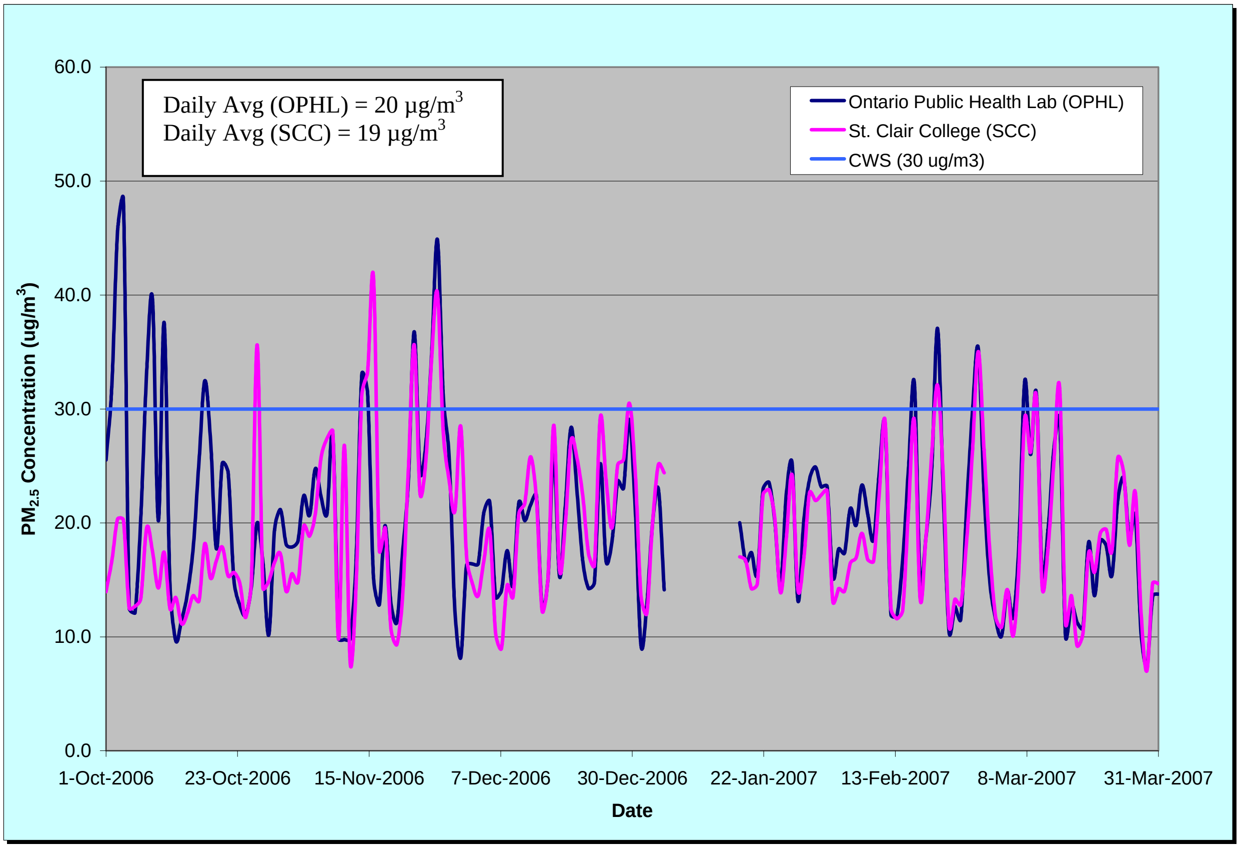
Table 3.3
Daily Max/Min/Average $PM_{2.5}$ Concentrations by Month
(January – March 2007)

Monitoring Station	Month	CCME Canada Wide Standard (µg/m^3)	Maximum Measured Concentration (µg/m^3)	Minimum Measured Concentration (µg/m^3)	Average Concentration (µg/m^3)	# of Exceedances of CWS
Ontario Public Health Laboratory	Oct. 2006	30	48	10	22	7
	Nov. 2007		45	10	22	6
	Dec. 2006		29	8	19	0
	Quarter #1		**48**	**8**	**21**	**13**
	Jan. 2007		25	9	19	0
	Feb. 2007		37	10	21	3
	Mar. 2007		33	7	18	2
	Quarter #2		**37**	**7**	**19**	**5**
St. Clair College	Oct. 2006	30	36	11	16	1
	Nov. 2006		42	8	23	6
	Dec. 2006		31	9	20	1
	Quarter #1		**42**	**8**	**20**	**8**
	Jan. 2007		25	12	19	0
	Feb. 2007		35	11	19	2
	Mar. 2007		32	7	18	2
	Quarter #2		**35**	**7**	**19**	**4**

Figure 3.3 presents a graph illustrating the daily fluctuations in $PM_{2.5}$ concentration over the entire sampling period, from October 1st, 2006 to March 31st, 2007. The figure shows a break in data between January 5th and January 17th, 2007. This was due to an instrument error at both stations, in which the filter tape reached the end of its length and thus no further concentrations could be recorded. This is described further in Section 4.3. Refer to Appendix A2 for a tabular summary of all $PM_{2.5}$ concentrations collected over the sampling period.

Figure 3.3

Daily Average $PM_{2.5}$ Concentrations (µg/m^3)



3.1.3 Aldehydes

Ambient concentrations of formaldehyde and acetaldehyde were measured on an approximate 3-day cycle (twice per week) coinciding with the EC NAPS network 6-day schedule. The samples were collected by a trained field technician and sent to an accredited laboratory for analysis. The resulting concentrations were compared to the MOE 24-hr AAQCs of 65 µg/m^3 for formaldehyde, and 500 µg/m^3 for acetaldehyde. Table 3.4 summarizes the maximum, minimum and average daily concentrations of each aldehyde collected during the quarter and the entire period.

Table 3.4
Daily Max/Min/Average Concentrations of Aldehydes for the Quarter (January – March 2007)

Monitoring Station	Contaminant	MOE 24-hr AAQC (µg/m³)	Maximum Measured Concentration (µg/m³)		Minimum Measured Concentration* (µg/m³)		Average Concentration (µg/m³)	
			Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)	Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)	Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)
Ontario Public Health Laboratory	Acetaldehyde	500	1.2	2.4	0.6	0.3	0.8	1.0
	Formaldehyde	65	2.8	5.0	1.0	1.0	1.8	2.2
St. Clair College	Acetaldehyde	500	1.3	2.5	0.6	0.4	0.8	1.1
	Formaldehyde	65	3.2	5.7	0.9	0.8	1.7	2.4

**note: column includes detected concentrations – levels that were below the detection limit of the lab instrumentation were not included.*

To put these results into perspective, Table 3.5 outlines historical results from the MOE Windsor monitoring station from the years 2003 and 2004.

Table 3.5
Max/Min/Average Concentrations of Aldehydes from MOE Windsor Station (2003 – 2004)

Contaminant	Maximum Measured Concentration (µg/m³)		Minimum Measured Concentration (µg/m³)		Mean Concentration (µg/m³)	
	2003	2004	2003	2004	2003	2004
Acetaldehyde	4.6	1.2	0.7	0.4	1.7	0.6
Formaldehyde	11.3	2.1	1.4	0.9	3.1	1.2

As can be seen in the tables, the average measurements at the DRIC monitoring stations for the sampling period thus far are less than the MOE measurements made in 2003, and greater than the MOE measurements made in 2004. The 2004 MOE values are somewhat lower than those in 2003.

3.1.4 Volatile Organic Compounds

Samples of VOCs were collected by a trained field technician on the same cycle as the aldehyde samples. The samples were collected in summa canisters and sent to an accredited laboratory for analysis. There are at present no MOE AAQCs for either acrolein or benzene. Instead, guideline limits from other jurisdictions or previous MOE AAQCs have been used as a measure of comparison. Table 3.6 outlines the maximum, minimum and average daily concentrations of each VOC for the quarter, as well as the guideline limits used for comparison.

Table 3.6
Daily Max/Min/Average Concentrations of VOCs for the Quarter
(January – March 2007)

Monitoring Station	Contaminant	Guideline Limit ($\mu g/m^3$)	Maximum Measured Concentration ($\mu g/m^3$)		Minimum Measured Concentration ($\mu g/m^3$)		Average Concentration ($\mu g/m^3$)	
			Jan-Mar 2007 (Q2)	Sampling Period To-Date (Q1+Q2)	Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)	Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)
Ontario Public Health Laboratory	Acrolein	9.6*	2.7	2.7	0.1	0.1	0.4	0.4
	Benzene	60+	1.8	1.8	0.3	0.3	0.6	0.6
St. Clair College	Acrolein	9.6*	1.5	1.5	0.1	0.1	0.3	0.4
	Benzene	60+	1.3	3.1	0.3	0.3	0.6	0.6

** - converted to 24-hr from 1-hr*
+ - not a health-based limit

To put these results into perspective, Table 3.7 outlines the historical VOC results (2003 – 2004) from the MOE Windsor monitoring station. Note that the MOE concentrations have been calculated from data collected over an entire year, whereas the concentrations in Table 3.6 have been calculated from data collected over six months.

Table 3.7
Max/Min/Average Concentrations of VOCs from MOE Windsor Station
(2003 – 2004)

Contaminant	Maximum Measured Concentration (µg/m³)		Minimum Measured Concentration (µg/m³)		Mean Concentration (µg/m³)	
	2003	2004	2003	2004	2003	2004
Acrolein	0.3	0.06	0.05	0.05	0.1	0.02
Benzene	6.3	6.3	0.6	0.4	1.7	1.8

The measured acrolein concentrations are higher on average than those measured previously at the MOE stations, while the measured benzene concentrations are lower.

3.2 METEOROLOGICAL DATA

Each of the two air monitoring stations are equipped with a fully functional meteorological station, which logs both 15-minute averages as well as 1-hour averages for outside temperature, relative humidity, wind direction and wind speed. The following sections summarize the meteorological data collected, and comparisons are made between the data set from the DRIC monitoring stations and other available data for the Windsor area.

3.2.1 Temperature

Table 3.8 summarizes temperature data from the second quarter of the ambient air monitoring program, as well as the period thus far. Temperature is an important parameter, since near the surface it controls the buoyant component of turbulence (vertical motion). Heat from the earth's surface warms the air near the ground causing it to rise, reaching a maximum in the early afternoon and a minimum near sunrise. This aids pollutant dispersion. The near-surface temperature also controls how fast the surface dries. If the temperature is low, the moisture on the surface of the ground may remain or freeze, effectively sealing the surface from wind erosion and thereby reducing re-suspension of surface dust. Conversely, high temperatures lead to dry conditions, which result in surface dust being suspended and/or generated as vehicles drive on roadways. This dust is generated through brake and tire wear, pavement degradation, etc.

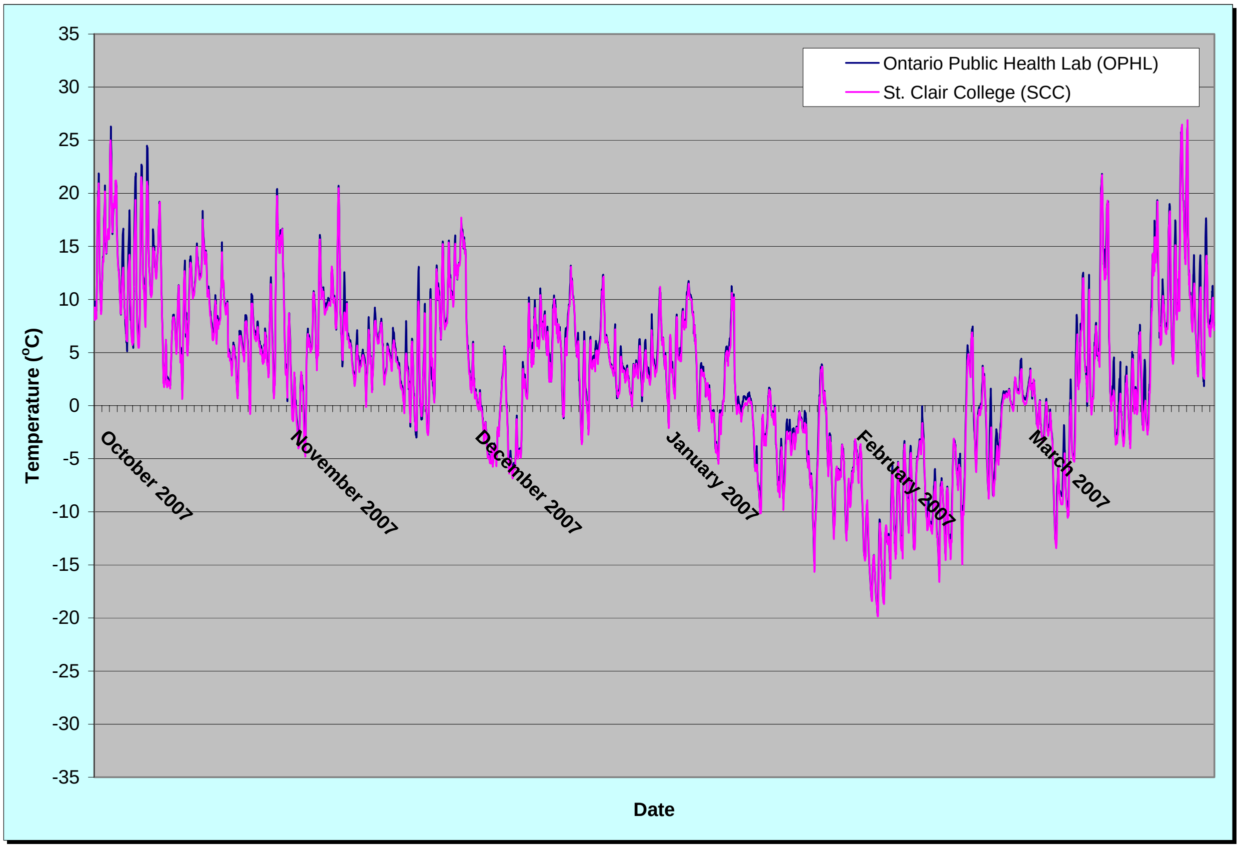
Table 3.8 outlines the maximum, minimum and average temperatures from the hourly data collected. The last row contains historical daily maximum, minimum and average temperatures from Environment Canada data, averaged over the years from 1971 through to 2000. According to this data, January 2007 and March 2007 were each warmer than typical, while February 2007 was cooler than typical. As such, particulate concentrations during January and March may be expected to be higher than usual for this time of year.

A graph of the entire set of temperature data is provided in Figure 3.4. This shows the fluctuations in temperature over the sampling period thus far. A full tabular summary of the meteorological data is provided in Appendix A3.

Table 3.8
Comparison of Temperature Data from Monitoring Stations to Local Normals

Data Set	January 2007			February 2007			March 2007			Sampling Period to-Date (Q1+Q2)		
	Max (°C)	Min (°C)	Avg (°C)	Max (°C)	Min (°C)	Avg (°C)	Max (°C)	Min (°C)	Avg (°C)	Max (°C)	Min (°C)	Avg (°C)
OPHL	11.8	-14.6	-0.6	7.5	-19.6	-6.4	26.3	-13.0	4.6	26.3	-19.6	3.0
SCC	11.5	-15.7	-1.0	6.9	-19.9	-6.8	26.9	-13.4	4.1	26.9	-19.9	2.6
EC 1971-2000	-0.9	-8.1	-4.5	0.6	-7.0	-3.2	6.4	-2.4	2.0	5.3	-2.5	1.4

Figure 3.4
Average Hourly Temperature for the Quarter



3.2.2 Wind Speed and Wind Direction

Wind is the most important meteorological parameter related to air contaminant dispersion. The concentrations of pollutants in air decrease with increasing wind speed as a result of dilution. When wind speeds are high, there is enhanced dispersion of gases and particles throughout the atmosphere, due to mechanical turbulence. However, there is also a greater potential for re-suspension of surface dust. When wind speeds are near zero (i.e. during calm conditions), reduced local circulation can lead to high pollutant concentrations near the surface due to very poor dispersion.

Wind roses for the OPHL location and the St. Clair College location are presented in Figure 3.5 and Figure 3.6, respectively. These figures display the predominant directions that the wind blew *from*, as well as the frequency of occurrence of each direction and wind speed category. These figures include a wind rose for the second quarter of sampling (a) and for the sampling period thus far (b).

Figure 3.5a
Ontario Public Health Laboratory Wind Rose for the Quarter

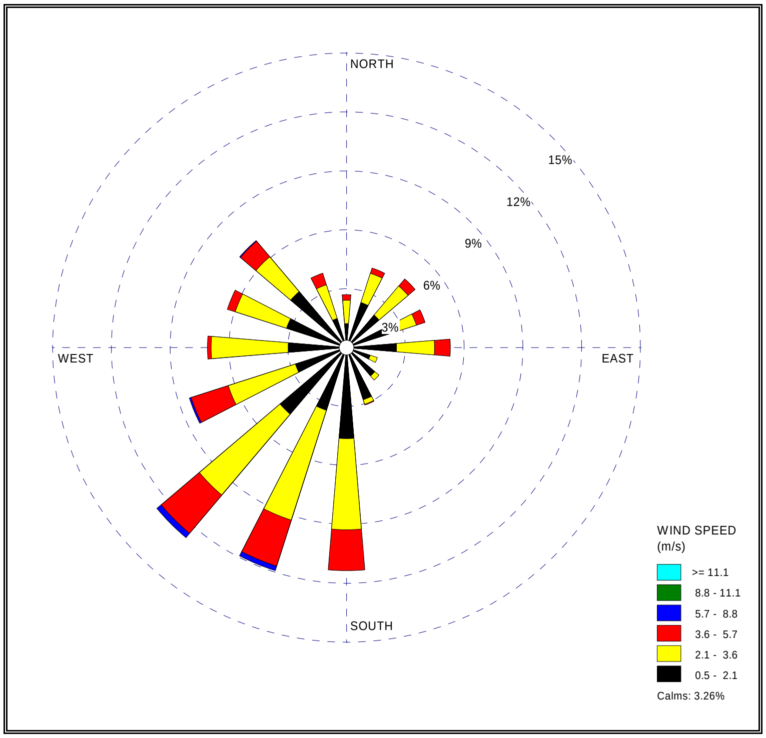


Figure 3.5b
Ontario Public Health Laboratory Wind Rose for the Period To-Date

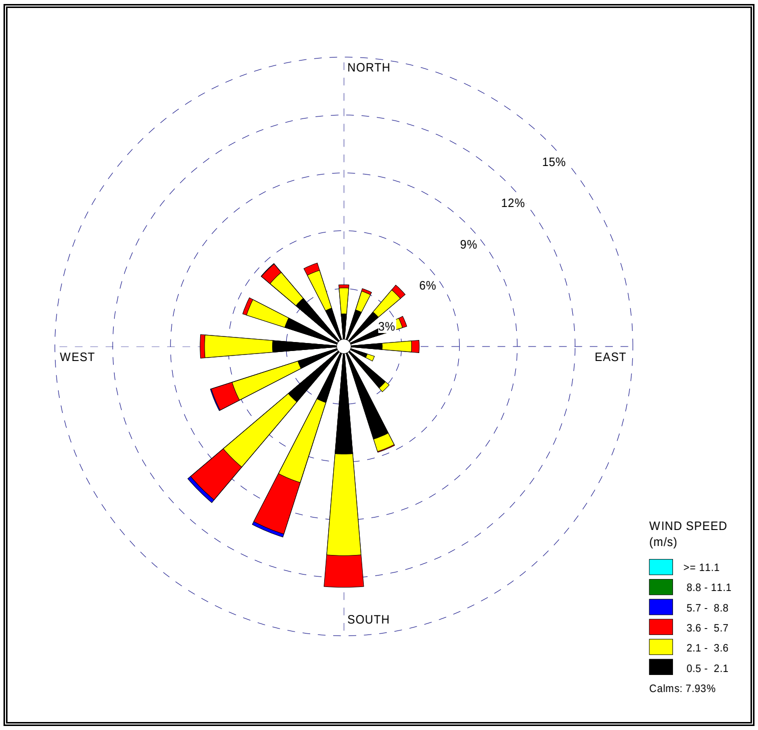


Figure 3.6a
St. Clair College Wind Rose for the Quarter

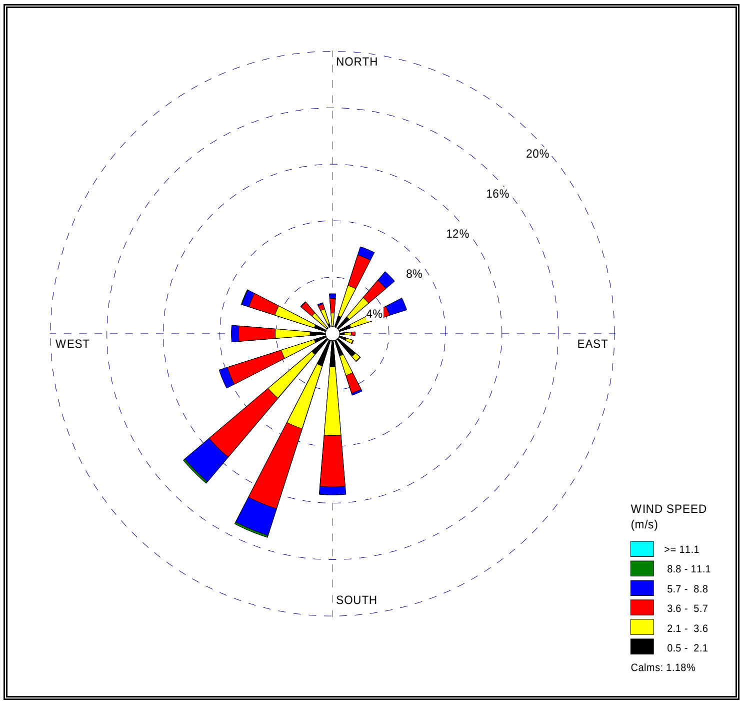
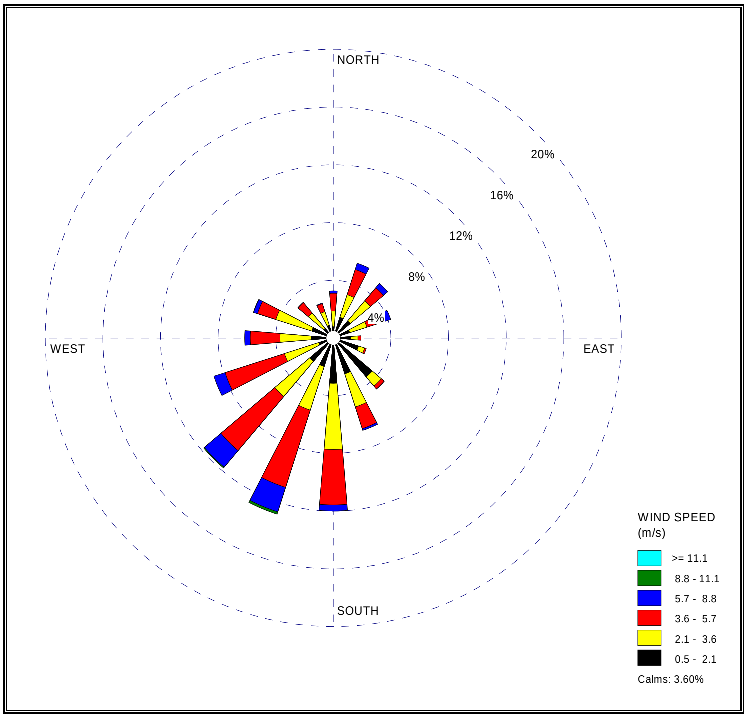


Figure 3.6b
St. Clair College Wind Rose for the Period To-Date



During the first quarter, winds were most frequently from the south at both locations. The wind roses for each monitoring station for the second quarter show that south-westerly and south-south-westerly winds are the most frequent during the winter months. As with the first quarter of monitoring, winds were generally stronger (i.e., higher speeds) at the St. Clair College location, as it is more exposed than the OPHL location. The objective of the meteorological monitoring was to determine the local wind patterns, in order to help interpret the monitoring results.

Figure 3.7 presents the wind rose data from the Environment Canada meteorological station at the Windsor Airport for purposes of comparison. Figure 3.7 shows that the wind behaviour at the airport is similar to the above wind roses, in that there is a strong contribution to from the south-west. The winds at the airport are much stronger than detected at the monitoring stations. The wind rose from the airport shows a strong westerly wind component, which is not prevalent at either of the DRIC monitoring stations. The monitoring stations each have a strong southerly component that is not prevalent at the airport. This comparison illustrates that the wind patterns in the area of the air monitoring stations are influenced by local effects (such as channelling due to the presence of the Huron Church/Highway 3 corridor) and are slightly different than the broader wind patterns of the area.

Figure 3.7a
Windsor Airport Wind Rose for the Quarter

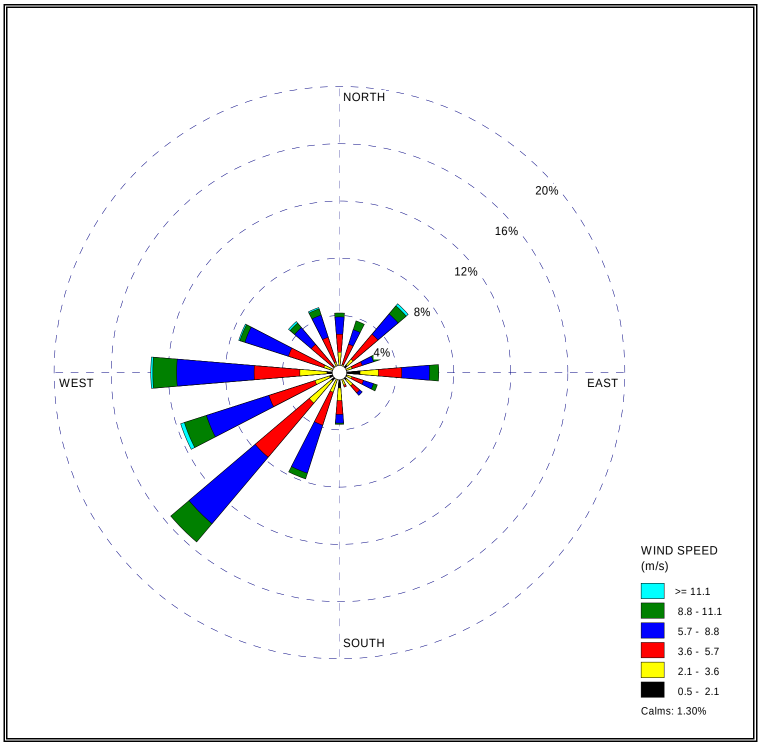
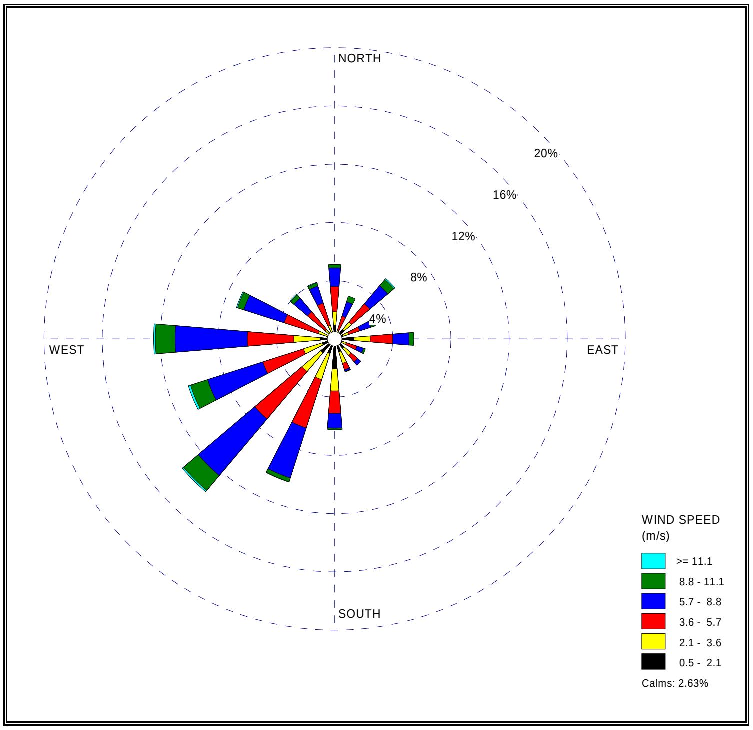


Figure 3.7b
Windsor Airport Wind Rose for the Period To-Date



3.3 TRAFFIC DATA

Information on the quantity and type of vehicle traffic travelling along Huron Church Road in the area of the air monitoring stations was provided to SENES by URS Canada via MTO to correlate with the monitoring results. The hourly maximum, minimum, and average traffic counts for the entire quarter are summarized in Table 3.9 for each vehicle type (car, short truck, long truck). The daily maximum, minimum, and average counts appear in Table 3.10. The same information separated by month is included in Table 3.11 and Table 3.12, respectively. Figure 3.8 illustrates the daily totals for cars and trucks over the course of the quarter. Refer to Appendix A4 for a tabular summary of all traffic data used in the study.

Table 3.9
Hourly Max/Min/Average Traffic Counts for the Quarter and Period

Vehicle Type	Maximum (#)		Minimum (#)		Average (#)	
	Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)	Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)	Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)
Car	1,500	1,746	21	21	623	655
Short Truck	101	121	0	0	30	31
Long Truck	573	603	13	7	295	285

Table 3.10
Daily Max/Min/Average Traffic Counts for the Quarter and Period

Vehicle Type	Maximum (#)		Minimum (#)		Average (#)	
	Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)	Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)	Jan-Mar 2007 (Q2)	Sampling Period to-Date (Q1+Q2)
Car	18,600	21,299	6,579	6,579	14,966	15,721
Short Truck	1,034	1,355	144	79	722	742
Long Truck	9,689	9,924	2,441	698	7,085	6,827

Table 3.11
Hourly Max/Min/Average Traffic Counts by Month

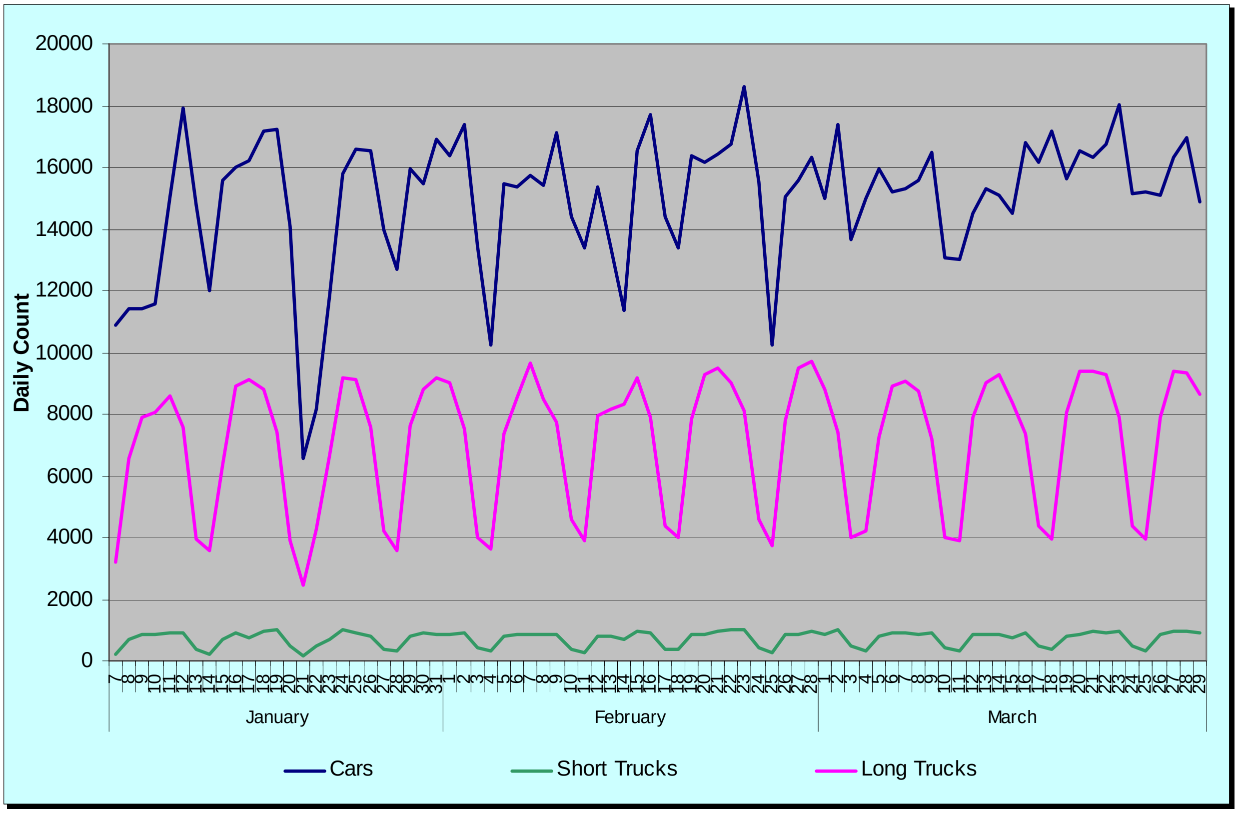
Vehicle Type	**January 2007**			**February 2007**			**March 2007**			**Sampling Period to-Date (Q1+Q2)**		
	Max ($^{\#}$)	**Min ($^{\#}$)**	**Avg ($^{\#}$)**	**Max ($^{\#}$)**	**Min ($^{\#}$)**	**Avg ($^{\#}$)**	**Max ($^{\#}$)**	**Min ($^{\#}$)**	**Avg ($^{\#}$)**	**Max ($^{\#}$)**	**Min ($^{\#}$)**	**Avg ($^{\#}$)**
Car	1,500	21	583	1,466	35	631	1,500	39	650	1,746	21	655
Short Truck	101	0	28	98	0	31	94	1	31	121	0	31
Long Truck	551	13	274	573	30	303	560	38	304	603	7	285

Table 3.12
Daily Max/Min/Average Traffic Counts by Month

Vehicle Type	**January 2007**			**February 2007**			**March 2007**			**Sampling Period to-Date (Q1+Q2)**		
	Max ($^{\#}$)	**Min ($^{\#}$)**	**Avg ($^{\#}$)**	**Max ($^{\#}$)**	**Min ($^{\#}$)**	**Avg ($^{\#}$)**	**Max ($^{\#}$)**	**Min ($^{\#}$)**	**Avg ($^{\#}$)**	**Max ($^{\#}$)**	**Min ($^{\#}$)**	**Avg ($^{\#}$)**
Car	17,899	6,579	14,070	18,600	10,262	15,124	18,008	13,016	15,586	21,299	6,579	15,721
Short Truck	1,022	144	683	1,034	253	731	1,025	307	746	1,355	79	742
Long Truck	9,175	2,441	6,660	9,689	3,618	7,259	9,385	3,891	7,283	9,924	698	6,827

Car traffic and short truck traffic decreased compared to the first quarter of monitoring. Long truck traffic increased on average.

Figure 3.8
Daily Traffic Count Totals (January to March, 2007)



As can be seen in Figure 3.8, there are weekly variations in traffic volumes, but the weekday daily maximum levels are relatively constant. The troughs in the daily total truck traffic data series represent the weekend days, in which less trucks are travelling to and from the border crossing.

3.4 DISCUSSION OF RESULTS

The following sections include a discussion of the results for each contaminant presented in Section 3.1.

3.4.1 Nitrogen Oxides

Ambient concentrations of NO_x were collected over the course of the sampling period as hourly averages. There were no measured exceedances of either the 1-hr AAQC of 400 µg/m^3, or the 24-hr AAQC of 200 µg/m^3 for NO_x. The highest measured hourly average NO_x concentration during the second quarter was 297 µg/m^3, or 74% of the AAQC. The highest measured daily average NO_x concentration was 117 µg/m^3, or 59% of the AAQC. Both of these were at the Ontario Public Health Laboratory location.

The highest measured hourly average NO_x concentration detected thus far in the sampling period (i.e., since October 1st, 2006) was 345 µg/m^3 (86% of the AAQC), and the highest daily average concentration was 149 µg/m^3 (75% of the AAQC). Both of these were detected at the St. Clair College location in the previous quarter.

3.4.2 $PM_{2.5}$

In total, there were 90 sampling days during the second quarter of sampling. The ambient concentrations of $PM_{2.5}$ at each station were comparable to those measured in the past three years (2003 – 2005) at the two MOE monitoring stations located in west Windsor, and the downtown area, respectively. Ambient concentrations exceeded the 24-hr CWS of 30 µg/m^3 a total of 5 times at the OPHL location, and 4 times at the St. Clair College location during the second quarter. The maximum number of exceedances of the CWS at the MOE stations in the years 2003 – 2005 was 11 and 12 at the Windsor West and Windsor Downtown stations, respectively. Exceedances of $PM_{2.5}$ may be due to any number of local influences, which may include (but may not be limited to):

- Traffic along the Huron Church/Highway 3 corridor;
- Upwind transboundary sources in the United States;
- Local industrial sources; and/or
- Any other local occurrences that may have resulted in the release of fine particulate matter (i.e. fires, construction activities, etc.)

Ambient concentrations of $PM_{2.5}$, when considered over the course of the entire sampling period thus far (i.e., since October 1st, 2006), have exceeded the 24-hr CWS of 30 µg/m^3 a total of 18 times at the OPHL location, and 12 times at the St. Clair College location. Since this includes only 6 months of monitoring, not including smog season (May – Sept/Oct), more exceedance days are expected.

As outlined in the introduction to this report, the purpose of this monitoring is to obtain a set of baseline air quality data along the Huron Church/Highway 3 corridor, which will be used in an air dispersion modelling assessment. This model will use the baseline data and associated meteorological data to determine the influence of traffic on local concentrations of fine particulate matter, and the extent that other local and transboundary sources may be contributing.

3.4.3 Aldehydes

There were no measured exceedances of the MOE AAQCs for formaldehyde or acetaldehyde during the sampling period. Concentrations of each were well within their respective criteria at both locations. The maximum concentration of each contaminant as a percentage of their respective MOE AAQCs at the Ontario Public Health Laboratory were 0.24% for acetaldehyde, and 4.3% for formaldehyde. At the St. Clair College location, the maximums were 0.26% for acetaldehyde and 4.9% for formaldehyde.

3.4.4 Volatile Organic Compounds

There were no exceedances of the acrolein guideline limit during the sampling period. As with the aldehydes, the concentrations of each of these contaminants were well within their respective standards. At the Ontario Public Health Laboratory, the concentration of benzene reached a maximum of 3.0% of the guideline limit of 60 $\mu g/m^3$, while the maximum concentration of acrolein was 28.1% of the guideline limit of 9.6 $\mu g/m^3$. The maximum concentrations of benzene and acrolein as percentages of the guidelines at the St. Clair College location were 2.2% and 15.6%, respectively.

4.0 Quality Assurance / Quality Control

4.1 VALIDITY OF DATA

For each of the contaminants being monitored, measures were taken to ensure that the data collected would be valid and representative. These measures included regular calibration of the equipment where applicable, as well as proper usage and handling of sampling media. SENES staff visited the stations approximately every 2 weeks to perform routine maintenance and calibrations.

The NO_x analysers were calibrated during every visit to the monitoring stations by SENES personnel. Tanks of zero gas (compressed air) and calibration gas (NO) located on-site were used to set the zero and span of the analysers to ensure that the data recorded was accurate. In addition to this, the units automatically check the zero and span daily.

The BAM units are self-calibrating, and therefore no ongoing calibrations measures were necessary. However, the filter tapes must be changed on occasion, as they run out. This was performed twice at each station.

Part of the procedure for collecting samples of aldehydes was to calibrate the pump before and after each sampling period. Also recorded during calibration was the rotometer reading on the pump itself. When the pump was turned on to commence sampling, and turned off at the end of the sampling period, the rotometer readings were compared to the readings during calibration to ensure that the flow rates gathered from calibration were valid to use to calculate the total volume of air sampled.

Another measure taken to ensure valid samples of aldehydes was through sealing of the cartridges and storage of the sampling media in the refrigerator, both before usage and after sampling until ready for shipment. Samples were shipped to the laboratory with an ice-pack, in order to keep the samples at sub-ambient temperature.

In order to ensure validity of the VOC samples, procedures were implemented to ensure that the valve on each canister did not leak, and that the sample was completed before all vacuum pressure was lost (i.e., before registering 0 ”Hg on the gauge).

4.2 OUTLIERS

Despite making the efforts outlined in Section 4.1 to ensure data quality, there were occasional erroneous readings from the continuous monitors that were removed before processing. The BAM outputs a reading of 999 $\mu g/m^3$ when there is an error. These were removed from the data set. During the first quarter, there were instances in which a repeated number was output for a number of consecutive hours, due to the filter tape getting stuck in place. In one instance this occurred for 19 hours. It is highly unlikely that the hourly ambient concentration would be the same to two decimal places for such a period, and thus the data was removed for 18 of the 19 hours. Early in the second quarter, each of the BAM units experienced a filter tape error, where the roll of filter tape ran out and the unit continued to output data until it was replaced. The errors began on January 5th (OPHL) and January 6th (SCC), and were rectified during the next site visit on January 17th. The units output the same concentration repeatedly until the units were in working order again. These repeated concentrations were removed from the data set.

The only NO_x data that was considered to be outlier data was for low concentrations that were recorded as negative values. This indicated that the analyser was in need of re-zeroing, which was part of the regular calibration procedure. Negative values were rare as the units were calibrated and zeroed on a regular basis. Since October 1st, 2006 a total of 23 and 45 negative hourly concentrations were removed from the data set at the OPHL and St. Clair College locations, respectively. All of the outliers occurred during the first quarter – the entire second quarter data set was considered valid.

4.3 MOE AUDIT OF MONITORING STATIONS

On February 21st, 2007, a Senior Environmental Officer (Air) from the MOE London District Office (Technical Services) visited the two air monitoring stations in order to audit the equipment performance and procedures. The Officer inspected the equipment, and observed the VOC and aldehyde sample set-up, as well as a NO_x analyser calibration. All sampling and QA/QC procedures were approved in a memorandum forwarded to SENES and MTO on February 26th, 2007. No recommendations for improvement were suggested.

5.0 Findings to Date

Two air monitoring stations were strategically set up on either side of the existing Huron Church/Highway 3 corridor in Windsor, Ontario in order to monitor traffic related airborne contaminants that would be expected in the corridor. The information from this monitoring program will be used to establish current baseline conditions in the area for use in the air modelling portion of the Environmental Assessment associated with the Detroit River International Crossing project. Data on ambient concentrations of nitrogen oxides, fine particulate matter, VOCs, aldehydes, and local meteorology were collected beginning on October 1st, 2006 and monitoring will continue until the end of September 2007. This report includes the results of the monitoring program for the second quarter of sampling (from January 1st, 2007 to March 31st, 2006). The main findings to date are as follows:

- There were no measured exceedances of the MOE AAQCs (1-hr and 24-hr) for NO_x at either station during the second quarter of sampling;
- The average NO_x concentrations at each of the monitoring stations remained relatively unchanged since the end of the first quarter;
- There were no measured exceedances of the guideline limits for either of the VOCs (acrolein, benzene) that were included in the monitoring program at any point during the second quarter of sampling;
- There were no exceedances of the MOE AAQCs for either of the aldehydes (acetaldehyde, formaldehyde) that were included in the monitoring program at any point during the second quarter of sampling;
- The proposed Canada Wide Standard (24-hr) for $PM_{2.5}$ was exceeded at both stations (5 days at OPHL and 4 days at St. Clair College), bringing the total thus far in the sampling period to 18 exceedance days at OPHL and 12 at St. Clair College. This may be attributed to any number of local or transboundary sources. The results of the air dispersion modelling which is currently underway will clarify the actual impact of traffic on local concentrations;
- The average 24-hr $PM_{2.5}$ concentration at each monitoring station for the period thus-far remained relatively unchanged since the end of the first quarter;
- Average daily car and short truck traffic volumes for the second quarter decreased when compared to daily average volumes from the first quarter. The percentage decrease in daily average volumes of cars and short trucks from the end of the first quarter to the end of the second quarter were approximately 8.7% and 5.1%, respectively. Average daily long truck traffic volumes increased by approximately 7.4%.

6.0 References

Ontario Ministry of the Environment. *Air Quality in Ontario – 2005 Report*. Queen's Printer, 2006.

Ontario Ministry of the Environment. Transboundary Air Pollution in Ontario. Queen's Printer, June 2005.