DETROIT RIVER INTERNATIONAL CROSSING FINAL AIR QUALITY MONITORING REPORT OCTOBER 1st, 2006 – OCTOBER 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

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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 began collecting data on ambient concentrations of nitrogen oxides, fine particulate matter, VOCs, aldehydes, and local meteorology on October 1st, 2006. The monitoring program was brought to a close at the end of October 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 entire sampling period, from October 1st, 2006 to October 31st, 2007, with data summaries for each individual quarter. The main findings are as follows:

- There were no exceedances of the MOE AAQCs (1-hr and 24-hr) for NO_2 at either station during the sampling period;
- There were no measured exceedances of the applicable guideline limits for either of the VOCs (acrolein, benzene) that were included in the monitoring program at any point during the sampling period;
- 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 sampling period;
- The proposed Canada Wide Standard (24-hr) for $PM_{2.5}$ was exceeded at both stations in the final four months of sampling (14 days at OPHL and 19 days at St. Clair College), bringing the total thus far in the sampling period to 43 exceedance days at each station. 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 $PM_{2.5}$, NO_x and NO_2 concentrations at each monitoring station for the fourth quarter of sampling remained relatively unchanged since the end of the third quarter; and
- Average daily car and short-truck traffic volumes for the fourth quarter were slightly higher than the average from the third quarter (increase of 2.6% and 1.7%, respectively). Average daily long truck traffic volumes decreased in the fourth quarter compared to the daily average volume from the third quarter. The percentage decrease was approximately 11.9%.

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1.0 Introduction

1.1 PURPOSE OF STUDY

As part of the Environmental Assessment, the Detroit River International Crossing (DRIC) team 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 was 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. Non-continuous monitoring for air toxics continued until the end of September 2007. Continuous monitoring for oxides of nitrogen and $PM_{2.5}$ were extended until the end of October 2007 to confirm some inconsistent measurements that were collected in October 2006, which are suspected to be a result equipment malfunction. This report presents the results from the entire sampling period, from October 1st, 2006 to October 31st, 2007, with data summaries for each individual quarter. For the purposes of reporting information in this document, the final four months of the sampling program will be referred to as 'Quarter #4' for consistency with the previous data.

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 fourth and final monitoring 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 above) 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 concurrent with the sampling period 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 µg/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. A record of the NO_x measurements is included in Appendix A1.

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

Samples of fine particulate matter with a diameter less than 2.5 micron ($PM_{2.5}$) were 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 were 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 were shipped to a laboratory for analysis for benzene and acrolein. Results were 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 were 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 were sealed and kept refrigerated until being packed in coolers and forwarded to the laboratory for analysis of formaldehyde and acetaldehyde.

2.3 MONITORING LOCATIONS

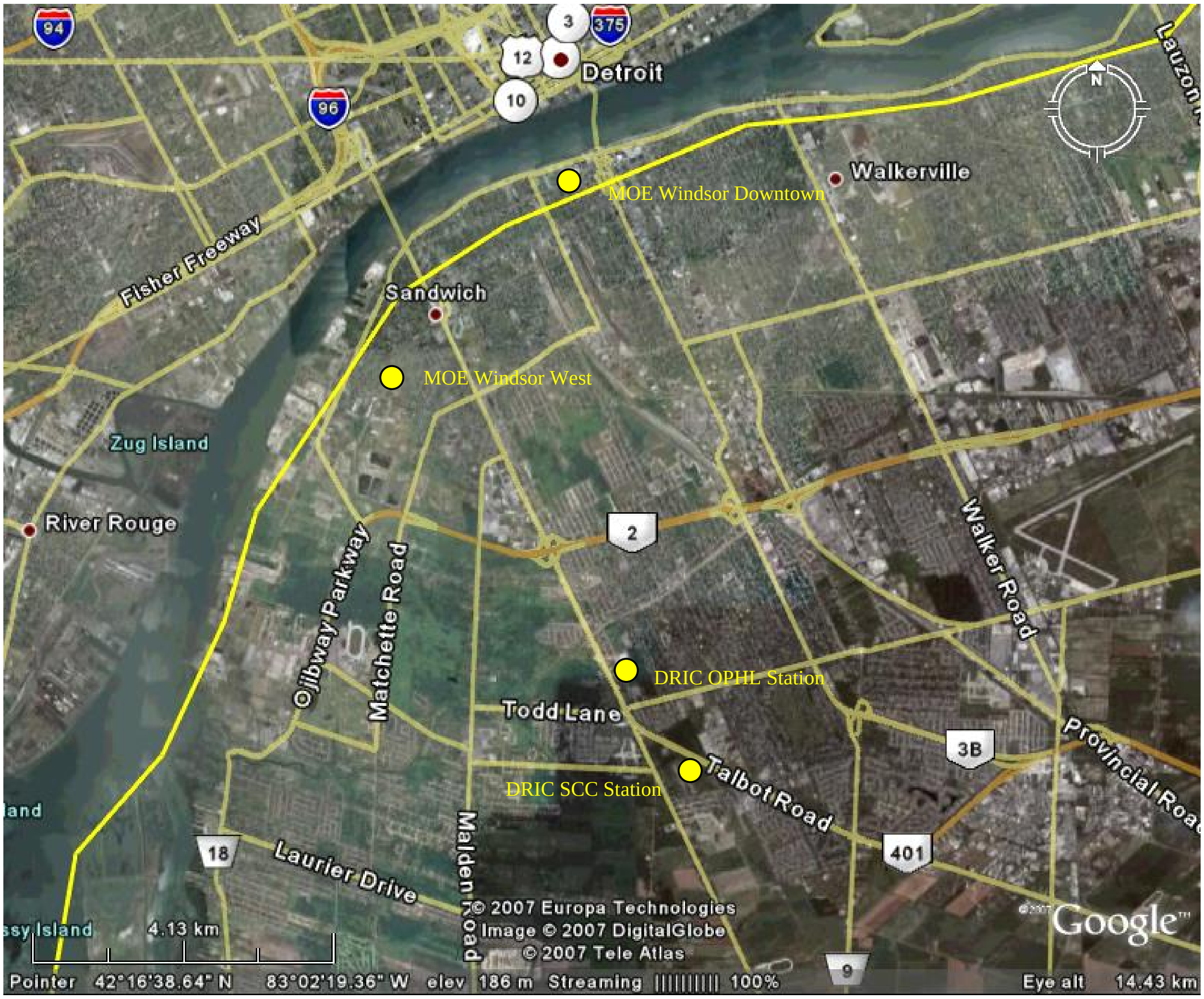
The DRIC team examined potential locations to site the monitoring stations within the Highway 3/Talbot Road/Huron Church corridor. In addition, suggested locations for each station were obtained from the DRIC Community Consultation Group (CCG). The final locations were selected based on the technical 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. 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 2.3 illustrates the DRIC monitoring stations in relation to the locations of the MOE monitoring stations.

Figure 2.1
Ontario Public Health Laboratory Air Monitoring Station Location

Figure 2.2
St. Clair College Air Monitoring Station Location

Figure 2.3
MOE Monitoring Station Locations and DRIC Monitoring Station Locations



3.0 Monitoring Results and Discussion

3.1 MONITORING RESULTS TO DATE

The following section outlines the monitoring results by contaminant, for the entire sampling period (from October 1st, 2006 – October 31st, 2007), including summaries of the results from each individual quarter. 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., $PM_{2.5}$). It is the NO_2 portion of nitrogen oxides that is typically used for comparison to regulatory standards and criteria for monitoring results.

Atmospheric concentrations of NO, NO_2 and 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 of NO_2 were compared to MOE Ambient Air Quality Criteria (AAQCs) for NO_2 of 200 ppb and 100 ppb, 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*, 2005). The MOE document specifically states that the one hour and 24 hour standards should only be compared to NO_2 monitored data. A summary of the hourly maximum, minimum and average NO_x and NO_2 concentrations separated by each month in the sampling period are presented in Tables 3.1 and 3.2, respectively. The daily maximum, minimum and average NO_x and NO_2 concentrations separated by each month in the sampling period are presented in Tables 3.3 and 3.4, respectively.

Table 3.1
Hourly Max/Min/Average NO_x Concentrations by Month

Monitoring Station	Month	Maximum Measured Concentration (ppb)	Minimum Measured Concentration (ppb)	Average Concentration (ppb)
Ontario Public Health Laboratory	Oct. 2006	319	0	30
	Nov. 2006	265	4	44
	Dec. 2006	231	2	33
	Quarter #1	**319**	**0**	**36**
	Jan. 2007	154	3	36
	Feb. 2007	297	0	38
	Mar. 2007	209	1	24
	Quarter #2	**297**	**0**	**32**
	Apr. 2007	182	0	20
	May 2007	181	0	22
	Jun. 2007	162	0	19
	Quarter #3	**182**	**0**	**21**
	Jul. 2007	119	0	20
	Aug. 2007	108	0	17
	Sept. 2007	240	0	25
	Oct. 2007	245	3	30
	Quarter #4	**245**	**0**	**23**
	Sampling Period	**319**	**0**	**28**
St. Clair College	Oct. 2006	140	0	15
	Nov. 2006	345	0	34
	Dec. 2006	222	2	20
	Quarter #1	**345**	**0**	**23**
	Jan. 2007	110	3	22
	Feb. 2007	237	4	24
	Mar. 2007	225	1	23
	Quarter #2	**237**	**1**	**23**
	Apr. 2007	239	0	22
	May 2007	192	0	22
	Jun. 2007	119	0	18
	Quarter #3	**239**	**0**	**21**
	Jul. 2007	87	0	13
	Aug. 2007	146	0	15
	Sept. 2007	237	0	21
	Oct. 2007	224	1	18
	Quarter #4	**237**	**0**	**17**
	Sampling Period	**345**	**0**	**21**

Table 3.2
Hourly Max/Min/Average NO_2 Concentrations by Month

Monitoring Station	Month	MOE AAQC (ppb)	Maximum Measured Concentration (ppb)	Minimum Measured Concentration (ppb)	Average Concentration (ppb)
Ontario Public Health Laboratory	Oct. 2006	200	39	0	10
	Nov. 2006		45	2	18
	Dec. 2006		37	2	15
	Quarter #1		**45**	**0**	**14**
	Jan. 2007		42	2	17
	Feb. 2007		52	0	19
	Mar. 2007		48	1	13
	Quarter #2		**52**	**0**	**16**
	Apr. 2007		52	0	12
	May 2007		50	0	13
	Jun. 2007		55	0	11
	Quarter #3		**55**	**0**	**12**
	Jul. 2007		38	0	11
	Aug. 2007		54	0	12
	Sept. 2007		46	0	13
	Oct. 2007		44	2	15
	Quarter #4		**54**	**0**	**13**
	Sampling Period		**55**	**0**	**14**
St. Clair College	Oct. 2006	200	25	0	7
	Nov. 2006		45	0	14
	Dec. 2006		38	2	12
	Quarter #1		**45**	**0**	**11**
	Jan. 2007		40	3	14
	Feb. 2007		49	3	15
	Mar. 2007		50	1	13
	Quarter #2		**50**	**1**	**14**
	Apr. 2007		55	0	12
	May 2007		44	0	13
	Jun. 2007		50	0	11
	Quarter #3		**55**	**0**	**12**
	Jul. 2007		38	0	9
	Aug. 2007		58	0	9
	Sept. 2007		44	0	11
	Oct. 2007		43	1	11
	Quarter #4		**58**	**0**	**10**
	Sampling Period		**58**	**0**	**12**

Table 3.3
Daily Max/Min/Average NO_x Concentrations by Month

Monitoring Station	Month	Maximum Measured Concentration (ppb)	Minimum Measured Concentration (ppb)	Average Concentration (ppb)
Ontario Public Health Laboratory	Oct. 2006	101	2	30
	Nov. 2006	144	8	44
	Dec. 2006	118	9	33
	Quarter #1	**144**	**2**	**36**
	Jan. 2007	68	8	36
	Feb. 2007	111	3	38
	Mar. 2007	73	2	24
	Quarter #2	**111**	**2**	**32**
	Apr. 2007	67	3	20
	May 2007	71	2	21
	Jun. 2007	43	7	19
	Quarter #3	**71**	**2**	**20**
	Jul. 2007	42	5	20
	Aug. 2007	49	1	19
	Sept. 2007	57	7	25
	Oct. 2007	85	8	31
	Quarter #4	**85**	**1**	**24**
	Sampling Period	**144**	**1**	**28**
St. Clair College	Oct. 2006	50	1	14
	Nov. 2006	149	7	34
	Dec. 2006	66	5	21
	Quarter #1	**149**	**1**	**23**
	Jan. 2007	47	6	22
	Feb. 2007	61	8	24
	Mar. 2007	66	3	23
	Quarter #2	**66**	**3**	**23**
	Apr. 2007	86	2	22
	May 2007	73	3	22
	Jun. 2007	44	3	18
	Quarter #3	**86**	**2**	**21**
	Jul. 2007	37	1	13
	Aug. 2007	36	4	15
	Sept. 2007	61	5	21
	Oct. 2007	81	4	18
	Quarter #4	**81**	**1**	**17**
	Sampling Period	**149**	**1**	**21**

Table 3.4
Daily Max/Min/Average NO_2 Concentrations by Month

Monitoring Station	Month	MOE AAQC (ppb)	Maximum Measured Concentration (ppb)	Minimum Measured Concentration (ppb)	Average Concentration (ppb)
Ontario Public Health Laboratory	Oct. 2006	100	21	1	9
	Nov. 2006		26	7	18
	Dec. 2006		28	7	15
	Quarter #1		**28**	**1**	**14**
	Jan. 2007		27	6	17
	Feb. 2007		36	3	19
	Mar. 2007		30	2	13
	Quarter #2		**36**	**2**	**16**
	Apr. 2007		31	3	11
	May 2007		26	2	13
	Jun. 2007		20	4	11
	Quarter #3		**31**	**2**	**12**
	Jul. 2007		24	3	11
	Aug. 2007		33	1	13
	Sept. 2007		23	6	13
	Oct. 2007		29	6	15
	Quarter #4		**33**	**1**	**13**
	Sampling Period		**36**	**1**	**14**
St. Clair College	Oct. 2006	100	14	1	7
	Nov. 2006		27	6	14
	Dec. 2006		25	5	12
	Quarter #1		**27**	**1**	**11**
	Jan. 2007		25	6	14
	Feb. 2007		28	7	15
	Mar. 2007		26	3	13
	Quarter #2		**28**	**3**	**14**
	Apr. 2007		27	2	12
	May 2007		26	2	13
	Jun. 2007		25	3	11
	Quarter #3		**27**	**2**	**12**
	Jul. 2007		18	1	9
	Aug. 2007		16	4	9
	Sept. 2007		21	5	11
	Oct. 2007		20	4	11
	Quarter #4		**21**	**1**	**10**
	Sampling Period		**28**	**1**	**12**

Tables 3.2 and 3.4 illustrate that maximum recorded hourly and daily average NO_2 concentrations were well below the AAQC values. The following figures present the entire data set for the sampling period in graphical format, in order to show fluctuations in the NO_x and NO_2 concentrations over the period. Figures 3.1 and 3.2 present the hourly average concentrations of NO_x and NO_2 over the sampling period, respectively. Figures 3.3 and 3.4 present the daily average concentrations of NO_x and NO_2 over the sampling period, respectively. 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 (ppb)

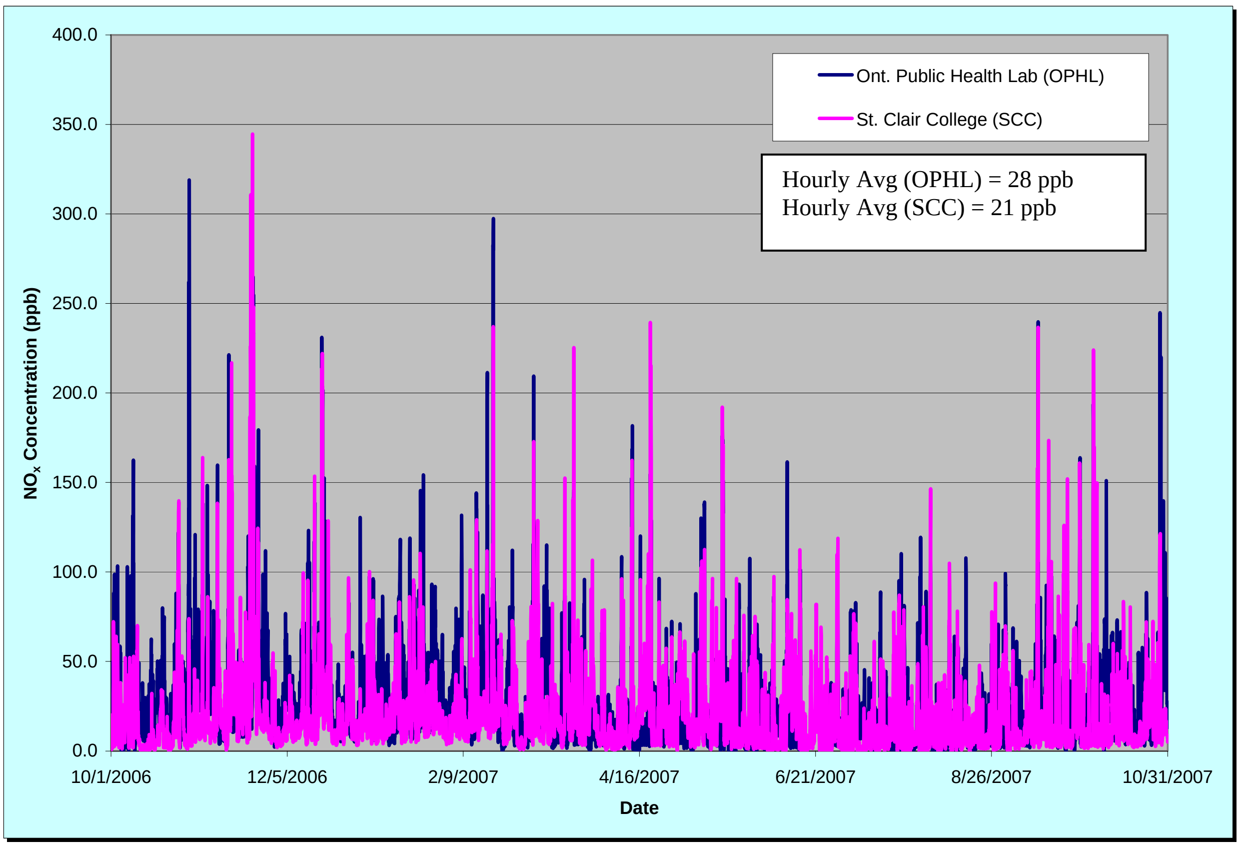


Figure 3.2
Hourly NO_2 Concentrations (ppb)

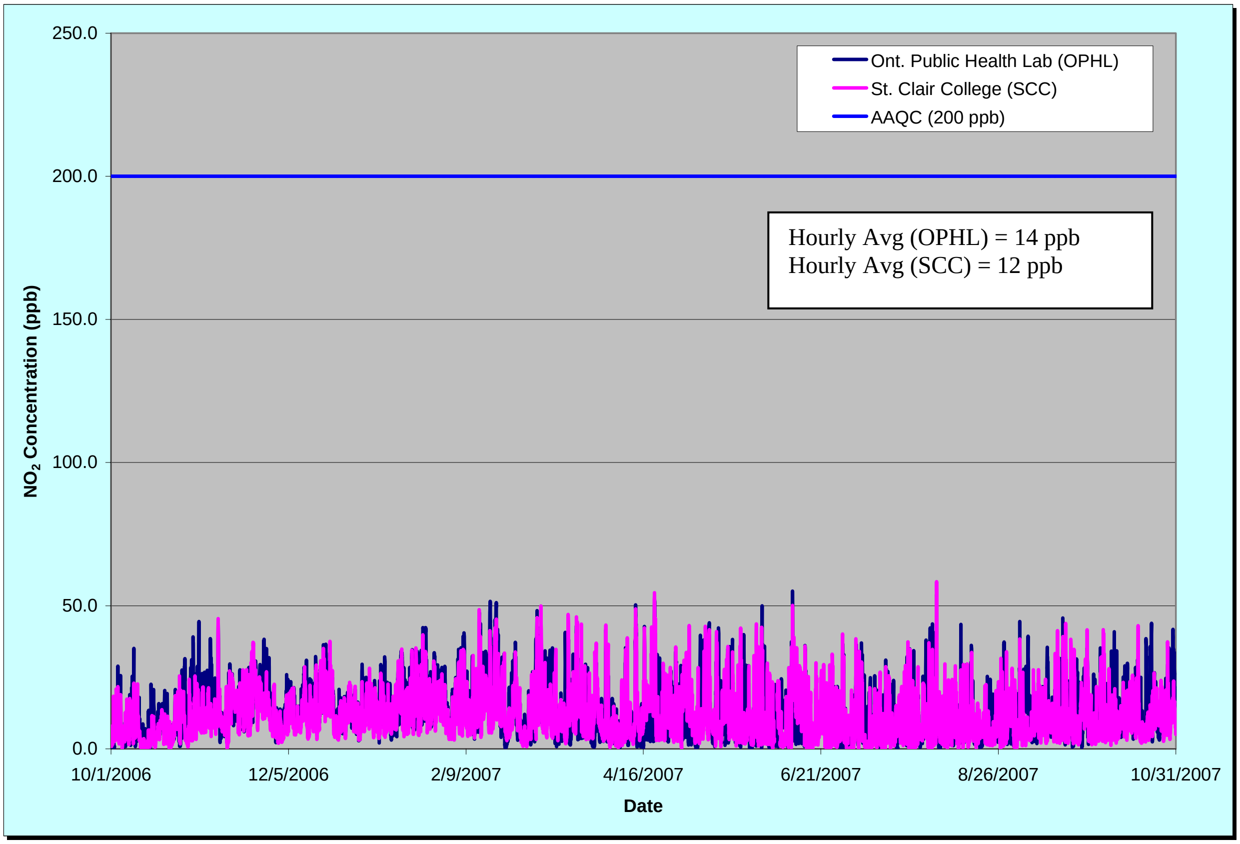


Figure 3.3
Daily Average NO_x Concentrations (ppb)

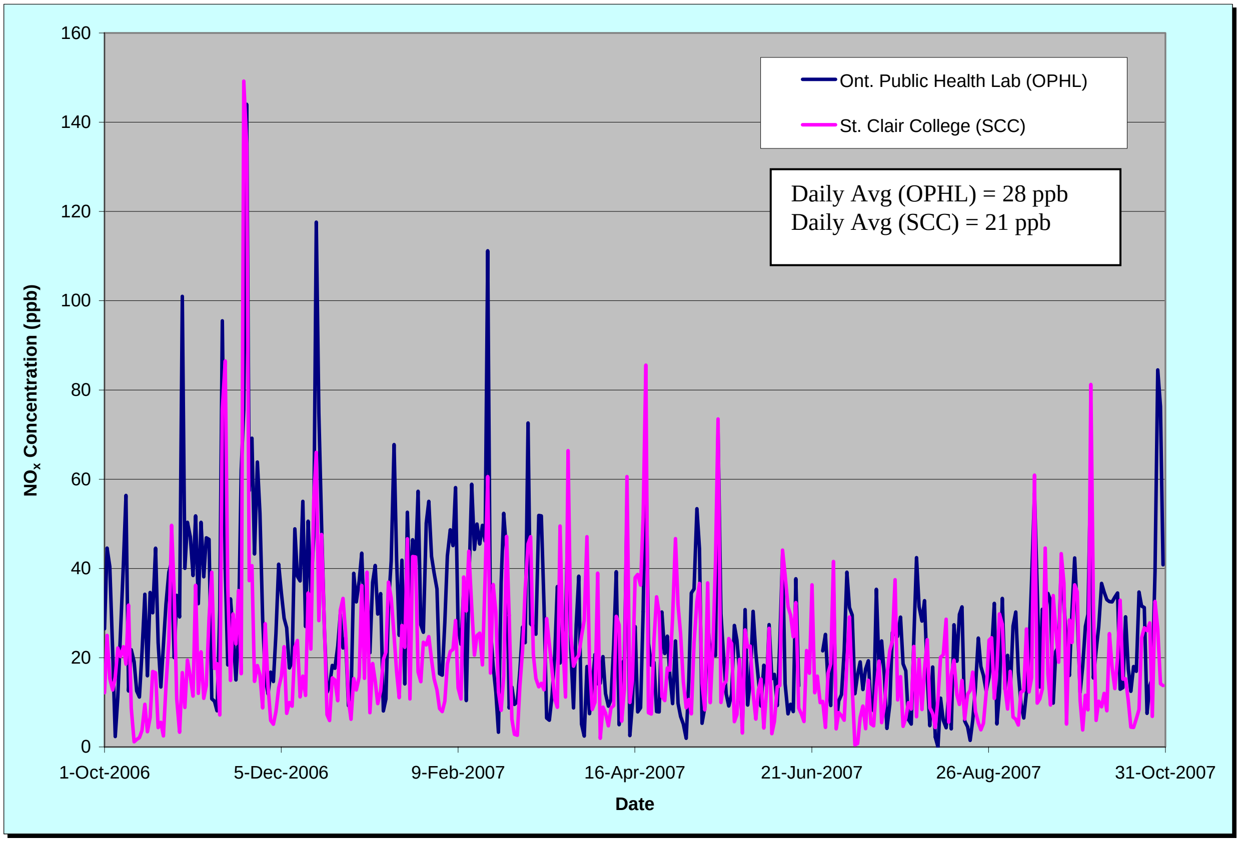
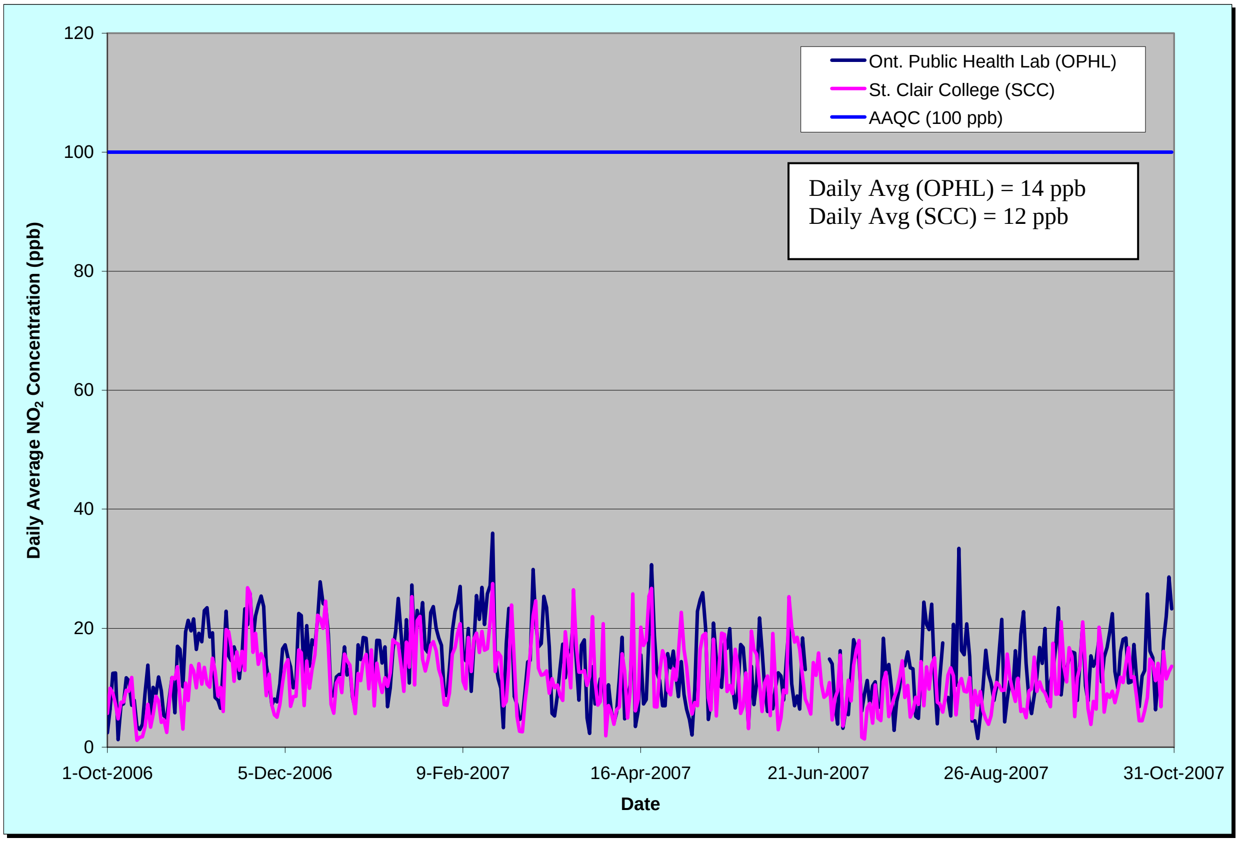


Figure 3.4
Daily Average NO_2 Concentrations (ppb)



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 are presented in Table 3.5.

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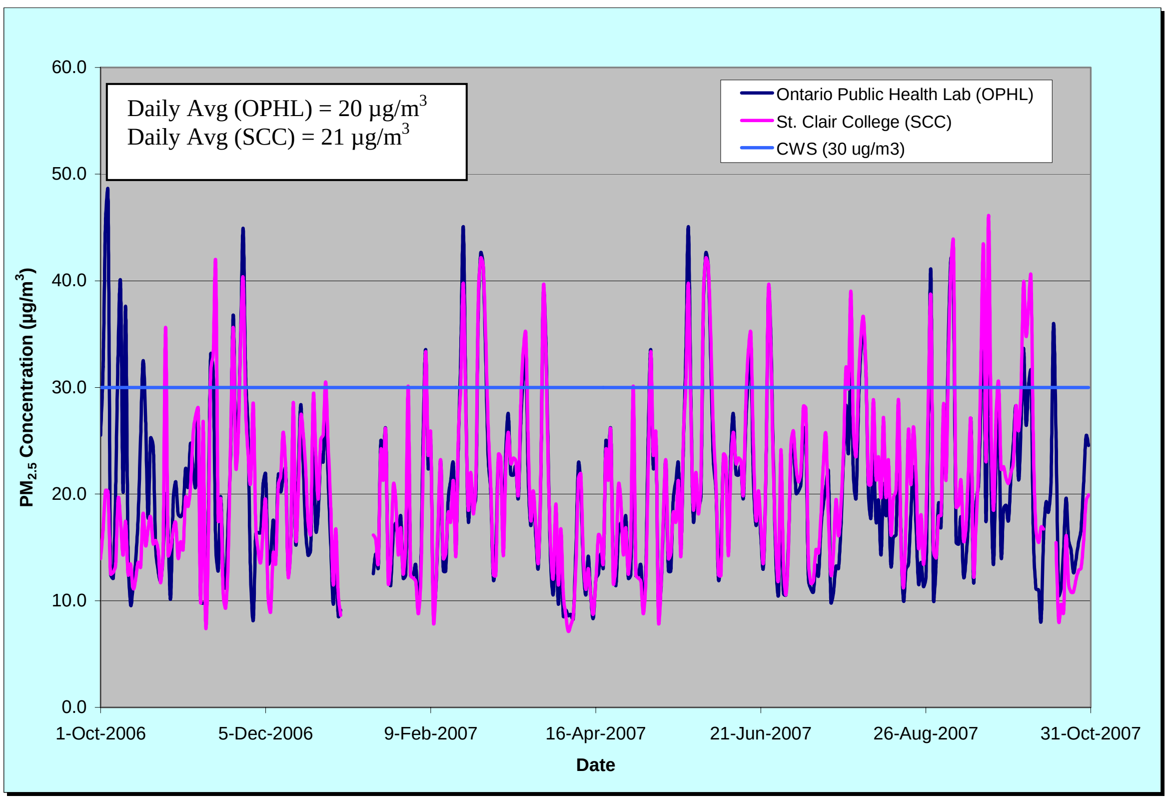
Table 3.5
Daily Max/Min/Average $PM_{2.5}$ Concentrations by Month

Monitoring Station	Month	CCME Canada Wide Standard (µg/m³)	Maximum Measured Concentration (µg/m³)	Minimum Measured Concentration (µg/m³)	Average Concentration (µg/m³)	# 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**
	Apr. 2007		26	8	14	0
	May 2007		45	9	21	5
	Jun. 2007		41	11	23	6
	Quarter #3		**45**	**8**	**20**	**11**
	Jul. 2007		33	10	19	1
	Aug. 2007		41	10	19	4
	Sep.2007		42	12	22	5
	Oct. 2007		36	8	20	4
	Quarter #4		**42**	**8**	**20**	**14**
	Sampling Period		**48**	**8**	**20**	**43**
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**
	Apr. 2007		26	7	15	0
	May 2007		42	8	21	6
	Jun. 2007		41	12	24	6
	Quarter #3		**42**	**7**	**20**	**12**
	Jul. 2007		39	11	21	3
	Aug. 2007		38	11	22	4
	Sep.2007		46	13	25	7
	Oct. 2007		40	8	20	5
	Quarter #4		**46**	**8**	**22**	**19**
	Sampling Period		**46**	**7**	**21**	**43**

Figure 3.5 presents a graph illustrating the daily fluctuations in $PM_{2.5}$ concentration over the entire sampling period, from October 1st, 2006 to October 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 until it was replaced. There is also a break in SCC data between October 13th and 18th, 2007 during which the instrument was experiencing a flow error and was removed for servicing. These instrument faults are 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 3.5
Daily Average $PM_{2.5}$ Concentrations (µg/m³)



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/m³ for formaldehyde, and 500 µg/m³ for acetaldehyde. Table 3.6 summarizes the maximum, minimum and average daily concentrations of each aldehyde collected during the quarter and the entire period.

Table 3.6
Daily Max/Min/Average Concentrations of Aldehydes for the Sampling Period

Monitoring Station	Contaminant	MOE 24-hr AAQC ($\mu g/m^3$)	Maximum Measured Concentration ($\mu g/m^3$)					Minimum Measured Concentration* ($\mu g/m^3$)					Average Measured Concentration ($\mu g/m^3$)				
			Oct – Dec 2006 (Q1)	Jan – Mar 2007 (Q2)	Apr – Jun 2007 (Q3)	Jul – Oct 2007 (Q4)	Sampling Period (Q1-Q4)	Oct – Dec 2006 (Q1)	Jan – Mar 2007 (Q2)	Apr – Jun 2007 (Q3)	Jul – Oct 2007 (Q4)	Sampling Period (Q1-Q4)	Oct – Dec 2006 (Q1)	Jan – Mar 2007 (Q2)	Apr – Jun 2007 (Q3)	Jul – Oct 2007 (Q4)	Sampling Period (Q1-Q4)
Ontario Public Health Laboratory	Acetaldehyde	500	2.4	1.2	1.2	0.7	2.4	0.6	0.6	0.2	0.3	0.2	1.5	0.8	0.6	0.4	0.8
	Formaldehyde	65	5.0	2.8	3.6	5.4	5.4	2.1	1.0	0.3	0.3	0.3	3.1	1.8	2.1	1.8	2.1
St. Clair College	Acetaldehyde	500	2.5	1.3	1.3	0.5	2.5	0.5	0.6	0.3	0.2	0.2	1.5	0.8	0.7	0.4	0.9
	Formaldehyde	65	5.7	3.2	5.4	5.4	5.7	2.5	0.9	0.3	0.3	0.3	3.5	1.7	2.3	1.9	2.2

**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 3.7 outlines historical results from the MOE Windsor monitoring station from the years 2003 and 2004.

Table 3.7
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[1]. Instead, guideline limits from other jurisdictions or previous MOE AAQCs have been used as a measure of comparison. Table 3.8 outlines the maximum, minimum and average daily concentrations of each VOC for the quarter, as well as the guideline limits used for comparison.

1 – Note that in February 2008 the MOE released a document *Ontario's Ambient Air Quality Criteria* which outlines a new acrolein standard. The collection of VOC data for this study precedes the release of this publication. The new acrolein standard will be considered in the modelling portion of the EA.

Table 3.8
Daily Max/Min/Average Concentrations of VOCs for the Sampling Period

Monitoring Station	Contaminant	Guideline Limit ($\mu g/m^3$)	Maximum Measured Concentration ($\mu g/m^3$)					Minimum Measured Concentration* ($\mu g/m^3$)					Average Measured Concentration ($\mu g/m^3$)				
			Oct – Dec 2006 (Q1)	Jan – Mar 2007 (Q2)	Apr – Jun 2007 (Q3)	Jul – Sep 2007 (Q4)	Sampling Period (Q1-Q4)	Oct – Dec 2006 (Q1)	Jan – Mar 2007 (Q2)	Apr – Jun 2007 (Q3)	Jul – Sep 2007 (Q4)	Sampling Period (Q1-Q4)	Oct – Dec 2006 (Q1)	Jan – Mar 2007 (Q2)	Apr – Jun 2007 (Q3)	Jul – Sep 2007 (Q4)	Sampling Period (Q1-Q4)
Ontario Public Health Laboratory	Acrolein	9.6*	1.2	2.7	4.6	2.2	4.6	0.1	0.1	0.1	0.2	0.1	0.6	0.4	0.9	1.2	0.8
	Benzene	60+	1.0	1.8	2.1	2.2	2.2	0.4	0.3	0.3	0.3	0.3	0.6	0.6	0.7	0.8	0.7
St. Clair College	Acrolein	9.6*	1.1	1.5	3.4	5.4	5.4	0.1	0.1	0.1	0.3	0.1	0.5	0.3	0.7	1.1	0.7
	Benzene	60+	3.1	1.3	2.0	2.9	3.1	0.4	0.3	0.4	0.4	0.3	0.8	0.6	0.7	0.8	0.7

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

To put these results into perspective, Table 3.9 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 3.8 have been calculated from data collected over six months.

Table 3.9
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	0.133	0.05	0.05	0.1	0.064
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 were equipped with a fully functional meteorological station, which logged 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 3.10 summarizes temperature data over the ambient air monitoring program, separated by month. 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 3.10 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, between 1971 and 2000. According to this data, the temperature data for each month of the quarter was fairly typical.

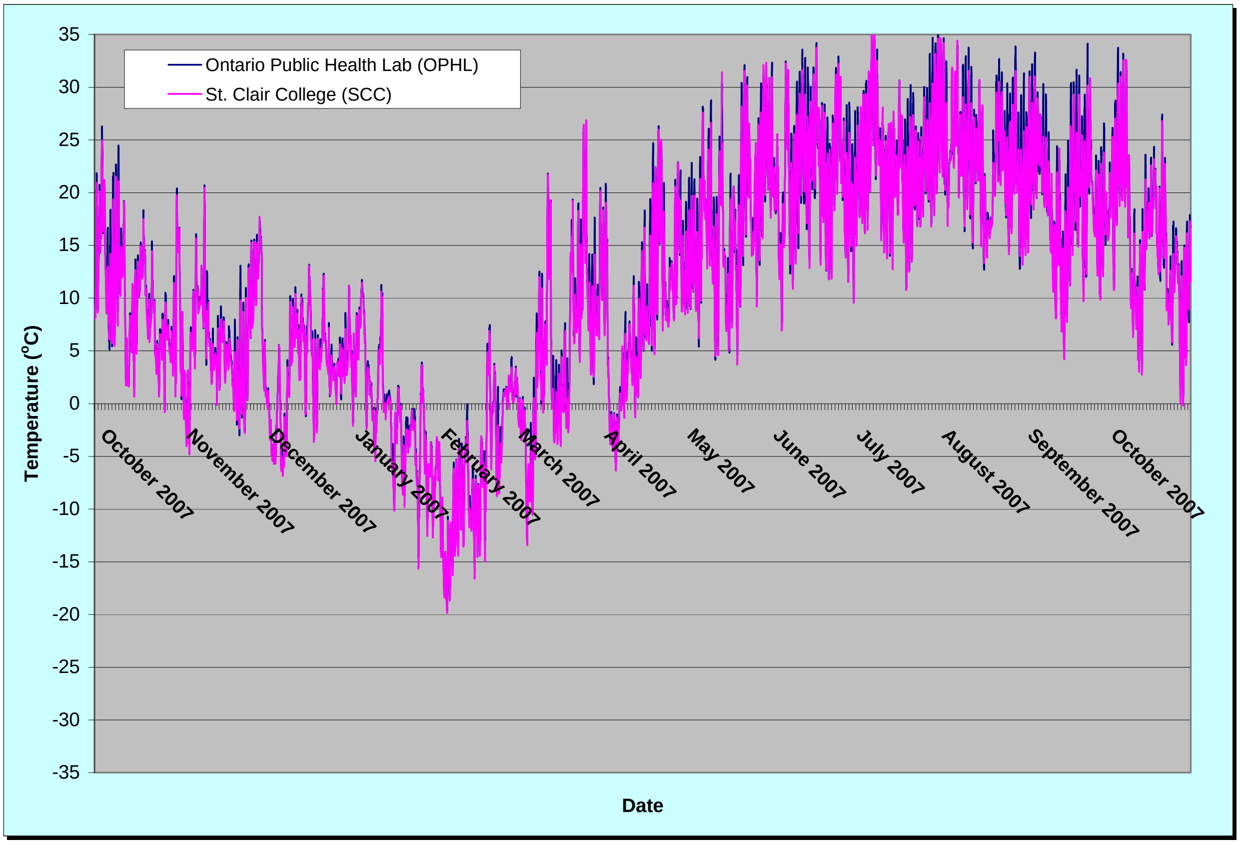
A graph of the entire set of temperature data is provided in Figure 3.6. This shows the fluctuations in temperature over the sampling period thus far. A full tabular summary of the meteorological data is provided in Appendix A3.

Table 3.10
Comparison of Temperature Data from Monitoring Stations to Local Normals

Data Set	Oct. 2006			Nov. 2006			Dec. 2006			Jan. 2007			Feb. 2007			Mar. 2007			Apr. 2007			May 2007		
	Max (°C)	Min (°C)	Avg (°C)	Max (°C)	Min (°C)	Avg (°C)	Max (°C)	Min (°C)	Avg (°C)	Max (°C)	Min (°C)	Avg (°C)	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	26.3	-0.3	10.2	20.7	-4.3	6.3	13.2	-6.5	3.1	11.8	-14.6	-0.6	7.5	-19.6	-6.4	26.3	-13.0	4.6	26.3	-6.1	8.7	32.1	4.1	16.9
SCC	25.0	-0.8	9.9	20.5	-4.8	5.9	13.1	-6.9	2.8	11.5	-15.7	-1.0	6.9	-19.9	-6.8	26.9	-13.4	4.1	26.0	-6.4	8.3	32.3	3.7	16.6
EC (1971-2000)	32.2	-5.0	11.0	26.1	-15.6	4.6	19.6	-23.4	-1.5	17.8	-29.1	-4.5	20.4	-23.4	-3.2	26.6	-19.4	2.0	31.1	-9.5	8.2	34.0	-2.8	14.9

Data Set	Jun. 2007			Jul. 2007			Aug. 2007			Sep. 2007			Oct. 2007			PERIOD		
	Max (°C)	Min (°C)	Avg (°C)	Max (°C)	Min (°C)	Avg (°C)	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	34.2	7.7	22.1	34.8	10.0	22.7	37.6	12.7	23.4	34.2	5.1	19.6	33.8	0.6	15.3	37.6	-19.6	11.0
SCC	33.8	6.9	22.0	35.7	9.6	22.5	34.7	13.3	23.1	31.0	4.2	19.1	32.6	-0.2	15.2	35.7	-19.9	11.0
EC (1971-2000)	40.2	2.8	20.1	38.3	5.6	22.7	37.7	5.2	21.6	37.2	-1.1	17.4	32.2	-5.0	11.0	40.2	-29.1	9.4

Figure 3.6
Average Hourly Temperature for the Period-to-Date



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 3.7 and Figure 3.8, 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 each quarter of sampling, and for the total sampling period.

Figure 3.7 (a – e): Ontario Public Health Laboratory Wind Rose for each Quarter and the Period

Fig 3.7a: Sampling Period

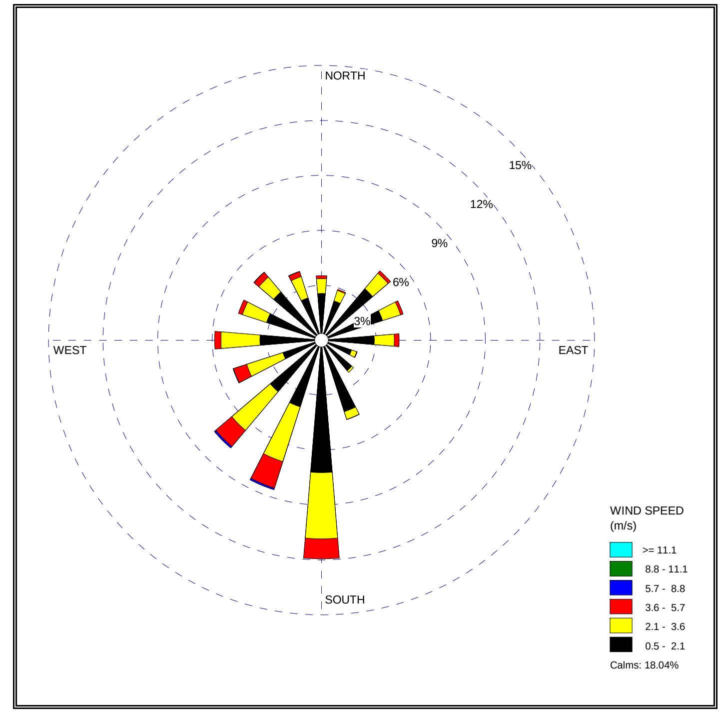


Fig. 3.7b: Quarter 1

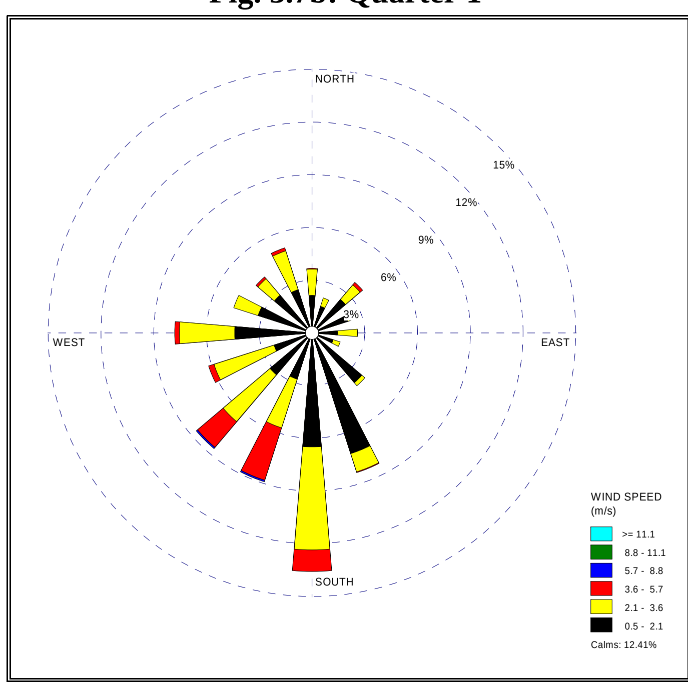


Fig. 3.7c: Quarter 2

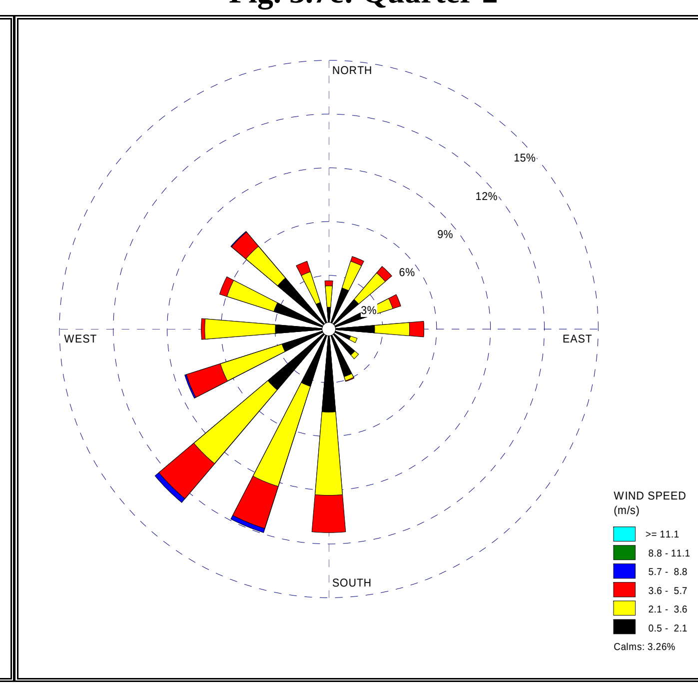


Fig. 3.7d: Quarter 3

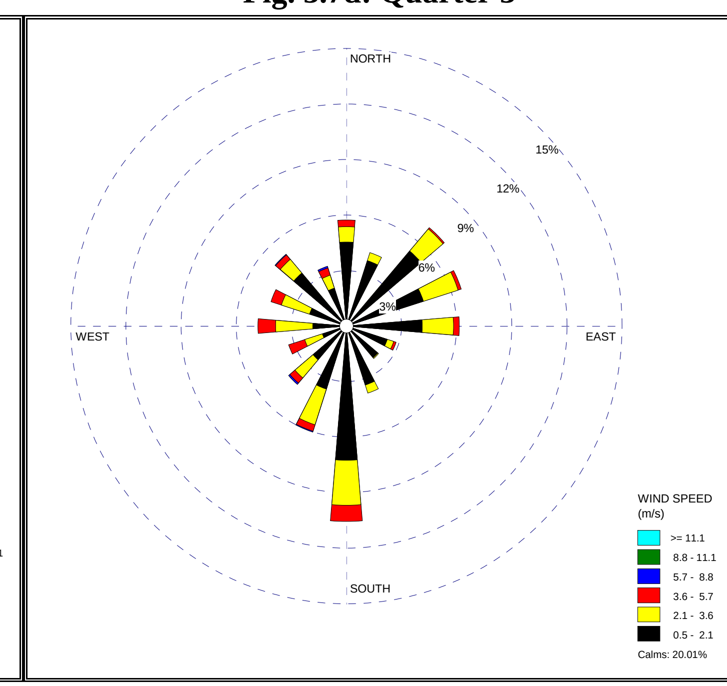


Fig. 3.7e: Quarter 4

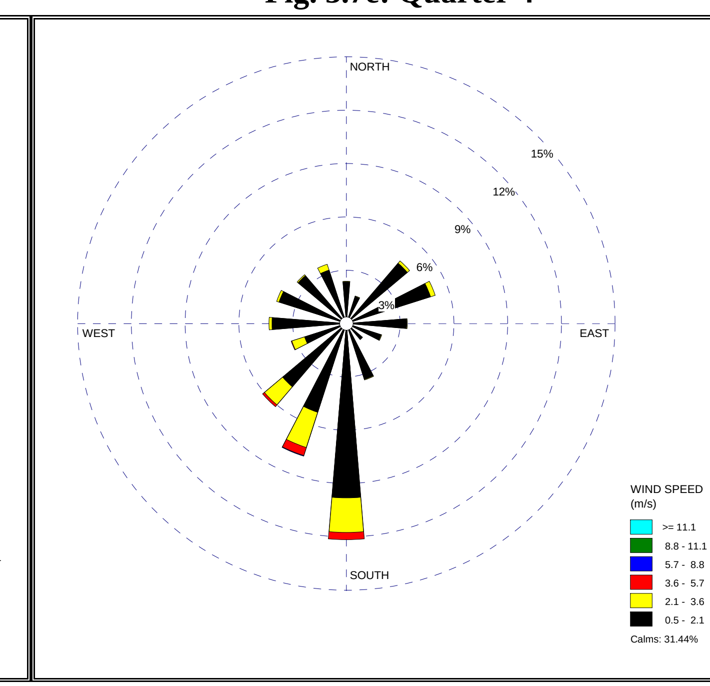


Figure 3.8 (a – e): St. Clair College Wind Rose for each Quarter and the Period

Fig 3.8a: Sampling Period

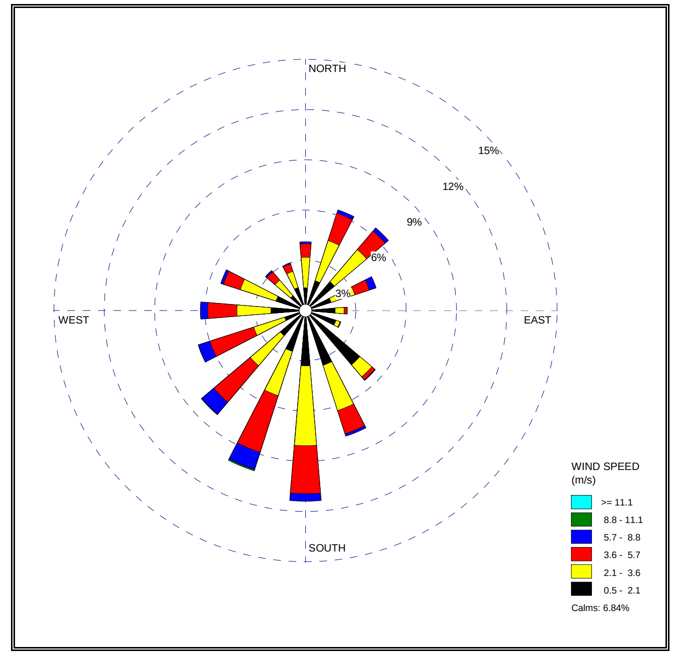


Fig. 3.8b: Quarter 1

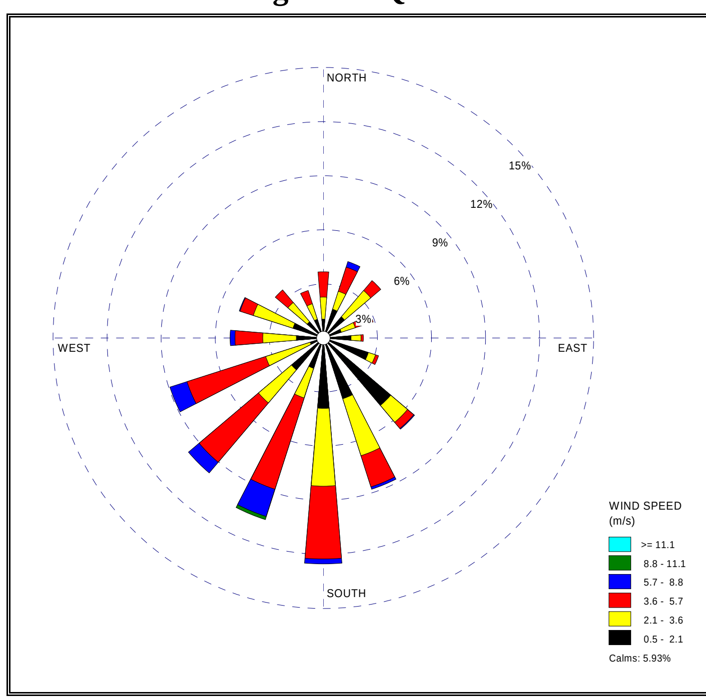


Fig. 3.8c: Quarter 2

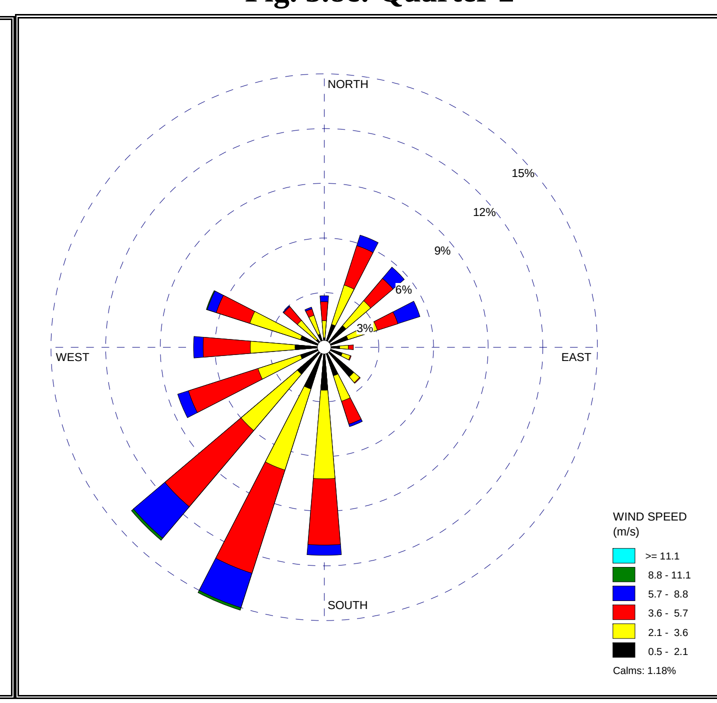


Fig. 3.8d: Quarter 3

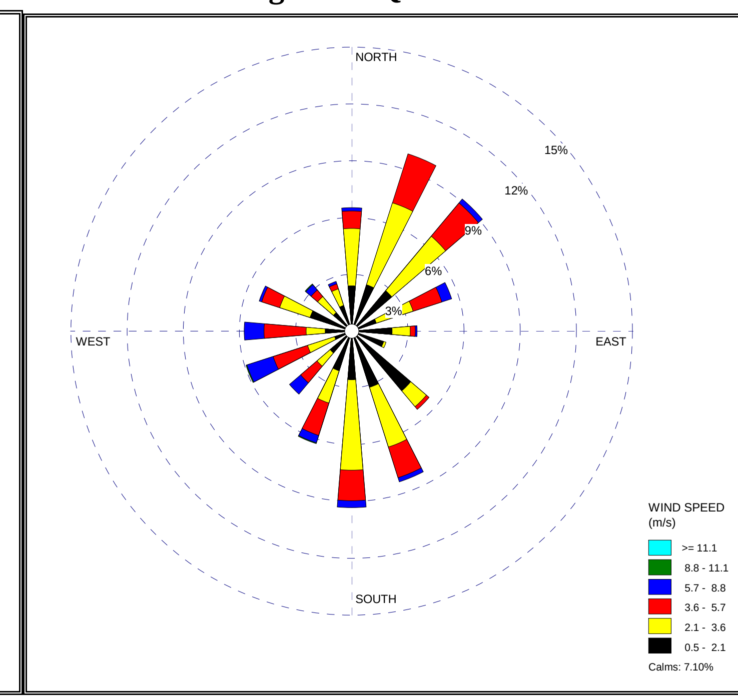
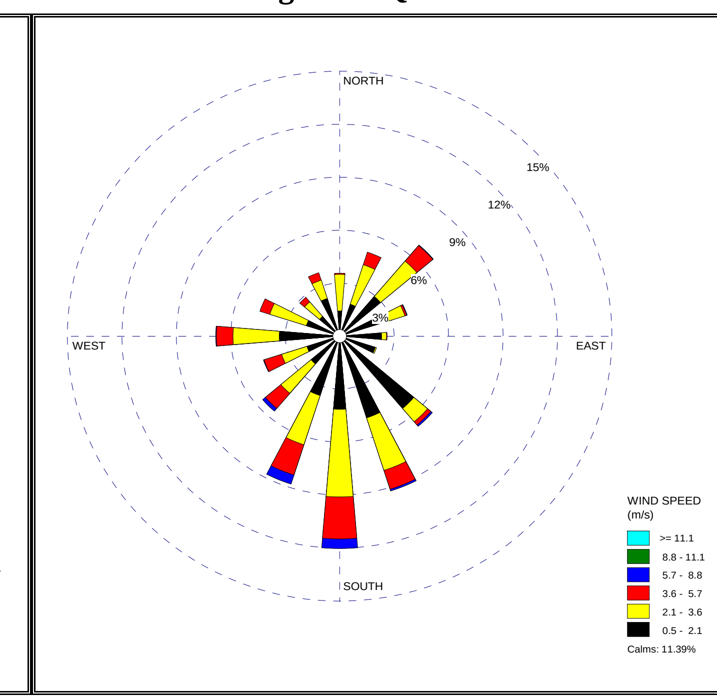


Fig. 3.8e: Quarter 4



Throughout the monitoring program, winds were most frequently from the south to south-westerly at both locations. The wind roses for each monitoring station for the third quarter show a much higher frequency of north-easterly winds than there was during any other period. 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 3.9 presents the wind rose data from the Environment Canada meteorological station at the Windsor Airport for purposes of comparison. While southerly winds are consistently dominant at the monitoring stations, the airport data shows a stronger contribution from the south-west. When a strong north-easterly contribution was detected at the St. Clair College location in the third quarter, the airport data also reflected this. The overall wind rose for the airport shows a fairly strong easterly component, which does not appear to the same extent at the monitoring stations. The wind speeds detected at the airport were much stronger than those detected at the monitoring stations. 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 3.9 (a – e): Windsor Airport Wind Rose for each Quarter and the Period

Fig 3.9a: Sampling Period

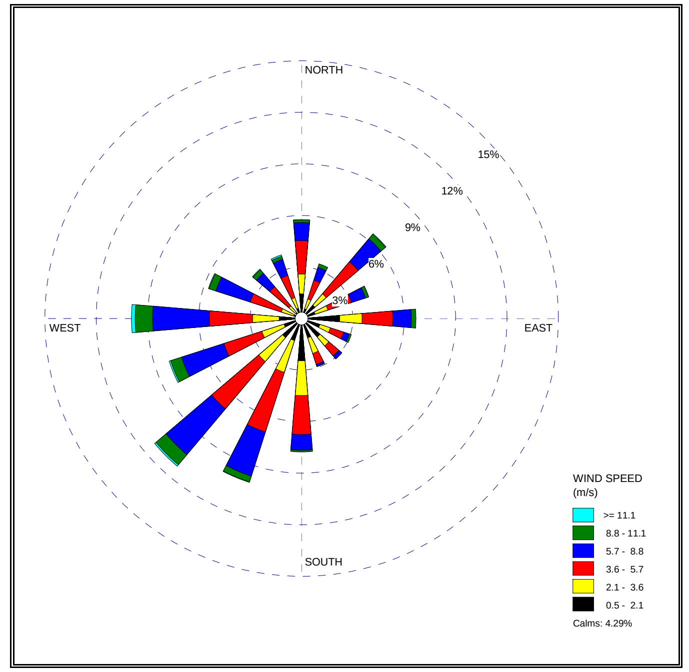


Fig. 3.9b: Quarter 1

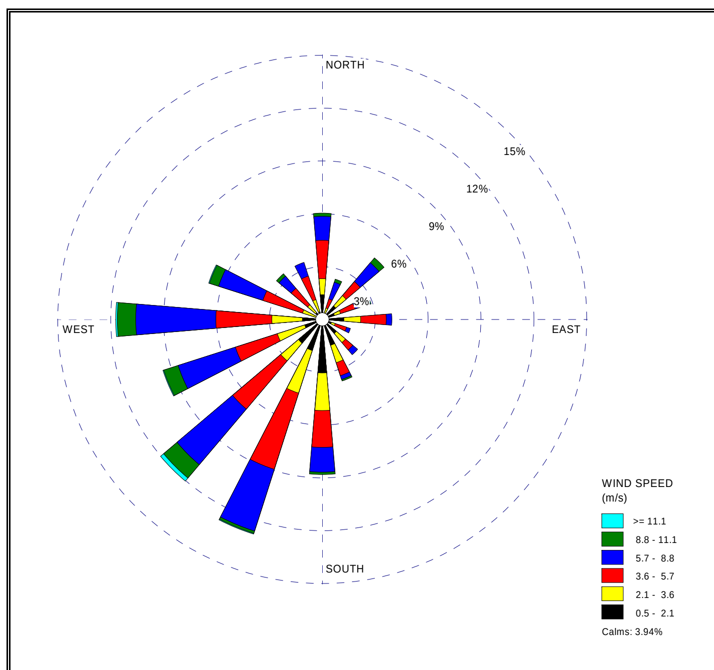


Fig. 3.9c: Quarter 2

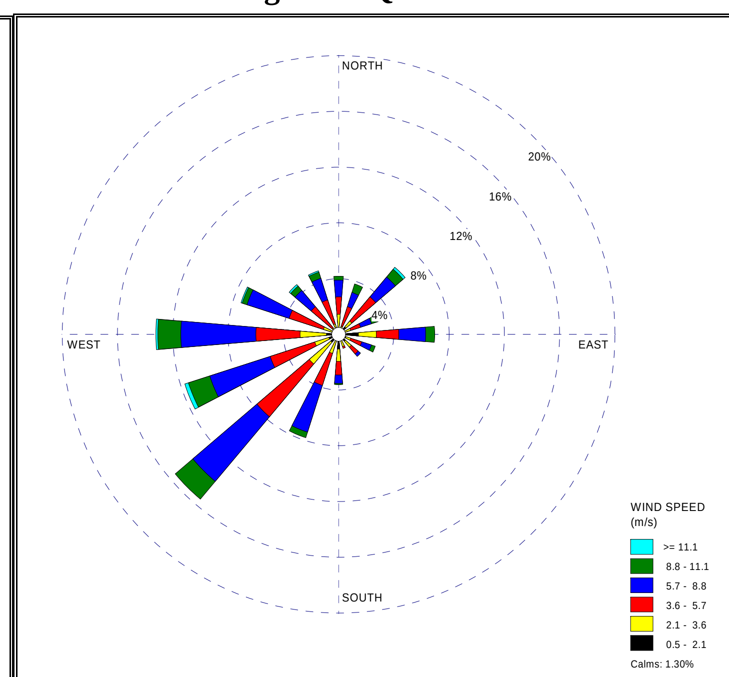


Fig. 3.9d: Quarter 3

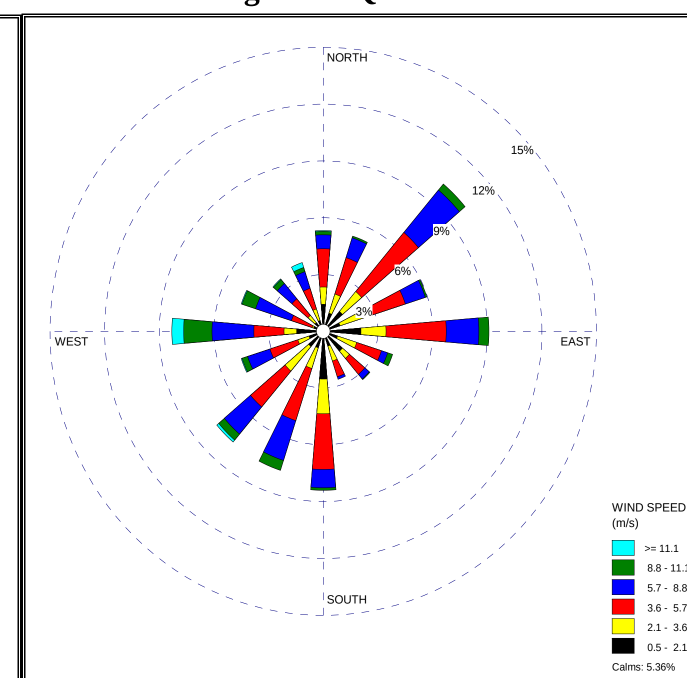
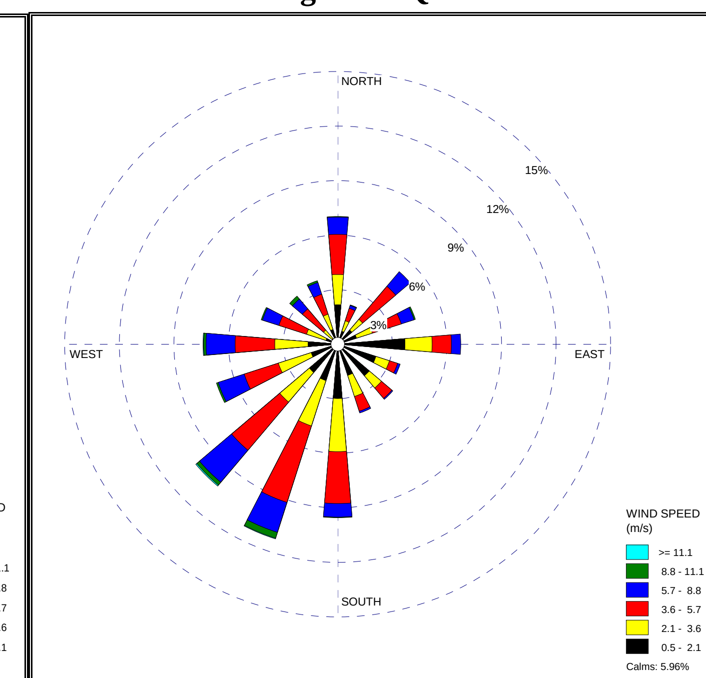


Fig. 3.9e: Quarter 4



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 to correlate with the monitoring results. The hourly maximum, minimum, and average traffic counts for the entire quarter are summarized in Table 3.11 for each vehicle type (car, short truck, long truck). The daily maximum, minimum, and average counts appear in Table 3.12. The same information separated by month is included in Table 3.13 and Table 3.14, respectively. Figure 3.10 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 3.11
Hourly Max/Min/Average Traffic Counts for the Quarter and Period

Vehicle Type	Maximum (#)					Minimum (#)					Average (#)				
	Oct-Dec 2006	Jan-Mar 2007	Apr-Jun 2007	Jul-Sep 2007	Sampling Period	Oct-Dec 2006	Jan-Mar 2007	Apr-Jun 2007	Jul-Sep 2007	Sampling Period	Oct-Dec 2006	Jan-Mar 2007	Apr-Jun 2007	Jul-Sep 2007	Sampling Period
Car	1,746	1,500	1,713	1,541	1,746	22	21	0	40	0	685	623	656	674	660
Short Truck	121	101	135	125	135	0	0	0	1	0	32	30	35	36	33
Long Truck	603	573	584	505	603	7	13	0	19	0	276	295	290	255	278

Table 3.12
Daily Max/Min/Average Traffic Counts for the Quarter and Period

Vehicle Type	Maximum (#)					Minimum (#)					Average (#)				
	Oct-Dec 2006	Jan-Mar 2007	Apr-Jun 2007	Jul-Sep 2007	Sampling Period	Oct-Dec 2006	Jan-Mar 2007	Apr-Jun 2007	Jul-Sep 2007	Sampling Period	Oct-Dec 2006	Jan-Mar 2007	Apr-Jun 2007	Jul-Sep 2007	Sampling Period
Car	21,299	18,600	19,207	19,137	21,299	6,837	6,579	11,499	12,829	6,579	16,423	14,966	15,718	16,129	15,825
Short Truck	1,355	1,034	1,321	1,216	1,355	79	144	211	354	79	761	722	838	852	795
Long Truck	9,924	9,689	9,596	8,672	9,924	698	2,441	2,564	2,119	698	6,597	7,085	6,932	6,109	6,669

Table 3.13
Hourly Max/Min/Average Traffic Counts by Month

Vehicle Type	Oct. 2006			Nov. 2006			Dec. 2006			Jan. 2007			Feb. 2007			Mar. 2007			Apr. 2007			May 2007		
	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)
Cars	1,713	22	681	1,746	40	715	1,579	28	659	1,500	21	583	1,466	35	631	1,500	39	650	1,562	0	659	1,713	35	638
Short Trucks	121	0	33	115	0	35	90	0	27	101	0	28	98	0	31	94	1	31	99	0	32	108	1	36
Long Trucks	568	20	278	603	29	302	565	7	248	551	13	274	573	30	303	560	38	304	584	0	283	549	31	296

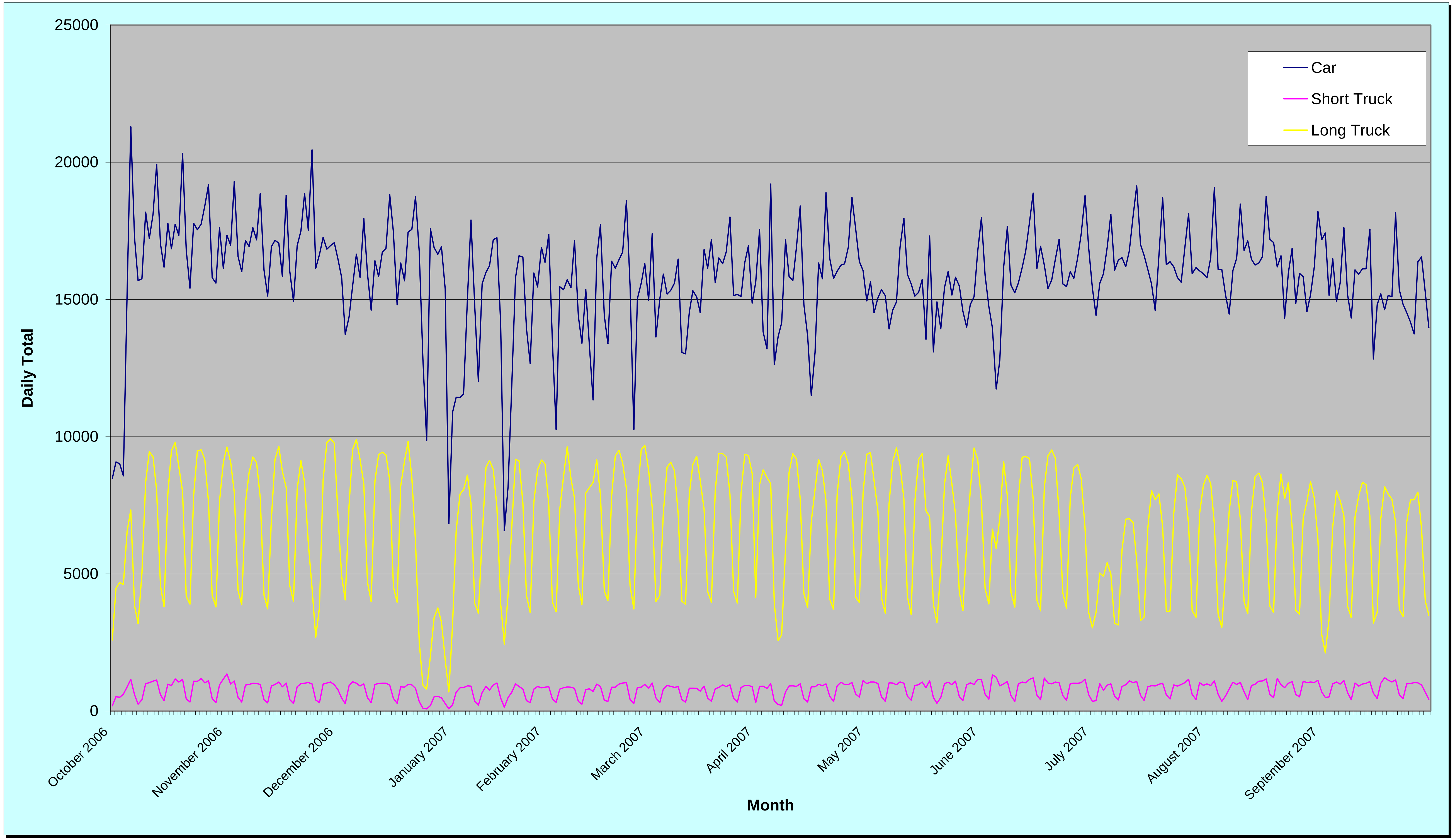
Vehicle Type	Jun. 2007			Jul. 2007			Aug. 2007			Sep. 2007			Oct. 2007			PERIOD		
	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)
Cars	1,483	41	673	1,541	43	687	1,515	53	684	1,469	40	649	No Data	No Data	No Data	1,746	0	660
Short Trucks	135	0	38	97	1	34	125	1	37	101	1	36	No Data	No Data	No Data	135	0	33
Long Trucks	550	32	289	504	19	240	505	29	275	481	27	250	No Data	No Data	No Data	603	0	278

Table 3.14
Daily Max/Min/Average Traffic Counts by Month

Vehicle Type	Oct. 2006			Nov. 2006			Dec. 2006			Jan. 2007			Feb. 2007			Mar. 2007			Apr. 2007			May 2007		
	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)
Cars	21,299	8,474	16,292	20,453	14,927	17,134	18,816	6,837	15,781	17,899	6,579	14,070	18,600	10,262	15,124	18,008	13,016	15,586	19,207	11,499	15,811	17,956	13,091	15,242
Short Trucks	1,183	196	800	1,355	274	836	1,069	79	648	1,022	144	683	1,034	253	731	1,025	307	746	1,117	211	757	1,160	285	851
Long Trucks	9,788	2,590	6,654	9,924	2,688	7,232	9,897	698	5,925	9,175	2,441	6,660	9,689	3,618	7,259	9,385	3,891	7,283	9,454	2,564	6,801	9,596	3,230	7,082

Vehicle Type	Jun. 2007			Jul. 2007			Aug. 2007			Sep. 2007			Oct. 2007			PERIOD		
	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)	Max (#)	Min (#)	Avg (#)
Cars	18,882	11,740	16,115	19,137	14,422	16,454	19,080	14,315	16,371	18,156	12,829	15,543	No Data	No Data	No Data	21,299	6,579	15,825
Short Trucks	1,321	354	906	1,160	354	812	1,190	356	885	1,216	412	860	No Data	No Data	No Data	1,355	79	795
Long Trucks	9,515	3,608	6,910	8,603	3,036	5,753	8,672	3,046	6,579	8,336	2,119	5,991	No Data	No Data	No Data	16,129	852	6,669

Figure 3.10
Daily Traffic Count Totals



As can be seen in Figure 3.10, 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_2 were collected over the course of the sampling period as hourly averages. The measured hourly concentrations and calculated daily averages were compared to the MOE 1-hr and 24-hr AAQC. There were no measured exceedances of either the 1-hr AAQC of 200 ppb, or the 24-hr AAQC of 100 ppb for NO_2 over the duration of the sampling period. The highest measured hourly average NO_2 concentration was 55 ppb, or 28% of the AAQC. The highest measured daily average NO_2 concentration was 36 ppb, or 36% of the AAQC. Both of these were at the Ontario Public Health Laboratory location.

3.4.2 $PM_{2.5}$

There were 396 sampling days in the sampling period. 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 $\mu g/m^3$ a total of 43 times at each station during the sampling period. During the final quarter of sampling, there were 14 exceedances of the CWS at the OPHL station, and 19 at the St. Clair College location. The maximum number of exceedances of the CWS at the MOE stations for any given year during the 2003 – 2005 period 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.)

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 0.5% for acetaldehyde, and 8.3% for formaldehyde. At the St. Clair College location, the maximums were 0.5% for acetaldehyde and 8.8% for formaldehyde.

3.4.4 Volatile Organic Compounds

There were no exceedances of the acrolein guideline limit during the sampling period[1]. 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 3.7% of the guideline limit of 60 $\mu g/m^3$, while the maximum concentration of acrolein was 48% 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 5.2% and 56%, respectively.

1 – Note that in February 2008 the MOE released a document *Ontario's Ambient Air Quality Criteria* which outlines a new acrolein standard. The collection of VOC data for this study precedes the release of this publication. The new acrolein standard will be considered in the modelling portion of the EA.

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 calibration measures were necessary. However, the filter tapes required changing before reaching the end of the roll. This was performed six times at each station over the course of the sampling period.

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 readings 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 BAMs did not experience any instrument errors during the third quarter. During the fourth quarter, the BAM unit at the SCC location experienced a flow error and was not logging accurate data as a result. SENES had the unit removed for service on October 13th, 2007 and was brought back online and in working order on October 18th, 2007.

The only NO_x data that was considered to be outlier data was for periods when calibrations were taking place, and low concentration readings 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. The following table summarizes the number of outliers of NO_x and NO_2 during each quarter of the period thus far.

Table 4.1
Summary of Outlier Data from the NO_x Analyser

	OPHL		SCC	
	NO_x	NO_2	NO_x	NO_2
Quarter 1	28	114	49	52
Quarter 2	7	8	5	5
Quarter 3	61	96	48	48
Quarter 4	156	184	127	131
TOTAL:	**252**	**402**	**229**	**236**

In addition to the outlier data from the NO_x analyser shown in Table 4.1, no data was recorded at the OPHL location between June 17th, 2007 and June 26th, 2007. Storm activity in the area caused the unit to stall. The unit was brought back online on June 26th, 2007 during the next site visit. A total of 216 possible hourly readings were not collected as a result of the instrument malfunction.

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 Monitoring Program Findings

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 in establishing applicable background and other model input parameters for the assessment of the Technically and Environmentally Preferred Alternative.

Data on ambient concentrations of nitrogen oxides, fine particulate matter, VOCs, aldehydes, and local meteorology were collected beginning on October 1st, 2006. Non-continuous monitoring for VOCs and aldehydes continued until the end of September 2007, while continuous monitoring for meteorology, NO_x and $PM_{2.5}$ ended on October 31st, 2007. This report includes the results of the entire monitoring program. The main findings are as follows:

- There were no exceedances of the MOE AAQCs (1-hr and 24-hr) for NO_2 at either station during the sampling period;
- There were no measured exceedances of the applicable guideline limits for either of the VOCs (acrolein, benzene) that were included in the monitoring program at any point during the sampling period;
- 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 sampling period;
- The proposed Canada Wide Standard (24-hr, effective 2010) for $PM_{2.5}$ was exceeded at both stations in the final four months of sampling (14 days at OPHL and 19 days at St. Clair College), bringing the total in the sampling period to 43 exceedance days at each station. This may be attributed to any number of local or transboundary sources;
- The average $PM_{2.5}$, NO_x and NO_2 concentrations at each monitoring station for the fourth quarter of sampling remained relatively unchanged since the end of the third quarter; and
- Average daily car and short-truck traffic volumes for the fourth quarter were slightly higher than the average from the third quarter (increase of 2.6% and 1.7%, respectively). Average daily long truck traffic volumes decreased in the fourth quarter compared to the daily average volume from the third quarter. The percentage decrease was approximately 11.9%.

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.