



Stantec Consulting Ltd.
401 Wellington Street West, Suite 100
Toronto ON M5V 1E7
Tel: (416) 596-6686
Fax: (416) 596-6680

April 24, 2015
File: 160950528

Attention: Mr. Greg Borchuk, P.Eng.
Project Manager, EFW
Waste Management Services

The Region of Durham
605 Rossland Rd.,
Whitby, ON L1N 6A3

Dear Mr. Borchuk,

**Reference: Q4 2014 Ambient Air Quality Monitoring Report for the Durham York Energy Centre –
Crago Road Station**

Please find attached with this letter the Q4 2014 quarterly report for the Durham York Energy Centre (DYEC) Crago Road Station.

The Crago Road ambient monitoring station shelter and instrumentation was installed by Stantec Consulting Limited and our instrumentation sub-consultant Valley Environmental Services Inc. (Valley Environmental) during October to November 15, 2014. This quarterly report provides a summary of the measurements collected at this station during November 15 – December 31, 2014 (which falls within calendar Quarter 4 of 2014). All equipment operated well during this initial measurement period with the exception of the continuous PM_{2.5} monitor.

A significant operational issue was encountered with the Thermo Sharpe 5030 PM_{2.5} monitor that resulted in a data recovery rate of about 25% during the November-December period. The monitor had to be removed and shipped back to the supplier for repair and replacement of the main board under warranty. After noting error messages on the unit, Valley Environmental removed the unit on December 3, 2014 and conducted tests on the unit at their facility. It was determined that the unit required manufacturer repairs and was delivered to the local representative of the instrument manufacturer, CD NOVA-Tech Inc. (CD NOVA) on December 11, 2014. CD NOVA went through a number of diagnostic tests/repairs on the unit in the period December 11, 2014 to January 20, 2015. CD NOVA returned the unit to Valley Environmental on January 20, 2015 and it was re-installed at the station on January 23, 2015. The unit has been operating normally since it was re-installed. Valley Environmental contacted the Thermo-Fisher offices in both Toronto and Edmonton and requested a replacement unit be provided for use on site during the repair period, however neither of the offices had a spare unit available.



April 24, 2015

Mr. Greg Borchuk, P.Eng.

Project Manager, EFW

Waste Management Services

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Reference: Q4 2014 Ambient Air Quality Monitoring Report for the Durham York Energy Centre – Crago Road Station

The root cause of the issue with the new instrument supplied by the manufacturer to Valley/Stantec was a defective mother board, as well as there being a design/manufacturing inconsistency with the mother board. Since these were manufacturer issues, the unit was repaired by the manufacturer under warranty, and no further remedial action should be required. Additional details on this instrumentation issue are presented in Section 3.2 of the report and a letter from the CD NOVA detailing their repairs/schedule is included in Appendix F.

Regional Council has requested that 98th percentile PM_{2.5} data also be provided along with the quarterly reports, which is provided in Table 1 below. A comparison to the Canadian Ambient Air Quality Standards (CAAQS) for PM_{2.5} requires averaging the 98th percentile daily average levels in each of three consecutive years. The value presented in Table 1 corresponds to the 98th percentile over the 2 month monitoring period (with less than one month of data actually collected for this quarter). Two years and 10-months of additional data will be required in order to provide an explicit comparison to the current CAAQS criteria of 28 µg/m³.

Table 1 Summary of the 98th Percentile Daily Average PM_{2.5} Concentrations Measured to Date (µg/m³)

Period	Crago Road Monitoring Station
November 2014 - December 2014	9.1

Regards,

STANTEC CONSULTING LTD.

Original Signed by G. Crooks

Gregory Crooks, M.Eng., P.Eng.
Principal, Environmental Services
Phone: (416) 598-7687
Fax: (416) 596-6680
gregory.crooks@stantec.com

c. Gio Anello, Region of Durham
Lindsay Waller, Region of Durham
Luis Carvalho, Region of York
Seth Dittman, Region of York
C. Lim, T. Hung, Stantec

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**Quarterly Ambient Air Quality
Monitoring Report for the Durham
York Energy Centre (Crago Road
Station) – November to
December 2014**

Durham York Energy Centre



Prepared for:
The Region of Durham
605 Rossland Rd
Whitby, ON L1N 6A3

Prepared by:
Stantec Consulting Ltd.
300-675 Cochrane Dr., West Tower,
Markham, ON L3R 0B8

Project No.: 160950528

April 24, 2015

Sign-off Sheet

This document entitled Quarterly Ambient Air Quality Monitoring Report for the Durham York Energy Centre (Crago Road Station) – November to December 2014 was prepared by Stantec Consulting Ltd. for the account of The Region of Durham. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

ORIGINAL SIGNATURE ON FILE

Prepared by _____
(signature)

Timothy Hung, B.A.Sc.

ORIGINAL SIGNATURE ON FILE

Reviewed by _____
(signature)

Gregory Crooks M.Eng., P.Eng.

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(CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014**

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**QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE
(CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014**

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Executive Summary

The Regional Municipalities of Durham and York are constructing the Durham York Energy Centre (DYEC) which is an Energy from Waste (EFW) Facility intended to provide a long-term, sustainable solution to manage municipal solid waste remaining after diversion from the Regions.

As requested by the Regional Municipality of Durham (the Region), a third ambient air monitoring station located near the corner of Crago and Osborne Roads was installed in October/November 2014. This station, which is not part of the Ambient Air Quality Monitoring Plan - Durham York Residual Waste Study (Stantec, May 8, 2012), will be operated following the same protocols as the other two stations (Courtice WPCP and Rundle Road Stations) already in operation. The plan was developed for the Courtice WPCP and Rundle Road Stations based on the Regional Council's mandate to provide ambient air quality monitoring in the area of the DYEC for a three year period. An ambient air quality monitoring and reporting program was also a requirement laid out in the Provincial Minister's Notice of Approval to Proceed with the Undertaking, detailed in Condition 11 of the Notice of Approval (MOECC, 2010). The air monitoring plan was also developed to satisfy the conditions of the Environmental Compliance Approval and the environmental mitigation and commitments set out in the Environmental Assessment (Jacques Whitford, 2009).

Since November 2014, the predominantly downwind, Crago Road Station, has measured the following air contaminants:

- Sulphur Dioxide (SO₂);
- Nitrogen Oxides (NO_x); and,
- Particulate Matter smaller than 2.5 microns (PM_{2.5});

Operation of non-continuous monitors at the third station was not started as per Section 1.2 of the Ambient Monitoring Plan (Stantec, 2012), which calls for collection of continuous parameters only during commissioning of the Facility. When the EFW facility is fully operational, monitoring of non-continuous monitors will start (as specified in the Ambient Monitoring Plan). The following air contaminants will be measured non-continuously:

- Metals in total suspended particulate matter (TSP);
- Polycyclic Aromatic Hydrocarbons (PAHs); and,
- Dioxins and Furans.

The predominantly downwind Crago Road station also measures horizontal wind speed, wind direction, atmospheric temperature, relative humidity and rainfall.

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

This quarterly report provides a summary of the ambient air quality data collected at the Crago Road station for the period November to December 2014 (Calendar Quarter 4). During this quarter, a few instrumentation issues were encountered with above acceptable data recovery rates for all measured air quality parameters except for PM_{2.5}. A significant operational issue was encountered with the Thermo Sharpe 5030 PM_{2.5} monitor that resulted in a 25% data recovery rate during the November-December period. The monitor was removed and shipped back to the supplier for repair and replacement of the main board under warranty. Additional details on instrumentation issues are presented in **Section 3.2** of this report.

The following observations and conclusions were made from a review of the measured ambient air quality monitoring data:

1. Measured levels of NO₂, SO₂ and PM_{2.5} were below the applicable O. Reg. 419/05 criteria or human health risk assessment (HHRA) health-based standards presented in **Table 2-1** of this report;
2. Since the Canadian Ambient Air Quality Standards (CAAQS) for PM_{2.5} is based on a 98th percentile level over 3 years, whereas the PM_{2.5} measurement period at the Crago Road station for this quarterly report was two months with less than one month of data recovered, there was insufficient data collected to determine with any certainty if exceedances of the CAAQS would occur. Therefore no comparison of the measured PM_{2.5} data during this quarter to the CAAQS was conducted for this report, as it would not be scientifically accurate or representative;
3. In summary, all monitored contaminants were below their applicable MOECC criteria for the monitoring data presented in this report. All measured levels of all monitored contaminants were below their applicable HHRA health-based standards.

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Abbreviations

AAQC	Ambient Air Quality Criteria
CAC	Criteria Air Contaminants
D/Fs	Dioxins and Furans
DYEC	Durham York Energy Centre
EFW	Energy from Waste
MOECC	Ontario Ministry of the Environment and Climate Change
SO ₂	Sulphur Dioxide
NO _x	Nitrogen Oxides
PAH	Polycyclic aromatic hydrocarbons
Particulate	A particle of a solid or liquid that is suspended in air.
PCB	Polychlorinated biphenyl
PCDD/PCDF	Polychlorinated dibenzo-p-dioxins and dibenzofurans
PM	Particulate Matter
PM _{2.5}	Particulate Matter smaller than 2.5 microns
TEQ	Toxic equivalent quotient
TEQs	Toxic Equivalents
TSP	Total Suspended Particulate
WPCP	Water Pollution Control Plant

Elements

Cd	Cadmium
Hg	Mercury
Pb	Lead
Al	Aluminum
As	Arsenic
Be	Beryllium
Cr	Chromium
Cu	Copper
Mn	Manganese
Ni	Nickel
Ag	Silver
Tl	Thallium
Sn	Tin
V	Vanadium
Zn	Zinc

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Miscellaneous

°C	temperature in degrees Celsius
N/A	not available
%	percent
ppm	part per million
ppb	part per billion
ppt	part per trillion
min	minimum
max	maximum
µg/m ³	microgram per cubic metre

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Introduction
April 24, 2015

1.0 INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

The Regional Municipalities of Durham and York are constructing the Durham York Energy Centre (DYEC) which is an Energy from Waste (EFW) Facility intended to provide a long-term, sustainable solution to manage municipal solid waste remaining after diversion from the Regions. The site location of the DYEC is shown in **Figure 1-1**.

As requested by the Regional Municipality of Durham (the Region), a third ambient air monitoring station located near the corner of Crago and Osborne Roads was installed. This station, which is not part of the Ambient Air Quality Monitoring Plan - Durham York Residual Waste Study (Stantec, May 8, 2012), will be operated following the same protocols as the other two stations (Courtice WPCP and Rundle Road Stations) already in operation. The plan was developed for the Courtice WPCP and Rundle Road Stations based on the Regional Council's mandate to provide ambient air quality monitoring in the area of the DYEC for a three year period.

The purposes of the ambient air quality monitoring program are to:

1. Quantify any measureable ground level concentrations resulting from emissions from the DYEC cumulative to local air quality, including validating the predicted concentrations from the dispersion modelling conducted in the Environmental Assessment (Jacques Whitford, 2009);
2. Monitor concentration levels of EFW-related air contaminants in nearby residential areas; and,
3. Quantify background ambient levels of air contaminants in the area.

Since November 2014, the predominantly downwind, Crago Road station has measured the following air contaminants:

- Sulphur Dioxide (SO₂);
- Nitrogen Oxides (NO_x);
- Particulate Matter smaller than 2.5 microns (PM_{2.5});

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

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Operation of the non-continuous monitors at the third station was not started as per Section 1.2 of the Ambient Monitoring Plan (Stantec, 2012), which calls for collection of continuous parameters only during commissioning of the Facility. When the EFW facility is fully operational, monitoring of non-continuous monitors will start (as specified in the Ambient Monitoring Plan). The following air contaminants will be measured non-continuously:

- Metals in total suspended particulate matter (TSP);
- Polycyclic Aromatic Hydrocarbons (PAHs); and,
- Dioxins and Furans.

This quarterly report provides a summary of the ambient air quality data collected at this station for the period November to December 2014.

1.2 LOCATION OF AMBIENT AIR QUALITY MONITORING STATION

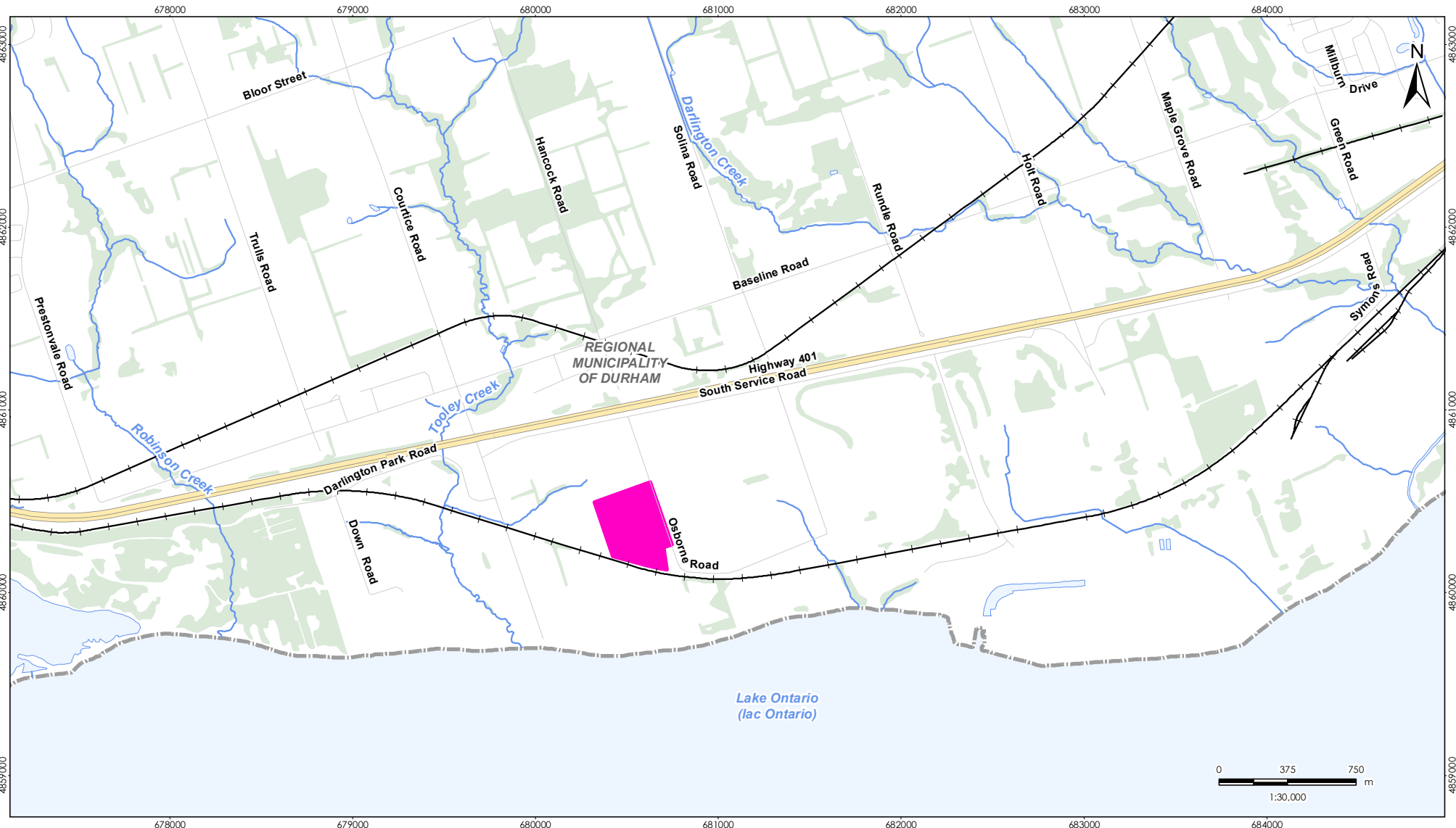
The selection of the site for the monitoring station was done in consultation with Durham/York representatives, the location of the existing monitoring stations and general MOECC siting criteria. The final location of the monitoring station was influenced by the availability of electrical power, accessibility of each location, and security.

The selected location is sited east of the DYEC in the vicinity of the Darlington Hydro Upper and Lower Soccer Fields. The predominantly downwind Crago Road Station is located on the east side of Crago Road, north of Osborne Road. Its location is shown in **Figure 1-2**. The monitoring station measures all the air contaminants listed in **Section 1.1** and meteorological data. This station is referred to as the Crago Road Station.

A fourth Fence Line Station, which will measure non-continuous parameters (metals and total particulate matter) will be installed prior to full operation of the DYEC and run for a one-year period.

A photograph of the Crago Road ambient air quality monitoring station is shown in **Figure 1-3**.

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Revised: 2013-10-28 By: scs



October 2013
160950528



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 17N
 2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

- Legend**
- Durham York Energy Centre Site
 - Railway
 - Road
 - Highway
 - Watercourse
 - Waterbody
 - Wooded Area



Client/Project
The Region of Durham
Durham York Energy Centre

Figure No.
1-1

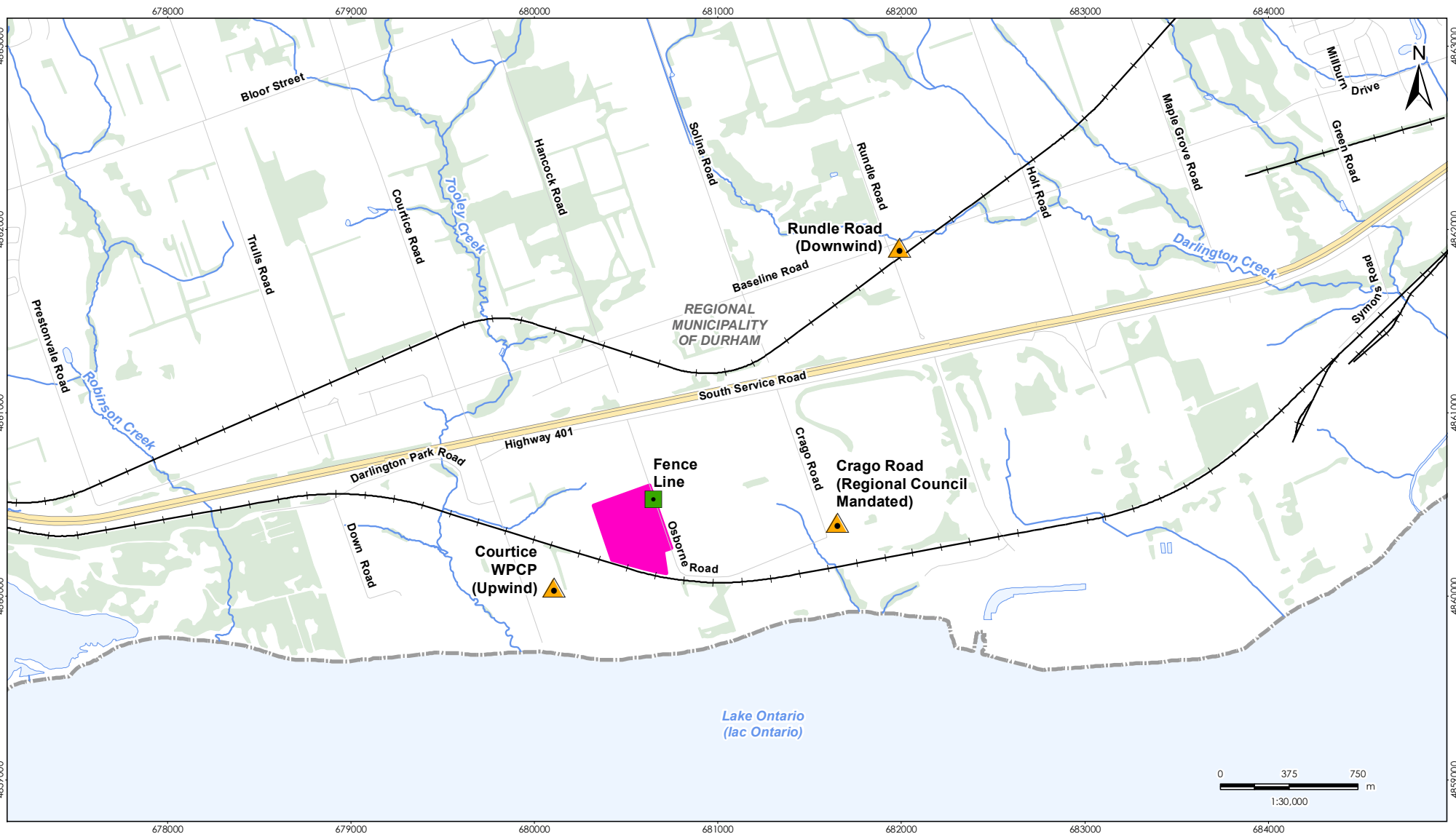
Title
Site Location Plan

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Introduction
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February 2015
160950528



Legend

- Station Location
- Fence Line Station Location
(Monitoring to begin after DYEC commissioning period)
- Durham York Energy Centre Site
- Railway
- Road
- Highway
- Watercourse
- Waterbody
- Wooded Area

Client/Project

The Region of Durham
Durham York Energy Centre

Figure No.

1-2

Title

**Locations of Ambient
Monitoring Stations**

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Introduction
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[back of Figure 1-2]

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Introduction
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Figure 1-3 View of Crago Road Ambient Air Quality Monitoring Station



QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Key Components Assessed
April 24, 2015

2.0 KEY COMPONENTS ASSESSED

2.1 METEOROLOGY

The following meteorological parameters are measured at the Crago Road monitoring station:

- Wind Speed and Direction @10-m
- Ambient Temperature @ 2-m
- Relative Humidity
- Rainfall

2.2 AIR QUALITY CONTAMINANTS OF CONCERN

The ambient air quality monitoring program for the DYEC includes the following contaminants specified in the Ambient Air Quality Monitoring Plan:

- Nitrogen Oxides (NO_x);
- Sulphur Dioxide (SO₂);
- Particulate Matter smaller than 2.5 microns (PM_{2.5});
- Total Suspended Particulate (TSP) matter and metals;
- Polycyclic Aromatic Hydrocarbons (PAHs); and,
- Dioxins and Furans (D/Fs).

Operation of the non-continuous monitors at the Crago Road station was not started as per Section 1.2 of the Ambient Monitoring Plan (Stantec, 2012), which calls for collection of continuous parameters only during commissioning of the Facility. When the EFW facility is fully operational, monitoring of non-continuous monitors will start (as specified in the Ambient Monitoring Plan). Therefore, the following contaminants were not measured this quarter:

- Total Suspended Particulate (TSP) matter and metals,
- Polycyclic Aromatic Hydrocarbons (PAHs), and
- Dioxins and Furans (D/Fs).

2.3 AIR QUALITY CRITERIA

Two sets of standards were used for comparison to the air quality data as specified in the Ambient Air Monitoring Plan. The first set of standards is the limits reported in O.Reg.419/05 (Schedules 3 and 6). These are compliance based standards used throughout the province of Ontario. However, not all chemicals have O.Reg.419/05 criteria, or in some instances updated health-based standards were used in the human health risk assessment (HHRA) conducted in support of the Environmental Assessment (July 31, 2009) - December 10, 2009). These health-based values, which were reported in Table 7-2 (Summary of Inhalation TRVs and Inhalation

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Key Components Assessed
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Benchmarks Selected for CACs) and Table 7-3 (Inhalation TRVs and Inhalation Benchmarks for Selected COPCs) of the HHRA (Stantec, 2009) were used as the second set of standards.

The previously applicable Canada-Wide Standard (CWS) for PM_{2.5} of 30 µg/m³ (98th percentile averaged over 3 consecutive years) has been superseded by the new Canadian Ambient Air Quality Standards (CAAQS) of 28 µg/m³ (98th percentile averaged over 3 consecutive years) as noted in **Table 2-1**. The proposed CAAQS by 2020 is 27 µg/m³.

A summary of the relevant air quality criteria for the contaminants monitored in Q4 2014 is presented in **Table 2-1**.

Table 2-1 Summary of Air Quality Criteria for CACs

Contaminant	CAS	O. Reg 419/05 – Schedule 3/AAQC			HHRA Health-Based Standards		
		1-Hour (µg/m ³)	24-Hour (µg/m ³)	Other time Period (µg/m ³)	1-Hour (µg/m ³)	24-Hour (µg/m ³)	Annual (µg/m ³)
Sulphur dioxide	7446095	690	275		690	275	29
Nitrogen oxides ^A	10102-44-0	400	200		400	200	60

Contaminant	CAS	Canadian Ambient Air Quality Standards (CAAQS)			HHRA Health-Based Standards		
		1-Hour (µg/m ³)	24-Hour (µg/m ³)	Other time Period (µg/m ³)	1-Hour (µg/m ³)	24-Hour (µg/m ³)	Other time Period (µg/m ³)
PM _{2.5}	N/A		28 ^B			30 ^C	

Notes:

- The Schedule 3 standards for NO_x are based on health effects of NO₂, as NO₂ has adverse health effects at much lower concentrations than NO. Therefore the standard was compared to NO₂ in this report. However, as per the current April 2012 version of O. Reg. 419 Summary of Standards and Guidelines, the standard was also compared to the monitored NO_x.
- Canadian Ambient Air Quality Standards (CAAQS) for Respirable Particulate Matter and Ozone, effective by 2015. The Respirable Particulate Matter Objective is referenced to the 98th percentile over 3 consecutive years.
- HHRA Health-Based Standard for PM_{2.5} was selected referencing CCME (2006).

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Instrumentation Summary
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3.0 INSTRUMENTATION SUMMARY

3.1 INSTRUMENTATION

The measurement program at the monitoring site includes both continuous and non-continuous monitors to sample air contaminant concentrations. The analyzers were set up in October to November 2014, and monitoring started on November 15, 2014.

Monitoring for respirable particulate matter (PM_{2.5}), nitrogen oxides (NO_x) and sulphur dioxide (SO₂) are conducted on a continuous basis. A summary of the continuous monitors and a brief description of their principle of operation are provided in **Table 3-1** below.

Table 3-1 Summary of Continuous Ambient Air Quality Monitors

Contaminant	Monitor	Principle of Operation	Range	Time Interval
PM _{2.5}	Thermo Sharp 5030 Synchronized Hybrid Ambient Real-time Particulate Monitor	Light Scattering Photometry / Beta Attenuation - Consists of a carbon 14 source, detector and light scattering Nephelometer in a rack-mountable enclosure. The Thermo Sharp utilizes a continuous (non-step wise) hybrid mass measurement and a combination of beta attenuation and light scattering technology. The unit's filter tape is automatically advanced based upon a user defined frequency or particulate loading.	0-10 mg/m ³	1 minute
NO, NO ₂ , NO _x	API Model 200E Chemiluminescence Analyzer	Chemiluminescence - Uses a chemiluminescence detection principle and microprocessor technology for ambient continuous emissions monitoring (CEM). Measurements are automatically compensated for temperature and pressure changes.	0 – 1000 ppb	1 second
SO ₂	Teledyne Monitor Labs Sulphur Dioxide Analyzer Model T100	Pulsed Fluorescence - SO ₂ levels are measured based on the principle that SO ₂ has a strong ultraviolet (UV) absorption at a wavelength between 200 and 240 nanometres (nm). The absorption of photons at these wavelengths results in the emission of fluorescence photons at a higher wavelength. The amount of fluorescence measured is directly proportional to the concentration of SO ₂ .	0 – 1000 ppb	1 second

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Instrumentation Summary
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The predominantly downwind Crago Road Station measures horizontal wind speed, wind direction, atmospheric temperature, relative humidity and rainfall. The meteorological sensors at the Crago Road Station are mounted on an external 10-m aluminum tower and are logged using a digital data acquisition system (DAS). The meteorological equipment includes the following:

Table 3-2 Summary of Meteorological Equipment

Parameter	Equipment
Wind Speed/Wind Direction	Met One Instruments Inc. Model 034B
Temperature	Campbell Scientific Model CS 107
Relative Humidity	Campbell Scientific Model HMP60
Rainfall	Texas Electronic TE525M

A Campbell Scientific CRX1000 station data acquisition system is used to collect continuous instrument monitoring data and status codes from the ambient air quality monitors. Continuous station data is maintained in the data loggers, and data is viewed locally using a laptop and the relevant DAS software applications. Remote data transmission is accomplished by the periodic transmission of collected station air quality data via cellular phone.

3.2 INSTRUMENTATION ISSUES

A few instrumentation issues were encountered during this quarter. A summary of operational issues for each measurement parameter during the monitoring period is presented in **Table 3-3**.

The monitors were set up in October/November 2014 and monitoring started on November 15, 2014. An issue was encountered with the Thermo Sharpe 5030 PM_{2.5} monitor in early December which necessitated removing the monitor and shipping it back to the supplier to replace the main board under warranty. A description of the issue, its resolution and the timeframe for solving it, supplied by the Canadian distributor of the instrument (CD NOVA) is presented in Appendix F.

QUARTERLY AMBIENT AIR QUALITY MONITORING REPORT FOR THE DURHAM YORK ENERGY CENTRE (CRAGO ROAD STATION) – NOVEMBER TO DECEMBER 2014

Instrumentation Summary
April 24, 2015

Table 3-3 Summary of Instrument Issues at Crago Road Station (Predominately Downwind)

Parameter	Issues	Time Frame	Remedial Action
SO ₂	Analog output failed	December 25, 2014 – January 29, 2015	Replaced motherboard
NO _x	-	-	-
PM _{2.5}	C rate and beta detector error	December 3, 2014 - January 23, 2015	Instrument removed for manufacturer repairs and replacement of motherboard
Other - Modem	Modem failed on initial installation	October 23, 2014 – January 23, 2015	Sim card holder damaged. New modem delivered.

3.3 INSTRUMENTATION RECOVERY RATES

Data recovery rates for each continuous monitor at the monitoring station during Quarter 4 (November to December 2014) is presented in **Table 3-4**. The first data record was on November 14, 2014 at 14:00. Data recovery rate calculations use an initial time of November 15, 2014 at 14:00 to allow a 24-hour “shake-down” period.

Table 3-4 Summary of Data Recovery Rates for the Crago Road Station (Predominately Downwind) – November to December 2014

Parameter	Valid Measurement Hours	Data Recovery Rate (%)
SO ₂	869	78.0%
NO _x	1109	99.6%
PM _{2.5}	278	25.0%
Temperature	1114	100.0%
Rainfall	1114	100.0%
Relative Humidity	1114	100.0%
Wind Speed/Direction	1114	100.0%
TSP/Metals	N/A ^A	N/A ^A
PAHs	N/A ^A	N/A ^A
Dioxins and Furans	N/A ^A	N/A ^A

Note:

A. Monitoring of these parameters was not started. Monitoring will begin when the Facility is fully operational.

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4.0 SUMMARY OF AMBIENT MEASUREMENTS

The following sections provide summaries of the validated data and the validation done on each parameter.

4.1 METEOROLOGICAL DATA

A summary of the maximum, minimum, arithmetic mean, and standard deviation of the hourly average meteorological parameters measured at the monitoring station for the November to December 2014 period are presented in **Table 4-1**.

Table 4-1 Summary of Hourly Meteorological Measurements – November to December 2014

Parameter		Crago Road Station (Predominately Downwind)	Units
Temperature	Max	10.5	C
	Min	-10.6	C
	Mean (November)	0.1	C
	Mean (December)	-0.3	C
	Mean (Period)	-0.2	C
	Standard Deviation	4.2	C
Rainfall	Max	6.1	mm
	Min	0.0	mm
	Mean (November)	0.06	mm
	Mean (December)	0.03	mm
	Mean (Period)	0.04	mm
	Standard Deviation	0.28	mm
Relative Humidity	Max	99.3	%
	Min	37.7	%
	Mean (November)	72.5	%
	Mean (December)	76.3	%
	Mean (Period)	75.1	%
	Standard Deviation	14.5	%

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Table 4-1 Summary of Hourly Meteorological Measurements – November to December 2014

Parameter		Crago Road Station (Predominately Downwind)	Units
Wind Speed ^A	Max	55.1	km/hr
	Min	0.0	km/hr
	Mean (November)	17.4	km/hr
	Mean (December)	14.0	km/hr
	Mean (Period)	15.1	km/hr
	Standard Deviation	8.4	km/hr

Notes:

A. Wind speed is measured at 10-m.

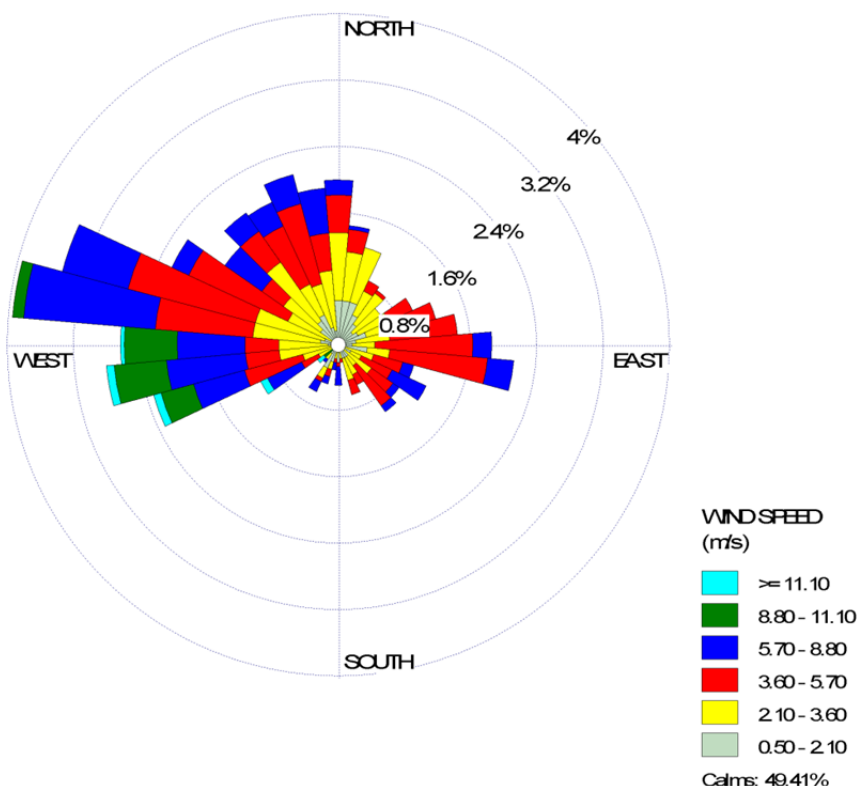
A wind rose showing the directionality and speed is presented in **Figure 4-1**. The length of the radial barbs gives the total percent frequency of winds from the indicated direction, while portions of the barbs of different widths indicate the frequency associated with each wind speed category.

Winds over the two-month period occurred predominantly from westerly directions. Wind contribution from the south was low. Higher wind speeds occurred from west-southwesterly directions, and lower wind speeds from the northerly directions.

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Figure 4-1 Wind Rose for November to December 2014



4.2 CAC AMBIENT AIR QUALITY MEASUREMENTS

A summary of the maximum, minimum, arithmetic mean and standard deviation of the CAC pollutant concentrations measured are presented in **Table 4-2**. Also presented in this table are the number of exceedances of the relevant Ontario ambient air quality criteria (AAQC) or health-based standard for each contaminant (if any occurred). All monitored contaminants were below their applicable criteria during the period between November to December, 2014.

Nitric oxide (NO) has no regulatory criteria as discussed in **Section 4.2.2** below. There are both hourly and daily AAQCs as well as Reg. 419 Schedule 3 criteria for NO_x which are based on health effects of NO₂. As specified in the MOECC's listing of AAQCs (MOECC, 2012a) the AAQC were compared to measured NO₂ concentrations in this report. However, as per the current April 2012 version of O. Reg. 419 Summary of Standards and Guidelines, the Schedule 3 criterion for NO_x (MOECC, 2012b) was compared to the monitored NO_x levels.

A comparison of the maximum measured data to their respective air quality criteria and the two existing ambient air monitoring stations (Stantec, 2015) is presented graphically in **Figure 4-2**.

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Table 4-2 Summary of Ambient CAC Monitoring Data – November to December 2014

Pollutant	Averaging Period	AAQC / Schedule 3 / HHRA Health-Based Standards			Crago Road Station (Predominately Downwind)	
		ppb	µg/m ³		Concentration (ppbv)	Concentration (µg/m ³)
SO ₂	1	250	690	Maximum	16.3	47.7
				Minimum	0.0	0.0
				Mean (November) D	1.3	3.8
				Mean (December)	2.3	6.7
				Mean (Period)	1.9	5.5
				Standard Deviation	1.4	3.9
				# of Exceedances	0	0
	24	100	275	Maximum	5.3	14.8
				Minimum	0.4	1.2
				Mean (November) D	1.3	3.7
				Mean (December)	2.3	6.7
				Mean (Period)	1.9	5.5
				Standard Deviation	0.9	2.4
				# of Exceedances	0	0

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Table 4-2 Summary of Ambient CAC Monitoring Data – November to December 2014

Pollutant	Averaging Period	AAQC / Schedule 3 / HHRA Health-Based Standards			Crago Road Station (Predominately Downwind)	
		ppb	µg/m ³		Concentration (ppbv)	Concentration (µg/m ³)
PM _{2.5}	24	N/A	30 ^A	Maximum	-	9.1
				Minimum	-	0.2
				Mean (November) D	-	3.7
				Mean (December)	-	N/A ^E
				Mean (Period)	-	3.7
				Standard Deviation	-	2.0
				# of Exceedances	-	N/A
NO ₂	1	200 ^B	400 ^B	Maximum	30.2	62.5
				Minimum	0.0	0.0
				Mean (November) D	6.6	13.5
				Mean (December)	7.0	14.3
				Mean (Period)	6.8	14.0
				Standard Deviation	5.3	11.0
				# of Exceedances	0	0
	24	100 ^B	200 ^B	Maximum	14.3	29.3
				Minimum	0.8	1.5
				Mean (November) D	6.7	13.7
				Mean (December)	7.0	14.2
				Mean (Period)	6.9	14.0
				Standard Deviation	3.2	6.6
				# of Exceedances	0	0

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Table 4-2 Summary of Ambient CAC Monitoring Data – November to December 2014

Pollutant	Averaging Period	AAQC / Schedule 3 / HHRA Health-Based Standards			Crago Road Station (Predominately Downwind)	
		ppb	µg/m ³		Concentration (ppbv)	Concentration (µg/m ³)
NO ^c	1	NA	NA	Maximum	33.1	43.1
				Minimum	0.0	0.0
				Mean (November) D	3.2	4.2
				Mean (December)	1.9	2.5
				Mean (Period)	2.3	3.1
				Standard Deviation	4.0	5.3
				# of Exceedances	N/A	N/A
	24	NA	NA	Maximum	11.5	15.1
				Minimum	0.1	0.1
				Mean (November) D	3.2	4.3
				Mean (December)	1.9	2.5
				Mean (Period)	2.3	3.1
				Standard Deviation	2.2	2.9
				# of Exceedances	N/A	N/A

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Table 4-2 Summary of Ambient CAC Monitoring Data – November to December 2014

Pollutant	Averaging Period	AAQC / Schedule 3 / HHRA Health-Based Standards			Crago Road Station (Predominately Downwind)	
		ppb	µg/m ³		Concentration (ppbv)	Concentration (µg/m ³)
NO _x	1	200 ^B	400 ^B	Maximum	57.9	116.1
				Minimum	0.0	0.0
				Mean (November) D	9.9	20.3
				Mean (December)	9.0	18.5
				Mean (Period)	9.3	19.1
				Standard Deviation	8.3	16.9
				# of Exceedances	0	0
	24	100 ^B	200 ^B	Maximum	25.4	50.8
				Minimum	2.4	2.7
				Mean (November)D	10.1	20.7
				Mean (December)	9.1	18.4
				Mean (Period)	9.4	19.1
				Standard Deviation	4.7	9.8
				# of Exceedances	0	0

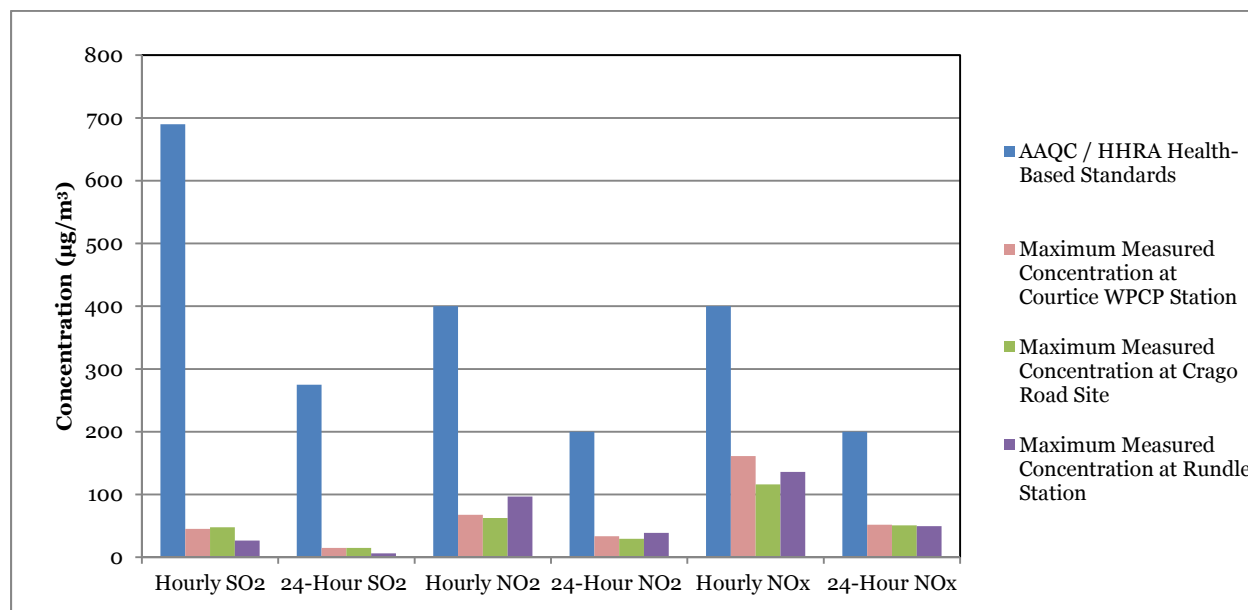
Note:

- A. Canadian Ambient Air Quality Standards (CAAQS) for Respirable Particulate Matter. The Respirable Particulate Matter Objective is referenced to the 98th percentile over 3 consecutive years.
- B. As per current version (April 2012) of Reg 419 Summary of Standards and Guidelines, the air standard for NO_x is compared to a monitored NO_x concentration, although the Reg419 Schedule 3 standard for NO_x is based on health effects of NO₂.
- C. NO has no regulatory criteria.
- D. Data collection started on November 15, 2014
- E. The PM_{2.5} analyzer had to be sent back for manufacturer repairs on December 3, 2014. Suspect data prior to this date have been invalidated

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Figure 4-2 Comparison of NO₂ / NO_x and SO₂ Ambient Air Quality Monitoring Data to Applicable Criteria and Existing Stations



Detailed discussion for each measured contaminant is presented in the following sections.

4.2.1 Sulphur Dioxide (SO₂)

Data summaries are presented in **Appendix A** for sulphur dioxide for each month as well as time history plots of the hourly and 24-hour average SO₂ concentrations. For the hourly and 24-hour averages, the Ontario AAQCs of 690 $\mu\text{g}/\text{m}^3$ and 275 $\mu\text{g}/\text{m}^3$ are shown as blue lines on each plot. As shown in these figures, measured ambient SO₂ concentrations at both stations were well below the criteria.

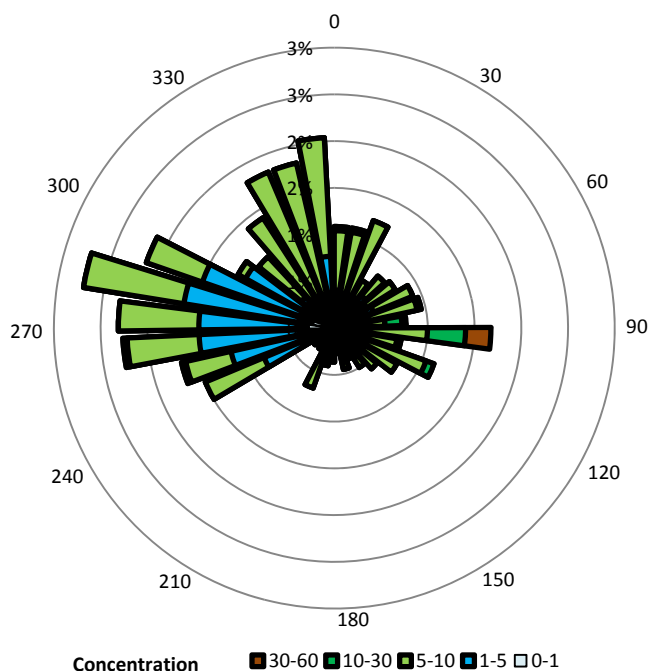
The maximum hourly and 24-hour average concentrations measured at the Crago Road Station during October to December 2014 were 47.7 and 14.8 $\mu\text{g}/\text{m}^3$ respectively, which are 7% and 5% of the applicable 1-hour and 24-hour ambient air quality criteria.

A pollution rose of hourly average SO₂ concentrations measured at the Crago Road Station is presented in **Figure 4-3**. The pollution rose plots present measured hourly average contaminant concentrations versus measured wind direction (over 10° wind sectors). The Crago Road station measured higher hourly concentrations from the easterly direction.

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Figure 4-3 Pollution Rose of Measured Hourly Average SO₂ Concentrations – November to December 2014



4.2.2 Nitrogen Dioxide (NO₂)

Nitrogen oxides (NO_x) are almost entirely made up of nitric oxide (NO) and nitrogen dioxide (NO₂). Together, they are often referred to as NO_x. Most NO₂ in the atmosphere is formed by the oxidation of NO, which is emitted directly by combustion processes, particularly those at high temperature and pressure. Exposure to both NO and NO₂ can result in adverse health effects to an exposed population. NO₂ is the regulated form of NO_x. Similar to other jurisdictions (e.g., Alberta Environment, World Health Organization), the O. Reg. 419/05 Schedule 3 standards for NO_x are based on health effects of NO₂, as health effects are seen at much lower concentrations of NO₂ than NO. In this report, because NO₂ is the regulated form of NO_x, the AAQC were compared to measured NO₂ concentrations (as per MOECC 2012a). However, as per the current April 2012 version of O. Reg. 419 Summary of Standards and Guidelines, the Schedule 3 NO_x criteria were also compared to the monitored NO_x concentrations (see **Section 4.2.3** below).

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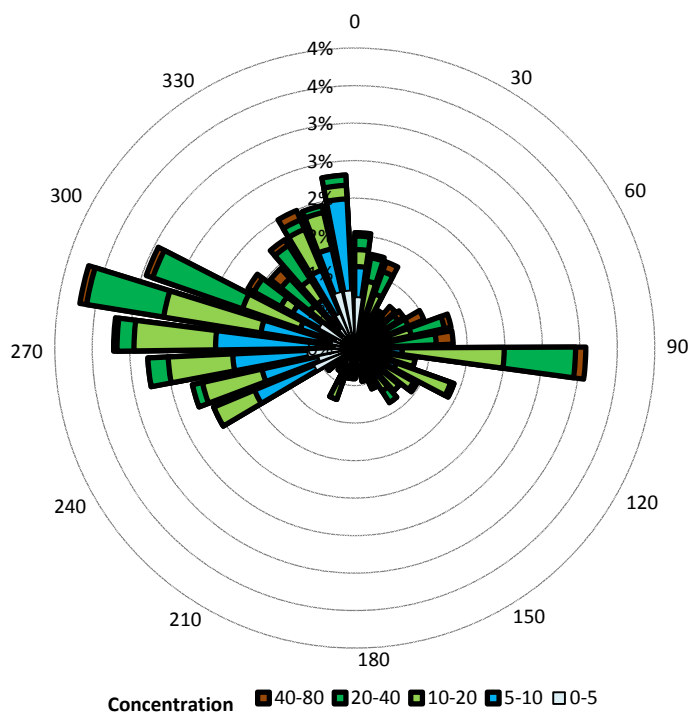
Summary of Ambient Measurements
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Data summaries are presented in **Appendix B** for nitrogen dioxide for the station each month as well as time history plots of the hourly and 24-hour average NO_2 concentrations. For the hourly and 24-hour averages, the Ontario AAQCs of $400 \mu\text{g}/\text{m}^3$ and $200 \mu\text{g}/\text{m}^3$ are shown as blue lines on each plot. As shown in these figures, measured ambient NO_2 concentrations were well below the criteria.

The maximum measured hourly and 24-hour average concentrations were 62.5 and $29.3 \mu\text{g}/\text{m}^3$, which are 16% and 15% of the applicable 1-hour and 24-hour ambient air quality criteria.

A pollution rose of measured hourly average NO_2 concentrations is presented in **Figure 4-4**. Higher measured hourly average concentrations occurred from the west-northwesterly to north-northwesterly and northeasterly to easterly directions.

Figure 4-4 Pollution Roses of Measured Hourly Average NO_2 – November to December 2014



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4.2.3 Nitrogen Oxides (NO_x)

Data summaries are presented in **Appendix C** for nitrogen oxides for each station and month as well as time history plots of the hourly and 24-hour average NO_x concentrations. For the hourly and 24-hour averages, the Ontario Schedule 3 criteria of 400 µg/m³ and 200 µg/m³ are shown as blue lines on each plot. As shown in these figures, the maximum measured ambient hourly and 24-hour average NO_x concentrations at the Crago Road Station were below the criteria during this quarter.

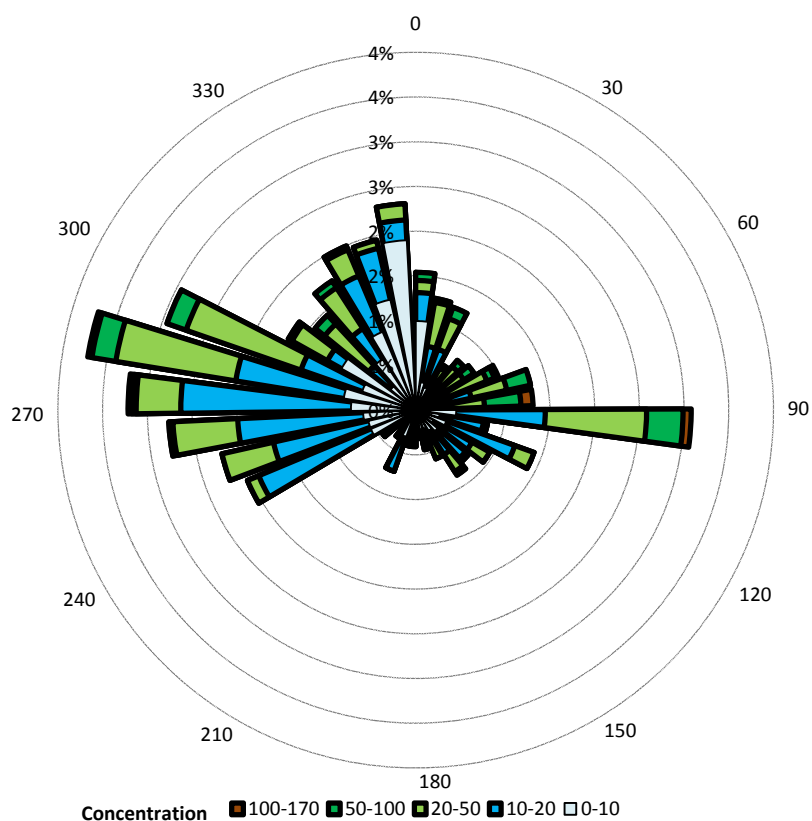
As shown in **Table 4-2**, the maximum hourly NO_x concentration measured at the Crago Road station was 116.1 µg/m³, which is 29% of the 1-hour ambient criteria. The 24-hour average NO_x concentration measured at this station was 50.8 µg/m³, which is 25% of the applicable 24-hour criteria.

A pollution rose of measured hourly average NO_x concentrations is presented in **Figure 4-5**. In Figure 4-5, higher measured hourly average NO_x concentrations occurred for winds blowing from the easterly direction.

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Figure 4-5 Pollution Roses of Measured Hourly Average NO_x Concentrations – November to December 2014



4.2.4 Particulate Matter Smaller than 2.5 Microns (PM_{2.5})

Data summaries and time history plots of measured 24-hour average concentrations are presented in **Appendix D** for PM_{2.5}.

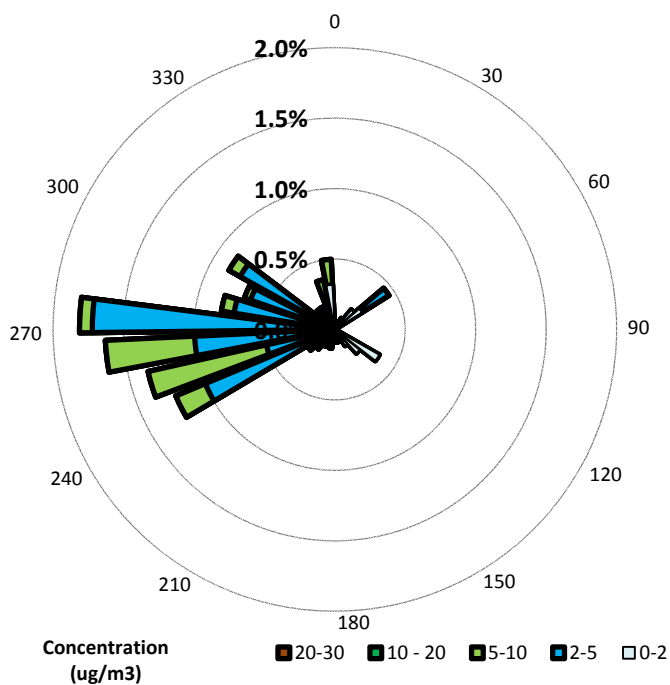
The maximum measured 24-hour average PM_{2.5} concentration was 9.1 µg/m³ during this quarter. Due to a PM_{2.5} analyzer malfunction, PM_{2.5} data were only collected between November 15 and December 3, 2014 for this quarter. It should be noted that since an exceedance of the CAAQS for PM_{2.5} requires the average of the 98th percentile levels in each of three consecutive years to be greater than 28 µg/m³, whereas the PM_{2.5} measurement at this station in the report consisted of less than one month of data, there is insufficient data to determine with any certainty if exceedances of the CAAQS would occur. Discussion of PM_{2.5} measurements with respect to the CAAQS will be provided in the 2015 annual report, at which time sufficient data will have been collected to make preliminary comparisons.

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A pollution rose showing the measured 24-hour average ambient PM_{2.5} concentrations versus direction is shown in **Figure 4-6**. The maximum measured concentrations occurred from the westerly directions.

Figure 4-6 Pollution Roses of Measured 24-Hour Average PM_{2.5} Concentrations – November 2014



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5.0 CONCLUSIONS

This quarterly report provides a summary of the ambient air quality data collected at the Crago Road monitoring station located predominantly downwind in the vicinity of the DYEC for the period November to December 2014.

The following observations and conclusions were made from a review of the measured ambient air quality monitoring data:

1. Measured levels of NO₂, SO₂ and PM_{2.5} were below the applicable O. Reg. 419/05 criteria or human health risk assessment (HHRA) health-based standards presented in **Table 2-1** of this report;
2. Since the Canadian Ambient Air Quality Standards (CAAQS) for PM_{2.5} is based on a 98th percentile level over 3 years, whereas the PM_{2.5} measurement period at this station for this quarterly report was two months with less than one month of data collected, there is insufficient data collected to determine with any certainty if exceedances of the CAAQS would occur. Therefore no comparison of the measured PM_{2.5} data during this quarter to the CAAQS was conducted for this report, as it would not be scientifically accurate or representative;
3. In summary, all monitored contaminants were below their applicable MOECC criteria for the monitoring data presented in this report. All measured levels of all monitored contaminants were below their applicable HHRA health-based standards.

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References
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6.0 REFERENCES

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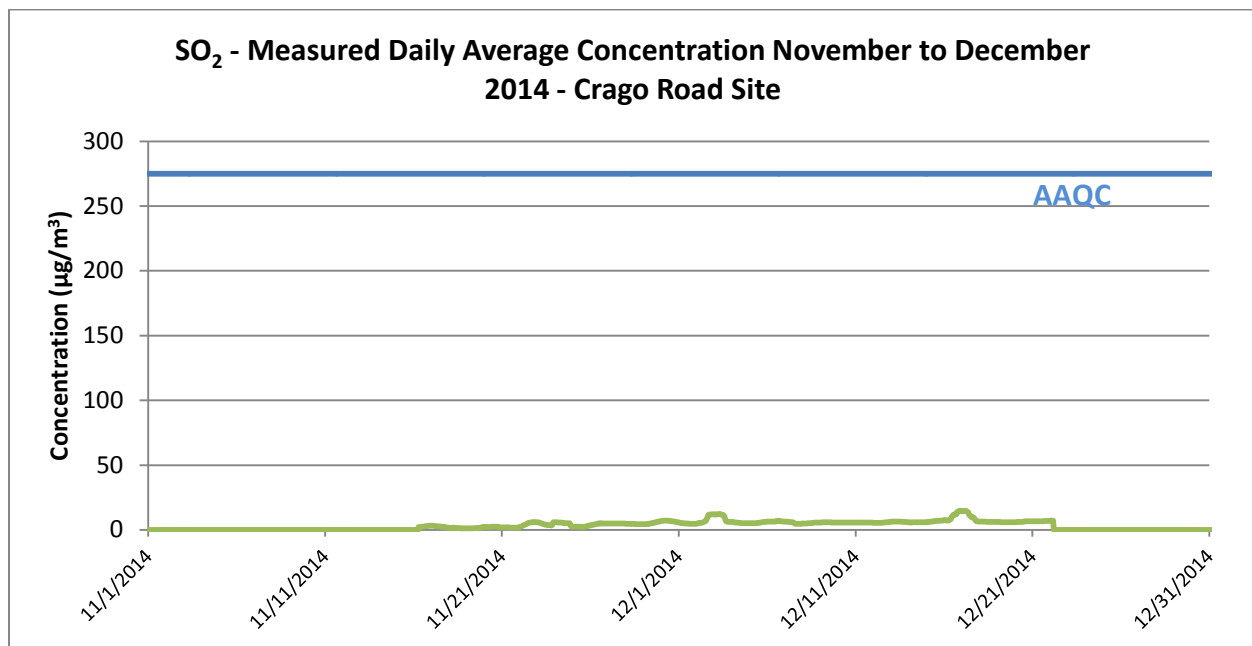
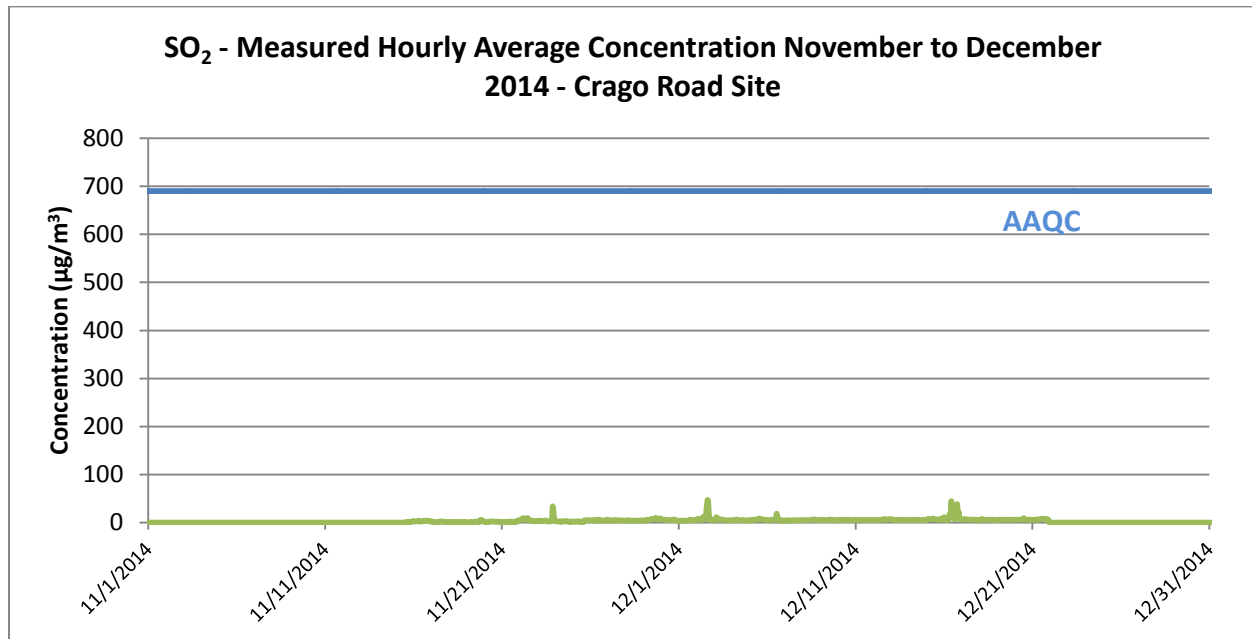
Appendix A

SO₂ Data Summaries And Time History Plots

SO2 - Crago Road																															
November 2014																															
(µg/m³)																															
Hour																															
Day	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Count	Maximum	Minimum	Average	Hrs>690	Days>275	
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0	
14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	T	T	T	T	T	T	T	T	T	0	0.0	0.0		0	0	
15	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	1.6	1.7	1.9	1.0	0.5	1.4	1.5	1.7	2.4	3.3	10	3.3	0.5		0	0
16	3.3	2.7	2.2	2.6	2.9	3.2	3.2	4.1	3.0	2.2	2.4	2.7	3.7	3.6	3.1	4.0	4.4	4.3	3.4	3.6	4.1	4.0	3.2	2.6	24	4.4	2.2	3.3	0	0	
17	2.4	2.7	2.0	1.5	0.7	1.2	1.0	1.5	1.2	1.4	1.8	2.1	2.9	2.6	2.4	2.6	2.8	1.8	1.9	1.9	1.5	1.1	0.5	0.9	24	2.9	0.5	1.8	0	0	
18	0.8	1.3	0.7	1.3	1.1	1.9	1.5	1.0	0.5	1.1	1.8	1.1	0.5	1.6	1.9	1.4	1.3	1.7	1.2	1.0	1.6	1.2	0.4	1.1	24	1.9	0.4	1.2	0	0	
19	0.9	0.8	1.2	1.3	1.8	1.7	1.7	1.7	1.1	1.3	1.6	1.4	2.0	2.4	1.7	1.5	1.8	1.0	4.6	5.3	6.1	4.9	3.2	3.2	24	6.1	0.8	2.3	0	0	
20	2.1	1.2	1.2	1.3	1.4	0.9	0.9	1.9	2.6	2.7	2.8	3.0	2.0	2.1	2.1	2.0	1.9	2.0	2.1	2.3	1.6	1.9	1.8	2.1	24	3.0	0.9	1.9	0	0	
21	1.8	1.9	1.4	1.2	1.4	1.4	1.3	2.5	2.0	1.1	1.1	1.6	1.5	3.1	2.4	1.7	1.4	0.0	T	2.1	2.4	4.0	5.1	4.3	23	5.1	0.0	2.0	0	0	
22	3.9	4.9	7.2	7.3	8.8	9.5	9.5	6.6	5.5	7.4	9.3	9.8	7.3	6.3	5.3	4.4	3.9	3.7	4.1	3.7	2.9	3.3	3.7	3.7	24	9.8	2.9	5.9	0	0	
23	3.5	3.8	3.5	4.0	4.0	3.3	3.1	4.0	3.4	3.6	4.5	5.0	4.1	3.8	3.2	3.0	2.5	2.6	3.3	2.8	5.2	34.3	24.9	6.2	24	34.3	2.5	5.9	0	0	
24	4.1	3.1	2.9	2.7	2.7	2.7	2.3	1.5	2.8	2.6	2.6	2.7	2.7	2.8	2.5	2.7	3.1	3.3	2.8	1.9	1.9	1.1	2.2	2.8	24	4.1	1.1	2.6	0	0	
25	2.3	2.4	2.5	2.4	1.9	1.9	2.2	2.8	2.7	2.0	1.4	2.2	C	C	C	C	4.0	5.0	5.1	5.2	5.0	4.9	5.3	5.3	21	5.3	1.4	3.4	0	0	
26	5.0	4.9	4.8	4.7	3.9	4.6	4.5	5.5	5.6	5.3	4.5	6.4	6.1	4.8	5.0	4.6	4.4	4.4	4.3	4.6	4.4	4.5	5.6	6.0	24	6.4	3.9	4.9	0	0	
27	5.6	4.8	4.6	4.7	4.5	4.7	4.9	5.0	4.7	4.5	4.9	5.1	5.6	5.1	5.1	5.1	4.7	4.7	4.9	4.6	4.7	4.5	4.4	4.4	24	5.6	4.4	4.8	0	0	
28	4.5	4.9	4.7	4.7	4.6	4.6	4.3	4.0	3.9	4.1	4.1	4.4	4.4	4.4	4.4	4.1	4.3	4.5	4.5	4.8	4.5	4.5	4.8	4.6	24	4.9	3.9	4.5	0	0	
29	4.5	4.6	4.4	4.7	4.6	6.0	5.9	5.8	6.0	6.2	7.0	7.7	7.3	7.2	7.3	7.3	8.0	9.9	8.4	7.2	6.9	7.3	7.3	8.7	24	9.9	4.4	6.7	0	0	
30	8.0	6.3	6.4	6.4	6.4	6.4	6.0	5.6	5.6	5.5	5.5	5.4	5.5	5.5	5.6	5.6	5.7	6.6	7.0	6.2	4.8	4.4	4.4	4.4	24	8.0	4.4	5.8	0	0	
31																									0	0.0	0.0		0	0	
Count	15	15	15	15	15	15	15	15	15	15	15	15	14	14	15	16	16	16	15	16	16	16	16	16	366	16	14	15			
Maximum	8.0	6.3	7.2	7.3	8.8	9.5	9.5	6.6	6.0	7.4	9.3	9.8	7.3	7.2	7.3	7.3	8.0	9.9	8.4	7.2	6.9	34.3	24.9	8.7	24	34.3	6.0	9.7			
Minimum	0.8	0.8	0.7	1.2	0.7	0.9	0.9	1.0	0.5	1.1	1.1	1.1	0.5	1.6	1.6	1.4	1.3	0.0	0.5	1.0	1.5	1.1	0.4	0.9	0	0.0	0.0				
Average	3.5	3.4	3.3	3.4	3.4	3.6	3.5	3.6	3.4	3.4	3.7	4.0	4.0	4.0	3.6	3.5	3.6	3.5	3.9	3.7	3.7	5.5	4.9	4.0	12	4	1	3.8			
#>900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							

SO2 - Crago Road December 2014 (µg/m³)																																														
Hour																																														
Day		0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Count	Maximum	Minimum	Average	Hrs>690	Days>275															
1		4.5	3.8	4.3	4.4	4.3	4.3	4.4	4.3	4.3	4.4	4.3	4.3	4.3	4.6	4.7	6.1	5.4	6.0	5.6	4.9	4.9	4.8	4.7	5.0	24	6.1	3.8	4.7	0	0															
2		6.2	7.7	8.4	7.9	7.1	6.4	5.5	5.1	6.0	12.5	11.2	11.0	7.1	12.9	30.2	47.7	42.9	17.9	6.0	6.9	5.9	5.9	5.6	5.2	24	47.7	5.1	12.0	0	0															
3		5.1	5.2	7.0	11.5	10.3	6.8	6.6	6.4	6.2	7.1	6.6	6.2	6.0	6.0	5.9	4.8	5.2	5.0	5.2	5.0	5.0	4.9	5.3	5.9	24	11.5	4.8	6.2	0	0															
4		4.9	5.0	4.6	4.9	4.8	6.0	6.4	7.2	5.6	4.9	4.7	4.9	5.2	5.4	5.2	5.3	4.8	4.7	4.8	4.8	4.7	4.7	4.7	4.7	24	7.2	4.6	5.1	0	0															
5		4.7	4.4	4.7	4.8	4.9	6.0	6.5	6.0	6.3	6.5	7.2	6.1	7.2	8.7	8.6	7.4	7.1	7.0	7.0	6.2	6.4	6.2	6.2	6.3	24	8.7	4.4	6.3	0	0															
6		5.4	5.1	5.1	5.0	5.4	5.6	6.0	6.0	6.1	6.1	6.1	6.1	8.9	19.0	12.7	7.7	4.8	4.7	4.6	4.5	4.7	4.3	4.5	4.7	24	19.0	4.3	6.4	0	0															
7		4.4	4.5	4.5	4.7	4.7	4.5	4.9	4.0	4.4	4.8	4.9	5.4	4.9	4.9	4.9	4.8	4.8	4.9	4.9	4.7	5.1	5.2	5.6	5.5	24	5.6	4.0	4.8	0	0															
8		5.7	5.3	5.2	5.3	5.1	5.3	5.4	5.6	5.5	5.7	5.8	5.8	5.7	6.5	7.2	6.7	6.8	6.2	5.8	5.9	5.5	5.3	5.6	5.1	24	7.2	5.1	5.7	0	0															
9		5.2	5.4	6.4	6.6	5.2	5.8	5.4	5.3	5.7	5.6	5.5	5.6	6.0	6.8	6.2	5.6	5.1	5.8	5.7	5.6	5.1	5.2	5.5	5.6	24	6.8	5.1	5.7	0	0															
10		5.2	5.2	5.6	5.1	5.4	6.1	5.8	5.2	5.9	6.0	6.0	6.0	5.9	5.9	5.9	6.2	5.8	5.7	5.1	5.2	5.7	5.7	5.7	6.0	24	6.2	5.1	5.7	0	0															
11		5.7	5.5	5.4	5.5	5.7	5.5	5.5	5.8	5.5	5.7	5.7	6.1	5.8	5.5	5.4	5.4	5.4	5.6	5.5	5.5	5.4	5.4	5.3	5.4	24	6.1	5.3	5.6	0	0															
12		5.3	5.4	5.4	5.4	5.4	5.3	5.6	5.3	5.4	5.5	5.7	6.1	6.4	6.6	6.5	6.7	7.4	7.1	6.5	6.4	6.6	6.9	7.7	7.3	24	7.7	5.3	6.2	0	0															
13		6.9	6.7	6.7	6.1	5.7	5.3	5.7	5.3	5.9	6.5	6.0	6.1	5.4	5.6	6.1	6.1	5.5	5.5	5.7	5.7	5.8	5.9	6.0	5.9	24	6.9	5.3	5.9	0	0															
14		5.6	5.9	5.6	5.8	6.0	6.2	6.4	6.1	5.9	5.5	5.1	6.2	6.2	6.0	5.8	5.6	5.6	5.8	5.9	5.8	6.1	5.9	6.2	5.6	24	6.4	5.1	5.9	0	0															
15		5.7	6.8	7.6	8.4	7.7	7.7	8.3	7.8	8.0	8.9	7.9	7.2	7.1	6.9	7.0	7.0	6.6	6.2	6.6	7.6	7.3	6.1	6.2	10.1	24	10.1	5.7	7.4	0	0															
16		11.4	5.8	5.9	5.9	5.8	5.9	5.7	16.1	18.2	16.1	44.6	20.9	16.4	32.1	7.8	10.6	7.5	18.0	38.6	13.1	22.3	8.5	6.9	6.5	24	44.6	5.7	14.6	0	0															
17		6.8	6.5	7.2	7.3	7.3	7.9	7.2	6.8	6.9	6.8	6.3	6.5	6.5	6.4	6.2	6.0	6.0	6.3	6.3	6.2	6.2	5.8	6.6	4.5	24	7.9	4.5	6.5	0	0															
18		5.6	6.1	6.6	7.4	7.5	6.9	6.0	6.4	6.3	6.5	6.1	5.8	5.8	6.0	6.1	6.4	5.8	5.9	6.0	5.9	5.9	5.9	5.9	5.7	24	7.5	5.6	6.2	0	0															
19		5.8	6.0	6.0	6.0	6.0	5.8	5.7	6.1	5.9	6.0	6.1	6.0	6.0	6.0	6.1	6.1	6.0	6.1	6.1	6.0	6.1	6.1	6.1	5.8	24	6.1	5.7	6.0	0	0															
20		6.0	6.2	6.3	6.2	6.3	6.2	6.3	6.3	6.3	6.9	6.9	7.8	9.4	8.4	6.9	6.4	6.3	6.5	6.4	6.2	5.8	6.0	6.2	6.2	24	9.4	5.8	6.6	0	0															
21		6.3	6.4	6.4	6.3	6.3	6.4	6.6	6.4	6.6	6.9	7.8	7.8	8.1	8.3	7.9	8.0	8.0	7.3	7.1	5.5	7.6	6.9	5.8	M	23	8.3	5.5	7.0	0	0															
22	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0		0	0															
23	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0		0	0															
24	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0		0	0															
25	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0		0	0															
26	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0		0	0															
27	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0		0	0															
28	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0		0	0															
29	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0		0	0															
30	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0		0	0															
31	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0		0	0															
Count		21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	20	503	21	20	21																	
Maximum		11.4	7.7	8.4	11.5	10.3	7.9	8.3	16.1	18.2	16.1	44.6	20.9	16.4	32.1	30.2	47.7	42.9	18.0	38.6	13.1	22.3	8.5	7.7	10.1	24	47.7	7.7	19.5																	
Minimum		4.4	3.8	4.3	4.4	4.3	4.3	4.4	4.0	4.3	4.4	4.3	4.3	4.3	4.6	4.7	4.8	4.8	4.7	4.6	4.5	4.7	4.3	4.5	4.5	0	0.0	3.8																		
Average		5.8	5.7	6.0	6.2	6.0	6.0	6.0	6.4	6.5	6.9	8.1	7.1	6.9	8.5	7.8	8.4	7.7	7.1	7.4	6.1	6.6	5.8	5.8	5.8	16	8	3	6.7																	
#>900		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																				
		Regs		Acceptable		Desirable		Violations		Maximum																																				
Percentiles		10		20		30		40		50		60		70		80		90		95		99		100		Hour				47.7																
Data		4.8		5.2		5.5		5.8		6.0		6.1		6.3		6.8		7.7		10.0		30.1		47.7		Day				14.6																
																										Month				6.7																
Notes		C - Calibration / Span Cycle				NA - No Data Available				T - Test				A- MOE Audit				M - Equipment Malfunction / Down				R - Rate of Change																								

Figure A-1 Time History Plots of Measured Hourly Average and 24-Hour Average SO₂ Concentrations– Crago Road Station



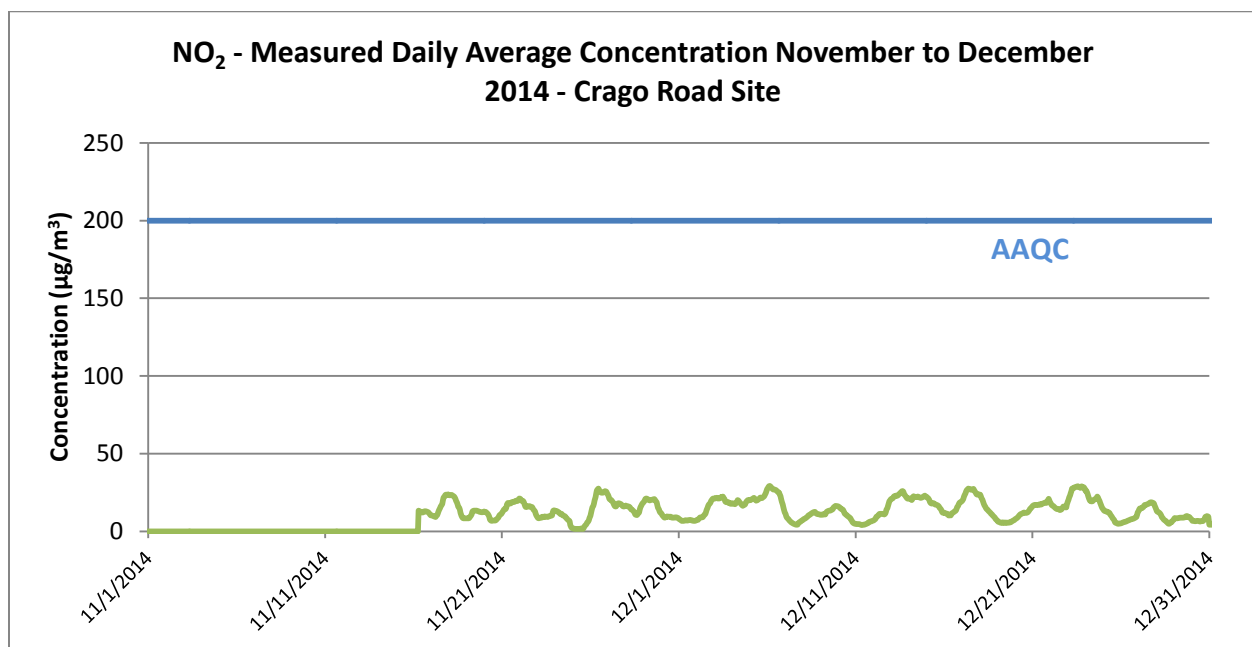
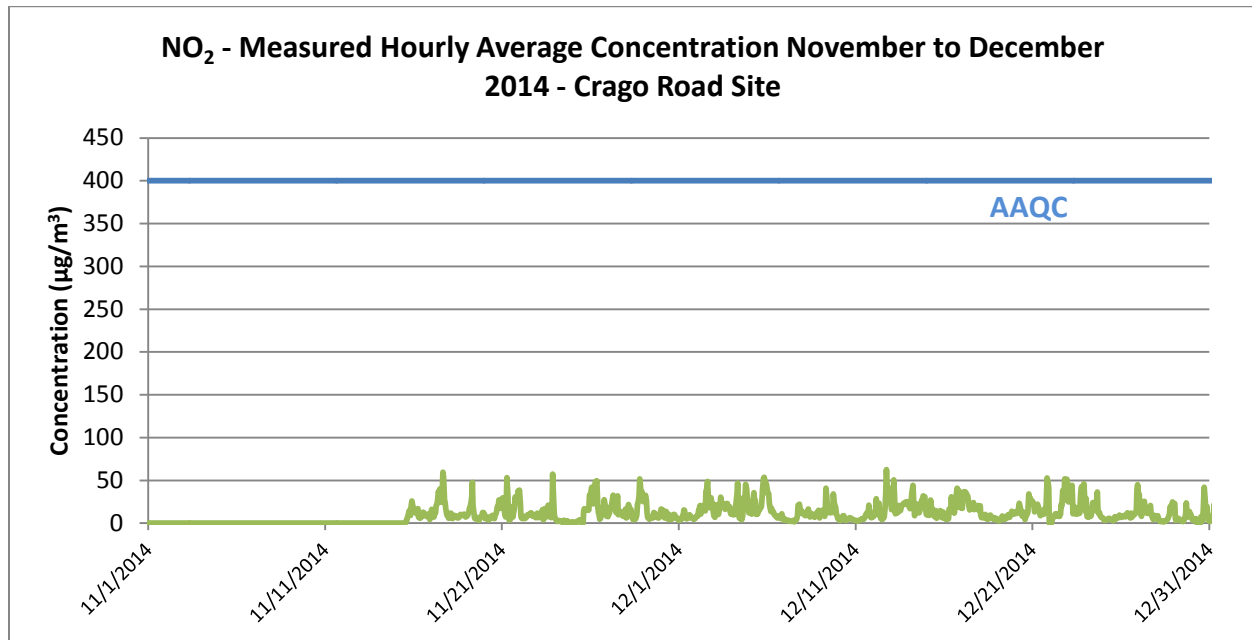
Appendix B

NO₂ Data Summaries And Time History Plots

NO ₂ - Crago Road November 2014 (µg/m ³)																															
Hour																															
Day		0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Count	Maximum	Minimum	Average	Hrs>400	Days>200
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
15	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	0	0.0	0.0		0	0
16	17.0	16.7	13.0	15.9	11.5	16.4	16.9	6.8	6.9	5.7	9.1	8.8	8.2	13.1	11.0	11.6	9.6	9.4	8.2	8.3	7.3	10.9	4.4	6.0	24	17.0	4.4	10.5	0	0	
17	13.1	16.4	8.3	7.4	7.4	13.2	12.2	21.0	22.3	29.4	37.1	33.7	40.2	38.1	24.4	38.5	59.5	54.1	27.2	24.2	16.5	10.2	8.7	8.3	24	59.5	7.4	23.8	0	0	
18	5.9	8.7	11.6	11.9	6.1	5.5	6.2	9.1	8.5	8.8	7.4	7.0	6.1	6.3	7.2	9.6	10.2	9.3	9.8	9.1	10.2	10.5	8.6	7.4	24	11.9	5.5	8.4	0	0	
19	8.1	8.4	9.8	12.9	17.7	18.4	24.7	30.5	47.7	20.5	11.6	6.1	4.9	6.2	6.9	4.9	5.7	3.4	7.0	6.9	7.2	8.8	12.6	12.3	24	47.7	3.4	12.6	0	0	
20	10.5	5.5	5.6	5.3	7.6	6.4	3.9	4.6	5.7	7.2	7.6	9.1	5.7	6.1	5.4	8.9	11.5	13.9	19.2	20.0	27.3	27.5	22.9	17.4	24	27.5	3.9	11.0	0	0	
21	28.3	29.8	21.5	23.6	11.9	7.4	23.1	53.1	31.8	7.1	3.6	3.9	7.2	13.2	19.4	7.4	13.0	16.6	30.8	25.8	24.1	26.5	38.0	33.1	24	53.1	3.6	20.8	0	0	
22	38.8	23.6	7.5	5.6	5.3	8.5	7.6	5.5	6.2	6.4	8.0	10.1	9.6	10.4	11.5	10.3	12.2	10.5	8.1	9.3	9.1	9.9	6.4	6.5	24	38.8	5.3	10.3	0	0	
23	11.8	8.7	6.6	7.6	11.4	7.0	11.2	16.0	4.3	4.1	17.0	9.5	8.1	8.7	7.6	21.0	11.5	13.8	15.8	6.7	14.7	57.2	36.1	10.1	24	57.2	4.1	13.6	0	0	
24	6.8	4.3	3.8	2.4	2.1	3.1	2.3	2.7	2.4	1.3	1.2	1.3	3.6	2.7	2.5	1.0	2.9	2.7	1.6	1.0	0.4	0.5	1.2	1.4	24	6.8	0.4	2.3	0	0	
25	0.6	1.5	0.9	0.0	0.8	0.7	2.1	2.6	3.1	2.4	4.1	3.3	C	C	C	14.4	17.0	16.4	15.5	15.8	15.0	15.9	15.4	32.8	21	32.8	0.0	8.6	0	0	
26	33.5	37.4	42.1	33.0	22.4	32.0	44.1	48.7	46.9	49.4	19.6	12.3	10.1	4.7	5.6	11.3	16.6	19.2	18.6	27.4	21.1	13.7	8.5	9.7	24	49.4	4.7	24.5	0	0	
27	7.8	11.3	11.5	18.7	19.6	20.6	28.3	32.8	20.2	19.1	14.9	12.5	26.7	32.1	10.0	13.0	12.1	13.3	13.1	9.3	11.5	8.0	8.0	15.2	24	32.8	7.8	16.2	0	0	
28	16.7	6.2	6.9	13.9	21.7	14.5	13.7	16.6	12.9	6.4	4.3	4.0	4.9	4.6	5.7	10.1	22.2	24.0	31.1	51.7	45.2	31.6	36.8	29.9	24	51.7	4.0	18.2	0	0	
29	25.3	25.8	28.6	32.6	26.1	11.6	6.5	6.9	4.8	7.1	7.4	6.3	5.7	6.6	12.6	12.3	7.5	10.9	9.0	6.8	6.4	6.2	9.7	7.9	24	32.6	4.8	12.1	0	0	
30	16.5	9.2	10.9	15.0	13.8	6.0	11.7	13.5	10.4	5.1	5.1	10.2	4.8	5.1	4.4	6.9	7.1	10.2	10.3	9.5	5.9	5.6	6.1	4.6	24	16.5	4.4	8.7	0	0	
31																									0	0.0	0.0		0	0	
Count	15	15	15	15	15	15	15	15	15	15	15	15	14	14	15	16	16	16	16	16	16	16	16	16	367	16	14	15			
Maximum	38.8	37.4	42.1	33.0	26.1	32.0	44.1	53.1	47.7	49.4	37.1	33.7	40.2	38.1	24.4	38.5	59.5	54.1	31.1	51.7	45.2	57.2	38.0	33.1	24	59.5	24.4	41.1			
Minimum	0.6	1.5	0.9	0.0	0.8	0.7	2.1	2.6	2.4	1.3	1.2	1.3	3.6	2.7	2.5	1.0	2.9	2.7	1.6	1.0	0.4	0.5	1.2	1.4	0	0.0	0.0				
Average	16.0	14.2	12.6	13.7	12.3	11.4	14.3	18.0	15.6	12.0	10.5	9.2	10.4	11.3	9.1	11.5	14.1	14.9	14.9	15.4	14.4	16.5	15.6	13.9	12	18	2	13.4			
#>900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
Percentiles	10		20		30		40		50		60		70		80		90		95		99		100		Regs Acceptable Desirable Violations				Maximum		
Data	3.9		5.7		6.9		8.3		9.9		11.7		15.0		20.0		29.6		37.0		52.2		59.5						59.5		
Notes	C - Calibration / Span Cycle			NA - No Data Available			T - Test/Startup period			A- MOE Audit			M - Equipment Malfunction / Down			R - Rate of Change													24.5		
																									Hour					13.4	
																									Day						
																									Month						

NO ₂ - Crago Road December 2014 (µg/m ³)																																			
Hour																								Count	Maximum	Minimum	Average	Hrs>400	Days>200						
Day	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300											
1	3.7	3.6	3.9	4.4	4.8	8.1	9.2	15.5	15.1	6.6	5.9	5.1	6.3	7.8	6.4	9.7	8.3	6.1	6.0	6.3	4.6	6.0	5.5	7.1	24	15.5	3.6	6.9	0	0					
2	7.8	8.6	8.4	15.0	17.0	20.6	10.6	15.0	16.8	16.8	19.5	21.6	14.3	37.3	39.4	48.9	33.6	29.9	18.1	20.0	29.8	22.9	22.8	12.9	24	48.9	7.8	21.2	0	0					
3	8.5	7.0	11.6	21.4	17.5	11.6	10.3	15.8	19.3	30.6	26.5	19.3	22.1	20.0	18.3	16.3	22.3	23.2	22.9	19.0	18.9	19.1	12.8	10.5	24	30.6	7.0	17.7	0	0					
4	15.7	10.8	9.7	9.9	12.9	18.4	23.4	33.9	46.8	26.5	6.2	7.0	8.4	4.0	4.9	9.5	29.6	28.2	28.7	45.4	40.5	30.2	20.4	12.1	24	46.8	4.0	20.1	0	0					
5	12.2	18.0	13.4	10.8	21.8	25.2	35.7	25.3	26.9	10.4	13.9	10.7	14.2	14.7	17.1	17.5	19.1	27.6	40.6	52.8	53.8	50.1	46.5	45.9	24	53.8	10.4	26.0	0	0					
6	40.6	34.5	34.4	23.8	18.7	13.8	17.4	14.9	13.8	12.3	9.7	8.8	8.0	7.8	6.3	8.4	8.2	7.0	5.4	9.7	11.1	6.5	5.4	3.6	24	40.6	3.6	13.8	0	0					
7	5.1	3.7	3.0	3.7	3.0	2.9	3.3	2.9	2.3	2.7	2.0	2.4	3.5	1.8	3.0	3.3	4.4	8.7	21.1	21.3	22.1	14.3	13.1	14.7	24	22.1	1.8	7.0	0	0					
8	11.2	12.1	11.0	9.2	8.8	11.5	12.9	14.3	16.8	10.0	7.2	9.9	11.4	10.7	10.3	10.0	6.8	9.7	7.9	11.4	13.0	12.1	15.0	6.3	24	16.8	6.3	10.8	0	0					
9	8.0	12.1	9.4	12.3	15.6	13.4	7.9	15.6	40.9	28.4	14.8	13.0	15.2	12.2	12.0	15.4	15.6	12.4	34.2	23.8	20.7	18.8	10.1	9.0	24	40.9	7.9	16.3	0	0					
10	5.5	4.3	3.4	3.1	3.2	4.6	6.5	8.9	8.9	4.2	4.0	3.3	4.1	5.0	4.9	5.1	6.5	6.2	5.5	5.2	4.5	4.0	3.7	3.4	24	8.9	3.1	4.9	0	0					
11	3.1	2.7	2.8	3.3	2.7	3.1	3.5	4.1	4.3	5.5	4.5	4.9	5.7	7.2	10.7	9.2	12.3	10.5	21.2	11.4	7.1	6.4	6.7	7.9	24	21.2	2.7	6.7	0	0					
12	7.8	8.6	13.5	15.1	28.4	15.2	10.2	11.5	23.4	10.7	5.9	6.9	4.3	5.2	6.3	7.1	18.8	36.8	62.5	35.6	39.3	40.1	41.1	28.0	24	62.5	4.3	20.1	0	0					
13	23.1	16.0	16.6	24.8	50.7	24.9	10.9	15.8	19.4	12.0	14.8	20.6	15.5	14.8	18.8	20.5	22.1	22.7	23.7	22.2	23.5	25.4	23.9	24.9	24	50.7	10.9	21.1	0	0					
14	21.2	18.3	17.2	19.4	33.9	39.3	44.3	26.7	8.9	11.4	15.3	16.8	22.1	14.1	12.0	14.1	18.6	23.2	27.6	28.6	31.8	31.1	30.7	16.9	24	44.3	8.9	22.6	0	0					
15	10.4	10.5	9.4	11.9	9.1	10.9	27.0	17.9	12.8	16.1	9.6	7.8	14.1	14.9	5.8	10.3	10.4	8.4	11.1	14.8	13.8	6.6	12.1	12.9	24	27.0	5.8	12.0	0	0					
16	11.7	5.4	5.9	4.7	8.3	6.6	5.1	16.6	16.3	15.1	30.8	17.9	18.8	28.3	11.9	18.0	18.3	36.0	41.0	30.7	38.2	30.9	18.1	19.2	24	41.0	4.7	18.9	0	0					
17	19.8	17.5	32.2	36.7	35.6	36.3	35.2	33.1	32.0	26.6	19.8	15.5	18.1	19.3	20.9	18.7	23.9	16.0	19.5	16.6	18.4	19.1	20.6	18.8	24	36.7	15.5	23.8	0	0					
18	14.4	20.4	9.3	6.7	9.6	6.6	6.4	6.5	10.3	5.5	5.0	5.3	4.5	6.4	9.2	9.4	7.6	5.6	6.2	4.8	6.5	4.8	4.1	5.6	24	20.4	4.1	7.5	0	0					
19	4.1	3.3	2.9	4.5	3.1	3.9	6.3	8.5	7.9	6.2	4.4	4.9	5.2	5.7	8.0	10.0	9.2	7.1	8.2	11.5	13.9	12.1	10.6	10.5	24	13.9	2.9	7.2	0	0					
20	12.7	13.3	11.7	11.3	14.2	15.6	23.2	20.2	17.1	11.8	8.4	10.6	12.9	7.9	4.4	6.8	9.5	10.5	13.1	34.3	29.3	29.5	22.4	23.1	24	34.3	4.4	15.6	0	0					
21	25.9	24.6	19.9	13.2	14.3	16.8	18.9	22.4	19.0	15.6	13.2	8.6	13.4	13.7	11.2	10.2	16.2	17.0	13.1	29.3	53.0	47.9	41.8	0.0	24	53.0	0.0	20.0	0	0					
22	0.0	0.0	0.0	3.9	8.0	7.9	7.6	10.9	11.2	8.3	10.3	8.1	8.6	7.9	10.7	21.9	20.1	38.4	27.4	26.7	51.8	39.1	39.1	51.5	24	51.8	0.0	17.5	0	0					
23	42.8	24.7	37.9	38.1	39.8	40.6	44.4	10.9	20.1	16.3	18.6	10.5	11.3	15.1	10.9	12.5	11.8	27.5	39.0	42.9	35.5	34.8	46.1	26.0	24	46.1	10.5	27.4	0	0					
24	13.6	28.9	7.8	7.3	6.9	8.8	12.7	8.1	9.1	18.2	24.0	23.7	20.6	21.7	14.9	23.4	36.6	14.0	11.4	12.6	8.7	7.3	6.9	6.3	24	36.6	6.3	14.7	0	0					
25	6.1	3.5	3.3	3.7	3.6	4.2	4.7	5.3	5.7	5.4	5.2	3.8	3.6	3.5	3.0	3.7	7.6	5.8	5.5	5.8	6.0	6.9	9.5	8.2	24	9.5	3.0	5.1	0	0					
26	6.8	6.9	7.7	8.7	8.7	7.8	9.3	7.5	8.9	12.1	11.9	7.9	8.1	6.1	11.6	6.9	10.0	10.1	9.5	11.6	11.9	15.7	39.3	45.0	24	45.0	6.1	12.1	0	0					
27	32.8	33.4	18.8	10.5	8.0	16.2	18.3	22.2	25.5	16.7	14.9	11.9	13.2	11.4	14.6	16.9	20.6	11.8	9.5	6.6	4.4	9.2	9.1	8.0	24	33.4	4.4	15.2	0	0					
28	6.4	4.9	8.7	5.0	3.7	2.2	3.2	2.1	2.0	2.5	1.8	1.7	2.6	3.0	3.2	4.4	5.6	7.9	9.6	19.7	15.0	12.3	24.7	19.1	24	24.7	1.7	7.1	0	0					
29	23.0	22.9	5.3	3.3	4.5	4.9	5.8	4.9	4.4	3.3	2.7	2.4	1.9	2.1	5.4	5.3	10.4	23.6	8.8	7.4	11.1	13.7	11.0	10.2	24	23.6	1.9	8.3	0	0					
30	7.3	3.8	3.2	3.1	3.4	4.8	5.6	C	C	0.0	0.0	0.0	0.3	7.8	7.1	3.2	14.4	41.9	32.7	21.8	18.0	19.1	6.4	3.2	22	41.9	0.0	9.4	0	0					
31	4.7	2.2	2.4	2.6	4.1	7.8	12.8	22.9	7.7	3.7	7.1	4.5	2.9	1.9	6.7	5.4	4.2	7.0	3.9	1.5	2.6	2.7	6.0	4.2	24	22.9	1.5	5.5	0	0					
Count	31	31	31	31	31	31	31	30	30	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	742	31	30	31							
Maximum	42.8	34.5	37.9	38.1	50.7	40.6	44.4	33.9	46.8	30.6	30.8	23.7	22.1	37.3	39.4	48.9	36.6	41.9	62.5	52.8	53.8	50.1	46.5	51.5	24	62.5	22.1	41.6							
Minimum	0.0	0.0	0.0	2.6	2.7	2.2	3.2	2.1	2.0	0.0	0.0	0.0	0.3	1.8	3.0	3.2	4.2	5.6	3.9	1.5	2.6	2.7	3.7	0.0	22	8.9	0.0	2.0							
Average	13.4	12.5	11.1	11.3	13.7	13.4	14.6	14.7	15.8	12.0	10.9	9.5	10.2	10.9	10.6	12.3	14.9	17.4	19.2	19.7	21.2	19.3	18.9	15.3	24	34	5	14.3							
#>900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0											
																														Regs	Acceptable	Desirable	Violations	Maximum	
Percentiles	10		20		30		40		50		60		70		80		90		95		99		100		Hour	62.5									
																												Day	27.4						
Data	3.7		5.4		7.1		8.9		11.1		13.7		17.0		21.7		30.2		39.0		49.6		62.5		Month	14.3									
Notes	C - Calibration / Span Cycle			NA - No Data Available			T - Test			A- MOE Audit			M - Equipment Malfunction / Down			R - Rate of Change																			

Figure B-1 Time History Plots of Measured Hourly Average and 24-Hour Average NO₂ Concentrations – Crago Road Station



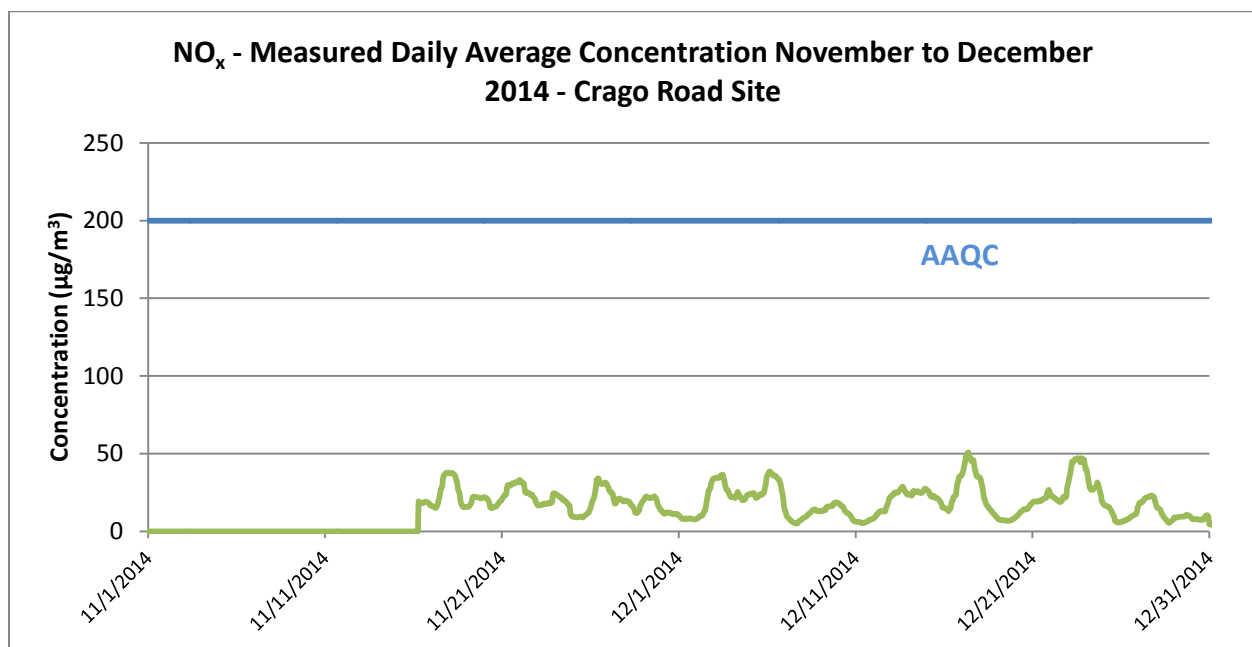
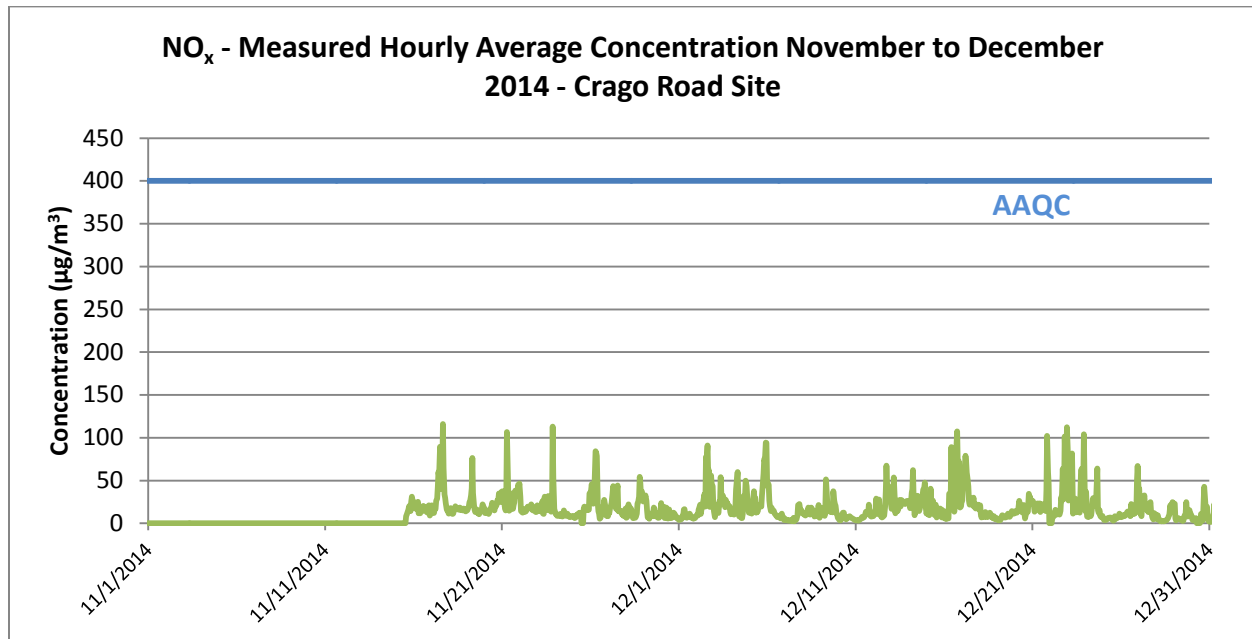
Appendix C

NO_x Data Summaries And Time History Plots

NOx Crago Road November (µg/m³) 2014																															
Day	Hour																							Count	Maximum	Minimum	Average	Hrs>400	Days>200		
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0		0	0
14	NA	T	T	T	T	T	T	T	T	NA	NA	NA	NA	NA	NA	NA	T	T	T	T	T	T	T	T	T	0	0.0	0.0		0	0
15	T	T	T	T	T	T	T	T	T	8.4	10.4	12.6	15.9	19.7	20.7	14.4	25.6	31.4	25.3	10	31.4	8.4			10	31.4	8.4		0	0	
16	22.8	24.8	18.2	21.3	16.6	21.6	25.4	11.9	12.0	11.6	15.3	17.6	14.2	20.4	17.0	19.6	15.6	16.1	13.2	14.0	12.0	21.0	9.0	10.5	24	25.4	9.0	16.7	0	0	
17	17.6	21.2	13.2	12.3	12.0	18.2	17.1	26.2	29.1	42.6	59.9	54.3	89.5	78.7	40.1	62.2	116.1	64.6	33.8	29.8	23.2	16.3	14.9	14.5	24	116.1	12.0	37.8	0	0	
18	11.5	15.1	17.8	17.8	11.4	10.9	11.5	15.3	16.6	20.1	17.3	17.9	16.6	16.2	16.1	18.6	16.8	15.4	16.0	15.2	17.3	16.9	15.2	13.8	24	20.1	10.9	15.7	0	0	
19	14.7	15.3	16.9	19.9	25.0	26.1	32.9	40.8	76.5	35.4	22.0	15.8	13.1	13.9	16.3	12.2	14.5	10.7	14.5	14.2	14.0	17.7	22.1	19.4	24	76.5	10.7	21.8	0	0	
20	17.4	12.3	12.7	12.0	15.1	14.4	11.0	12.8	15.3	18.2	19.9	24.1	16.6	16.6	15.3	19.3	20.0	21.9	26.7	27.3	35.1	34.9	30.4	24.7	24	35.1	11.0	19.8	0	0	
21	37.3	37.7	28.8	31.1	20.1	15.3	32.5	106.9	56.6	19.8	14.8	15.8	21.6	28.3	34.8	16.8	21.5	24.5	38.3	32.8	31.9	33.8	45.1	40.3	24	106.9	14.8	32.8	0	0	
22	46.5	31.2	14.5	13.7	12.4	17.1	16.2	13.2	14.7	14.4	17.0	19.8	17.4	17.9	18.9	17.5	22.3	19.8	15.1	16.7	16.8	17.8	13.5	13.2	24	46.5	12.4	18.2	0	0	
23	21.1	18.3	14.2	15.0	20.2	14.1	19.5	26.0	11.5	11.1	31.3	19.1	16.4	17.4	15.5	32.0	18.6	21.5	26.9	13.8	22.5	113.1	53.3	17.1	24	113.1	11.1	24.6	0	0	
24	13.8	11.1	10.7	8.7	8.7	10.1	9.3	11.2	9.0	8.3	8.1	8.6	15.2	11.6	10.3	8.9	10.5	11.3	9.2	8.5	7.4	7.6	8.4	8.1	24	15.2	7.4	9.8	0	0	
25	8.2	8.7	7.6	6.3	7.8	7.6	10.3	9.6	11.7	9.3	12.7	12.0	C	C	C	16.8	19.8	17.9	16.9	17.1	15.4	17.2	15.9	35.0	21	35.0	6.3	13.5	0	0	
26	35.9	38.8	45.9	36.9	22.9	34.3	48.1	84.1	82.4	78.6	22.8	14.2	11.6	5.2	6.4	12.4	17.4	19.5	18.8	27.6	21.3	13.9	8.8	10.2	24	84.1	5.2	29.9	0	0	
27	8.3	12.1	12.1	19.4	20.7	23.6	34.5	43.4	23.1	24.4	21.0	17.2	37.0	44.4	14.2	15.6	13.5	14.5	14.2	10.2	12.6	8.9	8.7	15.7	24	44.4	8.3	19.6	0	0	
28	17.4	6.5	7.5	14.5	22.3	14.9	14.6	17.8	15.4	9.1	6.2	6.1	6.7	6.5	7.6	11.5	23.3	24.7	31.3	54.5	47.0	31.9	37.3	30.6	24	54.5	6.1	19.4	0	0	
29	25.7	26.1	29.1	32.9	26.3	14.9	6.9	9.8	5.2	10.0	11.4	9.0	9.4	8.2	18.4	17.2	8.4	12.6	10.8	7.1	6.7	6.4	12.3	8.2	24	32.9	5.2	13.9	0	0	
30	23.8	10.1	12.5	19.6	19.2	6.3	17.0	18.6	11.8	5.6	5.9	16.1	6.7	6.4	6.1	8.0	8.0	12.7	11.2	10.8	7.0	6.7	7.2	5.0	24	23.8	5.0	10.9	0	0	
31																									0	0.0	0.0		0	0	
Count	15	15	15	15	15	15	15	15	15	15	15	15	14	14	15	16	16	16	16	16	16	16	16	16	367	16	14	15			
Maximum	46.5	38.8	45.9	36.9	26.3	34.3	48.1	106.9	82.4	78.6	59.9	54.3	89.5	78.7	40.1	62.2	116.1	64.6	38.3	54.5	47.0	113.1	53.3	40.3	24	116.1	26.3	60.7			
Minimum	8.2	6.5	7.5	6.3	7.8	6.3	6.9	9.6	5.2	5.6	5.9	6.1	6.7	5.2	6.1	8.0	8.0	10.7	9.2	7.1	6.7	6.4	7.2	5.0	0	0.0	5.0				
Average	21.5	19.3	17.4	18.8	17.4	16.6	20.4	29.8	26.1	21.2	19.0	17.8	20.9	20.8	16.4	18.7	22.4	20.2	19.8	20.0	19.0	24.4	20.8	18.2	12	28	5	20.3			
#>900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
Percentiles	10		20		30		40		50		60		70		80		90		95		99		100		Regs	Acceptable	Desirable	Violations	Maximum		
Data	8.2		10.8		12.6		14.6		16.3		17.7		20.3		25.6		35.1		46.3		85.9		116.1		Hour				116.1		
																									Day				37.8		
																									Month				20.3		
Notes	C - Calibration / Span Cycle			NA - No Data Available			T - Test/Startup period			A- MOE Audit			M - Equipment Malfunction / Down			R - Rate of Change															

NOx Crago Road																																
December 2014																																
(µg/m³)																																
Hour																																
Day	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Count	Maximum	Minimum	Average	Hrs>400	Days>200		
1	4.2	3.9	4.3	4.8	5.0	8.5	9.5	16.1	16.4	8.1	7.7	6.6	8.4	9.7	8.3	11.5	9.1	6.7	6.7	6.8	5.3	6.5	6.2	8.1	24	16.4	3.9	7.8	0	0		
2	9.2	9.9	9.1	16.0	18.0	21.8	11.2	16.2	20.7	24.4	29.1	33.8	19.5	77.6	75.1	91.1	56.9	62.3	19.4	28.6	56.0	46.0	43.7	21.5	24	91.1	9.1	34.0	0	0		
3	14.1	7.2	13.2	21.6	19.6	15.0	12.1	25.6	21.9	54.1	35.0	26.2	32.5	29.9	23.4	18.8	27.3	23.7	23.6	19.8	19.5	20.1	13.4	10.8	24	54.1	7.2	22.0	0	0		
4	16.9	11.3	10.6	10.2	13.3	19.2	39.6	52.7	59.9	33.9	7.9	10.0	12.3	6.3	6.3	11.2	31.5	29.3	30.0	49.9	43.6	31.4	21.1	12.7	24	59.9	6.3	23.8	0	0		
5	12.6	18.5	13.8	11.3	22.7	26.1	37.7	26.8	29.8	12.4	19.3	13.4	20.6	20.5	21.6	19.5	19.5	32.6	42.7	58.0	74.8	72.3	94.5	94.0	24	94.5	11.3	33.9	0	0		
6	51.3	43.3	45.6	26.7	20.2	14.3	18.6	15.7	15.0	14.6	11.8	10.2	9.3	9.3	7.2	8.8	8.9	7.3	5.8	10.3	11.6	7.2	6.4	3.8	24	51.3	3.8	16.0	0	0		
7	5.8	4.1	3.4	4.1	3.4	3.4	3.6	3.4	3.1	3.8	2.8	3.5	6.6	2.4	6.2	4.0	5.1	9.5	21.4	21.7	22.6	14.8	13.5	15.1	24	22.6	2.4	7.8	0	0		
8	11.5	12.7	11.6	9.6	9.1	11.9	13.3	14.7	18.6	11.9	10.4	14.8	18.7	16.5	12.9	13.1	8.0	14.2	8.5	12.7	14.8	15.3	21.3	6.6	24	21.3	6.6	13.0	0	0		
9	8.3	14.3	9.7	18.1	17.1	15.2	8.8	17.3	51.5	32.7	16.6	15.2	18.7	14.4	13.2	16.3	16.3	13.1	37.4	26.4	22.4	20.7	11.5	10.8	24	51.5	8.3	18.6	0	0		
10	6.5	5.0	4.0	3.6	3.7	5.8	8.7	12.5	12.6	6.2	6.3	4.8	5.6	6.9	7.0	6.8	8.2	7.6	6.4	6.3	5.8	4.9	4.8	4.0	24	12.6	3.6	6.4	0	0		
11	3.7	3.5	3.5	3.8	3.2	3.9	4.2	5.4	5.6	7.8	6.5	7.0	7.6	10.0	13.6	11.5	13.6	11.4	21.9	12.2	8.6	7.9	8.0	8.6	24	21.9	3.2	8.0	0	0		
12	8.4	9.6	14.1	16.5	28.9	16.2	11.1	13.0	27.8	14.8	8.9	11.1	6.9	7.8	8.9	9.3	19.9	37.8	67.4	36.5	40.4	43.1	41.8	28.5	24	67.4	6.9	22.0	0	0		
13	23.7	17.2	17.0	25.2	53.7	28.4	11.7	17.0	21.3	14.2	19.0	27.0	21.5	19.6	27.6	26.8	24.4	24.5	24.5	22.8	24.0	25.9	24.4	25.9	24	53.7	11.7	23.6	0	0		
14	24.4	21.8	17.6	20.6	35.7	39.9	62.1	29.5	9.4	13.6	20.0	22.9	32.5	18.7	14.5	16.8	20.5	24.9	30.6	33.1	39.3	41.2	47.6	21.4	24	62.1	9.4	27.4	0	0		
15	11.9	12.1	10.6	13.0	9.7	11.4	40.6	18.9	14.3	26.6	13.0	9.8	19.0	21.7	6.8	15.4	12.5	10.5	16.8	17.2	15.8	6.9	15.4	13.6	24	40.6	6.8	15.1	0	0		
16	13.8	5.8	6.9	5.1	14.6	7.5	5.6	34.5	35.1	36.3	89.3	40.2	33.9	72.2	13.8	25.4	22.5	92.0	107.4	47.9	72.7	36.2	18.5	19.7	24	107.4	5.1	35.7	0	0		
17	25.8	26.7	50.6	58.5	61.0	79.2	72.8	59.3	50.6	43.3	26.0	21.7	26.3	26.4	26.7	21.3	30.0	19.2	22.9	17.4	19.4	19.5	21.7	19.7	24	79.2	17.4	35.3	0	0		
18	15.9	20.9	10.2	7.1	10.5	7.9	7.7	7.8	13.3	7.7	7.6	9.2	7.5	9.7	12.4	11.6	9.2	6.9	7.1	5.8	8.3	5.7	4.8	6.5	24	20.9	4.8	9.2	0	0		
19	5.0	3.9	3.5	5.0	3.7	4.3	7.1	9.5	9.1	7.9	6.7	7.0	6.9	7.7	9.8	11.6	10.0	7.7	8.7	11.9	14.5	13.1	11.5	11.3	24	14.5	3.5	8.2	0	0		
20	13.9	14.5	12.6	12.4	15.1	16.7	26.2	21.9	20.6	16.3	12.9	17.3	21.5	12.6	5.9	9.1	13.5	13.0	13.5	34.6	30.1	31.0	23.3	23.6	24	34.6	5.9	18.0	0	0		
21	26.4	26.1	20.5	13.5	14.7	17.2	19.5	23.4	22.0	22.1	23.5	13.3	22.7	22.1	15.3	15.5	22.1	19.1	14.5	39.0	102.3	59.7	45.9	0.0	24	102.3	0.0	25.9	0	0		
22	0.0	0.0	0.0	5.0	9.2	8.4	10.0	15.9	12.6	10.4	14.4	11.4	11.6	10.2	14.7	30.4	26.5	63.8	30.3	28.6	101.5	61.4	61.2	112.4	24	112.4	0.0	27.1	0	0		
23	82.5	26.7	58.8	65.0	77.6	66.0	81.8	11.4	29.2	23.7	28.9	12.8	14.9	20.3	13.3	13.8	12.3	31.7	61.3	63.6	51.6	45.5	104.2	30.0	24	104.2	11.4	42.8	0	0		
24	14.0	36.8	8.1	7.5	7.2	9.7	13.7	8.5	9.9	20.5	29.1	29.6	27.4	28.9	20.2	34.4	64.2	15.6	12.7	15.6	9.3	7.6	7.3	8.7	24	64.2	7.2	18.6	0	0		
25	6.6	3.9	3.8	3.9	3.8	4.6	5.0	6.4	6.5	6.6	6.9	4.9	4.5	4.0	3.4	4.0	8.4	6.2	5.9	6.0	7.3	8.0	11.4	9.5	24	11.4	3.4	5.9	0	0		
26	7.3	7.4	8.2	9.4	9.3	8.4	10.4	10.6	11.7	13.5	14.1	10.1	13.3	8.3	22.8	10.3	12.2	12.2	11.0	13.0	12.6	16.1	50.7	67.0	24	67.0	7.3	15.4	0	0		
27	38.5	40.7	19.2	10.8	8.3	18.7	19.7	28.4	32.9	21.3	20.4	15.8	18.9	13.4	16.8	20.6	24.7	13.8	10.6	6.9	4.8	12.1	10.3	10.6	24	40.7	4.8	18.3	0	0		
28	6.6	5.0	9.4	5.3	3.9	2.8	3.6	2.5	2.5	2.9	2.4	2.6	3.4	3.6	3.7	5.1	6.3	8.5	10.0	20.9	15.4	13.0	24.9	19.5	24	24.9	2.4	7.7	0	0		
29	23.5	23.1	5.6	3.6	4.9	5.3	6.3	5.6	5.3	4.4	3.7	3.4	2.9	3.0	8.6	7.5	12.0	24.9	9.8	8.1	12.2	15.6	11.8	11.1	24	24.9	2.9	9.3	0	0		
30	8.3	4.3	3.6	3.6	3.8	5.3	6.3	C	C	0.0	0.0	0.0	0.8	11.1	8.2	3.3	13.8	42.9	32.3	21.6	17.3	19.1	6.1	2.6	22	42.9	0.0	9.7	0	0		
31	4.3	1.8	1.6	2.0	3.5	7.3	12.1	22.9	8.0	4.7	10.6	5.3	4.3	3.2	10.1	7.2	3.9	6.4	3.6	0.8	2.4	2.4	6.1	3.8	24	22.9	0.8	5.8	0	0		
Count	31	31	31	31	31	31	31	31	30	30	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	742	31	30	31			
Maximum	82.5	43.3	58.8	65.0	77.6	79.2	81.8	59.3	59.9	54.1	89.3	40.2	33.9	77.6	75.1	91.1	64.2	92.0	107.4	63.6	102.3	72.3	104.2	112.4	24	112.4	33.9	74.5				
Minimum	0.0	0.0	0.0	2.0	3.2	2.8	3.6	2.5	2.5	0.0	0.0	0.0	0.8	2.4	3.4	3.3	3.9	6.2	3.6	0.8	2.4	2.4	4.8	0.0	22	11.4	0.0	2.1				
Average	16.3	14.3	13.3	13.6	16.6	16.5	19.4	18.5	19.9	16.8	16.5	13.6	14.9	17.0	14.8	16.5	18.5	22.6	23.4	22.7	28.6	23.6	25.6	20.7	24	51	6	18.5				
#>900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
																											Regs	Acceptable	Desirable	Violations	Maximum	
Hour																																
Day																																
Month																															42.8 18.5	
Notes																																
C - Calibration / Span Cycle				NA - No Data Available				T - Test				A- MOE Audit				M - Equipment Malfunction / Down				R - Rate of Change												

Figure C-1 Time History Plots of Measured Hourly Average and 24-Hour Average NO_x Concentrations – Crago Road Station



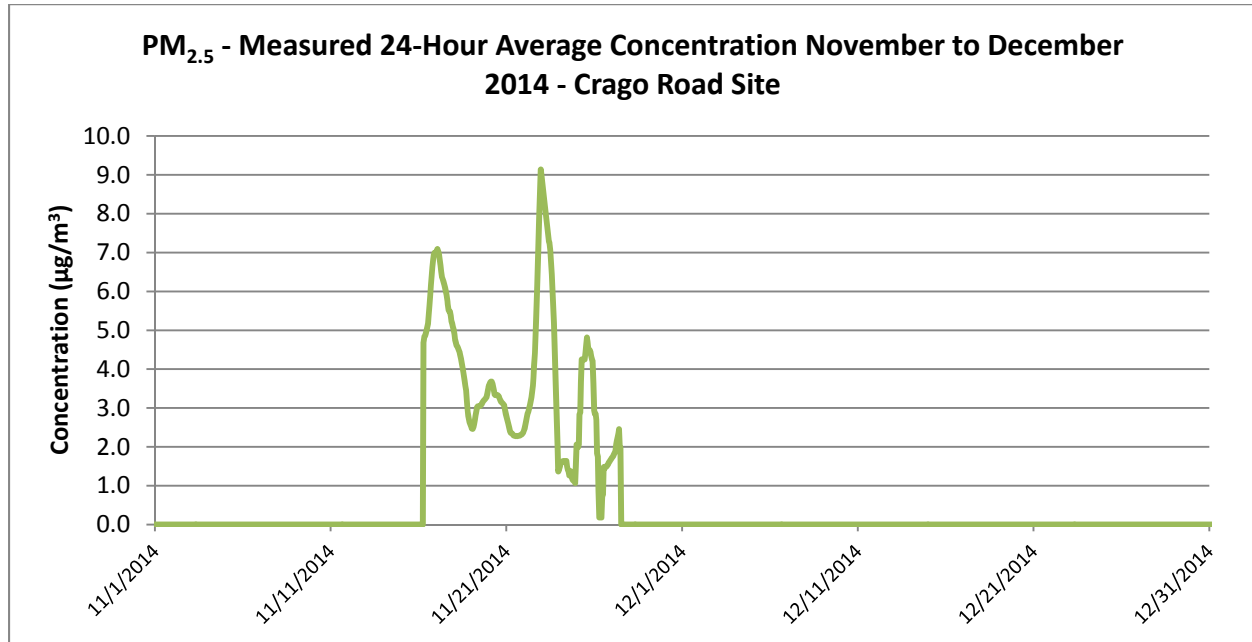
Appendix D

PM2.5 Data Summaries And Time History Plot

PM _{2.5} - Crago Road November (µg/m³) 2014																															
Hour		0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Count	Maximum	Minimum	Average		
Day	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0	0.0			
	14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	T	T	T	T	T	T	T	T	T	T	0	0.0	0.0			
	15	T	T	T	T	T	T	T	T	T	T	T	T	T	2.0	2.3	2.7	2.6	3.2	3.8	4.2	4.4	4.8	5.3	10	5.3	2.0				
	16	5.2	5.5	5.6	6.2	5.7	6.8	6.9	7.2	7.3	5.4	6.0	6.7	6.7	7.3	7.3	8.2	9.4	8.6	9.2	8.9	8.8	7.6	5.9	5.4	24	9.4	5.2	7.0		
	17	5.3	6.7	6.6	4.7	4.2	3.2	3.3	3.7	3.7	4.3	4.6	4.9	5.0	5.3	5.0	5.8	5.4	5.2	8.2	8.7	6.2	4.5	4.2	3.5	24	8.7	3.2	5.1		
	18	3.5	3.9	3.1	2.8	2.5	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.4	24	3.9	2.3	2.6			
	19	2.5	2.6	3.0	4.0	4.3	5.1	5.1	5.0	4.9	3.1	2.5	2.5	2.5	2.9	3.1	3.2	3.3	3.0	2.8	2.8	2.9	3.1	4.6	4.7	24	5.1	2.5	3.5		
	20	4.3	3.8	4.2	4.4	4.3	3.8	3.2	2.7	2.6	2.6	2.6	2.5	2.4	2.4	2.3	2.2	2.2	2.2	2.3	2.4	2.3	2.4	2.3	2.3	24	4.4	2.2	2.9		
	21	2.3	2.3	2.3	2.4	2.4	2.0	2.2	2.4	2.3	2.0	2.1	2.2	2.3	2.4	2.4	2.1	2.2	2.3	2.4	2.5	2.7	2.6	2.9	3.0	24	3.0	2.0	2.4		
	22	3.4	3.8	4.3	4.8	5.0	3.8	3.5	4.1	4.1	4.3	4.6	4.9	6.6	8.3	9.7	9.9	13.9	15.9	15.1	17.2	18.4	17.9	17.8	18.0	24	18.4	3.4	9.1		
	23	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	3.5	2.2	1.4	2.9	1.6	2.5	2.9	3.2	2.5	2.5	2.4	2.0	1.7	24	3.5	0.1	1.4		
	24	1.6	1.7	1.8	1.3	0.2	0.7	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.4	0.4	2.4	4.3	0.9	0.6	1.4	2.2	1.9	1.1	11.7	24	11.7	0.1	1.5		
	25	15.3	1.7	0.3	3.2	18.5	1.9	18.7	14.2	0.2	0.2	0.2	0.2	C	C	C	0.2	0.2	0.8	0.1	0.1	0.1	0.1	0.1	0.1	21	18.7	0.1	3.6		
	26	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	11.7	1.9	16.8	0.6	0.7	0.9	0.9	0.8	1.0	1.1	0.8	0.8	0.8	24	16.8	0.1	1.7		
	27	0.8	0.8	0.9	1.0	1.1	1.2	4.4	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	7	4.4	0.8			
	28	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0			
	29	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0			
	30	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	0	0.0	0.0			
	31																									0	0.0	0.0			
Count		12	12	12	12	12	12	12	11	11	11	11	11	10	10	11	12	12	12	12	12	12	12	12	12	278	12	10	12		
Maximum		15.3	6.7	6.6	6.2	18.5	6.8	18.7	14.2	7.3	5.4	6.0	11.7	6.7	16.8	9.7	9.9	13.9	15.9	15.1	17.2	18.4	17.9	17.8	18.0	24	18.7	5.4	12.5		
Minimum		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.4	0.4	0.2	0.2	0.8	0.1	0.1	0.1	0.1	0.1	0.1	0	0.0	0.1			
Average		3.7	2.8	2.7	2.9	4.0	2.6	4.2	3.8	2.5	2.3	2.3	3.8	3.2	5.0	3.5	3.4	4.1	4.0	4.2	4.5	4.5	4.2	4.1	4.9	9	4	1	3.7		
#>900		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0		
Percentiles		10		20		30		40		50		60		70		80		90		95		99		100		Regs Acceptable Desirable Violations				Maximum	
																										Hour				18.7	
																										Day				9.1	
Data		0.2		0.8		2.1		2.4		2.5		3.1		4.2		5.1		7.3		11.7		18.1		18.7		Month				3.7	
Notes		C - Calibration / Span Cycle			NA - No Data Available			T - Test/Startup period			A- MOE Audit			M - Equipment Malfunction / Down			R - Rate of Change														

[illegible]

Figure D-1 Time History Plot of Measured 24-Hour Average PM_{2.5} Concentrations – Crago Road Station



Appendix E

Continuous Parameter Edit Logs

EDIT LOG TABLE

[illegible]

Examples of Acceptable Edit Actions:

Add offset of

Delete hours

Zero Correction

Slope Correction

Manual data entry for missing, but collected data

Invalidating span & zero check data

Invalidating data due to equipment malfunctions and power failures.

Invalidating data when instrumentation off-line

Marking data as out-of-range

EDIT LOG TABLE

[illegible]

Examples of Acceptable Edit Actions:

Add offset of

Delete hours

Zero Correction

Slope Correction

Manual data entry for missing, but collected data

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Invalidating data due to equipment malfunctions and power failures.

Invalidating data when instrumentation off-line

Marking data as out-of-range

EDIT LOG TABLE

Project Name	Durham York Energy Centre Ambient Air Monitoring Program							
Contact	Greg Crooks / Connie Lim / Tim Hung		Phone:	905-944-7777	E-mail:	greg.crooks@stantec.com, connie.lim@stantec.com, tim.hung@stantec.com		
Station number:	N/A		Station Name:	Crago Road				
Station address:	Crago Road		Emitter Address:	The Region of Durham, 605 Rossland Rd, Whitby, ON				
Pollutant or parameter:	PM2.5	Instrument make & model:		Thermo Sharp 5030 Synchronized Hybrid Ambient Real-time		Serial Number:	CM 0269	
Data edit period	Start date:	1-Nov-14	End date:	31-Dec-14	Time Zone : EST			
Edit #	Edit date	Editor's Name	Edit Action	Starting		Ending		Reason
				Date (dd/mm/yyyy)	Hour (xx:xx)	Date (dd/mm/yyyy)	Hour (xx:xx)	
1	6-Feb-15	Timothy Hung	Invalidate Data	27/11/2014	07:00	31/12/2014	23:00	Issues identified with the analyzer which had to be sent back to manufacturer for repairs. Suspect data prior to identification of errors removed
2	25-Feb-15	Timothy Hung	Invalidate data	14/11/2014	14:00	15/11/2014	13:00	24-hour "shake-down" period
3	27-Feb-15	Connie Lim	Mark data as NA	1/11/2014	00:00	14/11/2014	13:00	Mark data as NA for period prior to equipment setup

Examples of Acceptable Edit Actions:

Add offset of
 Delete hours
 Zero Correction
 Slope Correction
 Manual data entry for missing, but collected data
 Invalidating span & zero check data
 Invalidating data due to equipment malfunctions and power failures.
 Invalidating data when instrumentation off-line
 Marking data as out-of-range

EDIT LOG TABLE

Project Name	Durham York Energy Centre Ambient Air Monitoring Program							
Contact	Greg Crooks / Connie Lim / Tim Hung		Phone:	905-944-7777	E-mail:	greg.crooks@stantec.com, connie.lim@stantec.com, tim.hung@stantec.com		
Station number:	N/A		Station Name:	Crago Road				
Station address:	Crago Road		Emitter Address:	The Region of Durham, 605 Rossland Rd, Whitby, ON				
Pollutant or parameter:	Temperature	Instrument make & model:		Campbell Scientific Model HMP60				
Data edit period	Start date:	1-Nov-14	End date:	31-Dec-14	Time Zone : EST			
Edit #	Edit date	Editor's Name	Edit Action	Starting		Ending		Reason
				Date (dd/mm/yyyy)	Hour (xx:xx)	Date (dd/mm/yyyy)	Hour (xx:xx)	
1	25-Feb-15	Timothy Hung	Invalidate data	14/11/2014	14:00	15/11/2014	13:00	24-hour "shake-down" period

EDIT LOG TABLE

Project Name	Durham York Energy Centre Ambient Air Monitoring Program							
Contact	Greg Crooks / Connie Lim / Tim Hung		Phone:	905-944-7777	E-mail:	greg.crooks@stantec.com, connie.lim@stantec.com, tim.hung@stantec.com		
Station number:	N/A		Station Name:	Crago Road				
Station address:	Crago Road		Emitter Address:	The Region of Durham, 605 Rossland Rd, Whitby, ON				
Pollutant or parameter:	Rainfall	Instrument make & model:		Texas Electronic TE525M				
Data edit period	Start date:	1-Nov-14	End date:	31-Dec-14	Time Zone : EST			
Edit #	Edit date	Editor's Name	Edit Action	Starting		Ending		Reason
				Date (dd/mm/yyyy)	Hour (xx:xx)	Date (dd/mm/yyyy)	Hour (xx:xx)	
1	25-Feb-15	Timothy Hung	Invalidate data	14/11/2014	14:00	15/11/2014	13:00	24-hour "shake-down" period

Examples of Acceptable Edit Actions:

Add offset of
Delete hours
Zero Correction
Slope Correction
Manual data entry for missing, but collected data
Invalidating span & zero check data
Invalidating data due to equipment malfunctions and power failures.
Invalidating data when instrumentation off-line
Marking data as out-of-range

EDIT LOG TABLE

Project Name	Durham York Energy Centre Ambient Air Monitoring Program							
Contact	Greg Crooks / Connie Lim / Tim Hung		Phone:	905-944-7777	E-mail:	greg.crooks@stantec.com, connie.lim@stantec.com, tim.hung@stantec.com		
Station number:	N/A		Station Name:	Crago Road				
Station address:	Crago Road		Emitter Address:	The Region of Durham, 605 Rossland Rd, Whitby, ON				
Pollutant or parameter:	Relative Humidity	Instrument make & model:		Campbell Scientific Model HMP60				
Data edit period	Start date:	1-Nov-14	End date:	31-Dec-14	Time Zone : EST			
Edit #	Edit date	Editor's Name	Edit Action	Starting		Ending		Reason
				Date (dd/mm/yyyy)	Hour (xx:xx)	Date (dd/mm/yyyy)	Hour (xx:xx)	
1	25-Feb-15	Timothy Hung	Invalidate data	14/11/2014	14:00	15/11/2014	13:00	24-hour "shake-down" period

EDIT LOG TABLE

Project Name	Durham York Energy Centre Ambient Air Monitoring Program							
Contact	Greg Crooks / Connie Lim / Tim Hung		Phone:	905-944-7777	E-mail:	greg.crooks@stantec.com, connie.lim@stantec.com, tim.hung@stantec.com		
Station number:	N/A		Station Name:	Crago Road				
Station address:	Crago Road		Emitter Address:	The Region of Durham, 605 Rossland Rd, Whitby, ON				
Pollutant or parameter:	Wind Speed/Wind Direction	Instrument make & model:		Met One Instruments Inc. Model 034B				
Data edit period	Start date:	1-Nov-14	End date:	31-Dec-14	Time Zone : EST			
Edit #	Edit date	Editor's Name	Edit Action	Starting		Ending		Reason
				Date (dd/mm/yyyy)	Hour (xx:xx)	Date (dd/mm/yyyy)	Hour (xx:xx)	
1	25-Feb-15	Timothy Hung	Invalidate data	14/11/2014	14:00	15/11/2014	13:00	24-hour "shake-down" period

Examples of Acceptable Edit Actions:

Add offset of
 Delete hours
 Zero Correction
 Slope Correction
 Manual data entry for missing, but collected data
 Invalidating span & zero check data
 Invalidating data due to equipment malfunctions and power failures.
 Invalidating data when instrumentation off-line
 Marking data as out-of-range

Appendix F
Letter from CD NOVA Detailing the Thermo Sharpe
5030 PM2.5 Monitor Instrument Issue

Timeline for Repair T141202

Received Dec 11th – On bench.

Dec 12th – found High Alpha and did HV procedure.

Dec 15th – Found high Alpha again and re-did HV procedure. Difficult to save parameters.

Dec 16th – Unable to save parameters – problem with main board. Request main boards be transferred from Toronto office.

Dec 19th – Installed first main board but no display function, board working otherwise. Sent query to Thermo.

Christmas Holidays.

Jan 5th – Installed 2nd main board with same issue. Confirmed display function using demo display. Request main board to be shipped from Edmonton office.

Jan 7th – Installed 3rd main board – no display. Discovered all three new boards are for a different model, a FH62C14. Boards were in correctly labelled packaging but wrong boards inside. Both boards are virtually identical in appearance. Request replacement main boards from Thermo.

Jan 14th – Received replacement boards and installed each one. Same problem – asked Thermo for help. Convinced the problem is a contrast issue considering the original display works on the original board and the demo display contrast is maxed out on the original board.

Jan 20th – Discovered trim pot on main board and noted original board pot is at a different position with respect to the other replacement boards. Adjusted trim pot on replacement board and installed. Original display works now. Proceeded to calibrate instrument and ship to Valley.

Steve Moulds,

CD Nova Ltd.

Jan 20th, 2015.

