REPORT

DURHAM YORK ENERGY CENTRE

DURHAM, ONTARIO

Q3 AMBIENT AIR QUALITY MONITORING REPORT: CRAGO STATION
RWDI # 1803743
December 14, 2018

Companion Report: November 14, 2018 for Courtice, Rundle Road and Fence Line Stations

SUBMITTED TO

The Director, Legislative Services-
Regional Clerk or Designate,
The Regional Municipality of Durham

605 Rossland Road, East, 1st Floor,
Corporate Services-Legislative Services
Division, Whitby, ON L1N 6A3

cc: Lyndsay Waller
lyndsay.waller@durham.ca

SUBMITTED BY

Matthew Lantz, B.Sc., C.Tech., QSTI
Project Manager/Senior Specialist
matt.lantz@rwdi.com

Brad Bergeron, A.Sc.T., d.E.T., QSTI
Senior Project Manager/ Principal
brad.bergeron@rwdi.com

RWDI AIR Inc.
Consulting Engineers & Scientists
600 Southgate Drive
Guelph Ontario Canada N1G 4P6
T: 519.823.1311
F: 519.823.1316

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

RWDI AIR Inc. (RWDI) was retained by The Regional Municipality of Durham and York (the Regions) to conduct discrete and continuous ambient air quality monitoring at the Durham York Energy Centre (DYEC) monitoring stations. The facility address is 1835 Energy Drive, Clarington, Ontario. The DYEC is a facility that manages diverted municipal solid waste from the Durham and York Regions to create energy from waste combustion. Operation of the DYEC commenced commercially on February 1, 2016. The site location is shown below in **Figure 1**.

Condition 11 of the Environmental Assessment Notice of Approval and Condition 7(4) of the Environmental Compliance Approval (ECA) requires ambient air monitoring to be undertaken by the DYEC. An Ambient Air Monitoring and Reporting Plan was prepared and approved by the Ministry of Environment, Conservation and Parks (MECP) to satisfy these conditions. Four (4) monitoring stations were established to monitor ambient air quality around the DYEC. Three (3) of the stations, Courtice, Rundle Road and Fence Line are reported to the MECP in a companion report titled *Durham York Energy Centre – Q3 Ambient Air Quality Monitoring Report November 14, 2018*. The Crago Station is reported only to the Regions and is addressed in this report.

The monitoring plan was developed based on the Regional Council mandate to provide ambient monitoring in the area of the DYEC. The purposes of the ambient monitoring program are to:

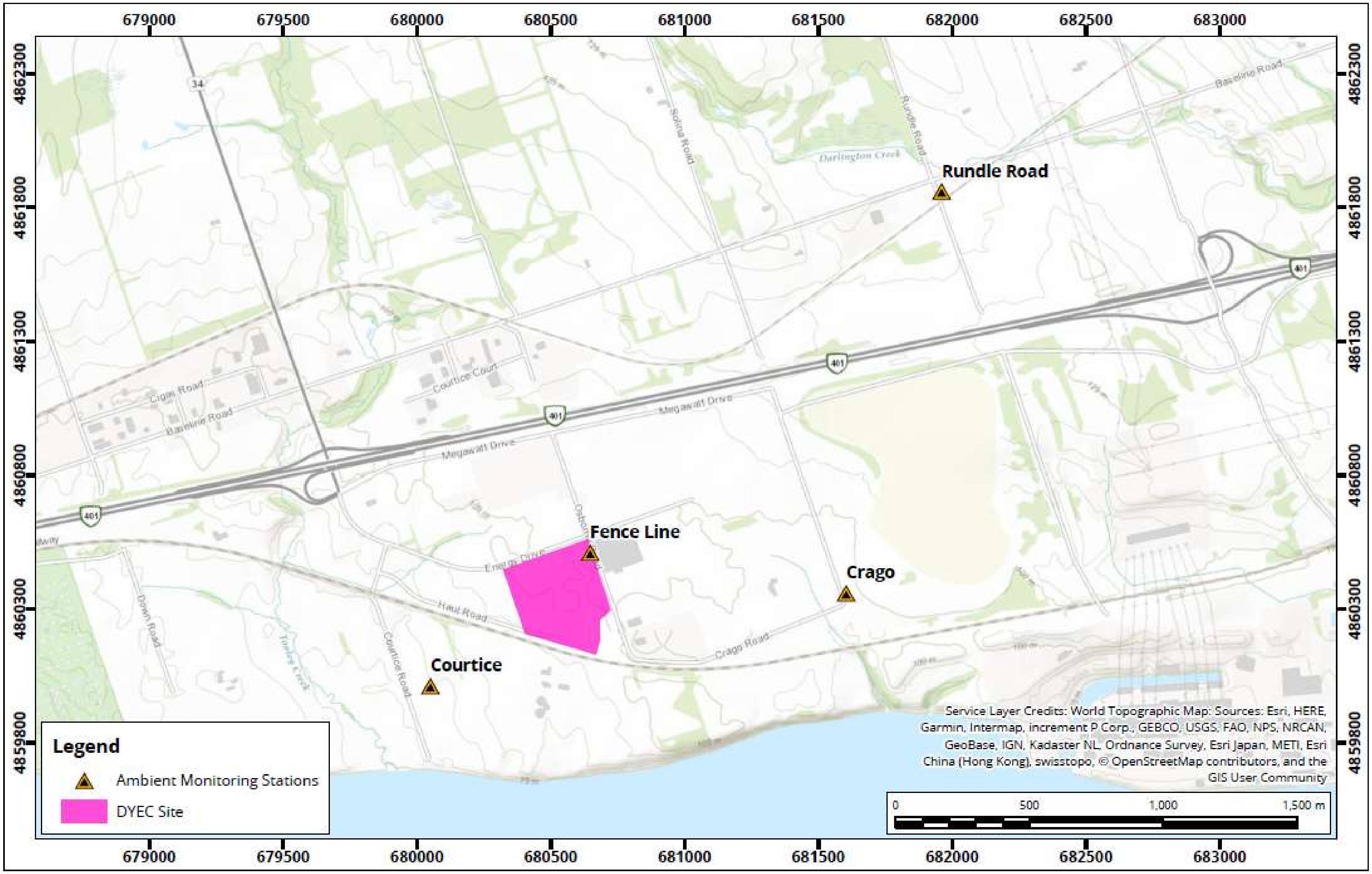
1. Quantify any measurable ground level concentrations resulting from emissions from the DYEC cumulative to local air quality, including validating the predicted concentrations from the dispersion modelling conducted in the Environmental Assessment (2009a);
2. Monitor concentration levels of EFW-related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

The facility has three (3) monitoring stations which collect continuous and discrete ambient measurements, known as the Courtice Station, Rundle Road Station and Crago Station, and one (1) ambient monitoring station which collects discrete measurements only, known as the Fence Line Station. The station locations are shown in **Figure 1**. The Crago Station has been operational since late 2014, and was installed at the request of the Durham Regional Council. It is operated following the same protocols as the other monitoring stations. RWDI has overseen the operation of the stations on behalf of the Regions since August 1, 2018.

The Courtice, Rundle Road and Crago Stations continuously monitor the following air quality parameters: Particulate Matter less than 2.5 microns ($PM_{2.5}$), Nitrogen Oxides (NO_x) and Sulfur Dioxide (SO_2). In addition, all stations discretely monitor the following air quality parameters: Total Suspended Particulate (TSP), Metals, Dioxins and Furans (D&F) and Polycyclic Aromatic Hydrocarbons (PAHs). The Fence Line Station discretely monitors Total Suspended Particulate (TSP) and metals only.

Continuous meteorological data is collected at the Courtice, Rundle Road and Crago Stations. The Crago Station collects the following meteorological parameters: wind speed, wind direction, ambient temperature, precipitation and relative humidity.

Data recovery for all parameters measured at the Crago Station was greater than 88% during the third quarter. This meets the quarterly validity criteria. None of the measurements for any parameter were in excess of the Ambient Air Quality Criteria during the third quarter.



DYEC Site and Ambient Monitoring Station Locations

Map Projection: NAD 1983 UTM Zone 17N
DYEC - Region of Durham, Ontario

True North

Project #: 1803743

Drawn by: DJH	Figure: 1
Approx. Scale:	1:20,000
Date Revised:	Nov 7, 2018

1.1 Sampling Location

The Crago site was selected in consultation with the Regions representatives and was chosen based on considerations of nearby receptors and agreeability with MECP siting criteria. The Crago Station is located east of the DYEC and is located close to where Crago Road and Osborne Road intersect.

2 SAMPLING METHODOLOGY

The Crago Station is equipped with the following continuous monitors: Thermo Scientific Model 5030 SHARP (Synchronized Hybrid Ambient Real-time Particulate) monitor ($PM_{2.5}$ analyzer), Teledyne Nitrogen Oxides Analyzer Model T200 (NO_x analyzer), and a Teledyne Sulfur Dioxide Analyzer Model T100 (SO_2 analyzer). It also has the following periodic monitors: High Volume (Hi-Vol) Air Sampler outfitted with a TSP inlet head as approved by the United States Environmental Protection Agency (U.S. EPA), and a Hi-Vol Air Sampler outfitted with a polyurethane foam plug and circular quartz filter for measuring PAH's and D&F's as approved by U.S. EPA.

2.1 Nitrogen Oxide Analyzer

The Teledyne T200 Nitrogen Oxide (NO_X) analyzer uses chemiluminescence detection, coupled with microprocessor technology to provide sensitivity and stability for ambient air quality applications. The instrument determines real-time concentration of nitric oxide (NO), total nitrogen oxides (NO_X) (the sum of NO and NO_2), and nitrogen dioxide (NO_2). The amount of NO is measured by detecting the chemiluminescence reaction that occurs in the reaction cell when NO molecules are exposed to ozone (O_3). The NO and O_3 molecules collide in the reaction cell and enter a higher energy state. When these excited molecules return to a stable energy state, they emit a photon of light which is proportional to the amount of NO in the sample stream of gas entering the analyzer. To determine the total NO_x (NO+NO_2) measurement, sample gas is periodically bypassed through a heated molybdenum converter cartridge that converts any NO_2 molecules in the sample stream into NO (any existing NO molecules in the stream remain as is). The instrument will switch the sample stream through the converter periodically and then through the reaction cell where the same chemiluminescence reaction occurs with ozone. The resultant response produced is now the sum of NO and converted NO_2 producing a NO_x measurement. The resultant NO_2 determination is the NO_x measurement subtracted from the NO measurement.

The NO_X analyzers were zero and span checked daily using the internal zero and span (IZS) system and calibrated once a month using either EPA protocol span gases and a dilution system or an ESA permeation tube calibrator. Automatic IZS checks were performed on a daily basis commencing at approximately 23:45 on one day and ending at 00:10 the next day. On September 18, 2018 the IZS checks were changed and programmed to occur at 00:45 to 01:10 on the same day. The checks consisted of a 10-minute zero check, a 10-minute span check and a 5-minute purge. These checks provide a way to monitor daily performance of the analyzer using an external charcoal and purafil zeroing cartridge for the zero, and an internal permeation oven with a permeation tube for the span. These IZS checks are not for calibration purposes but are merely a diagnostic tool to identify instrument drift. Data was collected at 1-minute intervals by an external datalogger using analog output connections, and was averaged using Envista processing software over a 1-hour and 24-hour period to compare to the applicable ambient air quality criteria. The instrument also collects data using its own data acquisition system (DAS) on a 5-minute resolution.

2.2 Sulphur Dioxide Analyzer

The SO_2 Analyzer is a microprocessor controlled analyzer that determines the concentration of SO_2 in a sample gas drawn through the instrument. In the sample chamber, sample gas is excited by ultraviolet light causing the SO_2 to absorb energy from the light and move to an active state (SO_2*). These active SO_2* molecules must decay into a stable state back to SO_2, and when this happens a photon of light is released which is recognized by the instrument as fluorescence. The instrument measures the amount of florescence to determine the amount of SO_2 present in the sample gas.

The SO_2 analyzers were zero and span checked daily using the IZS system and calibrated once a month using either EPA protocol span gases and a dilution system or an ESA permeation tube calibrator. Automatic IZS checks were performed on a daily basis commencing at approximately 23:45 on one day and ending at 00:10 the next day. On September 18, 2018 the IZS checks were changed and programmed to occur at 00:45 to 01:10 on the same day. The checks consisted of a 10-minute zero check, a 10-minute span check and a 5-minute purge. These checks provide a way to monitor daily performance of the analyzer using an external charcoal and purafil zeroing cartridge for the zero, and an internal permeation oven with a permeation tube for the span. These IZS checks are not for calibration purposes but are merely a diagnostic tool to identify instrument drift. Data was collected at 1-minute intervals by an external datalogger using analog output connections, and was averaged using Envista processing software over a 1-hour and 24-hour period to compare to the applicable ambient air quality criteria. The instrument also collects data using its own data acquisition system (DAS) on a 1-hour resolution.

2.3 SHARP 5030 $PM_{2.5}$ Analyzer

The SHARP is a hybrid nephelometric/radiometric particulate mass monitor capable of providing precise, real-time measurements with a superior detection limit. The SHARP incorporates a high sensitivity light scattering photometer whose output signal is continuously referenced to the time-averaged measurement of an integral beta attenuating mass sensor. The SHARP also incorporates a dynamic inlet heating system designed to maintain the relative humidity of the air passing through the filter tape constant.

The SHARP is calibrated once a month to ensure accuracy and validity of its data. The $PM_{2.5}$ inlet head and sharp cut cyclone is cleaned monthly as well to ensure proper performance. The monthly calibration process consists of the following: zeroing the nephelometer if necessary, calibration of ambient temperature, calibration of barometric pressure, and calibration of the flow.

2.4 TSP High Volume Air Sampler

The Tisch TE-5170 TSP high volumetric air sampler (Hi-Vols) was outfitted with a TSP inlet capable of collecting particulate of all aerodynamic diameters. The Hi-Vol is equipped with a mass flow controller, which ensures a flow rate of 40 cubic feet per minute (CFM), a chart recorder for measuring cfm flow throughout the run time, an elapsed timer and a wheel timer for starting and stopping each sample. The Hi-Vol has a Teflon coated glass fibre filter that is outfitted at the top of the sampler, and air is drawn through the filter, thereby collecting all TSP. The TSP Hi-Vol operates on a six-day cycle, each consisting of 24-hour (midnight to midnight) samples, concurrent with the National Air Pollution Surveillance (NAPS) schedule. The Hi-Vol is calibrated monthly to ensure accuracy and validity of the volume of air drawn through the filter.

The Teflon coated glass fibre filter media is pre and post weighed by Maxxam Analytics in Mississauga, Ontario (July) and ALS Laboratories in Burlington, Ontario (August and September 2018). The filters are then analyzed for total particulate weight, metals analysis and mercury.

2.5 Polyurethane Foam Samplers

The Dioxins, Furans, and PAH samples were collected using Tisch TE-1000 sampler which is listed as reference device for U.S. EPA Methods TO-9 and TO-13. The sampler uses a collection filter that is 'backed-up' by a polyurethane foam (PUF) plug. The airborne compounds present in the particulate phase are collected on the Teflon coated glass fibre filter and any compounds present in the vapour phase are absorbed in the PUF plug. At the start of August, the PUF media was changed to include two PUF plugs enclosing XAD material. This was a recommendation from ALS Laboratories to achieve lower detection limits due to the stability of the compounds being absorbed into the XAD material. Each PUF sampler is equipped with a mass flow controller, which can sustain 8 cubic feet per minute (CFM) of flow over the sampling period, an elapsed timer and a wheel timer for starting and stopping each sample. All PUF samplers operate on a twelve-day cycle, each consisting of 24-hour (midnight to midnight) samples, concurrent with the NAPS schedule. Every twelve days, the PUF plugs and filters are analyzed for PAH's, and every twenty-four days they are analyzed for both PAH's and D&F's. The PUF sampler is calibrated monthly to ensure accuracy and validity of the volume of air drawn through the filters.

The filter and PUF media/glassware is proofed and analyzed by Maxxam Analytics in Mississauga, Ontario (July) and ALS Laboratories in Burlington, Ontario (August and September 2018). The filters and PUF/XAD plugs are then analyzed for PAH's and D&F's.

2.6 Meteorological Tower

Meteorological data was collected from the Crago Station. The meteorological tower at the Crago Station was outfitted with a MET One Instruments Model 034B wind head that recorded wind direction and wind speed. This was done so that a vector could be associated with the applicable contaminant concentrations. It was also outfitted with a Campbell Scientific HMP60 Temperature/Relative Humidity probe, and a Texas Instruments TE525M rain gauge. Meteorological data was collected at 1-minute intervals and was averaged using Envista processing software over a 1-hour period.

3 AIR QUALITY CRITERIA AND STANDARDS

The monitored contaminant concentrations were compared to air quality criteria and standards set by the MECP and by Environment Canada. The MECP developed Ambient Air Quality Criteria (AAQCs) which are the maximum desirable concentrations in the outdoor air, based on effects to the environment and health (MECP, 2012). Not all contaminants have an applicable regulatory limit; therefore, other criteria were used for comparison. These included human health risk assessment (HHRA) criteria. For $PM_{2.5}$, Environment Canada has established a Canadian Ambient Air Quality Standard (CAAQS) (Environment Canada, 2013). CAAQS are health-based air quality objectives for the outdoor air. The current CAAQS' for $PM_{2.5}$ are 28 µg/m^3 for the 3-year average of annual 98th percentile 24-hour concentration, and 10 µg/m^3 for the 3-year average of annual average concentrations (in effect as of 2015). Since the 24-hour and annual CAAQS are based on the average of three calendar years of data, it should be noted that these standards do not apply to the quarterly data presented in this report.

All applicable criteria and standards are shown in the 'Summary of Ambient Measurements' section of this report.

4 SUMMARY OF AMBIENT MEASUREMENTS

Ambient air quality monitoring results for all contaminants sampled at the Crago Station is discussed herein. Summary statistics from July 1, 2018 to September 30, 2018 are presented in a summary format below and in a more detailed matrix format in **Appendix A** for continuous measurements and **Appendix B** for discrete measurements.

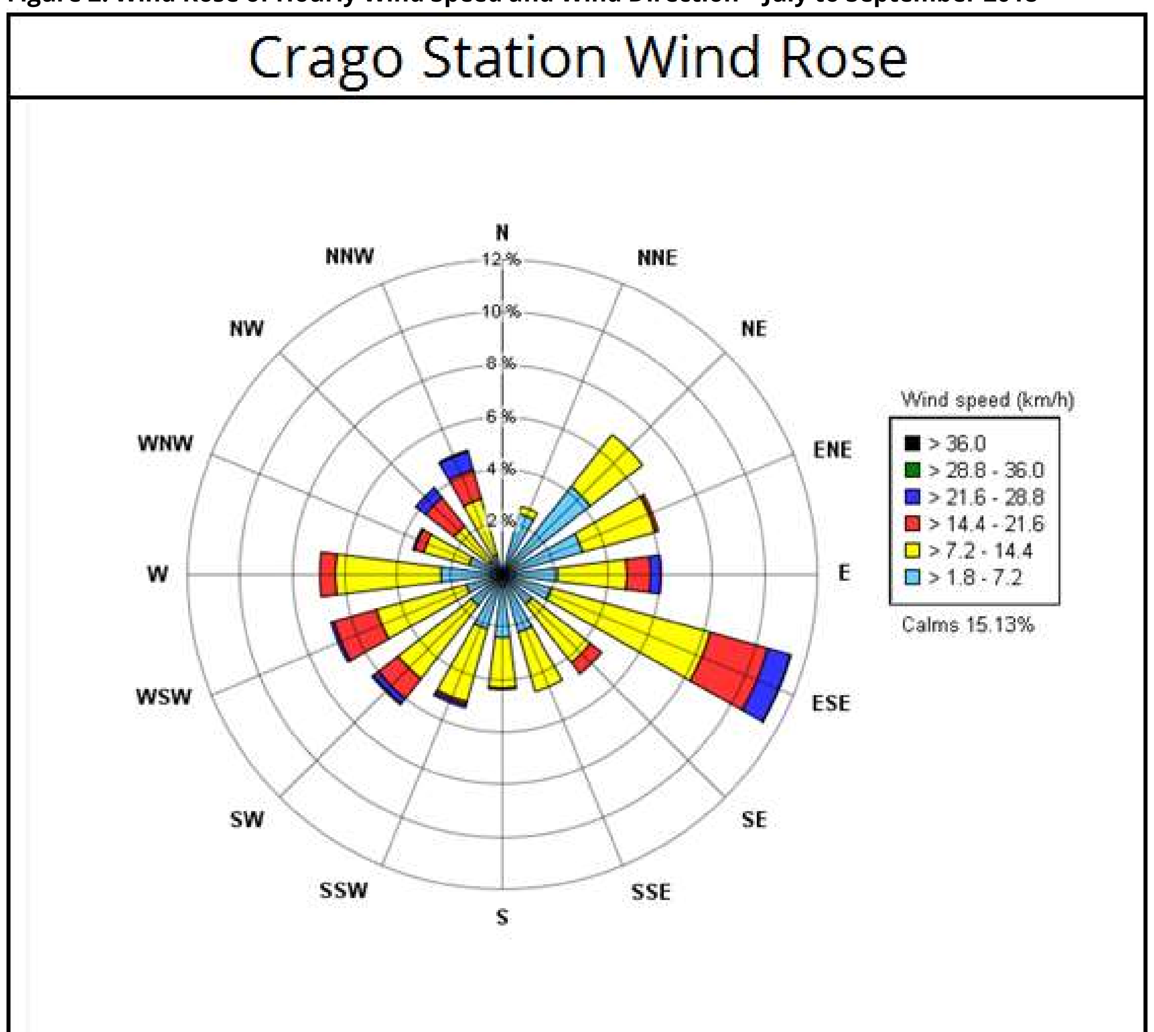
4.1 Meteorological Station Results

The Crago Station collected the following meteorological parameters: wind speed, wind direction, relative humidity, ambient temperature and precipitation. The Crago Station maintained greater than 99% of data collection for all of the parameters measured during Q3 and experienced some very minor data loss due to a power outage. Hourly statistics from the meteorological station is presented in Table 1. A wind rose showing trends in wind speed and wind direction during Q3 is provided in **Figure 2**. The prominent wind direction at the Crago station was from the east, southeast.

Table 1: Hourly Statistics from the Crago Station

Crago Station MET Statistics	Maximum 1 hr Mean				Minimum 1 hr Mean				Monthly Mean				Total	% valid hours				
Parameter	WS	Temp	RH	Rain	WS	Temp	RH	Rain	WS	Temp	RH	Rain	Rain	WS	WD	Temp	RH	Rain
Units	(km/hr)	(°C)	(%)	mm	(km/hr)	(°C)	(%)	mm	(km/hr)	(°C)	(%)	mm	mm	(%)				
July	26	29	98	21.6	0	12	34	0.0	9	21	73	0.1	104.6	100.0	100.0	100.0	100.0	100.0
August	25	28	98	20.1	0	12	42	0.0	8	21	81	0.1	75.7	99.9	99.9	99.9	99.9	99.9
September	32	28	98	5.6	0	6	38	0.0	9	17	79	0.1	75.5	100.0	100.0	100.0	100.0	100.0
Q3 Arithmetic Mean									8	20	77	0.1	256	100.0	100.0	100.0	100.0	100.0

Figure 2. Wind Rose of Hourly Wind Speed and Wind Direction – July to September 2018



4.2 NO_x, SO_2 and $PM_{2.5}$ Summary Table Results

Table 2 provides a summary of Maximum 1-hour Means, Maximum 24-hour Means, Monthly Means, Quarterly Means, Percent valid data for the Crago Station. Table 3 provides a summary of Exceedance Statistics for the Crago Station. There were no exceedances for any parameters at the Crago Station during this quarter.

Table 2: Summary of Percent Valid Data for Crago Station

Crago Monitoring Station Data Statistics	Maximum 1 hr Mean					Maximum 24 hr Mean					Monthly Mean					% valid hours				
Compound	$PM_{2.5}$	NO_x	NO	NO_2	SO_2	$PM_{2.5}$	NO_x	NO	NO_2	SO_2	$PM_{2.5}$	NO_x	NO	NO_2	SO_2	$PM_{2.5}$	NO_x	NO	NO_2	SO_2
Units	(µg/m³)	ppb				(µg/m³)	ppb				(µg/m³)	ppb				(%)				
AAQC				200	250	28[A]			100	100										
July	20	36	13	23	24	16	11	3	8	4	6	5	1	5	1	99.7	99.7	99.7	99.7	99.7
August	24	43	24	32	14	17	13	5	10	2	8	6	2	5	1	99.6	99.6	99.6	99.6	99.5
September	24	46	29	23	23	10	11	4	7	5	4	5	1	4	2	97.4	96.8	96.8	96.8	96.9
Q3 Arithmetic Mean											6	5	1	4	1	98.9	98.7	98.7	98.7	98.7

[A] The 24-hour $PM_{2.5}$ criterion applies to the 98^{th} percentile over 3 consecutive years.

Table 3: Summary of Exceedance Statistics

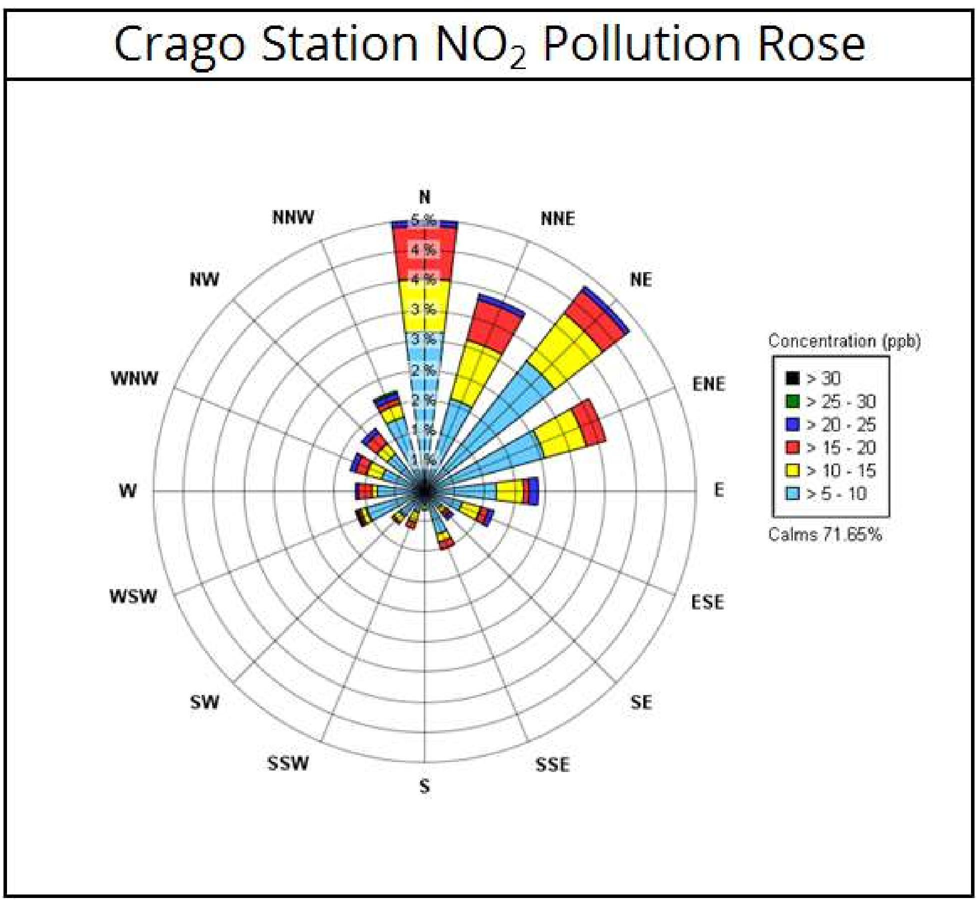
Event Statistics	Mean > 1 hr AAQC for Crago Monitoring Station			Rolling Mean > 24 hr AAQC for Crago Monitoring Station		
Compound	$PM_{2.5}$	NO_2	SO_2	$PM_{2.5}$	NO_2	SO_2
Units	No.			No.		
July	N/A	0	0	N/A	0	0
August	N/A	0	0	N/A	0	0
September	N/A	0	0	N/A	0	0
Q3 Total	-	0	0	-	0	0

4.3 Oxides of Nitrogen Results

Data recovery levels were high for oxides of nitrogen (98.7% valid data for Q3). Monitoring results were compared to the AAQC for NO_2 only, as it is the only parameter that has AAQC values for 1-hour and 24-hour averaging periods (there are no AAQC's for NO or NO_x). There were no exceedances above the AAQC values for the entirety of the sampling period for 1-hour and 24-hour averaged data. The highest NO_2 value seen among the 1-hour averages was 32 ppb, which is 16% of the AAQC. The highest NO_2 value seen among the rolling 24-hour averages was 10 ppb, which is 10% of the AAQC. The measurements are summarized in Table 2 above. A pollution rose is presented in **Figure 3** for the Crago Station during Q3 composed of hourly average NO_2 concentrations. A pollution rose indicates the percentage of time that the wind originates from a given direction coupled with the pollutant measurement for that time in either ppb or micrograms per meter cubed.

In order to show where possible major sources of pollutants are coming from levels below 5 ppb were omitted from the graphic pollution rose representation. The pollution rose below shows that the majority of elevated NO_2 events at Crago occurred when the winds are from the north and northeast directions. The pollution wind rose indicates that the DYEC was not a major contributor to NO_2 levels at the station.

Figure 3. Pollution Rose of Hourly Average NO_2 Concentrations – July to September 2018

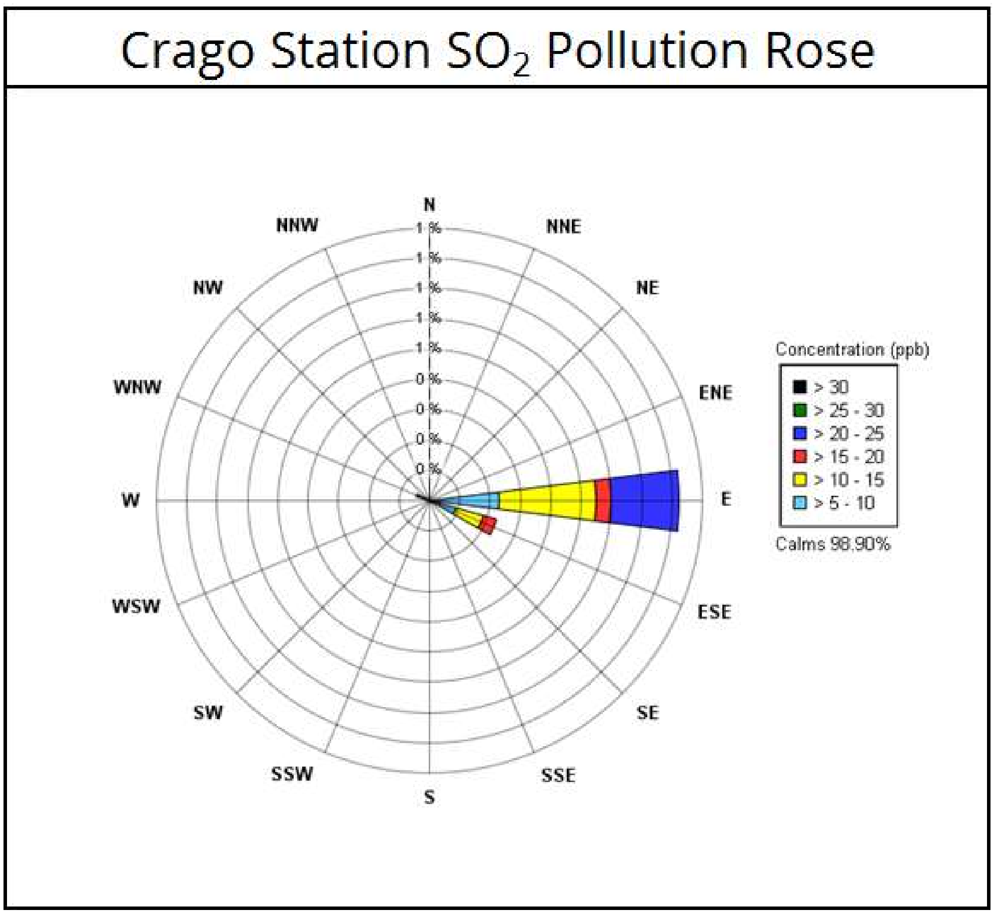


4.4 Sulphur Dioxide Results

Data recovery levels were high for sulphur dioxide (98.7% valid data). Monitoring results were compared to the AAQC for 1-hour and 24-hour averaging periods. There were no exceedances above these AAQC values for the entirety of the sampling period for 1-hour and 24-hour averaged data. The highest SO_2 value seen among the 1-hour averages was 24 ppb, which is 9.6% of the AAQC. The highest SO_2 value seen among the 24-hour averages was 5 ppb, which is 5% of the AAQC. The results are summarized in Table 2 of this report. A pollution rose is presented in **Figure 4** for the Crago Station during Q3 composed of hourly average SO_2 concentrations.

In order to show where possible major sources of pollutants are coming from levels below 5 ppb were omitted from the graphic pollution rose representation. The pollution rose below shows that the majority of elevated SO_2 events at Crago occurred when the winds were from the east direction. The pollution rose indicates that the DYEC was not a major contributor to SO_2 levels at the station.

Figure 4. Pollution Rose of Hourly Average SO_2 Concentrations – July to September 2018

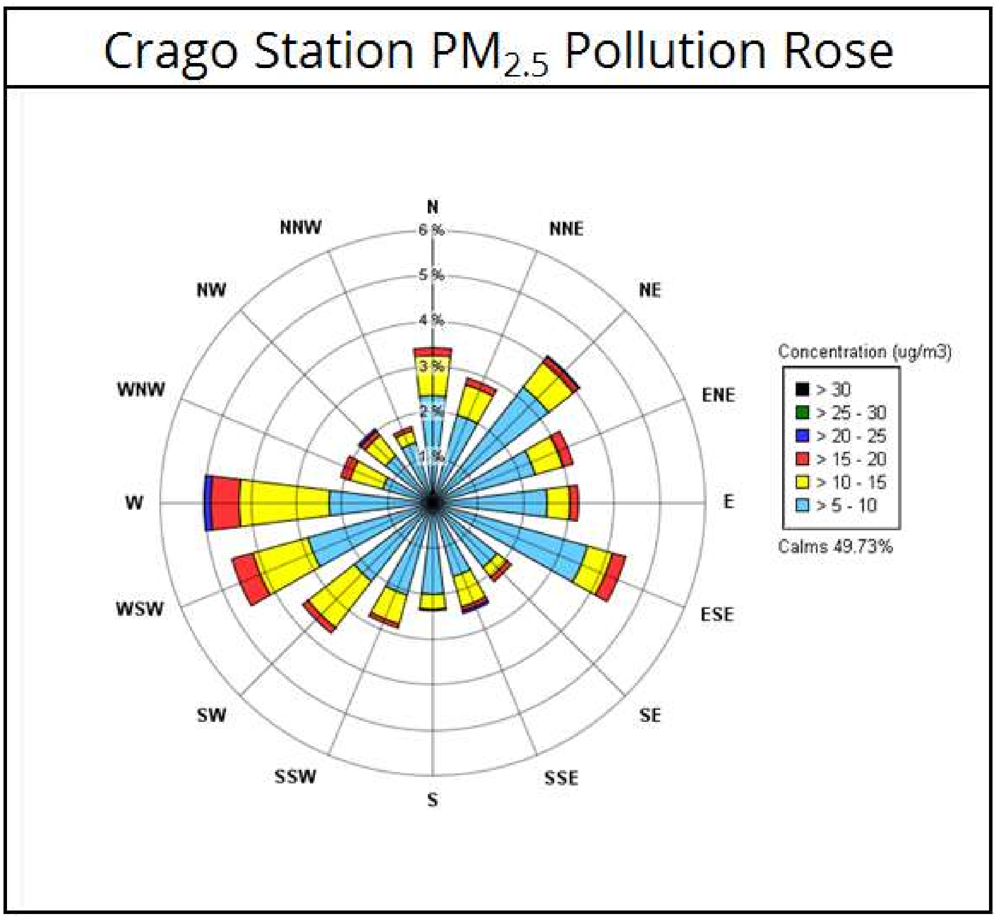


4.5 Fine Particulate Matter ($PM_{2.5}$) Results

Data recovery levels were high for particulate matter less than 2.5 microns (98.9% valid data). The highest $PM_{2.5}$ value seen among the 1-hour averages was 24 µg/m^3 and the highest value seen among the rolling 24-hour averages was 17 µg/m^3. A pollution rose is presented in **Figure 5** for the Crago Station during Q3 composed of hourly average $PM_{2.5}$ concentrations. The results are summarized in Table 2 of this report.

In order to show where possible major sources of pollutants are coming from levels below 5 µg/m^3 were omitted from the graphic pollution rose representation. The pollution wind rose below shows that the majority of elevated $PM_{2.5}$ events at Crago occurred when the winds were from the westerly and southwesterly directions. Elevated $PM_{2.5}$ also occurred when the winds were from the easterly-southeasterly direction. Some of the elevated $PM_{2.5}$ measurements may have been related to emissions from the DYEC but were more likely related to nearby roadway construction.

Figure 5. Pollution Rose of Hourly Average $PM_{2.5}$ Concentrations – July to September 2018



4.6 TSP and Metals Hi-Vol Results

All of the TSP Hi-Vols operated on a discrete schedule every 6 days according to the NAPS schedule during Q3 with the sample days being: July 1, 7, 13, 19, 25, 31, August 6, 12, 18, 24, 30, September 5, 11, 17, 23, and 29, 2018. Data recovery levels were high for the TSP sampler at the Crago Station (94% valid data). There were no exceedances of any of the AAQC's or HHRA Criteria for TSP, mercury or metals during Q3. Table 4 provides a summary of the statistics for the Crago Station.

Table 4: Summary of TSP Sampler Crago Station

Contaminant	Units	*MECP Criteria*	*HHRA Health Based Criteria*	No. > Criteria	Geometric Mean	Arithmetic Mean	Minimum Concentration	Q3 Maximum Concentration	July Maximum Concentration	August Maximum Concentration	September Maximum Concentration	Number of Valid Samples	% Valid data
Particulate (TSP)	µg/m³	*120*	*120*	0	23.2	24.5	11.3	39.3	39.3	32.1	30.2	15	94
Total Mercury (Hg)	µg/m³	*2*	*2*	0	8.97E-06	1.11E-05	3.86E-06	2.70E-05	1.85E-05	1.77E-05	2.70E-05	15	94
Aluminum (Al)	µg/m³	*4.8*	-	0	1.05E-01	1.16E-01	3.50E-02	2.15E-01	2.15E-01	1.60E-01	1.75E-01	15	94
Antimony (Sb)	µg/m³	*25*	*25*	0	1.26E-03	1.70E-03	3.00E-04	3.09E-03	3.09E-03	1.33E-03	1.04E-03	15	94
Arsenic (As)	µg/m³	*0.3*	*0.3*	0	1.22E-03	1.29E-03	9.20E-04	1.86E-03	1.86E-03	9.20E-04	9.20E-04	15	94
Barium (Ba)	µg/m³	*10*	*10*	0	6.22E-03	6.82E-03	3.30E-03	1.40E-02	1.40E-02	1.33E-02	8.30E-03	15	94
Beryllium (Be)	µg/m³	*0.01*	*0.01*	0	7.72E-05	1.42E-04	3.07E-05	3.09E-04	3.09E-04	3.07E-05	3.07E-05	15	94
Bismuth (Bi)	µg/m³	-	-	-	8.96E-04	1.07E-03	5.52E-04	1.86E-03	1.86E-03	5.52E-04	5.52E-04	15	94
Boron (B)	µg/m³	*120*	-	0	5.76E-03	8.10E-03	1.84E-03	1.23E-02	1.86E-03	1.23E-02	1.23E-02	15	94
Cadmium (Cd)	µg/m³	*0.025*	*0.025*	0	6.15E-04	6.15E-04	6.13E-04	6.19E-04	6.19E-04	6.13E-04	6.13E-04	15	94
Chromium (Cr)	µg/m³	*0.5*	-	0	3.83E-03	4.68E-03	1.53E-03	9.10E-03	3.09E-03	9.10E-03	7.10E-03	15	94
Cobalt (Co)	µg/m³	*0.1*	*0.1*	0	6.15E-04	6.15E-04	6.13E-04	6.19E-04	6.19E-04	6.13E-04	6.13E-04	15	94
Copper (Cu)	µg/m³	*50*	-	0	1.77E-02	2.12E-02	7.10E-03	7.56E-02	2.76E-02	3.12E-02	7.56E-02	15	94
Iron (Fe)	µg/m³	*4*	-	0	2.76E-01	3.17E-01	9.50E-02	8.89E-01	8.89E-01	5.05E-01	3.61E-01	15	94
Lead (Pb)	µg/m³	*0.5*	*0.5*	0	1.71E-03	1.97E-03	9.20E-04	3.70E-03	3.22E-03	3.70E-03	3.40E-03	15	94
Magnesium (Mg)	µg/m³	-	-	-	1.77E-01	1.90E-01	9.90E-02	3.37E-01	3.03E-01	3.37E-01	2.30E-01	15	94
Manganese (Mn)	µg/m³	*0.4*	-	0	8.17E-03	8.94E-03	4.25E-03	1.75E-02	1.56E-02	1.75E-02	1.10E-02	15	94
Molybdenum (Mo)	µg/m³	*120*	-	0	8.59E-04	9.54E-04	3.07E-04	2.33E-03	9.28E-04	1.34E-03	2.33E-03	15	94
Nickel (Ni)	µg/m³	*0.2*	-	0	9.68E-04	9.88E-04	9.20E-04	1.91E-03	1.91E-03	9.20E-04	9.20E-04	15	94
Phosphorus (P)	µg/m³	-	-	-	1.26E-01	2.19E-01	2.10E-02	5.90E-01	4.75E-02	5.90E-01	5.80E-01	15	94
Selenium (Se)	µg/m³	*10*	*10*	0	3.07E-03	3.07E-03	3.07E-03	3.09E-03	3.09E-03	3.07E-03	3.07E-03	15	94
Silver (Ag)	µg/m³	*1*	*1*	0	5.85E-04	8.01E-04	3.07E-04	1.55E-03	1.55E-03	3.07E-04	3.07E-04	15	94
Strontium (Sr)	µg/m³	*120*	-	0	4.60E-03	4.92E-03	2.59E-03	8.00E-03	7.58E-03	6.40E-03	8.00E-03	15	94
Thallium (Tl)	µg/m³	-	-	-	1.82E-04	1.25E-03	2.76E-05	3.09E-03	3.09E-03	2.76E-05	2.76E-05	15	94
Thorium (Th)	µg/m³	-	-	-	6.13E-04	6.13E-04	6.13E-04	6.13E-04	0.00E+00	6.13E-04	0.00E+00	2	13
Tin (Sn)	µg/m³	*10*	*10*	0	1.29E-03	1.73E-03	3.07E-04	3.09E-03	3.09E-03	1.66E-03	1.24E-03	15	94
Titanium (Ti)	µg/m³	*120*	-	0	4.36E-03	4.95E-03	3.07E-03	1.17E-02	1.17E-02	3.37E-03	3.37E-03	15	94
Uranium (Ur)	µg/m³	*1.5*	-	0	5.61E-05	7.39E-05	3.07E-05	1.39E-04	1.39E-04	3.07E-05	3.07E-05	15	94
Vanadium (V)	µg/m³	*2*	*1*	0	1.54E-03	1.54E-03	1.53E-03	1.55E-03	1.55E-03	1.53E-03	1.53E-03	15	94
Zinc (Zn)	µg/m³	*120*	-	0	1.80E-02	2.02E-02	9.00E-03	5.63E-02	2.24E-02	5.63E-02	2.81E-02	15	94
Zirconium (Zr)	µg/m³	*20*	-	0	8.87E-04	9.85E-04	6.13E-04	1.55E-03	1.55E-03	6.13E-04	6.13E-04	15	94

Note: All non-detectable results were reported as 1/2 of the detection limit
[1] O. Reg. 419/05 Schedule 6 Upper Risk Thresholds

4.7 PAH Results

The PUF Hi-Vol operated on a discrete schedule every 12 days for PAH's according to the NAPS schedule during Q3 with the sample days being: July 1, 13, 25, August 6, 18, 30, September 11 and 23, 2018.

Data recovery levels were high for the PAH results at the Crago Station (88% valid data). There were no exceedances of any of the AAQC's or HHRA Criteria for any of the PAH's during Q3. Table 5 provides a summary of the statistics for the Crago Station.

Table 5: Statistics Summary of PAH Results for Crago Station

Contaminant	Units	*MECP Criteria*	*HHRA Health Based Criteria*	No. > Criteria	Arithmetic Mean	Minimum Q3 Concentration	Maximum Q3 Concentration	July Maximum Concentration	August Maximum Concentration	September Maximum Concentration	Number of Valid Samples	% Valid data
1-Methylnaphthalene	ng/m³	*12000*	-	0	4.81E+00	2.09E+00	9.63E+00	9.63E+00	5.15E+00	2.57E+00	7	88
2-Methylnaphthalene	ng/m³	*10000*	-	0	8.79E+00	3.42E+00	1.76E+01	1.76E+01	1.08E+01	4.46E+00	7	88
Acenaphthene	ng/m³	-	-	-	5.37E+00	6.39E-01	1.48E+01	1.48E+01	5.82E+00	1.26E+00	7	88
Acenaphthylene	ng/m³	*3500*	-	0	1.37E-01	4.70E-02	3.57E-01	1.30E-01	3.57E-01	1.21E-01	7	88
Anthracene	ng/m³	*200*	-	0	2.80E-01	7.23E-02	6.71E-01	6.71E-01	3.49E-01	7.64E-02	7	88
Benzo(a)Anthracene	ng/m³	-	-	-	3.82E-02	7.02E-03	1.30E-01	1.30E-01	1.87E-02	8.95E-03	7	88
Benzo(a)fluorene	ng/m³	-	-	-	7.76E-02	1.51E-03	2.60E-01	2.60E-01	6.56E-02	2.91E-02	7	88
Benzo(a)Pyrene	ng/m³	*0.05[1]* *5[2* *1.1[3]*	*1*	0	1.67E-02	6.12E-03	3.60E-02	1.87E-02	3.60E-02	1.21E-02	7	88
Benzo(b)Fluoranthene	ng/m³	-	-	-	4.69E-02	1.06E-03	1.30E-01	1.30E-01	6.07E-02	1.92E-02	7	88
Benzo(b)fluorene	ng/m³	-	-	-	6.95E-02	1.51E-03	2.60E-01	2.60E-01	3.02E-02	1.48E-02	7	88
Benzo(e)Pyrene	ng/m³	-	-	-	7.76E-02	7.33E-03	2.60E-01	2.60E-01	3.25E-02	3.89E-02	7	88
Benzo(g,h,i)Perylene	ng/m³	-	-	-	4.46E-02	2.64E-03	1.30E-01	1.30E-01	4.20E-02	2.37E-02	7	88
Benzo(k)Fluoranthene	ng/m³	-	-	-	3.82E-02	1.20E-03	1.30E-01	1.30E-01	1.98E-02	1.34E-02	7	88
Biphenyl	ng/m³	-	-	-	2.77E+00	9.57E-01	6.04E+00	6.04E+00	3.18E+00	2.13E+00	7	88
Chrysene	ng/m³	-	-	-	5.62E-02	1.98E-02	1.30E-01	1.30E-01	6.90E-02	2.93E-02	7	88
Dibenzo(a,h)Anthracene	ng/m³	-	-	-	3.52E-02	3.12E-03	1.30E-01	1.30E-01	1.07E-02	1.08E-02	7	88
Fluoranthene	ng/m³	-	-	-	1.80E+00	3.60E-01	5.30E+00	5.30E+00	2.18E+00	5.82E-01	7	88
Indeno(1,2,3-cd)Pyrene	ng/m³	-	-	-	4.34E-02	2.48E-03	1.30E-01	1.30E-01	4.15E-02	1.46E-02	7	88
Naphthalene	ng/m³	*22500*	*22500*	0	2.04E+01	9.53E+00	4.12E+01	4.12E+01	2.45E+01	1.12E+01	7	88
o-Terphenyl	ng/m³	-	-	-	6.95E-02	1.55E-03	2.60E-01	2.60E-01	2.26E-02	2.12E-02	7	88
Perylene	ng/m³	-	-	-	6.04E-02	7.53E-04	2.60E-01	2.60E-01	4.05E-03	1.52E-03	7	88
Phenanthrene	ng/m³	-	-	-	7.52E+00	1.52E+00	1.99E+01	1.99E+01	8.98E+00	2.55E+00	7	88
Pyrene	ng/m³	-	-	-	7.37E-01	2.13E-01	2.01E+00	2.01E+00	8.85E-01	3.00E-01	7	88
Tetralin	ng/m³	-	-	-	1.81E+00	1.30E+00	2.38E+00	2.18E+00	2.38E+00	1.94E+00	7	88
Total PAH[4]	ng/m³	-	-	-	5.51E+01	2.08E+01	1.20E+02	1.20E+02	6.46E+01	2.62E+01	7	88

NOTE: All non-detectable results were reported as 1/2 of the detection limit
[1] AAQC
[2] O. Reg. 419/05 Schedule 6 Upper Risk Thresholds
[3] O. Reg. 419/05 24 Hour Guideline
[4] Total PAH sums all PAH contaminants

4.8 Dioxin and Furan Results

The PUF Hi-Vol operated on a discrete schedule every 24 days for D&F's according to the NAPS schedule during Q3 with the sample days being: July 13, August 6, 30, and September 23, 2018.

Data recovery levels were acceptable for the D&F results at the Crago Station (100% valid data). There were no exceedances of any of the AAQC's or HHRA Criteria for any of the D&F's during Q3. Table 6 provides a summary of the statistics for the Crago Station.

Table 6: 2018 Q3 Monitoring Results for Dioxin and Furan, Crago Station

Contaminant	Units	*MECP Criteria*	*HHRA Health Based Criteria*	No. > Criteria	Arithmetic Mean	Minimum Concentration	Q3 Maximum Concentration	July Maximum Concentration	August Maximum Concentration	September Maximum Concentration	Number of Valid Samples	% Valid data
2,3,7,8-TCDD	pg/m³	-	-	-	2.40E-03	3.01E-04	6.23E-03	6.23E-03	2.70E-03	3.01E-04	4	100
1,2,3,7,8-PeCDD	pg/m³	-	-	-	2.90E-03	2.71E-04	6.23E-03	6.23E-03	4.74E-03	2.71E-04	4	100
1,2,3,4,7,8-HxCDD	pg/m³	-	-	-	3.15E-03	2.48E-04	8.65E-03	8.65E-03	2.99E-03	7.23E-04	4	100
1,2,3,6,7,8-HxCDD	pg/m³	-	-	-	4.48E-03	2.48E-04	9.60E-03	7.09E-03	9.60E-03	9.64E-04	4	100
1,2,3,7,8,9-HxCDD	pg/m³	-	-	-	4.30E-03	4.52E-04	8.65E-03	7.44E-03	8.65E-03	4.52E-04	4	100
1,2,3,4,6,7,8-HpCDD	pg/m³	-	-	-	4.35E-02	5.09E-03	1.40E-01	7.44E-03	1.40E-01	2.14E-02	4	100
OCDD	pg/m³	-	-	-	1.13E-01	1.25E-02	2.96E-01	6.57E-02	2.96E-01	7.77E-02	4	100
2,3,7,8-TCDF	pg/m³	-	-	-	3.12E-03	3.01E-04	7.44E-03	7.44E-03	4.36E-03	3.01E-04	4	100
1,2,3,7,8-PeCDF	pg/m³	-	-	-	3.11E-03	4.04E-04	7.27E-03	7.27E-03	4.28E-03	4.97E-04	4	100
2,3,4,7,8-PeCDF	pg/m³	-	-	-	3.09E-03	2.48E-04	7.27E-03	7.27E-03	4.32E-03	5.12E-04	4	100
1,2,3,4,7,8-HxCDF	pg/m³	-	-	-	2.77E-03	2.80E-04	7.09E-03	7.09E-03	2.54E-03	1.17E-03	4	100
1,2,3,6,7,8-HxCDF	pg/m³	-	-	-	2.58E-03	2.95E-04	6.06E-03	6.06E-03	2.66E-03	1.33E-03	4	100
2,3,4,6,7,8-HxCDF	pg/m³	-	-	-	2.67E-03	7.76E-04	7.44E-03	7.44E-03	1.06E-03	1.42E-03	4	100
1,2,3,7,8,9-HxCDF	pg/m³	-	-	-	4.04E-03	6.17E-04	8.82E-03	8.82E-03	4.49E-03	6.17E-04	4	100
1,2,3,4,6,7,8-HpCDF	pg/m³	-	-	-	3.78E-03	1.58E-03	6.06E-03	6.06E-03	4.78E-03	2.71E-03	4	100
1,2,3,4,7,8,9-HpCDF	pg/m³	-	-	-	2.92E-03	1.48E-04	9.86E-03	9.86E-03	5.82E-04	1.08E-03	4	100
OCDF	pg/m³	-	-	-	6.75E-03	1.49E-03	1.14E-02	7.27E-03	1.14E-02	6.84E-03	4	100
Total Toxic Equivalency	pg TEQ/m³	*0.1* *1*[1]	-	0	9.57E-03	1.41E-03	2.11E-02	2.11E-02	1.40E-02	1.72E-03	4	100

5 DATA REQUESTS

The following section outlines any instrumentation issues encountered that have caused data loss at the monitors at the Crago Station.

Appendix C contains monthly IZS zero trends for the NO_x and SO_2 analyzers at the Crago Station.

Edit logs identifying missing data, maintenance times, calibrations and any other missing data have been included in **Appendix D**.

The PAH sample on July 25, 2018 was invalid as the GFI had tripped resulting in the PUF unit not running on that sample day

On July 26, 2018, takeout calibrations were performed on the temporary NO_x and SO_2 analyzers at the station and were removed. The original NO_x and SO_2 analyzers were reinstalled and calibrated.

On August 22, 2018, there was a loss of power to the datalogger, as a new program was being sent which resulted less than 75% of valid data for the one hour from 20:00-21:00.

The TSP sample on September 11, 2018 was invalid as the GFI had tripped resulting in the Hi-Vol unit not running on that sample day.

On September 18, 2018 the overnight IZS sequence was changed from spanning from 23:45 (on one day) to 00:10 (on the following day), to 00:45 to 01:10 on the same day.

On September 19, 2018, there was a suspected loss of power to the station which resulted in data loss from 08:00 to 13:00.

On September 21-22, 2018, there was a suspected loss of power to the station which resulted in data loss from 16:00 on the 21st to 04:00 on the 22nd.

Due to time based drift between the NO_x and SO_2 unit time prompting overnight IZS response and the datalogger time recording the response, the overnight IZS response spanned over 15 min of the 00:00-01:00 hour from September 28-30. Since 75% valid data was not captured, there was less than the sample size required for the hour to be valid.

6 CONCLUSIONS

This Q3 report provides a summary of the ambient air quality data collected at the Crago Station. Throughout this monitoring period, there were no exceedances of any AAQC or HHRA Health Based Criteria. Data recovery rates were acceptable and valid for all measured Q3 parameters.

7 REFERENCES

1. Canadian Council of Ministers of the Environment, 2012. Guidance Document on Achievement Determination Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone. PN 1483 978-1-896997-91-9 PDF
2. Environment Canada, 2013. Canadian Ambient Air Quality Standards. [Online]
3. Ontario Ministry of the Environment and Climate Change, 2012. [Standards Development Branch] Ontario's Ambient Air Quality Criteria (Sorted by Contaminant Name). PIBS #6570e01

APPENDIX A - CONTINUOUS MONITORING RESULTS

Table A1: 2018 Summary Statistics for Q3

Crago Monitoring Station Data Statistics	Maximum 1 hr Mean					Maximum 24 hr Mean					Monthly Mean					% valid hours				
Compound	$PM_{2.5}$	NO_x	NO	NO_2	SO_2	$PM_{2.5}$	NO_x	NO	NO_2	SO_2	$PM_{2.5}$	NO_x	NO	NO_2	SO_2	$PM_{2.5}$	NO_x	NO	NO_2	SO_2
Units	($\mu g/m^3$)	ppb				($\mu g/m^3$)	ppb				($\mu g/m^3$)	ppb				(%)				
AAQC				200	250	28			100	100										
July	20	36	13	23	24	16	11	3	8	4	6	5	1	5	1	99.7	99.7	99.7	99.7	99.7
August	24	43	24	32	14	17	13	5	10	2	8	6	2	5	1	99.6	99.6	99.6	99.6	99.5
September	24	46	29	23	23	10	11	4	7	5	4	5	1	4	2	97.4	96.8	96.8	96.8	96.9
Q3 Arithmetic Mean											6	5	1	4	1	98.9	98.7	98.7	98.7	98.7

Note: This table is the same as Table 2 in the body of the report

Event Statistics	Mean > 1 hr AAQC for Crago Monitoring Station			Rolling Mean > 24 hr AAQC for Crago Monitoring Station		
Compound	$PM_{2.5}$	NO_2	SO_2	$PM_{2.5}$	NO_2	SO_2
Units	No.			No.		
July	N/A	0	0	N/A	0	0
August	N/A	0	0	N/A	0	0
September	N/A	0	0	N/A	0	0
Q3 Total	-	0	0	-	0	0

Note: This table is the same as Table 3 in the body of the report

Crago Station MET Statistics	Maximum 1 hr Mean				Minimum 1 hr Mean				Monthly Mean				Total	% valid hours				
Parameter	WS	Temp	RH	Rain	WS	Temp	RH	Rain	WS	Temp	RH	Rain	Rain	WS	WD	Temp	RH	Rain
Units	(km/hr)	(°C)	(%)	mm	(km/hr)	(°C)	(%)	mm	(km/hr)	(°C)	(%)	mm	mm	(%)				
July	26	29	98	21.6	0	12	34	0.0	9	21	73	0.1	104.6	100.0	100.0	100.0	100.0	100.0
August	25	28	98	20.1	0	12	42	0.0	8	21	81	0.1	75.7	99.9	99.9	99.9	99.9	99.9
September	32	28	98	5.6	0	6	38	0.0	9	17	79	0.1	75.5	100.0	100.0	100.0	100.0	100.0
Q3 Arithmetic Mean									8	20	77	0.1	256	100.0	100.0	100.0	100.0	100.0

Note: This table is the same as Table 1 in the body of the report

Table A2: 2018 Q3 Station Crago Monitoring Results for $PM_{2.5}$

Data Statistics	Rolling Mean > 24 hr AAQC	Arithmetic Mean	Maximum 1 hr Mean	Maximum 24 hr Rolling Mean	Number of valid Hours	% valid data
Month	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$
	No.	(µg/m^3)	(µg/m^3)	(µg/m^3)	No.	%
July	N/A	6	20	16	742	99.7
August	N/A	8	24	17	741	99.6
September	N/A	4	24	10	701	97.4

Table A3: 2018 Q3 Station Crago Monitoring Results for NOx

Data Statistics	Events > 1 hr AAQC	Events > 24 hr AAQC	Arithmetic Mean	Maximum 1 hr Mean	Maximum 24 hr Rolling Mean	Number of valid Hours	% valid data
Month	NO_x	NO_x	NO_x	NO_x	NO_x	NO_x	NO_x
	No.	No.	(ppb)	(ppb)	(ppb)	No.	%
July	N/A	N/A	5	36	11	742	99.7
August	N/A	N/A	6	43	13	741	99.6
September	N/A	N/A	5	46	11	697	96.8

Table A4: 2018 Q3 Station Crago Monitoring Results for NO

Data Statistics	Events > 1 hr AAQC	Events > 24 hr AAQC	Arithmetic Mean	Maximum 1 hr Mean	Maximum 24 hr Rolling Mean	Number of valid Hours	% valid data
Month	NO	NO	NO	NO	NO	NO	NO
	No.	No.	(ppb)	(ppb)	(ppb)	No.	%
July	N/A	N/A	1	13	3	742	99.7
August	N/A	N/A	2	24	5	741	99.6
September	N/A	N/A	1	29	4	697	96.8

Table A5: 2018 Q3 Station Crago Monitoring Results for NO_2

Data Statistics	Events > 1 hr AAQC	Rolling Mean > 24 hr AAQC	Arithmetic Mean	Maximum 1 hr Mean	Maximum 24 hr Rolling Mean	Number of valid Hours	% valid data
Month	NO_2	NO_2	NO_2	NO_2	NO_2	NO_2	NO_2
	No.	No.	(ppb)	(ppb)	(ppb)	No.	%
July	0	0	5	23	8	742	99.7
August	0	0	5	32	10	741	99.6
September	0	0	4	23	7	697	96.8

Table A6: 2018 Q3 Station Crago Monitoring Results for SO_2

Data Statistics	Events > 1 hr AAQC	Rollling Mean > 24 hr AAQC	Arithmetic Mean	Maximum 1 hr Mean	Maximum 24 hr Rolling Mean	Number of valid Hours	% valid data
Month	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
	No.	No.	(ppb)	(ppb)	(ppb)	No.	%
July	0	0	0.7	24	4	742	99.7
August	0	0	1.4	14	2	740	99.5
September	0	0	2.0	23	5	698	96.9

Table A7: 2018 Q3 Crago Meteorological Station Windspeed Data Summary

MET Statistics	Maximum 1 hr Mean	Minimum 1 hr	Quarterly Mean	% valid hours
Month	Wind Speed (km/hr)	Wind Speed (km/hr)	Wind Speed (km/hr)	Wind Speed (%)
July	26	0	9	100.0
August	25	0	8	99.9
September	32	0	9	100.0

Table A8: 2018 Q3 Crago Meteorological Station Wind Direction Data Summary

MET Statistics	% valid hours
Month	Wind Direction (%)
July	100.0
August	99.9
September	100.0

Table A9: 2018 Q3 Crago Meteorological Station Temperature Data Summary

MET Statistics	Maximum 1 hr Mean	Minimum 1 hr	Quarterly Mean	% valid hours
Month	Temperature	Temperature	Temperature	Temperature
	(°C)	(°C)	(°C)	(%)
July	29	12	21	100.0
August	28	12	21	99.9
September	28	6	17	100.0

Table A10: 2018 Q3 Crago Meteorological Station Relative Humidity Data Summary

MET Statistics	Maximum 1 hr Mean	Minimum 1 hr	Monthly Mean	% valid hours
Month	Relative Humidity (%)	Relative Humidity (%)	Relative Humidity (%)	Relative Humidity (%)
July	98	34	73	100.0
August	98	42	81	99.9
September	98	38	79	100.0

Table A11: 2018 Q3 Crago Meteorological Station Precipitation Data Summary

MET Statistics	Maximum 1 hr Mean	Minimum 1 hr	Monthly Mean	Total	% valid hours
Month	Precipitation (mm)	Precipitation (mm)	Precipitation (mm)	Precipitation (mm)	Precipitation (mm)
July	21.6	0.0	0.1	104.6	100.0
August	20.1	0.0	0.1	75.7	99.9
September	5.6	0.0	0.1	75.5	100.0

APPENDIX B - DISCRETE MONITORING RESULTS

Table B1: Summary of Sample Flow Rate and Sample Duration for D&Fs

Sample Date	Crago		
	Filter ID	Sample Duration	Sample Volume
	No.	(min)	(m^3)
July 13, 2018	102GFF-CRAGO-20180713 & GYU312-01	1439	289
August 6, 2018	CRAGO DF/PAH 08/06	1440	241
August 30, 2018	CRAGO-DIOXIN/PAH-AUG30	1442	322
September 23, 2018	CRAGO-PAH/DX-SEP23	1446	332

Table B2: 2018 Crago Station Q3 Monitoring Results for D&F

Contaminant	Units	*MECP Criteria*	*HHRA Health Based Criteria*	13-Jul-18	6-Aug-18	30-Aug-18	23-Sep-18	No. > Criteria	Arithmetic Mean	Minimum Concentration	Q3 Maximum Concentration	July Maximum Concentration	August Maximum Concentration	September Maximum Concentration	Number of Valid Samples	% Valid data
2,3,7,8-TCDD	pg/m^3	-	-	6.23E-03	2.70E-03	3.73E-04	3.01E-04	-	2.40E-03	3.01E-04	6.23E-03	6.23E-03	2.70E-03	3.01E-04	4	100
1,2,3,7,8-PeCDD	pg/m^3	-	-	6.23E-03	4.74E-03	3.73E-04	2.71E-04	-	2.90E-03	2.71E-04	6.23E-03	6.23E-03	4.74E-03	2.71E-04	4	100
1,2,3,4,7,8-HxCDD	pg/m^3	-	-	8.65E-03	2.99E-03	2.48E-04	7.23E-04	-	3.15E-03	2.48E-04	8.65E-03	8.65E-03	2.99E-03	7.23E-04	4	100
1,2,3,6,7,8-HxCDD	pg/m^3	-	-	7.09E-03	9.60E-03	2.48E-04	9.64E-04	-	4.48E-03	2.48E-04	9.60E-03	7.09E-03	9.60E-03	9.64E-04	4	100
1,2,3,7,8,9-HxCDD	pg/m^3	-	-	7.44E-03	8.65E-03	6.52E-04	4.52E-04	-	4.30E-03	4.52E-04	8.65E-03	7.44E-03	8.65E-03	4.52E-04	4	100
1,2,3,4,6,7,8-HpCDD	pg/m^3	-	-	7.44E-03	1.40E-01	5.09E-03	2.14E-02	-	4.35E-02	5.09E-03	1.40E-01	7.44E-03	1.40E-01	2.14E-02	4	100
OCDD	pg/m^3	-	-	6.57E-02	2.96E-01	1.25E-02	7.77E-02	-	1.13E-01	1.25E-02	2.96E-01	6.57E-02	2.96E-01	7.77E-02	4	100
2,3,7,8-TCDF	pg/m^3	-	-	7.44E-03	4.36E-03	3.57E-04	3.01E-04	-	3.12E-03	3.01E-04	7.44E-03	7.44E-03	4.36E-03	3.01E-04	4	100
1,2,3,7,8-PeCDF	pg/m^3	-	-	7.27E-03	4.28E-03	4.04E-04	4.97E-04	-	3.11E-03	4.04E-04	7.27E-03	7.27E-03	4.28E-03	4.97E-04	4	100
2,3,4,7,8-PeCDF	pg/m^3	-	-	7.27E-03	4.32E-03	2.48E-04	5.12E-04	-	3.09E-03	2.48E-04	7.27E-03	7.27E-03	4.32E-03	5.12E-04	4	100
1,2,3,4,7,8-HxCDF	pg/m^3	-	-	7.09E-03	2.54E-03	2.80E-04	1.17E-03	-	2.77E-03	2.80E-04	7.09E-03	7.09E-03	2.54E-03	1.17E-03	4	100
1,2,3,6,7,8-HxCDF	pg/m^3	-	-	6.06E-03	2.66E-03	2.95E-04	1.33E-03	-	2.58E-03	2.95E-04	6.06E-03	6.06E-03	2.66E-03	1.33E-03	4	100
2,3,4,6,7,8-HxCDF	pg/m^3	-	-	7.44E-03	1.06E-03	7.76E-04	1.42E-03	-	2.67E-03	7.76E-04	7.44E-03	7.44E-03	1.06E-03	1.42E-03	4	100
1,2,3,7,8,9-HxCDF	pg/m^3	-	-	8.82E-03	4.49E-03	2.24E-03	6.17E-04	-	4.04E-03	6.17E-04	8.82E-03	8.82E-03	4.49E-03	6.17E-04	4	100
1,2,3,4,6,7,8-HpCDF	pg/m^3	-	-	6.06E-03	4.78E-03	1.58E-03	2.71E-03	-	3.78E-03	1.58E-03	6.06E-03	6.06E-03	4.78E-03	2.71E-03	4	100
1,2,3,4,7,8,9-HpCDF	pg/m^3	-	-	9.86E-03	5.82E-04	1.48E-04	1.08E-03	-	2.92E-03	1.48E-04	9.86E-03	9.86E-03	5.82E-04	1.08E-03	4	100
OCDF	pg/m^3	-	-	7.27E-03	1.14E-02	1.49E-03	6.84E-03	-	6.75E-03	1.49E-03	1.14E-02	7.27E-03	1.14E-02	6.84E-03	4	100
Total Toxic Equivalency	pg TEQ/m^3	*0.1* *1* [1]	-	2.11E-02	1.40E-02	1.41E-03	1.72E-03	0	9.57E-03	1.41E-03	2.11E-02	2.11E-02	1.40E-02	1.72E-03	4	100

NOTE: All non-detectable results were reported as 1/2 of the detection limit

[1] O. Reg. 419/05 Schedule 6 Upper Risk Thresholds

Table B3: Summary of Sample Flow Rate and Sample Duration for PAHs

Sample Date	Crago		
	Filter ID No.	Sample Duration (min)	Sample Volume (m^3)
July 1, 2018	102GFF-CRAGO-20180701 GSI486-01	1446	328
July 13, 2018	102GFF-CRAGO-20180713 & GYU312-01	1439	289
July 25, 2018	Invalid Sample		
August 6, 2018	CRAGO DF/PAH 08/06	1440	241
August 18, 2018	CRAGO-PAH-AUG18	1441	311
August 30, 2018	CRAGO-DIOXIN/PAH-AUG30	1442	322
September 11, 2018	CRAGO-PAH-SEP11	1454	330
September 23, 2018	CRAGO-PAH/DX-SEP23	1446	332

Table B4 2018 Crago Station Q3 Monitoring Results for PAHs

Contaminant	Units	*MECP Criteria*	*HHRA Health Based Criteria*	1-Jul-18	13-Jul-18	25-Jul-18	6-Aug-18	18-Aug-18	30-Aug-18	11-Sep-18	23-Sep-18	No. > Criteria	Arithmetic Mean	Minimum Q3 Concentration	Maximum Q3 Concentration	July Maximum Concentration	August Maximum Concentration	September Maximum Concentration	Number of Valid Samples	% Valid data
1-Methylnaphthalene	ng/m^3	*12000*	-	9.63E+00	9.13E+00	Invalid Sample	5.15E+00	2.79E+00	2.09E+00	2.57E+00	2.27E+00	0	4.81E+00	2.09E+00	9.63E+00	9.63E+00	5.15E+00	2.57E+00	7	88
2-Methylnaphthalene	ng/m^3	*10000*	-	1.76E+01	1.61E+01		1.08E+01	4.98E+00	3.42E+00	4.18E+00	4.46E+00	0	8.79E+00	3.42E+00	1.76E+01	1.76E+01	1.08E+01	4.46E+00	7	88
Acenaphthene	ng/m^3	-	-	1.48E+01	1.18E+01		5.82E+00	2.26E+00	9.88E-01	1.26E+00	6.39E-01	-	5.37E+00	6.39E-01	1.48E+01	1.48E+01	5.82E+00	1.26E+00	7	88
Acenaphthylene	ng/m^3	*3500*	-	7.62E-02	1.30E-01		4.70E-02	3.57E-01	1.41E-01	1.21E-01	8.83E-02	0	1.37E-01	4.70E-02	3.57E-01	1.30E-01	3.57E-01	1.21E-01	7	88
Anthracene	ng/m^3	*200*	-	6.71E-01	5.19E-01		3.49E-01	2.00E-01	7.48E-02	7.64E-02	7.23E-02	0	2.80E-01	7.23E-02	6.71E-01	6.71E-01	3.49E-01	7.64E-02	7	88
Benzo(a)Anthracene	ng/m^3	-	-	7.62E-02	1.30E-01		1.80E-02	1.87E-02	7.02E-03	8.76E-03	8.95E-03	-	3.82E-02	7.02E-03	1.30E-01	1.30E-01	1.87E-02	8.95E-03	7	88
Benzo(a)fluorene	ng/m^3	-	-	1.52E-01	2.60E-01		1.87E-02	6.56E-02	1.61E-02	2.91E-02	1.51E-03	-	7.76E-02	1.51E-03	2.60E-01	2.60E-01	6.56E-02	2.91E-02	7	88
Benzo(a)Pyrene	ng/m^3	*0.05* [1] *5* [2] *1.1* [3]	*1*	1.33E-02	1.87E-02		3.60E-02	2.18E-02	8.66E-03	6.12E-03	1.21E-02	0	1.67E-02	6.12E-03	3.60E-02	1.87E-02	3.60E-02	1.21E-02	7	88
Benzo(b)Fluoranthene	ng/m^3	-	-	7.62E-02	1.30E-01		6.07E-02	2.69E-02	1.06E-03	1.42E-02	1.92E-02	-	4.69E-02	1.06E-03	1.30E-01	1.30E-01	6.07E-02	1.92E-02	7	88
Benzo(b)fluorene	ng/m^3	-	-	1.52E-01	2.60E-01		2.02E-02	3.02E-02	7.64E-03	1.48E-02	1.51E-03	-	6.95E-02	1.51E-03	2.60E-01	2.60E-01	3.02E-02	1.48E-02	7	88
Benzo(e)Pyrene	ng/m^3	-	-	1.52E-01	2.60E-01		3.25E-02	2.95E-02	2.30E-02	7.33E-03	3.89E-02	-	7.76E-02	7.33E-03	2.60E-01	2.60E-01	3.25E-02	3.89E-02	7	88
Benzo(g,h,i)Perylene	ng/m^3	-	-	7.62E-02	1.30E-01		4.20E-02	2.48E-02	2.64E-03	1.31E-02	2.37E-02	-	4.46E-02	2.64E-03	1.30E-01	1.30E-01	4.20E-02	2.37E-02	7	88
Benzo(k)Fluoranthene	ng/m^3	-	-	7.62E-02	1.30E-01		1.98E-02	1.81E-02	1.20E-03	8.61E-03	1.34E-02	-	3.82E-02	1.20E-03	1.30E-01	1.30E-01	1.98E-02	1.34E-02	7	88
Biphenyl	ng/m^3	-	-	6.04E+00	4.67E+00		3.18E+00	1.40E+00	9.57E-01	1.01E+00	2.13E+00	-	2.77E+00	9.57E-01	6.04E+00	6.04E+00	3.18E+00	2.13E+00	7	88
Chrysene	ng/m^3	-	-	7.62E-02	1.30E-01		6.90E-02	4.24E-02	1.98E-02	2.93E-02	2.67E-02	-	5.62E-02	1.98E-02	1.30E-01	1.30E-01	6.90E-02	2.93E-02	7	88
Dibenzo(a,h)Anthracene	ng/m^3	-	-	7.62E-02	1.30E-01		3.12E-03	1.07E-02	8.79E-03	1.08E-02	6.93E-03	-	3.52E-02	3.12E-03	1.30E-01	1.30E-01	1.07E-02	1.08E-02	7	88
Fluoranthene	ng/m^3	-	-	5.30E+00	2.91E+00		2.18E+00	8.52E-01	3.60E-01	5.82E-01	4.40E-01	-	1.80E+00	3.60E-01	5.30E+00	5.30E+00	2.18E+00	5.82E-01	7	88
Indeno(1,2,3-cd)Pyrene	ng/m^3	-	-	7.62E-02	1.30E-01		4.15E-02	3.20E-02	2.48E-03	7.39E-03	1.46E-02	-	4.34E-02	2.48E-03	1.30E-01	1.30E-01	4.15E-02	1.46E-02	7	88
Naphthalene	ng/m^3	*22500*	*22500*	4.12E+01	3.44E+01		2.45E+01	1.12E+01	9.53E+00	1.08E+01	1.12E+01	0	2.04E+01	9.53E+00	4.12E+01	4.12E+01	2.45E+01	1.12E+01	7	88
o-Terphenyl	ng/m^3	-	-	1.52E-01	2.60E-01		1.72E-02	2.26E-02	1.55E-03	1.22E-02	2.12E-02	-	6.95E-02	1.55E-03	2.60E-01	2.60E-01	2.26E-02	2.12E-02	7	88
Perylene	ng/m^3	-	-	1.52E-01	2.60E-01		3.12E-03	1.61E-03	4.05E-03	1.52E-03	7.53E-04	-	6.04E-02	7.53E-04	2.60E-01	2.60E-01	4.05E-03	1.52E-03	7	88
Phenanthrene	ng/m^3	-	-	1.99E+01	1.37E+01		8.98E+00	3.60E+00	1.52E+00	2.32E+00	2.55E+00	-	7.52E+00	1.52E+00	1.99E+01	1.99E+01	8.98E+00	2.55E+00	7	88
Pyrene	ng/m^3	-	-	2.01E+00	1.04E+00		8.85E-01	4.89E-01	2.13E-01	3.00E-01	2.21E-01	-	7.37E-01	2.13E-01	2.01E+00	2.01E+00	8.85E-01	3.00E-01	7	88
Tetralin	ng/m^3	-	-	1.59E+00	2.18E+00		2.38E+00	1.30E+00	1.43E+00	1.85E+00	1.94E+00	-	1.81E+00	1.30E+00	2.38E+00	2.18E+00	2.38E+00	1.94E+00	7	88
Total PAH[4]	ng/m^3	-	-	1.20E+02	9.88E+01		6.46E+01	2.98E+01	2.08E+01	2.52E+01	2.62E+01	-	5.51E+01	2.08E+01	1.20E+02	1.20E+02	6.46E+01	2.62E+01	7	88

NOTE: All non-detectable results were reported as 1/2 of the detection limit

[1] AAQC

[2] O. Reg. 419/05 Schedule 6 Upper Risk Thesholds

[3] O. Reg. 419/05 24 Hour Guideline

[4] Total PAH sums all PAH contaminants

Table B5: Summary of Sample Flow Rate and Sample Duration for TSP and Metals

Sample Date	Crago		
	Filter ID No.	Sample Duration (min)	Sample Volume (m^3)
July 1, 2018	18052309	1427	1616
July 7, 2018	18061342	1429	1619
July 13, 2018	18061343	1430	1619
July 19, 2018	18061591	1432	1622
July 25, 2018	18061592	1430	1620
July 31, 2018	18061597	1440	1630
August 6, 2018	738026	1439	1630
August 12, 2018	738030	1442	1630
August 18, 2018	738034	1427	1630
August 24, 2018	738038	1432	1630
August 30, 2018	738042	1423	1630
September 5, 2018	738046	1427	1630
September 11, 2018	Invalid Sample		
September 17, 2018	738311	1424	1630
September 23, 2018	738315	1445	1630
September 29, 2018	738319	1423	1630

Table B6: 2018 Crago Station Q3 Monitoring Results for TSP and Metals

Contaminant	Units	*MECP Criteria*	*HHRA Health Based Criteria*	1-Jul-18	7-Jul-18	13-Jul-18	19-Jul-18	25-Jul-18	31-Jul-18	6-Aug-18	12-Aug-18	18-Aug-18	24-Aug-18	30-Aug-18	5-Sep-18	11-Sep-18
Particulate (TSP)	µg/m³	*120*	*120*	36.5	21.3	36.0	39.3	22.2	24.7	25.3	16.5	17.7	32.1	16.1	30.2	
Total Mercury (Hg)	µg/m³	*2*	*2*	6.19E-06	6.18E-06	6.17E-06	1.85E-05	6.17E-06	6.13E-06	1.77E-05	4.41E-06	3.86E-06	1.77E-05	4.41E-06	7.73E-06	Invalid Sample
Aluminum (Al)	µg/m³	*4.8*	-	1.13E-01	1.07E-01	2.15E-01	2.12E-01	7.53E-02	1.09E-01	1.06E-01	5.90E-02	3.50E-02	1.60E-01	8.20E-02	8.00E-02	
Antimony (Sb)	µg/m³	*25*	*25*	3.09E-03	3.09E-03	3.09E-03	3.08E-03	3.09E-03	3.07E-03	7.10E-04	1.21E-03	3.00E-04	1.33E-03	4.30E-04	9.80E-04	
Arsenic (As)	µg/m³	*0.3*	*0.3*	1.86E-03	1.85E-03	1.85E-03	1.85E-03	1.85E-03	1.84E-03	9.20E-04	9.20E-04	9.20E-04	9.20E-04	9.20E-04	9.20E-04	
Barium (Ba)	µg/m³	*10*	*10*	1.40E-02	3.52E-03	7.78E-03	8.63E-03	4.88E-03	5.34E-03	6.10E-03	5.80E-03	3.30E-03	1.33E-02	4.70E-03	7.60E-03	
Beryllium (Be)	µg/m³	*0.01*	*0.01*	3.09E-04	3.09E-04	3.09E-04	3.08E-04	3.09E-04	3.07E-04	3.07E-05	3.07E-05	3.07E-05	3.07E-05	3.07E-05	3.07E-05	
Bismuth (Bi)	µg/m³	-	-	1.86E-03	1.85E-03	1.85E-03	1.85E-03	1.85E-03	1.84E-03	5.52E-04	5.52E-04	5.52E-04	5.52E-04	5.52E-04	5.52E-04	
Boron (B)	µg/m³	*120*	-	1.86E-03	1.85E-03	1.85E-03	1.85E-03	1.85E-03	1.84E-03	1.23E-02	1.23E-02	1.23E-02	1.23E-02	1.23E-02	1.23E-02	
Cadmium (Cd)	µg/m³	*0.025*	*0.025*	6.19E-04	6.18E-04	6.17E-04	6.16E-04	6.17E-04	6.13E-04	6.13E-04	6.13E-04	6.13E-04	6.13E-04	6.13E-04	6.13E-04	
Chromium (Cr)	µg/m³	*0.5*	-	1.55E-03	1.54E-03	3.09E-03	1.54E-03	1.54E-03	1.53E-03	5.40E-03	6.10E-03	6.30E-03	9.10E-03	7.60E-03	6.00E-03	
Cobalt (Co)	µg/m³	*0.1*	*0.1*	6.19E-04	6.18E-04	6.17E-04	6.16E-04	6.17E-04	6.13E-04	6.13E-04	6.13E-04	6.13E-04	6.13E-04	6.13E-04	6.13E-04	
Copper (Cu)	µg/m³	*50*	-	1.51E-02	1.11E-02	1.77E-02	1.43E-02	1.43E-02	2.76E-02	8.70E-03	1.80E-02	2.98E-02	1.70E-02	3.12E-02	1.56E-02	
Iron (Fe)	µg/m³	*4*	-	3.55E-01	2.34E-01	8.89E-01	4.71E-01	2.13E-01	2.37E-01	2.33E-01	1.88E-01	9.50E-02	5.05E-01	1.87E-01	3.15E-01	
Lead (Pb)	µg/m³	*0.5*	*0.5*	3.22E-03	9.27E-04	2.04E-03	1.97E-03	9.26E-04	2.45E-03	2.90E-03	1.90E-03	9.20E-04	3.70E-03	9.20E-04	2.40E-03	
Magnesium (Mg)	µg/m³	-	-	1.73E-01	1.30E-01	2.56E-01	3.03E-01	1.11E-01	1.25E-01	2.31E-01	1.58E-01	9.90E-02	3.37E-01	1.11E-01	2.23E-01	
Manganese (Mn)	µg/m³	*0.4*	-	9.84E-03	6.80E-03	1.56E-02	1.33E-02	6.54E-03	6.56E-03	1.19E-02	4.88E-03	4.25E-03	1.75E-02	5.71E-03	1.10E-02	
Molybdenum (Mo)	µg/m³	*120*	-	9.28E-04	9.27E-04	9.26E-04	9.25E-04	9.26E-04	9.20E-04	3.07E-04	8.60E-04	1.34E-03	1.01E-03	9.70E-04	8.10E-04	
Nickel (Ni)	µg/m³	*0.2*	-	9.28E-04	9.27E-04	1.91E-03	9.25E-04	9.26E-04	9.20E-04	9.20E-04	9.20E-04	9.20E-04	9.20E-04	9.20E-04	9.20E-04	
Phosphorus (P)	µg/m³	-	-	3.59E-02	2.10E-02	2.47E-02	3.82E-02	4.75E-02	3.37E-02	5.90E-01	2.30E-01	2.30E-01	2.30E-01	2.30E-01	2.30E-01	
Selenium (Se)	µg/m³	*10*	*10*	3.09E-03	3.09E-03	3.09E-03	3.08E-03	3.09E-03	3.07E-03	3.07E-03	3.07E-03	3.07E-03	3.07E-03	3.07E-03	3.07E-03	
Silver (Ag)	µg/m³	*1*	*1*	1.55E-03	1.54E-03	1.54E-03	1.54E-03	1.54E-03	1.53E-03	3.07E-04	3.07E-04	3.07E-04	3.07E-04	3.07E-04	3.07E-04	
Strontium (Sr)	µg/m³	*120*	-	6.37E-03	2.59E-03	6.24E-03	7.58E-03	2.78E-03	3.87E-03	4.40E-03	5.70E-03	3.10E-03	6.40E-03	3.90E-03	8.00E-03	
Thallium (Tl)	µg/m³	-	-	3.09E-03	3.09E-03	3.09E-03	3.08E-03	3.09E-03	3.07E-03	2.76E-05	2.76E-05	2.76E-05	2.76E-05	2.76E-05	2.76E-05	
Thorium (Th)	µg/m³	-	-	-	-	-	-	-	-	-	6.13E-04	6.13E-04	-	-	-	
Tin (Sn)	µg/m³	*10*	*10*	3.09E-03	3.09E-03	3.09E-03	3.08E-03	3.09E-03	3.07E-03	7.10E-04	6.80E-04	3.07E-04	1.66E-03	3.07E-04	7.80E-04	
Titanium (Ti)	µg/m³	*120*	-	7.43E-03	7.41E-03	1.11E-02	1.17E-02	3.09E-03	3.07E-03	3.37E-03	3.37E-03	3.37E-03	3.37E-03	3.37E-03	3.37E-03	
Uranium (Ur)	µg/m³	*1.5*	-	1.39E-04	1.39E-04	1.39E-04	1.39E-04	1.39E-04	1.38E-04	3.07E-05	3.07E-05	3.07E-05	3.07E-05	3.07E-05	3.07E-05	
Vanadium (V)	µg/m³	*2*	*1*	1.55E-03	1.54E-03	1.54E-03	1.54E-03	1.54E-03	1.53E-03	1.53E-03	1.53E-03	1.53E-03	1.53E-03	1.53E-03	1.53E-03	
Zinc (Zn)	µg/m³	*120*	-	1.94E-02	9.45E-03	1.80E-02	2.24E-02	1.59E-02	1.94E-02	2.18E-02	1.26E-02	9.00E-03	5.63E-02	9.30E-03	2.81E-02	
Zirconium (Zr)	µg/m³	*20*	-	1.55E-03	1.54E-03	1.54E-03	1.54E-03	1.54E-03	1.53E-03	6.13E-04	6.13E-04	6.13E-04	6.13E-04	6.13E-04	6.13E-04	

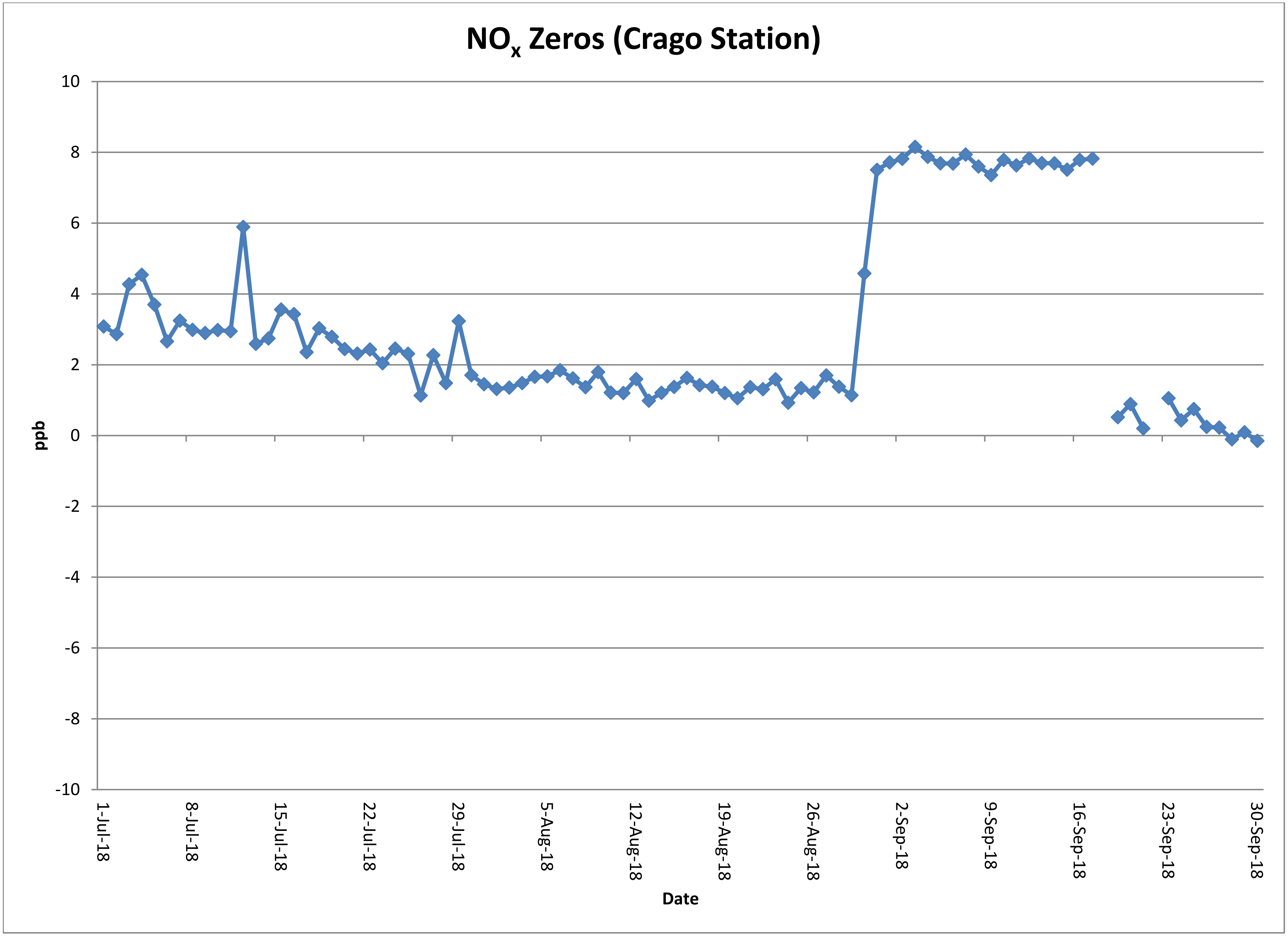
NOTE: All non-detectable results were reported as 1/2 of the detection limit

Table B6 Cont: 2018 Crago Station Q3 Monitoring Results for TSP and Metals

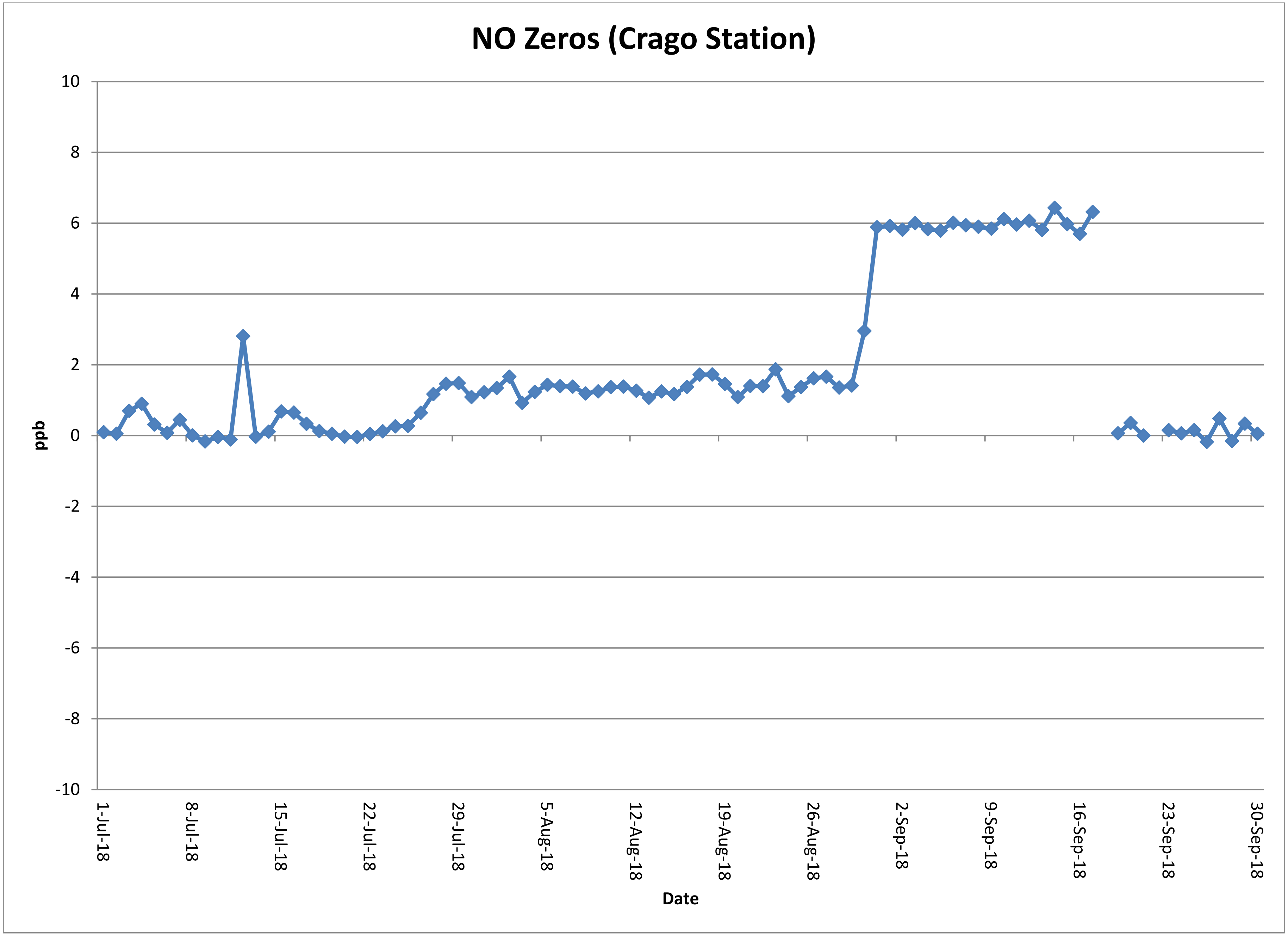
Contaminant	17-Sep-18	23-Sep-18	29-Sep-18	No. > Criteria	Geometric Mean	Arithmetic Mean	Minimum Concentration	Q3 Maximum Concentration	July Maximum Concentration	August Maximum Concentration	September Maximum Concentration	Number of Valid Samples	% Valid data
Particulate (TSP)	19.6	19.5	11	0	23.2	24.5	11.3	39.3	39.3	32.1	30.2	15	94
Total Mercury (Hg)	2.43E-05	2.70E-05	9.93E-06	0	8.97E-06	1.11E-05	3.86E-06	2.70E-05	1.85E-05	1.77E-05	2.70E-05	15	94
Aluminum (Al)	1.05E-01	1.75E-01	1.06E-01	0	1.05E-01	1.16E-01	3.50E-02	2.15E-01	2.15E-01	1.60E-01	1.75E-01	15	94
Antimony (Sb)	1.04E-03	4.80E-04	5.20E-04	0	1.26E-03	1.70E-03	3.00E-04	3.09E-03	3.09E-03	1.33E-03	1.04E-03	15	94
Arsenic (As)	9.20E-04	9.20E-04	9.20E-04	0	1.22E-03	1.29E-03	9.20E-04	1.86E-03	1.86E-03	9.20E-04	9.20E-04	15	94
Barium (Ba)	8.30E-03	5.00E-03	4.10E-03	0	6.22E-03	6.82E-03	3.30E-03	1.40E-02	1.40E-02	1.33E-02	8.30E-03	15	94
Beryllium (Be)	3.07E-05	3.07E-05	3.07E-05	0	7.72E-05	1.42E-04	3.07E-05	3.09E-04	3.09E-04	3.07E-05	3.07E-05	15	94
Bismuth (Bi)	5.52E-04	5.52E-04	5.52E-04	-	8.96E-04	1.07E-03	5.52E-04	1.86E-03	1.86E-03	5.52E-04	5.52E-04	15	94
Boron (B)	1.23E-02	1.23E-02	1.23E-02	0	5.76E-03	8.10E-03	1.84E-03	1.23E-02	1.86E-03	1.23E-02	1.23E-02	15	94
Cadmium (Cd)	6.13E-04	6.13E-04	6.13E-04	0	6.15E-04	6.15E-04	6.13E-04	6.19E-04	6.19E-04	6.13E-04	6.13E-04	15	94
Chromium (Cr)	7.10E-03	6.50E-03	5.30E-03	0	3.83E-03	4.68E-03	1.53E-03	9.10E-03	3.09E-03	9.10E-03	7.10E-03	15	94
Cobalt (Co)	6.13E-04	6.13E-04	6.13E-04	0	6.15E-04	6.15E-04	6.13E-04	6.19E-04	6.19E-04	6.13E-04	6.13E-04	15	94
Copper (Cu)	1.48E-02	7.56E-02	7.10E-03	0	1.77E-02	2.12E-02	7.10E-03	7.56E-02	2.76E-02	3.12E-02	7.56E-02	15	94
Iron (Fe)	2.90E-01	3.61E-01	1.85E-01	0	2.76E-01	3.17E-01	9.50E-02	8.89E-01	8.89E-01	5.05E-01	3.61E-01	15	94
Lead (Pb)	3.40E-03	9.20E-04	9.20E-04	0	1.71E-03	1.97E-03	9.20E-04	3.70E-03	3.22E-03	3.70E-03	3.40E-03	15	94
Magnesium (Mg)	2.30E-01	2.20E-01	1.48E-01	-	1.77E-01	1.90E-01	9.90E-02	3.37E-01	3.03E-01	3.37E-01	2.30E-01	15	94
Manganese (Mn)	6.59E-03	7.89E-03	5.77E-03	0	8.17E-03	8.94E-03	4.25E-03	1.75E-02	1.56E-02	1.75E-02	1.10E-02	15	94
Molybdenum (Mo)	8.20E-04	2.33E-03	3.07E-04	0	8.59E-04	9.54E-04	3.07E-04	2.33E-03	9.28E-04	1.34E-03	2.33E-03	15	94
Nickel (Ni)	9.20E-04	9.20E-04	9.20E-04	0	9.68E-04	9.88E-04	9.20E-04	1.91E-03	1.91E-03	9.20E-04	9.20E-04	15	94
Phosphorus (P)	5.40E-01	5.80E-01	2.30E-01	-	1.26E-01	2.19E-01	2.10E-02	5.90E-01	4.75E-02	5.90E-01	5.80E-01	15	94
Selenium (Se)	3.07E-03	3.07E-03	3.07E-03	0	3.07E-03	3.07E-03	3.07E-03	3.09E-03	3.09E-03	3.07E-03	3.07E-03	15	94
Silver (Ag)	3.07E-04	3.07E-04	3.07E-04	0	5.85E-04	8.01E-04	3.07E-04	1.55E-03	1.55E-03	3.07E-04	3.07E-04	15	94
Strontium (Sr)	4.40E-03	5.70E-03	2.70E-03	0	4.60E-03	4.92E-03	2.59E-03	8.00E-03	7.58E-03	6.40E-03	8.00E-03	15	94
Thallium (Tl)	2.76E-05	2.76E-05	2.76E-05	-	1.82E-04	1.25E-03	2.76E-05	3.09E-03	3.09E-03	2.76E-05	2.76E-05	15	94
Thorium (Th)	-	-	-	-	6.13E-04	6.13E-04	6.13E-04	6.13E-04	0.00E+00	6.13E-04	0.00E+00	2	13
Tin (Sn)	1.24E-03	9.70E-04	7.20E-04	0	1.29E-03	1.73E-03	3.07E-04	3.09E-03	3.09E-03	1.66E-03	1.24E-03	15	94
Titanium (Ti)	3.37E-03	3.37E-03	3.37E-03	0	4.36E-03	4.95E-03	3.07E-03	1.17E-02	1.17E-02	3.37E-03	3.37E-03	15	94
Uranium (Ur)	3.07E-05	3.07E-05	3.07E-05	0	5.61E-05	7.39E-05	3.07E-05	1.39E-04	1.39E-04	3.07E-05	3.07E-05	15	94
Vanadium (V)	1.53E-03	1.53E-03	1.53E-03	0	1.54E-03	1.54E-03	1.53E-03	1.55E-03	1.55E-03	1.53E-03	1.53E-03	15	94
Zinc (Zn)	1.91E-02	2.19E-02	1.99E-02	0	1.80E-02	2.02E-02	9.00E-03	5.63E-02	2.24E-02	5.63E-02	2.81E-02	15	94
Zirconium (Zr)	6.13E-04	6.13E-04	6.13E-04	0	8.87E-04	9.85E-04	6.13E-04	1.55E-03	1.55E-03	6.13E-04	6.13E-04	15	94

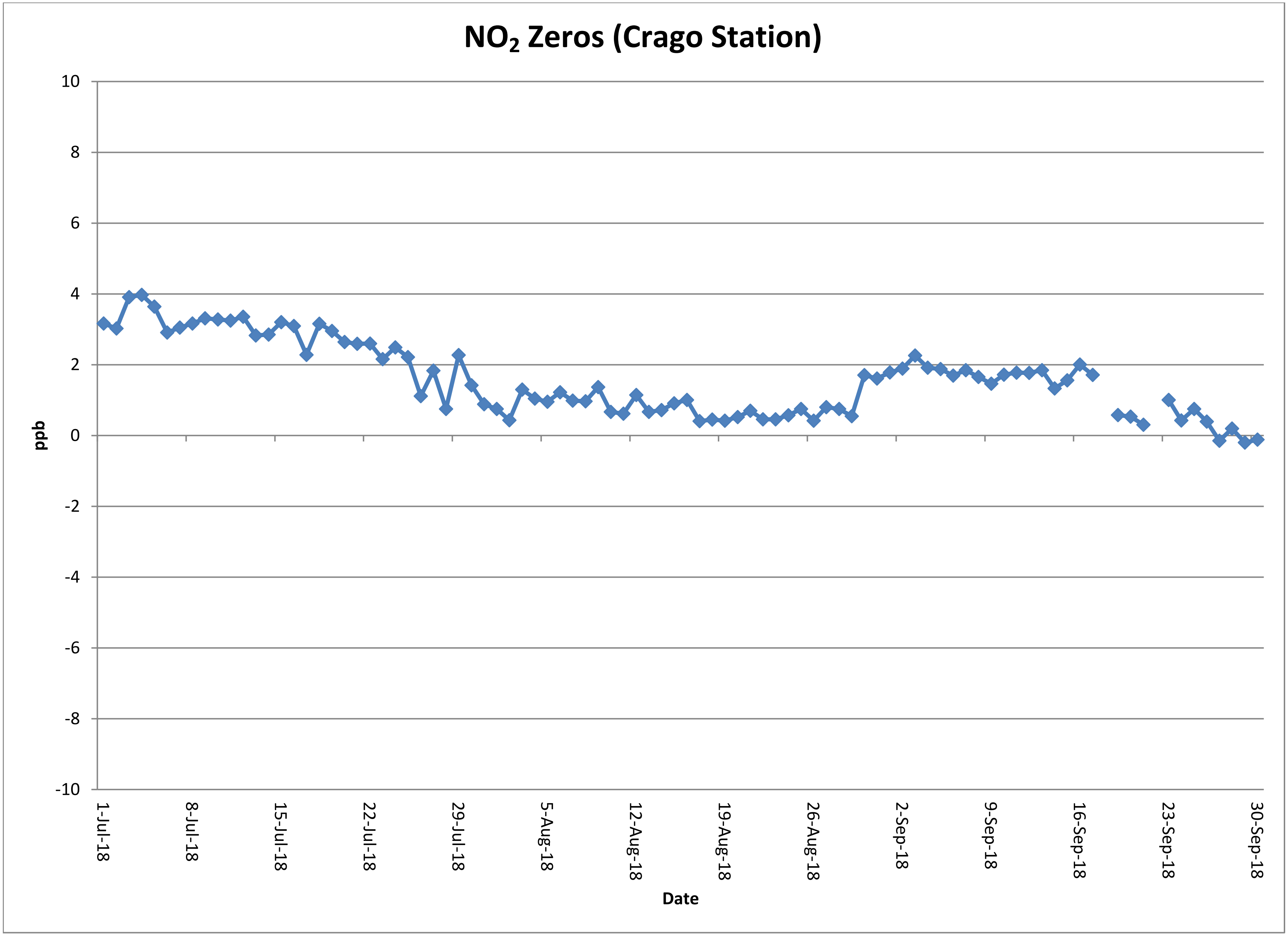
NOTE: All non-detectable results were reported as 1/2 of the detection limit

APPENDIX C - CRAGO STATION ZERO GRAPHS

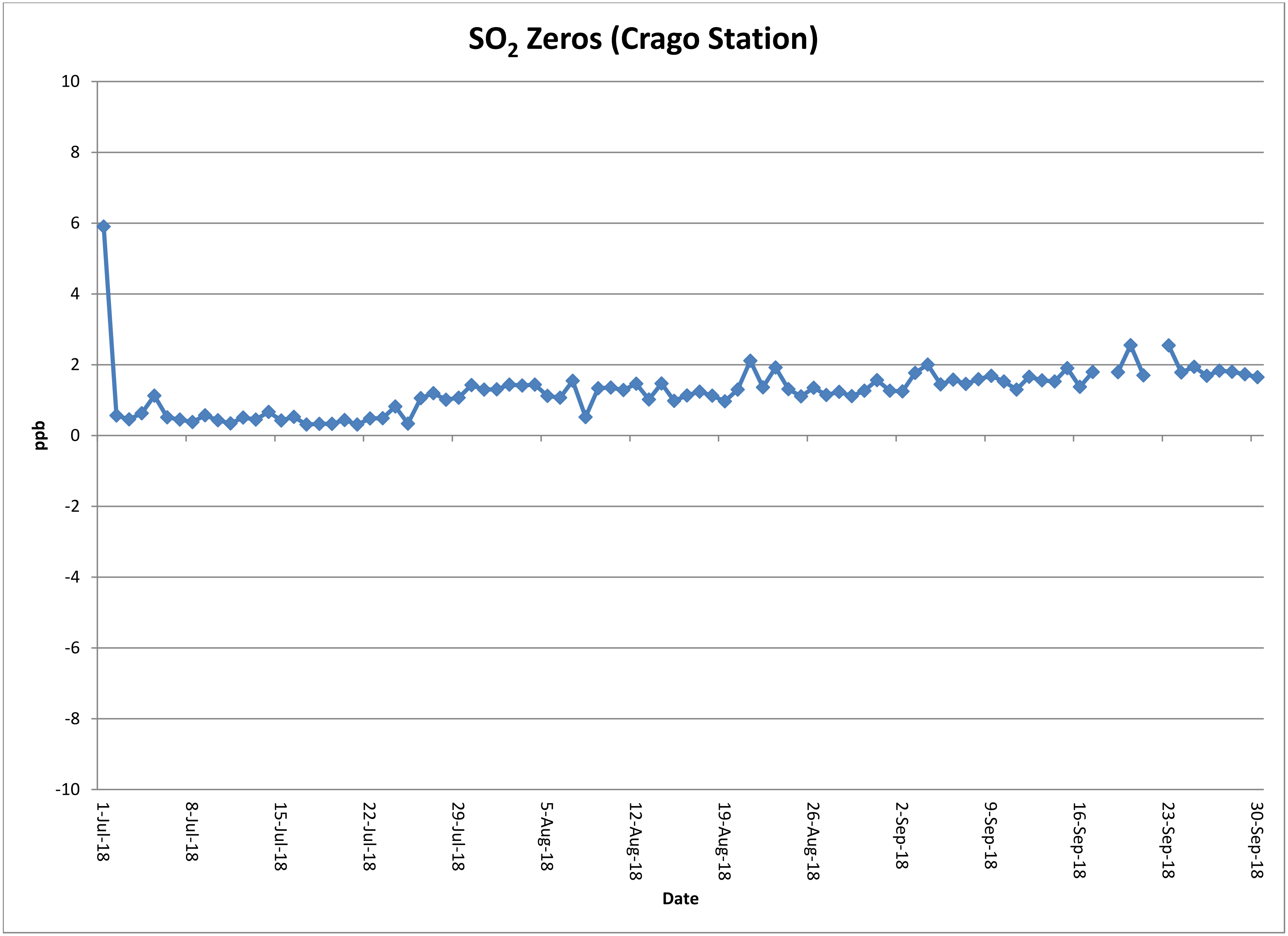


NOx Zeros (Crago Station)
ppb
10
8
6
4
2
0
-2
-4
-6
-8
-10
1-Jul-18
8-Jul-18
15-Jul-18
22-Jul-18
29-Jul-18
5-Aug-18
12-Aug-18
19-Aug-18
26-Aug-18
2-Sep-18
9-Sep-18
16-Sep-18
23-Sep-18
30-Sep-18
Date


NO Zeros (Crago Station)
10
8
6
4
2
0
-2
-4
-6
-8
-10
ppb
1-Jul-18
8-Jul-18
15-Jul-18
22-Jul-18
29-Jul-18
5-Aug-18
12-Aug-18
19-Aug-18
26-Aug-18
2-Sep-18
9-Sep-18
16-Sep-18
23-Sep-18
30-Sep-18
Date



NO$_2$ Zeros (Crago Station)
ppb
10
8
6
4
2
0
-2
-4
-6
-8
-10
1-Jul-18
8-Jul-18
15-Jul-18
22-Jul-18
29-Jul-18
5-Aug-18
12-Aug-18
19-Aug-18
26-Aug-18
2-Sep-18
9-Sep-18
16-Sep-18
23-Sep-18
30-Sep-18
Date


SO2 Zeros (Crago Station)
ppb
10
8
6
4
2
0
-2
-4
-6
-8
-10
1-Jul-18
8-Jul-18
15-Jul-18
22-Jul-18
29-Jul-18
5-Aug-18
12-Aug-18
19-Aug-18
26-Aug-18
2-Sep-18
9-Sep-18
16-Sep-18
23-Sep-18
30-Sep-18
Date

APPENDIX D - STATION EDIT LOG SUMMARIES

Table D1: 3rd Quarter Edit Log for $PM_{2.5}$ at Crago Station

Emitter's Name: Durham York Energy Centre									
Contact	**Name:** Ms. Lyndsay Waller		**Phone:** (905) 404-0888 ext 4107		**Email:** Lyndsay.Waller@Durham.ca				
Station Number: N/A				**Station Name:** Crago Station					
Station Address: Crago and Osborne Road				**Emitter Address:** The Region of Durham, 605 Rossland Road, Whitby, ON					
Pollutants or Parameter: $PM_{2.5}$			**Instrument Make & Model:** Thermo Scientific Model 5030 SHARP Monitor					**s/n:** CM-0269	
Data Edit Period		**Start Date:** July 1, 2018		**End Date:** September 30, 2018			All testing done in EST		
Edit #	**Edit date (dd/mm/yyyy)**	**Editor's Name**	**Edit Action**	**Starting Date (dd/mm/yyyy)**	**Starting Hour (xx:xx)**	**Ending Date (dd/mm/yyyy)**	**Ending Hour (xx:xx)**	**Reason**	
1	23/08/2018	VML	Deleted Hours	26/07/2018	13:00	26/07/2018	15:00	Monthly Calibration	
2	31/08/2018	VML	Deleted Hours	22/08/2018	20:00	22/08/2018	21:00	Power failure	
3	07/09/2018	VML	Deleted Hours	30/08/2018	12:00	30/08/2018	14:00	Monthly Calibration and Cleaning the Inlet Head	
4	19/10/2018	VML	Deleted Hours	19/09/2018	8:00	19/09/2018	13:00	Suspected Power Failure/Equipment Shutoff	
5	19/10/2018	VML	Deleted Hours	21/09/2018	16:00	22/09/2018	04:00	Suspected Power Failure/Equipment Shutoff	
6	19/10/2018	VML	Deleted Hours	26/09/2018	08:00	26/09/2018	10:00	Monthly Calibration and Cleaning the Inlet Head	

Table D2: 3rd Quarter Edit Log for NO_x at Crago Station

Emitter's Name: Durham York Energy Centre								
Contact	**Name:** Ms. Lyndsay Waller		**Phone:** (905) 404-0888 ext 4107		**Email:** Lyndsay.Waller@Durham.ca			
Station Number: N/A				**Station Name:** Crago Station				
Station Address: Crago and Osborne Road				**Emitter Address:** The Region of Durham, 605 Rossland Road, Whitby, ON				
Pollutants or Parameter: NOx			**Instrument Make & Model:** Teledyne Nitrogen Oxide Analyzer Model T200					**s/n:** 1424
Data Edit Period		**Start Date:** July 1, 2018		**End Date:** September 30, 2018		All testing done in EST		
				Starting		**Ending**		
Edit #	**Edit date (dd/mm/yyyy)**	**Editor's Name**	**Edit Action**	**Date (dd/mm/yyyy)**	**Hour (xx:xx)**	**Date (dd/mm/yyyy)**	**Hour (xx:xx)**	**Reason**
1	23/08/2018	VML	Deleted Hours	26/07/2018	13:00	26/07/2018	15:00	Monthly Calibration
2	31/08/2018	VML	Zero correction	01/07/2018	00:00	01/08/2018	00:00	Correcting values <0 to 0
3	31/08/2018	VML	Deleted Hours	22/08/2018	20:00	22/08/2018	21:00	Power failure
4	07/09/2018	VML	Deleted Hours	30/08/2018	12:00	30/08/2018	14:00	Monthly Calibration
5	07/09/2018	VML	Zero offset adjustment	30/08/2018	14:00	18/09/2018	13:00	Correcting zero drift
6	07/09/2018	VML	Zero correction	01/08/2018	00:00	01/09/2018	00:00	Correcting values <0 to 0
7	21/09/2018	VML	Deleted Hours	18/09/2018	13:00	18/09/2018	14:00	Maintenance: Calibrating analog outputs and zero calibration
8	19/10/2018	VML	Deleted Hours	19/09/2018	8:00	19/09/2018	13:00	Suspected Power Failure/Equipment Shutoff
9	19/10/2018	VML	Deleted Hours	21/09/2018	16:00	22/09/2018	04:00	Suspected Power Failure/Equipment Shutoff
10	19/10/2018	VML	Deleted Hours	26/09/2018	08:00	26/09/2018	10:00	Monthly Calibration
11	19/10/2018	VML	Deleted Hours	28/09/2018	00:00	30/09/2018	01:00	Due to time based drift between the NOx unit time prompting overnight z/s response and the datalogger time recording the response, the z/s response spanned over 15 min of the 00:00-01:00 hour. Since 75% valid data was not captured, there was <Sample size required for the hour to be valid.
12	19/10/2018	VML	Zero correction	01/09/2018	00:00	01/10/2018	00:00	Correcting values <0 to 0

Table D3: 3rd Quarter Edit Log for SO_2 at Crago Station

Emitter's Name: Durham York Energy Centre

Contact | **Name:** Ms. Lyndsay Waller | **Phone:** (905) 404-0888 ext 4107 | **Email:** Lyndsay.Waller@Durham.ca

Station Number: N/A | **Station Name:** Crago Station

Station Address: Crago and Osborne Road | **Emitter Address:** The Region of Durham, 605 Rossland Road, Whitby, ON

Pollutants or Parameter: SO_2 | **Instrument Make & Model:** Teledyne Sulfur Dioxide Analyzer Model T100 | **s/n:** 1228

Data Edit Period | **Start Date:** July 1, 2018 | **End Date:** September 30, 2018 | All testing done in EST

Edit #	Edit Date (dd/mm/yyyy)	Editor's Name	Edit Action	Starting Date (dd/mm/yyyy)	Starting Hour (xx:xx)	Ending Date (dd/mm/yyyy)	Ending Hour (xx:xx)	Reason
1	23/08/2018	VML	Deleted Hours	26/07/2018	13:00	26/07/2018	15:00	Monthly Calibration
2	31/08/2018	VML	Zero correction	01/07/2018	00:00	01/08/2018	00:00	Correcting values <0 to 0
3	31/08/2018	VML	Deleted Hours	22/08/2018	20:00	22/08/2018	21:00	Power failure
4	07/09/2018	VML	Deleted Hours	30/08/2018	12:00	30/08/2018	15:00	Monthly Calibration
5	07/09/2018	VML	Zero correction	01/08/2018	00:00	01/09/2018	00:00	Correcting values <0 to 0
6	19/10/2018	VML	Deleted Hours	19/09/2018	8:00	19/09/2018	13:00	Suspected Power Failure/Equipment Shutoff
7	19/10/2018	VML	Deleted Hours	21/09/2018	16:00	22/09/2018	04:00	Suspected Power Failure/Equipment Shutoff
8	19/10/2018	VML	Deleted Hours	26/09/2018	08:00	26/09/2018	10:00	Monthly Calibration
9	19/10/2018	VML	Deleted Hours	28/09/2018	00:00	30/09/2018	01:00	Due to time based drift between the SO_2 unit time prompting overnight z/s response and the datalogger time recording the response, the z/s response spanned over 15 min of the 00:00-01:00 hour. Since 75% valid data was not captured, there was <Sample size required for the hour to be valid.
10	19/10/2018	VML	Zero correction	01/09/2018	00:00	01/10/2018	00:00	Correcting values <0 to 0

Table D4: 3rd Quarter Edit Log for Meterological Parameters at Crago Station

<table>
<tr><td colspan="10">Emitter's Name: Durham York Energy Centre</td></tr>
<tr><td>Contact</td><td colspan="2">Name: Ms. Lyndsay Waller</td><td colspan="2">Phone: (905) 404-0888 ext 4107</td><td colspan="5">Email: Lyndsay.Waller@Durham.ca</td></tr>
<tr><td colspan="4">Station Number: N/A</td><td colspan="6">Station Name: Crago Station</td></tr>
<tr><td colspan="4">Station Address: Crago and Osborne Road</td><td colspan="6">Emitter Address: The Region of Durham, 605 Rossland Road, Whitby, ON</td></tr>
<tr><td colspan="3">Pollutants or Parameter: Ambient T, P, RH and Rain</td><td colspan="6">Instrument Make & Model: Miscellaneous Meteorological Instrumentation</td><td>s/n: N/A</td></tr>
<tr><td colspan="2">Data Edit Period</td><td colspan="2">Start Date: July 1, 2018</td><td colspan="3">End Date: September 30, 2018</td><td colspan="3">All testing done in EST</td></tr>
<tr><th rowspan="2">Edit #</th><th rowspan="2">Edit date (dd/mm/yyyy)</th><th rowspan="2">Editor's Name</th><th rowspan="2">Edit Action</th><th colspan="2">Starting</th><th colspan="2">Ending</th><th rowspan="2" colspan="2">Reason</th></tr>
<tr><th>Date (dd/mm/yyyy)</th><th>Hour (xx:xx)</th><th>Date (dd/mm/yyyy)</th><th>Hour (xx:xx)</th></tr>
<tr><td>1</td><td>31/08/2018</td><td>VML</td><td>Deleted Hours</td><td>22/08/2018</td><td>20:00</td><td>22/08/2018</td><td>21:00</td><td colspan="2">Power failure</td></tr>
</table>