REPORT

DURHAM YORK ENERGY CENTRE

DURHAM, ONTARIO

2019 ANNUAL AMBIENT AIR QUALITY MONITORING REPORT: CONTINUOUS & PERIODIC MONITORING PROGRAM

RWDI #1803743

May 13, 2020

SUBMITTED TO

The Director, Legislative Services-Regional Clerk or Designate,

The Regional Municipality of Durham
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1 INTRODUCTION

RWDI AIR Inc. (RWDI) was retained by Durham Region and York Region (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 post diversion municipal solid waste from Durham Region and York Region to create energy from waste combustion. Commercial operation of the DYEC commenced on February 1, 2016. The site location is shown in **Figure 1**.

In 2019, the facility had two monitoring stations which collected continuous and discrete ambient measurements, known as the Courtice Station and Rundle Road Station. The station locations are shown in **Figure 1**. The Courtice and Rundle Road 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, both discretely monitor the following air quality parameters: Total Suspended Particulate (TSP), Metals, Dioxins and Furans (D&F) and Polycyclic Aromatic Hydrocarbons (PAHs).

Continuous meteorological data is collected at the Courtice and Rundle Road Stations. The Rundle Road Station collects the following meteorological parameters: wind speed, wind direction, ambient temperature, precipitation and relative humidity. The meteorological tower at the Rundle Road Station, is approximately 10 meters tall. The Courtice Station collects the following meteorological parameters: ambient temperature, ambient pressure, precipitation and relative humidity. For purposes of this report, wind speed and wind direction data presented for the Courtice Station have been obtained from the adjacent Courtice Water Pollution Control Plant (WPCP) meteorological tower, which is approximately 20 meters tall.

All 2019 quarterly reports were issued to the MECP by RWDI on behalf of the Region of Durham. This report presents the annual results from January 1st to December 31st, 2019.

Throughout 2019, there were four (4) exceedances of the AAQC for Benzo(a) Pyrene in Q1; two (2) occurred on February 17 at the Courtice and Rundle Road stations, and two (2) occurred on March 23 at the Courtice and Rundle Road station. Data recovery rates were acceptable and valid for all measured parameters at the Rundle Road and Courtice Monitoring Stations.

2 BACKGROUND

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. The monitoring plan established the Courtice and Rundle Road monitoring stations to monitor ambient air quality and quantify the background ambient air quality levels and DYEC contributed emissions to ambient air quality levels. On a voluntary basis, the Regions operated a third ambient air monitoring station on Crago Road from Q4 2014 through Q4 2018, which has since been decommissioned.

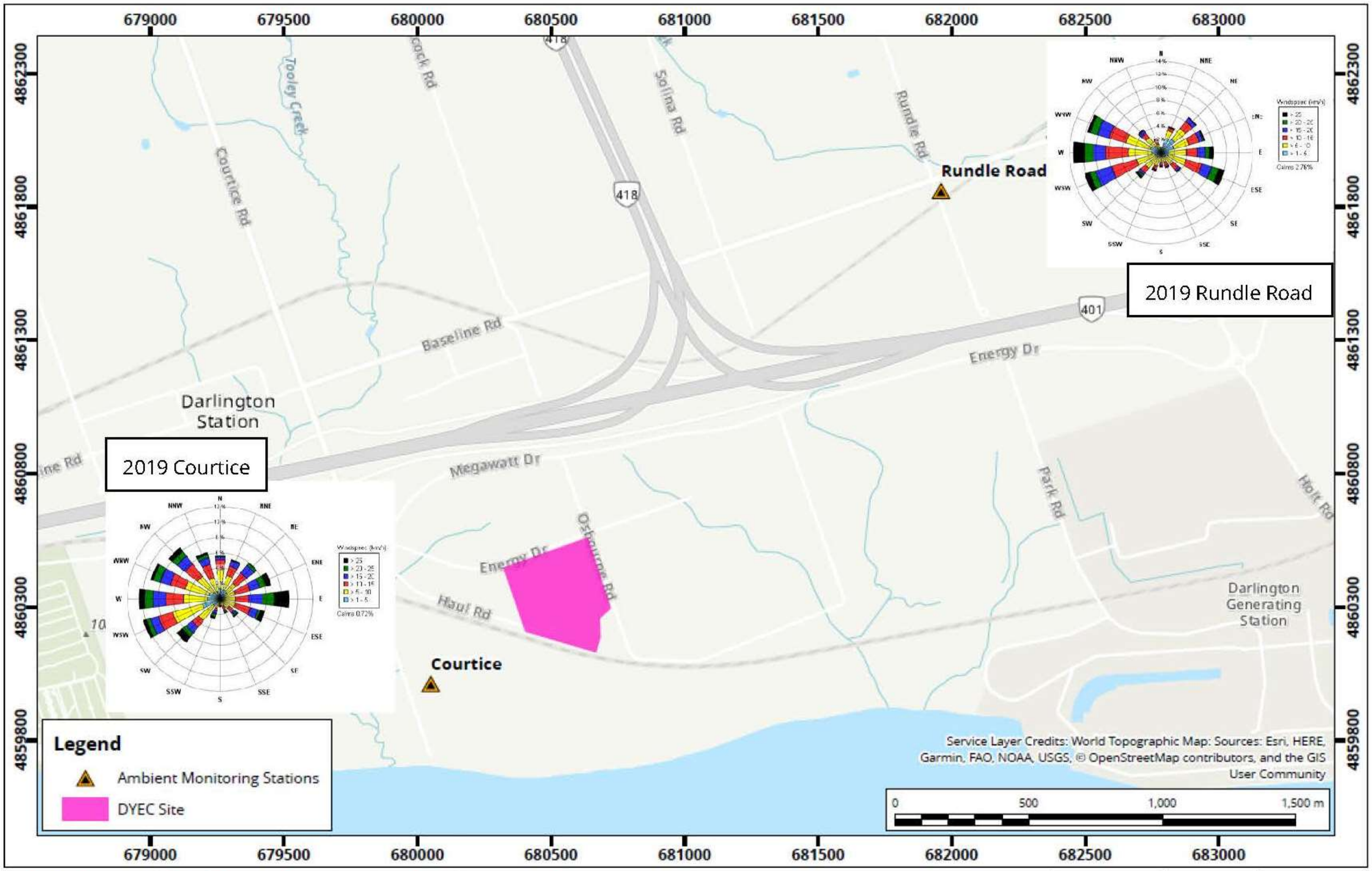
This monitoring plan was developed based on the Regional Council mandate to provide ambient monitoring in the area of the DYEC. The purpose of the ambient air monitoring program is to:

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 (Jacques Whitford, 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.

3 MONITORING LOCATIONS

The station sites were selected in consultation with a working group that included representatives from the MECP, the Region of Durham, York Region, and the Energy from Waste Advisory Committee (EFWAC), as required by Condition 11.3 of the Environmental Assessment Notice of Approval. The DYEC Site and Ambient Monitoring Station Locations are presented in Figure 1, in addition to an annual windrose for each Station. A windrose is a visual representation of the wind speed and wind direction over a specified time period.

The Courtice Station is predominantly upwind of the DYEC and is located on the Courtice WPCP property just southwest of the DYEC. The Rundle Road Station is predominantly downwind of the DYEC and is located just southeast of the intersection of Baseline Road and Rundle Road just northeast of the DYEC. Pictures of the two (2) Stations are presented as **Figure 2** and **3**.



DYEC Site and Ambient Monitoring Station Locations

True North

Drawn by: DJH	Figure: 1
Approx. Scale:	1:20,000
Date Revised:	Apr 17, 2020

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

Project #: 1803743

Figure 2. Courtice Station

Figure 3. Rundle Road Station

4 SAMPLING PROGRAM

4.1 Field Operations

RWDI representatives were responsible for completing the following:

- Day-to-day changing of the filters where applicable;
- Field notes and recording observations;
- Monthly calibrations;
- Attending quarterly audits;
- General and preventative maintenance of the units (e.g., flow calibrations, motor replacements etc.);
- Troubleshooting, maintenance and repairs when problems were encountered;
- Routine cleaning (e.g. PUF housing, SHARP $PM_{2.5}$ heads, sample lines etc.);
- Preparation and recovery of PUF media;
- Completion of chain of custody forms for submission to ALS Laboratories in Burlington, ON; and
- Preparation of the media for shipment to ALS Laboratories using MECP accepted methods.

The samplers were operated according to the Operations Manual for Air Quality Monitoring in Ontario published by the MECP (January 2018) and the Ambient Air Quality Monitoring Plan. RWDI adhered to the manual for any operational changes conducted during the contract period.

4.2 Sample Schedules

All discrete sampling at the Courtice and Rundle Road Stations adhered to the National Air Pollution Surveillance (NAPS) sampling schedule, sampling for 24 hours (midnight to midnight). Sampling was as follows:

- TSP/Metals hi-vol samplers operated on the six-day schedule; and
- PUF samplers operated on the twelve-day schedule. The samples were analyzed for PAH's every twelve days, and D&F's every twenty-four days.

4.3 Instrumentation

Courtice and Rundle Road Monitoring Stations are both equipped with the following continuous monitors: Teledyne T200 Nitrogen Oxide Analyzer Model (NO_X analyzer), Teledyne T100 Sulfur Dioxide Analyzer and Thermo Scientific Model 5030 SHARP Monitor (SHARP) with a $PM_{2.5}$ inlet head. Courtice and Rundle Road Stations also have the following periodic monitors: High Volume (Hi-Vol) Air Sampler outfitted with a total suspended particulate (TSP) inlet capable of collecting particulate of all aerodynamic diameters and a Tisch TE-1000 sampler used to collect D&F's and PAH's using a polyurethane foam plug.

The Courtice and Rundle Road Stations also collect continuous meteorological parameters. The Courtice Station is equipped with the following continuous monitors: Campbell Scientific Model HMP60 (temperature/relative humidity), Campbell Scientific Model CS106 (atmospheric pressure), Texas Electronic TE525M (precipitation). The

Courtice Monitoring Station uses the Courtice WPCP wind speed and direction data. The wind speed and direction data are provided to RWDI by Courtice WPCP staff upon request. The Rundle Road Station is equipped with the following continuous monitors: Campbell Scientific Model HMP60 (temperature/relative humidity), Texas Electronic TE525M (precipitation) and RM Young Model 05103-10 wind head (wind speed and direction).

4.4 Analytical Methods

4.4.1 Synchronized Hybrid Ambient Real-time Particulate (SHARP) Monitor

The SHARP 5030 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.

The instrument collects data using its own data acquisition system (DAS) on a 5-minute interval. Data is collected from the instrument directly which is attached to an Envidas computer. The computer can be accessed remotely, and all instrument parameters can be examined as well as the measurement data. This allows the tracking of instrument performance. Data was also collected at 1-minute intervals by an external datalogger using analog output connections as a back-up. The measurement data was averaged using Envista processing software over a 1-hour and 24-hour period to compare to the applicable ambient air quality criteria.

4.4.2 Nitrogen Oxide Analyzer

The Teledyne T200 NO_X analyzers use 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 EPA protocol span gases and a dilution system. Automatic IZS checks were performed on a daily basis commencing at approximately 1:45 and ending at 02:15 the same day. The checks consisted of a 10-minute zero check, a 10-minute span check and a 10-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.

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4.4.3 Sulphur Dioxide Analyzer

The Teledyne T100 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 EPA protocol span gases and a dilution system. Automatic IZS checks were performed on a daily basis commencing at approximately 1:45 and ending at 02:15 the same day. The checks consisted of a 10-minute zero check, a 10-minute span check and a 10-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.

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4.4.4 High Volume Air Sampler (Hi-Vol)

The Tisch TE-5170 Total Suspended Particulate (TSP) high volume (Hi-Vol) air samplers were outfitted with a TSP gabled inlet capable of collecting particulate of all aerodynamic diameters. Each 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. In the latter part of 2019, the pin-based wheel timer was modified with an automated relay system controlled by a data logger to toggle the sampler on and off, and the chart recorder system was replaced by a digital pressure transducer to record the blower output pressure. Teflon coated glass fibre filters are outfitted at the top of the hi-vol samplers where air is drawn through the filter, thereby collecting TSP. Each Hi-Vol is calibrated quarterly (every three months) to ensure accuracy and validity of the volume of air drawn through the sampler.

The Teflon coated glass fibre filter media are pre and post weighed by ALS Laboratories in Burlington, Ontario. The filters are then analyzed for total particulate weight, metals analysis and mercury. The specific list of metals analyzed can be found in Table 3 and the list and rationale is also provided in the Ambient Air Quality Monitoring Plan (Stantec, 2012).

4.4.5 Polyurethane Foam Samplers

The D&F, and PAH samples were collected using Tisch TE-1000 samplers, which are listed as reference devices for U.S. EPA Methods TO-9 and TO-13. The samplers use 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. Each PUF sampler is equipped with a mass flow controller, which can sustain 8 CFM of flow over the sampling period, an elapsed timer and a wheel timer for starting and stopping each sample. In the latter part of 2019, the pin-based wheel timer was modified with an automated relay system controlled by a data logger to toggle the sampler on and off, and the chart recorder system was replaced by a digital pressure transducer to record the blower output pressure. Each PUF sampler is calibrated quarterly (every three months) to ensure accuracy and validity of the volume of air drawn through the sampler.

The filter and PUF media/glassware is proofed and analyzed by ALS Laboratories in Burlington, Ontario. The filters and PUF/XAD plugs are then analyzed for PAH's and D&F's. The specific list of PAHs and D&F analyzed can be found in Tables 4 & 5 and the list and rationale is also provided in the Ambient Air Quality Monitoring Plan (Stantec, 2012).

4.5 EQUIPMENT REPLACEMENT / FAILURES

4.5.1 Courtice Monitoring Station

4.5.1.1 Continuous Samplers

On December 30, 2018 a tape break occurred in the $PM_{2.5}$ unit which resulted in data loss in 2019 from January 1, 2019 at 00:00 to January 3, 2019 at 15:00. The tape was replaced, the unit was calibrated, and the instrument resumed normal operation on January 3, 2019 at 18:00.

On January 4, there was a power failure between 12:00 and 13:00 that resulted in data loss.

On February 6, the SO_2 analyzer experienced a drop in the UV lamp output between 10:00 and 19:00, after which it recovered to a regular output on its own. The analyzer was checked the following day on February 7 and a takeout calibration was done to verify proper operation.

On April 4, a tape break occurred in the $PM_{2.5}$ unit which resulted in data loss from 00:00 to 18:00. The tape was replaced, the unit was calibrated, and the instrument resumed normal operation the same day at 19:00.

On April 17, there was a power failure between 14:00 and 16:00 that resulted in data loss.

On August 26, the NOx analyzer was removed for maintenance and was replaced with another NOx analyzer. This resulted in missing data from 15:00 to 19:00.

On September 24, the SO_2 analyzer was removed and replaced with another SO2 analyzer from 13:00 to 18:00 due to unstable UV lamp output. Data was invalidated from September 19 at 02:00 to September 23 due to this instability.

On October 2, pressure transducers and relays were installed in the PS1 and hivol units. The CR1000 logger was rewired and reprogrammed to accommodate measurement of hivol and PS1 motor pressure. The Envidas logging layout was also modified to accept these pressure measurements in the logging channels.

On October 4, there was some anomalous $PM_{2.5}$ data from 23:00 to 24:00 that was invalidated. It is believed that the instrument malfunctioned during that time, perhaps during a tape change.

On October 10, there was a power failure between 17:00 and 18:00 that resulted in data loss.

On October 11, relay bypass switches were installed for the PS1 and hivol units.

On November 10-11, low overnight SO_2 spans were observed, which prompted an unscheduled visit on November 12 to check the analyzer performance. A takeout calibration was performed, and the instrument was outside of the 10% span tolerance. Upon troubleshooting the SO_2 analyzer, it was discovered that there were dead flies in the shutter assembly which had caused a UV output shift. Maintenance was performed and the unit was recalibrated. Data was invalidated from when the UV output shifted which occurred after the autospan sequence (02:15) on November 10.

On November 22 during a site visit, it was noted that there was a UV lamp warning on the SO_2 instrument. A takeout calibration was performed, and the instrument was within the 10% span tolerance. The issue was investigated the same day and determined to be flies in the shutter assembly again. Maintenance was performed and the unit was recalibrated.

4.5.1.2 Discrete Samplers

The TSP sample on February 26 was invalid due to an excessive sample volume collected.

The TSP sample on March 10 was invalid due to an insufficient sample volume collected.

The TSP sample on July 26 was invalid due to an excessive sample duration and resultant excessive sample volume collected.

On October 24, the CR1000 data logger failed to initiate the hivol and PS1 run due to a programming error. The TSP/Metals and PUF samples were invalidated for the October 24 sampling day.

4.5.2 Rundle Road Monitoring Station

4.5.2.1 Continuous Samplers

On January 4 between 10:00 to 11:00, and on January 7 between 14:00 to 15:00 there were power failures that resulted in data loss.

On March 27 between 07:00 to 09:00, and on April 16, 2019 between 10:00 to 12:00 there were power failures that resulted in data loss.

During a visit on October 1, it was discovered that the SHARP tape was broken; the tape was respooled and reattached that same day. Based on diagnostic data, it is believed that the tape broke on September 28 at 16:00 which resulted in invalidated data until October 1 at 14:00.

On October 1, the NO_X unit was removed for annual maintenance, however the unit put in its place had stability issues, so the original unit was reinstalled.

On October 2, pressure transducers and relays were installed in the PS1 and hivol units. The CR1000 logger was rewired and reprogrammed to accommodate measurement of hivol and PS1 motor pressure. The Envidas logging channels were also modified to accept these pressure measurements.

On October 11, relay bypass switches were installed for the PS1 and hivol units.

On October 30, a high overnight SO_2 span was observed, which prompted an unscheduled visit the next day to check the analyzer performance. A takeout calibration was performed, and the instrument was outside of the 10% span tolerance. Upon troubleshooting the SO_2 analyzer, it was discovered that there were dead flies in the shutter assembly which had caused a UV output shift. Maintenance was performed and the unit was recalibrated. Data was invalidated from when the UV output shifted which occurred at 15:00 on October 29.

On November 13, during a calibration visit to the station, it was noted that the UV output had shifted again on the SO_2 unit. A takeout calibration was performed, and the instrument was within the 10% span tolerance. The SO_2 analyzer shutter assembly was inspected for flies; in which some were found, removed and the unit was recalibrated.

On November 14, it was discovered that the wiring for the wind direction component of the wind data was wired incorrectly and was outputting erroneous values. The wires were corrected, and the proper offset was applied in the datalogger program. Wind direction data from October 2 – November 14 was invalidated.

4.5.2.2 Discrete Samplers

The TSP and PUF samples on February 26, 2019 were invalid due to excessive sample volume collected.

The TSP sample on March 10, 2019 was invalid due to an insufficient sample volume collected.

The TSP sample on July 26 was invalid due to an excessive sample duration and resultant excessive sample volume collected.

On November 7, it was noted by the field technician that the PS1 motor would not turn on. After some troubleshooting, it was discovered that the motor brushes were worn down. They were replaced and the unit was recalibrated on November 11. The PUF sample for November 5 was invalidated.

The PS1 (PUF) sample was invalidated on December 11, due to an issue with the relay switch resulting in a 9 hour run time.

4.6 Final Data Editing

There were edits made to the 2019 continuous monitoring dataset after a final review. The changes have been reflected in the 2019 final statistics. The edits were as follows:

- Data was invalidated in the $PM_{2.5}$ Rundle Road Monitoring Station dataset from September 28th at 16:00 to October 1st at 00:00 due to closer review of when the SHARP tape broke. Diagnostic data suggests that flow ceased during this time period.
- Due to a transposition error, select data points in the Q1 and Q3 dataset were incorrectly entered into the calculation statistics. Edits to the following data points with the correct values are listed below:
  - Courtice Monitoring Station:
    - NO_X – January 1, 2019 12:00 (0.1 ppb), January 4, 2019 11:00 (4.6 ppb) and 12:00 (FailPwr), July 4, 2019 05:00 (16.5 ppb)
    - NO – July 4, 2019 05:00 (2.8 ppb)
    - NO_2 – July 4, 2019 05:00 (13.7 ppb)
    - SO_2 – February 15, 2019 12:00 (0.352 ppb), July 4, 2019 05:00 (11.146 ppb)
    - $PM_{2.5}$ – July 4, 2019 05:00 (10.2 µg/m^3)

- Rundle Road Monitoring Station:
  - NO_X – January 7, 2019 15:00 (2.8 ppb), July 4, 2019 05:00 (3.6 ppb)
  - NO – July 4, 2019 05:00 (0.5 ppb)
  - NO_2 – July 4, 2019 05:00 (3.1 ppb)
  - SO_2 – July 4, 2019 05:00 (0.530 ppb)
  - $PM_{2.5}$ – July 5, 2019 05:00 (24.2 µg/m^3)
- The sample volume (m^3) for the TSP sample taken at the Courtice Monitoring Station on February 14th, 2019 was 1515 m^3 and not 1598 m^3 as had been reported in the CofC report. This did not affect the calculations that were submitted in the Q1 or annual report.

4.7 MECP Audits

A third-party audit was completed on all continuous analyzers at the Courtice and Rundle Road Monitoring Stations twice in 2019, with one follow up audit. There were no MECP audits during the third and fourth quarter of 2019.

- The first audit was on all continuous analyzers and periodic samplers, which was completed on February 15th, 2019 by Mr. Colman Wong from the MECP as a follow up audit due to failed performance in December 2018. Results from the audit indicated that all of the equipment was working within MECP requirements at both Courtice and Rundle Road Monitoring Stations with the exception of the Courtice Station high-volume sampler which failed to operate. A follow up audit was performed on February 28th, 2019 to re-audit the failed hi-vol sampler. Results from the audit indicated that the equipment was working within MECP requirements.
- The second audit was completed on all continuous analyzers and periodic samplers on June 18th, 2019 by Colman Wong from the MECP. Results from the audit indicated that all of the equipment was working within MECP requirements at Courtice and Rundle Road Monitoring Stations.

5 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.

Environment Canada has established a Canadian Ambient Air Quality Standard (CAAQS) which are health-based air quality objectives for the outdoor air (Environment Canada, 2013). 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). In 2020, there are new CAAQS' being implemented which are listed in **Table 1**. No direct comparison to the 2020 CAAQS' is appropriate for this report as the standards are not in effect until the 2020 reporting year, however we are providing the current 2019 values in statistical form to facilitate future calculations for the CAAQS that require a 3-year average.

Table 1. $PM_{2.5}$, SO_2 and NO_2 CAAQS' by Implementation Year

Parameter	Averaging Time	Year Applied			Statistical Form
		2015	2020	2025	
Fine Particulate Matter ($PM_{2.5}$)	24-hour	28 µg/m³	27 µg/m³		The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
	Annual	10 µg/m³	8.8 µg/m³		The 3-year average of the annual average of all 1-hour concentrations
Sulphur Dioxide (SO_2)	1-hour	-	70 ppb	65 ppb	The 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations
	Annual	-	5 ppb	4 ppb	The average over a single calendar year of all 1-hour average SO_2 concentrations
Nitrogen Dioxide (NO_2)	1-hour	-	60 ppb	42 ppb	The 3-year average of the annual 99th percentile of the daily maximum 1-hour average concentrations
	Annual	-	17 ppb	12 ppb	The average over a single calendar year of all 1-hour average concentrations

(http://airquality-qualitedelair.ccme.ca/en/)

All applicable criteria and standards are presented in the following section of this report.

6 SUMMARY OF AMBIENT MEASUREMENTS

Ambient air quality monitoring results of all parameters sampled for the Courtice and Rundle Road Monitoring Stations are discussed herein. Detailed results of the all continuous and discrete sampling throughout the year are included in **Appendix B** and **C**, respectively.

Table 2 below presents the number and percentage of valid samples collected at each sampling site for each parameter sampled. Data recovery above 75% is considered acceptable. Data recovery was 90% or higher at each station for all continuous and discrete parameters.

Table 2. 2019 Summary of Data Recovery by Sampling Site and Sampled Parameter

Station	Parameter	Total Possible # of Hours or Samples	# of Valid Hours or Samples Collected	Percentage of Valid Samples (%)	Overall Percentage of Valid Samples for the Station (%)
Courtice Monitoring Station	$PM_{2.5}$	8760	8645	98.7	**98.1**
	NO_X	8760	8704	99.4	
	NO	8760	8704	99.4	
	NO_2	8760	8704	99.4	
	SO_2	8760	8540	97.5	
	TSP & Metals	61	57	93.4	
	PAHs	30	29	96.7	
	D&F	15	15	100	
Rundle Road Monitoring Station	$PM_{2.5}$	8760	8665	98.9	**96.8**
	NO_X	8760	8702	99.3	
	NO	8760	8702	99.3	
	NO_2	8760	8702	99.3	
	SO_2	8760	8665	98.9	
	TSP & Metals	61	58	95.1	
	PAHs	30	27	90	
	D&F	15	14	93.3	

Table 3 presents a summary of the continuous sampling statistics at each station for 2019 compared to Ontario AAQC, Ontario Regulation 419/05 and HHRA values. **Table 4** presents a summary of the continuous sampling statistics at each station for 2019 compared to applicable CAAQS'. It should be noted that $PM_{2.5}$ is the only parameter that currently has applicable CAAQS'. 2020 CAAQS' for NO_2 and SO_2 will be applied in the 2020 annual report. **Table 5** presents a summary of the 2019 TSP/metals discrete sampling statistics at Courtice and Rundle Road Stations. All results were compared to the applicable twenty-four (24) hour criteria/standards/HHRA. **Table 6** presents a summary of the 2019 PAH discrete sampling statistics at Courtice and Rundle Road Stations. All results were compared to the applicable twenty-four (24) hour criteria/standards/HHRA. **Table 7** presents a summary of the 2019 D&F discrete sampling statistics at Courtice and Rundle Road Stations. All results were compared to the applicable twenty-four (24) hour criteria/standards.

Table 3. 2019 Summary of Statistics for Continuous Sampling Parameter Levels at Courtice and Rundle Road Stations Compared to AAQC/HHRA's

Station	Parameter	Max 1-hr Mean	1-hr AAQC/ HHRA	Events > 1-hr AAQC / HHRA	Max 24-hr Running Mean	24-hr AAQC / HHRA	Events > 24-hr AAQC / HHRA	Annual Arithmetic Mean	Annual AAQC / HHRA	Events > Annual AAQC / HRRA
Courtice Monitoring Station	$PM_{2.5}$ (µg/m^3)	68.6			35.7			6.4		
	NO_X (ppb)	98.7			38.6			7.1		
	NO (ppb)	62.6			19.5			1.5		
	NO_2 (ppb)	41.3	200	0	23.2	100	0	5.8		
	SO_2 (ppb)	58.2	250	0	18.6	100	0	1.9	4[1]/ 11	0
Rundle Road Monitoring Station	$PM_{2.5}$ (µg/m^3)	49.0			33.6			5.7		
	NO_X (ppb)	275.7			27.9			5.1		
	NO (ppb)	218.6			14.7			1.0		
	NO_2 (ppb)	57.2	200	0	19.8	100	0	4.3		
	SO_2 (ppb)	34.8	250	0	5.6	100	0	0.5	4[1]/ 11	0

Notes: [1] MECP comments on the Q4 report called for comparison to the 2020 annual SO_2 AAQC of 4 ppb in the 2019 Annual Report

Table 4. 2017-2019 Summary of Statistics for Continuous $PM_{2.5}$ at Courtice and Rundle Road Stations Compared to CAAQS'

Station	Parameter	2017-2019[1] 24-Hour Mean[2]	24-Hour CAAQS[2]	Events > 24-Hour CAAQS	2017-2019[1] Annual Mean[3]	Annual CAAQS[3]	Events > Annual CAAQS
Courtice Monitoring Station	$PM_{2.5}$ (µg/m^3)	19.0	28	0	6.4	10	0
Rundle Road Monitoring Station	$PM_{2.5}$ (µg/m^3)	18.8	28	0	6.0	10	0

Notes: [1] 2017-2018 Q2 data taken from Stantec's 2017 Annual Report (Stantec, 2018) and Stantec's 2018 Q1 (Stantec, 2018a) and Q2 Reports (Stantec, 2018b)
[2] The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
[3] The 3-year average of the annual average of all 1-hour concentrations

Table 5. 2019 Summary of Statistics for Discrete Sampling of TSP and Metal Parameter Levels at Courtice and Rundle Road Stations

Parameter	Units	AAQC	HHRA	Courtice Monitoring Station				Rundle Road Monitoring Station			
				Geometric Mean	Arithmetic Mean	Maximum 24-hour	No. of Elevated Readings	Geometric Mean	Arithmetic Mean	Maximum 24-hour	No. of Elevated Readings
Particulate (TSP)	µg/m³	120	120	19.1	23.8	146.4	1	21.6	25.0	81.7	0
Total Mercury (Hg)	µg/m³	2	2	1.06E-05	1.82E-05	7.75E-05	0	7.30E-06	1.47E-05	6.10E-05	0
Aluminum (Al)	µg/m³	4.8	-	1.07E-01	1.32E-01	1.00E+00	0	1.27E-01	1.52E-01	6.64E-01	0
Antimony (Sb)	µg/m³	25	25	7.34E-04	8.13E-04	2.55E-03	0	5.01E-04	6.57E-04	4.81E-03	0
Arsenic (As)	µg/m³	0.3	0.3	9.97E-04	1.04E-03	2.76E-03	0	9.58E-04	9.98E-04	4.79E-03	0
Barium (Ba)	µg/m³	10	10	6.33E-03	7.19E-03	2.23E-02	0	6.24E-03	7.17E-03	2.67E-02	0
Beryllium (Be)	µg/m³	0.01	0.001	3.19E-05	3.21E-05	7.19E-05	0	3.10E-05	3.10E-05	3.27E-05	0
Bismuth (Bi)	µg/m³	-	-	5.75E-04	5.81E-04	1.42E-03	-	5.68E-04	5.74E-04	1.46E-03	-
Boron (B)	µg/m³	120	-	1.26E-02	1.26E-02	1.39E-02	0	1.24E-02	1.24E-02	1.31E-02	0
Cadmium (Cd)	µg/m³	0.025	0.025	6.29E-04	6.29E-04	6.95E-04	0	6.21E-04	6.21E-04	6.54E-04	0
Chromium (Cr)	µg/m³	0.5	-	3.12E-03	3.98E-03	2.25E-02	0	3.18E-03	3.68E-03	8.54E-03	0
Cobalt (Co)	µg/m³	0.1	0.1	6.29E-04	6.29E-04	6.95E-04	0	6.21E-04	6.21E-04	6.54E-04	0
Copper (Cu)	µg/m³	50	-	1.85E-02	2.17E-02	6.10E-02	0	2.15E-02	2.63E-02	8.54E-02	0
Iron (Fe)	µg/m³	4	-	3.12E-01	4.10E-01	3.31E+00	0	3.02E-01	3.44E-01	1.25E+00	0
Lead (Pb)	µg/m³	0.5	0.5	1.92E-03	2.40E-03	1.39E-02	0	1.61E-03	1.93E-03	5.81E-03	0
Magnesium (Mg)	µg/m³	-	-	1.66E-01	1.98E-01	1.25E+00	-	1.81E-01	2.12E-01	9.90E-01	-
Manganese (Mn)	µg/m³	0.4	-	9.21E-03	1.21E-02	1.20E-01	0	8.81E-03	1.08E-02	5.56E-02	0
Molybdenum (Mo)	µg/m³	120	-	6.26E-04	7.49E-04	2.20E-03	0	6.24E-04	7.79E-04	2.20E-03	0
Nickel (Ni)	µg/m³	0.2	-	1.05E-03	1.14E-03	5.35E-03	0	1.01E-03	1.06E-03	2.42E-03	0
Phosphorus (P)	µg/m³	-	-	3.77E-01	5.82E-01	2.02E+00	-	3.75E-01	5.97E-01	2.15E+00	-

Parameter	Units	AAQC	HHRA	Courtice Monitoring Station				Rundle Road Monitoring Station			
				Geometric Mean	Arithmetic Mean	Maximum 24-hour	No. of Elevated Readings	Geometric Mean	Arithmetic Mean	Maximum 24-hour	No. of Elevated Readings
Selenium (Se)	µg/m^3	10	10	3.14E-03	3.15E-03	3.48E-03	0	3.10E-03	3.10E-03	3.27E-03	0
Silver (Ag)	µg/m^3	1	1	3.14E-04	3.15E-04	3.48E-04	0	3.10E-04	3.10E-04	3.27E-04	0
Strontium (Sr)	µg/m^3	120	-	3.42E-03	4.54E-03	4.35E-02	0	4.16E-03	5.21E-03	3.13E-02	0
Thallium (Tl)	µg/m^3	-	-	2.94E-05	3.04E-05	9.81E-05	-	2.83E-05	2.85E-05	6.36E-05	-
Tin (Sn)	µg/m^3	10	10	6.91E-04	8.35E-04	2.52E-03	0	6.85E-04	8.70E-04	4.30E-03	0
Titanium (Ti)	µg/m^3	120	-	4.89E-03	6.15E-03	4.31E-02	0	5.23E-03	6.28E-03	2.52E-02	0
Uranium (Ur)	µg/m^3	0.3	-	3.21E-05	3.28E-05	1.11E-04	0	3.10E-05	3.10E-05	3.27E-05	0
Vanadium (V)	µg/m^3	2	1	1.73E-03	2.03E-03	2.02E-02	0	1.77E-03	2.47E-03	3.46E-02	0
Zinc (Zn)	µg/m^3	120	-	3.12E-02	3.62E-02	1.66E-01	0	2.13E-02	2.45E-02	5.87E-02	0
Zirconium (Zr)	µg/m^3	20	-	6.43E-04	6.59E-04	2.35E-03	0	6.21E-04	6.21E-04	6.54E-04	0

Table 6. 2019 Summary of Statistics for Discrete Sampling of PAH Parameter Levels at Courtice and Rundle Road Stations

Parameter	Units	AAQC	HHRA	Courtice Monitoring Station			Rundle Road Monitoring Station		
				Arithmetic Mean	Maximum 24-hour	No. of Elevated Readings	Arithmetic Mean	Maximum 24-hour	No. of Elevated Readings
1-Methylnaphthalene	ng/m³	12000	-	3.33E+00	1.46E+01	0	4.84E+00	1.61E+01	0
2-Methylnaphthalene	ng/m³	10000	-	5.17E+00	2.35E+01	0	8.20E+00	2.94E+01	0
Acenaphthene	ng/m³	-	-	1.79E+00	1.01E+01	-	3.80E+00	1.80E+01	-
Acenaphthylene	ng/m³	3500	-	1.21E-01	4.95E-01	-	1.55E-01	5.63E-01	0
Anthracene	ng/m³	200	-	9.46E-02	3.98E-01	0	3.55E-01	1.85E+00	0
Benzo(a)Anthracene	ng/m³	-	-	1.34E-02	8.71E-02	-	1.75E-02	9.31E-02	-
Benzo(a)fluorene	ng/m³	-	-	2.10E-02	7.84E-02	-	3.91E-02	1.20E-01	-
Benzo(a)Pyrene	ng/m³	0.05 [1] 5 [2] 1.1 [3]	1	1.64E-02	9.85E-02	2	1.92E-02	1.11E-01	2
Benzo(b)Fluoranthene	ng/m³	-	-	2.62E-02	1.32E-01	-	3.29E-02	1.55E-01	-
Benzo(b)fluorene	ng/m³	-	-	1.21E-02	6.28E-02	-	2.08E-02	7.10E-02	-
Benzo(e)Pyrene	ng/m³	-	-	2.32E-02	1.07E-01	-	2.74E-02	1.16E-01	-
Benzo(g,h,i)Perylene	ng/m³	-	-	2.55E-02	1.22E-01	-	3.00E-02	1.32E-01	-
Benzo(k)Fluoranthene	ng/m³	-	-	2.92E-02	1.34E-01	-	3.79E-02	1.47E-01	-
Biphenyl	ng/m³	-	-	1.30E+00	5.03E+00	-	1.87E+00	5.53E+00	-
Chrysene	ng/m³	-	-	5.17E-02	2.17E-01	-	7.15E-02	2.23E-01	-
Dibenzo(a,h)Anthracene	ng/m³	-	-	4.45E-03	3.20E-02	-	4.83E-03	3.50E-02	-
Fluoranthene	ng/m³	-	-	4.02E-01	1.23E+00	-	1.21E+00	4.74E+00	-
Fluorene [4]	ng/m³	-	-	-	2.89E+00	-	-	6.87E+00	-
Indeno(1,2,3-cd)Pyrene	ng/m³	-	-	2.44E-02	1.21E-01	-	2.80E-02	1.35E-01	-

Parameter	Units	AAQC	HHRA	Courtice Monitoring Station			Rundle Road Monitoring Station		
				Arithmetic Mean	Maximum 24-hour	No. of Elevated Readings	Arithmetic Mean	Maximum 24-hour	No. of Elevated Readings
Naphthalene	ng/m³	22500	22500	1.64E+01	4.81E+01	0	1.87E+01	5.37E+01	0
o-Terphenyl	ng/m³	-	-	7.52E-03	1.77E-02	-	7.59E-03	1.98E-02	-
Perylene	ng/m³	-	-	4.48E-03	2.30E-02	-	3.89E-03	2.39E-02	-
Phenanthrene	ng/m³	-	-	2.04E+00	8.66E+00	-	5.08E+00	2.40E+01	-
Pyrene	ng/m³	-	-	2.03E-01	5.65E-01	-	5.40E-01	2.04E+00	-
Tetralin	ng/m³	-	-	1.96E+00	7.80E+00	-	3.02E+00	3.60E+01	-
Total PAH [5]	ng/m³	-	-	3.32E+01	1.18E+02	-	4.83E+01	1.60E+02	-

Notes: [1] Ontario Ambient Air Quality Criteria. The Standard for benzo(a)Pyrene (B(a)P) is for B(a)P as a surrogate for PAHs,
[2] O.Reg. 419/05 Schedule 6 Upper Risk Thresholds,
[3] O.Reg. 419/05 24 Hour Guideline,
[4] Fluorene was reported on the April 27, August 25, and December 11 sampling events for Courtice Station, and April 27, and August 25 sampling events for Rundle Road Station. The fluorene levels below instrument response were not listed on the analytical reports,
[5] The reported total PAH is the sum of all analysed PAH species

Table 7. 2019 Summary of Statistics for Discrete Sampling of D&F Parameter Levels at Courtice and Rundle Road Stations

Parameter	Units	AAQC	HHRA	Courtice Monitoring Station			Rundle Road Monitoring Station		
				Arithmetic Mean	Maximum 24-hour	Number of Elevated Readings	Arithmetic Mean	Maximum 24-hour	Number of Elevated Readings
2,3,7,8-TCDD	pg/m^3	-	-	1.21E-03	3.44E-03	-	1.37E-03	3.73E-03	-
1,2,3,7,8-PeCDD	pg/m^3	-	-	1.19E-03	3.10E-03	-	1.85E-03	1.38E-02	-
1,2,3,4,7,8-HxCDD	pg/m^3	-	-	6.04E-04	2.05E-03	-	6.06E-04	2.84E-03	-
1,2,3,6,7,8-HxCDD	pg/m^3	-	-	8.33E-04	2.62E-03	-	8.73E-04	3.55E-03	-
1,2,3,7,8,9-HxCDD	pg/m^3	-	-	7.80E-04	2.38E-03	-	8.26E-04	4.04E-03	-
1,2,3,4,6,7,8-HpCDD	pg/m^3	-	-	8.91E-03	4.30E-02	-	1.20E-02	5.50E-02	-
OCDD	pg/m^3	-	-	3.31E-02	1.25E-01	-	2.96E-02	1.42E-01	-
2,3,7,8-TCDF	pg/m^3	-	-	4.59E-04	1.84E-03	-	4.17E-04	1.23E-03	-
1,2,3,7,8-PeCDF	pg/m^3	-	-	6.52E-04	2.59E-03	-	4.34E-04	1.47E-03	-
2,3,4,7,8-PeCDF	pg/m^3	-	-	9.10E-04	3.53E-03	-	7.95E-04	1.93E-03	-
1,2,3,4,7,8-HxCDF	pg/m^3	-	-	8.13E-04	5.54E-03	-	5.40E-04	1.53E-03	-
1,2,3,6,7,8-HxCDF	pg/m^3	-	-	4.14E-04	1.34E-03	-	4.59E-04	9.03E-04	-
2,3,4,6,7,8-HxCDF	pg/m^3	-	-	6.72E-04	3.15E-03	-	6.30E-04	2.06E-03	-
1,2,3,7,8,9-HxCDF	pg/m^3	-	-	6.32E-04	2.27E-03	-	7.30E-04	2.24E-03	-
1,2,3,4,6,7,8-HpCDF	pg/m^3	-	-	2.47E-03	1.57E-02	-	1.87E-03	6.92E-03	-
1,2,3,4,7,8,9-HpCDF	pg/m^3	-	-	7.14E-04	6.06E-03	-	4.38E-04	1.34E-03	-
OCDF	pg/m^3	-	-	3.86E-03	2.91E-02	-	2.52E-03	9.47E-03	-
Total Toxic Equivalency	pg/m^3	0.1 [1] 1 [2]	-	5.00E-03	1.16E-02	0	6.02E-03	2.53E-02	0

Notes: [1] O.Reg. 419/05 Schedule 3 Standard phased in after July 1, 2016
[2] O.Reg. 419/05 Schedule 6 Upper Risk Thresholds

6.1 Exceedances

6.1.1 Courtice Monitoring Station

The Courtice Monitoring Station observed no exceedances of metals, D&F's, $PM_{2.5}$, NO_2 or SO_2 over their applicable AAQC, HHRA or CAAQS during 2019.

The Courtice Monitoring Station observed one (1) exceedance over the daily AAQC for Total Suspended Particulates (TSP) of 120 µg/m^3 during 2019. The exceedance occurred on May 9, 2019 with a 24-hour average concentration of 146.41 µg/m^3. The exceedance details are provided in **Table 8**.

Table 8. 2019 Courtice Monitoring Station TSP Exceedance Details

Date	Percentage of TSP Criteria	Wind Direction	Potential Source Contributions
May 9, 2019	122%	ENE-E	According to the WPCP meteorological data, the Courtice Station was located downwind of the DYEC for part of the day. In addition to the DYEC, other industrial facilities along the lakeshore are upwind of the Courtice Station with the prevailing wind direction during the day, therefore the DYEC may have been a potential contributor among others to the exceedance event.

The Courtice Monitoring Station observed two (2) exceedances over the daily AAQC for Benzo(a)pyrene (0.05 pg/m^3) during 2019. The exceedances occurred on November 17th and December 23rd, 2019 with 24-hour average concentrations of 0.069 and 0.098 ng/m^3 respectively. The November 17th exceedance had been reported in the exceedance document provided to the MECP as 0.071 ng/m^3, however due to a minor difference in sample volume that was discovered during quality control in preparation of the Q4 report, the actual concentration was 0.069 ng/m^3 as reported in the Q4 report and this annual report. The exceedance details are provided in **Table 9**. The Courtice Monitoring Station had no other PAH exceedances (with the exception of Benzo(a)pyrene) during 2019.

Table 9: 2019 Courtice Monitoring Station BaP Exceedance Details

Date	Percentage of BaP Criteria	Wind Direction	Potential Source Contributions
November 17, 2019	138%	E-ESE	According to the Rundle Road meteorological data, the Courtice Station was located downwind of the DYEC for part of the sample day. It is possible that the DYEC contributed to the exceedance, however it is more likely that the exceedance was due to regional air quality issues, as the Rundle Road Station experienced a BaP exceedance on November 17th as well.
December 23, 2019	196%	W-WSW	According to the Rundle Road meteorological data, the Courtice Station was located upwind of the DYEC during the sampling day therefore it is highly unlikely that the DYEC contributed to the exceedance. It is likely that the exceedance was due to regional air quality issues, as the Rundle Road Station experienced a BaP exceedance on December 23rd as well..

6.1.2 Rundle Road Monitoring Station

The Rundle Road Monitoring Station observed no exceedances of TSP, metals, D&F's, $PM_{2.5}$, NO_2 or SO_2 over their applicable AAQC, HHRA or CAAQS during 2019.

The Rundle Road Monitoring Station observed two (2) exceedances over the daily AAQC for Benzo(a)pyrene (0.05 ng/m^3) during 2019. The exceedances occurred on November 17th and December 23rd, 2019 with 24-hour average concentrations of 0.081 and 0.111 ng/m^3 respectively. The November 17th exceedance had been reported in the exceedance document provided to the MECP as 0.083 ng/m^3, however due to a minor difference in sample volume that was discovered during quality control in preparation of the Q4 report, the actual concentration was 0.081 ng/m^3 as reported in the Q4 report and this annual report. The exceedance details are provided in **Table 10**. The Rundle Road Monitoring Station had no other PAH exceedances (with the exception of Benzo(a)pyrene) during 2019.

Table 10: 2019 Rundle Road Monitoring Station BaP Exceedance Details

Date	Percentage of BaP Criteria	Wind Direction	Potential Source Contributions
November 17, 2019	162%	E-ESE	The Rundle Road Station was located upwind of the DYEC during the sampling period for part of the day. Land use in that direction is primarily agricultural and residential properties, however it is believed that the exceedance was due to regional air quality issues, as the Courtice Station experienced a BaP exceedance on November 17th as well.
December 23, 2019	222%	W-WSW	According to the Rundle Road meteorological data, the Rundle Road Station was neither upwind nor downwind of the Energy Centre during the sampling period, therefore it is unlikely that the DYEC contributed to the exceedance. It is likely that the exceedance was due to regional air quality issues, as the Courtice Station experienced a BaP exceedance on December 23rd as well.

7 AMBIENT AIR QUALITY TRENDS

Ambient air quality measurements from the Courtice and Rundle Road Monitoring Stations from 2013 to 2019 are compared in this section of the report. Stantec collected and reported the data from 2013 until the end of Quarter 2 of 2018. RWDI has been responsible for collecting and reporting data from Quarter 3 of 2018 to present. The data from 2013 to 2017 was obtained from Stantec's 2017 Annual Ambient Air Quality Monitoring Report for the Durham York Energy Centre (Stantec, 2018).

7.1 Criteria Air Contaminant Comparisons

A summary of the criteria air contaminant (CAC) concentration statistics for Courtice and Rundle Road Stations from 2013-2019 are presented in following sections, as well as plotted graphs and observations made from comparing the annual NO_2, SO_2 and $PM_{2.5}$ data statistics.

7.1.1 NO_2 Comparison

All continuously monitored NO_2 levels were below the applicable hourly, 24-hour and annual average criteria from 2013 to 2019 for both the Courtice and Rundle Road Monitoring Stations. A summary of annual NOx, NO and NO_2 data for both stations is presented in **Table 11** for 2013-2019. It should be noted that NOx and NO do not have any applicable AAQC's/CAAQS', and that no NO_2 CAAQS' apply to 2019 data; however, some statistics are being presented for future use to be applied against 2020 CAAQS'.

Table 11. 2013-2019 Comparison of Measured NO_X, NO and NO_2 Statistics for Courtice and Rundle Road Monitoring Stations

Contaminant	Statistic	Courtice Station							Rundle Road Station						
		2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
NO_x (ppb)	Annual Arithmetic Mean	9.6	10.8	9.1	8.8	9.0	8.0	7.1	8	7.8	8.2	7.1	7.2	6.7	5.1
	Maximum 1-hour Mean	151.3	122.2	148.5	97.1	146.9	86.8	98.7	68.5	70	102	71.3	89.3	73.6	275.7
	Maximum 24-hour Mean	49.6	52.1	42.6	44.7	45.0	35.6	38.6	34.9	38.6	31.9	28.3	35.5	32.3	27.9
NO (ppb)	Annual Arithmetic Mean						2.1	1.5						1.9	1.0
	Maximum 1-hour Mean	111.1	79.1	88.5	69.5	128.9	68.5	62.6	40.7	38.2	90.9	42.8	88.5	54.3	218.6
	Maximum 24-hour Mean	22.9	21.7	22.3	21.9	25.1	17.2	19.5	10.6	11.2	15.9	9.2	7.9	11.9	14.7
NO_2 (ppb)	Annual Arithmetic Mean	6.4	8	6.8	6.4	6.4	6.1	5.8	6.5	6.1	6.6	5.4	5.5	4.9	4.3
	Annual CAAQS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Events > Annual CAAQS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Maximum 1-hour Mean	48	52.7	62.3	62.4	42.8	70.6	41.3	39.3	62.2	42.6	36.2	42.9	38.3	57.2
	1-hour AAQC	200	200	200	200	200	200	200	200	200	200	200	200	200	200
	Events > 1-hour AAQC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	98^{th} Percentile (Daily Maximum 1-hr Mean) [2]						37.4	36.6						30.2	26.9
	3-Year Average of the Annual 98th Percentile of the Daily Maximum 1-hour Mean Concentrations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1-Hour CAAQS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Events > 1-Hour CAAQS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Maximum Running 24-hour Mean	26.8	31.7	25.9	23.1	26.4	21.0	23.2	24.7	28	22.6	21.5	30.5	20.5	19.8
	24-hour AAQC	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Events > 24-hour AAQC	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: [1] 2013-2018 Q2 data taken from Stantec's 2017 Annual Report (Stantec, 2018) and Stantec's 2018 Q1 (Stantec, 2018a) and Q2 Reports (Stantec, 2018b).

Annual variations in measured NO_2 data for maximum 1-hour, 24-hour and annual means and their applicable AAQC limits are presented in **Figures 4**, **5** and **6** respectively. The following observations were made from the data plots:

- The maximum measured hourly average NO_2 concentrations at the two stations have generally shown the Courtice Station having higher maximums than Rundle Road apart from 2014 and 2019; 2017 showed similar levels (as seen in **Figure 4**).
- The maximum measured 24-hour average NO_2 concentrations at the two stations have remained relatively constant and have generally shown similar levels between both stations year to year (as seen in **Figure 5**).
- Measured annual average NO_2 concentrations at the Courtice Station have been slightly higher than the Rundle Road Station apart from 2013 and 2015 where they showed similar levels (as seen in **Figure 6**). Measured annual average NO_2 concentrations at both stations were relatively constant for all of the years presented.
- Measured maximum 1-hour and 24-hour average NO_2 concentrations have not come close to exceeding the applicable AAQC's over the timeseries.

Figure 4. Maximum Measured 1-hour Mean NO_2 Concentrations by Year

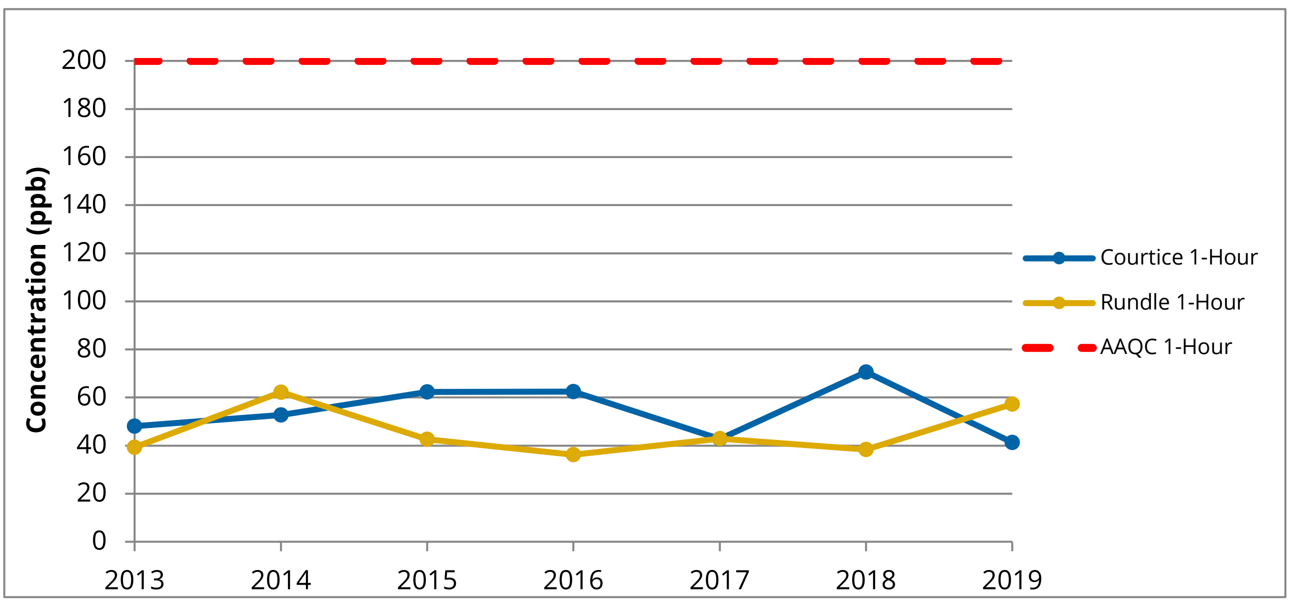


Figure 5. Maximum Measured 24-hour Mean NO_2 Concentrations by Year

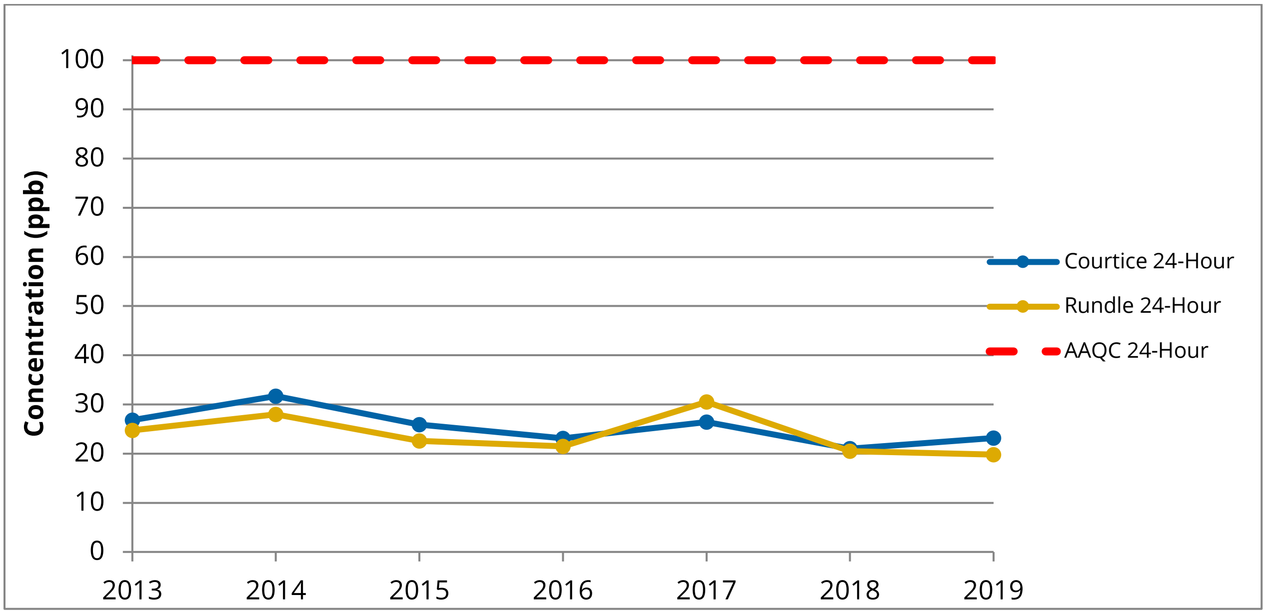
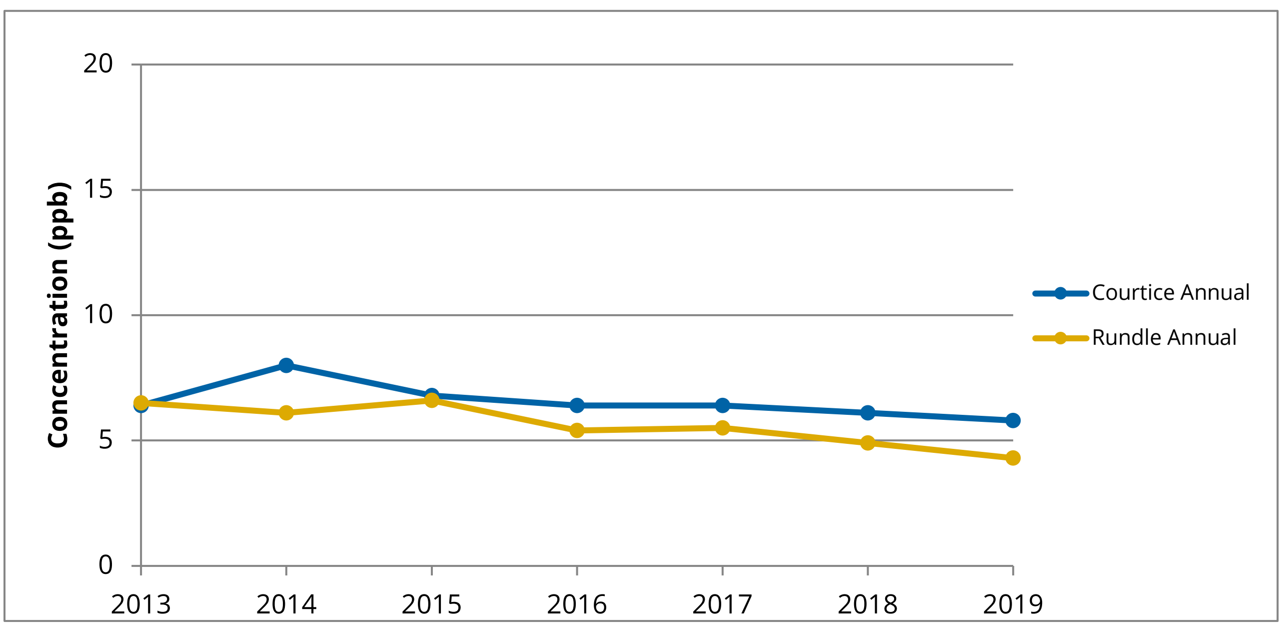


Figure 6. Maximum Measured Annual Mean NO_2 Concentrations by Year



7.1.2 SO_2 Comparison

All continuously monitored SO_2 levels were below the applicable hourly, 24-hour and annual average criteria from 2013 to 2019 for both the Courtice and Rundle Road Monitoring Stations. A summary of annual SO_2 data for both stations is presented in **Table 12** for 2013-2019. It should be noted that no SO_2 CAAQS' apply to 2019 data; however, some statistics are being presented for future use to be applied against 2020 CAAQS'

Table 12. 2013-2019 Comparison of Measured SO_2 Statistics for Courtice and Rundle Road Monitoring Stations

Contaminant	Statistic	Courtice Station							Rundle Road Station						
		2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
SO_2 (ppb)	Annual Arithmetic Mean	1.6	1.5	1	1.7	1.8	2.7	1.9	0	0.7	0.7	0.8	0.6	0.7	0.5
	Annual AAQC	20	20	20	20	20	20	4[3]	20	20	20	20	20	20	4[3]
	Events > Annual AAQC	N/A [2]	0	0	0	0	0	0	N/A	0	0	0	0	0	0
	Maximum 1-hour Mean	56.3	43.3	39	57.1	95.6	96.2	58.2	24.8	34.1	28.3	30.7	61.0	66.0	34.8
	1-hour AAQC	250	250	250	250	250	250	250	250	250	250	250	250	250	250
	Events > 1-hour AAQC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	99^{th} Percentile (Daily Maximum 1-hr Mean)						73.0	50.8						33.4	25.7
	3-Year Average of the Annual 99th Percentile of the Daily Maximum 1-hour Mean Concentrations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1-Hour CAAQS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Events > 1-Hour CAAQS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Maximum Running 24-hour Mean	13.8	15.6	8.8	13	18.7	17.0	18.6	3.9	4.2	8.3	6.2	5.2	8.1	5.6
	24-hour AAQC	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Events > 24-hour AAQC	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: [1] 2013-2018 Q2 data taken from Stantec's 2017 Annual Report (Stantec, 2018) and Stantec's 2018 Q1 (Stantec, 2018a) and Q2 Reports (Stantec, 2018b).
[2] As per Stantec's 2017 Annual Report (Stantec, 2018), the measurement period in 2013 was less than 9 months therefore annual averages are not comparable to the AAQC
[3] MECP comments on the Q4 report called for comparison to the 2020 annual SO_2 AAQC of 4 ppb in the 2019 Annual Report

Annual variations in measured SO_2 data for maximum 1-hour, 24-hour and annual means and their applicable AAQC limits are presented in **Figures 7**, **8** and **9** respectively. The following observations were made from the data plots:

- The maximum measured hourly average SO_2 concentrations at the two stations have generally shown the Courtice Station consistently having higher maximums than Rundle Road and both stations trending the same over the entire timeseries (as seen in **Figure 7**).
- The maximum measured 24-hour average SO_2 concentrations at the two stations have generally shown the Courtice Station consistently having higher maximums than Rundle Road with the exception of 2015 where maximums were generally the same (as seen in **Figure 8**). Measured 24-hour average SO_2 concentrations at both stations were relatively constant for all of the years presented.
- Measured annual average SO_2 concentrations at the Courtice Station have been slightly higher than the Rundle Road Station apart from 2015 where they showed similar levels (as seen in **Figure 9**). Measured annual average SO_2 concentrations at both stations were relatively constant for all of the years presented.
- Measured maximum 1-hour, 24-hour average and annual average SO_2 concentrations have not come close to exceeding the applicable AAQC's over the timeseries.

Figure 7. Maximum Measured 1-hour Mean SO_2 Concentrations by Year

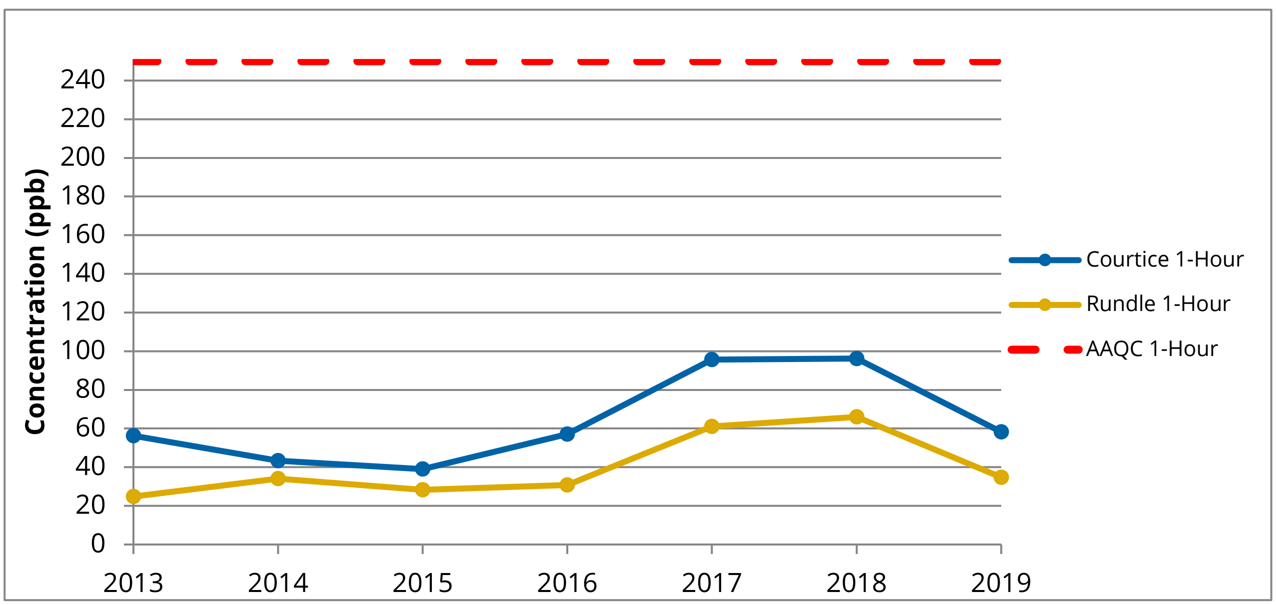


Figure 8. Maximum Measured 24-Hour Mean SO_2 Concentrations by Year

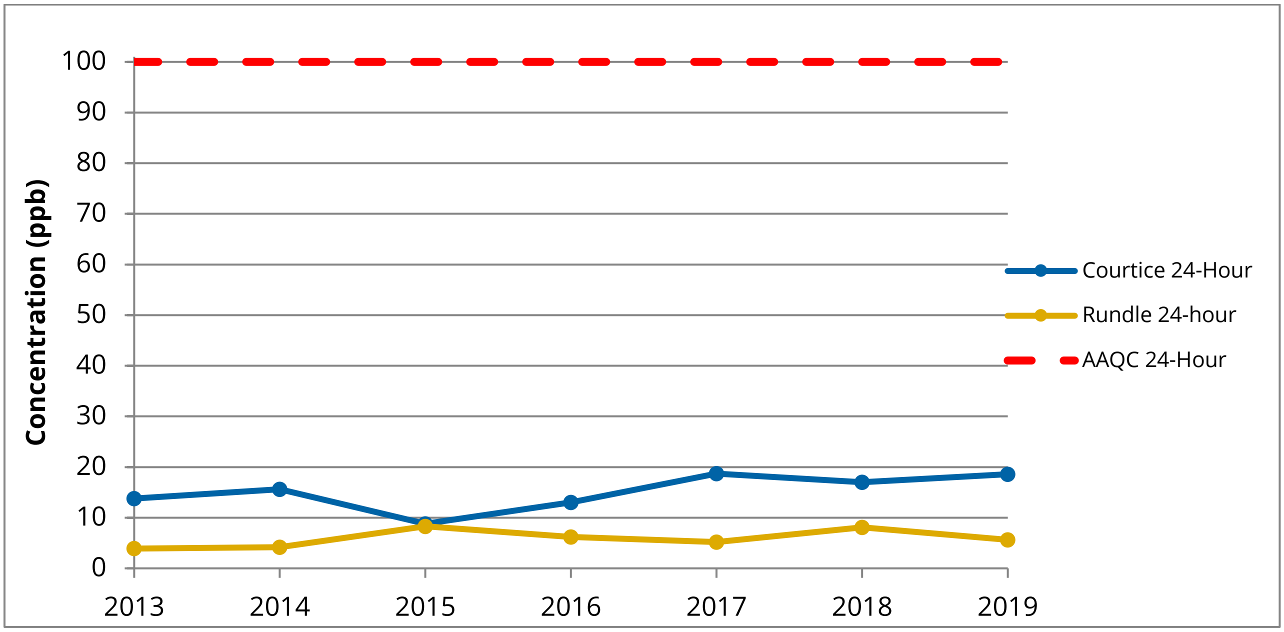
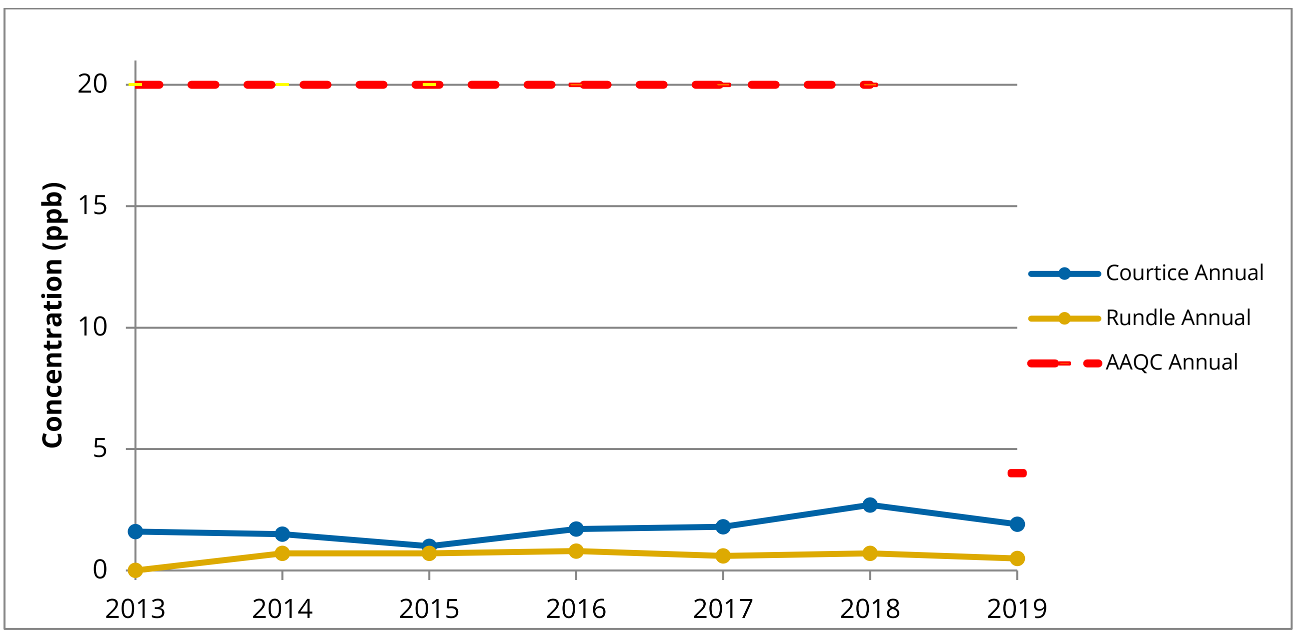


Figure 9. Maximum Measured Annual Mean SO_2 Concentrations by Year



7.1.3 $PM_{2.5}$ Comparison

All continuously monitored $PM_{2.5}$ levels were below the applicable CAAQS' from 2013 to 2019 for both the Courtice and Rundle Road Monitoring Stations. A summary of annual $PM_{2.5}$ data for both stations is presented in **Table 13** for 2013-2019.

Table 13. 2013-2019 Comparison of Measured $PM_{2.5}$ Statistics for Courtice and Rundle Road Monitoring Stations

Contaminant	Statistic	Courtice Station							Rundle Road Station						
		2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
$PM_{2.5}$ (µg/m³)	Annual Arithmetic Mean	8.4	8.6	7.7	6.8	6.4	6.3	6.4	8.4	8.5	9.5	9.6	6.3	6.1	5.7
	3-Year Average of the Annual Arithmetic Mean of all 1-hour Concentrations	N/A	N/A	N/A [2]	7.7	7.0	6.5	6.4	N/A	N/A	N/A [2]	9.2	8.5	7.3	6.0
	Annual CAAQS	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Events > Annual CAAQS	N/A [3]	N/A [3]	N/A [3]	0	0	0	0	N/A [3]	N/A [3]	N/A [3]	0	0	0	0
	Maximum 1-hour Mean						64.8	68.6						68.3	49.0
	Maximum Running 24-hour Mean	27	43.2	59.6	34.7	70.6	34.6	35.7	50.6	41.3	64.7	43.1	35.8	31.4	33.6
	98th Percentile (24-hour Mean)	21.5	22.3	27.3	21.6	19.8	18.7	18.5	21.7	21.1	28.4	32.9	20.3	18.6	17.4
	3-Year Average of the Annual 98th Percentile of the Daily 24-hour Mean Concentrations	N/A	N/A	N/A [2]	23.7	22.9	20.0	19.0	N/A	N/A	N/A [2]	27.5	27.2	23.9	18.8
	24-hour CAAQS	30	30	28	28	28	28	28	30	30	28	28	28	28	28
	Events > 24-hour CAAQS	N/A [3]	N/A [3]	N/A [3]	0	0	0	0	N/A [3]	N/A [3]	N/A [3]	0	0	0	0

Notes: [1] 2013-2018 Q2 data taken from Stantec's 2017 Annual Report (Stantec, 2018) and Stantec's 2018 Q1 (Stantec, 2018a) and Q2 Reports (Stantec, 2018b).
[2] As per Stantec's 2017 Annual Report (Stantec, 2018), the measurement period in 2013 was less than 9 months, therefore the 3-year average for 2013-2015 is not applicable.
[3] As per Stantec's 2017 Annual Report (Stantec, 2018), the measurement period in 2013 was less than 9 months, therefore the 3-year averages for comparison to CAAQS' are not comparable.

One-hour mean $PM_{2.5}$ concentrations were averaged over 3-year consecutive periods and compared to the annual CAAQS, which is presented visually in **Figure 10**. The annual 98th percentiles of the daily 24-Hour mean $PM_{2.5}$ concentrations were averaged over 3-year consecutive periods and compared to the 24-Hour CAAQS, which is presented visually in **Figure 11**. It should be noted that that averaged period from 2013-2015 is not plotted in **Figure 10** or **11** as the measurement period in 2013 was less than 9 months (Stantec, 2018) and does not meet the validity requirements for averaging over the 3-year period. The following observations were made from the data plots:

- The 3-year averaged annual $PM_{2.5}$ concentrations measured at the two stations have generally shown a declining trend in overall averages and the Rundle Road Station has had a slightly higher average as compared to the Courtice Station, with the exception of 2017-2019 where both stations were similar (as seen in **Figure 10**).
- The 3-Year averages of annual 98th percentile 24-Hour $PM_{2.5}$ mean concentrations measured at the two stations have generally shown a declining trend in overall averages and the Rundle Road Station has had a slightly higher average as compared to the Courtice Station, with the exception of 2017-2019 where both stations were similar (as seen in **Figure 11**).
- Measured 3-year averaged 98th percentile 24-hour average values and 3-year averaged annual $PM_{2.5}$ concentrations measured at both the Courtice and Rundle Road Stations were fairly close to the CAAQS limits in the 2014-2016 and 2015-2017 yearly averages with the highest being 92% of the CAAQS, but have since declined to as high as 68% of the CAAQS in the 2017-2019 groupings.

Figure 10. 3-Year Averages of Annual $PM_{2.5}$ Arithmetic Means (of 1-Hour Average Concentrations) by 3-Year Grouping

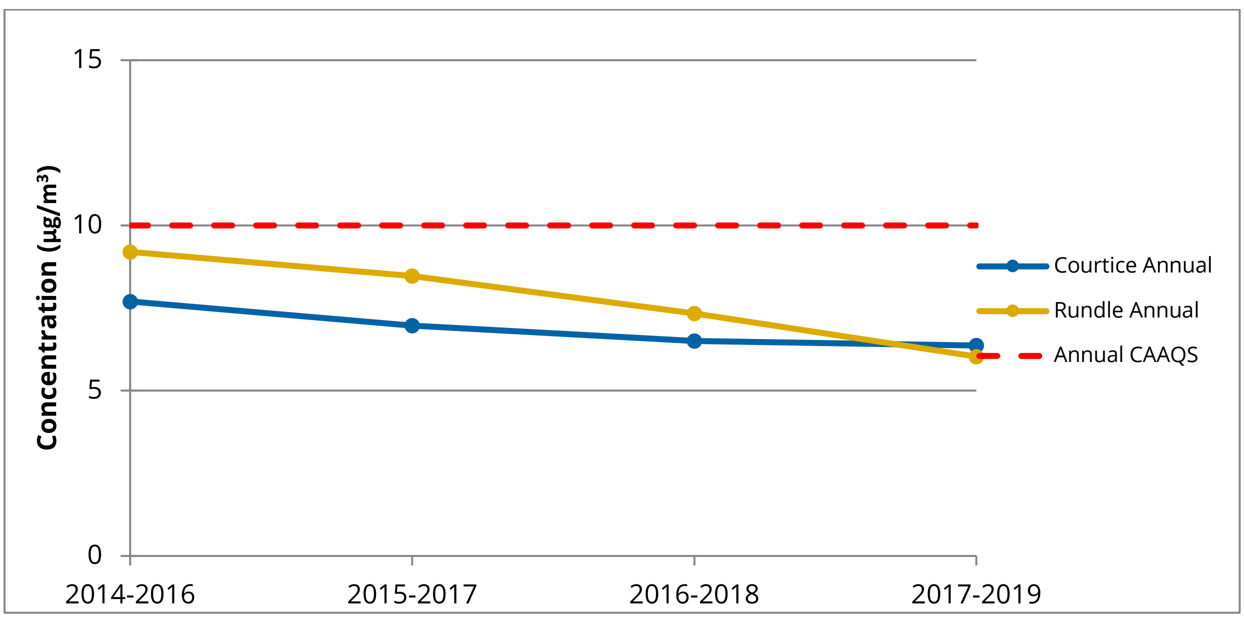
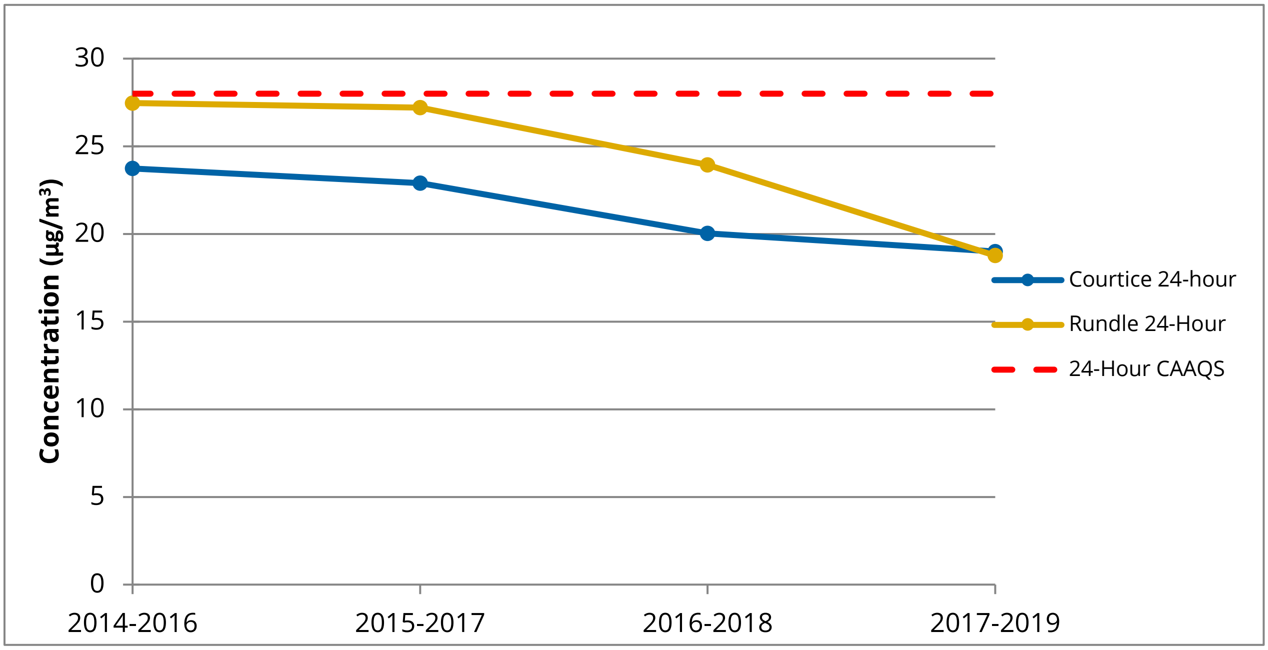


Figure 11. 3-Year Averages of Annual 98th Percentile 24-Hour $PM_{2.5}$ Mean Concentrations by 3-Year Grouping



7.2 TSP and Metals Comparisons

A summary of the maximum measured daily average TSP and Metal concentrations and percentage of the applicable AAQC's/HHRC's from 2013-2014, and 2016-2019 at the Courtice and Rundle Road Monitoring Stations is presented in **Table 14** and **15** respectively. As per Stantec's comment in the 2017 Annual Report, the 2013, 2014 and 2016 data should be reviewed with caution "since the measurement period in 2013 was eight months (April-December), six months (January-June) in 2014, and 11 months (February-December) in 2016, due to the non-continuous monitoring being temporarily discontinued as per the ambient monitoring plan. Caution should be exercised in comparing the data, as the measurement period lengths were different and cover different periods of each year (with different meteorological conditions)" (Stantec, 2018).

There were two (2) TSP exceedances in 2017, four (4) exceedances in 2018, and one (1) exceedance in 2019. No other exceedances of TSP or Metals have occurred at the Courtice or Rundle Road Monitoring Stations from 2013 to 2019.

Table 14. 2013-2019 Comparison of Measured TSP and Metals Concentrations at the Courtice Station

Contaminant	Units	AAQC	HHRA	Maximum Concentration							Percentage of Criteria						
				2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
Particulate (TSP)	µg/m^3	*120*	*120*	62.0	57.0		94.7	59.6	84.7	146.4	51.7%	47.5%		78.9%	49.7%	70.6%	122.0%
Total Mercury (Hg)	µg/m^3	*2*	*2*	3.12E-05	2.15E-05		3.62E-05	3.60E-05	4.19E-05	7.75E-05	0.002%	0.001%		0.002%	0.002%	0.002%	0.004%
Aluminum (Al)	µg/m^3	*4.8*	-	3.34E-01	3.57E-01		6.78E-01	4.49E-01	8.95E-01	1.00E+00	7.0%	7.4%		14.1%	9.4%	18.6%	20.8%
Antimony (Sb)	µg/m^3	*25*	*25*	2.69E-03	3.91E-03		3.67E-03	3.73E-03	7.14E-03	2.55E-03	0.01%	0.02%		0.01%	0.01%	0.03%	0.01%
Arsenic (As)	µg/m^3	*0.3*	*0.3*	3.79E-03	2.35E-03		2.20E-03	4.14E-03	4.29E-03	2.76E-03	1.3%	0.8%		0.7%	1.4%	1.4%	0.9%
Barium (Ba)	µg/m^3	*10*	*10*	1.58E-02	1.90E-02		3.39E-02	2.05E-02	1.89E-02	2.23E-02	0.2%	0.2%		0.3%	0.2%	0.2%	0.2%
Beryllium (Be)	µg/m^3	*0.01*	*0.01*	2.69E-04	3.91E-04		3.67E-04	3.73E-04	1.56E-03	7.19E-05	2.7%	3.9%		3.7%	3.7%	15.6%	0.7%
Bismuth (Bi)	µg/m^3	-	-	1.66E-03	2.35E-03		2.20E-03	2.24E-03	4.29E-03	1.42E-03	-	-		-	-	-	-
Boron (B)	µg/m^3	*120*	-	1.13E-02	5.61E-03		8.50E-03	5.39E-03	1.31E-02	1.39E-02	0.009%	0.005%		0.007%	0.004%	0.011%	0.012%
Cadmium (Cd)	µg/m^3	*0.025*	*0.025*	5.59E-04	1.18E-03		7.34E-04	7.45E-04	1.90E-03	6.95E-04	2.2%	4.7%		2.9%	3.0%	7.6%	2.8%
Chromium (Cr)	µg/m^3	*0.5*	-	3.82E-03	6.29E-03	N/A	7.74E-03	1.03E-02	9.50E-03	2.25E-02	0.8%	1.3%	N/A	1.5%	2.1%	1.9%	4.5%
Cobalt (Co)	µg/m^3	*0.1*	*0.1*	5.59E-04	7.83E-04		7.34E-04	7.45E-04	1.43E-03	6.95E-04	0.6%	0.8%		0.7%	0.7%	1.4%	0.7%
Copper (Cu)	µg/m^3	*50*	-	7.68E-02	5.95E-02		1.27E-01	9.85E-02	4.55E-02	6.10E-02	0.2%	0.1%		0.3%	0.2%	0.1%	0.1%
Iron (Fe)	µg/m^3	*4*	-	9.90E-01	9.26E-01		1.58E+00	1.01E+00	2.53E+00	3.31E+00	24.8%	23.2%		39.5%	25.3%	63.3%	82.8%
Lead (Pb)	µg/m^3	*0.5*	*0.5*	6.47E-03	5.50E-03		7.52E-03	1.09E-02	1.43E-02	1.39E-02	0.3%	0.3%		0.4%	0.5%	0.7%	0.7%
Magnesium (Mg)	µg/m^3	-	-	5.71E-01	4.13E-01		1.14E+00	5.61E-01	1.21E+00	1.25E+00	-	-		-	-	-	-
Manganese (Mn)	µg/m^3	*0.4*	-	3.31E-02	3.08E-02		4.86E-02	5.25E-02	7.25E-02	1.20E-01	8.3%	7.7%		12.2%	13.1%	18.1%	30.1%
Molybdenum (Mo)	µg/m^3	*120*	-	1.65E-03	2.36E-03		3.15E-03	4.44E-03	7.69E-03	2.20E-03	0.001%	0.002%		0.003%	0.004%	0.006%	0.002%
Nickel (Ni)	µg/m^3	*0.2*	-	4.35E-03	2.78E-03		2.40E-03	3.95E-03	3.85E-03	5.35E-03	2.2%	1.4%		1.2%	2.0%	1.9%	2.7%
Phosphorus (P)	µg/m^3	-	-	1.45E-01	1.05E-01		4.60E-01	9.76E-02	1.08E+00	2.02E+00	-	-		-	-	-	-
Selenium (Se)	µg/m^3	*10*	*10*	2.69E-03	3.91E-03		3.67E-03	3.73E-03	7.14E-03	3.48E-03	0.03%	0.04%		0.04%	0.04%	0.07%	0.03%

Contaminant	Units	AAQC	HHRA	Maximum Concentration							Percentage of Criteria						
				2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
Silver (Ag)	µg/m³	*1*	*1*	1.89E-03	1.96E-03		1.83E-03	1.86E-03	3.57E-03	3.48E-04	0.2%	0.2%		0.2%	0.2%	0.4%	0.0%
Strontium (Sr)	µg/m³	*120*	-	1.10E-02	1.34E-02		1.86E-02	1.38E-02	1.73E-02	4.35E-02	0.01%	0.01%		0.02%	0.01%	0.01%	0.04%
Thallium (Tl)	µg/m³	-	-	2.69E-03	3.91E-03		3.67E-03	3.73E-03	7.14E-03	9.81E-05	-	-		-	-	-	-
Tin (Sn)	µg/m³	*10*	*10*	4.79E-03	3.91E-03		3.67E-03	3.73E-03	7.14E-03	2.52E-03	0.05%	0.04%		0.04%	0.04%	0.07%	0.03%
Titanium (Ti)	µg/m³	*120*	-	1.73E-02	2.26E-02		2.82E-02	2.08E-02	3.19E-02	4.31E-02	0.01%	0.02%		0.02%	0.02%	0.03%	0.04%
Uranium (Ur)	µg/m³	*0.3*	-	1.24E-04	1.76E-04		1.65E-04	1.68E-04	3.57E-03	1.11E-04	0.04%	0.06%		0.06%	0.06%	1.19%	0.04%
Vanadium (V)	µg/m³	*2*	*1*	6.50E-02	1.14E-01		9.54E-02	2.46E-01	3.57E-03	2.02E-02	3.3%	5.7%		4.8%	12.3%	0.2%	1.0%
Zinc (Zn)	µg/m³	*120*	-	1.39E-03	1.96E-03		1.83E-03	1.86E-03	1.86E-01	1.66E-01	0.001%	0.002%		0.002%	0.002%	0.155%	0.138%
Zirconium (Zr)	µg/m³	*20*	-	1.92E-03	1.96E-03		1.83E-03	1.86E-03	1.64E-03	2.35E-03	0.010%	0.010%		0.009%	0.009%	0.008%	0.012%

Notes: [1] 2013-2018 Q2 data taken from Stantec's 2017 Annual Report (Stantec, 2018) and Stantec's 2018 Q1 (Stantec, 2018a) and Q2 Reports (Stantec, 2018b).

Table 15. 2013-2019 Comparison of Measured TSP and Metals Concentrations at the Rundle Road Station

Contaminant	Units	AAQC	HHRA	Maximum Concentration							Percentage of Criteria						
				2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
Particulate (TSP)	µg/m³	*120*	*120*	78.0	59.0		97.1	232	203.6	81.7	65.0%	49.2%		80.9%	193.3%	169.7%	68.1%
Total Mercury (Hg)	µg/m³	*2*	*2*	5.14E-05	2.94E-05		2.50E-05	4.80E-05	9.83E-05	6.10E-05	0.003%	0.001%		0.001%	0.002%	0.005%	0.003%
Aluminum (Al)	µg/m³	*4.8*	-	4.54E-01	2.90E-01		7.86E-01	1.08E+00	1.42E+00	6.64E-01	9.5%	6.0%		16.4%	22.5%	29.6%	13.8%
Antimony (Sb)	µg/m³	*25*	*25*	2.86E-03	3.41E-03		3.57E-03	3.69E-03	2.64E-02	4.81E-03	0.01%	0.01%		0.01%	0.01%	0.11%	0.02%
Arsenic (As)	µg/m³	*0.3*	*0.3*	1.76E-03	2.05E-03	N/A	4.72E-03	2.21E-03	2.06E-02	4.79E-03	0.6%	0.7%	N/A	1.6%	0.7%	6.9%	1.6%
Barium (Ba)	µg/m³	*10*	*10*	1.61E-02	1.18E-02		2.37E-02	3.20E-02	2.58E-02	2.67E-02	0.2%	0.1%		0.2%	0.3%	0.3%	0.3%
Beryllium (Be)	µg/m³	*0.01*	*0.01*	2.86E-04	3.41E-04		3.57E-04	3.69E-04	1.81E-03	3.27E-05	2.9%	3.4%		3.6%	3.7%	18.1%	0.3%
Bismuth (Bi)	µg/m³	-	-	1.76E-03	2.05E-03		2.14E-03	2.21E-03	2.63E-03	1.46E-03	-	-		-	-	-	-
Boron (B)	µg/m³	*120*	-	1.45E-02	4.43E-03		7.45E-03	6.12E-03	1.33E-02	1.31E-02	0.012%	0.004%		0.006%	0.005%	0.011%	0.011%

Contaminant	Units	AAQC	HHRA	Maximum Concentration							Percentage of Criteria						
				2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
Cadmium (Cd)	$\mu g/m^3$	*0.025*	*0.025*	8.99E-04	6.83E-04		7.13E-04	7.38E-04	4.73E-03	6.54E-04	3.6%	2.7%		2.9%	3.0%	18.9%	2.6%
Chromium (Cr)	$\mu g/m^3$	*0.5*	-	1.78E-02	4.75E-03		7.93E-03	1.75E-02	8.20E-03	8.54E-03	3.6%	1.0%		1.6%	3.5%	1.6%	1.7%
Cobalt (Co)	$\mu g/m^3$	*0.1*	*0.1*	5.95E-04	6.83E-04		2.78E-03	7.38E-04	8.77E-04	6.54E-04	0.6%	0.7%		2.8%	0.7%	0.9%	0.7%
Copper (Cu)	$\mu g/m^3$	*50*	-	2.36E-01	1.93E-01		1.16E-01	2.29E-01	6.15E-02	8.54E-02	0.5%	0.4%		0.2%	0.5%	0.1%	0.2%
Iron (Fe)	$\mu g/m^3$	*4*	-	1.31E+00	9.30E-01		1.83E+00	2.26E+00	2.97E+00	1.25E+00	32.8%	23.3%		45.8%	56.5%	74.1%	31.2%
Lead (Pb)	$\mu g/m^3$	*0.5*	*0.5*	6.80E-03	7.34E-03		7.25E-03	1.30E-02	3.96E-01	5.81E-03	0.3%	0.4%		0.4%	0.7%	19.8%	0.3%
Magnesium (Mg)	$\mu g/m^3$	-	-	6.76E-01	2.97E-01		1.10E+00	1.76E+00	2.10E+00	9.90E-01	-	-		-	-	-	-
Manganese (Mn)	$\mu g/m^3$	*0.4*	-	1.02E-01	2.60E-02		6.56E-02	7.74E-02	1.13E-01	5.56E-02	25.5%	6.5%		16.4%	19.4%	28.1%	13.9%
Molybdenum (Mo)	$\mu g/m^3$	*120*	-	3.79E-03	2.76E-03		6.24E-03	3.13E-02	6.26E-03	2.20E-03	0.003%	0.002%		0.005%	0.026%	0.005%	0.002%
Nickel (Ni)	$\mu g/m^3$	*0.2*	-	4.67E-03	4.58E-03		1.94E-02	3.62E-03	3.26E-03	2.42E-03	2.3%	2.3%		9.7%	1.8%	1.6%	1.2%
Phosphorus (P)	$\mu g/m^3$	-	-	1.59E-01	1.85E-01		1.03E-01	1.45E-01	1.75E+00	2.15E+00	-	-		-	-	-	-
Selenium (Se)	$\mu g/m^3$	*10*	*10*	2.86E-03	3.41E-03		3.57E-03	3.69E-03	4.39E-03	3.27E-03	0.03%	0.03%		0.04%	0.04%	0.04%	0.03%
Silver (Ag)	$\mu g/m^3$	*1*	*1*	2.33E-03	1.71E-03		1.78E-03	1.85E-03	1.06E-02	3.27E-04	0.2%	0.2%		0.2%	0.2%	1.1%	0.0%
Strontium (Sr)	$\mu g/m^3$	*120*	-	1.95E-02	1.09E-02		2.11E-02	7.54E-02	5.82E-02	3.13E-02	0.02%	0.01%		0.02%	0.06%	0.05%	0.03%
Thallium (Tl)	$\mu g/m^3$	-	-	2.86E-03	3.41E-03		3.57E-03	3.69E-03	4.39E-03	6.36E-05	-	-		-	-	-	-
Tin (Sn)	$\mu g/m^3$	*10*	*10*	2.86E-03	3.41E-03		4.12E-02	3.69E-03	3.09E-02	4.30E-03	0.03%	0.03%		0.41%	0.04%	0.31%	0.04%
Titanium (Ti)	$\mu g/m^3$	*120*	-	2.40E-02	1.71E-02		3.50E-02	6.46E-02	5.57E-02	2.52E-02	0.02%	0.01%		0.03%	0.05%	0.05%	0.02%
Uranium (Ur)	$\mu g/m^3$	*0.3*	-	1.32E-04	1.54E-04		1.60E-04	1.66E-04	1.97E-04	3.27E-05	0.04%	0.05%		0.05%	0.06%	0.07%	0.01%
Vanadium (V)	$\mu g/m^3$	*2*	*1*	7.43E-02	1.24E-01		6.66E-02	2.95E-01	1.88E-02	3.46E-02	3.7%	6.2%		3.3%	14.8%	0.9%	1.7%
Zinc (Zn)	$\mu g/m^3$	*120*	-	1.48E-03	1.71E-03		1.78E-03	1.85E-03	1.12E-01	5.87E-02	0.001%	0.001%		0.001%	0.002%	0.093%	0.049%
Zirconium (Zr)	$\mu g/m^3$	*20*	-	3.22E-03	1.71E-03		3.14E-03	3.43E-03	2.19E-03	6.54E-04	0.016%	0.009%		0.016%	0.017%	0.011%	0.003%

Notes: [1] 2013-2018 Q2 data taken from Stantec's 2017 Annual Report (Stantec, 2018) and Stantec's 2018 Q1 (Stantec, 2018a) and Q2 Reports (Stantec, 2018b)

7.3 PAH Comparisons

A summary of the maximum measured daily average PAH concentrations and percentage of the applicable AAQC's from 2013-2014, and 2016-2019 for both Courtice and Rundle Road Monitoring Stations is presented in **Table 16** and **17** respectively. As per Stantec's comment in the 2017 Annual Report, the 2013, 2014 and 2016 data should be reviewed with caution "since the measurement periods are not the same in each year, the data are not directly comparable" (Stantec, 2018).

The maximum measured PAH concentrations, with the exception of Benzo(a)Pyrene, were all well below applicable AAQC's from 2013-2019. There have been twenty (20) exceedances of Benzo(a)Pyrene above the applicable AAQC from 2013-2019 at the Courtice Monitoring Station and thirty-one (31) exceedances of Benzo(a)Pyrene above the applicable AAQC from 2013-2019 at the Rundle Road Monitoring Station.

Table 16. 2013-2019 Comparison of Measured PAH Concentrations at the Courtice Station

Contaminant	Units	*MECP Criteria*	*HHRA*	Maximum Concentration							Percentage of Criteria						
				2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
1-Methylnaphthalene	ng/m^3	*12000*	-	27.2	8.2		24.0	19.7	21.8	14.6	0.2%	0.1%		0.2%	0.2%	0.2%	0.1%
2-Methylnaphthalene	ng/m^3	*10000*	-	54.3	13.9		50.4	33.5	39.9	23.5	0.5%	0.1%		0.5%	0.3%	0.4%	0.2%
Acenaphthene	ng/m^3	-	-	38.7	11.8		29.6	17.0	20.2	10.1	-	-		-	-	-	-
Acenaphthylene	ng/m^3	*3500*	-	1.1	0.4		0.3	0.8	0.6	0.5	0.03%	0.01%		0.01%	0.02%	0.02%	0.01%
Anthracene	ng/m^3	*200*	-	13.1	1.1		0.5	0.6	0.8	0.4	6.6%	0.6%		0.3%	0.3%	0.4%	0.2%
Benzo(a)Anthracene	ng/m^3	-	-	0.2	0.2		0.1	0.1	0.1	0.1	-	-		-	-	-	-
Benzo(a)fluorene	ng/m^3	-	-	0.3	0.3		0.2	0.2	0.2	0.1	-	-		-	-	-	-
Benzo(a)Pyrene	ng/m^3	*0.05[2]* *5[3]* *1.1[4]*	*1*	0.1	0.1		0.1	0.1	0.2	0.1	129.6%	264%		207%	176%	361%	197%
Benzo(b)Fluoranthene	ng/m^3	-	-	0.4	0.6		2.5	0.1	0.3	0.1	-	-		-	-	-	-
Benzo(b)fluorene	ng/m^3	-	-	0.3	0.3	N/A	0.2	0.2	0.2	0.1	-	-	N/A	-	-	-	-
Benzo(e)Pyrene	ng/m^3	-	-	0.3	0.3		0.2	0.2	0.2	0.1	-	-		-	-	-	-
Benzo(g,h,i)Perylene	ng/m^3	-	-	0.4	0.3		2.5	0.1	0.1	0.1	-	-		-	-	-	-
Benzo(k)Fluoranthene	ng/m^3	-	-	0.4	0.3		2.5	0.1	0.1	0.1	-	-		-	-	-	-
Biphenyl	ng/m^3	-	-	14.9	4.5		11.1	9.7	10.1	5.0	-	-		-	-	-	-
Chrysene	ng/m^3	-	-	0.2	0.5		0.2	0.1	0.3	0.2	-	-		-	-	-	-
Dibenzo(a,h)Anthracene	ng/m^3	-	-	0.3	0.5		2.8	0.1	0.1	0.03	-	-		-	-	-	-
Fluoranthene	ng/m^3	-	-	4.5	4.0		3.2	2.6	3.3	1.2	-	-		-	-	-	-
Fluorene	ng/m^3	-	-	-	-		-	-	-	2.9	-	-		-	-	-	-
Indeno(1,2,3-cd)Pyrene	ng/m^3	-	-	0.4	0.5		2.8	0.1	0.1	0.1	-	-		-	-	-	-
Naphthalene	ng/m^3	*22500*	*22500*	143.0	38.7		60.9	92.2	77.8	48.1	0.6%	0.2%		0.3%	0.4%	0.3%	0.2%

Contaminant	Units	*MECP Criteria*	*HHRA*	Maximum Concentration							Percentage of Criteria						
				2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
o-Terphenyl	ng/m³	-	-	0.3	0.3		0.2	0.2	0.2	0.02	-	-		-	-	-	-
Perylene	ng/m³	-	-	0.3	0.3		0.2	0.2	0.2	0.02	-	-		-	-	-	-
Phenanthrene	ng/m³	-	-	33.9	14.2		23.1	16.4	21.6	8.7	-	-		-	-	-	-
Pyrene	ng/m³	-	-	1.7	2.5		1.3	1.2	1.4	0.6	-	-		-	-	-	-
Tetralin	ng/m³	-	-	5.8	25.3		3.8	4.9	4.6	7.8	-	-		-	-	-	-
Total PAH[5]	ng/m³	-	-	327.0	95.0		208.7	200.0	203.6	117.9	-	-		-	-	-	-

Notes: [1] 2013-2018 Q2 data taken from Stantec's 2017 Annual Report (Stantec, 2018) and Stantec's 2018 Q1 (Stantec, 2018a) and Q2 Reports (Stantec, 2018b)
[2] Ontario AAQC. The Standard for benzo(a)Pyrene (B(a)P) is for B(a)P as a surrogate for PAHs
[3] O.Reg. 419/05 Schedule 6 Upper Risk Thresholds
[4] O.Reg. 419/05 24 Hour Guideline
[5] The reported total PAH is the sum of all analysed PAH species

Table 17. 2013-2019 Comparison of Measured PAH Concentrations at the Rundle Road Station

Contaminant	Units	*MECP Criteria*	*HHRA*	Maximum Concentration							Percentage of Criteria						
				2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
1-Methylnaphthalene	ng/m³	*12000*	-	26.6	10.8	N/A	238.2	29.4	26.6	16.1	0.2%	0.1%	N/A	2.0%	0.2%	0.2%	0.1%
2-Methylnaphthalene	ng/m³	*10000*	-	45.4	18.7		502.5	69.2	54.1	29.4	0.5%	0.2%		5.0%	0.7%	0.5%	0.3%
Acenaphthene	ng/m³	-	-	18.9	8.1		303.2	44.1	40.4	18.0	-	-		-	-	-	-
Acenaphthylene	ng/m³	*3500*	-	1.6	2.0		3.3	1.2	0.6	0.6	0.1%	0.1%		0.1%		0.02%	0.02%
Anthracene	ng/m³	*200*	-	1.5	0.7		7.5	3.1	2.6	1.9	0.8%	0.4%		3.8%		1.3%	0.9%
Benzo(a)Anthracene	ng/m³	-	-	0.5	0.2		0.2	0.1	0.1	0.1	-	-		-	-		
Benzo(a)fluorene	ng/m³	-	-	0.6	0.3		0.4	0.4	0.3	0.1	-	-					
Benzo(a)Pyrene	ng/m³	*0.05[2]* *5[3]* *1.1[4]*	*1*	0.4	0.3		0.2	0.2	0.1	0.1	826%	576%		415%	316%	278%	221%

Contaminant	Units	*MECP Criteria*	*HHRA*	Maximum Concentration							Percentage of Criteria						
				2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019	2013 [1]	2014 [1]	2015 [1]	2016 [1]	2017 [1]	2018[1]	2019
Benzo(b)Fluoranthene	ng/m³	-	-	1.0	0.7		0.5	0.4	0.1	0.2	-	-		-	-	-	-
Benzo(b)fluorene	ng/m³	-	-	0.5	0.3		0.2	0.3	0.3	0.1	-	-		-	-	-	-
Benzo(e)Pyrene	ng/m³	-	-	0.5	0.3		0.2	0.3	0.3	0.1	-	-		-	-	-	-
Benzo(g,h,i)Perylene	ng/m³	-	-	0.6	0.3		0.1	0.1	0.1	0.1	-	-		-	-	-	-
Benzo(k)Fluoranthene	ng/m³	-	-	0.3	0.2		0.1	0.1	0.1	0.1	-	-		-	-	-	-
Biphenyl	ng/m³	-	-	7.4	5.8		125.9	14.2	13.2	5.5	-	-		-	-	-	-
Chrysene	ng/m³	-	-	0.9	0.7		0.4	0.1	0.2	0.2	-	-		-	-	-	-
Dibenzo(a,h)Anthracene	ng/m³	-	-	0.2	0.2		0.1	0.1	0.1	0.03	-	-		-	-	-	-
Fluoranthene	ng/m³	-	-	7.7	3.5		14.7	13.9	13.5	4.7	-	-		-	-	-	-
Fluorene	ng/m³	-	-	-	-		-	-	-	6.9	-	-		-	-	-	-
Indeno(1,2,3-cd)Pyrene	ng/m³	-	-	0.5	0.3		0.2	0.1	0.1	0.1	-	-		-	-	-	-
Naphthalene	ng/m³	*22500*	*22500*	94.1	92.6		294.6	85.4	74.2	53.7	0.4%	0.4%		1.3%	0.4%	0.3%	0.2%
o-Terphenyl	ng/m³	-	-	0.5	0.3		0.2	0.3	0.3	0.02	-	-		-	-	-	-
Perylene	ng/m³	-	-	0.5	0.3		0.2	0.3	0.3	0.02	-	-		-	-	-	-
Phenanthrene	ng/m³	-	-	29.4	13.0		209.7	69.8	58.1	24.0	-	-		-	-	-	-
Pyrene	ng/m³	-	-	3.2	1.9		6.6	5.6	5.4	2.0	-	-		-	-	-	-
Tetralin	ng/m³	-	-	5.1	4.0		4.4	3.8	7.7	36.0	-	-		-	-	-	-

Notes: [1] 2013-2018 Q2 data taken from Stantec's 2017 Annual Report (Stantec, 2018) and Stantec's 2018 Q1 (Stantec, 2018a) and Q2 Reports (Stantec, 2018b)
[2] Ontario AAQC. The Standard for benzo(a)Pyrene (B(a)P) is for B(a)P as a surrogate for PAHs
[3] O.Reg. 419/05 Schedule 6 Upper Risk Thresholds
[4] O.Reg. 419/05 24 Hour Guideline
[5] The reported total PAH is the sum of all analysed PAH species

7.4 D&F Comparisons

The maximum measured ambient toxic equivalent D&F concentrations from 2013 – 2019 and their specific measurement period for both Courtice and Rundle Road Monitoring Stations is presented in **Table 18**. As per Stantec's comment in the 2017 Annual Report, the 2013-2016 data should be reviewed with caution "as the measurement periods were different and cover different periods of each year (with different meteorological conditions). Only the 2017 measurements encompassed a full year as previous years sampling were dependent on the star-up date of the DYEC" (Stantec, 2018).

There was one (1) exceedance of the maximum measured toxic equivalent D&F concentration AAQC at the Courtice Monitoring Station in 2018, but none in 2013-2017 or 2019. The maximum measured toxic equivalent D&F concentrations at the Rundle Road Station were all below the applicable AAQC from 2013-2019.

Table 18. 2013-2019 Comparison of Maximum Measured D&F Concentrations at the Courtice and Rundle Road Stations

Year	Sampling Period Throughout Year	Courtice Station		Rundle Road Station	
		Maximum Concentration (pg TEQ/m³)	No. of Exceedances	Maximum Concentration (pg TEQ/m³)	No. of Exceedances
2013 [1]	May - December	0.036	0	0.029	0
2014 [1]	January - June	0.038	0	0.065	0
2015 [1]	October - December	0.017	0	0.021	0
2016 [1]	February - December	0.044	0	0.026	0
2017 [1]	January – December	0.052	0	0.065	0
2018 [1]	January - December	0.109	1	0.091	0
2019	January - December	0.012	0	0.025	0

Notes: [1] 2013-2018 Q2 data taken from Stantec's 2017 Annual Report (Stantec, 2018) and Stantec's 2018 Q1 (Stantec, 2018a) and Q2 Reports (Stantec, 2018b)

8 CONCLUSIONS

The ambient air monitoring program at the DYEC for 2019 had one (1) TSP and four (4) Benzo(a)pyrene daily average concentrations above the applicable AAQC at the Courtice and Rundle Road Monitoring Stations.

Throughout the 2019 year, there were a few minor issues with equipment failures and malfunctions. These were addressed as soon as they were identified, and preventive actions were put in place to prevent reoccurrences.

Data recovery was 90% or higher at each station for all contaminants, which exceeds the MECP's requirement of 75% of collected readings to be considered valid. The overall data recovery was 98.1% for the Courtice Monitoring Station and was 96.8% for the Rundle Road Monitoring Station.

9 REFERENCES

1. Jacques Whitford, (2009). Final Environmental Assessment, December 4, 2009.

2. Stantec Consulting Ltd., (2012). Ambient Air Quality Monitoring Plan, Durham York Residual Waste Study, May 8, 2012.

3. Stantec Consulting Ltd., (2018). 2017 Annual Ambient Air Quality Monitoring Report for the Durham York Energy Centre.

4. Stantec Consulting Ltd., (2018a). Quarterly Ambient Air Quality Monitoring Report for the Durham York Energy Centre – January to March 2018.

5. Stantec Consulting Ltd., (2018b). Quarterly Ambient Air Quality Monitoring Report for the Durham York Energy Centre – April to June 2018.

APPENDIX A

EPA Sampling Schedule 2019

Important Dates

Notes

3-Day schedule is shown in orange, green, and purple
6-Day schedule is shown in green and purple
12-Day schedule is shown in purple

January

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

February

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28		

March

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

April

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

May

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

June

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

July

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

August

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

September

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

October

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

November

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

December

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				