Technical Memorandum

2017-2018 Monitoring Survey in the Vicinity of St. Marys Cement: 2nd Interim Report

Ontario Ministry of the Environment, Conservation and Parks

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Introduction

This study was initiated in response to a request from the London District Office, Ontario Ministry of the Environment, Conservation and Parks, to measure the ambient concentrations of sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and coarse particulate matter (PM_{10}) in the vicinity of St. Marys Cement over a period of at least one year. The purpose of this study was to determine if St. Marys Cement contributes significantly to concentrations of SO_2, NO_2, and PM_{10} in air which can have adverse effects on human health and the environment. The concentrations of these pollutants were compared to Ontario's Ambient Air Quality Criteria (AAQC) and data from nearby fixed ministry Air Quality Health Index (AQHI) air monitoring stations (London, Brantford, Hamilton Mountain and Windsor Downtown) to provide context to the results.

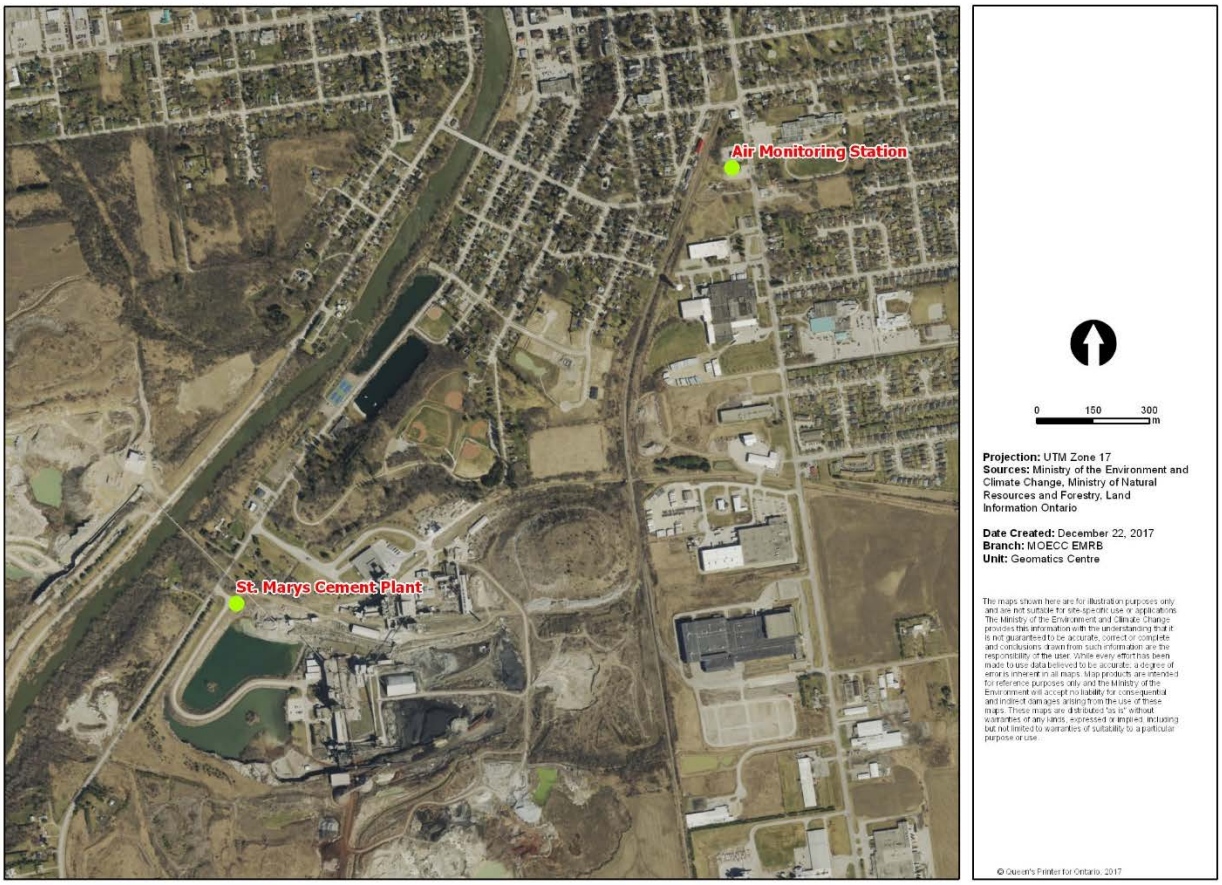
For this study, the Ministry's Terrestrial Assessment and Field Services Unit deployed a portable AirPointer® air monitoring station (herein referred to as St. Marys air monitoring station) at the St. Marys Fire Department, which is located north east of St. Marys Cement in a residential area of St. Marys as depicted in Figure 1. The St. Marys air monitoring station, located in an area predominantly downwind from the facility, was outfitted with instruments that measure SO_2, NO_2, and PM_{10} along with an anemometer for local wind measurements.

Reporting from the St. Marys air monitoring station began on July 11, 2017. The first interim report, published in January 2018, summarized data collected up to October 11, 2017. This second interim report summarizes nine months of data collected between October 1, 2017 and June 30, 2018.

Monitoring Results from October 1, 2017 to June 30, 2018

Meteorological parameters were measured concurrently with the SO_2, NO_2, and PM_{10} measurements to assist in determining the potential source(s) of emissions. The meteorological sensor is integrated with the AirPointer® at the St. Marys air monitoring station using a 2.5 metre (m) high tower. This height conforms to acceptable siting requirements for tripod-mounted or temporary wind sensors (Operations Manual for Air Quality Monitoring in Ontario, PIBS 6687e); however these types of sensors are more subject to influence from surrounding topography and can thus be more representative of a microclimate. There was good correlation with regional wind direction when the measurements were compared to other permanent meteorological towers in the area. As expected with a 2.5m tower, wind speed measurements collected at the St. Marys air monitoring station were lower than measurements collected by the permanent 10m regional meteorological towers. To visually assess potential emission sources, pollution rose diagrams that indicate the frequency of given concentration levels of a pollutant as a function of wind direction are included in this report.

Figure 1: Location of the St. Marys Portable Air Monitoring Station and St. Marys Cement



Sulphur Dioxide (SO_2)

Continuous measurements of SO_2 were acquired from three ambient air monitoring stations during the study period – St. Marys, Windsor Downtown and Hamilton Mountain. Maximum 1-hour SO_2 concentrations of 113 parts per billion (ppb), 42 ppb and 27 ppb were reported for Hamilton Mountain, St. Marys and Windsor Downtown, respectively. During this study period, there were no exceedances of the then provincial 1-hour SO_2 Ambient Air Quality Criteria (AAQC) of 250 ppb which was in effect until March 19, 2018. As of March 20, 2018, the updated 1-hour SO_2 AAQC of 40 ppb took effect. For informational purposes, Table 1 compares the SO_2 data to both the old and updated 1-hour AAQC.

Both St. Marys and Hamilton Mountain recorded only one instance above 40 ppb prior to the updated SO_2 AAQC taking effect. Hamilton Mountain experienced 17 occasions above 40 ppb after the updated SO_2 AAQC took effect, whereas there were no additional instances above 40 ppb at St. Marys.

Table 1: SO_2 Concentrations Summary

Station Location	1h Maximum (ppb)	No. of Hours Above 250 ppb AAQC[1]	No. of Hours Above 40 ppb AAQC[2]	Average (ppb)
St. Marys	42	0	1[a]	0.9
Windsor Downtown	27	0	0	1.0
Hamilton Mountain	113	0	18[b]	2.4

Notes:

St. Marys data are presented in **bold** font.

[1] The Ministry's 1h SO_2 AAQC of 250 ppb was in effect prior to March 20, 2018.

[2] The Ministry's 1h SO_2 AAQC of 40 ppb was in effect as of March 20, 2018.

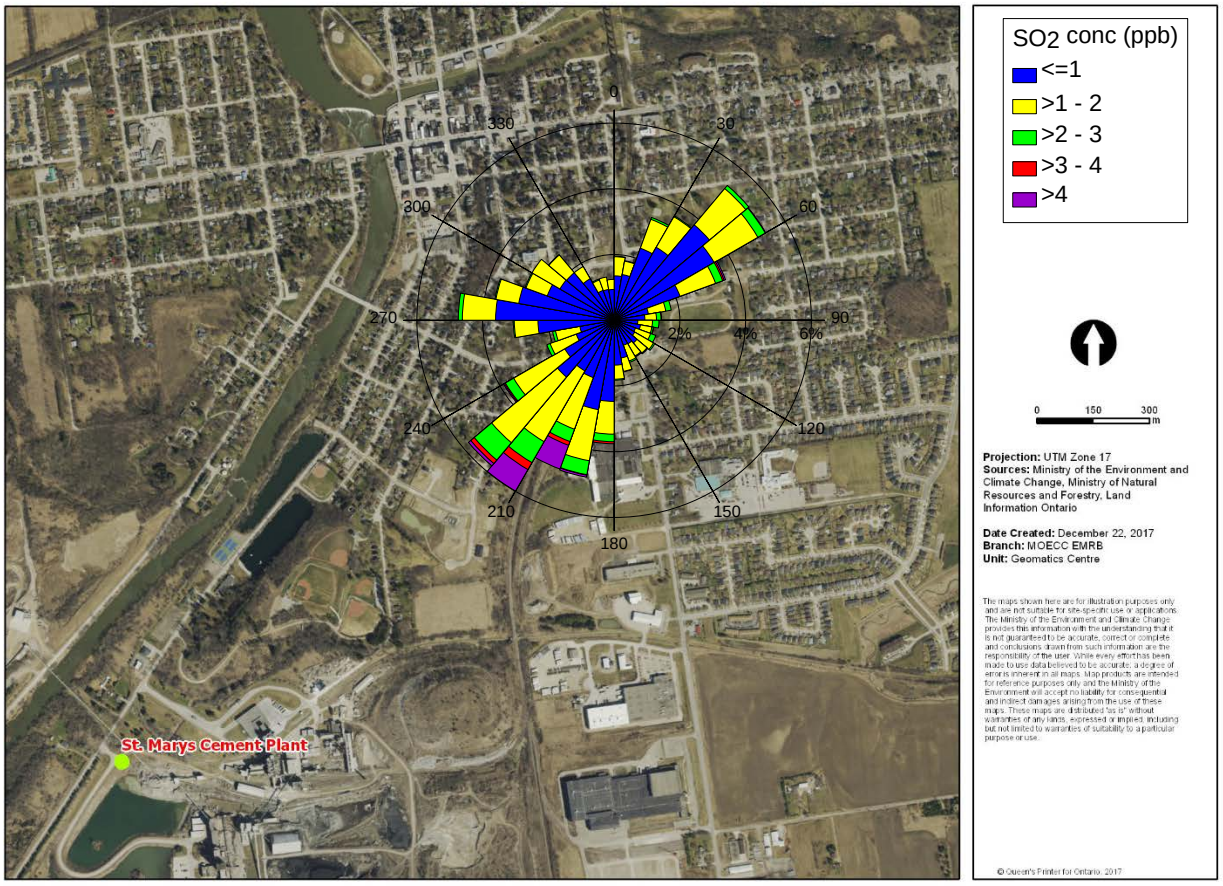
[a] This instance occurred on November 21 2017, when the old SO_2 AAQC of 250 ppb was in effect.

[b] One instance occurred on December 17 2017, when the old SO_2 AAQC of 250 ppb was in effect. The remaining 17 exceedances occurred when the updated SO_2 AAQC of 40 ppb was in effect.

The average SO_2 concentration at St. Marys, 0.9 ppb, is comparable to the SO_2 average of 1.0 ppb reported for the Windsor Downtown AQHI station. The St. Marys station average SO_2 concentration was 1.5 ppb less than the average SO_2 concentration of 2.4 ppb measured at the Hamilton Mountain AQHI air monitoring station. Although the Ministry's AQHI air monitoring stations are generally representative of regional air quality which is less influenced by local and industrial sources of air contaminants, Windsor Downtown does receive some influence from nearby heavy industry (e.g. Zug Island) and vehicular traffic on the Ambassador Bridge. Similarly, Hamilton Mountain, located away from the industrial area of the city, is still influenced by local sources including iron and steel making facilities which are known sources of SO_2. St. Marys Cement's Emission Summary and Dispersion Modelling (ESDM) report confirms that the facility is an emitter of SO_2. These data suggests that St. Marys Cement is a likely source of SO_2 in the area surrounding the Ministry's St. Marys air monitoring station.

Figure 2 shows the SO_2 pollution rose during the study period at St. Marys. The majority of hourly SO_2 concentrations measured at St. Marys were less than 3 ppb. Higher concentrations were generally recorded during periods with southwesterly winds coming from the direction of St. Marys Cement.

Figure 2: SO_2 Pollution Rose at St. Marys during the Study Period



Nitrogen Dioxide (NO_2)

Continuous measurements of NO_2 were acquired from five ministry AQHI air monitoring stations during the study period – St. Marys, Windsor Downtown, London, Brantford and Hamilton Mountain. Table 2 provides a summary of NO_2 concentrations over the study period. Maximum 1-hour NO_2 concentrations ranged from 37 ppb recorded at Brantford to 57 ppb at Hamilton Mountain; the maximum 1-hour NO_2 concentration at St. Marys was 47 ppb. During this study period, there were no exceedances of the provincial 1-hour NO_2 AAQC of 200 ppb.

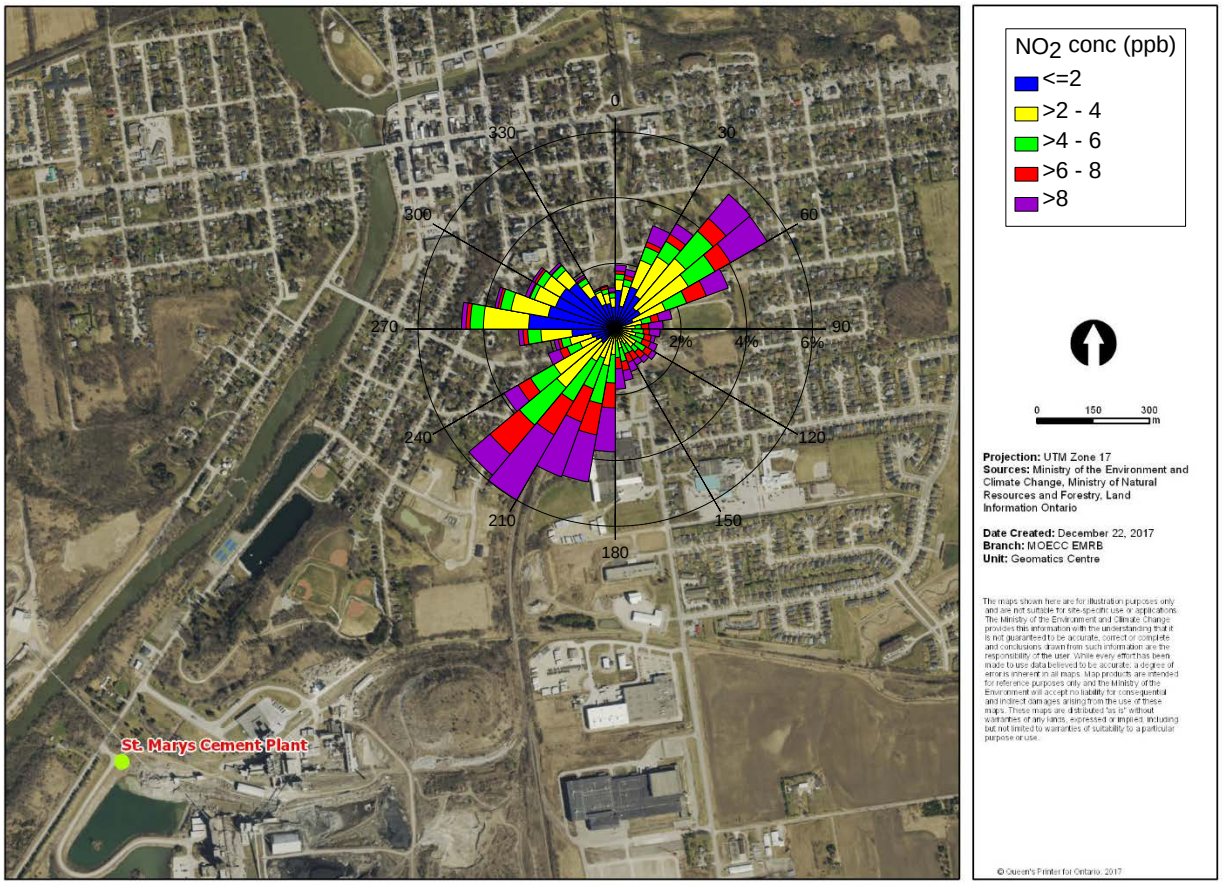
Table 2: NO_2 Concentrations Summary

Station Location	1h Maximum (ppb)	No. of Hours Above 200 ppb AAQC	Average (ppb)
St. Marys	**47**	**0**	**5**
Windsor Downtown	48	0	12
London	39	0	6
Brantford	37	0	6
Hamilton Mountain	57	0	9

Note:
St. Marys data are presented in **bold** font.

The average NO_2 concentration at St. Marys, 5 ppb, was similar to the averages recorded at London and Brantford but lower than the stations that are influenced by heavy industry and/or significant contributions from vehicular traffic such as Windsor and Hamilton. Figure 3 shows the NO_2 pollution rose during the study period at St. Marys. The pollution rose indicates that multiple nitrogen oxides (NOx) sources, which are measured as NO_2, are impacting the St. Marys air monitoring station. St. Marys Cement's ESDM report confirms that the facility emits NOx; however, there are many sources in urban and industrial environments that generate NOx. Therefore, other potential sources of NOx exist between St. Marys Cement and the St. Marys air monitoring station including some industrial facilities located on James St. South and even vehicular traffic. Nonetheless, St. Marys Cement is likely a contributing source of NOx in the vicinity of the air monitoring station.

Figure 3: NO_2 Pollution Rose at St. Marys during the Study Period



Particulate Matter (PM_{10})

The Ministry's portable AirPointer® air monitoring station in St. Marys was outfitted with a PM_{10} size selective inlet which measures particulate matter with an aerodynamic diameter of less than 10 micrometres (µm). Continuous measurements of PM_{10} were acquired from the St. Marys location over the study period, but PM_{10} was not monitored at other ambient air monitoring stations. The maximum 24-hour PM_{10} average concentration was 46 micrograms per cubic metre (µg/m^3). During this study period, there were no exceedances of the provincial 24-hour PM_{10} AAQC of 50 µg/m^3. The average PM_{10} concentration at the St. Marys location was 14 µg/m^3. Table 3 provides a summary of PM_{10} concentrations over the study period.

Table 3: PM_{10} Concentrations Summary

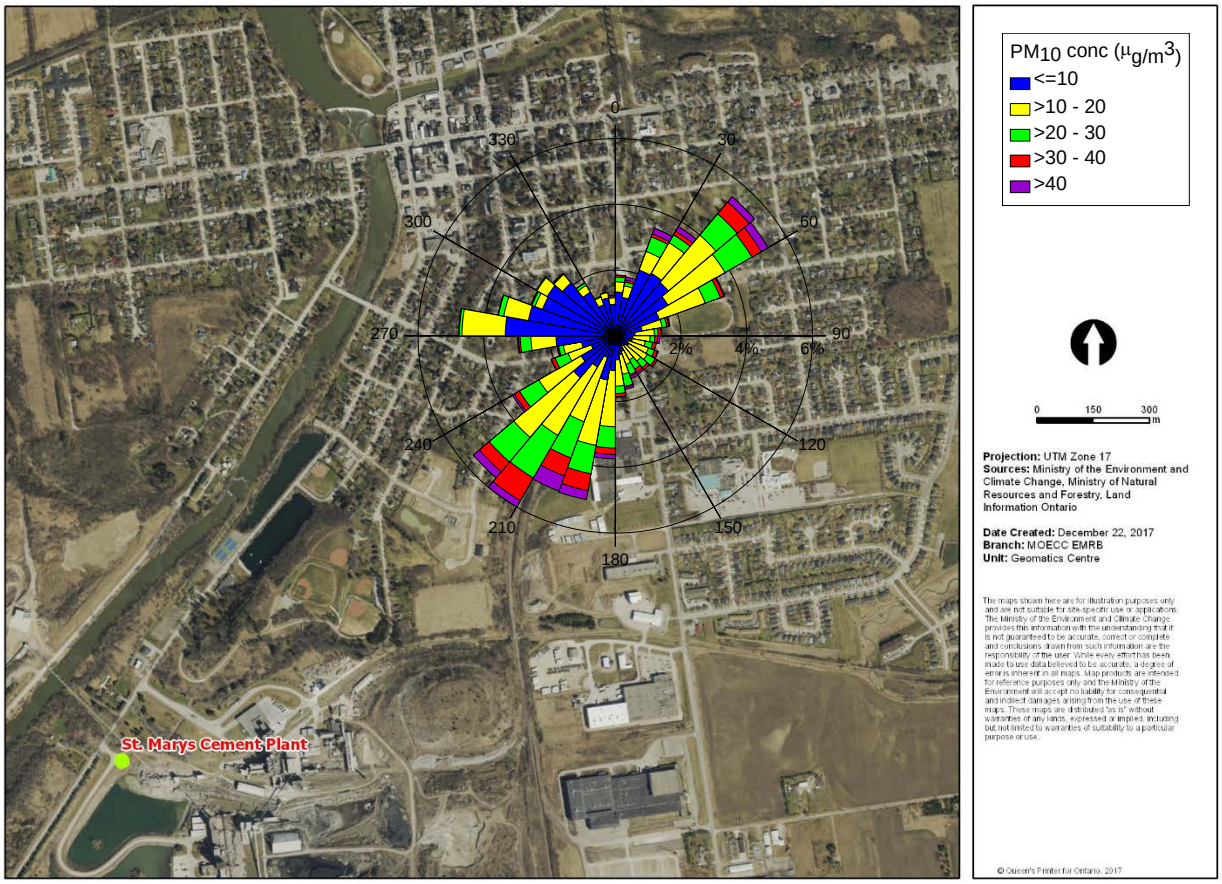
Station Location	24h Maximum (µg/m^3)	No. of Hours Above 50 µg/m^3 AAQC	Average (µg/m^3)
St. Marys	46	0	14

St. Marys Cement's ESDM report states that they are an emitter of total suspended particulate. This confirms that they generate particulate matter, but specifics about particle size distribution are not given. Total suspended particulate (TSP) matter is typically measured with non-continuous measurement technology, averaged over a 24-hour period, whereas PM_{10} is often measured in real-time.

Real-time particulate matter measurements of PM_{10} were chosen for this survey over TSP since they are more relevant for this type of community monitoring. Larger particulate matter (>10 μm) tends to settle out of the air quickly, and is less likely transported long distances into the community. Additionally, source identification and potential health impacts are more easily assessed with real-time PM_{10} measurements as it provides hourly concentrations throughout the day.

Figure 4 shows the PM_{10} pollution rose during the study period at St. Marys. Higher concentrations were mainly recorded during periods with southwesterly winds coming from the direction of St. Marys Cement and also northeasterly. The lowest concentrations were measured during northwest winds. This suggests that there are multiple sources of PM_{10} in the area surrounding the Ministry's St. Marys air monitoring station.

Figure 4: PM_{10} Pollution Rose at St. Marys during the Study Period



Conclusion

Results from the Ministry's St. Marys air monitoring station have been presented and discussed in this second interim report for the time period of October 1, 2017 to June 30, 2018. Monitoring results were compared to the applicable AAQC for all parameters, including the updated AAQC for SO_2 effective on March 20, 2018. The provincial AAQCs in effect during the study period were not exceeded at St. Marys, however, St. Marys did exceed the updated SO_2 AAQC on one occasion in November 2017 prior to its effective date of March 20, 2018. Hamilton Mountain exceeded the updated SO_2 AAQC on one occasion prior to its effective date and on 17 occasions after the updated SO_2 AAQC took effect.

Overall, the study shows,

- St. Marys Cement is a likely source of SO_2. The pollution rose showed higher SO_2 concentrations when winds were coming from the direction of the facility.

- St. Marys Cement is a likely contributing source of NO_x emissions along with other nearby industrial facilities and urban activities including vehicular traffic; as suggested by the pollution rose which showed that higher NO_2 concentrations were influenced from all directions.

- The air monitoring station measured PM_{10} from multiple sources mainly from southwesterly and northeasterly directions, with possible contributions from St. Marys Cement.

In summary, St. Marys Cement is a potential contributor to the concentrations of SO_2, NO_2 and PM_{10} measured at St. Marys for the time period referenced. The average concentrations of SO_2 and NO_2 are similar to or lower than those from other nearby Ministry AQHI ambient air monitoring stations.

The next interim report will include a full year of data collection allowing for a more representative assessment of the air quality at the site including potential seasonal variations and fluctuations in emissions from contributing sources.