Ministry of the Environment, Conservation and Parks
Environmental Monitoring and Reporting Branch
125 Resources Road
Etobicoke ON M9P 3V6
Tel.: 416 235-6300
Fax: 416 235-6235

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Direction de la Surveillance Environnmentale
125, chemin Resources
Etobicoke ON M9P 3V6
Tél. : 416 235-6300
Téléc. : 416 235-6235

Ontario

MEMORANDUM

April 5, 2019

To: Rob Wrigley, Manager
London District Office
Southwest Region

From: Chris Charron, Manager
Air Monitoring and Transboundary Air Sciences Section
Environmental Monitoring and Reporting Branch

Re: **2018 Mobile Air Monitoring Survey of Carmeuse Lime (Ingersoll)**

The Terrestrial Assessment and Field Services Unit has completed a 2018 Mobile Air Monitoring Survey of Carmeuse Lime (Ingersoll). On behalf of the Unit, please find attached a Technical Memorandum summarizing the results of the survey.

For further information regarding this survey, please contact me at 416-235-6157.

Chris Charron

cc: Aaron Todd
Emmilia Kuisma
Jonathan Wang

Technical Memorandum

2018 Mobile Air Monitoring Survey of Carmeuse Lime (Ingersoll)

Ontario Ministry of the Environment, Conservation and Parks

Report Prepared by:

Terrestrial Assessment and Field Services Unit
Air Monitoring and Transboundary Air Sciences Section
Environmental Monitoring and Reporting Branch

Report Completion Date: April 2019

Ontario

Survey Background

Carmeuse Lime Canada (Beachville Operation), located at 374681 Oxford County 6 Road, Ingersoll, Ontario, is a quarrying and cement/limestone processing facility (http://www.carmeusena.com). Environment and Climate Change Canada's National Pollutant Release Inventory (NPRI) (http://pollution-waste.canada.ca/national-release-inventory/archives/index.cfm) indicates that Carmeuse Lime Beachville Operation released 579 tonnes of nitrogen oxides, 304 tonnes of carbon monoxide, and 262 and 120 tonnes of coarse and fine particulate matter (PM_{10} and $PM_{2.5}$), respectively, in 2017.

At the request of the London District Office, Southwest Region (SWR), the Environmental Monitoring and Reporting Branch (EMRB) of the Ontario Ministry of the Environment, Conservation and Parks (MECP or Ministry) completed a mobile air monitoring survey near the Carmeuse Lime Beachville Operation in 2018. The survey objectives were to determine particulate matter (PM) and selected volatile organic compounds (VOCs) concentrations near the facility and compare these measurements to relevant *Ontario Regulation 419/05 - Local Air Quality* (O. Reg. 419/05) point-of-impingement (POI) standards and guidelines, and ambient air quality criteria (AAQC) values.

The Ministry's mobile or Trace Atmospheric Gas Analyzer (TAGA) surveys utilize stationary half-hour VOC thermal desorption (TD) tube sampling with active pumping and real-time mobile VOC and PM measurements useful for identifying emission sources and thorough investigations of short-term events. Carmeuse Lime's Beachville Operation is subject to O. Reg. 419/05 Schedule 3 standards and guidelines, which are based on annual or 24-hour averages. In general, these standards are set at protective levels and based on effects that occur after long-term exposure and therefore direct comparison of shorter-term measurements is not always appropriate. To give context to the monitoring results, O. Reg. 419/05 standards, guidelines and jurisdictional screening levels with annual averaging periods (found on the Ministry's Air Contaminants Benchmark List) have been converted to shorter term assessment values as described in Section 17 of the regulation (Appendix A). Since this conversion only considers meteorological variation and does not account for other factors, such as changes in facility operations, the calculated assessment values are for screening purposes only and cannot be used to determine non-compliance or whether an adverse health effect has occurred or will occur. Additional information on the use of the O. Reg. 419/05 air standards, guideline values and other screening levels to interpret air monitoring results is provided in Appendix A.

Survey Methodology

Sampling was conducted using thermal desorption (TD) tubes containing Carbopack X sorbent with active pumping using a Gilian GilAir PLUS miniature pump at 200 mL/min for half-hour periods (6 L samples) at upwind and downwind locations of the facility, chosen based on local meteorological conditions (i.e., wind direction) and odour observations by TAGA staff. Global Positioning System (GPS) coordinates were recorded for each tube sampling location. After sampling, the TD tubes were collected, sealed, refrigerated, and subsequently analyzed off-line using a PerkinElmer TurboMatrix 650-Clarus 680 thermal desorption-gas chromatograph coupled with a PerkinElmer SQ8C mass spectrometer. The TSI DustTrak DRX (model 8533EP) was utilized for real-time measurement of particulate matter of diameters less than 1 µm (PM_1), 2.5 µm ($PM_{2.5}$), and 10 µm (PM_{10}), and total suspended particles (TSP). Supplementary meteorological data from Environment and Climate Change Canada were also used for this report, using the nearest station located in London, Ontario (43.03306º N, 81.15111º W).

Real-time air monitoring of VOCs in ambient air was also performed using a diesel/hybrid truck outfitted with a Thermo-Fisher Scientific mass spectrometer equipped with an Atmospheric Pressure Chemical Ionization (APCI) source and Atmospheric Pressure Photoionization (APPI) source. The TAGA unit performed chemical fingerprinting to identify VOCs in ambient air near the Carmeuse facility. Seven VOCs were included in the quantitative analysis using this TAGA unit. The TAGA unit was used to identify locations reporting the highest concentrations of VOCs downwind of the facility for site selection. One half-hour concentration of VOCs measured by this TAGA unit is the average of 360 five-second readings. Concentrations of target VOCs were determined at upwind and downwind locations while the mobile unit was stationary. Predominant wind direction, average wind speed, and ambient temperature were recorded concurrently with VOC monitoring using a portable meteorological unit.

Survey Results

EMRB conducted the air monitoring survey on August 27-28, September 5, and October 2, 2018. The monitoring locations near Carmeuse Lime Beachville Operation are shown in Figure 1. Odours similar to the combustion of rubber were noted by TAGA staff while downwind of the facility. Thermal desorption tubes with active pumping, a method that offers low detection limit for VOCs, were used to quantify the concentrations of six target VOCs (1,3-butadiene, benzene, toluene, ethylbenzene, *m,p*-xlyene, and styrene). In total, three and ten half-hour TD tube samples were collected over three days upwind and downwind of the facility, respectively (Table 1). Additionally, both stationary half-hour and mobile measurements were made by the APCI/APPI TAGA unit, however, concentrations of target VOCs (acetone, butyl acetate, butyl alcohol, ethyl acetate, ethylene glycol, methyl ethyl ketone, propyl alcohol) were comparable upwind and downwind of the facility (Table 2).

Table 1 summarizes the data collected during the air monitoring survey including sampling times, monitoring sites, on-site meteorological data, and half-hour integrated concentrations near the facility. The highest half-hour VOC concentrations observed for benzene, toluene, styrene, and 1,3-butadiene were 0.45, 0.79, 0.04, and 0.28 µg m^{-3} (Table 1), respectively.

Due to limitations with the accuracy of the DustTrak (Kingham et al., 2006; Yanosky et al., 2002), PM measurements in this report should not be used to assess non-compliance. However, the DustTrak can be used to compare spatial and temporal differences in PM concentrations. Average half-hour concentrations of PM_1, $PM_{2.5}$, PM_{10} and TSP near the facility are summarized in Table 3. On average, downwind concentrations for PM_1, $PM_{2.5}$, PM_{10}, and TSP were 1.7, 1.9, 3.0, and 3.3 times higher respectively than upwind concentrations based on stationary measurements on August 28. Mobile plume-tracking measurements were also made operating the DustTrak in the TAGA unit, with $PM_{2.5}$ and PM_{10} concentrations shown in Figures 2-3. The maximum 10 second instantaneous $PM_{2.5}$ and PM_{10} concentrations during these plume-tracking measurements were 167 and 401 µg m^{-3}. However, many of the dust events observed during the plume-tracking measurements were due to re-suspended dust from unpaved roadways and/or shoulders, resulting in some measurements of higher PM concentrations upwind of the facility.

Table 4 highlights the survey average VOC concentrations, the highest half-hour concentrations, the converted half-hour assessment values, the O. Reg. 419/05 air standard or guideline, and AAQC for each target compound. Ambient concentrations of all target VOC compounds did not exceed the O. Reg. 419/05 air standards and guidelines or their respective converted half-hour assessment values.

Figure 1: Locations of stationary half-hour measurements near Carmeuse Lime Beachville Operation (Ingersoll), August 27-28, September 5, and October 2, 2018. The arrow denotes the direction the wind was blowing during sampling dates. Sites UW1 and A, B, C, D are where TD tube samples were collected, UW2 and E are where the APCI/APPI TAGA unit measurements were made, and UW1 and C are where PM and TSP measurements were made.

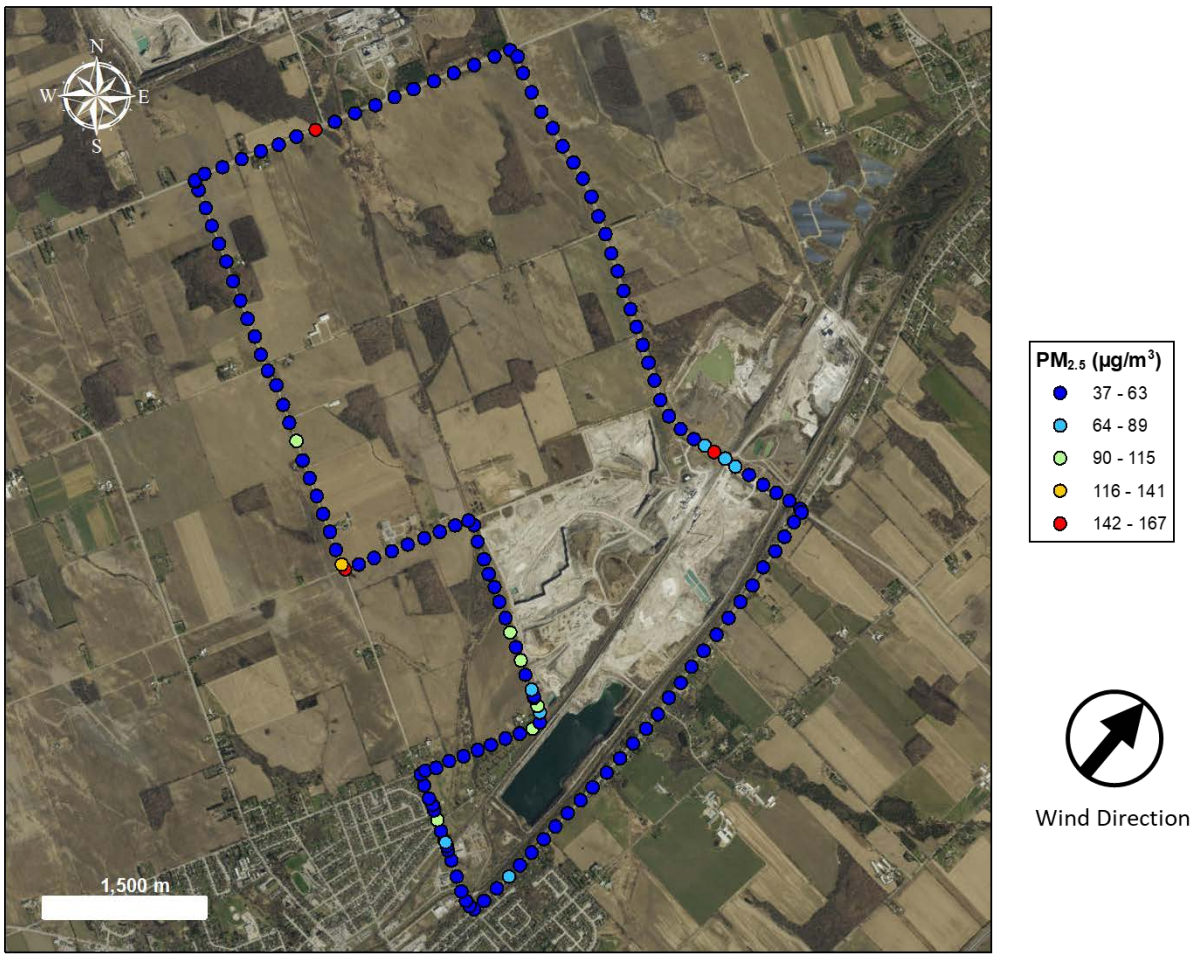

Figure 2: Mobile measurements of $PM_{2.5}$ near Carmeuse Lime Beachville Operation (Ingersoll), August 28, 2018, 12:02-12:28. The arrow denotes the direction the wind was blowing during sampling. The maximum instantaneous $PM_{2.5}$ concentration observed was 167 µg m^{-3}.

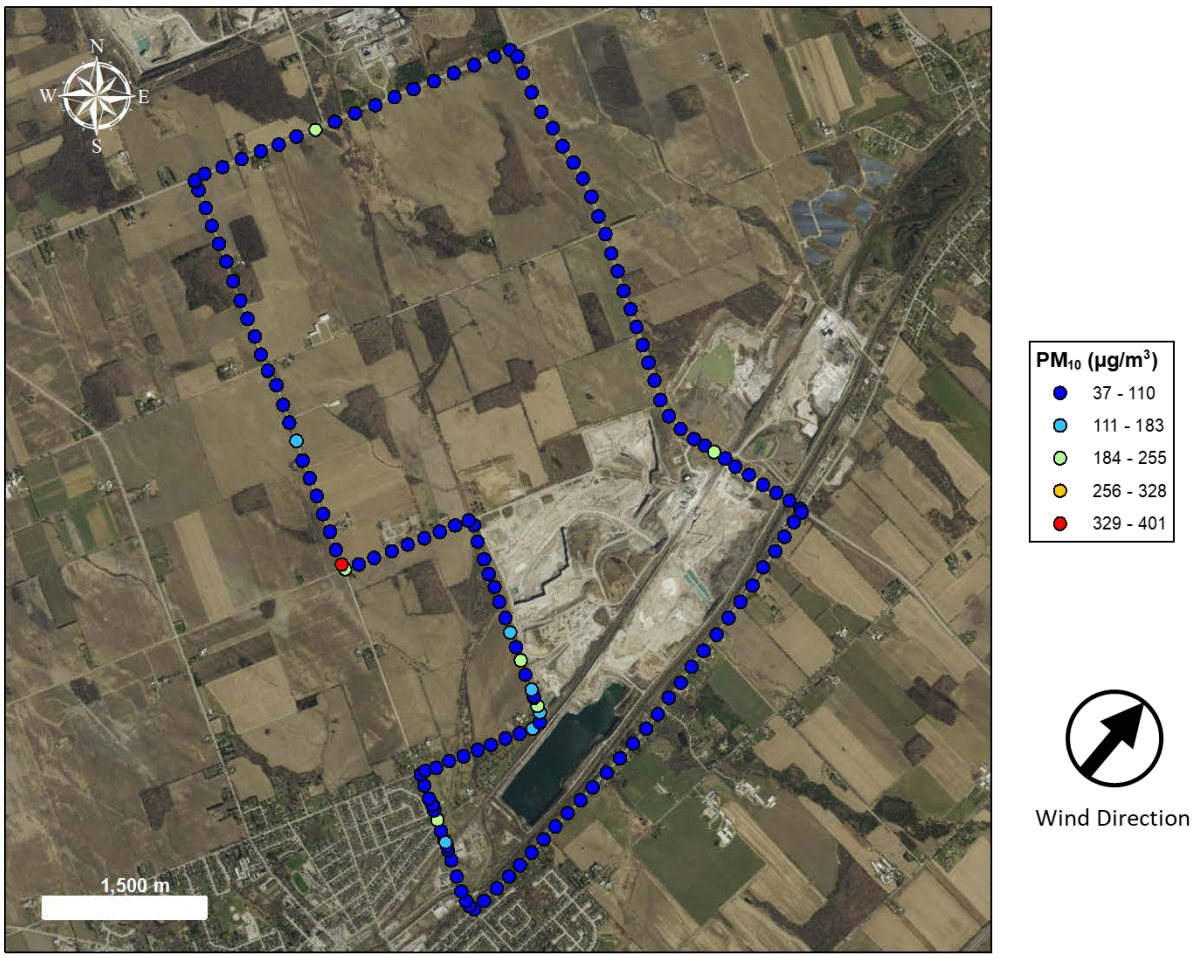

Figure 3: Mobile measurements of PM_{10} near Carmeuse Lime Beachville Operation (Ingersoll), August 28, 2018, 12:02-12:28. The arrow denotes the direction the wind was blowing during sampling. The maximum instantaneous PM_{10} concentration observed was 401 µg m^{-3}.

Table 1: Half-hour average concentrations of VOCs measured using TD tubes with active pumping in vicinity of Carmeuse Lime Beachville Operation, Ingersoll, Ontario. TAGA (EMRB, MECP) air monitoring survey, 2018.

			Met **(3)**			VOC **(4)**					
Date	Starting Time **(1)**	Monitoring Site **(2)**	Wind Direction (from)	Wind Speed (km/hr)	Ambient Temp. (°C)	**Benzene**	**Toluene**	**Ethylbenzene**	**m,p-Xylene**	**Styrene**	**1,3-Butadiene**
Aug 27, 2018	11:31	UW1	SSW	17	25	0.27	0.44	0.12	0.44	0.02	0.03
	12:18	A	SW	20	25.6	0.31	0.28	0.05	0.16	0.01	0.03
	12:55	B	SW	17	26.5	0.39	0.60	0.15	0.54	0.02	0.07
	13:29	B	SW	17	26.5	0.38	0.28	0.06	0.15	0.02	0.09
	14:05	B	SW	18	27.1	0.40	0.79	0.21	0.77	0.03	0.17
Aug 28, 2018	11:54	UW1	SW	29	28.8	0.33	0.59	0.11	0.33	0.02	<MDL
	13:36	C	SW	26	29.7	0.31	0.28	0.05	0.10	0.03	0.15
	14:08	C	WSW	16	30.2	0.45	0.34	0.06	0.13	0.04	0.28
	14:42	C	WSW	16	30.2	0.39	0.30	0.05	0.15	0.03	0.23
Sept 5, 2018	11:27	UW1	SW	18	30.3	0.31	0.64	0.07	0.14	0.01	0.03
	11:37	D	SW	18	30.3	0.38	0.58	0.08	0.17	0.02	0.14
	13:17	D	SW	12	29.6	0.37	0.33	0.05	0.11	0.03	0.22
	13:48	D	SW	12	29.6	0.35	0.28	0.05	0.11	0.03	0.26
Method Detection Limit (MDL) **(5)**						0.013	0.034	0.026	0.052	0.026	0.027

Notes:

(1) Local starting time half-hour sample period.

(2) Monitoring sites near the facility - see Figure 1.

(3) Weather conditions were measured at hourly resolution at the nearest meteorological station in London, Ontario.

(4) Concentrations of measured VOCs are in micrograms per cubic metre ($\mu g\ m^{-3}$).

(5) Method detection limits converted from Healy et al. 2018. *Evaluation of a Passive Sampling Method for Long-Term Continuous Monitoring of Volatile Organic Compounds in Urban Environments*. Environ. Sci. Technol. 52, 18, 10580-10589.

Table 2: Half-hour average concentrations of VOCs measured using the APCI/APPI TAGA units in vicinity of Carmeuse Lime Beachville Operation, Ingersoll, Ontario. TAGA (EMRB, MECP) air monitoring survey, 2018.

			Met **(3)**			VOC **(4)**						
Date	Starting Time **(1)**	Monitoring Site **(2)**	Wind Direction (from)	Wind Speed (km/hr)	Ambient Temp. (°C)	**Acetone**	**Butyl Acetate**	**Butyl Alcohol**	**Ethyl Acetate**	**Ethylene Glycol**	**Methyl Ethyl Ketone**	**Propyl Alcohol**
Oct 2, 2018	12:58	UW2	W	10	19.9	3.3	<MDL	0.8	<MDL	2.2	<MDL	1.3
	14:07	E	W	30	19.0	2.1	<MDL	<MDL	<MDL	1.1	<MDL	<MDL
	14:39	E	W	30	19.0	2.8	<MDL	<MDL	<MDL	1.2	<MDL	<MDL
	15:09	E	WNW	17	15.7	2.6	<MDL	<MDL	<MDL	0.9	<MDL	<MDL
Method Detection Limit (MDL)						1.1	0.5	0.5	0.5	0.3	0.5	1.2

Notes:

(1) Local starting time half-hour sample period.

(2) Monitoring sites near the facility - see Figure 1.

(3) Weather conditions were measured at hourly resolution at the nearest meteorological station in London, Ontario.

(4) Concentrations of measured VOCs are in micrograms per cubic metre ($\mu g\ m^{-3}$).

Table 3: Half-hour average concentrations of PM (for comparative purposes only) measured using the TSI DustTrak DRX in vicinity of Carmeuse Lime Beachville Operation, Ingersoll, Ontario. TAGA (EMRB, MECP) air monitoring survey August 28, 2018.

			Met **(3)**			Pollutant **(4)**			
Date	Starting Time **(1)**	Monitoring Site **(2)**	Wind Direction (from)	Wind Speed (km/hr)	Ambient Temp. (°C)	**PM_1**	**$PM_{2.5}$**	**PM_{10}**	**TSP (5)**
Aug 28, 2018	11:50	UW1	SW	29	28.8	52	53	67	73
	13:30	C	SW	26	29.7	83	88	127	139
	14:00	C	WSW	16	30.2	99	108	184	203
	14:30	C	WSW	16	30.2	89	97	163	182
Manufacturer Reported Detection Limit						1	1	1	1

Notes:

(1) Local starting time half-hour sample period.

(2) Monitoring sites near the facility - see Figure 1.

(3) Weather conditions were measured at hourly resolution at the nearest meteorological station in London, Ontario.

(4) Concentrations of measured PM are in micrograms per cubic metre ($\mu g\ m^{-3}$).

(5) TSP measured by DustTrak DRX is PM with diameters < 150 μm (PM_{150}).

Table 4: Half-hour average downwind concentrations of VOCs measured using TD tubes with active pumping in vicinity of Carmeuse Lime Beachville Operation, Ingersoll, Ontario. TAGA (EMRB, MECP) air monitoring survey, 2018.

Pollutant **(1)**	Survey average half-hour concentration **(2)**	Survey highest half-hour concentration **(3)**	Converted half-hour Assessment Value **(4)**	O. Reg. 419/05 Standard/Guideline **(5)**	AAQC/CWS **(6)**
Benzene	0.37	0.45	6.9	0.45 (S, annual)	2.3 (24-hour)
Toluene	0.41	0.79	5913	2000 (G, 24-hour)	2000 (24-hour)
Ethylbenzene	0.08	0.21	2956	1000 (S, 24-hour)	N/A
Xylenes	0.24	0.77	2158	730 (S, 24-hour)	730 (24-hour)
Styrene	0.03	0.04	1183	400 (S, 24-hour)	400 (24-hour)
1,3-butadiene	0.17	0.28	31	2 (S, annual)	10 (24-hour)

Notes:

(1) Compound measured by TAGA.

(2) Average of all downwind half-hour concentrations (µg m^{-3}) measured by TAGA.

(3) Survey highest downwind half-hour concentrations (µg m^{-3}) measured by TAGA.

(4) Converted half-hour Assessment Values are provided for comparison purposes only.

(5) Benchmarks for which a Converted Assessment Value was calculated with respective averaging periods- (S) O. Reg. 419/05 Schedule 3 Standard, (G) O. Reg. 419/05 Guideline when section 20 applies.

(6) Ambient Air Quality Criteria (AAQC) and Canada Wide Standards (CWS) for target pollutants where applicable.

Summary

The Environmental Monitoring and Reporting Branch conducted mobile and stationary air monitoring near Carmeuse Lime Beachville Operation, Ingersoll over four days from August to October 2018.

- Real-time mobile particulate matter (PM) measurement data were combined with concurrent Global Positioning System and meteorological data to produce plume-tracking maps.

- Half-hour average benzene, toluene, styrene, and 1,3-butadiene concentrations up to 0.45, 0.79, 0.04, and 0.28 µg m^{-3}, respectively, were observed during stationary measurements downwind of the facility using thermal desorption (TD) tube sampling with active pumping.

- Half-hour average downwind $PM_{2.5}$, PM_{10}, and total suspended particulate (TSP) concentrations up to 108, 184, and 203 µg m^{-3}, respectively, were observed during stationary measurements downwind of the facility and were higher than upwind concentrations.

- Stationary measurements using TD tubes enabled a comparison of concentrations of volatile organic compounds with Ontario Regulation 419/05 - Local Air Quality standards and guidelines using converted assessment values where necessary.

- None of the target compounds exceeded their respective half-hour converted assessment values.

References

Kingham, S., Durand, M., Aberkane, T., Harrison, J., Gaines Wilson, J., & Epton, M. (2006). Winter comparison of TEOM, MiniVol and DustTrak PM10 monitors in a woodsmoke environment. *Atmospheric Environment, 40*(2), 338-347.

Yanosky, J. D., Williams, P. L., & MacIntosh, D. L. (2002). A comparison of two direct-reading aerosol monitors with the federal reference method for PM2.5 in indoor air. *Atmospheric Environment, 36*(1), 107-113.

Appendix A

Conversion of O. Reg 419/05 Standards/Guidelines/Jurisdictional Screening Levels to Converted Assessment Values

To compare a short-term monitoring value to a benchmark with a longer averaging period a conversion factor was applied. Conversion factors were calculated using the method described in Section 17 of O. Reg. 419/05. This conversion only takes meteorological variation into account.

Calculation of a Conversion Factor for monitoring periods shorter than the averaging period specified by the standard/guideline/jurisdictional screening level.

$(t_0 \div t_1)^n$

t_0 = the averaging period specified by the standard/guideline, expressed in hours
t_1 = the averaging period used for monitoring, expressed in hours
n = 0.28

The standard is multiplied by this calculated conversion factor to give a Converted Assessment Value

Use of the O. Reg. 419/05 air standards, guideline values and other screening levels to interpret air monitoring results

Ontario regulates contaminants released to air by various sources, including local industrial and commercial facilities, to limit exposure to substances that can affect human health and the environment. The Ministry's *Ontario Regulation 419/05 – Local Air Quality* (O. Reg. 419/05) air standards, guideline values, and other screening levels are found on the Air Contaminants Benchmarks List. These standards and guidelines are used under the general provisions of the *Environmental Protection Act*, including compliance purposes under O. Reg. 419/05. These values are, however, sometimes used to interpret air quality outside of the purposes of O. Reg. 419/05.

Many of the applicable standards or guidelines are based on annual or 24-hour averages. In general, they are set at protective levels and based on effects that occur following long-term exposure. Therefore, direct comparison of short-term measurements is not always appropriate. To give context to the short-term monitored results (i.e., half-hour TAGA survey measurements), applicable O. Reg. 419/05 standards or guidelines are converted to half-hour assessment values, as described in Section 17 of O. Reg. 419/05. Since this conversion only considers meteorological variation and not factors such as changes in facility operations, these calculated assessment values are for screening purposes only, and cannot be used to determine non-compliance or whether an adverse health effect has occurred or will occur. However, these calculated assessment value comparisons can be used to provide context to monitoring results. Short-term monitoring results that are elevated with respect to the assessment values may be used to flag potential issues worthy of further investigation.

In these situations, monitoring results that are elevated with respect to the half-hour assessment values do not necessarily indicate that an adverse effect will occur or has occurred. Rather, an air quality analyst or risk assessor should consider, on a case-specific basis, whether there is a potential for adverse effects when using the converted O. Reg. 419/05 standards or guidelines to interpret air monitoring data. This could include considerations of the nature of the contaminant, how the air limits were developed, supplementary monitoring or air dispersion modelling, or other elements typical of a human health risk assessment (i.e., frequency, magnitude and duration of elevated values).

For additional details regarding the development of the Ministry's air standards, and the Ministry's framework for managing risk, please refer to the following document: *Guideline A-12: Guideline for the Implementation of Air Standards in Ontario* (GIASO).

https://www.ontario.ca/page/guideline-12-guideline-implementation-air-standards-ontario