September 16, 2008

Mike Bricks
Senior Environmental Planner
ECOPLANS LIMITED
2655 North Sheridan Way
Mississauga, ON. L5K 2P8

RWDI AIR Inc.
650 Woodlawn Road West
Guelph, ON
Canada N1K 1B8

A member of the RWDI Group of Companies

Re: Air Quality Assessment for Mississauga BRT
Mississauga, Ontario
Letter-Report
Job #W08-5148A

Email: mbricks@ecoplans.com

Dear Mr. Bricks:

RWDI AIR Inc. (RWDI) is pleased to submit this Letter-Report detailing the findings of the screening level air quality assessment that was conducted for the proposed Mississauga Bus Rapid Transit (BRT) project.

1) OVERVIEW

The Mississauga BRT project involves a high-efficiency transit corridor running east-west across Mississauga. The current project represents Phase 1 of the capital works and includes BRT East (Centre View Drive to Renforth Drive) and BRT West (Winston Churchill Boulevard to Erin Mills Parkway) herein referred to as the Study Area. The portion of the Misssissauga BRT facility between BRT East and BRT West (i.e. along Highway 403) is currently operational along the existing Highway 403 bus bypass lanes.

RWDI was retained by Ecoplans Ltd. to conduct a screening level air quality assessment for the BRT project (BRT East and BRT West). The specific objective of this study was to provide the City, GO Transit and other government agencies information on potential air quality and health effects to area residents associated with the BRT project.

2) METHODOLOGY

In addition to the project objectives, the screening level air quality assessment was designed such that the results of this assessment could also be used to support a detailed air quality assessment, if deemed necessary. So as not to underestimate potential effects, a worst-case modelling approach was employed for both the incremental (transitway) and combined (transitway and Highway 403) scenarios.

Contaminant Profiles:

Contaminants of Concern (CoCs) considered include inhalable (coarse) particulate matter (PM_{10}) and respirable (fine) particulate matter ($PM_{2.5}$). These contaminants were chosen for the screening level assessment because they are representative of both tailpipe and roadway dust emissions. Additionally, these contaminants usually have the greatest potential to exceed ambient air quality guidelines since background concentrations are often elevated compared with other vehicle-related pollutant emissions. Historical ambient air quality measurements for the CoCs presented in the Ministry of the Environment (MOE) annual Air Quality in Ontario Reports for the most recent 5 years were compiled and summarized. Concentration data for each contaminant from MOE monitoring station 46109 (Frank McKechnie Community Centre, 310 Bristol Road East) were tabulated and 90^{th} percentile concentration values calculated using 2005 monitoring data results. Station 46109 was selected because it was the monitoring station considered to provide the most representative air quality data for the Study Area.

Emissions and Dispersion Modelling:

Future tailpipe emission factors were estimated using the United States Environmental Protection Agency's (US EPA) MOBILE6.2 emissions based on the year 2017. Similarly, roadway dust emission rates were estimated based on published emission factors in the US EPA's AP-42. Emissions were estimated based on assumed silt loading values for Highway 403 and the transitway. Both MOBILE6.2 and AP-42 are accepted regulatory methods and have been used extensively to evaluate emissions from highways and other transportation-related projects in Ontario.

The emission factor data, traffic volumes and meteorological data were then inputted into the U.S. EPA's CAL3QHCR air dispersion model in order to estimate future air concentrations at critical sensitive receptor locations representing schools and daycares in the study area. The worst-case section of roadway with the highest traffic volumes was modelled, which corresponded to the section of Highway 403 between Hurontario Street and Cawthra Road. RWDI was provided with average daily traffic volumes, which were varied by hour of day based on a published distribution to explicitly account for coincident traffic volumes and meteorological conditions on an hour-by-hour basis. Representative surface meteorological data from Pearson and upper air data from the Buffalo airport for the Year 2005 were compiled and used as input into the dispersion model. Predicted concentrations of PM_{10} and $PM_{2.5}$ at the sensitive receptor locations were then estimated for the incremental (transitway) and combined (transitway and Highway 403) scenarios.

The dispersion modelling results were also used to produce concentration versus distance profiles for the incremental and combined scenarios. The profiles generated represent worst-case 24-hours concentrations. These have been included for reference so that effects at sensitive locations (i.e., residence, nursing home, school, place of worship, daycare facility, etc.) 20m-500m beyond the model domain can be determined by comparing the distance from the edge of roadway of the receptor of interest with the concentration versus distance profiles.

The section of the roadway and the sensitive receptor locations considered in the modelling assessment (i.e. R1-R4) are shown in Figure 1.

Criteria and Health Effect Assessment:

Potential effects to air quality and health were determined by plotting the applicable provincial and federal ambient air quality criteria for $PM_{2.5}$ and PM_{10} with the concentration versus distance profiles. Potential human health effects associated with the increase in contaminant concentrations due to the project over the existing ambient background concentrations were qualitatively discussed.

3) RESULTS AND DISCUSSION

Background, incremental and combined concentrations of $PM_{2.5}$ and PM_{10} at various receptor locations are given in Tables 1 and 2, respectively. Similarly, the concentration versus distance profiles for $PM_{2.5}$ and PM_{10} are given in Figures 3 and 4, respectively. The significance of these results is discussed below.

$PM_{2.5}$: The maximum predicted concentration of $PM_{2.5}$ associated with emissions from the transitway or the transitway plus Highway 403 were estimated at approximately 2.6 $\mu g/m^3$ at receptor locations RN1 and RS1 (see Table 1). Overall, the incremental increase in $PM_{2.5}$ concentrations are considerably less than the local background concentration of 22 $\mu g/m^3$. The results indicate that emissions associated with the transitway are not expected to contribute significantly to background levels.

More importantly, when emissions from the transitway, Highway 403 and local background levels are combined, the predicted concentrations are less than the Canada Wide Standard (CWS) of 30 $\mu g/m^3$ at all receptor locations (see Figure 2). It is unlikely that vehicle emissions associated with the transitway are likely to contribute to adverse health effects to area residents. As a result no significant adverse effects are anticipated.

PM_{10}: As shown in Table 2, the maximum predicted concentration of PM_{10} associated with emissions from the transitway plus Highway 403 were estimated at approximately 24.6 $\mu g/m^3$ at receptor location RN1 whereas, the maximum concentration at sensitive receptor locations was 7.2 $\mu g/m^3$. Similarly, the maximum predicted PM_{10} concentration associated with emissions from the transitway alone was predicted to be 10.4 $\mu g/m^3$ at receptor location RS1 and the maximum concentration at sensitive receptor locations was 2.7 $\mu g/m^3$. The local background concentration of PM_{10} is 37 $\mu g/m^3$. While the relative contribution to PM_{10} levels at sensitive receptor locations is relatively minor, the contribution at other receptor locations might be an important contributor to local background concentrations.

When emissions from the transitway, Highway 403 and local background levels are combined, the predicted concentrations are greater than the MOE AAQC of 50 $\mu g/m^3$ at receptor locations located within 60 m of the roadway (see Figure 3). This result indicates that under worst-case conditions, PM_{10} has the potential to exceed the standard at these receptor locations. It should be noted that the major contributor to high ambient background concentrations is believed to be Highway 403 based on the location of the monitoring station, which was also accounted for in the modelling. Therefore, the results are likely conservative as there is a certain amount of double-counting of the effects of Highway 403. In contrast, when emissions from the transitway are considered alone, then the predicted concentrations including background are less than the AAQC at all receptor locations. This result suggests that no significant adverse effects are anticipated.

Other Substances:

As summarized in Table 3, ambient concentrations for other common air pollutants measured at the MOE monitoring station located at the Frank McKechnie Community Centre were tabulated and 90th percentile concentration values calculated. The concentrations of carbon monoxide (CO), nitrogen dioxide (NO2)

and sulphur dioxide (SO2), which are substances present in vehicle exhaust, were considerably less than the applicable AAQCs. Although there are no AAQCs for benzene, 1,3-butadiene and acrolein, the concentrations measured are typical of concentrations measured in urban air throughout the province. Based on our experience, it is anticipated that emissions of these substances due to the transitway will be relatively minor in comparison with background levels.

While ozone (O_3) was occasionally detected at concentrations greater than the AAQC, ozone levels are associated with long range transport and complex chemical interactions in the atmosphere. Furthermore, ozone is not directly discharged as a vehicular emission.

Summary:

In conclusion, the results indicate that emissions associated with the transitway are relatively minor compared with local background concentrations. $PM_{2.5}$ concentrations including background levels for all scenarios are less than the CWS of 30 $\mu g/m^3$, which indicates that adverse health effects are unlikely. PM_{10} emissions might be an important contributor to local background concentrations under some conditions. Under these situations, individuals could experience some minor health effects, but these are expected to be infrequent and transient in nature.

It should be noted that the maximum predicted concentrations are associated with the worst-case meteorological conditions, therefore, most of the time the concentration would be significantly lower. Furthermore, these predicted cumulative concentrations are similar to those on comparable highways in Ontario.

4) CLOSING

I trust that the above information is satisfactory, however; should you have any questions or require additional information, please give me a call at (519) 823-1311 ext. 2370 or Ron Haley at ext. 2276.

Yours very truly,

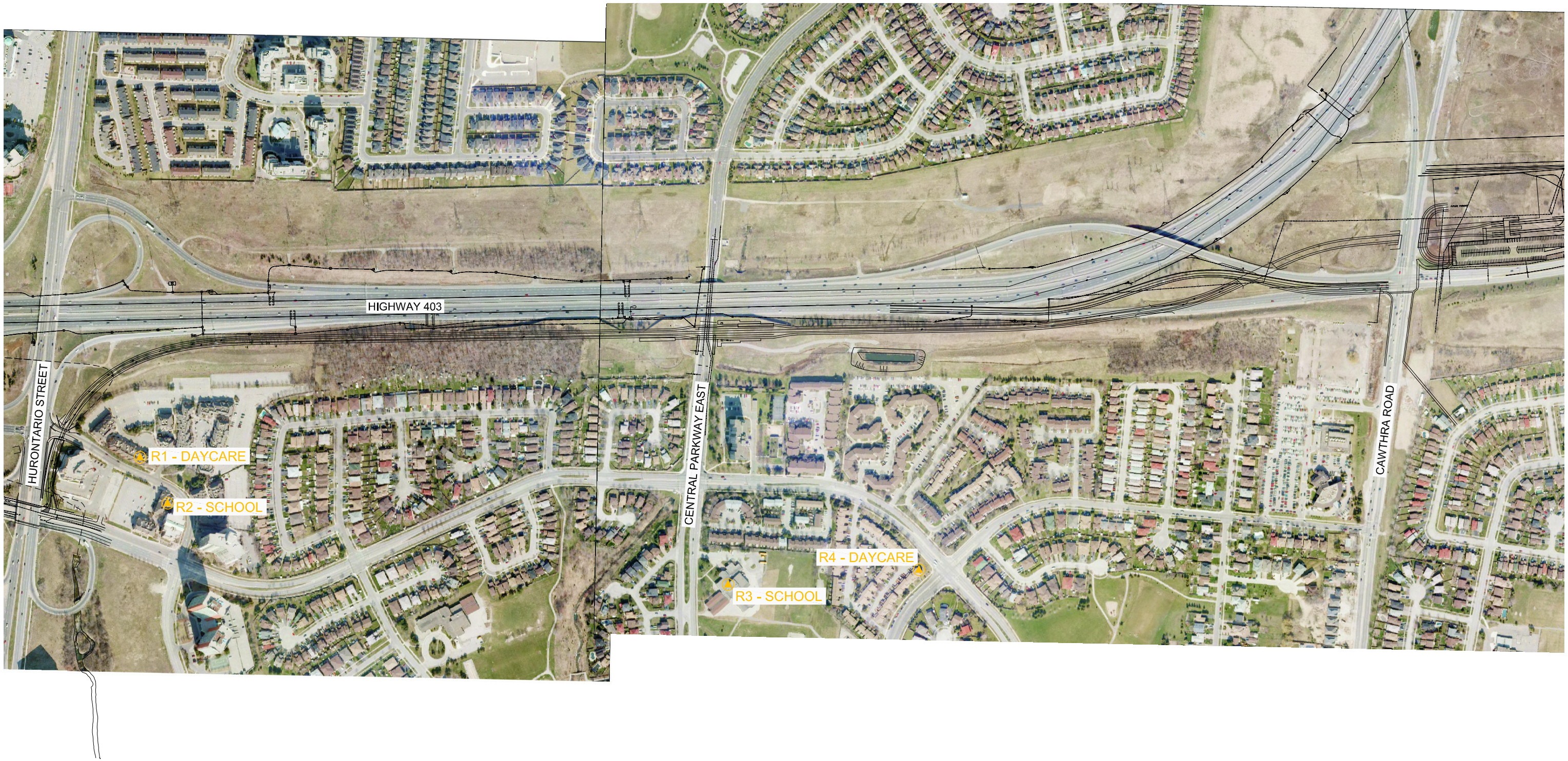
RWDI AIR Inc.

Scott Shayko, Hon. B.Comm., B.Sc.
Senior Project Manager
Associate

Attachments:

LIST OF FIGURES

LIST OF TABLES



LEGEND:

Receptor

0 100 250m

Site Plan Showing Location of Modelling Domains and Receptors

True North

Mississauga BRT - Mississauga, Ontario

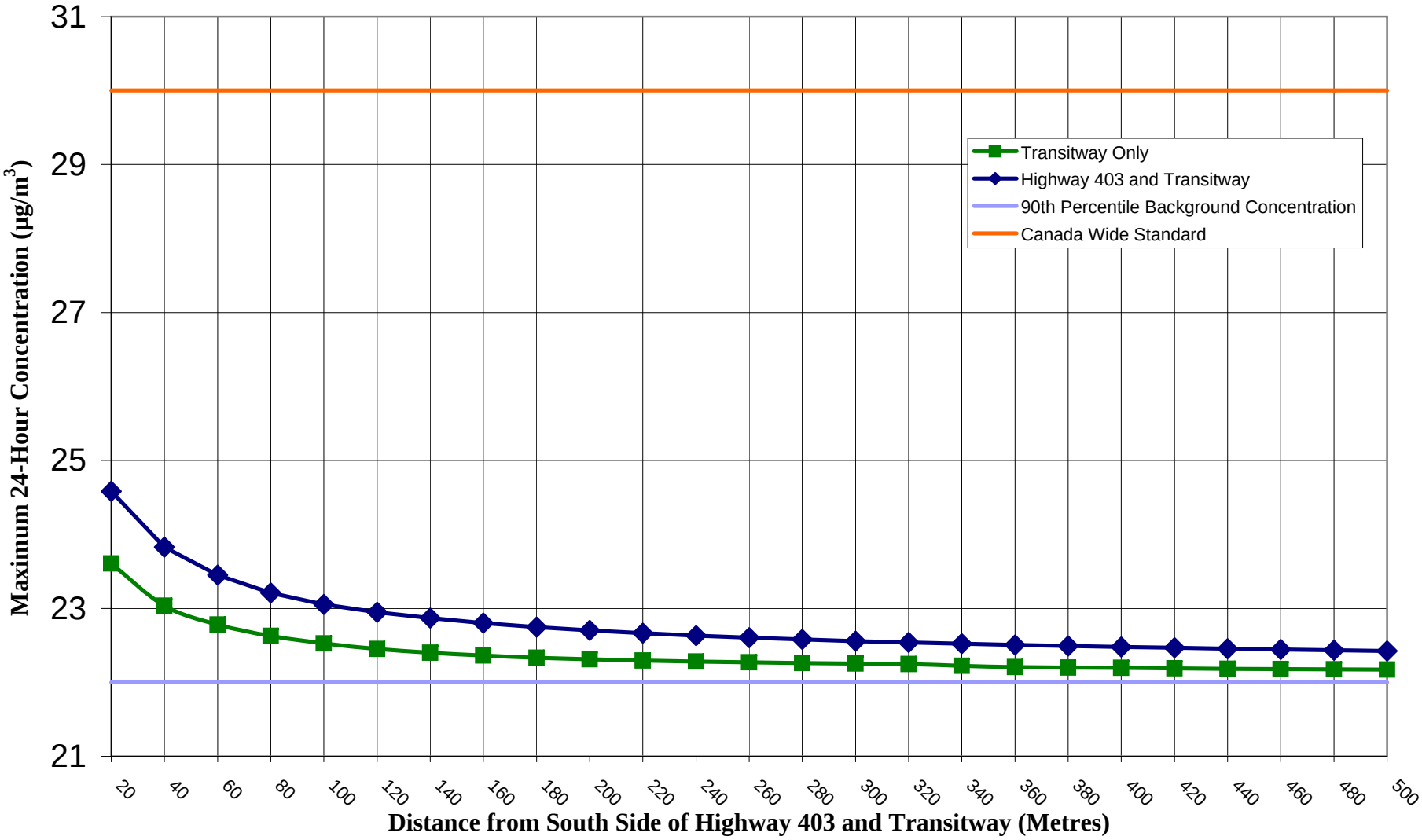
Project #W08-5148

Drawn by: NTN	Figure:	1
Approx. Scale:	1:6000	
Date Revised:	July 17, 2008	

RWDI

Figure 2: Concentration Profile for $PM_{2.5}$

Year 2017 with Background Concentrations

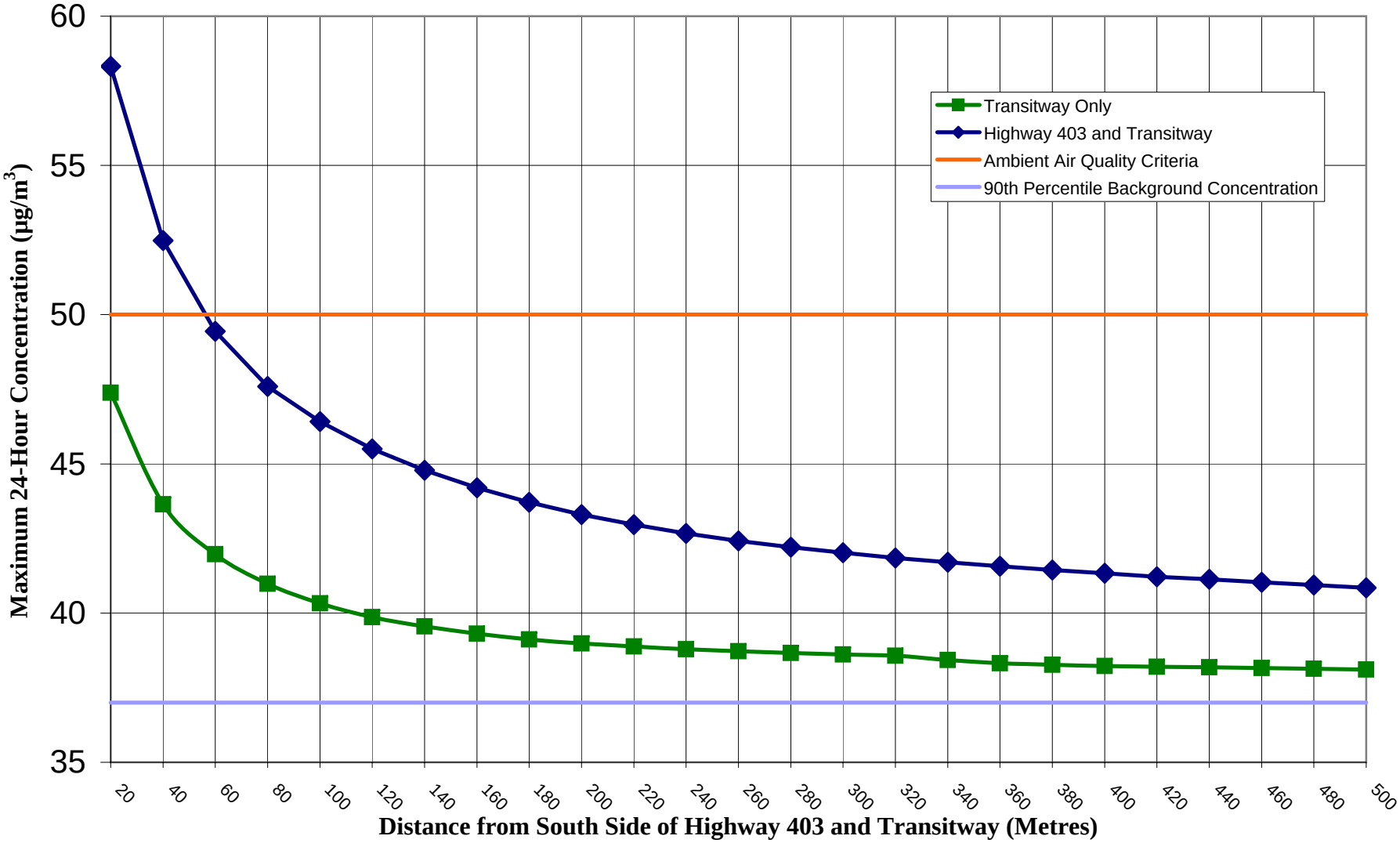


Note: Canada Wide Standard for $PM_{2.5}$ is 30 µg/m³

The 90th percentile background concentration from MOE Station No. 46109 for Year 2005 for $PM_{2.5}$ is 22 µg/m³

Figure 3: Concentration Profile for PM_{10}

Year 2017 with Background Concentrations



Note: MOE's 24-hr AAQC for PM_{10} is 50 µg/m³

The 90th percentile background concentration from MOE Station No. 46109 for Year 2005 for PM_{10} is 37 µg/m³

Table 1: $PM_{2.5}$ Concentrations at Receptor Locations

	Hwy 403 and Transitway			Transitway Only		
	Predicted Concentration (µg/m³)	**Background (µg/m³)**	**Predicted + Background (µg/m³)**	**Predicted Concentration (µg/m³)**	**Background (µg/m³)**	**Predicted + Background (µg/m³)**
Sensitive Receptors						
R1 Daycare	0.81	22	22.8	0.42	22	22.42
R2 School	0.63	22	22.6	0.31	22	22.31
R3 School	0.50	22	22.5	0.20	22	22.20
R4 Daycare	0.46	22	22.5	0.19	22	22.19
R5 MOE Station 4610	0.23	22	22.2	0.10	22	22.10
Receptor Profile[1]						
North Receptor Profile						
RN25	0.52	22	22.5	0.24	22	22.24
RN24	0.53	22	22.5	0.25	22	22.25
RN23	0.54	22	22.5	0.25	22	22.25
RN22	0.56	22	22.6	0.25	22	22.25
RN21	0.57	22	22.6	0.26	22	22.26
RN20	0.59	22	22.6	0.26	22	22.26
RN19	0.60	22	22.6	0.27	22	22.27
RN18	0.62	22	22.6	0.28	22	22.28
RN17	0.64	22	22.6	0.28	22	22.28
RN16	0.67	22	22.7	0.29	22	22.29
RN15	0.71	22	22.7	0.30	22	22.30
RN14	0.75	22	22.7	0.32	22	22.32
RN13	0.79	22	22.8	0.34	22	22.34
RN12	0.83	22	22.8	0.36	22	22.36
RN11	0.88	22	22.9	0.39	22	22.39
RN10	0.94	22	22.9	0.41	22	22.41
RN9	1.01	22	23.0	0.44	22	22.44
RN8	1.08	22	23.1	0.47	22	22.47

[1] Receptor Profile locations represent a variety of sensitive receptors located 20m-500m north or south of Highway 403.

	Hwy 403 and Transitway			Transitway Only		
	Predicted Concentration (µg/m³)	**Background (µg/m³)**	**Predicted + Background (µg/m³)**	**Predicted Concentration (µg/m³)**	**Background (µg/m³)**	**Predicted + Background (µg/m³)**
RN7	1.16	22	23.2	0.50	22	22.50
RN6	1.27	22	23.3	0.54	22	22.54
RN5	1.39	22	23.4	0.58	22	22.58
RN4	1.54	22	23.5	0.63	22	22.63
RN3	1.76	22	23.8	0.69	22	22.69
RN2	2.06	22	24.1	0.76	22	22.76
RN1	2.56	22	24.6	0.87	22	22.87
South Side Receptor Profile						
RS1	2.58	22	24.6	1.61	22	23.61
RS2	1.83	22	23.8	1.04	22	23.04
RS3	1.45	22	23.4	0.78	22	22.78
RS4	1.21	22	23.2	0.63	22	22.63
RS5	1.05	22	23.1	0.53	22	22.53
RS6	0.95	22	22.9	0.45	22	22.45
RS7	0.87	22	22.9	0.40	22	22.40
RS8	0.80	22	22.8	0.36	22	22.36
RS9	0.75	22	22.7	0.33	22	22.33
RS10	0.70	22	22.7	0.31	22	22.31
RS11	0.66	22	22.7	0.30	22	22.30
RS12	0.63	22	22.6	0.28	22	22.28
RS13	0.60	22	22.6	0.27	22	22.27
RS14	0.58	22	22.6	0.26	22	22.26
RS15	0.56	22	22.6	0.25	22	22.25
RS16	0.54	22	22.5	0.25	22	22.25
RS17	0.52	22	22.5	0.23	22	22.23
RS18	0.51	22	22.5	0.21	22	22.21
RS19	0.49	22	22.5	0.20	22	22.20
RS20	0.48	22	22.5	0.19	22	22.19
RS21	0.47	22	22.5	0.19	22	22.19
RS22	0.46	22	22.5	0.18	22	22.18

	Hwy 403 and Transitway			Transitway Only		
	Predicted Concentration (µg/m³)	**Background (µg/m³)**	**Predicted + Background (µg/m³)**	**Predicted Concentration (µg/m³)**	**Background (µg/m³)**	**Predicted + Background (µg/m³)**
RS23	0.45	22	22.4	0.18	22	22.18
RS24	0.43	22	22.4	0.18	22	22.18
RS25	0.42	22	22.4	0.17	22	22.17

Table 2: PM_{10} Concentrations at Receptor Locations

	Hwy 403 and Transitway			Transitway Only		
	Predicted Concentration (µg/m³)	**Background (µg/m³)**	**Predicted + Background (µg/m³)**	**Predicted Concentration (µg/m³)**	**Background (µg/m³)**	**Predicted + Background (µg/m³)**
Sensitive Receptors						
R1 Daycare	7.16	37	44.2	2.65	37	39.7
R2 School	5.55	37	42.6	2.00	37	39.0
R3 School	4.49	37	41.5	1.26	37	38.3
R4 Daycare	4.13	37	41.1	1.19	37	38.2
R5 MOE Station 4610	2.24	37	39.2	0.65	37	37.7
Receptor Profile[2]						
North Receptor Profile						
RN25	4.62	37	41.6	1.52	37	38.5
RN24	4.71	37	41.7	1.54	37	38.5
RN23	4.81	37	41.8	1.56	37	38.6
RN22	4.93	37	41.9	1.59	37	38.6
RN21	5.06	37	42.1	1.62	37	38.6
RN20	5.20	37	42.2	1.66	37	38.7
RN19	5.35	37	42.4	1.70	37	38.7
RN18	5.53	37	42.5	1.74	37	38.7
RN17	5.73	37	42.7	1.78	37	38.8
RN16	5.95	37	43.0	1.83	37	38.8
RN15	6.19	37	43.2	1.88	37	38.9
RN14	6.52	37	43.5	1.96	37	39.0
RN13	6.88	37	43.9	2.08	37	39.1
RN12	7.30	37	44.3	2.21	37	39.2
RN11	7.76	37	44.8	2.36	37	39.4
RN10	8.28	37	45.3	2.51	37	39.5
RN9	8.88	37	45.9	2.67	37	39.7
RN8	9.56	37	46.6	2.86	37	39.9

[2] Receptor Profile locations represent a variety of sensitive receptors located 20m-500m north or south of Highway 403.

	Hwy 403 and Transitway			Transitway Only		
	Predicted Concentration (µg/m³)	**Background (µg/m³)**	**Predicted + Background (µg/m³)**	**Predicted Concentration (µg/m³)**	**Background (µg/m³)**	**Predicted + Background (µg/m³)**
RN7	10.37	37	47.4	3.06	37	40.1
RN6	11.34	37	48.3	3.30	37	40.3
RN5	12.51	37	49.5	3.56	37	40.6
RN4	14.07	37	**51.1**	3.88	37	40.9
RN3	16.20	37	**53.2**	4.28	37	41.3
RN2	19.31	37	**56.3**	4.77	37	41.8
RN1	24.58	37	**61.6**	5.44	37	42.4
South Side Receptor Profile						
RS1	21.32	37	**58.3**	10.38	37	47.4
RS2	15.48	37	**52.5**	6.64	37	43.6
RS3	12.44	37	49.4	4.97	37	42.0
RS4	10.59	37	47.6	3.98	37	41.0
RS5	9.42	37	46.4	3.33	37	40.3
RS6	8.50	37	45.5	2.86	37	39.9
RS7	7.79	37	44.8	2.55	37	39.6
RS8	7.20	37	44.2	2.31	37	39.3
RS9	6.71	37	43.7	2.12	37	39.1
RS10	6.30	37	43.3	1.98	37	39.0
RS11	5.96	37	43.0	1.88	37	38.9
RS12	5.67	37	42.7	1.79	37	38.8
RS13	5.42	37	42.4	1.72	37	38.7
RS14	5.21	37	42.2	1.66	37	38.7
RS15	5.02	37	42.0	1.61	37	38.6
RS16	4.85	37	41.9	1.57	37	38.6
RS17	4.70	37	41.7	1.43	37	38.4
RS18	4.57	37	41.6	1.32	37	38.3
RS19	4.44	37	41.4	1.27	37	38.3
RS20	4.33	37	41.3	1.23	37	38.2
RS21	4.22	37	41.2	1.20	37	38.2
RS22	4.13	37	41.1	1.18	37	38.2

	Hwy 403 and Transitway			Transitway Only		
	Predicted Concentration (µg/m³)	**Background (µg/m³)**	**Predicted + Background (µg/m³)**	**Predicted Concentration (µg/m³)**	**Background (µg/m³)**	**Predicted + Background (µg/m³)**
RS23	4.03	37	41.0	1.16	37	38.2
RS24	3.94	37	40.9	1.13	37	38.1
RS25	3.85	37	40.9	1.11	37	38.1

Table 3: Ambient Pollutant Concentrations at MOE Station

Pollutant	Statistic	2002 [1]	2003 [2]	2004 [3]	2005 [3]	2006 [3]	Average
CO (ppm)	1-hr Max	5.98	5.36	1.87	2.65	2.98	3.77
	8-hr Max	3.71	3.34	1.19	1.66	2.48	2.48
	Annual Mean	0.70	0.66	INS	0.38	0.35	0.52
	1hr-90th Percentile	1.23	1.43	0.66	0.63	0.55	0.90
	Times > 1-hr AAQC (36,200)	0.00	0.00	0.00	0.00	0.00	0.00
	Times > 8-hr AAQC (15,700)	0.00	0.00	0.00	0.00	0.00	0.00
NO_2 (ppb)	1-hr Max	95	71	87	89	75	83.40
	24-hr Max	47	43	53	54	42	47.80
	Annual Mean	20	INS	16	17	15	16.93
	1hr-90th Percentile	34	37	34	36	33	34.80
	Times > 1-hr AAQC (200)	0	0	0	0	0	0.00
	Times > 24-hr AAQC (100)	0	0	0	0	0	0.00
$PM_{2.5}$ TEOM ($\mu g/m^3$) [4]	1-hr Max	119	67	67	78	53	76.80
	24-hr Max	38	45	40	47	34	40.80
	Annual Mean	9	8	8	9	8	8.26
	1hr-90th Percentile	19	17	18	22	17	18.60
	24hr-90th Percentile	19	15	16	22	15	17.26
	Times > CWS (30)	5	7	10	12	3	7.40
PM_{10} TEOM ($\mu g/m^3$) [5]	1-hr Max	198	112	112	130	88	128.00
	24-hr Max	63	75	67	78	57	68.00
	Annual Mean	14	13	13	15	13	13.77
	1hr-90th Percentile	32	28	30	37	28	31.00
	24hr-90th Percentile	32	24	26	37	25	28.77
	Times > 24-hr AAQC (50) *	n/a	n/a	n/a	n/a	n/a	n/a
SO_2 (ppb)	1-hr Max	162	103	95	66	20	89.20
	24-hr Max	17	16	16	9	8	13.20
	Annual Mean	INS	3	INS	3	INS	2.55
	1hr-90th Percentile	8	6	4	5	5	5.60
	Times > 1-hr AAQC (250)	0	0	0	0	0	0.00
	Times > 24-hr AAQC (100)	0	0	0	0	0	0.00

Pollutant	Statistic	2002 [1]	2003 [2]	2004 [3]	2005 [3]	2006 [3]	Average
O_3 (ppb)	1-hr Max	111	110	82	102	90	99.00
	24-hr Max	62	76	58	74	71	68.20
	Annual Mean	23	25	21	23	22	22.82
	1hr-90th Percentile	45	45	39	47	43	43.80
	Times > 1-hr AAQC (80)	72	61	1	54	14	40.40
Benzene (µg/m³) [6]	24-hr Max	3.2	2.9	2.3	n/a	n/a	2.80
	Annual Mean	0.9	n/a	n/a	n/a	n/a	0.90
	1hr-90th Percentile	1.4	2.0	1.5	n/a	n/a	1.63
	Times > AAQC	n/a	n/a	n/a	n/a	n/a	n/a
1,3-Butadiene (µg/m³) [6]	24-hr Max	0.5	0.4	0.3	n/a	n/a	0.40
	Annual Mean	0.1	n/a	n/a	n/a	n/a	0.10
	1hr-90th Percentile	0.2	0.2	0.2	n/a	n/a	0.20
	Times > AAQC	n/a	n/a	n/a	n/a	n/a	n/a
Acrolein (µg/m³) [7]	24-hr Max	0.69	0.32	0.13	n/a	n/a	0.38
	Annual Mean	0.11	0.13	0.06	n/a	n/a	0.10
	1hr-90th Percentile	0.16	0.28	0.08	n/a	n/a	0.17
	Times > AAQC	n/a	n/a	n/a	n/a	n/a	n/a

Notes:

(1) Year 2002 data from MOE Station No. 46110 (Mississauga, Mississauga General Hospital). PM2.5 24 hr-90th percentile based on 1 hour concentrations as hourly data was not available to calculate the 24 hr-90th percentile.

(2) Year 2003 data from MOE Station No. 46110 (Mississauga, Mississauga General Hospital)

(3) Year 2004 through 2006 PM2.5, SO2 data from MOE Station No. 46109 (Mississauga, Frank McKechnie Community Centre (Bristol Road East)). Year 2004 through 2006 NO2 data from MOE Station No. 46089 (Brampton, 525 Main St. N., Peel Manor). Year 2005 thourgh 2006 CO data from MOE Station No. 35125 (Toronto West, 125 Resources Rd.).

(4) Canada Wide Standard for PM2.5 established for the year 2010 based on the 98th percentile ambient measurement annually, averaged over three consecutive years

(5) Year 2002 through Year 2006 PM10 data was unavailable for MOE Stations, therefore the MOE equation of PM10 = PM2.5/0.6 was used to predict Year 2002 through 2006 PM10 data

(6) Year 2002 through Year 2004 data from NAPs Station No. 60428 (Brampton, 525 Main St. N.). Year 2005 through 2006 data unavailable.

(7) Acrolein data from MOE Station in Windsor.

* Interim AAQC

TEOM – Tapered Element Oscillating Microbalance (Continuous Monitor)

AAQC – Ambient Air Quality Criterion

n/a – data not available

INS - Site does not meet requirement of 75% valid data per quarter; INS represents insufficient data for a valid mean.

Data is presented as reported in government documents