



**Cross City Tunnel**  
**Stack Emissions Monitoring Report**  
**January 2020**

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**Executive Summary**

Data capture rates can be found in the Summary of Results table on page 5. Explanations for missing data can be found in the Data Validation table on page 6.

There are no data available for CO from 1/01/2020 to 3/01/2020 due to an instrument fault.

There are no data available for VOC parameters from 21/01/2020 to 31/01/2020 due to an instrument fault.

There were no readings over the specified limits for the reporting period.

January 2020 Exceedances						
	Unit of measurement	Averaging Period	Total CO	Total NO <sub>x</sub>	Total PM <sub>10</sub>	Total VOC
<b>Concentration Limit</b>	mg/m <sup>3</sup>	1 hour	109	19	1	11
<b>Number of readings over limit</b>			0	0	0	0

## Monitored Parameters

The Cross City Tunnel Stack Emissions Monitoring System has been designed to continuously monitor for the following gaseous and particulate parameters:

- CO (Carbon Monoxide)
- NO (Nitrogen Oxide)
- NO<sub>2</sub> (Nitrogen Dioxide)
- NO<sub>x</sub> (Total Oxides of Nitrogen)
- Methane
- TNMHC (Total Non-Methane Hydrocarbons)
- PM<sub>10</sub> (Particulate matter less than 10 microns in aerodynamic equivalent diameter)
- PM<sub>2.5</sub> (Particulate matter less than 2.5 microns in aerodynamic equivalent diameter)

Atmospheric parameters also monitored in the stack are:

- Temperature (°C)
- Pressure (kPa)
- Velocity (m/s)
- Relative Humidity (%)

Data are recorded to a data logger at 5 minute averaging periods, calculated from 10 second samples. All data are retrieved periodically, at least once per 24 hours, over a private 3G network, to a central WinCollect database, where data validation is performed to remove any data not deemed as valid. Data validation is performed versus the relevant standard, and/or as per the instrument manufacturers recommended guidelines.

Nightly calibrations for the gaseous analysers are performed between 1:30am and 2:05am. This data is removed from the report automatically, and is not included in the Validation Table.

Parameter	Method	Last Calibration Date	Applicable Standard	Uncertainty
NO NO <sub>2</sub> NO <sub>x</sub>	Chemiluminescence	16/01/2020	AS 3580.5.1	± 0.008 mg/m <sup>3</sup> ± 0.005 mg/m <sup>3</sup> ± 0.005 mg/m <sup>3</sup>
CO	Gas filter correlation non-dispersive infrared photometer	16/01/2020	AS 3580.7.1	± 0.029 mg/m <sup>3</sup>
Methane TNMHC	Flame Ionisation Detection	22/01/2020	AS 3580.11.1	± 0.0164 mg/m <sup>3</sup>
PM <sub>10</sub>	Tapered Element Oscillating Microbalance	11/11/2019	AS3580.9/8 AS 4323.2 – 1995	± 3.6% of reading or ± 5µg/m <sup>3</sup> whichever is greater
PM <sub>2.5</sub>		11/11/2019		± 3.6% of reading or ± 5µg/m <sup>3</sup> whichever is greater
Stack Temperature	Vaisala HMP235a	11/10/2016	US EPA 454-99-005	± 0.25 °C
Stack Pressure	Pitot Tube	-		± 0.3 kPa
Relative Humidity	Vaisala HMP235a	11/10/2016		± 5%
Stack Velocity	Pitot Tube	-	ISO 10780	TBA

## Glossary

The following terms may be found throughout this report:

NO – Nitric Oxide

NO<sub>2</sub> – Nitrogen Dioxide

NO<sub>x</sub> – Total Oxides of Nitrogen

CO – Carbon Monoxide

CH<sub>4</sub> - Methane

PM<sub>10</sub> – Particulate Matter of 10 microns or less (aerodynamic equivalent diameter)

PM<sub>2.5</sub> – Particulate Matter of 2.5 microns or less (aerodynamic equivalent diameter)

MET – Methane

TNMHC – Total Non Methane Hydrocarbons

VOC – Volatile Organic Compounds

ppb – Parts Per Billion

ppm – Parts Per Million

µg/m<sup>3</sup> – micrograms per cubic meter

mg/m<sup>3</sup> – milligrams per cubic meter

m/s – meters per second

m<sup>3</sup>/s – cubic meters per second

kg/hr – kilograms per hour

g/5min – grams per 5 minutes

## Summary of results

### January 2020 Summary

#### Tonnes per month (5 minute data)

	NO	NO <sub>2</sub>	NO <sub>x</sub>	CO	PM <sub>2.5</sub>	PM <sub>10</sub>	Met.	TNMHC
<b>Tonnes (Corrected)</b>	<b>0.387</b>	<b>0.062</b>	<b>0.653</b>	<b>2.245</b>	<b>0.026</b>	<b>0.033</b>	<b>0.882</b>	<b>0.154</b>
<b>Tonnes (Measured)</b>	<b>0.369</b>	<b>0.059</b>	<b>0.623</b>	<b>1.952</b>	<b>0.025</b>	<b>0.032</b>	<b>0.488</b>	<b>0.085</b>
Available Data Points	8513	8513	8513	7763	8819	8819	4939	4939
Total Data Points	8928	8928	8928	8928	8928	8928	8928	8928
Capture Rate (%)	97.8	97.8	97.8	89.4	98.8	98.8	57.7	57.7

#### Tonnes per month (1 hr data)

	NO	NO <sub>2</sub>	NO <sub>x</sub>	CO	PM <sub>2.5</sub>	PM <sub>10</sub>	Met.	TNMHC
<b>Tonnes (Corrected)</b>	<b>0.378</b>	<b>0.061</b>	<b>0.639</b>	<b>1.758</b>	<b>0.025</b>	<b>0.032</b>	<b>0.879</b>	<b>0.151</b>
<b>Tonnes (Measured)</b>	<b>0.373</b>	<b>0.060</b>	<b>0.630</b>	<b>1.581</b>	<b>0.025</b>	<b>0.032</b>	<b>0.504</b>	<b>0.086</b>
Available Data Points	734	734	734	669	736	736	426	426
Total Data Points	744	744	744	744	744	744	744	744
Capture Rate (%)	98.7	98.7	98.7	89.9	98.9	98.9	57.3	57.3

#### Average hourly concentrations

	NO(mg/m <sup>3</sup> )	NO <sub>2</sub> (mg/m <sup>3</sup> )	NO <sub>x</sub> (mg/m <sup>3</sup> )	CO(mg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	PM <sub>10</sub> (µg/m <sup>3</sup> )	Met. (mg/m <sup>3</sup> )	TNMHC (mg/m <sup>3</sup> )
<b>Minimum</b>	0.01	0.00	0.06	0.00	0.00	0.00	1.03	0.00
<b>Maximum</b>	1.93	0.29	3.23	7.63	193.48	203.38	1.45	0.57
<b>Average</b>	0.52	0.08	0.88	2.42	33.88	43.33	1.18	0.21

## Validation Table

January 2020 Data Validation					
Start Date	End Date	Affected Parameters	Reason for Change	Changed By	Date
1/01/2020 00:00	10/01/2020 01:25	NMHC	Multiplier applied to data; Multiplier A: 1.126126, multiplier B: 1.126126;	TA	7/02/2020
1/01/2020 00:00	9/01/2020 01:25	CH4	Multiplier applied to data; Multiplier A: 0.946746, multiplier B: 0.946746;	TA	7/02/2020
1/01/2020 00:00	9/01/2020 01:25	CH4	Offset applied to data; Offset A: 0.7, multiplier B: 0.7;	TA	7/02/2020
1/01/2020 00:00	3/01/2020 16:25	NO, NO2, NOx	Multiplier applied to data; Multiplier A: 0.893289, multiplier B: 0.893289;	TA	7/02/2020
1/01/2020 00:00	3/01/2020 16:25	CO	Instrument fault	TA	7/02/2020
3/01/2020 16:30	3/01/2020 17:30	CO, NO, NO2, NOx, CH4, NMHC	Maintenance	TA	7/02/2020
9/01/2020 02:10	16/01/2020 09:55	CH4	Offset applied to data; Offset A: 0.6, multiplier B: 0.6;	TA	7/02/2020
10/01/2020 02:10	12/01/2020 01:25	NMHC, CH4	Span calibration out of tolerance	TA	7/02/2020
16/01/2020 10:00	16/01/2020 18:45	All parameters	Maintenance	TA	7/02/2020
16/01/2020 18:50	21/01/2020 01:25	CH4	Offset applied to data; Offset A: 0.7, multiplier B: 0.7;	TA	7/02/2020
19/01/2020 02:10	21/01/2020 01:25	NMHC	Multiplier applied to data; Multiplier A: 1.098097, multiplier B: 1.098097;	TA	7/02/2020
21/01/2020 02:10	31/01/2020 23:55	NMHC, CH4	Instrument fault	TA	7/02/2020
21/01/2020 22:55	21/01/2020 23:00	All parameters	Not enough samples	TA	7/02/2020
22/01/2020 12:35	22/01/2020 12:40	CO, NO, NO2, NOx, CH4, NMHC	Maintenance	TA	7/02/2020
22/01/2020 17:20	22/01/2020 20:20	CO, NO, NO2, NOx, CH4, NMHC	Maintenance	TA	7/02/2020
23/01/2020 10:25	23/01/2020 10:50	CO, NO, NO2, NOx, CH4, NMHC	Maintenance	TA	7/02/2020

This table identifies any data removed which is not automatically removed due to overnight calibration checks which are performed from 1:30 AM to 2:05 AM