



Cross City Tunnel
Stack Emissions Monitoring Report
May 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 were no readings over the specified limits for the reporting period.

| May 2020 Exceedances | | | | | | |
|--------------------------------------|---------------------|------------------|----------|-----------------------|------------------------|-----------|
| | Unit of measurement | Averaging Period | Total CO | Total NO _x | Total PM ₁₀ | Total VOC |
| Concentration Limit | mg/m ³ | 1 hour | 109 | 19 | 1 | 11 |
| Number of readings over limit | | | 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)
- NO₂ (Nitrogen Dioxide)
- NO_x (Total Oxides of Nitrogen)
- Methane
- TNMHC (Total Non-Methane Hydrocarbons)
- PM₁₀ (Particulate matter less than 10 microns in aerodynamic equivalent diameter)
- PM_{2.5} (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 ₂ NO _x | Chemiluminescence | 28/05/2020 | AS 3580.5.1 | ± 0.008 mg/m ³ ± 0.005 mg/m ³ ± 0.005 mg/m ³ |
| CO | Gas filter correlation non-dispersive infrared photometer | 28/05/2020 | AS 3580.7.1 | ± 0.029 mg/m ³ |
| Methane TNMHC | Flame Ionisation Detection | 28/05/2020 | AS 3580.11.1 | ± 0.0164 mg/m ³ |
| PM ₁₀ | Tapered Element Oscillating Microbalance | 29/04/2020 | AS3580.9/8 AS 4323.2 – 1995 | ± 3.6% of reading or ± 5µg/m ³ whichever is greater |
| PM _{2.5} | | 29/04/2020 | | ± 3.6% of reading or ± 5µg/m ³ whichever is greater |
| Stack Temperature | Vaisala HMP235a | 12/05/2020 | US EPA 454-99-005 | ± 0.25 °C |
| Stack Pressure | Pitot Tube | - | | ± 0.3 kPa |
| Relative Humidity | Vaisala HMP235a | 12/05/2020 | | ± 5% |
| Stack Velocity | Pitot Tube | - | ISO 10780 | TBA |

Glossary

The following terms may be found throughout this report:

NO – Nitric Oxide

NO₂ – Nitrogen Dioxide

NO_x – Total Oxides of Nitrogen

CO – Carbon Monoxide

CH₄ - Methane

PM₁₀ – Particulate Matter of 10 microns or less (aerodynamic equivalent diameter)

PM_{2.5} – 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/m³ – micrograms per cubic meter

mg/m³ – milligrams per cubic meter

m/s – meters per second

m³/s – cubic meters per second

kg/hr – kilograms per hour

g/5min – grams per 5 minutes

Summary of results

May 2020 Summary

Tonnes per month (5 minute data)

| | NO | NO ₂ | NO _x | CO | PM _{2.5} | PM ₁₀ | Met. | TNMHC |
|---------------------------|--------------|-----------------|-----------------|--------------|-------------------|------------------|--------------|--------------|
| Tonnes (Corrected) | 0.411 | 0.042 | 0.672 | 2.141 | 0.022 | 0.028 | 0.953 | 0.169 |
| Tonnes (Measured) | 0.393 | 0.040 | 0.642 | 2.045 | 0.022 | 0.028 | 0.851 | 0.151 |
| Available Data Points | 8529 | 8529 | 8529 | 8529 | 8815 | 8815 | 7972 | 7972 |
| Total Data Points | 8928 | 8928 | 8928 | 8928 | 8928 | 8928 | 8928 | 8928 |
| Capture Rate (%) | 97.9 | 97.9 | 97.9 | 97.9 | 98.7 | 98.7 | 91.7 | 91.7 |

Tonnes per month (1 hr data)

| | NO | NO ₂ | NO _x | CO | PM _{2.5} | PM ₁₀ | Met. | TNMHC |
|---------------------------|--------------|-----------------|-----------------|--------------|-------------------|------------------|--------------|--------------|
| Tonnes (Corrected) | 0.400 | 0.042 | 0.655 | 1.672 | 0.022 | 0.028 | 0.950 | 0.166 |
| Tonnes (Measured) | 0.395 | 0.041 | 0.647 | 1.651 | 0.022 | 0.028 | 0.877 | 0.153 |
| Available Data Points | 735 | 735 | 735 | 735 | 737 | 737 | 687 | 687 |
| Total Data Points | 744 | 744 | 744 | 744 | 744 | 744 | 744 | 744 |
| Capture Rate (%) | 98.8 | 98.8 | 98.8 | 98.8 | 99.1 | 99.1 | 92.3 | 92.3 |

Average hourly concentrations

| | NO(mg/m ³) | NO ₂ (mg/m ³) | NO _x (mg/m ³) | CO(mg/m ³) | PM _{2.5} (µg/m ³) | PM ₁₀ (µg/m ³) | Met. (mg/m ³) | TNMHC (mg/m ³) |
|----------------|------------------------|--------------------------------------|--------------------------------------|------------------------|----------------------------------------|---------------------------------------|---------------------------|----------------------------|
| Minimum | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 1.07 | 0.00 |
| Maximum | 1.74 | 0.18 | 2.72 | 6.55 | 88.39 | 120.96 | 1.89 | 0.57 |
| Average | 0.54 | 0.05 | 0.89 | 2.25 | 28.80 | 37.14 | 1.27 | 0.22 |

Validation Table

| May 2020 Data Validation | | | | | |
|--------------------------|------------------|--------------------------------|----------------------------------------------------------------------------------|------------|-----------|
| Start Date | End Date | Affected Parameters | Reason for Change | Changed By | Date |
| 1/05/2020 00:00 | 31/05/2020 23:55 | CH4 | Multiplier applied to data; Multiplier A: 0.9333679; Multiplier B: 0.9339679; | TA | 3/06/2020 |
| 1/05/2020 00:00 | 31/05/2020 23:55 | CH4 | Offset applied to data; Offset A: 1.0; Offset B: 1.0; | TA | 3/06/2020 |
| 4/05/2020 10:20 | 31/05/2020 23:55 | All parameters | Intermittent missing data | TA | 3/06/2020 |
| 12/05/2020 08:45 | 12/05/2020 16:00 | All parameters | Maintenance | TA | 3/06/2020 |
| 16/05/2020 02:10 | 18/05/2020 01:25 | CH4, NMHC | Calibration out of tolerance | TA | 3/06/2020 |
| 28/05/2020 14:25 | 28/05/2020 17:45 | CO, NO, NO2, NOx, CH4, NMHC | Maintenance | TA | 3/06/2020 |

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