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West Gate Tunnel Project

Ambient Air Quality Monitoring

Validated Report

1st April 2018 – 30th April 2018

Report No.: DAT13210

Report issue date: 8th June 2018

Maintenance contract: MC1984

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT13210	08/06/18	Diep LAM

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Executive Summary

Ecotech Pty Ltd is an independent company, contracted Transurban Limited (Principal) to undertake continuous ambient air quality monitoring (AAQM) at West Gate Tunnel Project network of sites in Yarraville, Victoria, Australia. Monitoring is being conducted to inform environmental compliance requirements of the planned West Gate Tunnel Project. The air quality monitoring contract between Ecotech and Transurban Limited (Principal) has ended as per schedule in March 2018. Ecotech is assisting the D&C Subcontractor in the transition program in the month of April 2018.

The West Gate Tunnel Project monitoring network consists of five AAQM stations. Ecotech commissioned the West Gate Tunnel Project monitoring stations as following:

- Station 1 on 19th July 2016.
- Station 2 on 26th August 2016.
- Station 4 on 3rd November 2016. BTEX sampling at Station 4 commenced on 21st November 2016.
- Station 5 on 17th January 2017.
- Station 3 on 25th January 2017.

This report presents the data for April 2018.

- The percentage of valid data capture for most of parameters at West Gate Tunnel Project was above 85% for the reporting month, with the exception of $PM_{2.5}$ at Station 5.
- The low $PM_{2.5}$ data capture at Station 5 was due to instrument fault - tape alarm from the 5th to 23rd April 2018.
- Three recorded PM_{10} readings at Station 4 were exceeded the SEPP(AQM) Schedule B intervention levels during the reporting period. Refer to Table 17 for more details.
- Five recorded $PM_{2.5}$ readings at stations 2, 3 and 4 were exceeded the SEPP(AQM) Schedule B intervention levels during the reporting period. Refer to Tables 15, 16 and 17 for more details.
- Four recorded $PM_{2.5}$ readings at Station 1 were exceeded the SEPP(AAQ) EQO during the reporting period. Refer to Table 14 for more details.

Introduction

Ecotech Pty Ltd was commissioned by Transurban Limited (Principal) to provide monitoring and data reporting for the West Gate tunnel Project ambient air quality monitoring stations, located as detailed in Table 1. Ecotech commenced data collection at Station 1 on the 19th July 2016, at Station 2 on the 26th August 2016, and at Station 4 on the 3rd November 2016. BTEX sampling at Station 4 commenced on 21st of November 2016. Monitoring commenced at Stations 5 and 3 on the 17th and 25th of January 2017 respectively.

The monitoring contract between Ecotech and Transurban Limited (Principal) has ended in the month of March 2018 as per contract schedule. Ecotech is assisting the D&C Subcontractor in the transition program which begins in April 2018. This report presents the available data for the month of April 2018 where no formal monitoring contract were in place.

The data presented in this report:

- Describes air quality measurements;
- Compares monitoring results;
- Has been quality assured;
- Complies with NATA accreditation requirements, where applicable.

1.0 Monitoring and Data Collection

1.1. Siting Details

The West Gate Tunnel Project consists of five ambient air quality monitoring stations. The station's location and siting details are described below.

Table 1: West Gate Tunnel Project monitoring locations

Site Name	Street Address	Geographical Coordinates	Height Above Sea Level (m)
Station 1	Barbara Beyer Reserve, 2 Harris St, Yarraville	37°48'43.20"S 144°54'0.00"E	10m
Station 2	51-53 Francis Street, Yarraville	37°49'15.59"S 144°53'38.41"E	12m
Station 3	Railway Reserve, Woods St, Yarraville	37°48'50.40"S 144°53'27.60"E	17m
Station 4	Primula Ave, Brooklyn	37°49'27.28"S 144°50'45.72"E	23m
Station 5	Donald McLean Reserve, Spotswood	37°49'35.28"S 144°52'55.25"E	6m

Siting audits were conducted to assess for compliance with *AS/NZS 3580.1.1:2016 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

Siting audits performed at West Gate Tunnel Project monitoring network as follows:

- Statin 1 on 31st July 2017.
- Station 2 on 22nd September 2017.
- Station 3 on 4th February 2018.
- Station 4 on 1st November 2017.
- Station 5 on 8th February 2018.

The siting audits of these stations showed general compliance with the guidelines in AS/NZS 3580.1.1:2016. These stations are classified as peak stations according to AS/NZS 3580.1.1:2016. Please see details of any non-compliance in Section 1.3.1.

The meteorological monitoring siting audits were completed at West Gate Tunnel Project as follows:

- Station 1 on 31st July 2017.
- Station 2 on 22nd September 2017.
- Station 3 on 1st February 2018.
- Station 4 on 1st November 2017.
- Station 5 on 2nd February 2018.

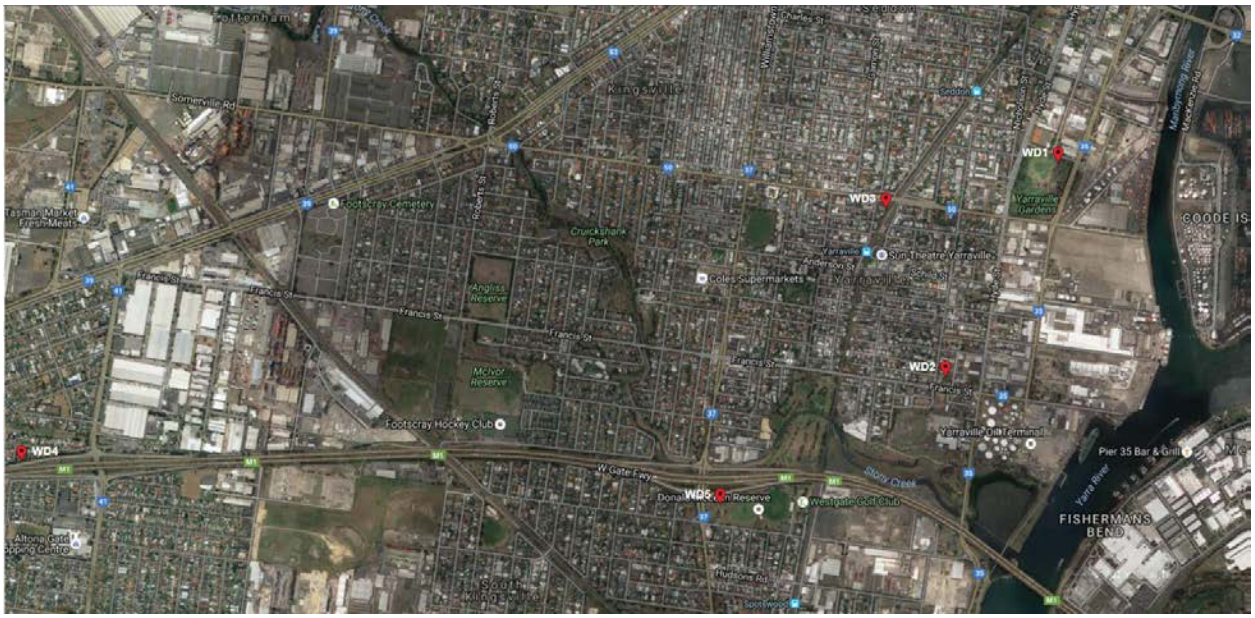

Figure 1: West Gate Tunnel Project Monitoring Station Location

1.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at West Gate Tunnel Project monitoring stations. Appendix 1 defines any abbreviated parameter names used throughout the report.

Sampling of all parameters is continuous, with the exception of BTEX. BTEX sampling is typically conducted by Ecotech on a one in six-day cycle at WD4 station. BTEX samples are collected from 12:30 AM to 11:30 PM on the sampling day. Only two BTEX samples were collected in the month of April during the transition program.

For meteorological sensors, the elevation given in Table 2 is the height above ground level at the monitoring station.

Table 2: Parameters measured at the West Gate Tunnel Project monitoring stations

Station	Parameter Measured	Instrument and Measurement Technique
Stations 1, 2, 3, 4 and 5	PM_{10}	Rupprecht & Patashnick / Thermo – TEOM (Tapered Element Oscillating Microbalance)
	$PM_{2.5}$	Met One BAM 1020 – Beta ray attenuation
	Wind Speed (horizontal, elevation 10m)	Vaisala WS425 – ultrasonic
	Wind Direction (elevation 10m)	Vaisala WS425 – ultrasonic
Station 4	Benzene, Toluene, Ethyl benzene, Xylene (BTEX)	Collected In Specially-Prepared Canisters And Analysed By Gas Chromatography/Mass Spectrometry (GC/MS)
	NO, NO_2, NO_x	Ecotech EC9841 – gas phase chemiluminescence
	CO	Ecotech EC9830 – NDIR gas filter correlation infrared photometry

1.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in sections 1.3.1. and 1.3.3.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS/NZS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
CO	AS/NZS 3580.7.1-2011	Methods for sampling and analysis of ambient air. Method 7.1: Determination of carbon monoxide - direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.3 Carbon monoxide by gas filter correlation spectrophotometry
BTEX (Sampling only)	US EPA TO-15	Method TO-15 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition. Compendium Method TO-15 Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analysed By Gas Chromatography/Mass Spectrometry (GC/MS)
	Ecotech Laboratory Manual	In-house method 6.9 Volatile organic compounds in air collected in specially prepared canisters and analysed by gas chromatography/mass spectrometry
PM_{10} (TEOM)	AS/NZ 3580.9.8-2008	Methods for sampling and analysis of ambient air. Method 9.8: Determination of suspended particulate matter - PM_{10} continuous direct mass method using a tapered element oscillating microbalance analyser.
	Ecotech Laboratory Manual	In-house method 7.3- Particulates - $PM_{2.5}$, PM_{10} by TEOM

Parameter Measured	Data Collection Methods Used	Description of Method
$PM_{2.5}$ (BAM 1020)	AS/NZS 3580.9.12 - 2013	Methods of sampling and analysis of ambient air. Method 9.12: Determination of suspended particulate matter – $PM_{2.5}$ beta attenuation monitors
	Ecotech Laboratory Manual	In-house method 7.5 – Measurement of PM_{10}, $PM_{2.5}$ and TSP using Beta Attenuation Monitor.
Vector Wind Speed (Horizontal)	AS/NZS 3580.14 2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS/NZS 3580.14 2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

1.3.1. NATA Endorsement and Compliance with Standards

Unless stated below, parameters are monitored at the West Gate Tunnel Project monitoring network according to the methods detailed in Table 3 above.

- Siting of all stations may not fully comply with the guidelines in *AS 3580.14-2014 "Methods for sampling and analysis of ambient air – Meteorological monitoring for ambient air quality monitoring applications guidelines"*, due to possible air flow disturbances caused by nearby trees. Locating monitoring stations in urban areas often requires compromise due to a lack of clear space areas without obstructions as well as the availability of usable power supplies. Given the location, the site is fit for purpose while not fully compliant.

- AS/NZS 3580.1.1:2007 recommends a minimum distance between inlets and the roof of the supporting structure of 1.0m. However, all stations have inlets less than 1.0m above the roof. It is not thought this small difference will have any impact on measured concentrations.

- Ecotech's NATA scope of accreditation covers sampling only for BTEX parameters. Analysis and canister preparation is conducted by NATA accredited laboratories ALS as outlined in 1.3.3 below.

- Wind sensors at WD3 and WD5 stations were out of wind tunnel calibrations from 18th January 2018 and 14th April 2018 respectively. Ecotech will try to arrange the wind tunnel calibration at the next suitable maintenance visit.

1.3.2. Data Acquisition (Continuous Monitoring)

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at each of the monitoring sites. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS loggers on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5-minute intervals.

1.3.3. Sampling and analysis for BTEX

BTEX canister sampling was conducted by Ecotech field service technicians. ALS (NATA Accreditation No. 825) provided the canisters and laboratory analysis services according to method US EPA TO-15.

1.4. Data Validation and Reporting

1.4.1. Validation

The Ecotech ERS department performs daily data checks on continuously monitored parameters to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Ecotech ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g. backed by maintenance notes, calibration sheets etc.) in the database for flagging any data as invalid.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated 5-minute data, while $PM_{2.5}$ is based on validated 1-hour data.

1.4.2. Reporting

The reported data for continuously monitored parameters is in a Microsoft Excel format file named "*West Gate Tunnel Project Monthly Data Report_April 2018.xls*".

The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5 Minute Data
3. 1 Hour Data
4. 1 Day Data
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

Averages are based on a minimum of 75% valid readings within the averaging period. All averages are calculated from the 5-minute data, while $PM_{2.5}$ averages are calculated from 1-hour data.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00am is for the data collected from 1:00am to 2:00am. For the purposes of calculating and reporting 4 and 8-hour averages, the first rolling average in a calendar day ends at 1.00 am and includes hours from the previous calendar day. One-hour averages are calculated based on a clock hour. One day and one-year averages are calculated based on calendar days.

Wind Data Reporting

Wind speed and wind direction data associated with calm wind conditions are reported in accordance with the requirements of AS 3580.14-2014. Calm wind conditions are defined as wind speeds below the starting threshold of the wind speed / direction sensors. Sensor starting thresholds are given in Table 6 under "Measurement Range".

BTEX Reporting

Results will be provided to Ecotech by the analytical laboratory and summarised within this report. Full analytical results will be included as an Appendix 3 at the end of this report.

2.0 Air Quality Standards and Goals

The air quality standards for pollutants monitored at the West Gate Tunnel Project monitoring network are based on:

- State Environmental Protection Policy (Ambient Air Quality) Environmental Quality Objectives (SEPP (AAQ) EQO) for WD1 (Yarraville Gardens) monitoring station, and
- State Environmental Protection Policy (Air Quality Management) (SEPP (AQM)) Schedule B for the remaining West Gate Tunnel Project monitoring stations.

The air quality goals are shown in Tables 4 and 5 below.

Table 4: Air Quality Standards for Station 1

Parameter	Time Period	Exceedance Level	Units	Maximum allowable exceedances
PM_{10}	1 day	50	µg/m³	None (see note)
PM_{10}	1 year	20	µg/m³	None
$PM_{2.5}$	1 day	25	µg/m³	None (see note)
$PM_{2.5}$	1 year	8	µg/m³	None

Note:

Exceptional events are excluded from this standard. As per the Ambient Air Quality NEPM, ***Exceptional event*** means a fire or dust occurrence that adversely affects air quality at a particular location and causes an exceedance of 1-day average standards in excess of normal historical fluctuations and background levels and is directly related to: bushfire; jurisdiction authorised hazard reduction burning; or continental scale windblown dust.

Ecotech will include any valid data identified as being associated with an exceptional event in all report tables and graphic representations. However, 1-day averages associated with exceptional events will not be counted as exceedances of the Air Quality standard.

Table 5: Air Quality Standards and SEPP(AQM) Goals for Station` 2, 3,` an` .

Parameter	Time Period	Exceedance Level	Units	Maximum allowable exceedances
CO	1 hour	29.0	ppm	-
NO_2	1 hour	140	ppb	-
Benzene[1]	1 year (based on 1-day averages)	0.003	ppm	8-year goal is to gather sufficient data nationally to facilitate development of a standard.
Toluene[1]	1 day	1	ppm	8-year goal is to gather sufficient data nationally to facilitate development of a standard.
	1 year (based on 1-day averages)	0.1	ppm	
Xylene [1]	1 day	0.25	ppm	8-year goal is to gather sufficient data nationally to facilitate development of a standard.
	1 year (based on 1-day averages)	0.2	ppm	
PM_{10}	1 day	60	µg/m³	-
$PM_{2.5}$	1 day	36	µg/m³	-

Note:

SEPP (AQM)) Schedule B – Intervention levels for Class 1, 2 and 3 indicators:

> Intervention levels are used to assess the air quality monitoring data to determine whether the beneficial uses set out in Clause 9 of this Policy are being protected. Intervention levels are not used in the assessment of the design of individual sources. An intervention level is numerically greater than the design criteria for a given pollutant as it does not apply to an individual source but to all sources of the pollutant within a defined area.

[1] This value is monitoring investigation level of air pollution only, not limits according to Legislation F2011C00855 - National Environment Protection (Air Toxic) Measure 2011.

3.0 Calibrations and Maintenance

3.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[2]
NO, NO_x (EC9841)	ppb	1 ppb	± 13 ppb or 10% of reading K factor of 2.0	0 ppb to 500 ppb
NO_2 (EC9841)	ppb	1 ppb	± 17 ppb K factor of 2.0	0 ppb to 500 ppb
CO (EC9830)	ppm	0.1 ppm	± 1 ppm or 10% of reading, K factor of 2.0	0 ppm to 50 ppm
PM_{10} (TEOM)	µg/m³	0.1 µg/m³	±5.0 µg/m³ or 3.6% of reading, K factor of 2.0	0 µg/m³ to 1 g/m³
$PM_{2.5}$ (BAM 1020)	µg/m³	1 µg/m³	±5.0 µg/m³ + 5.4% of reading, K factor of 2.0	5 to 1000 µg/m³
Vector Wind Speed	m/s	0.1 m/s	±0.4 m/s or 2.0% of reading, K factor of 2.0	0 m/s to 30 m/s
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.0	0 deg to 360 deg *Starting threshold:* 0 m/s

[2] Uncertainties may not be calculated based on the full measurement range. Uncertainty for CO by EC9830 is calculated based on a range of 0-10 ppm. Uncertainty for NO, NO_2 and NO_x by EC 9841 are calculated based on a measurement range of 0-125 ppb.

3.2. Automatic calibration checks

Automatic span, zero and background checks occur each night for continuously monitored gaseous parameters. Data associated with these checks is invalidated and is not specifically referred to in the valid data exception reports. Table 7 displays the times for when these checks occur.

Table 7: Automatic Span/Zero and Background Check Times

Parameter	Span/Zero	Background
CO	01:00 to 01:25	23:45 to 23:55
NO, NO_2, NO_x	01:00 to 01:25	-

3.3. Maintenance

3.3.1. Maintenance notes

Only basic maintenance was performed at these stations during April 2018 due to the expiration of the operation and maintenance contract. This included response to breakdowns and may have resulted in reduced data capture.

3.3.2. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Tables 8 – 12 on the next pages indicate when the particulate, gas and meteorological equipment were last maintained/calibrated.

Table 8: Station 1 Maintenance Table April 2018

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
PM_{10}	05/04/18	Monthly	02/02/18	6-Monthly
$PM_{2.5}$	23/04/18	Non-scheduled	05/04/18	Yearly
Wind Speed	05/04/18	Monthly	04/05/16[3]	2-Yearly
Wind Direction	05/04/18	Monthly	04/05/16[3]	2-Yearly

Table 9: Station Maintenance Table April 2018

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
PM_{10}	03/04/18	3 Monthly	01/02/18	6-Monthly
$PM_{2.5}$	03/04/18	Monthly	07/03/18	Yearly
Wind Speed	03/04/18	Monthly	24/05/16[4]	2-Yearly
Wind Direction	03/04/18	Monthly	24/05/16[4]	2-Yearly

Table 10: Station 3 Maintenance Table April 2018

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
PM_{10}	04/04/18	3 Monthly	01/02/18	6-Monthly
$PM_{2.5}$	04/04/18	3 Monthly	07/03/18	Yearly

[3] Wind tunnel calibration performed on 04/05/2016 and installed at Station 1 on 22/07/2016.

[4] Wind tunnel calibration performed on 24/05/2016 and installed at Station 2 on 12/09/2016.

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
Wind Speed	04/04/18	Monthly	18/01/16[5]	2-Yearly
Wind Direction	04/04/18	Monthly	18/01/16[5]	2-Yearly

Table 11: Station 4 Maintenance Table April 2018

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
PM_{10}	05/04/18	6 Monthly	05/04/18	6-Monthly
$PM_{2.5}$	23/04/18	6 Monthly	05/04/18	Yearly
CO	23/04/18	6 Monthly	06/04/18	Monthly
NO, NO_2, NO_x	23/04/18	6 Monthly	06/04/18	Monthly
BTEX	10/04/18	Weekly	Every sample	On supply of flow controller[6]
Wind Speed	05/04/18	Monthly	21/10/16[7]	2-Yearly
Wind Direction	05/04/18	Monthly	21/10/16[7]	2-Yearly

[5] Wind tunnel calibration performed on 18/01/2016 and installed at Station 3 on 06/02/2017.

[6] Sampling flow orifice checks and calibrations performed by ALS for each orifice mass flow controller supplied. Records are held by Ecotech and available on request.

[7] Wind tunnel calibration performed on 21/10/2016 and installed at Station 4 on 22/11/2016.

Table 12: Station 5 Maintenance Table April 2018

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
PM_{10}	05/04/18	3 Monthly	07/03/18	6-Monthly
$PM_{2.5}$	23/04/18	Non-scheduled	07/03/17	Yearly
Wind Speed	05/04/18	Monthly	15/04/16[8]	2-Yearly
Wind Direction	05/04/18	Monthly	15/04/16[8]	2-Yearly

[8] Wind tunnel calibration performed on 15/04/2016 and installed at Station 5 on 27/01/2017.

4.0 Results

4.1. Valid Data Capture

Valid data capture refers to the amount of valid data collected during the report period. It is based on 5-minute data for all continuously monitored parameters, with the exception of $PM_{2.5}$. The $PM_{2.5}$ data is based on 1-hour data.

The percentage of valid data captured is calculated using the following equation:

Percentage Valid Data capture = (Reported air quality data / Total data) x 100%

Where:

- Reported air quality data = Number of samples (instrument readings) which have been validated through a quality assured process and excludes all data errors, zero data collection due to calibration, equipment failures, planned and unplanned maintenance.
- Total data = Total number of samples (instrument readings) expected for the sampling period. Total data is calculated based on the same averaging period as "reported air quality data" and the duration of the corresponding report period. e.g. for 5-minute data collected over a month of 31 days, the total data would be equal to 12 (5-minute samples in an hour) x 24 (hours in a day) x 31 (days in a month) = 8928 samples.

Table 13 below displays data capture statistics for April 2018. **Bold** values in the table indicates the of percentage valid data capture below 85%.

Table 13: West Gate Tunnel Project Monthly Data Capture for April 2018

Parameter	Station 1 (%)	Station 2 (%)	Station 3 (%)	Station 4 (%)	Station 5 (%)
PM_{10}	99.8	99.8	99.7	99.8	99.4
$PM_{2.5}$	99.6	99.6	99.9	95.4	**39.0**
WS, WD	100.0	100.0	100.0	100.0	99.9
CO	-	-	-	97.0	-
NO, NO_2, NO_x	-	-	-	97.8	-
BTEX	-	-	-	100.0	-

4.2. Air Quality Monthly Summary

Tables 14 - 19 below include a summary of any air quality exceedances recorded at West Gate Tunnel Project during the report period.

Table 14: Station 1 Exceedances recorded for April 2018

Parameter	Time Period	Exceedance Level	Number of exceedances	Value of Exceedance	End Date/Time of Exceedance
PM_{10}	1 day	50 µg/m³	None recorded	-	-
$PM_{2.5}$	1 day	25 µg/m³	4	40 µg/m³	20/04/18
				38 µg/m³	21/04/18
				36 µg/m³	22/04/18
				31 µg/m³	23/04/18
PM_{10}	1 year	20 µg/m³	None recorded	-	-
$PM_{2.5}$	1 year	8 µg/m³	None recorded	-	-

Table 15: Station 2 Exceedances recorded for April 2018

Parameter	Time Period	Exceedance Level	Number of exceedances	Value of Exceedance	End Date/Time of Exceedance
PM_{10}	1 day	60 µg/m³	None recorded	-	-
$PM_{2.5}$	1 day	36 µg/m³	1	39 µg/m³	20/04/18

Table 16: Station 3 Exceedances recorded for April 2018

Parameter	Time Period	Exceedance Level	Number of exceedances	Value of Exceedance	End Date/Time of Exceedance
PM_{10}	1 day	60 µg/m³	None recorded	-	-
$PM_{2.5}$	1 day	36 µg/m³	2	39 µg/m³	20/04/18
				37 µg/m³	21/04/18

Table 17: Station 4 Exceedances recorded for April 2018

Parameter	Time Period	Exceedance Level	Number of exceedances	Value of Exceedance	End Date/Time of Exceedance
PM_{10}	1 day	60 µg/m³	3	66.4 µg/m³	10/04/18
				64.7 µg/m³	19/04/18
				70.1 µg/m³	24/04/18
$PM_{2.5}$	1 day	36 µg/m³	2	40 µg/m³	20/04/18
				38 µg/m³	21/04/18
CO	1 hour	29 ppm	None recorded	-	-
NO_2	1 hour	140 ppb	None recorded	-	-

Table 18: Station 4 readings above Monitoring Investigation Level recorded for April 2018

Parameter	Time Period	Exceedance Level	Number of exceedances	Value of Exceedance	End Date/Time of Exceedance
Toluene	1 day	1 ppm	None recorded	-	-
Xylenes	1 day	0.25 ppm	None recorded	-	-

Table 19: Station 5 Exceedances recorded for April 2018

Parameter	Time Period	Exceedance Level	Number of exceedances	Value of Exceedance	End Date/Time of Exceedance
PM_{10}	1 day	60 µg/m³	None recorded	-	-
$PM_{2.5}$	1 day	36 µg/m³	None recorded	-	-

4.3. BTEX Analytical Results Summary

Table 20 below displays a summary of the analytical results for BTEX during the reporting period. Full analysis reports from ALS are included in Appendix 3. Results displayed as "<x ppb" indicated a reading below the lower detectable limit.

Table 20: Station 4 BTEX Analytical Results for April 2018

Parameter	NEMP MIL	Units	Samples	
Canister Number			C4986	C12624†
Sample Date			03/04/18	09/04/18
Final Vacuum		inHg	5	3
Benzene	3 (1 year)	ppb	<0.5	<0.5
Toluene	1000 (1 day) 100 (1 Year)	ppb	0.7	1
Ethyl benzene	-	ppb	<0.5	<0.5
m,p-xylenes	250 (1 day) 200 (1 Year)	ppb	<1.0	<1.0
o-xylene		ppb	<0.5	<0.5

†Sample flow may have decreased towards the end of the 24 hours sampling period. Therefore, the reported result may not be fully representative of the 24-hour average concentration.

4.4. Graphic Representations

Validated 5-minute data for NO, NO_2, NO_x, CO and PM_{10}, and validated 1-hour data for $PM_{2.5}$ were used to construct the following monthly graphic representations.

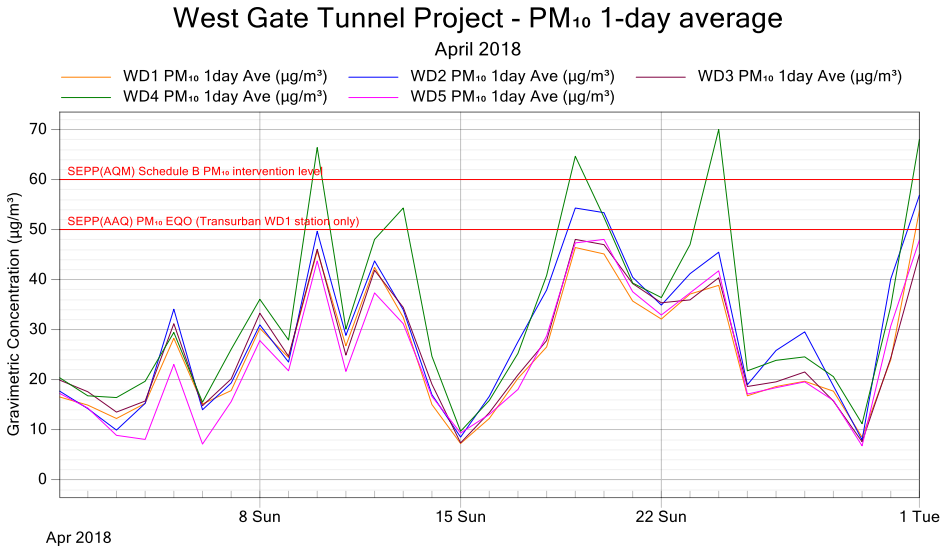

Figure 2: West Gate Tunnel Project - PM_{10} 1-day Averages for April 2018

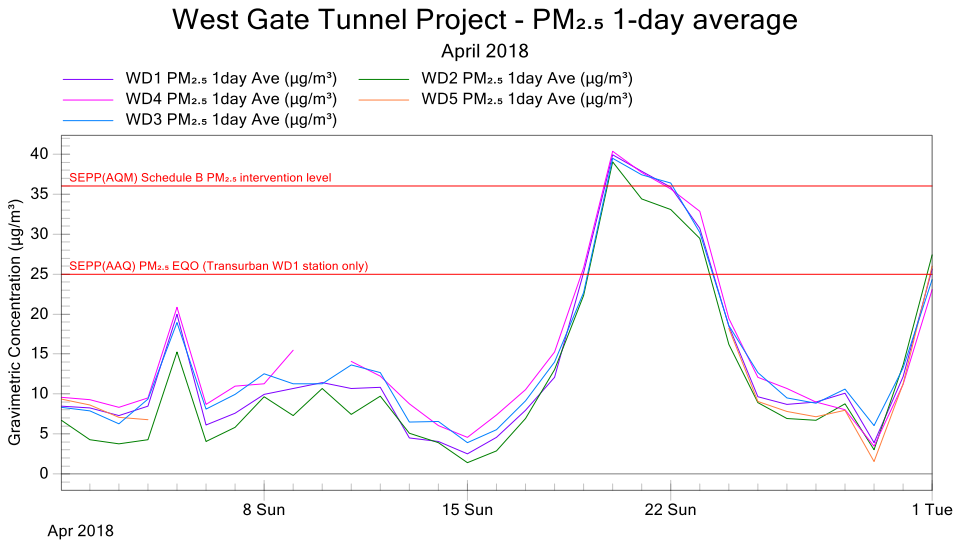

Figure 3: West Gate Tunnel Project - $PM_{2.5}$ 1-day Averages for April 2018

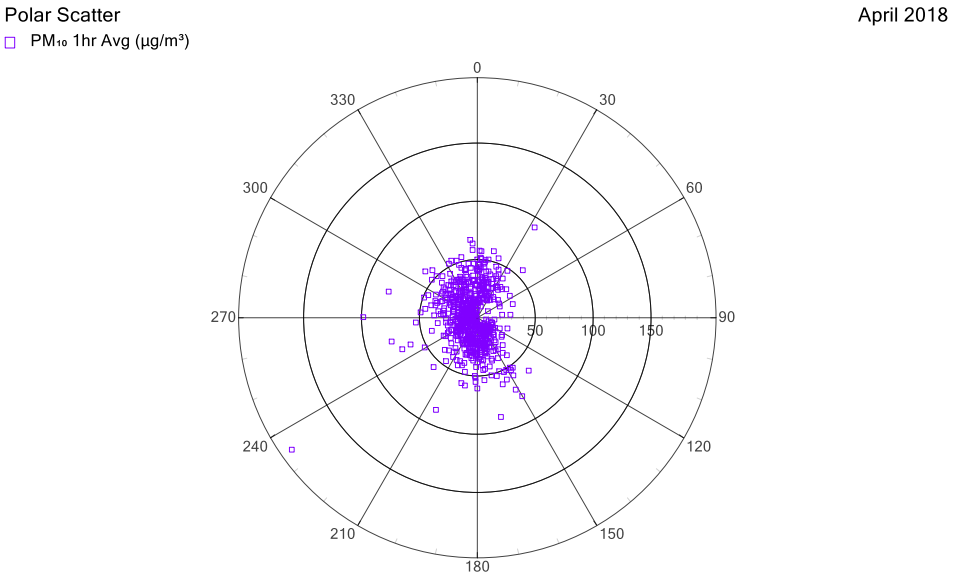

Figure 4: Station 1 - PM_{10} 1-hour Averages scatter plot for April 2018

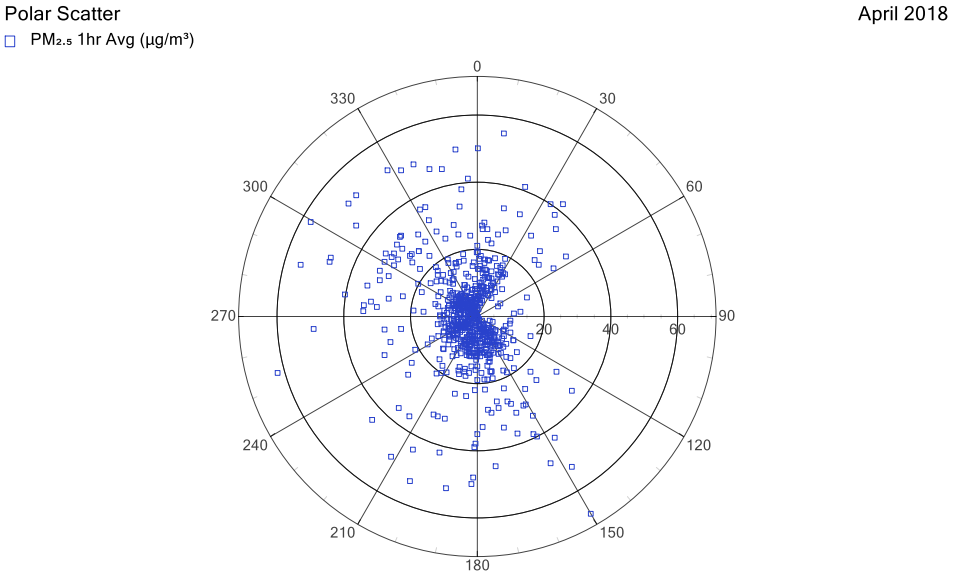

Figure 5: Station 1 - $PM_{2.5}$ 1-hour Averages scatter plot for April 2018

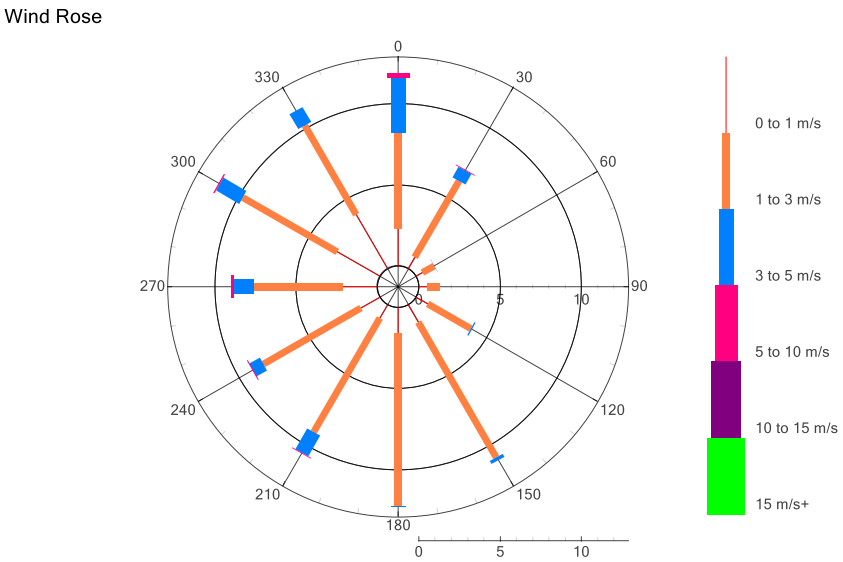

Figure 6: Station 1 - Monthly Wind Rose for April 2018

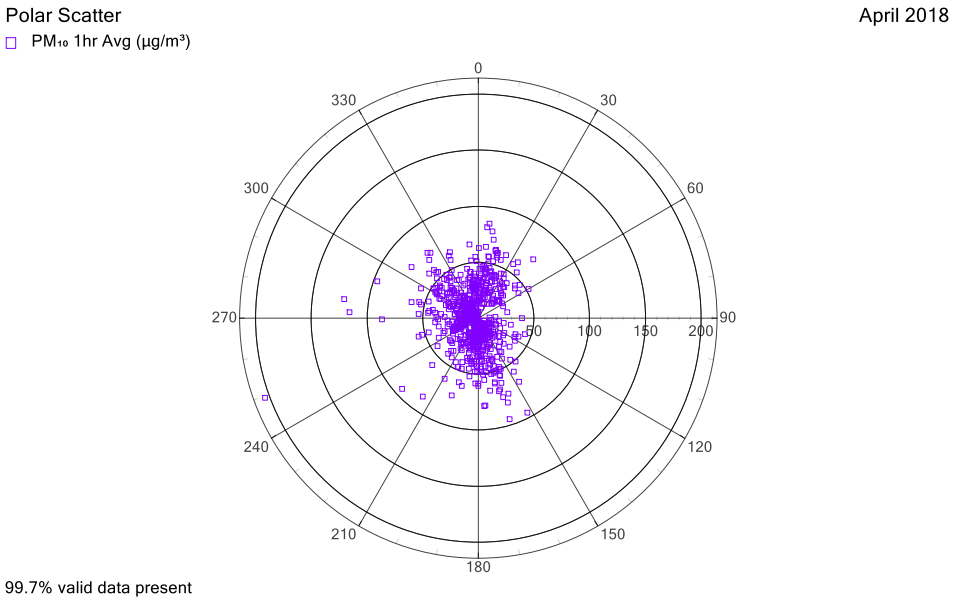

Figure 7: Station 2 - PM_{10} 1-hour Averages scatter plot for April 2018

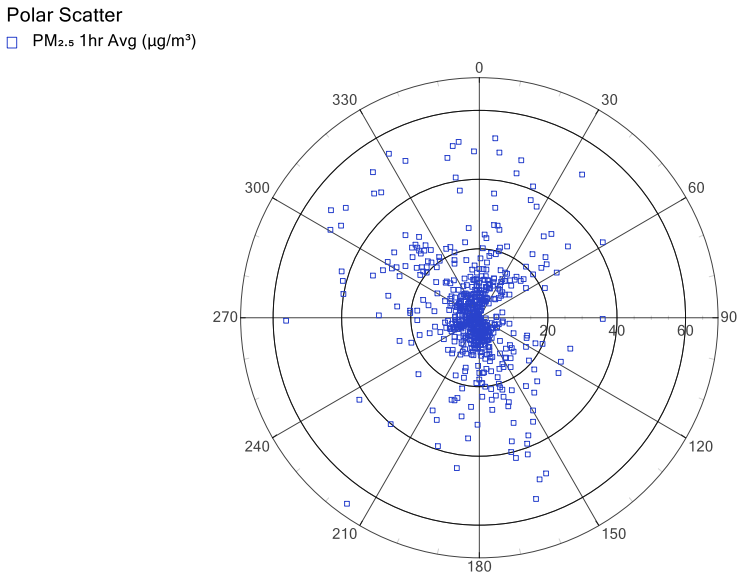

Figure 8: Station 2 - $PM_{2.5}$ 1-hour Averages scatter plot for April 2018

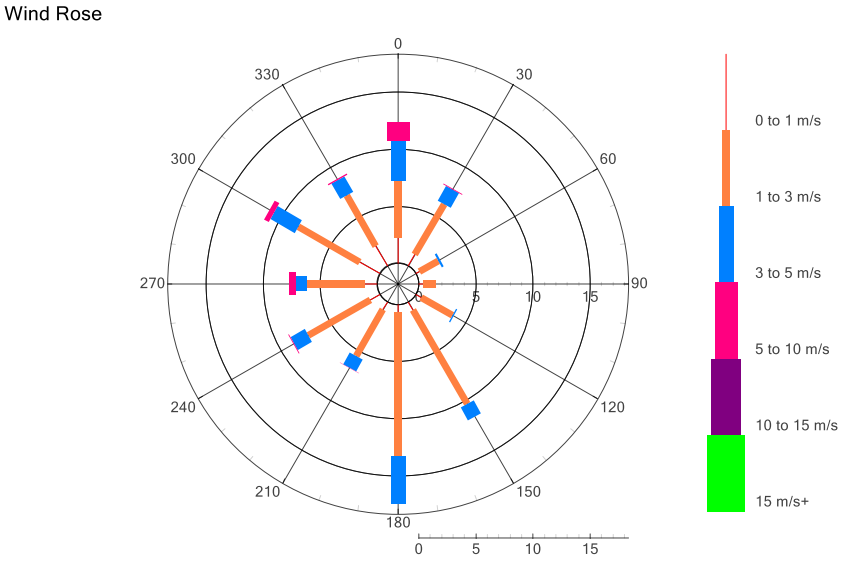

Figure 9: Station 2 - Monthly Wind Rose for April 2018

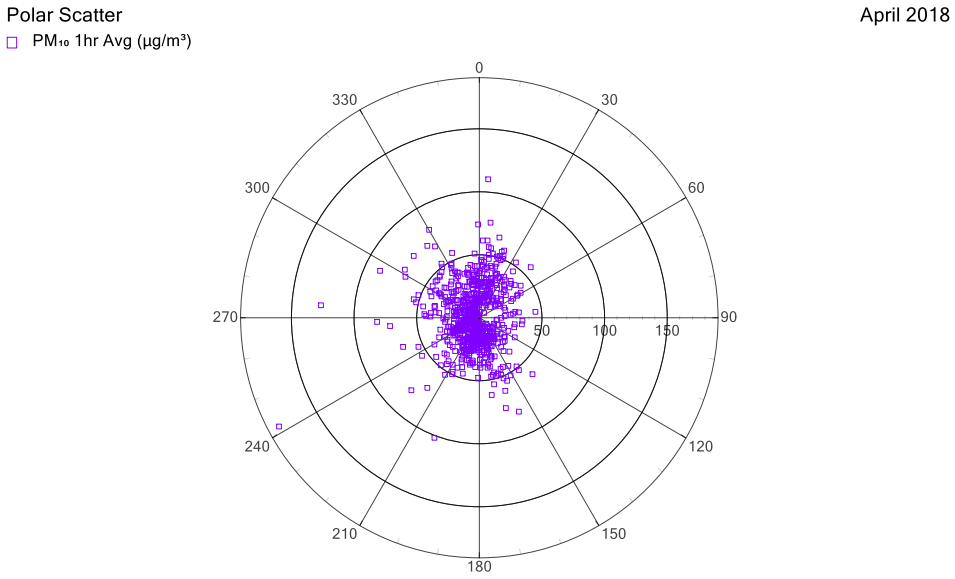

Figure 10: Station 3 - PM_{10} 1-hour Averages scatter plot for April 2018

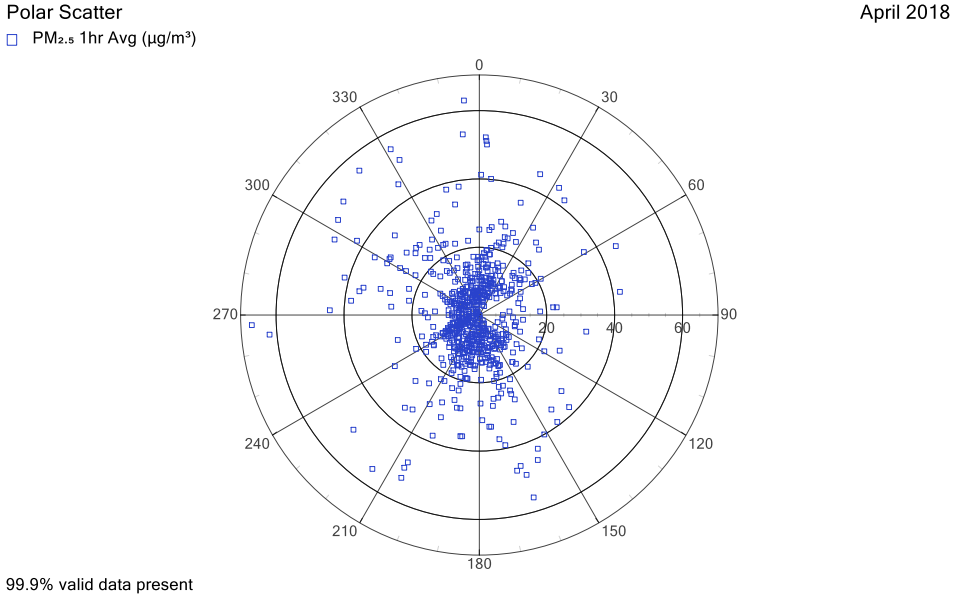

Figure 11: Station 3 - $PM_{2.5}$ 1-hour Averages scatter plot for April 2018

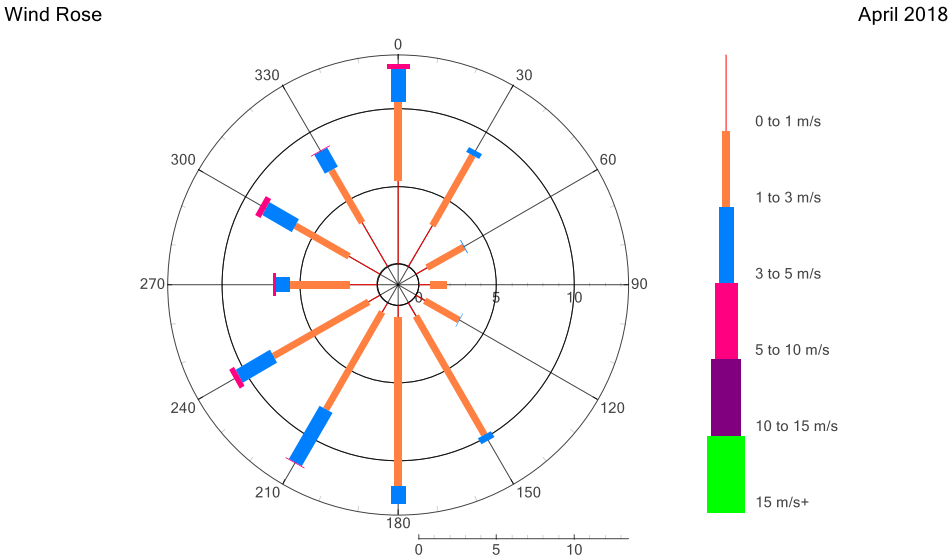

Figure 12: Station 3 - Monthly Wind Rose for April 2018

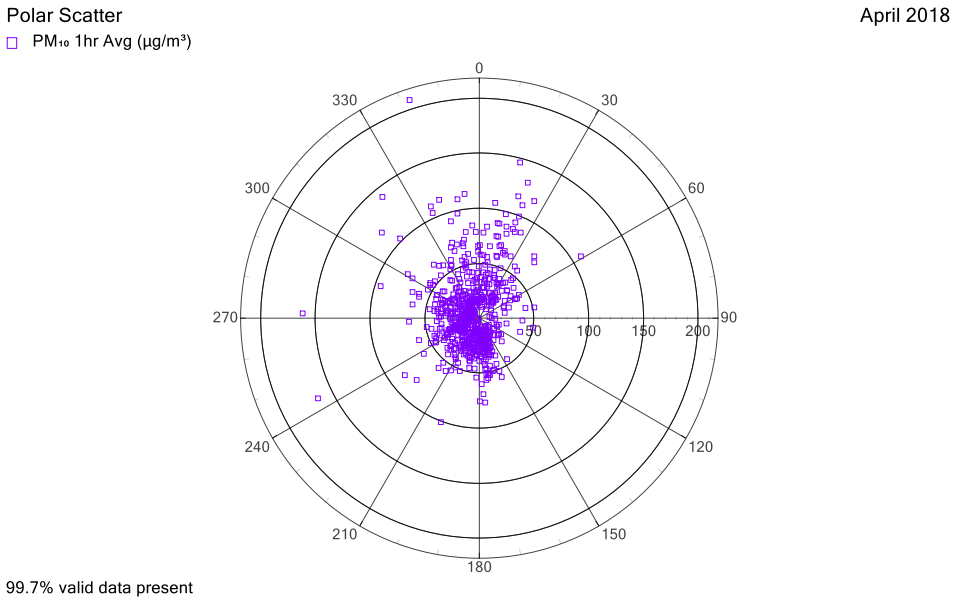

Figure 13: Station 4 - PM_{10} 1-hour Averages scatter plot for April 2018

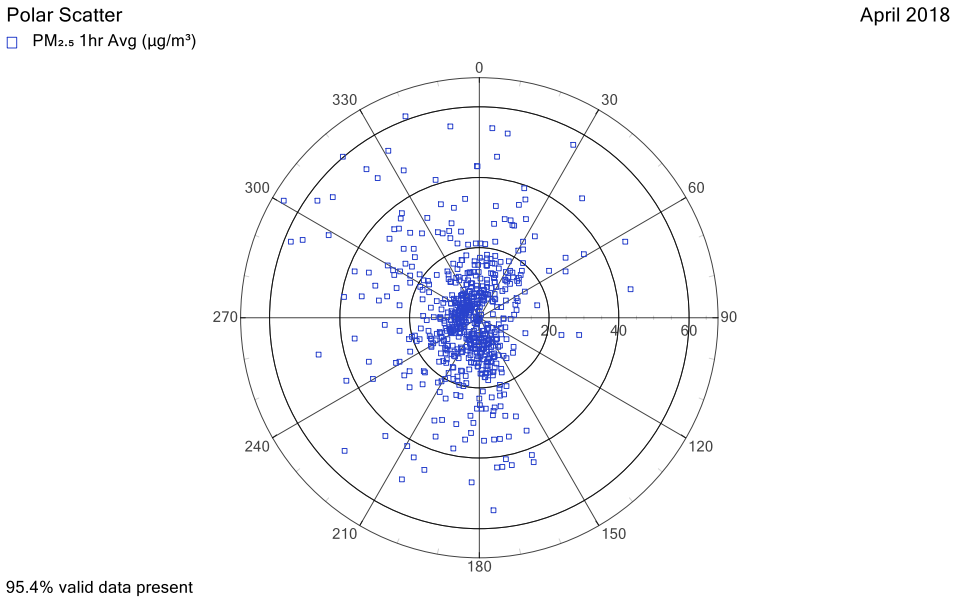

Figure 14: WStation 4- $PM_{2.5}$ 1-hour Averages scatter plot for April 2018

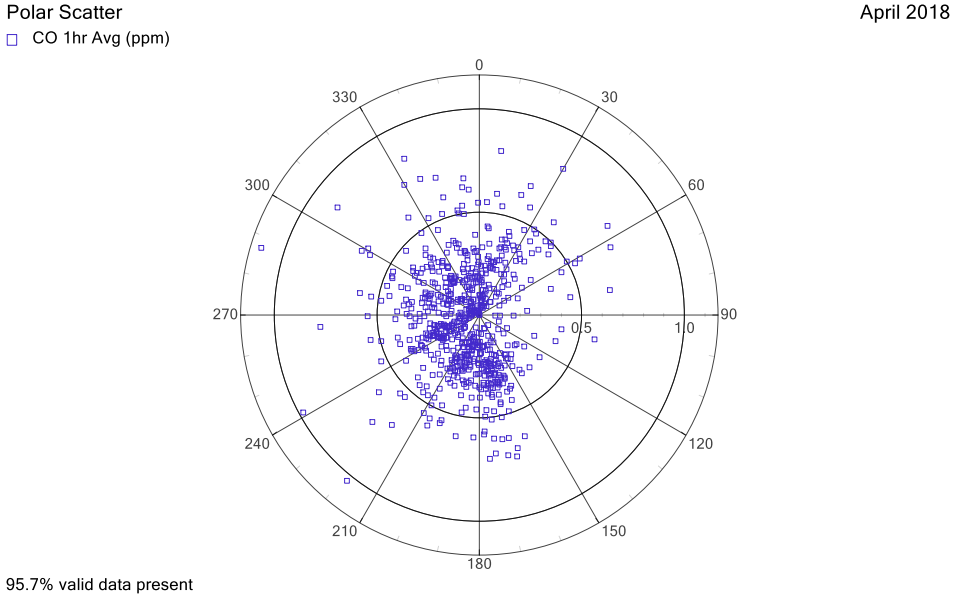

Figure 15: Station 4 - CO 1-hour Averages scatter plot for April 2018

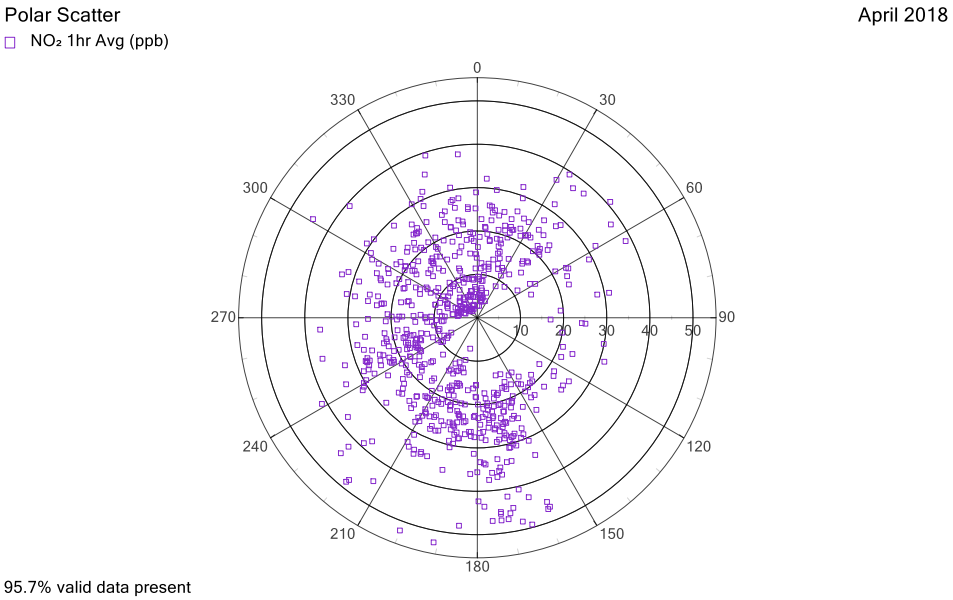

Figure 16: Station 4 - NO_2 1-hour Averages scatter plot for April 2018

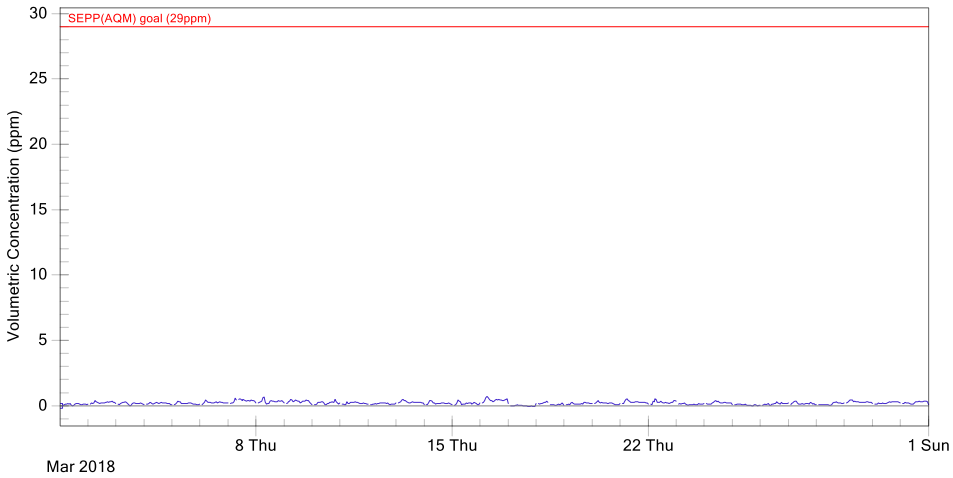

Figure 17: Station 4 - CO 1-hour Averages for April 2018

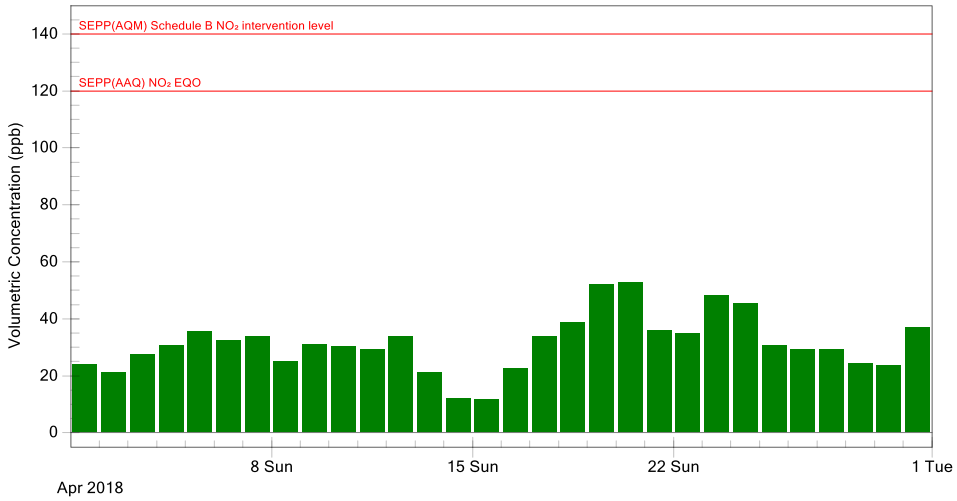

Figure 18: Station 4 - NO_2 1-hour Averages for April 2018

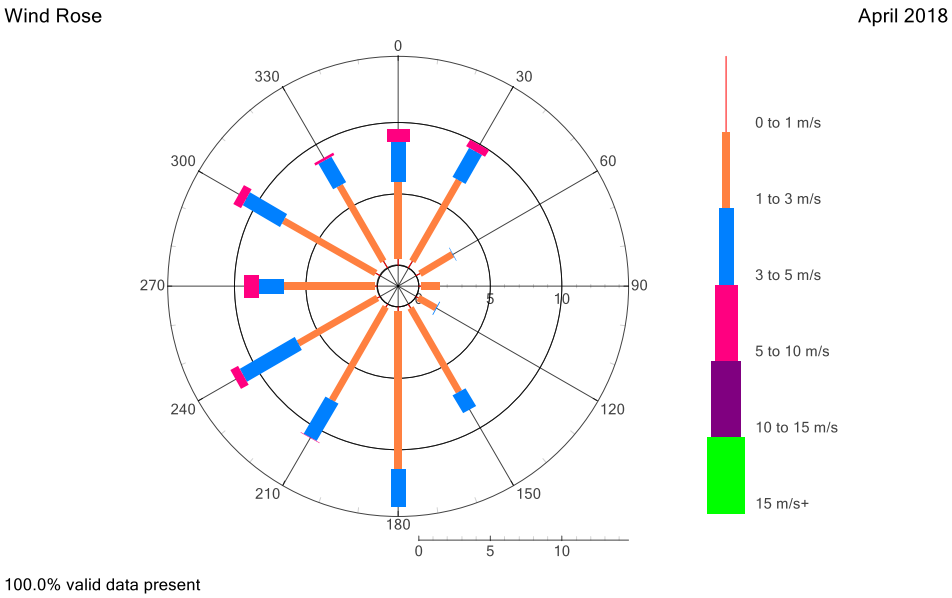

Figure 19: Station 4 - Monthly Wind Rose for April 2018

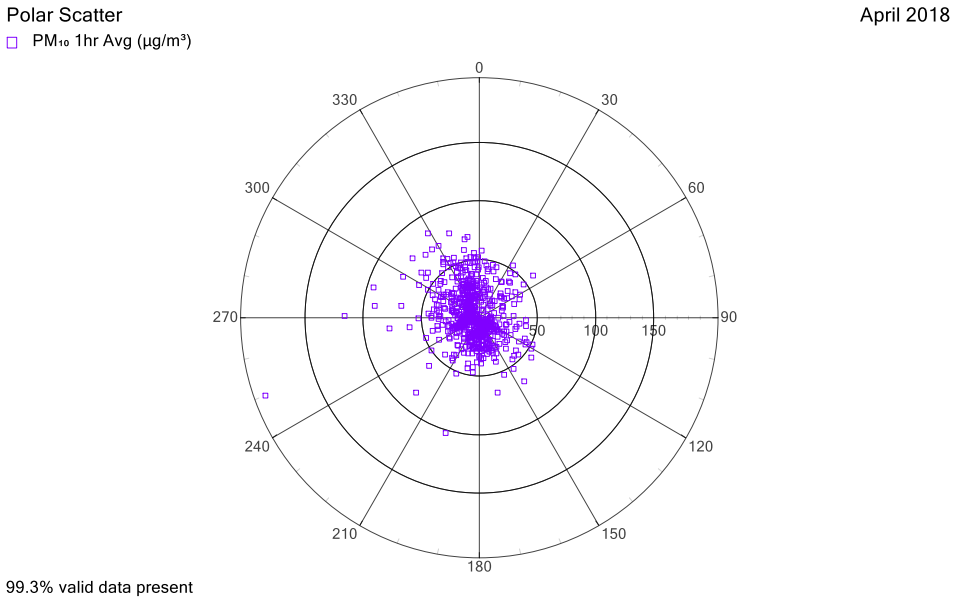

Figure 20: Station 5 - PM_{10} 1-hour Averages scatter plot for April 2018

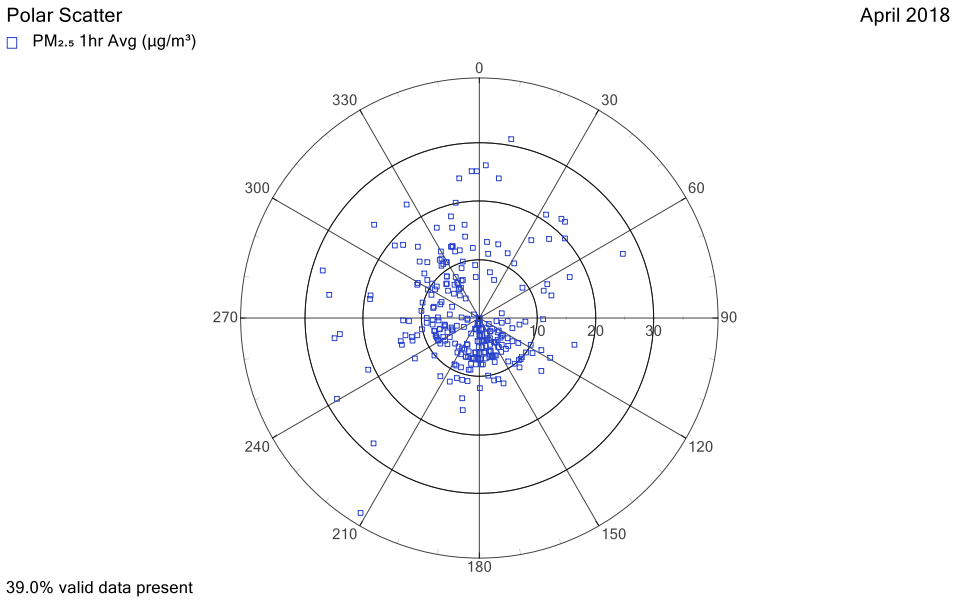

Figure 21: Station 5 - $PM_{2.5}$ 1-hour Averages scatter plot for April 2018

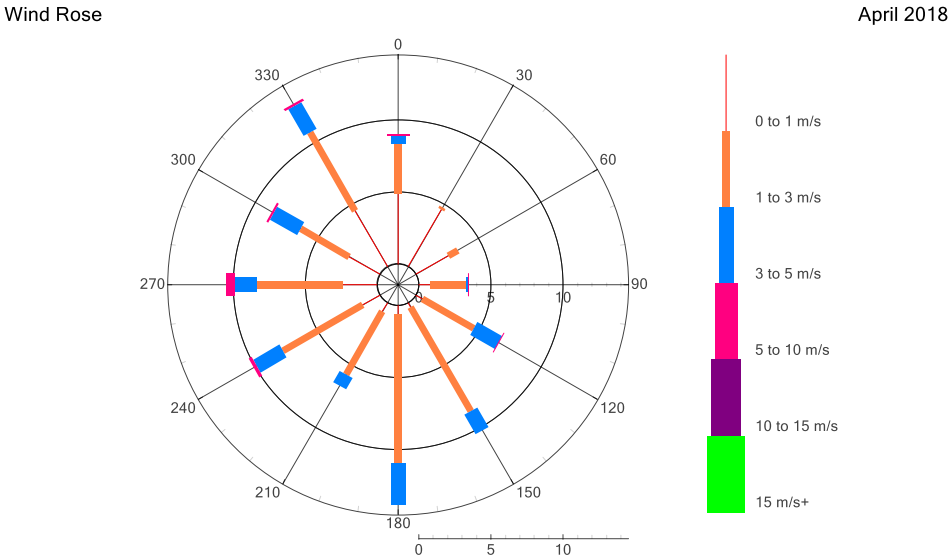

Figure 22: Station 5 - Monthly Wind Rose for April 2018

5.0 Valid Data Exception Table

Tables 21 - 25 below detail all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 21: Station 1 Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
05/04/18 10:00	05/04/18 12:00	Scheduled monthly maintenance	$PM_{2.5}$, PM_{10}	DL	17/05/18
23/04/18 16:00	23/04/18 16:00	Non-scheduled maintenance - Tape replaced	$PM_{2.5}$	DL	17/05/18

Table 22: Station 2 Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
03/04/18 10:00	03/04/18 12:20	Scheduled monthly maintenance	$PM_{2.5}$, PM_{10}	DL	17/05/18
29/04/18 01:00	29/04/18 01:00	Unrealistic data - Readings below the instrument range	$PM_{2.5}$	DL	17/05/18

Table 23: Station 3 Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
04/04/18 12:00	04/04/18 14:30	Scheduled 3 monthly maintenance	$PM_{2.5}$, PM_{10}	DL	17/05/18
23/04/18 15:45	23/04/18 16:00	Non-scheduled maintenance - Tape replaced	No data affected	DL	17/05/18

Table 24: Station 4 Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/04/18 01:30	30/04/18 01:30	Additional instrument stabilisation following the automatic span checks	CO	DL	17/05/18
02/04/18 03:00	11/04/18 00:00	Intermittent unrealistic data - Readings below the instrument range and high level of noise	$PM_{2.5}$	DL	17/05/18
05/04/18 12:00	05/04/18 15:05	Scheduled 6 monthly maintenance and Canister changed over	$PM_{2.5}$, PM_{10}	DL	17/05/18
06/04/18 09:05	06/04/18 09:55	Scheduled 6 monthly maintenance (cont.)	CO, NO, NO_2, NO_x	DL	17/05/18
08/04/18 20:00	08/04/18 21:00	Brief power interruption and subsequent instrument stabilisation	$PM_{2.5}$	DL	17/05/18
09/04/18 00:30	09/04/18 23:30	Sample 12624 flow final vacuum was low. Sample flow may have decreased towards the end of the 24 hours sampling period. Therefore, the reported result may not be fully representative of the 24 hours average concentration	BTX TO-15	DL	17/05/18
10/04/18 08:00	10/04/18 08:00	Scheduled weekly maintenance - BTX TO-15 Canister removed	No data affected	DL	17/05/18
19/04/18 03:00	19/04/18 03:00	Data transmission error	WS & WD	DL	17/05/18
23/04/18 16:00	23/04/18 17:00	Non-scheduled maintenance - Tape replaced and gas calibration checks	$PM_{2.5}$, CO, NO, NO_2, NO_x	DL	17/05/18

Table 25: Station 5 Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
04/04/18 10:00	04/04/18 14:30	Scheduled 3 monthly maintenance	$PM_{2.5}$, PM_{10}	DL	17/05/18
05/04/18 09:20	28/04/18 10:20	Intermittent unrealistic data - WS spikes and not tracking with other sites	WS & WD	DL	17/05/18
05/04/18 11:00	23/04/18 15:00	Instrument fault - Tape alarm	$PM_{2.5}$	DL	17/05/18
06/04/18 09:10	06/04/18 09:30	Unrealistic data - Possible moisture interference	PM_{10}	DL	17/05/18
23/04/18 16:00	23/04/18 16:00	Non-scheduled maintenance - Tape replaced	$PM_{2.5}$	DL	17/05/18

6.0 Report Summary

- The percentage of valid data capture for most of parameters at West Gate Tunnel Project monitoring network was above 85% for the reporting month, with the exception of $PM_{2.5}$ at Station 5.

- The low $PM_{2.5}$ data capture at Station 5 was due to instrument fault – tape alarm from the 5th to 23rd April 2018.

- The flow final vacuum of canister sampled on the 9th April 2018 was low. The sample flow may have decreased towards the end of the 24 hours sampling period. Therefore, the reported results may not be fully representative of the 24-hour average concentration. Refer to Table 20 for more details.

- Three recorded 24-hour PM_{10} reading at Station 4 exceeded the SEPP(AQM) Schedule B intervention levels during the reporting period. Refer to Table 17 for more details.

- Five recorded 24-hour $PM_{2.5}$ reading at Stations 2, 3 and 4 exceeded the SEPP(AQM) Schedule B intervention levels during the reporting period. Refer to Tables 15, 16 and 17 for more details.

- Four recorded 24-hour $PM_{2.5}$ reading at Station 1 exceeded the SEPP(AAQ) EQO levels during the reporting period. Refer to Table 14 for more details.

----------END OF REPORT----------

Appendix 1 - Definitions & Abbreviations

µg/m³	Micrograms per cubic metre at standard temperature and pressure (0°C and 101.3 kPa)
BTEX	Benzene, Toluene, Ethyl Benzene and Xylene *ortho-, meta-* and *para-* isomers
calm	Wind conditions where the wind speed is below the operating range of the wind sensor
CO	Carbon monoxide
deg	Degrees (True North)
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
PM_{10}	Particulate less than 10 microns in equivalent aerodynamic diameter
$PM_{2.5}$	Particulate less than 2.5 microns in equivalent aerodynamic diameter
ppb	Parts per billion
ppm	Parts per million
SEPP (AAQ) EQO	State Environmental Protection Policy (Ambient Air Quality) Environmental Quality Objectives
SEPP (AQM)	State Environmental Protection Policy (Air Quality Management)
Sigma	Sigma Theta is the standard deviation of the horizontal wind direction fluctuations over the averaging period.
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Beta count failure refers to a fault in the functioning of the beta attenuation monitor.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance.

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

Data transmission error refers to a period of time when the instrument could not transmit data. This may be due to interference, or a problem with the phone line or modem.

Equipment malfunction/instrument fault refers to a period of time when the instrument was not in the normal operating mode and did not measure a representative value of the existing conditions.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

Instrument out of service refers to a lack of data due to an instrument being shut down for repair, maintenance, or factory calibration.

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

Maintenance refers to a period of time when the logger / instrument was switched off due to maintenance.

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

Overnight zero out of tolerance refers to when the automatic zero reading measured by the analyser falls outside the expected limits.

Power Interruption refers to no power to the station therefore no data was collected at this time.

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Tape break refers to the breaking of the beta attenuation monitor sample tape during operation.

Warm up after power interruption refers to the start up period of an instrument after power has been restored.

Appendix 3 – BTEX Analytical Results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1802617**	Page	: 1 of 4
Client	: **ECOTECH PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: LARA NICHOLAS	Contact	: Hayley Withers
Address	: 1492 FERNTREE GULLY ROAD KNOXFIELD VICTORIA, AUSTRALIA 3180	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 03 9730 7800	Telephone	: +612 4014 2500
Project	: WD4 PRIMULA AVE	Date Samples Received	: 19-Apr-2018 09:30
Order number	: 234215	Date Analysis Commenced	: 20-Apr-2018
C-O-C number	: ----	Issue Date	: 24-Apr-2018 17:00
Sampler	: DANIEL RAYMOND		
Site	: ----		
Quote number	: NE/070/17		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dale Semple	Analyst	Newcastle - Organics, Mayfield West, NSW
Dale Semple	Analyst	Newcastle, Mayfield West, NSW
Daniel Junek	Senior Air Analyst	Newcastle - Organics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP101: Results reported in µg/m³ are calculated from PPBV results based on a temperature of 25°C and atmospheric pressure of 101.3 kPa.
- CAN-001: Results for Pressure - As Received are measured under controlled conditions using calibrated laboratory gauges. These results are expressed as an Absolute Pressure. Equivalent gauge pressures may be calculated by subtracting the Pressure - Laboratory Atmosphere taken at the time of measurement.
- CAN-001: Results for Pressure - Gauge as Received are obtained from uncalibrated field gauges and are indicative only. These results may not precisely match calibrated gauge readings and may vary from field measurements due to changes in temperature and pressure

Analytical Results

Sub-Matrix: AIR (Matrix: AIR)			Client sample ID	030418 C4986_S2846	090418 C12624_S2833	----	----	----
			Client sampling date / time	03-Apr-2018 23:30	09-Apr-2018 23:30	----	----	----
Compound	CAS Number	LOR	Unit	EN1802617-001	EN1802617-002	--------	--------	--------
				Result	Result	----	----	----
EP101: VOCs by USEPA Method TO15 (Calculated Concentration)								
Benzene	71-43-2	1.6	µg/m³	<1.6	<1.6	----	----	----
Toluene	108-88-3	1.9	µg/m³	**2.6**	**3.8**	----	----	----
Ethylbenzene	100-41-4	2.2	µg/m³	<2.2	<2.2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	4.3	µg/m³	<4.3	<4.3	----	----	----
ortho-Xylene	95-47-6	2.2	µg/m³	<2.2	<2.2	----	----	----
Naphthalene	91-20-3	2.6	µg/m³	<2.6	<2.6	----	----	----
Total Xylenes	----	6.6	µg/m³	<6.6	<6.6	----	----	----
EP101: VOCs by USEPA Method TO15r								
Benzene	71-43-2	0.5	ppbv	<0.5	<0.5	----	----	----
Toluene	108-88-3	0.5	ppbv	**0.7**	**1.0**	----	----	----
Ethylbenzene	100-41-4	0.5	ppbv	<0.5	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	1.0	ppbv	<1.0	<1.0	----	----	----
ortho-Xylene	95-47-6	0.5	ppbv	<0.5	<0.5	----	----	----
Naphthalene	91-20-3	0.5	ppbv	<0.5	<0.5	----	----	----
Total Xylenes	----	1.5	ppbv	<1.5	<1.5	----	----	----
Sampling Quality Assurance								
Pressure - As received	PRESSURE	0.1	kPaa	**98.2**	**96.0**	----	----	----
Pressure - Gauge as Received	----	1	Inches Hg	**-5**	**-3**	----	----	----
Pressure - Laboratory Atmosphere	----	0.1	kPaa	**102**	**102**	----	----	----
Temperature as Received	----	0.1	°C	**21.0**	**21.0**	----	----	----
USEPA Air Toxics Method TO15r Surrogates								
4-Bromofluorobenzene	460-00-4	0.5	%	**97.3**	**98.7**	----	----	----

Surrogate Control Limits

Sub-Matrix: **AIR**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
USEPA Air Toxics Method TO15r Surrogates			
4-Bromofluorobenzene	460-00-4	60	140

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EN1802617**	Page	: 1 of 3
Client	: **ECOTECH PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: LARA NICHOLAS	Contact	: Hayley Withers
Address	: 1492 FERNTREE GULLY ROAD KNOXFIELD VICTORIA, AUSTRALIA 3180	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
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Order number	: 234215	Date Analysis Commenced	: 20-Apr-2018
C-O-C number	: ----	Issue Date	: 24-Apr-2018
Sampler	: DANIEL RAYMOND		
Site	: ----		
Quote number	: NE/070/17		
No. of samples received	: 2		
No. of samples analysed	: 2		

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Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dale Semple	Analyst	Newcastle - Organics, Mayfield West, NSW
Dale Semple	Analyst	Newcastle, Mayfield West, NSW
Daniel Junek	Senior Air Analyst	Newcastle - Organics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **AIR**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP101: VOCs by USEPA Method TO15r (QC Lot: 1587996)									
EN1802617-001	030418 C4986_S2846	EP101-H: Benzene	71-43-2	0.5	ppbv	<0.5	<0.5	0.00	No Limit
		EP101-H: Toluene	108-88-3	0.5	ppbv	0.7	0.7	0.00	No Limit
		EP101-H: Ethylbenzene	100-41-4	0.5	ppbv	<0.5	<0.5	0.00	No Limit
		EP101-H: ortho-Xylene	95-47-6	0.5	ppbv	<0.5	<0.5	0.00	No Limit
		EP101-H: meta- & para-Xylene	108-38-3 106-42-3	1	ppbv	<1.0	<1.0	0.00	No Limit

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control terms Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (DCS) refers to certified reference materials, or known interference free matrices spiked with target analytes. The purpose of these QC parameters are to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS and DCS.

Sub-Matrix: **AIR**

		Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control Limit
EP101: VOCs by USEPA Method TO15r (QCLot: 1587996)											
EP101-H: Benzene	71-43-2	0.5	ppbv	<0.5	100 ppbv	89.5	88.2	77	114	25	25
EP101-H: Toluene	108-88-3	0.5	ppbv	<0.5	100 ppbv	89.7	89.3	78	115	25	25
EP101-H: Ethylbenzene	100-41-4	0.5	ppbv	<0.5	100 ppbv	83.3	82.8	82	121	25	25
EP101-H: meta- & para-Xylene	108-38-3 106-42-3	1	ppbv	<1.0	200 ppbv	82.8	82.2	82	122	25	25
EP101-H: ortho-Xylene	95-47-6	0.5	ppbv	<0.5	100 ppbv	84.3	83.8	83	122	25	25

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EN1802617**	Page	: 1 of 4
Client	: **ECOTECH PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: LARA NICHOLAS	Telephone	: +612 4014 2500
Project	: WD4 PRIMULA AVE	Date Samples Received	: 19-Apr-2018
Site	: ----	Issue Date	: 24-Apr-2018
Sampler	: DANIEL RAYMOND	No. of samples received	: 2
Order number	: 234215	No. of samples analysed	: 2

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **AIR**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP101: VOCs by USEPA Method TO15r							
Summa style Canister - ALS Supplied Silonite (EP101-H) 030418 - C4986_S2846	**03-Apr-2018**	**----**	----	----	**23-Apr-2018**	03-May-2018	✓
Summa style Canister - ALS Supplied Silonite (EP101-H) 090418 - C12624_S2833	**09-Apr-2018**	**----**	----	----	**23-Apr-2018**	09-May-2018	✓
Sampling Quality Assurance							
Summa style Canister - ALS Supplied Silonite (CAN-001) 030418 - C4986_S2846	**03-Apr-2018**	**----**	----	----	**20-Apr-2018**	04-Apr-2019	✓
Summa style Canister - ALS Supplied Silonite (CAN-001) 090418 - C12624_S2833	**09-Apr-2018**	**----**	----	----	**20-Apr-2018**	09-Apr-2019	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **AIR**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Duplicate Control Samples (DCS)							
Hydrocarbons in Air by USEPA TO15	EP101-H	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Duplicates (DUP)							
Hydrocarbons in Air by USEPA TO15	EP101-H	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Hydrocarbons in Air by USEPA TO15	EP101-H	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hydrocarbons in Air by USEPA TO15	EP101-H	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Canister Sampling - Field Data	CAN-001	AIR	In house: Referenced to USEPA TO14 / TO15
Hydrocarbons in Air by USEPA TO15	EP101-H	AIR	In house: Referenced to USEPA TO15r Volatile Organic Compounds in Air by USEPA TO15. Aliphatic and Aromatic Hydrocarbons
Hydrocarbons in Air by USEPA TO15 (mass/volume)	EP101-H-MV	AIR	In house: Referenced to USEPA TO15r Hydrocarbons in Air by USEPA TO15 (Calculated Concentration)

AIR CANISTER CHAIN OF CUSTODY

If sourced from an ALS Laboratory: please tick →

Client Supplied Canister(s)? Y / N

CLIENT: ECOTECH	TURNAROUND REQUIREMENTS : (Standard TAT may be extended for multiple sequential analysis suites)	☐ Standard TAT (List due date):	LABORATORY USE ONLY (Circle) Received/or to initial and date/time
OFFICE: 1492 Ferntree Gully Rd, KNOXFIELD VIC		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Rec Lab Y / N NE Y / N N/A
PROJECT: WD4 PRIMULA AVE	ALS QUOTE NO.: NE/070/17	COC SEQUENCE NUMBER (Circle)	Valves closed on Receipt? Rec Lab Y / N NE Y / N N/A
PURCHASE ORDER NC 234215	COUNTRY OF ORIGIN:	COC: 1 2 3 4 5 6 7	Canister/Sampler Complete and Not Damaged Yes No
PROJECT MANAGER: Lara Nicholas	CONTACT PH: 03 9370 7845 0417351053	OF: 1 2 3 4 5 6 7	Other comment: Temperature °C
SAMPLER: Daniel Raymond	SAMPLER MOBILE: 0419424932	RELINQUISHED BY:	RELINQUISHED BY:
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):	RECEIVED BY: Jones 19/4/18 9:30am	RECEIVED BY:
Email Reports to (will default to PM if no other addresses are listed): lara.nicholas@ecotech.com, daniel.raymond@ecotech.com			
Email Invoice to (will default to PM if no other addresses are listed): naomi.dans@ecotech.com			

COMMENTS/SPECIAL HANDLING/REPLACEMENT OR RETURN INSTRUCTIONS: Toll: APYG007811

GAS SAMPLE CONTAINER INFORMATION

Canister Gauge Pressures (PSI) — Refer to Canister Verification Reports and COAs for pressures measured by the Lab

ANALYSES REQUESTED

Suite Codes must be listed to attract suite price

Additional Information

ALS USE ONLY	CANISTER / SAMPLE DETAILS					Pre-Sampling	Post Sampling	Reporting Requirements					VI-V1 BTEXN						Additional Information
LAB ID	CANISTER SERIAL NO.	FLOW CONTROLLER SERIAL NO.	CLIENT SAMPLE ID	DATE / TIME SAMPLED	MATRIX (eg Air, Soil Gas)			LORs			Units								
								Ambient Air	Soil Gas (NEPM)	Other / Indoor	ppbv, µg/m³	ppmv, mg/m³							
1	4986	2846	030418	03/04/18 00:30 - 23:30	AIR	32	5	X			X		X						There will be a break in sampling so
2	12624	2833	090418	09/04/18 00:30 - 23:30	AIR	30	3	X			X		X						this is the last round of sampling for
																			now. Please do not send any more
																			canisters but please send samplers
																			back cleaned. Thanks

Environmental Division
Newcastle
Work Order Reference
EN1802617

Telephone : +61 2 4014 2500

Job Specific Instructions: Ecotech Timers Sent with samples to be cleaned with nitrogen and returned with new canisters

AIR SAMPLING EQUIPMENT — DISPATCH RECORD

Inquiries: Client Services - Newcastle **Phone: +61 (02) 4014 2500** E-mail: samples.newcastle@alsenviro.com

Dispatch to:				
Client / Office:	ECOTECH	**ALS Use ONLY**		
Contact:	Lara Nicholas	**Request Received By:**	HW	
Telephone:	03 9730 7800	**Deliver By:**	asap	
ALS Quotation:	NE/070/17	**Dispatched By:**	asap	
Delivery Address:	1492 Ferntree Gully Rd	**Workorder:**		
	Knoxfield VIC 3180	**Agreed Rent Free Period:**	14	days

SPECIAL INSTRUCTIONS: **PLEASE EMAIL CLEAN CERTIFICATES TO lara.nicholas@ecotech.com ON DISPATCH .....**

Air Sampling Equipment Request

CANISTERS

No.	Canister Type	Size	Gauge	Valve	Cap	Rental[1]	No Returned	Analysis Initials & Date: Leak Checked	Certified OK
2	Entech Silonite Canister (Summa™)	6L	Yes	S	Yes	$200 ea		VS	19/3/18

CONNECTORS AND FLOW CONTROL DEVICES

No.	Equipment Type	Duration (hrs)	Flow (ml/min)	T-Piece	Gauge	Certified	Sealed / Vacuum	Connection Q Quick Connect S Swagelok	No. Returned	Rental[1]
2	Passive Sampler -TWA	24hr		No	Yes	Yes	Yes / No	S		Incl Above
2	Flow Sampler Caps			No	No	No	Yes / No			$20 ea. Replacement
1	ECOTECH Autosampler			No	No	No	Yes / No			N/A
5	¼" Swagelok connectors and ferrules (spares)	-	-	-	-	-	-			$5 ea. Replacement

☑ Other (specify) Ecotech owned fitting for their autosampler + ALS T-piece

[1] *Refer to Acceptance of Terms*

ALS use only:			
Sampling Guide Included (Y / N)	Packed by: VS	Dispatch Time / Date	VS 19/3/18
Number of Boxes:	1	Consignment Note Number:	EON009767667
Courier / Dispatcher:	TNT	Consignment Dispatched by:	

AIR SAMPLING EQUIPMENT — DISPATCH RECORD

ALS SUPPLIED EQUIPMENT

Item	Quantity	Item Description	Serial Nos
	2	6L Silonite Summa™ canister	12641 ✓ (VH 9/4/18) 4986 ✓
	2	Passive Sampler – TWA – 24hr 3.5 mL/min #4	~~2846~~ 2846 ✓ 2833 ✓

ENFMCDR1.1 11-05-11

RIGHT SOLUTIONS

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www.alsglobal.com

AIR SAMPLING EQUIPMENT DISPATCH RECORD

Acceptance of Terms:

Acceptance and use of the accompanying ALS Air Sampling Equipment constitutes acceptance of the following terms:

1. This equipment remains the property of ALS Laboratory Group.
2. Subject to the conditions below and unless stated otherwise in the relevant quotation, the supply and use of this equipment is included in the price of analysis.
3. No responsibility is accepted by ALS for equipment requirements that have been incorrectly or incompletely specified by the client, interfacing of ALS equipment with other sampling equipment or structures is solely the client's responsibility.
4. Sampling equipment is configured and supplied based on client specified requirements. ALS will take all reasonable care to meet these specifications, but will not accept responsibility for changes in equipment calibration or failures during transit. Replacement equipment will be provided at no charge if required.
5. Equipment calibration and verification records are available for review on request. Verification reports are provided with equipment and electronic copies are available on request.
6. This Air Sampling Equipment is provided solely for the use of the nominated client. Responsibility for ensuring the equipment is not damaged and for returning all equipment to ALS remains with the nominated client until all equipment is returned to the ALS Group.
7. Unless otherwise agreed in writing, if equipment is not returned within the agreed rent free period after dispatch, the quoted rental fees above will apply per week per unit thereafter. If equipment is returned unused, the cleaning fees quoted will apply (1 weeks rental charge). If sampling equipment return is delayed, please contact the laboratory prior to expiry of the rent free period to negotiate and extension.
8. Irreparably damaged equipment and any equipment not returned within 40 days will be charged to the client at a replacement cost per unit equal to 15 weeks rent, less rental costs already paid.
9. Cleaning costs will apply for equipment marked or defaced by the client. Please attach labels for return.

If these conditions are not acceptable please return all equipment to ALS Newcastle immediately.

EQUIPMENT SUPPLY AND LOGISTICS

Additional air sampling equipment can be ordered through any ALS Environmental Laboratory and supplied direct to your site or office by courier. For the fastest turnaround, equipment should be returned direct to Newcastle Laboratory.

ALS Environmental, Newcastle
5/585 Maitland Road
Mayfield West, NSW 2304

Note that Dangerous Goods Transport Regulations may apply after sampling if the air cylinders are pressurised or contain hazardous materials.

AIR SAMPLING EQUIPMENT — DISPATCH RECORD

Inquiries: Client Services - Newcastle Phone: +61 (02) 4014 2500 E-mail: samples.newcastle@alsenviro.com

Dispatch to:				
Client / Office:	ECOTECH	ALS Use ONLY		
Contact:	Lara Nicholas	Request Received By:	HW	
Telephone:	03 9730 7800	Deliver By:	asap	
ALS Quotation:	NE/070/17	Dispatched By:	asap	
Delivery Address:	1492 Ferntree Gully Rd	Workorder:		
	Knoxfield VIC 3180	Agreed Rent Free Period:	14	days

SPECIAL INSTRUCTIONS: PLEASE EMAIL CLEAN CERTIFICATES TO lara.nicholas@ecotech.com ON DISPATCH .....

Air Sampling Equipment Request

CANISTERS

No	Canister Type	Size	Gauge	Valve	Cap	Rental[1]	Leak Checked (Initials & Date)	Certified OK
2	Entech Silonite Canister (Summa™)	6L	Yes	S	Yes	$200 ea	[illegible]	27/3/18

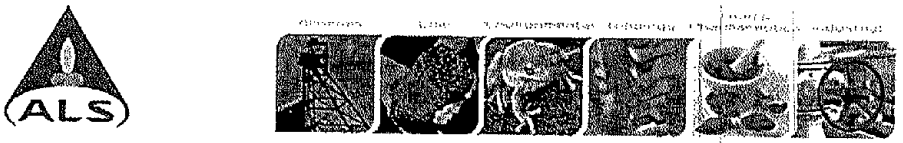
CONNECTORS AND FLOW CONTROL DEVICES

No	Equipment Type	Duration (hrs)	Flow (ml/min)	T-Piece	Gauge	Certified	Sealed / Vacuum	Connection (Q Quick Connect, S Swagelok)	No. Returned	Rental[1]
2	Passive Sampler-TWA	24hr		No	Yes	Yes	Yes / No	S		Incl Above
4	Flow Sampler Caps			No	No	No	Yes / No			$20 ea. Replacement
2	ECOTECH Autosampler			No	No	No	Yes / No			N/A
5	¼" Swagelok connectors and ferrules (spares)	-	-	-	-	-	-			$5 ea. Replacement

☑ Other (specify) T piece

[1] *Refer to Acceptance of Terms*

ALS use only			
Sampling Guide Included (Y / N)	Packed by:	Dispatch Time / Date	27/3/18
Number of Boxes:	1	Consignment Note Number:	ECN 002 787682
Courier / Dispatcher:	TNT	Consignment Dispatched by:	



AIR SAMPLING EQUIPMENT — DISPATCH RECORD

ALS SUPPLIED EQUIPMENT

Item	Quantity	Item Description	Serial Nos
	2	6L Silonite Summa™ canister	4739 12624 ✓ Rec'd 19/4 HY
	2	Passive Sampler – TWA – 24hr 3.5mL/min #4	2837 2849

ALS

Canister Verification Report

Canister No: 4986

Specified Purpose:	USEPA TO15 (Extended Suite) Ambient Air	**Verification Date:** **Valid To (At least):** **Verification File:**	09-Mar-2018 06-Apr-2018 180309_11.D
Canister Type:	Entech Silonite - Summa Style	**Last Stability Check:**	08-Sep-2016
Canister Size:	6L	**Next Check Scheduled:**	08-Sep-2018
Valve Type:	Nupro	**Analyst:**	K. Gelderman
Dispatch Pressure:	<0.01 psia	**Approved for Dispatch by:**	19/3/18

Canister Verification Protocol

Canisters are verified fit for purpose for the requested analyses and applications (if known). For most applications, canisters are verified clean according to the requirements of USEPA method TO15.

Each verification involves a check for contamination, leaks and damage to valves. Stability checks are performed after 2 years or if damage to the canister is suspected, then every two years, within the designated holding time to ensure each canister is capable of holding the target chemicals without significant degradation.

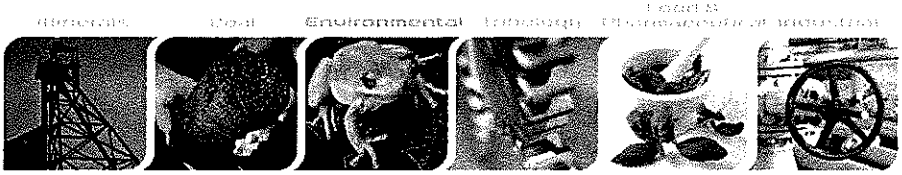
ALS METHOD: [illegible]
REFERENCE METHOD: [illegible]
ALS METHOD CODE: [illegible]

Target Compound	Alt. Name	Qualifiers	Verification Goal (<) ppbv	Result ppbv
1,1,1-Trichloroethane	1,1,1-TCA / Methyl chloroform		0.2	<0.2
1,1,2,2-Tetrachloroethane	R-130 / Acetylene tetrachloride		0.2	<0.2
1,1,2-Trichloroethane	Vinyl trichloride		0.2	<0.2
1,1-Dichloroethane	Ethylidene chloride		0.2	<0.2
1,1-Dichloroethene	1,1-DCE / Vinylidene chloride		0.2	<0.2
1,2-Dichloroethane	Ethylene chloride		0.2	<0.2
1,2,4-Trimethylbenzene	Pseudocumene		0.2	<0.2
1,2-Dibromoethane	EDB / Ethylene dibromide		0.2	<0.2
1,2-Dichlorobenzene	o-Dichlorobenzene		0.2	<0.2
1,2-Dichloropropane	Propylene dichloride		0.2	<0.2
1,3,5-Trimethylbenzene	Mesitylene		0.2	<0.2
1,3-Dichlorobenzene	m-Dichlorobenzene		0.2	<0.2
1,4-Dichlorobenzene	p-Dichlorobenzene		0.2	<0.2
Benzene	Cyclohexatriene		0.2	<0.2
Bromomethane	Methyl bromide		0.2	<0.2
Tetrachloromethane	Carbon tetrachloride		0.2	<0.2
Chlorobenzene	Phenyl chloride		0.2	<0.2
Chloroethane	Ethyl chloride		0.2	<0.2
Chloroform	Trichloromethane		0.2	<0.2
Chloromethane	Methyl chloride		0.2	<0.2
cis-1,2-Dichloroethene	cis-1,2-Dichloroethylene		0.2	<0.2
cis-1,3-Dichloropropene	cis-1,3-Dichloropropylene		0.2	<0.2
Ethylbenzene	Phenyl ethane		0.2	<0.2
Freon 12	Dichlorodifluoromethane		0.2	<0.2
Freon 11	Trichlorofluoromethane		0.2	<0.2
Freon 113	1,1,2-Trichloro-1,2,2-trifluoroethane		0.2	<0.2
Freon 114	1,2-Dichlorotetrafluoroethane		0.2	<0.2
Hexachlorobutadiene	Hexachloro-1,3-Butadiene		0.2	<0.2

Qualifiers - F: Fails Stability Check, V: Fails Verification

Target Compound	Alt. Name	Qualifiers	Verification Goal (<) ppbv	Result ppbv
Dichloromethane	Methylene chloride		0.2	<0.2
m -& p-Xylene	1,3 & 1,4 -Dimethylbenzene		0.4	<0.4
o-Xylene	1,2-Dimethylbenzene		0.2	<0.2
Styrene	Vinyl benzene		0.2	<0.2
Tetrachloroethene	PCE / Perchlorethylene		0.2	<0.2
Toluene	Methyl Benzene		0.2	<0.2
trans-1,3-Dichloropropene	trans-1,3-Dichloropropylene		0.2	<0.2
Trichloroethene	TCE / Trichloroethylene		0.2	<0.2
Vinyl chloride	Chloroethene		0.2	<0.2
1,2,4-Trichlorobenzene			0.2	<0.2
1,3-Butadiene	Biethylene		0.2	<0.2
1,4-Dioxane	p-Dioxane		0.2	<0.2
2,2,4-Trimethylpentane	Isooctane		0.2	<0.2
4-Ethyltoluene	p-Ethyltoluene		0.2	<0.2
Acetone	2-Propanone		0.2	<0.2
Allyl chloride	3-Chloropropene		0.2	<0.2
Bromodichloromethane	Dichlorobromomethane		0.2	<0.2
Bromoform	Tribromomethane		0.2	<0.2
Carbon disulfide	CS2		0.2	<0.2
Cyclohexane			0.2	<0.2
Dibromochloromethane	Chlorodibromoethane		0.2	<0.2
Ethyl acetate	Acetic ester		0.2	<0.2
Isopropyl alcohol	Isopropanol / 2-Propanol		0.2	<0.2
Methyl butyl ketone	MBK / 2-Hexanone		0.2	<0.2
Methyl ethyl ketone	MEK / 2-Butanone		0.2	<0.2
Methyl isobutyl ketone	MIBK / 4-Methyl-2-pentanone		0.2	<0.2
Methyl tert-butyl ether	MTBE		0.2	<0.2
n-Heptane			0.2	<0.2
n-Hexane			0.2	<0.2
Propene	Propylene		0.2	<0.2
Tetrahydrofuran	THF		0.2	<0.2
trans-1,2-Dichloroethene	trans-1,2-Dichloroethylene		0.2	<0.2
Vinyl acetate	Acetic acid vinyl ester		0.2	<0.2
Bromoethene	Vinyl bromide		0.2	<0.2
Benzyl chloride	α-Chlorotoluene		0.2	<0.2
Ethanol	Ethyl alcohol		0.2	<0.2
Acetonitrile	Methyl cyanide		0.2	<0.2
Acrolein	2-Propenal		0.2	<0.2
Acrylonitrile	2-Propenenitrile		0.2	<0.2
tert-Butyl alcohol	TBA		0.2	<0.2
2-Chloroprene	2-Chloro-1,3-butadiene		0.2	<0.2
Diisopropyl Ether	DIPE		0.2	<0.2
Ethyl tert-butyl ether	ETBE		0.2	<0.2
tert-Amyl methyl ether	TAME		0.2	<0.2
Methyl methacrylate	MMA		0.2	<0.2
1,1,1,2-Tetrachloroethane	R-130a / Acetylene trichloride		0.2	<0.2
Isopropylbenzene	Cumene		0.2	<0.2
2-Chlorotoluene	o-Chlorotoluene		0.2	<0.2
n-Propylbenzene	Phenyl propane		0.2	<0.2
tert-Butylbenzene	1,1-Dimethylethylbenzene		0.2	<0.2
sec-Butylbenzene	1-Methylpropylbenzene		0.2	<0.2
2-Isopropyltoluene	o-Cymene		0.2	<0.2
n-Butylbenzene	Phenyl butane		0.2	<0.2
Naphthalene			0.2	<0.2

Qualifiers - F: Fails Stability Check, V: Fails Verification



Sampler Verification Report

Sampler No: 2846

Specified Purpose:	USEPA TO15 (Extended Suite)	**Verification Date:**	09-Mar-2018
LORs Required:	Ambient Air	**Valid To (At least):**	06-Apr-2018
Sampler Type:	Passive Sampler	**Verification File:**	180309_12.D
Flow Rate Calibrated at:	3.5 ml/min	**Analyst:**	K. Gelderman
Calibrated by:	KF 14/3/18	**Approved for Dispatch by:**	KF 19/3/18

Sampler Verification Protocol

Samplers are verified for the purpose for the required analytes and applications. For more information, samplers are verified according to the requirements of USEPA method TO15.

Each verification includes a check for contamination, leaks and damaged fittings.

Target Compound	Alt. Name	Verified to ppbv	Result ppbv
1,1,1-Trichloroethane	1,1,1-TCA / Methyl chloroform	0.2	<0.2
1,1,2,2-Tetrachloroethane	R-130 / Acetylene tetrachloride	0.2	<0.2
1,1,2-Trichloroethane	Vinyl trichloride	0.2	<0.2
1,1-Dichloroethane	Ethylidene chloride	0.2	<0.2
1,1-Dichloroethene	1,1-DCE / Vinylidene chloride	0.2	<0.2
1,2-Dichloroethane	Ethylene chloride	0.2	<0.2
1,2,4-Trimethylbenzene	Pseudocumene	0.2	<0.2
1,2-Dibromoethane	EDB / Ethylene dibromide	0.2	<0.2
1,2-Dichlorobenzene	o-Dichlorobenzene	0.2	<0.2
1,2-Dichloropropane	Propylene dichloride	0.2	<0.2
1,3,5-Trimethylbenzene	Mesitylene	0.2	<0.2
1,3-Dichlorobenzene	m-Dichlorobenzene	0.2	<0.2
1,4-Dichlorobenzene	p-Dichlorobenzene	0.2	<0.2
Benzene	Cyclohexatriene	0.2	<0.2
Bromomethane	Methyl bromide	0.2	<0.2
Tetrachloromethane	Carbon tetrachloride	0.2	<0.2
Chlorobenzene	Phenyl chloride	0.2	<0.2
Chloroethane	Ethyl chloride	0.2	<0.2
Chloroform	Trichloromethane	0.2	<0.2
Chloromethane	Methyl chloride	0.2	<0.2
cis-1,2-Dichloroethene	cis-1,2-Dichloroethylene	0.2	<0.2
cis-1,3-Dichloropropene	cis-1,3-Dichloropropylene	0.2	<0.2
Ethylbenzene	Phenyl ethane	0.2	<0.2
Freon 12	Dichlorodifluoromethane	0.2	<0.2
Freon 11	Trichlorofluoromethane	0.2	<0.2
Freon 113	1,1,2-Trichloro-1,1,2-trifluoroethane	0.2	<0.2
Freon 114	1,2-Dichlorotetrafluoroethane	0.2	<0.2
Hexachlorobutadiene	Hexachloro-1,3-Butadiene	0.2	<0.2

Target Compound	Alt. Name	Verified to ppbv	Result ppbv
Dichloromethane	Methylene chloride	0.2	<0.2
m -& p-Xylene	1,3 & 1,4 -Dimethylbenzene	0.4	<0.4
o-Xylene	1,2-Dimethylbenzene	0.2	<0.2
Styrene	Vinyl benzene	0.2	<0.2
Tetrachloroethene	PCE / Perchlorethylene	0.2	<0.2
Toluene	Methyl Benzene	0.2	<0.2
trans-1,3-Dichloropropene	trans-1,3-Dichloropropylene	0.2	<0.2
Trichloroethene	TCE / Trichloroethylene	0.2	<0.2
Vinyl chloride	Chloroethene	0.2	<0.2
1,2,4-Trichlorobenzene		0.2	<0.2
1,3-Butadiene	Biethylene	0.2	<0.2
1,4-Dioxane	p-Dioxane	0.2	<0.2
2,2,4-Trimethylpentane	Isooctane	0.2	<0.2
4-Ethyltoluene	p-Ethyltoluene	0.2	<0.2
Acetone	2-Propanone	0.2	<0.2
Allyl chloride	3-Chloropropene	0.2	<0.2
Bromodichloromethane	Dichlorobromomethane	0.2	<0.2
Bromoform	Tribromomethane	0.2	<0.2
Carbon disulfide	CS2	0.2	<0.2
Cyclohexane		0.2	<0.2
Dibromochloromethane	Chlorodibromoethane	0.2	<0.2
Ethyl acetate	Acetic ester	0.2	<0.2
Isopropyl alcohol	Isopropanol / 2-Propanol	0.2	<0.2
Methyl butyl ketone	MBK / 2-Hexanone	0.2	<0.2
Methyl ethyl ketone	MEK / 2-Butanone	0.2	<0.2
Methyl isobutyl ketone	MIBK / 4-Methyl-2-pentanone	0.2	<0.2
Methyl tert-butyl ether	MTBE	0.2	<0.2
n-Heptane		0.2	<0.2
n-Hexane		0.2	<0.2
Propene	Propylene	0.2	<0.2
Tetrahydrofuran	THF	0.2	<0.2
trans-1,2-Dichloroethene	trans-1,2-Dichloroethylene	0.2	<0.2
Vinyl acetate	Acetic acid vinyl ester	0.2	<0.2
Bromoethene	Vinyl bromide	0.2	<0.2
Benzyl chloride	o-Chlorotoluene	0.2	<0.2
Ethanol	Ethyl alcohol	0.2	<0.2
Acetonitrile	Methyl cyanide	0.2	<0.2
Acrolein	2-Propenal	0.2	<0.2
Acrylonitrile	2-Propenenitrile	0.2	<0.2
tert-Butyl alcohol	TBA	0.2	<0.2
2-Chloroprene	2-Chloro-1,3-butadiene	0.2	<0.2
Diisopropyl Ether	DIPE	0.2	<0.2
Ethyl tert-butyl ether	ETBE	0.2	<0.2
tert-Amyl methyl ether	TAME	0.2	<0.2
Methyl methacrylate	MMA	0.2	<0.2
1,1,1,2-Tetrachloroethane	R-130a / Acetylene trichloride	0.2	<0.2
Isopropylbenzene	Cumene	0.2	<0.2
2-Chlorotoluene	o-Chlorotoluene	0.2	<0.2
n-Propylbenzene	Phenyl propane	0.2	<0.2
tert-Butylbenzene	1,1-Dimethylethylbenzene	0.2	<0.2
sec-Butylbenzene	1-Methylpropylbenzene	0.2	<0.2
2-Isopropyltoluene	o-Cymene	0.2	<0.2
n-Butylbenzene	Phenyl butane	0.2	<0.2
Naphthalene		0.2	<0.2

Canister Verification Report

Canister No: 12624

Specified Purpose:	USEPA TO15 (Extended Suite) Ambient Air	**Verification Date:**	22-Mar-2018
		Valid To (At least):	19-Apr-2018
		Verification File:	180322B_02.D
Canister Type:	Entech Silonite - Summa Style	**Last Stability Check:**	19-Aug-2016
Canister Size:	6L	**Next Check Scheduled:**	19-Aug-2018
Valve Type:	TOV	**Analyst:**	K. Gelderman
Dispatch Pressure:	<0.01 psia	**Approved for Dispatch by:**	27/3/18

Canister Verification Protocol

Canisters are verified fit for purpose for the requested analyses and applications, if known. For most applications, canisters are verified clean according to the requirements of USEPA method TO15.

Each verification involves a check for contamination, leaks and damage to valves. Stability checks are performed after 5 uses or if damage to the canister is suspected, then every two years, within the designated holding times to ensure each canister is capable of holding the target chemicals without significant degradation.

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Target Compound	Alt. Name	Qualifiers	Verification Goal (<) ppbv	Result ppbv
1,1,1-Trichloroethane	1,1,1-TCA / Methyl chloroform		0.2	<0.2
1,1,2,2-Tetrachloroethane	R-130 / Acetylene tetrachloride		0.2	<0.2
1,1,2-Trichloroethane	Vinyl trichloride		0.2	<0.2
1,1-Dichloroethane	Ethylidene chloride		0.2	<0.2
1,1-Dichloroethene	1,1-DCE / Vinylidene chloride		0.2	<0.2
1,2-Dichloroethane	Ethylene chloride		0.2	<0.2
1,2,4-Trimethylbenzene	Pseudocumene		0.2	<0.2
1,2-Dibromoethane	EDB / Ethylene dibromide		0.2	<0.2
1,2-Dichlorobenzene	o-Dichlorobenzene		0.2	<0.2
1,2-Dichloropropane	Propylene dichloride		0.2	<0.2
1,3,5-Trimethylbenzene	Mesitylene		0.2	<0.2
1,3-Dichlorobenzene	m-Dichlorobenzene		0.2	<0.2
1,4-Dichlorobenzene	p-Dichlorobenzene		0.2	<0.2
Benzene	Cyclohexatriene		0.2	<0.2
Bromomethane	Methyl bromide		0.2	<0.2
Tetrachloromethane	Carbon tetrachloride		0.2	<0.2
Chlorobenzene	Phenyl chloride		0.2	<0.2
Chloroethane	Ethyl chloride		0.2	<0.2
Chloroform	Trichloromethane		0.2	<0.2
Chloromethane	Methyl chloride		0.2	<0.2
cis-1,2-Dichloroethene	cis-1,2-Dichloroethylene		0.2	<0.2
cis-1,3-Dichloropropene	cis-1,3-Dichloropropylene		0.2	<0.2
Ethylbenzene	Phenyl ethane		0.2	<0.2
Freon 12	Dichlorodifluoromethane		0.2	<0.2
Freon 11	Trichlorofluoromethane		0.2	<0.2
Freon 113	1,1,2-Trichloro-1,2,2-trifluoroethane		0.2	<0.2
Freon 114	1,2-Dichlorotetrafluoroethane		0.2	<0.2
Hexachlorobutadiene	Hexachloro-1,3-Butadiene		0.2	<0.2

Qualifiers - F: Fails Stability Check, V: Fails Verification

Target Compound	Alt. Name	Qualifiers	Verification Goal (<) ppbv	Result ppbv
Dichloromethane	Methylene chloride		0.2	<0.2
m -& p-Xylene	1,3 & 1,4 -Dimethylbenzene		0.4	<0.4
o-Xylene	1,2-Dimethylbenzene		0.2	<0.2
Styrene	Vinyl benzene		0.2	<0.2
Tetrachloroethene	PCE / Perchlorethylene		0.2	<0.2
Toluene	Methyl Benzene		0.2	<0.2
trans-1,3-Dichloropropene	trans-1,3-Dichloropropylene		0.2	<0.2
Trichloroethene	TCE / Trichloroethylene		0.2	<0.2
Vinyl chloride	Chloroethene		0.2	<0.2
1,2,4-Trichlorobenzene			0.2	<0.2
1,3-Butadiene	Biethylene		0.2	<0.2
1,4-Dioxane	p-Dioxane		0.2	<0.2
2,2,4-Trimethylpentane	Isooctane		0.2	<0.2
4-Ethyltoluene	p-Ethyltoluene		0.2	<0.2
Acetone	2-Propanone		0.2	<0.2
Allyl chloride	3-Chloropropene		0.2	<0.2
Bromodichloromethane	Dichlorobromomethane		0.2	<0.2
Bromoform	Tribromomethane		0.2	<0.2
Carbon disulfide	CS2		0.2	<0.2
Cyclohexane			0.2	<0.2
Dibromochloromethane	Chlorodibromoethane		0.2	<0.2
Ethyl acetate	Acetic ester		0.2	<0.2
Isopropyl alcohol	Isopropanol / 2-Propanol		0.2	<0.2
Methyl butyl ketone	MBK / 2-Hexanone		0.2	<0.2
Methyl ethyl ketone	MEK / 2-Butanone		0.2	<0.2
Methyl isobutyl ketone	MIBK / 4-Methyl-2-pentanone		0.2	<0.2
Methyl tert-butyl ether	MTBE		0.2	<0.2
n-Heptane			0.2	<0.2
n-Hexane			0.2	<0.2
Propene	Propylene		0.2	<0.2
Tetrahydrofuran	THF		0.2	<0.2
trans-1,2-Dichloroethene	trans-1,2-Dichloroethylene		0.2	<0.2
Vinyl acetate	Acetic acid vinyl ester		0.2	<0.2
Bromoethene	Vinyl bromide		0.2	<0.2
Benzyl chloride	α-Chlorotoluene		0.2	<0.2
Ethanol	Ethyl alcohol		0.2	<0.2
Acetonitrile	Methyl cyanide		0.2	<0.2
Acrolein	2-Propenal		0.2	<0.2
Acrylonitrile	2-Propenenitrile		0.2	<0.2
tert-Butyl alcohol	TBA		0.2	<0.2
2-Chloroprene	2-Chloro-1,3-butadiene		0.2	<0.2
Diisopropyl Ether	DIPE		0.2	<0.2
Ethyl tert-butyl ether	ETBE		0.2	<0.2
tert-Amyl methyl ether	TAME		0.2	<0.2
Methyl methacrylate	MMA		0.2	<0.2
1,1,1,2-Tetrachloroethane	R-130a / Acetylene trichloride		0.2	<0.2
Isopropylbenzene	Cumene		0.2	<0.2
2-Chlorotoluene	o-Chlorotoluene		0.2	<0.2
n-Propylbenzene	Phenyl propane		0.2	<0.2
tert-Butylbenzene	1,1-Dimethylethylbenzene		0.2	<0.2
sec-Butylbenzene	1-Methylpropylbenzene		0.2	<0.2
2-Isopropyltoluene	o-Cymene		0.2	<0.2
n-Butylbenzene	Phenyl butane		0.2	<0.2
Naphthalene			0.2	<0.2

Qualifiers - F: Fails Stability Check, V: Fails Verification

ALS

Minerals Coal Environmental Tribology Food & Pharmaceutical Industrial

Sampler Verification Report

Sampler No: 2833

Specified Purpose:	USEPA TO15 (Extended Suite)	**Verification Date:**	09-Mar-2018
LORs Required:	Ambient Air	**Valid To (At least):**	06-Apr-2018
Sampler Type:	Passive Sampler	**Verification File:**	180309_11.D
Flow Rate Calibrated at:	3.5 ml/min	**Analyst:**	K. Gelderman
Calibrated by:	VB 14/3/18	**Approved for Dispatch by:**	VB 19/3/18

Sampler Verification Protocol

Samplers are generally verified 'fit for purpose' for the requested analyses and applications. For most applications samplers are verified clean according to the requirements of USEPA method TO15.

Each verification receives a check for contamination, leaks and damage to fittings.

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Target Compound	Alt. Name	Verified to ppbv	Result ppbv
1,1,1-Trichloroethane	1,1,1-TCA / Methyl chloroform	0.2	<0.2
1,1,2,2-Tetrachloroethane	R-130 / Acetylene tetrachloride	0.2	<0.2
1,1,2-Trichloroethane	Vinyl trichloride	0.2	<0.2
1,1-Dichloroethane	Ethylidene chloride	0.2	<0.2
1,1-Dichloroethene	1,1-DCE / Vinylidene chloride	0.2	<0.2
1,2-Dichloroethane	Ethylene chloride	0.2	<0.2
1,2,4-Trimethylbenzene	Pseudocumene	0.2	<0.2
1,2-Dibromoethane	EDB / Ethylene dibromide	0.2	<0.2
1,2-Dichlorobenzene	o-Dichlorobenzene	0.2	<0.2
1,2-Dichloropropane	Propylene dichloride	0.2	<0.2
1,3,5-Trimethylbenzene	Mesitylene	0.2	<0.2
1,3-Dichlorobenzene	m-Dichlorobenzene	0.2	<0.2
1,4-Dichlorobenzene	p-Dichlorobenzene	0.2	<0.2
Benzene	Cyclohexatriene	0.2	<0.2
Bromomethane	Methyl bromide	0.2	<0.2
Tetrachloromethane	Carbon tetrachloride	0.2	<0.2
Chlorobenzene	Phenyl chloride	0.2	<0.2
Chloroethane	Ethyl chloride	0.2	<0.2
Chloroform	Trichloromethane	0.2	<0.2
Chloromethane	Methyl chloride	0.2	<0.2
cis-1,2-Dichloroethene	cis-1,2-Dichloroethylene	0.2	<0.2
cis-1,3-Dichloropropene	cis-1,3-Dichloropropylene	0.2	<0.2
Ethylbenzene	Phenyl ethane	0.2	<0.2
Freon 12	Dichlorodifluoromethane	0.2	<0.2
Freon 11	Trichlorofluoromethane	0.2	<0.2
Freon 113	1,1,2-Trichloro-1,1,2-trifluoroethane	0.2	<0.2
Freon 114	1,2-Dichlorotetrafluoroethane	0.2	<0.2
Hexachlorobutadiene	Hexachloro-1,3-Butadiene	0.2	<0.2

Target Compound	Alt. Name	Verified to ppbv	Result ppbv
Dichloromethane	Methylene chloride	0.2	<0.2
m -& p-Xylene	1,3 & 1,4 -Dimethylbenzene	0.4	<0.4
o-Xylene	1,2-Dimethylbenzene	0.2	<0.2
Styrene	Vinyl benzene	0.2	<0.2
Tetrachloroethene	PCE / Perchlorethylene	0.2	<0.2
Toluene	Methyl Benzene	0.2	<0.2
trans-1,3-Dichloropropene	trans-1,3-Dichloropropylene	0.2	<0.2
Trichloroethene	TCE / Trichloroethylene	0.2	<0.2
Vinyl chloride	Chloroethene	0.2	<0.2
1,2,4-Trichlorobenzene		0.2	<0.2
1,3-Butadiene	Biethylene	0.2	<0.2
1,4-Dioxane	p-Dioxane	0.2	<0.2
2,2,4-Trimethylpentane	Isooctane	0.2	<0.2
4-Ethyltoluene	p-Ethyltoluene	0.2	<0.2
Acetone	2-Propanone	0.2	<0.2
Allyl chloride	3-Chloropropene	0.2	<0.2
Bromodichloromethane	Dichlorobromomethane	0.2	<0.2
Bromoform	Tribromomethane	0.2	<0.2
Carbon disulfide	CS2	0.2	<0.2
Cyclohexane		0.2	<0.2
Dibromochloromethane	Chlorodibromoethane	0.2	<0.2
Ethyl acetate	Acetic ester	0.2	<0.2
Isopropyl alcohol	Isopropanol / 2-Propanol	0.2	<0.2
Methyl butyl ketone	MBK / 2-Hexanone	0.2	<0.2
Methyl ethyl ketone	MEK / 2-Butanone	0.2	<0.2
Methyl isobutyl ketone	MIBK / 4-Methyl-2-pentanone	0.2	<0.2
Methyl tert-butyl ether	MTBE	0.2	<0.2
n-Heptane		0.2	<0.2
n-Hexane		0.2	<0.2
Propene	Propylene	0.2	<0.2
Tetrahydrofuran	THF	0.2	<0.2
trans-1,2-Dichloroethene	trans-1,2-Dichloroethylene	0.2	<0.2
Vinyl acetate	Acetic acid vinyl ester	0.2	<0.2
Bromoethene	Vinyl bromide	0.2	<0.2
Benzyl chloride	α-Chlorotoluene	0.2	<0.2
Ethanol	Ethyl alcohol	0.2	<0.2
Acetonitrile	Methyl cyanide	0.2	<0.2
Acrolein	2-Propenal	0.2	<0.2
Acrylonitrile	2-Propenenitrile	0.2	<0.2
tert-Butyl alcohol	TBA	0.2	<0.2
2-Chloroprene	2-Chloro-1,3-butadiene	0.2	<0.2
Diisopropyl Ether	DIPE	0.2	<0.2
Ethyl tert-butyl ether	ETBE	0.2	<0.2
tert-Amyl methyl ether	TAME	0.2	<0.2
Methyl methacrylate	MMA	0.2	<0.2
1,1,1,2-Tetrachloroethane	R-130a / Acetylene trichloride	0.2	<0.2
Isopropylbenzene	Cumene	0.2	<0.2
2-Chlorotoluene	o-Chlorotoluene	0.2	<0.2
n-Propylbenzene	Phenyl propane	0.2	<0.2
tert-Butylbenzene	1,1-Dimethylethylbenzene	0.2	<0.2
sec-Butylbenzene	1-Methylpropylbenzene	0.2	<0.2
2-Isopropyltoluene	o-Cymene	0.2	<0.2
n-Butylbenzene	Phenyl butane	0.2	<0.2
Naphthalene		0.2	<0.2