REPORT

Ambient Air Quality Monitoring (AAQM) Report February 2020

West Gate Tunnel Project

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Executive Summary

Air quality monitoring for the West Gate Tunnel Project has been specifically established to develop a "baseline" of data from current local conditions. This baseline will be used to measure any changes once the tunnel opens in 2022. When the project opens, air quality monitoring will continue for up to 5 years.

The results of the West Gate Tunnel Project Ambient Air Quality Monitoring (AAQM) program for the period of 1 February 2020 to 29 February 2020 are presented below.

The following tables present the maximum measured concentration for each parameter at Stations 1, 2, 3, 4, 5 and 6 during the reporting period. The maximum concentration for each parameter is compared with the respective criteria.

Station 1 Summary February 2020

Parameter	Units	Averaging period	Maximum concentration	Air quality objective[A]	Exceedances[B]
$PM_{2.5}$	ug/m^3	24 hour	37	25	2
PM_{10}	ug/m^3	24 hour	52	50	1

Note:
A - SEPP(AAQ) objective
B - Exceedances refers to the number of individual days the criterion was exceeded at any station

Station 2, Station 3, Station 5 and Station 6 Summary February 2020

Parameter	Units	Averaging period	Maximum concentration				Air quality objective[A]	Exceedances[B]
			Station 2	Station 3	Station 5	Station 6		
$PM_{2.5}$	ug/m^3	24 hour	42	36	34	39	36	1
PM_{10}	ug/m^3	24 hour	55	58	59	60	60	Nil

Note:
A - SEPP(AQM) Intervention level
B - Exceedances refers to the number of individual days the criterion was exceeded at any station

Station 4 Summary February 2020

Parameter	Units	Averaging period	Maximum concentration	Air quality objective	Exceedances[C]
$PM_{2.5}$	ug/m^3	24 hour	35	36[A]	Nil
PM_{10}	ug/m^3	24 hour	73	60[A]	4
NO_2	ppb	1 hour	39	140[A]	Nil
CO	ppm	1 hour	1.1	29[A]	Nil
Benzene	ppb	24 hour	<0.5	3.0[B]	Nil
Toluene	ppb	24 hour	<0.5	1000[B]	Nil
Total xylene isomers	ppb	24 hour	<1	250[B]	Nil

Note:
A - SEPP(AQM) Intervention level
B - Air NEPM Monitoring investigation level
C - Exceedances refers to the number of individual days the criterion was exceeded at any station

$PM_{2.5}$ results for the February 2020 ambient air quality monitoring programme were less than the respective air quality objectives at Station 3 (Railway Reserve), Station 4 (Primula Avenue) and Station 5 (Donald McLean Reserve). Station 1 (Yarraville Gardens) exceeded $PM_{2.5}$ air quality objectives on two days occasions (6th and 7th February 2020). Station 2 (Francis Street) and Station 6 (Millers Road) both recorded one exceedance (7th February 2020).

PM_{10} results for the February 2020 ambient air quality monitoring programme were less than the respective air quality objectives for all sites except for Station 1 (Yarraville Gardens) and Station 4 (Primula Avenue). Station 1 (Yarraville Gardens) exceeded the PM_{10} air quality objectives on one occasion (7th February 2020). Station 4 (Primula Avenue) recorded four exceedances of the PM_{10} air quality objective (6th, 7th, 8th and 13th February 2020).

NO_2 and CO at Station 4 were below their respective air quality objectives for February 2020.

EPA Victoria's historical air quality data[1] reported elevated levels of PM_{10} and $PM_{2.5}$ at Brooklyn, Footscray and Alphington AAQMS on the 6th and 7th February 2020, indicating the exceedances at the West Gate Tunnel AAQMS on those dates were likely due to a regional event.

A construction area (Millers Road exit ramp and noise wall relocation) is now adjacent Station 4, as a result the measured PM_{10} concentrations may be impacted by construction activities and may not be representative of traffic emissions.

Relative Humidity at Station 1 (Yarraville Gardens) continues to be impacted by the gardens sprinkler system.

Data capture statistics for February 2020 were above 90 percent for all parameters at all stations.

[1] www.epa.vic.gov.au/ our-work/monitoring-the-environment/epa-airwatch/historic-air-quality-data-table

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1.0 INTRODUCTION

Air quality monitoring for the West Gate Tunnel Project has been specifically established to develop a "baseline" of data from current local conditions. This baseline will be used to measure any changes once the tunnel opens in 2022. When the project opens, air quality monitoring will continue for up to 5 years.

The results of the West Gate Tunnel Project West Gate Tunnel Project Ambient Air Quality Monitoring (AAQM) program for the period of 1 February 2020 to 29 February 2020 are contained in the following report.

The AAQM program was conducted in accordance with the Environmental Performance Requirement (EPR) AQP4 for the Project and consists of six AAQM stations (AAQMS) monitoring the following ambient air quality indicators:

- continuous measurement of particulate matter with an equivalent aerodynamic diameter less than 10 microns (PM_{10})
- continuous measurement of particulate matter with an equivalent aerodynamic diameter less than 2.5 microns ($PM_{2.5}$)
- continuous measurement of wind speed and wind direction.

Additionally, one of the specified AAQMS (Primula Avenue) monitors the following additional air quality indicators in combination with PM_{10} and $PM_{2.5}$:

- continuous monitoring of oxides of nitrogen ([NO_x] comprising of nitrogen dioxide (NO_2) and nitric oxide [NO])
- continuous monitoring of carbon monoxide (CO)
- one in six day monitoring of benzene, toluene, ethylbenzene and xylene isomers (BTEX)
- continuous measurement of atmospheric pressure.

AAQMS Station 1 to Station 6 were installed and commissioned during the period 22/08/2018 to 12/10/2018. Specific installation dates can be found below in Section 2.1.

Details of the air quality indicators monitored at each AAQMS are provided in Table 1.

Table 1: AAQMS monitoring details

Site name	Location	Coordinates	Monitoring parameters
Station 1	Barbara Beyer Reserve, 2 Harris Street, Yarraville	-37.812730°S 144.900017°E	PM_{10} and $PM_{2.5}$ Ambient temperature, relative humidity, wind speed and wind direction
Station 2	51-53 Francis Street	-37.821800°S 144.894383°E	PM_{10} and $PM_{2.5}$ Ambient temperature, relative humidity, wind speed and wind direction
Station 3	Railway Lot 64, (part) 15 Goulburn Street, Yarraville	-37.814063°S 144.891320°E	PM_{10} and $PM_{2.5}$ Ambient temperature, relative humidity, wind speed and wind direction
Station 4	44 Primula Avenue, Brooklyn	-37.824284°S 144.846425°E	PM_{10} and $PM_{2.5}$ NO, NO_2, NOx and CO BTEX – one in six day sampling (24 hour average)

Site name	Location	Coordinates	Monitoring parameters
			Ambient temperature, relative humidity, atmospheric pressure, wind speed and wind direction
Station 5	Donald McLean Reserve, Spotswood	-37.826442°S 144.882133°E	PM_{10} and $PM_{2.5}$ Ambient temperature, relative humidity, atmospheric pressure, wind speed and wind direction
Station 6	44 Millers Road Brooklyn	-37.821252°S 144.848878°E	PM_{10} and $PM_{2.5}$ Ambient temperature and relative humidity

2.0 AAQMS DETAILS

2.1 Site locations

AAQMS Station 1 to Station 5 were installed and commissioned during the period 22/08/2018 to 31/08/2018. AAQMS Station 6 (Millers Road) was commissioned on 12/10/2018. Meteorological sensors (wind speed and direction) were installed later due to delays in calibration from the instrument supplier. AAQMS commissioning dates are provided in Table 2. Figure 1 presents the locations of the AAQMS.

Table 2: AAQMS commissioning dates

Parameter	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
AAQMS	23/08/2018	22/08/2018	22/08/2018	22/08/2018	31/08/2018	12/10/2018
Wind speed & direction	07/09/2018	20/09/2018	14/09/2018	10/09/2018	17/09/2018	23/11/2018[A]

A – wind sensor is not compliant with siting criteria specified in AS 3580.14

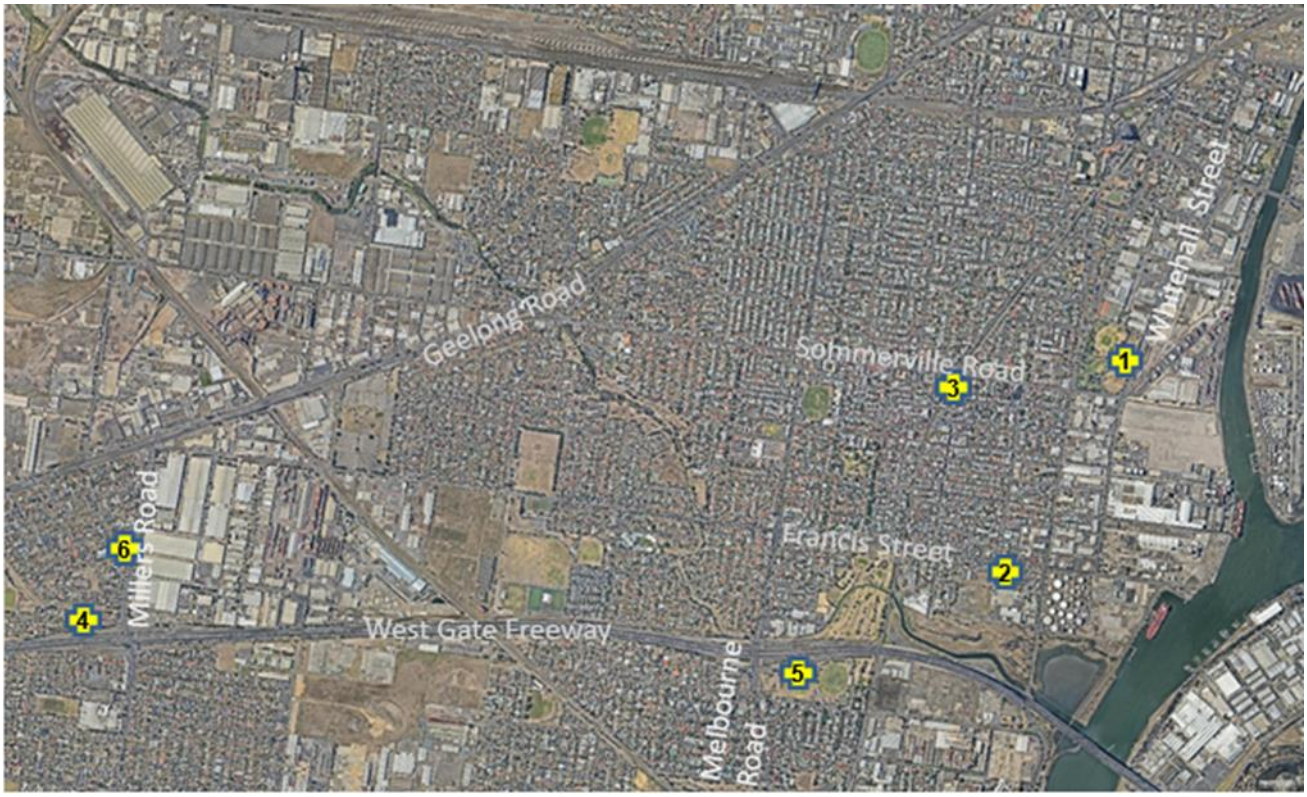


Figure 1: West Gate Tunnel AAQMS site locations

2.2 Siting assessment

Australian Standard AS/NZS 3580.1.1 *"Methods for Sampling and Analysis of Ambient Air – Part 1.1. Guide to Siting Air Monitoring Equipment"* provides general guidance for the siting of ambient air monitoring equipment and specific siting parameters for individual air pollutants. Table 3 provides a comparison between recommended criteria contained in the Standard for the parameters monitored at neighbourhood and peak monitoring stations with actual conditions at each AAQMS.

Table 3: Australian standard AAQMS siting criteria compliance

Station	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
Station type	Neighbourhood	Peak	Peak	Peak	Peak	Peak
Inlet height above ground level 1.0 m – 15 m	✓	✓	✓	✓	✓	✓
Clear sky angle 120° (Neighbourhood)	✓	-	-	-	-	-
Unrestricted 270° airflow around inlet (Neighbourhood)	✓	-	-	-	-	-
Unrestricted 180° airflow around inlet (Peak)	-	✓	✓	✓	✓	✓
Distance to supporting structure ≥ 1 m	✓	✓	✓	✓	✓	✓

Station	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
Station type	Neighbourhood	Peak	Peak	Peak	Peak	Peak
10 m from drip line of trees	✓	✓	✓	✓	✓	✗[A]
No extraneous sources nearby	✓	✓	✓	✗[B]	✓	✗[C]
Greater than 50 m from road (≤ 10,000 vehicles/day)	✓	-	-	-	-	-
Greater than 2 m from road (Peak station)	-	✓	✓	✓	✓	✓

Note:
A Tree drip line is <3 m from sampler inlets and meteorological monitoring equipment
B Temporary construction area for Millers Road noise wall and exit ramp relocation works
C Residential chimney is <5 m from the sampler inlet.

2.3 Equipment specifications

Table 4 provides a list of the monitoring equipment installed at the AAQMS.

Table 4: AAQMS instrumentation

Parameter	Equipment item	Manufacturer	Model
$PM_{2.5}$	Beta Attenuation Monitor (BAM)	Thermo Fisher Scientific Inc.	5014i
PM_{10}	Beta Attenuation Monitor (BAM)	Thermo Fisher Scientific Inc.	5014i
Oxides of Nitrogen	Chemiluminescence	Thermo Fisher Scientific Inc.	42i
Carbon Monoxide	Infra-red gas filter correlation	Thermo Fisher Scientific Inc.	48i
Temperature	Pt100 resistive platinum sensor	Thermo Fisher Scientific Inc.	5014i
BTEX	Summa canister	Restek	6 litre
Relative humidity	Capacitive thin film sensor	Thermo Fisher Scientific Inc.	5014i
Atmospheric Pressure	Beta Attenuation Monitor (BAM)	Thermo Fisher Scientific Inc.	5014i
Wind speed and wind direction	Ultrasonic anemometer	RM Young	Model 86000

3.0 AIR QUALITY CRITERIA

The ambient air quality criteria applicable to the West Gate Tunnel Project are derived from the following legislation:

- State Environment Protection Policy (Ambient Air Quality) [SEPP(AAQ)]
- State Environment Protection Policy (Air Quality Management) [SEPP(AQM)].
- National Environment Protection (Air Toxics) Measure Monitoring Investigation Levels (MILs)

SEPP(AAQ)

The SEPP(AAQ) adopts the requirements of the National Environment Protection (Ambient Air Quality) Measure (Air NEPM) and its environmental quality objectives (EQOs) for CO, NO_2, and particles (as PM_{10} and $PM_{2.5}$). The SEPP(AAQ) EQOs apply to air quality within a region or sub-region considered to be representative of exposure of the general population in Victoria. These objectives have been adopted for the purposes of comparison with results from background/ neighbourhood monitoring stations for the West Gate Tunnel Project and are relevant to Station 1 (Yarraville Gardens).

SEPP(AQM)

The SEPP(AQM) sets out legislative requirements for managing and assessing air emissions in Victoria. The aim of the SEPP(AQM) is to ensure that prescribed air quality objectives are met and protect the beneficial uses of the air environment. Schedule B lists intervention levels which are used in the assessment of local or neighbourhood air monitoring data. Consistent with assessment of impacts described in the Environment Effects Statement for the West Gate Tunnel Project, the intervention levels have been adopted for purposes of comparison with results from peak monitoring stations for the West Gate Tunnel Project and are applicable to Station 2 (Francis Street), Station 3 (Railway Reserve), Station 4 (Primula Avenue), Station 5 (Donald McLean Reserve) and Station 6 (Millers Road).

NEPM (Air Toxics)

The aim of the Air Toxics NEPM is to gain a greater understanding of the levels of air toxics at specific locations where elevated concentrations are likely to occur and where the potential for significant human exposure exists. The Air Toxics NEPM established monitoring investigation levels (MILs) relevant for the West Gate Tunnel Project for benzene, toluene and xylene isomers. The MILs are used purposes of comparison with results from the air toxics monitored at Station 4 (Primula Avenue). Table 5 presents the air quality indicators and objectives for each AAQMS for the West Gate Tunnel Project.

Table 5: Air quality indicators and objectives

Location	Pollutant	Units	Air Quality Objective	Averaging period
Station 1	PM_{10}	µg/m^3	50	24 hour
			20	Annual
	$PM_{2.5}$		25	24 hour
			8	Annual
Station 2 Station 3 Station 4 Station 5 Station 6	PM_{10}	µg/m^3	60	24 hour
	$PM_{2.5}$		36	
Station 4	CO	ppm	29	1 hour
	NO_2	ppb	140	1 hour
	Benzene	ppb	3	Annual

Location	Pollutant	Units	Air Quality Objective	Averaging period
Station 4	Toluene	ppb	1000	24 hour
			100	Annual
	Ethylbenzene	ppb	NA	24 hour
	Xylene isomers	ppb	250	24 hour
			200	Annual

4.0 TEST METHODS

4.1 Particulate matter ($PM_{2.5}$)

$PM_{2.5}$ concentrations are determined using a Beta Attenuation Monitor (BAM).

Suspended particulate matter in ambient air is measured using the attenuation of beta rays as a surrogate for continuous mass determination. Beta rays are high energy electrons generated from the radioactive decay of the radon isotope Rn-222. When contacting particulate matter beta rays are either absorbed or their energy level is diminished. The relationship between the attenuation of beta rays between the source and detector is used to determine the mass density.

The BAM is equipped with a flow control and measurement system. The flow control system volumetrically controls the flowrate to 16.7 l/min. The flowrate is used with the mass density to calculate the particulate matter concentration.

The sampler is fitted with a size selective inlet, which separates particles with an equivalent aerodynamic diameter greater than 10 microns from the sample stream. An in-line $PM_{2.5}$ particle size separator is also fitted to further separate particles; only those with an equivalent aerodynamic diameter less than 2.5 microns can pass through the particle size separator to the filter for mass determination.

The $PM_{2.5}$ monitoring method is based on the requirements contained within Australian Standard AS/NZS 3580.9.12 "*Methods for Sampling and Analysis of Ambient Air – Method 9.12: Determination of Suspended Particulate Matter – $PM_{2.5}$ Beta Attenuation Monitors*" (NATA Laboratory Accreditation No. 1910).

4.2 Particulate matter (PM_{10})

PM_{10} concentrations are determined using a continuous BAM without an in-line $PM_{2.5}$ particle size separator. All other measurement processes remain the same as for the $PM_{2.5}$ test method.

The PM_{10} monitoring method is based on the requirements contained within Australian Standard AS/NZS 3580.9.11:2016 "*Methods for Sampling and Analysis of Ambient Air – Method 9.11: Determination of Suspended Particulate Matter – PM_{10} Beta Attenuation Monitors*" (NATA Laboratory Accreditation No. 1910).

4.3 Nitrogen dioxide (NO_2)

Oxides of nitrogen concentrations were determined using a 42i Thermo Scientific chemiluminescence gas analyser.

Automatic calibrations are carried out daily against a NATA certified reference gas mixture. Manual calibrations are conducted at one month intervals.

The oxides of nitrogen (NO, NO_2 and NO_x) monitoring method is based on the requirements of Australian Standard AS 3580.5.1, *"Determination of Oxides of Nitrogen – Chemiluminescence Method"*.

4.4 Carbon monoxide (CO)

Carbon monoxide concentrations are determined using a 48i Thermo Scientific infra-red gas filter correlation analyser.

Automatic calibrations are carried out daily against a NATA certified reference gas mixture. Manual calibrations are conducted at one month intervals.

The carbon monoxide monitoring method is based on the requirements of Australian Standard AS 3580.7.1, "*Determination of Carbon Monoxide – Direct Reading Instrumental Method"*.

4.5 Volatile organic compounds (BTEX)

A sample is collected in an evacuated electro-polished and passivated stainless steel canister. Analysis involves separation by gas chromatography (GC) and measurement by mass selective (MS) detector.

The procedure for sampling Volatile Organic Compounds (VOCs) using evacuated canisters, and for the subsequent analysis, is described in USEPA 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)".

Samples were analysed by Queensland Health (NATA Laboratory Accreditation No. 41) based on USEPA method TO-15. The test method used was in accordance with Golder Source Test Method C9, "Canister (Evacuated) Sampling for VOC: In Ambient Air and Source Emissions".

4.6 Meteorological parameters

Monitoring of meteorological parameters; wind speed/direction, temperature, relative humidity, solar radiation and rainfall was conducted in accordance with Australian Standard AS 3580.14 "*Methods for Sampling and Analysis of Ambient Air – Part 14: Meteorological Monitoring for Ambient Air Quality Monitoring Applications"* (NATA Laboratory Accreditation No. 1910).

5.0 MEASUREMENT UNCERTAINTY

5.1 $PM_{2.5}$

The measurement uncertainty for $PM_{2.5}$ by BAM is published by Thermo-Fisher as ±2 µg/m^3 (24 hour average).

5.2 PM_{10}

The measurement uncertainty for $PM_{2.5}$ by BAM is published by Thermo-Fisher as ±2 µg/m^3 (24 hour average).

5.3 NO_2

The measurement uncertainty for NO, NO2 and NOx by Chemiluminescence is published in AS3580.5.1 as ±10% (24 hour average).

5.4 CO

The measurement uncertainty for CO by Infra-red gas filter correlation is published in AS3580.7.1 as ±10% (24 hour average).

5.5 Benzene

USEPA Method TO-15 cites the accuracy and precision for two ambient air quality studies conducted in the United States of America. The average replicate precision for a range of 16 compounds in both studies was 15%. Replicate precision was defined as the ratio of the average difference between replicates to the average value of replicates.

The reported accuracies for both studies ranged between ± 4 % and ± 31%. The average accuracy for both studies for the range of 16 compounds was ± 11%. Accuracy is defined as the ratio of the difference between expected and observed audit results to the expected audit result.

5.6 Meteorological parameters

The estimated measurement uncertainty for each of the parameters is presented in Table 6.

Table 6: Meteorological parameters measurement uncertainty

Parameter	Measurement uncertainty [A]
Wind speed	Greater of ±0.6 m/s or 5%
Wind direction	±5°
Barometric pressure	±3 hPa
Temperature	±6%
Relative humidity	±5 – 7%RH

Note:
A Measurement uncertainty estimates are as published in AS3580.14 "*Methods for Sampling and Analysis of Ambient Air – Part 14 Meteorological Monitoring for Ambient Air Quality Monitoring Applications".*

5.7 Calibration and maintenance

Sample flow rate calibration was conducted on a monthly basis using a NATA calibrated primary standard flowmeter. Calibration details for the reporting period are presented in Table 7.

Table 7: Calibrations

Location	Parameter	Last Calibration Date	Calibration Type
Station 1	PM_{10}	20/02/2020	monthly
	$PM_{2.5}$	20/02/2020	monthly
	Wind speed and direction	9/08/2018	two yearly
Station 2	PM_{10}	21/02/2020	monthly
	$PM_{2.5}$	21/02/2020	monthly
	Wind speed and direction	7/08/2018	two yearly
Station 3	PM_{10}	20/02/2020	monthly
	$PM_{2.5}$	20/02/2020	monthly
	Wind speed and direction	10/08/2018	two yearly
Station 4	PM_{10}	19/02/2020	monthly
	$PM_{2.5}$	19/02/2020	monthly
	NO/ NO_2 / NOx	11/02/2020	monthly
	CO	11/02/2020	monthly

Location	Parameter	Last Calibration Date	Calibration Type
Station 4	BTEX	NA	Flow-controllers and canisters certified by lab
	Wind speed and direction	10/08/2018	two yearly
Station 5	PM_{10}	20/02/2020	monthly
	$PM_{2.5}$	20/02/2020	monthly
	Wind speed and direction	10/09/2018	two yearly
Station 6	PM_{10}	21/02/2020	monthly
	$PM_{2.5}$	21/02/2020	monthly

6.0 RESULTS

The monitoring results for 1 February 2020 to 29 February 2020 are presented in the following sections.

6.1 Particulate matter (BAM $PM_{2.5}$ & PM_{10})

$PM_{2.5}$ and PM_{10} were continuously monitored and 5-minute averages logged. The 5-minute average data was transformed to 24 hour averages for reporting.

$PM_{2.5}$ and PM_{10} concentration statistics from the reporting period for Station 1 to Station 6 are presented in Table 8 to Table 13. The 24 hour average plots for Station 1 to Station 6 are presented in Figure 2 to Figure 7.

6.1.1 Station 1 – Yarraville Gardens

Table 8: Station 1 (Yarraville Gardens AAQMS) $PM_{2.5}$ and PM_{10} percentiles (24 hour average)

Parameter	Concentration (µg/m³)[A]							Air quality objective[B]
	Maximum	99th	98th	95th	90th	75th	50th	(µg/m³)
$PM_{2.5}$	37	34	31	24	15	9.6	7.0	25
PM_{10}	52	48	45	38	30	21	16	50

Note:
A Micrograms per cubic metre at 0°C and 101.3 kPa
B SEPP(AAQ) Objective
Values rounded to two significant figures.

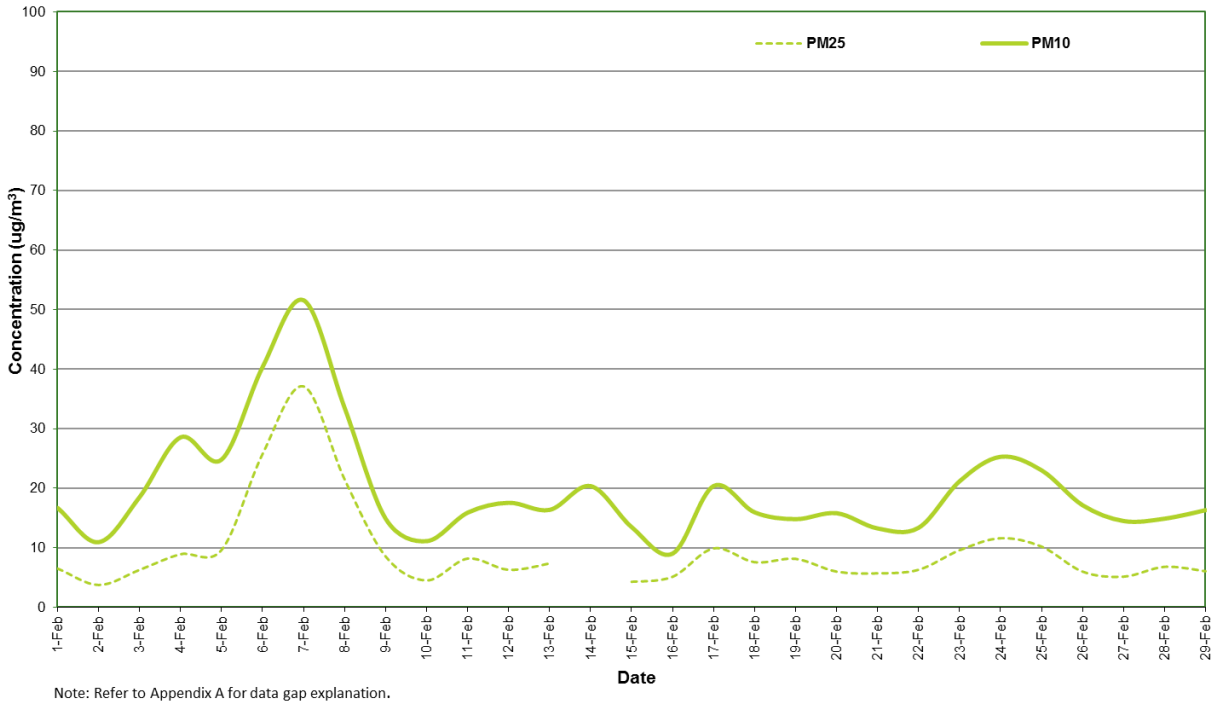


Figure 2: Station 1 $PM_{2.5}$ and PM_{10} concentration (24 hour average) – February 2020

6.1.2 Station 2 – Francis Street

Table 9: Station 2 (Francis Street AAQMS) $PM_{2.5}$ and PM_{10} percentiles (24 hour average)

Parameter	Concentration (µg/m³)[A]							Air quality objective[B]
	Maximum	99th	98th	95th	90th	75th	50th	(µg/m³)
$PM_{2.5}$	42	38	34	24	16	11	7.3	36
PM_{10}	55	51	47	37	28	22	17	60

Note:
A Micrograms per cubic metre at 0°C and 101.3 kPa
B SEPP(AQM) Intervention level
Values rounded to two significant figures.

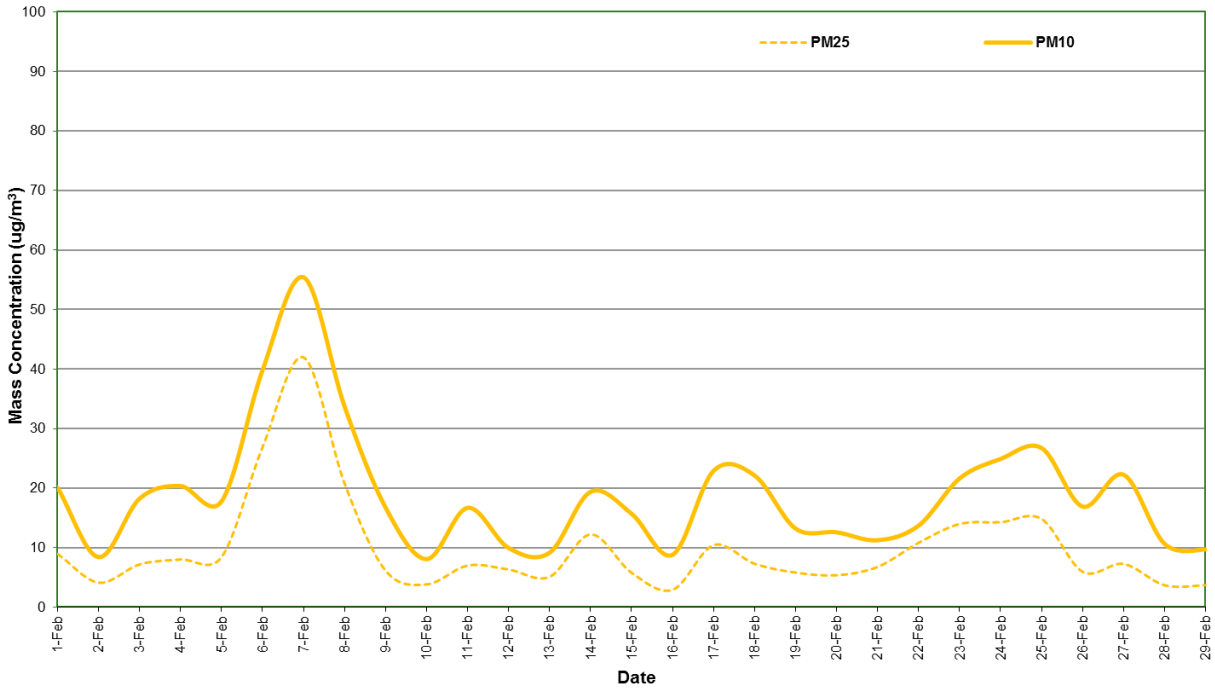


Figure 3: Station 2 $PM_{2.5}$ and PM_{10} concentration (24 Hour Average) – February 2020

6.1.3 Station 3 – Railway Reserve

Table 10: Station 3 (Railway Reserve AAQMS) $PM_{2.5}$ and PM_{10} percentiles (24 hour average)

Parameter	Concentration (µg/m³)[A]							Air quality objective[B]
	Maximum	99th	98th	95th	90th	75th	50th	(µg/m³)
$PM_{2.5}$	36	32	29	23	16	8.7	6.4	36
PM_{10}	58	54	50	43	32	21	18	60

Note:
A Micrograms per cubic metre at 0°C and 101.3 kPa
B SEPP(AQM) Intervention level
Values rounded to two significant figures.

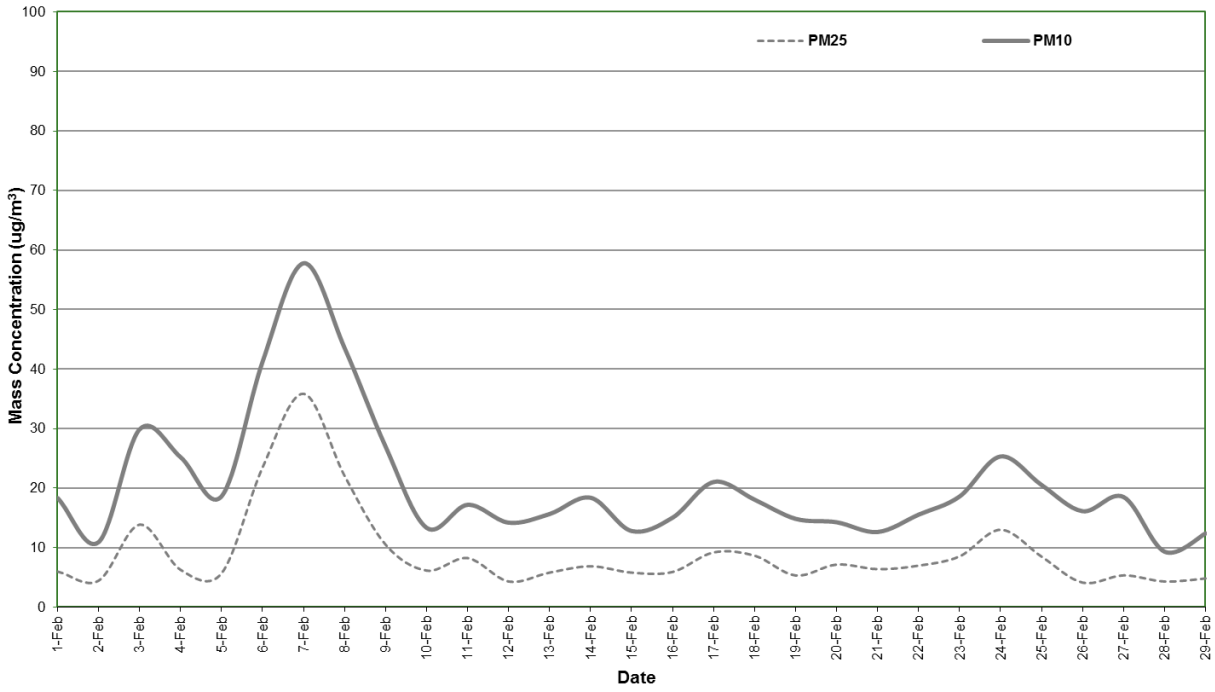


Figure 4: Station 3 $PM_{2.5}$ and PM_{10} concentration (24 hour average) – February 2020

6.1.4 Station 4 – Primula Avenue

Table 11: Station 4 (Primula Avenue AAQMS) $PM_{2.5}$ and PM_{10} percentiles (24 hour average)

Parameter	Concentration (µg/m³)[A]							Air quality objective[B]
	Maximum	99th	98th	95th	90th	75th	50th	(µg/m³)
$PM_{2.5}$	35	33	30	23	15	9.8	8.0	36
PM_{10}	73	72	70	68	62	31	23	60

Note:
A Micrograms per cubic metre at 0°C and 101.3 kPa
B SEPP(AQM) Intervention level
Values are rounded to two significant figures

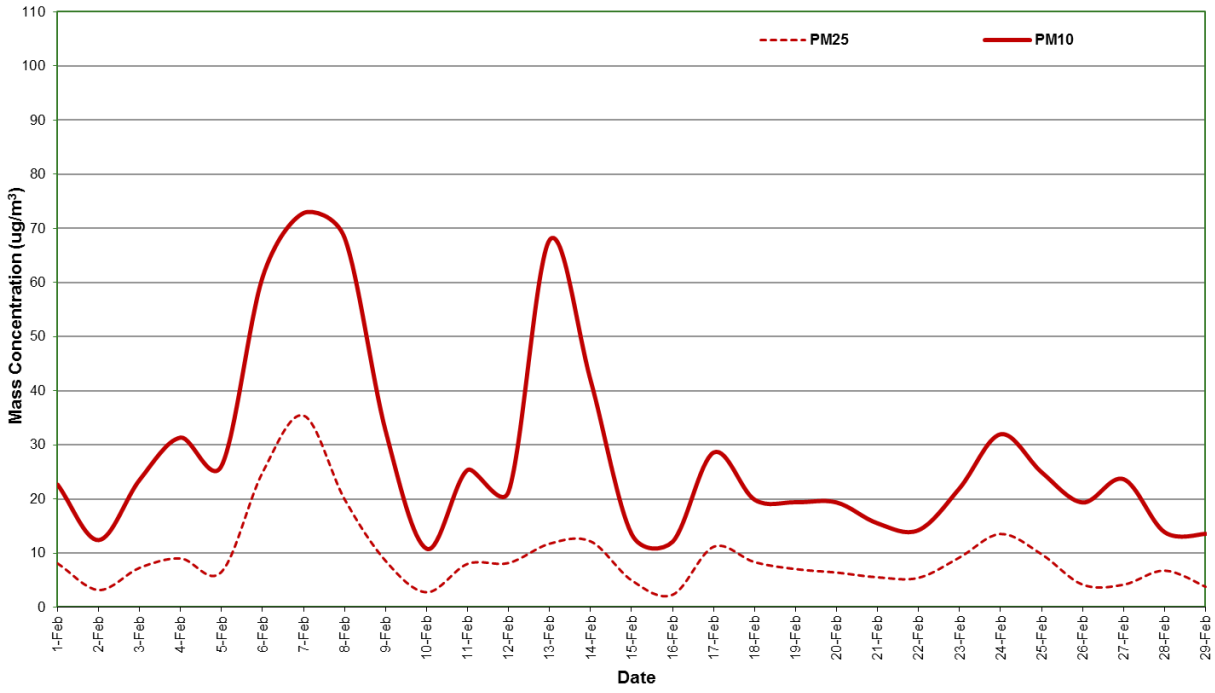


Figure 5: Station 4 $PM_{2.5}$ and PM_{10} concentration (24 hour average) – February 2020

6.1.5 Station 5 – Donald McLean Reserve

Table 12: Station 5 (Donald McLean Reserve AAQMS) $PM_{2.5}$ and PM_{10} percentiles (24 hour average)

Parameter	Concentration (µg/m³)[A]							Air quality objective[B]
	Maximum	99th	98th	95th	90th	75th	50th	(µg/m³)
$PM_{2.5}$	34	31	28	23	15	8.4	5.5	36
PM_{10}	59	58	57	51	33	22	17	60

Note:
A Micrograms per cubic metre at 0°C and 101.3 kPa
B SEPP(AQM) Intervention level
Values rounded to two significant figures.

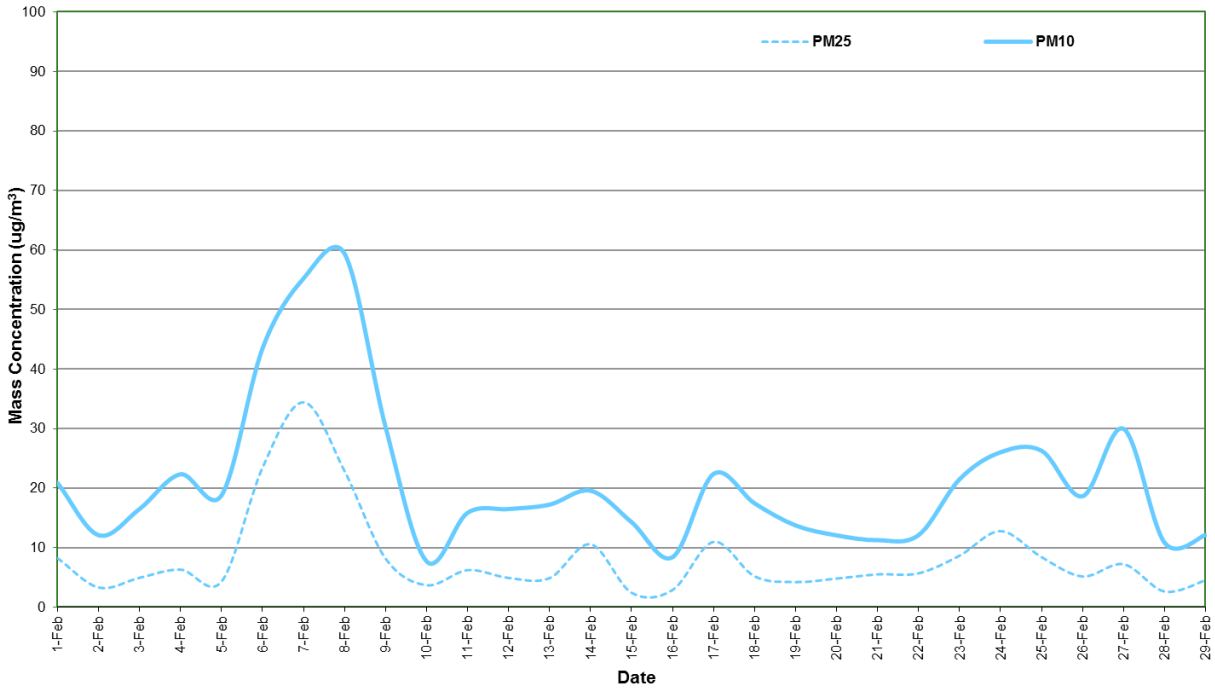


Figure 6: Station 5 $PM_{2.5}$ and PM_{10} concentration (24 hour average) – February 2020

6.1.6 Station 6 – Millers Road

Table 13: Station 6 (Millers Road AAQMS) $PM_{2.5}$ and PM_{10} percentiles (24 hour average)

Parameter	Concentration (µg/m³)[A]							Air quality objective[B]
	Maximum	99th	98th	95th	90th	75th	50th	(µg/m³)
$PM_{2.5}$	39	35	32	24	16	10	6.9	36
PM_{10}	60	56	52	43	35	27	18	60

Note:
A Micrograms per cubic metre at 0°C and 101.3 kPa
B SEPP(AQM) Intervention level
Values rounded to two significant figures.

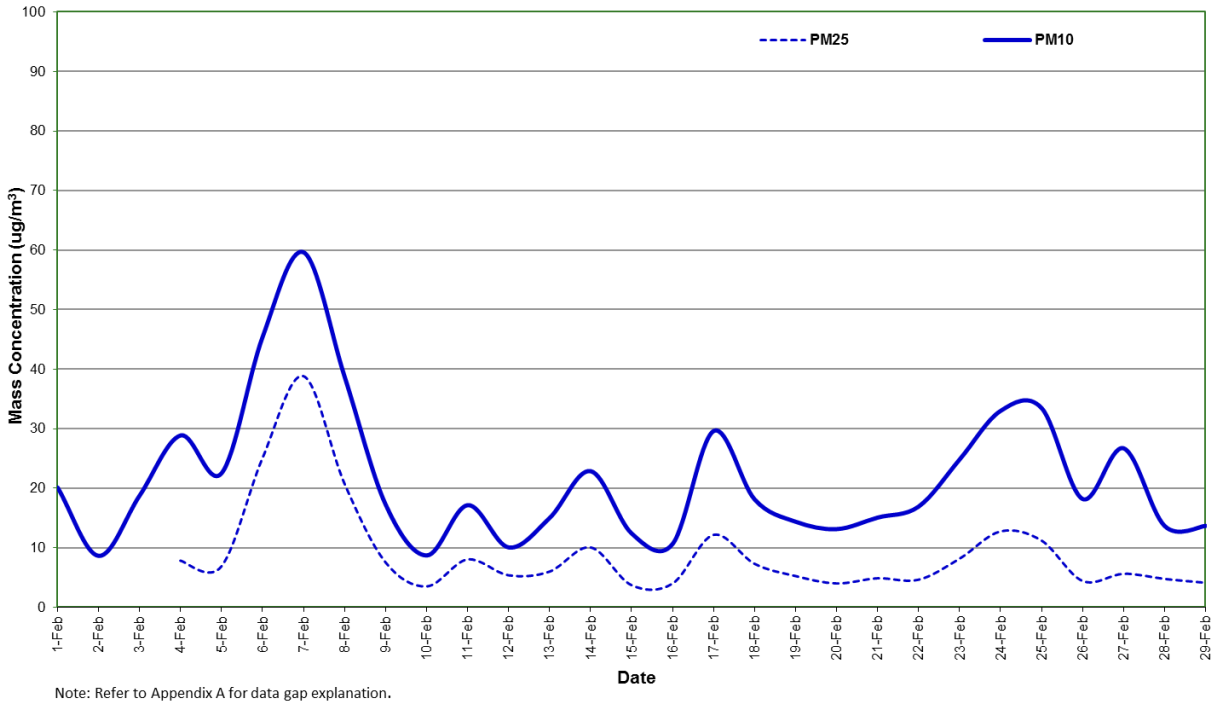


Figure 7: Station 6 $PM_{2.5}$ and PM_{10} concentration (24 hour average) – February 2020

6.1.7 Combined $PM_{2.5}$ mass concentrations

Combined plots of the AAQMS $PM_{2.5}$ and PM_{10} are presented in Figure 8 and Figure 9 respectively.

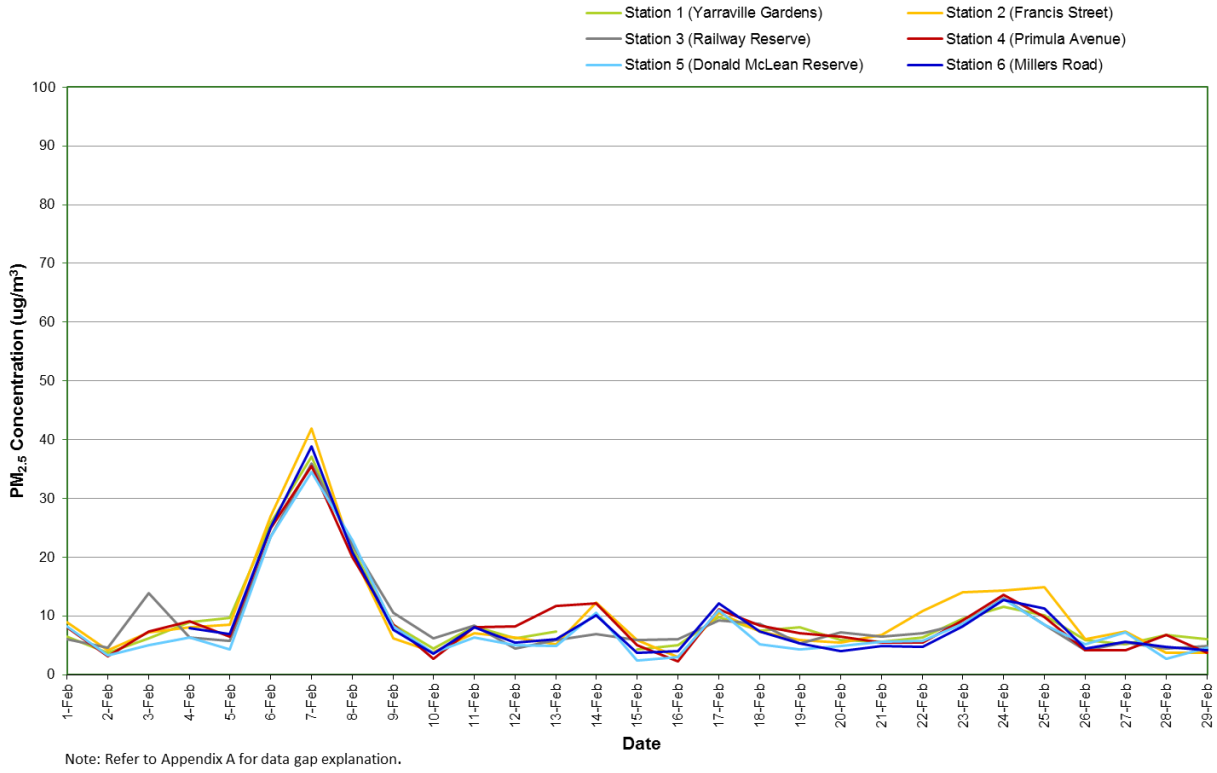


Figure 8: Combined $PM_{2.5}$ concentration (24 hour average) – February 2020

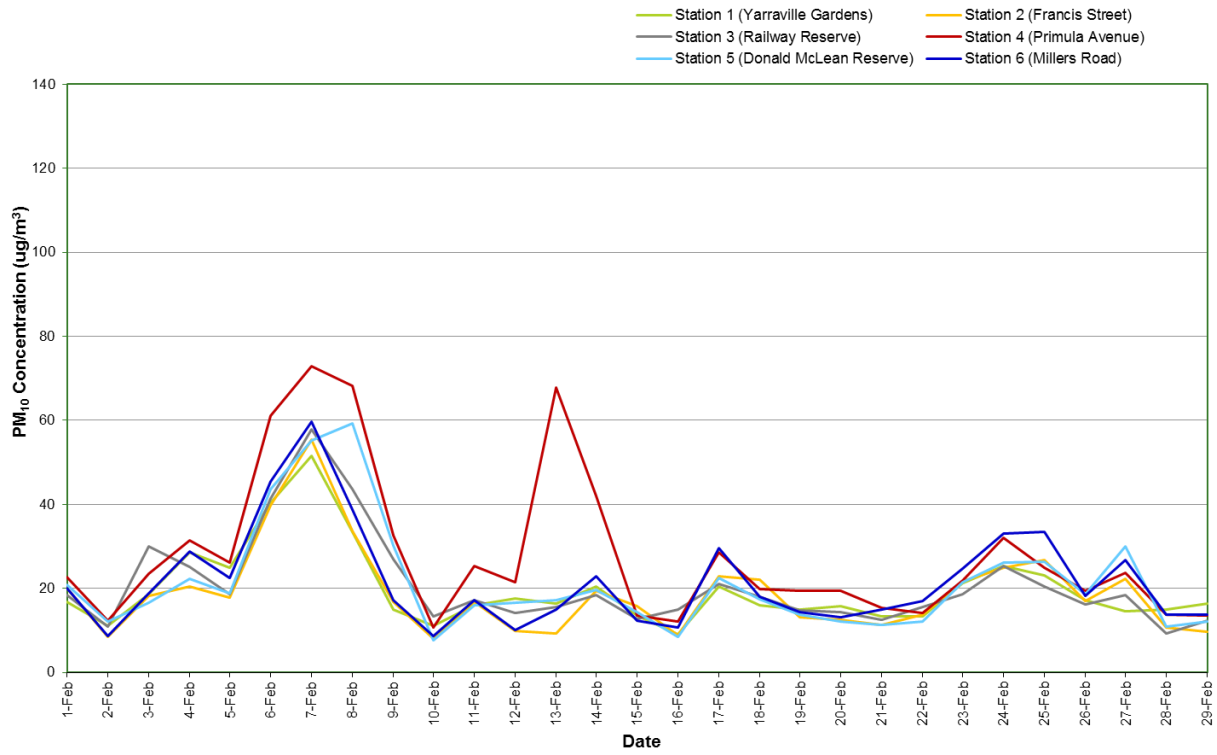


Figure 9: Combined PM_{10} concentration (24 hour average) – February 2020

6.2 Nitrogen dioxide (NO_2)

NO_2 (1 hour average) mass concentration statistics for the reporting period are given in Table 14. A plot of NO_2 (1 hour average) mass concentration for the reporting period is presented in Figure 10.

Table 14: Station 4 (Primula Avenue AAQMS) NO_2 percentiles (1 hour average)

Parameter	Concentration (ppb)[A]							SEPP (AQM) intervention level
	Maximum	99th	98th	95th	90th	75th	50th	(ppb)
NO_2	39	28	27	23	20	15	12	140

Note:
A Parts per billion

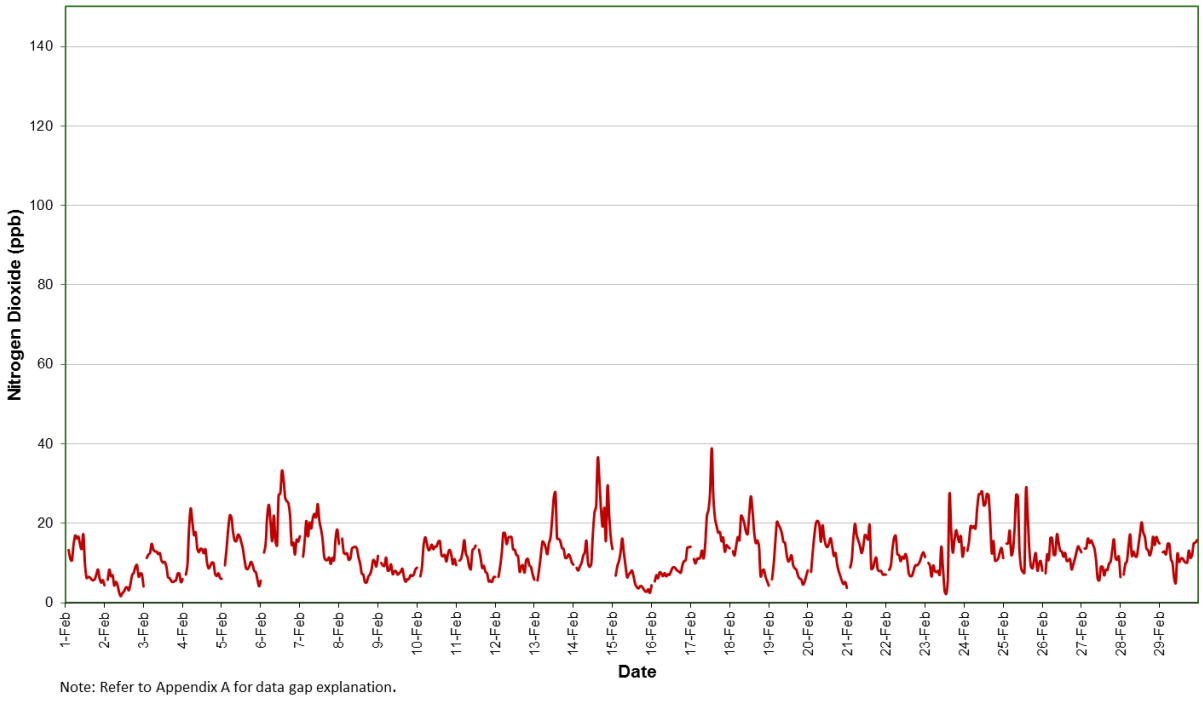


Figure 10: Station 4 NO_2 concentration (1 hour average) – February 2020

6.3 Carbon monoxide (CO)

CO (1 hour average) mass concentration statistics for the reporting period are given in Table 15. A plot of CO (1 hour average) concentration for the reporting period is presented in Figure 11.

Table 15: Station 4 (Primula Avenue AAQMS) CO percentiles (1 hour average)

Parameter	Concentration (ppm)[A]							SEPP (AQM) intervention level
	Maximum	99th	98th	95th	90th	75th	50th	(ppm)
CO	1.1	0.83	0.73	0.66	0.61	0.53	0.47	29

Note:
A Parts per million

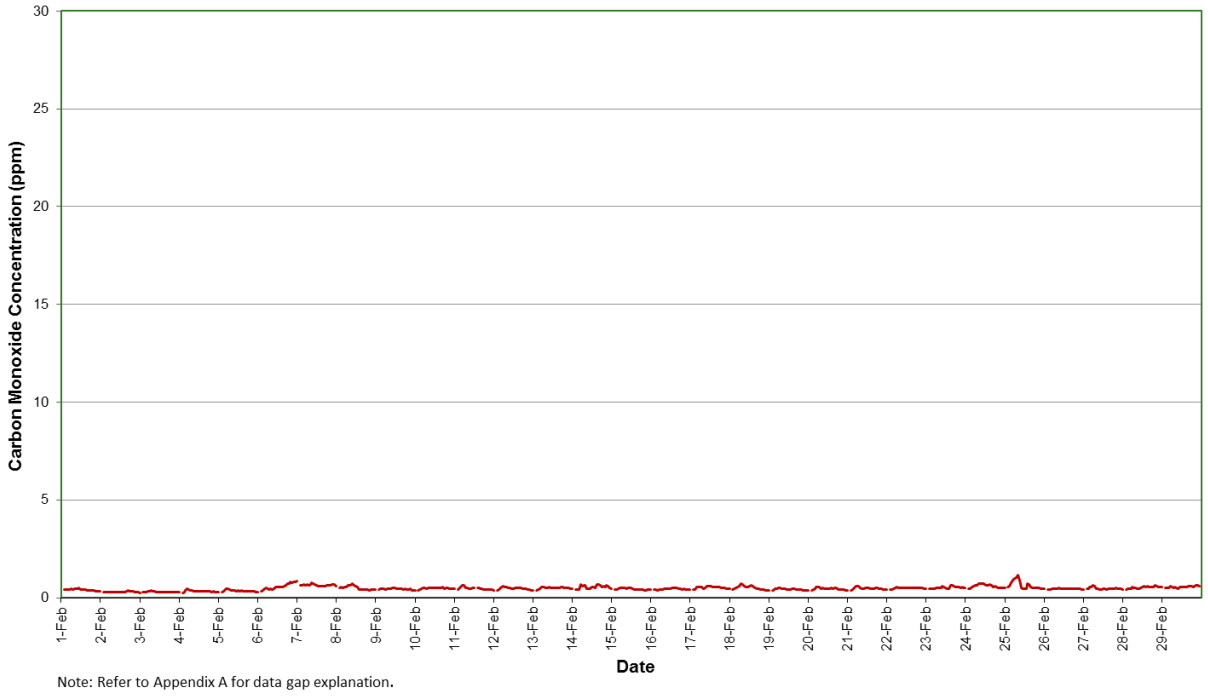


Figure 11: Station 4 CO concentration (1 hour average) – February 2020

6.4 Volatile organic compounds (BTEX)

VOC samples were collected from Station 4 (Primula Avenue), in an evacuated electro-polished and passivated stainless steel canister. Analysis involves separation by gas chromatography (GC) and measurement by mass selective (MS) detector.

The procedure for sampling Volatile Organic Compounds (VOCs) using evacuated canisters, and for the subsequent analysis, is described in USEPA 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)”.

Samples were analysed by Queensland Health (NATA Laboratory Accreditation No. 41) based on USEPA method TO-15 (Laboratory Report Nos. SSP68698, SSP68900 and SSP68950).

The test method used was in accordance with Golder Source Test Method C9, "Canister (Evacuated) Sampling for VOC: In Ambient Air and Source Emissions".

BTEX (24 hour average) mass concentration statistics for the reporting period are given in Table 16. Laboratory certificates are presented in APPENDIX B.

Table 16: Station 4 - Primula Avenue AAQMS BTEX concentrations (24 hour average)

Date	Sample no.	Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	Total xylene isomers (ppb)
03/02/2020	20-340	<0.5	<0.5	<0.5	<1
09/02/2020	20-369	<0.5	<0.5	<0.5	<1
15/02/2020	20-370	<0.5	<0.5	<0.5	<1
21/02/2020	20-391	<0.5	<0.5	<0.5	<1
27/02/2020	20-392	<0.5	<0.5	<0.5	<1
NEPM MIL[A]		3.0[B]	1000	NA	250

Note:
A National Environment Protection Measure (Air Toxics) Monitoring Investigation Level
B Annual average
Sample analysis conducted by Queensland Health, NATA Accreditation No. 41/ Eurofins Pty Ltd, NATA Accreditation No. 1261.
Analysis dates: 14/02/2020 (20-340), 27/02/2020 (20-369, 20-370), 2/03/2020 (20-391, 20-392)

6.5 Meteorological parameters

6.5.1 Ambient temperature

Ambient Temperature data for all AAQMS sites are presented in Figure 12 for the reporting period.

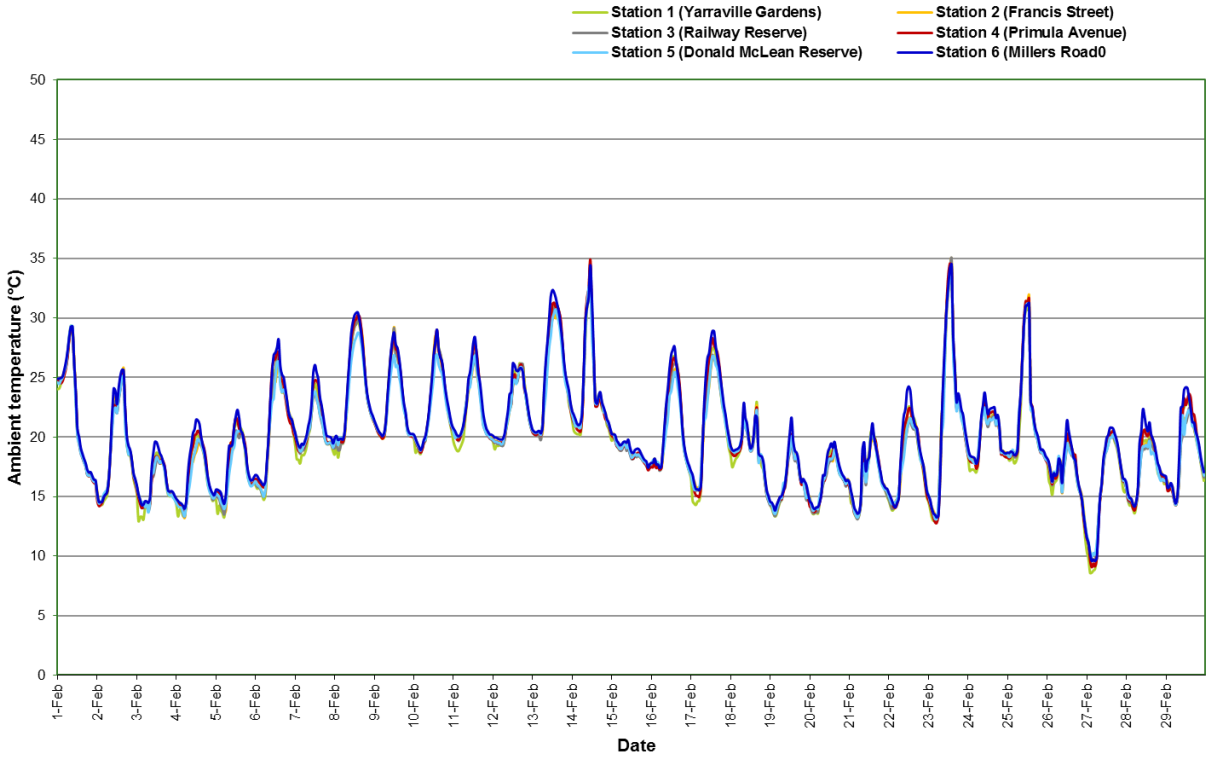


Figure 12: Ambient temperature (1 hour average) All AAQMS – February 2020

6.5.2 Relative humidity

Relative Humidity data for all AAQMS sites are presented in Figure 13 for the reporting period.

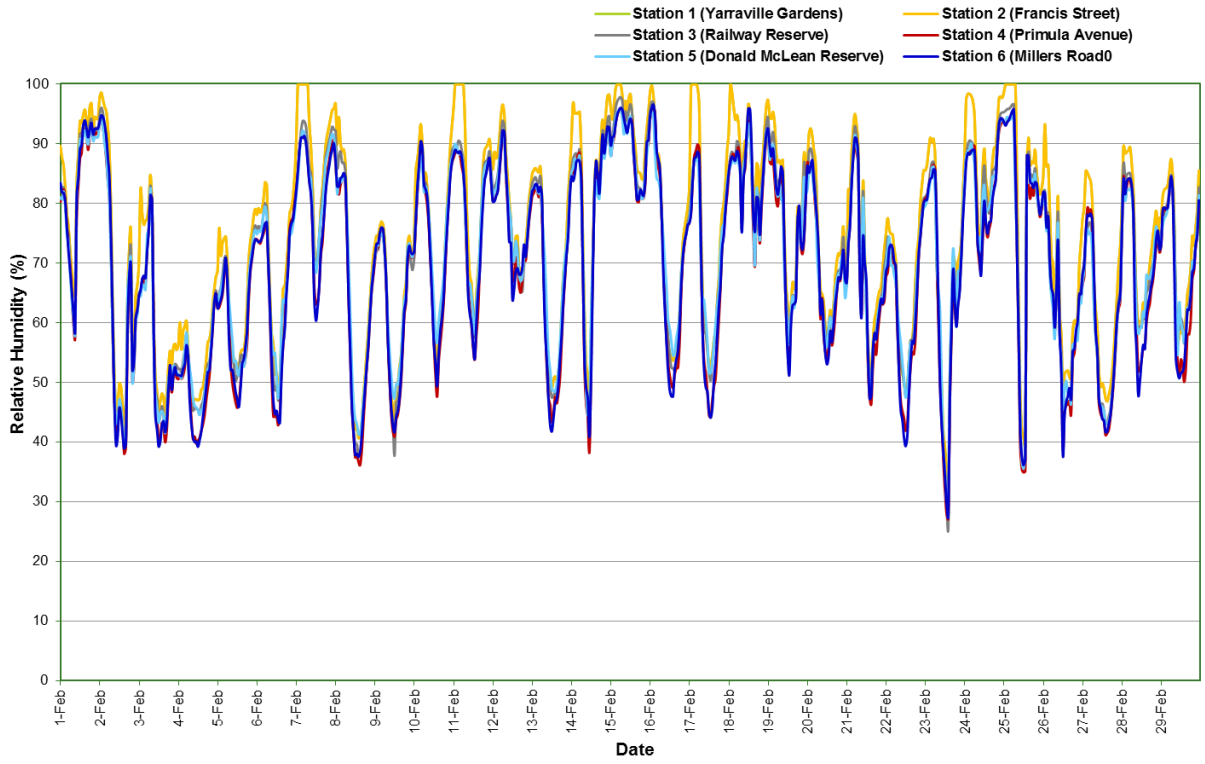


Figure 13: Relative humidity (1 hour average) All AAQMs – February 2020

6.5.3 Atmospheric pressure

Atmospheric pressure data for Station 4 (Primula Avenue AAQMS) is presented in Figure 14 for the reporting period.

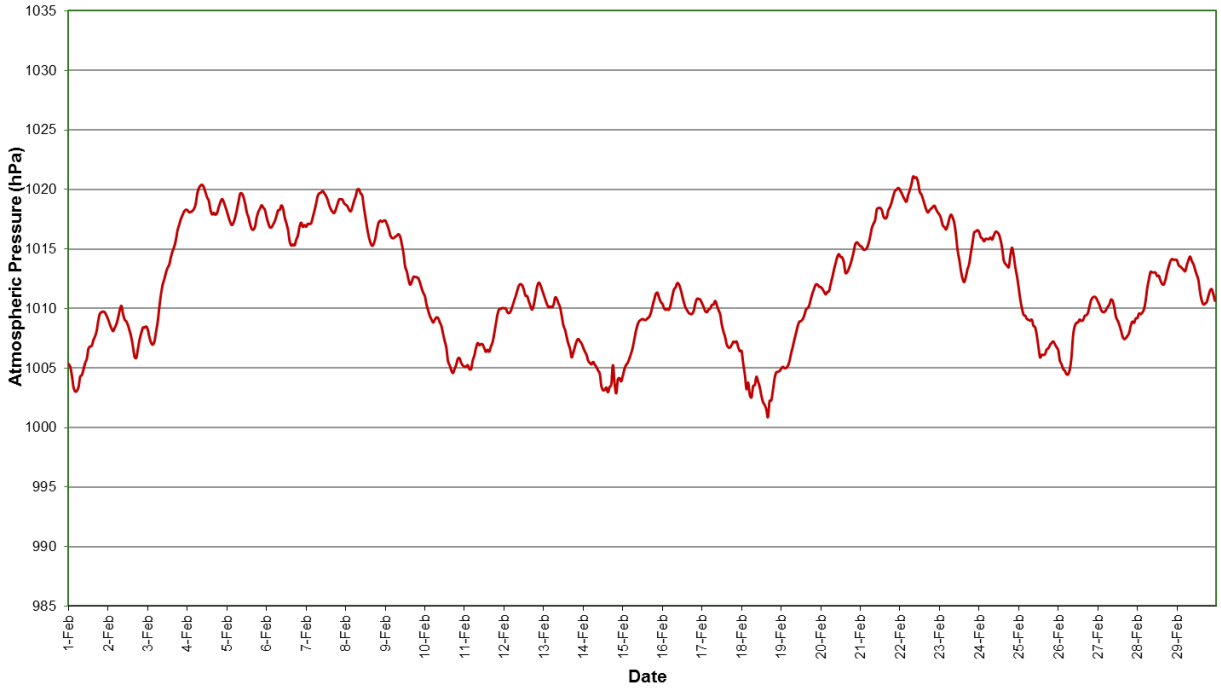


Figure 14: Atmospheric pressure (1 hour average) Station 4 Primula Avenue – February 2020

6.5.4 Wind speed

Wind Speed data for all AAQMS sites are presented in Figure 15 for the reporting period.

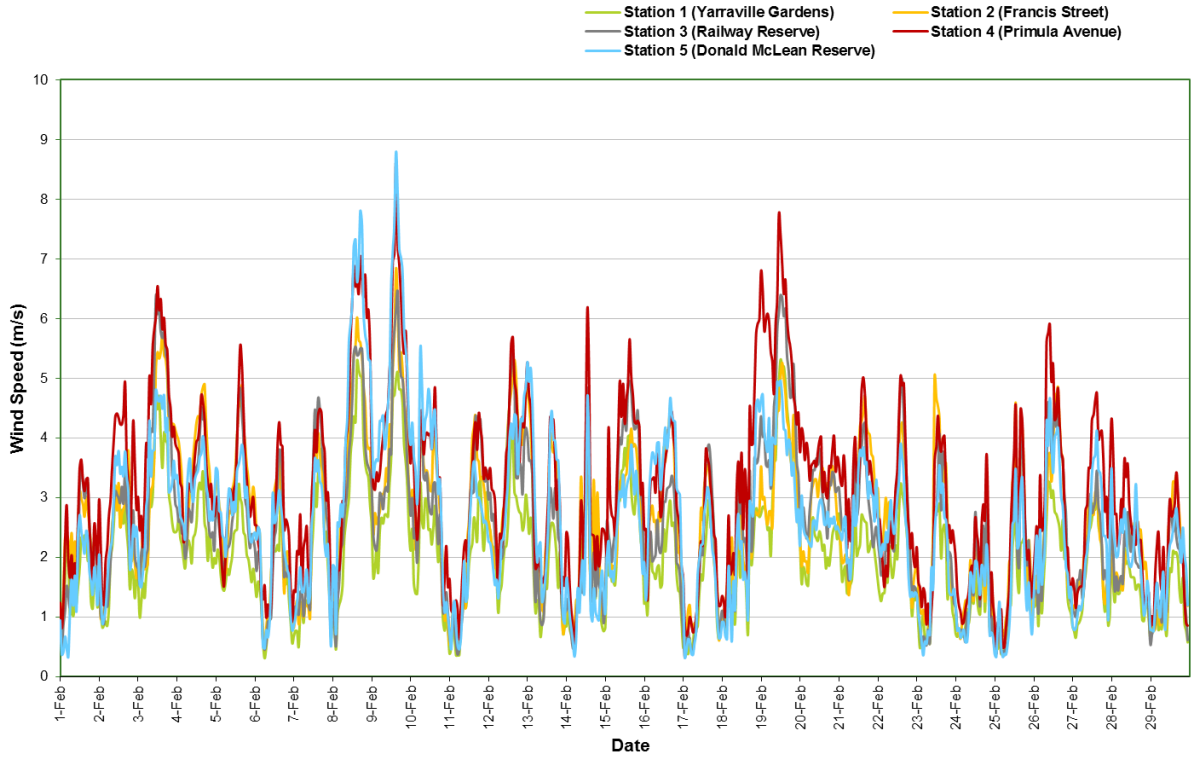


Figure 15: Wind speed (1 hour average) All AAQMs – February 2020

6.5.5 Wind rose – Station 1 (Yarraville Gardens)

A wind rose (1 hour average) for Yarraville Gardens AAQMS is presented in Figure 16.

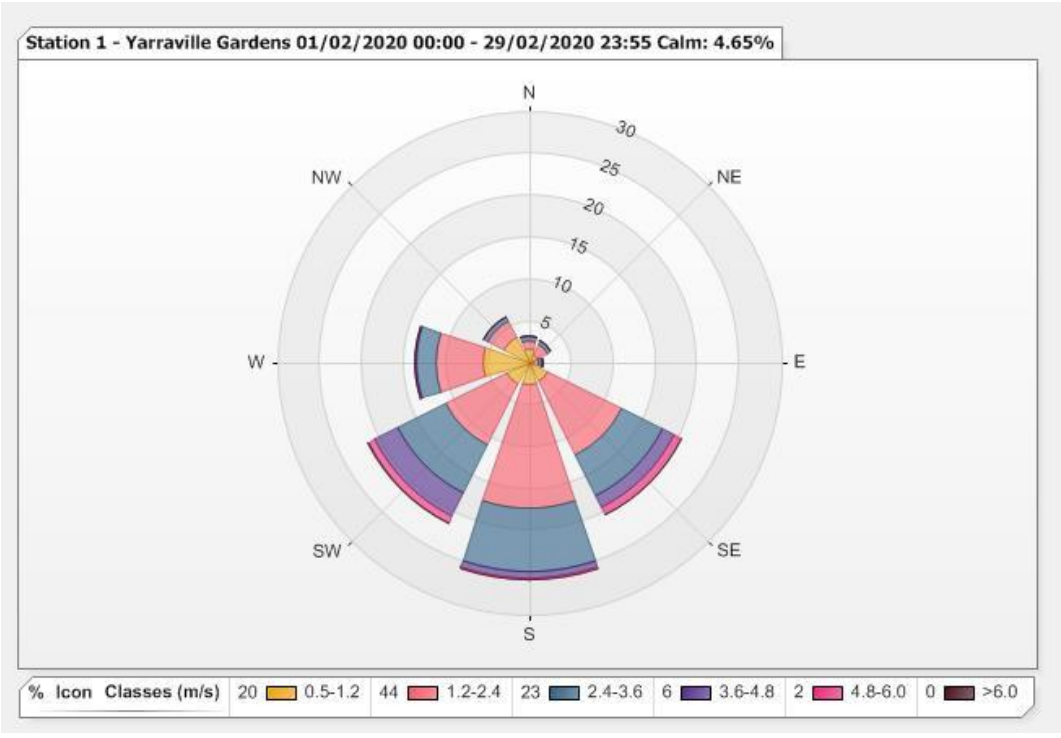


Figure 16: Wind speed (1 hour average) Station 1 - Yarraville Gardens

6.5.6 Wind rose – Station 2 (Francis Street)

A wind rose (1 hour average) for Station 2 (Francis Street AAQMS) is presented in Figure 17.

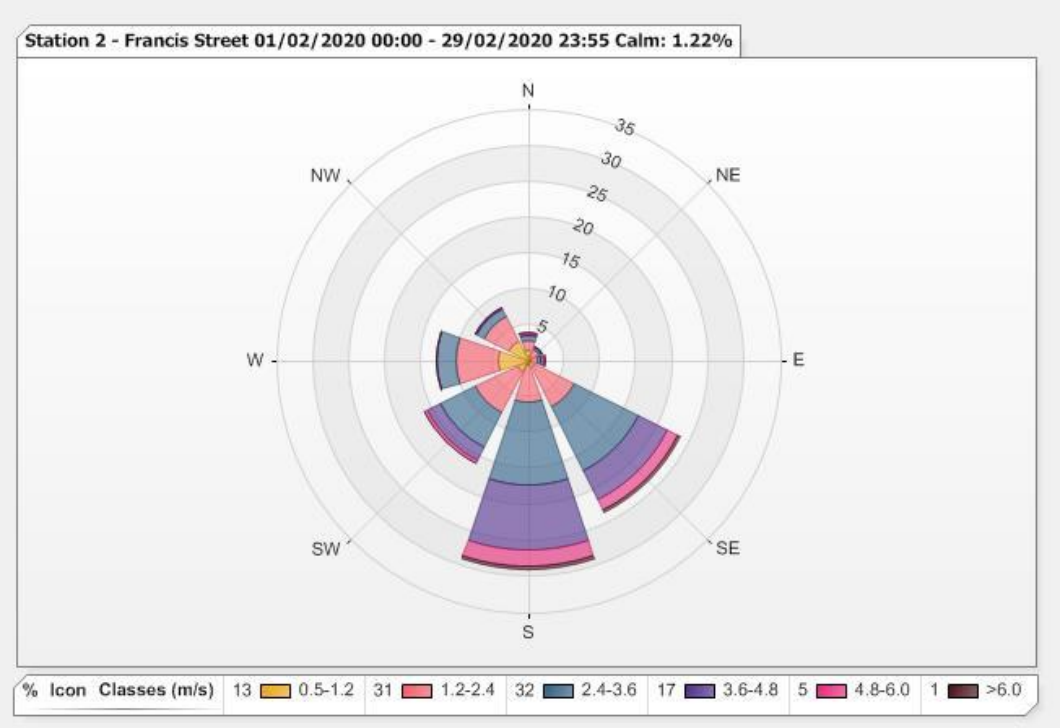


Figure 17: Wind speed (1 hour average) Station 2 - Francis Street

6.5.7 Wind rose – Station 3 (Railway Reserve)

A wind rose (1 hour average) for Station 3 (Railway Reserve AAQMS) is presented in Figure 18.

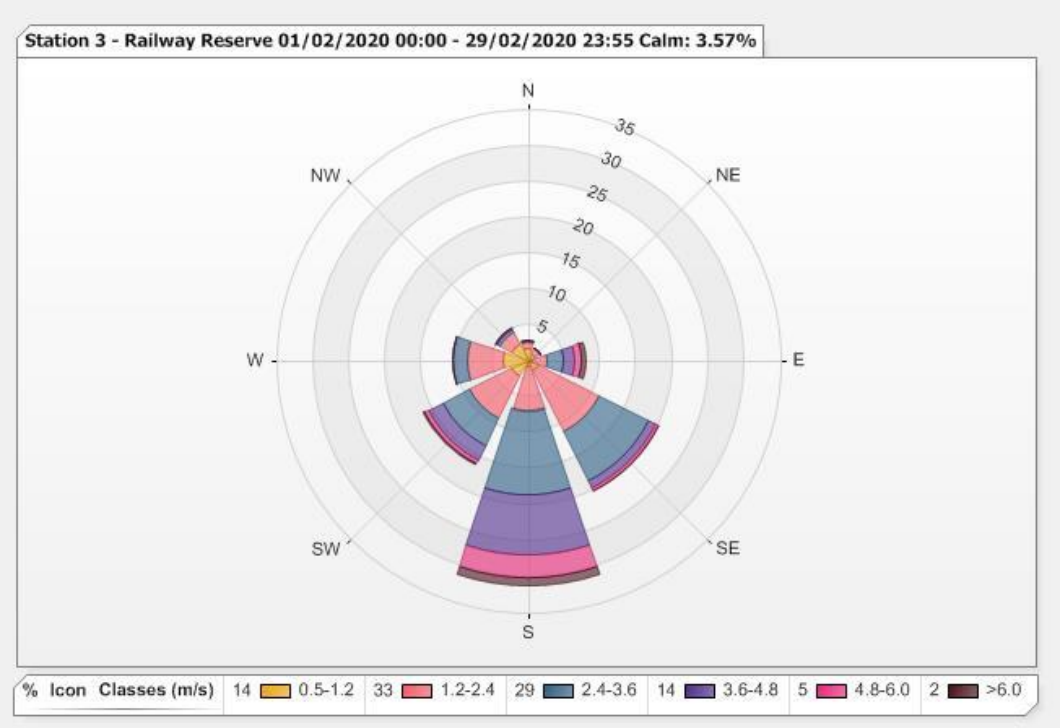


Figure 18: Wind speed (1 hour average) Station 3 Railway Reserve

6.5.8 Wind rose – Station 4 (Primula Avenue)

A wind rose (1 hour average) for Station 4 (Primula Avenue AAQMS) is presented in Figure 19.

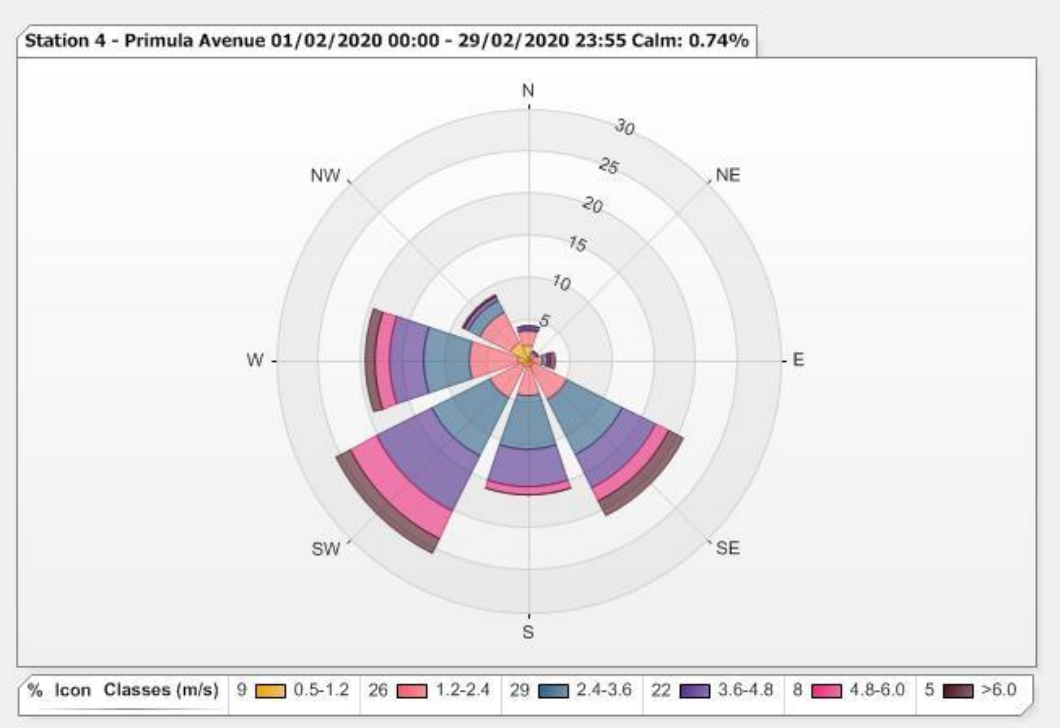


Figure 19: Wind speed (1 hour average) Station 4 Primula Avenue

6.5.9 Wind rose – Station 5 (Donald McLean Reserve)

A wind rose (1 hour average) for Station 5 (Donald McLean Reserve AAQMS) is presented in Figure 20.

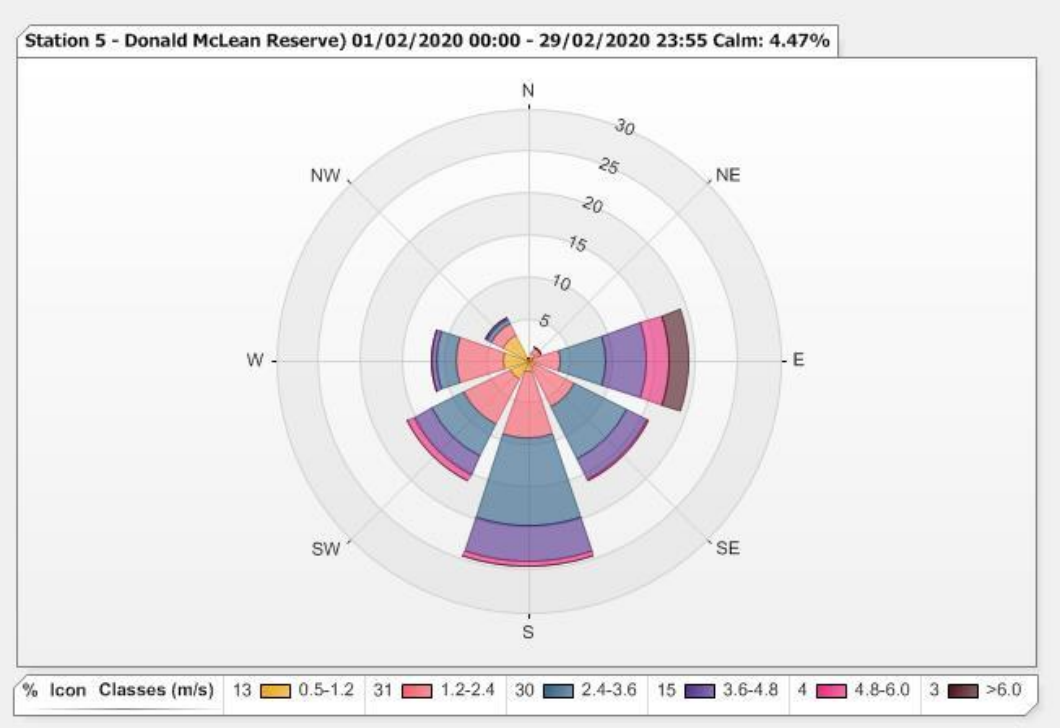


Figure 20: Wind speed (1 hour average) Station 5 Donald McLean Reserve

7.0 QUALITY ASSURANCE

7.1 Data capture

Data capture is defined as the number of valid data periods collected divided by the number of available data periods. Valid data excludes periods where the instrument is unavailable due to calibration and maintenance and excludes periods where the data has been rejected due to quality assurance/data validation procedures.

Automatic calibrations are conducted for NO_2 and CO daily to monitor and correct instrument drift where necessary. NO_2 and CO automatic calibrations are conducted once per day between 01:00 and 01:45 hours.

Data capture statistics for the reporting period 1 February to 29 February 2020 are shown in Table 17. Averages were only collected for those periods where the 5 minute data constituted 75% data capture.

Data capture statistics for February 2020 were above 90 percent for all parameters at all stations.

Table 17: Data capture

Parameter	Averaging period	Station	Collected periods	Available periods	Data capture[1]
$PM_{2.5}$	24 hour	1 – Yarraville Gardens	28	29	97%
	24 hour	2 – Francis Street	29	29	100%
	24 hour	3 – Railway Reserve	29	29	100%
	24 hour	4 – Primula Avenue	29	29	100%
	24 hour	5 – Donald McLean Reserve	29	29	100%
	24 hour	6 – Millers Road	27	29	93%
PM_{10}	24 hour	1 – Yarraville Gardens	29	29	100%
	24 hour	2 – Francis Street	29	29	100%
	24 hour	3 – Railway Reserve	29	29	100%
	24 hour	4 – Primula Avenue	29	29	100%
	24 hour	5 – Donald McLean Reserve	29	29	100%
	24 hour	6 – Millers Road	29	29	100%
NO_2	1 hour	4 – Primula Avenue	666	696	96%
CO	1 hour	4 – Primula Avenue	666	696	96%
Ambient temperature & relative humidity	1 hour	1 – Yarraville Gardens	696	696	100%
	1 hour	2 – Francis Street	696	696	100%
	1 hour	3 – Railway Reserve	696	696	100%
	1 hour	4 – Primula Avenue	696	696	100%
	1 hour	5 – Donald McLean Reserve	696	696	100%
	1 hour	6 – Millers Road	693	696	100%

Atmospheric pressure	1 hour	4 – Primula Avenue	696	696	100%
Wind speed and direction	1 hour	1 – Yarraville Gardens	696	696	100%
	1 hour	2 – Francis Street	696	696	100%
	1 hour	3 – Railway Reserve	696	696	100%
	1 hour	4 – Primula Avenue	696	696	100%
	1 hour	5 – Donald McLean Reserve	696	696	100%

Note:
1 Rounded to two significant figures

7.2 Data validation

Data contained in this report has been validated against performance and calibration requirements for each instrument. Data during commissioning, maintenance and calibration periods has been removed from the validated data sets. APPENDIX A lists the data exceptions for all AAQMS. Missing data periods during automatic calibrations of the gaseous atmospheric contaminants NO_2 and CO are not shown.

8.0 DISCUSSION

Table 18 presents the maximum measured concentration during the reporting period at Station 1 for $PM_{2.5}$ and PM_{10} compared with the respective criteria.

Table 18: Station 1 Summary – February 2020

Parameter	Units	Averaging period	Maximum concentration	Air quality objective[A]	Exceedances[B]
$PM_{2.5}$	ug/m^3	24 hour	37	25	2
PM_{10}	ug/m^3	24 hour	52	50	1

Notes:
A - SEPP(AAQ) objective
B - Exceedances refers to the number of individual days the criterion was exceeded at any station.

Table 19 presents the maximum measured concentration during the reporting period at Station 2, Station 3, Station 5 and Station 6 for $PM_{2.5}$ and PM_{10} compared with the respective criteria.

Table 19: Station 2, Station 3, Station 5 and Station 6 Summary – February 2020

Parameter	Units	Averaging period	Maximum concentration				Air quality objective[A]	Exceedances[B]
			Station 2	Station 3	Station 5	Station 6		
$PM_{2.5}$	ug/m^3	24 hour	42	36	34	39	36	1
PM_{10}	ug/m^3	24 hour	55	58	59	60	60	Nil

Notes:
A - SEPP(AQM) Intervention level
B - Exceedances refers to the number of individual days the criterion was exceeded at any station

Table 20 presents maximum measured concentration during the reporting period at Station 4 for $PM_{2.5}$, PM_{10}, NO_2, CO and BTEX compared with the respective criteria.

Table 20: Station 4 Summary – February 2020

Parameter	Units	Averaging period	Maximum concentration	Air quality objective	Exceedances[C]
$PM_{2.5}$	ug/m^3	24 hour	35	36[A]	Nil
PM_{10}	ug/m^3	24 hour	73	60[A]	4
NO_2	ppb	1 hour	39	140[A]	Nil
CO	ppm	1 hour	1.1	29[A]	Nil
Benzene	ppb	24 hour	<0.5	3.0[B]	Nil
Toluene	ppb	24 hour	<0.5	1000[B]	Nil
Total xylene isomers	ppb	24 hour	<1	250[B]	Nil

Notes:
A - SEPP(AQM) Intervention level
B - Air NEPM Monitoring investigation level
C - Exceedances refers to the number of individual days the criterion was exceeded at any station.

$PM_{2.5}$ results for the February 2020 ambient air quality monitoring programme were less than the respective air quality objectives at Station 3 (Railway Reserve), Station 4 (Primula Avenue) and Station 5 (Donald McLean Reserve). Station 1 (Yarraville Gardens) exceeded $PM_{2.5}$ air quality objectives on two days occasions (6th and 7th February 2020). Station 2 (Francis Street) and Station 6 (Millers Road) both recorded one exceedance (7th February 2020).

PM_{10} results for the February 2020 ambient air quality monitoring programme were less than the respective air quality objectives for all sites except for Station 1 (Yarraville Gardens) and Station 4 (Primula Avenue). Station 1 (Yarraville Gardens) exceeded the PM_{10} air quality objectives on one occasion (7th February 2020). Station 4 (Primula Avenue) recorded four exceedances of the PM_{10} air quality objective (6th, 7th, 8th and 13th February 2020).

NO_2 and CO at Station 4 were below their respective air quality objectives for February 2020.

EPA Victoria's historical air quality data[2] reported elevated levels of PM_{10} and $PM_{2.5}$ at Brooklyn, Footscray and Alphington AAQMS on the 6th and 7th February 2020, indicating the exceedances at the West Gate Tunnel AAQMS on those dates were likely due to a regional event.

A construction area (Millers Road exit ramp and noise wall relocation) is now adjacent Station 4, as a result the measured PM_{10} concentrations may be impacted by construction activities and may not be representative of traffic emissions.

Relative Humidity at Station 1 (Yarraville Gardens) continues to be impacted by the gardens sprinkler system.

Data capture statistics for February 2020 were above 90 percent for all parameters at all stations.

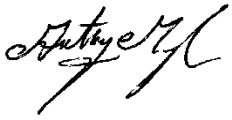
[2] www.epa.vic.gov.au/ our-work/monitoring-the-environment/epa-airwatch/historic-air-quality-data-table

9.0 IMPORTANT INFORMATION RELATING TO THIS REPORT

Your attention is drawn to the document titled - “Important Information Relating to this Report”, which is included in APPENDIX C of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

Signature Page

Golder Associates Pty Ltd



Anthony Myszka
Environmental Technician

Mark Tulau
Senior Environmental Scientist

AM/MDT/am

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APPENDIX A

Data Exceptions

Date from	Date to	Station	Parameters	Reason
2/02/2020 00:00	3/02/2020 09:45	6	$PM_{2.5}$	Filter tape error
6/02/2020 13:40	6/02/2020 17:55	4	PM_{10}	Calibration / stabilisation
11/02/2020 13:05	11/02/2020 13:50	4	CO, NO, NO_2, NOx	Maintenance / calibration
14/02/2020 00:05	14/02/2020 09:05	1	$PM_{2.5}$	Filter tape error
19/02/2020 07:40	19/02/2020 12:55	4	$PM_{2.5}$ / PM_{10}	Calibration / stabilisation
19/02/2020 12:55	19/02/2020 18:00	1	PM_{10}	Maintenance / calibration
19/02/2020 13:00	19/02/2020 13:35	1	$PM_{2.5}$	Maintenance / calibration
20/02/2020 10:35	20/02/2020 15:40	5	PM_{10}	Calibration / stabilisation
20/02/2020 10:40	20/02/2020 11:20	5	$PM_{2.5}$	Calibration / stabilisation
20/02/2020 12:25	20/02/2020 17:55	3	$PM_{2.5}$ / PM_{10}	Calibration / stabilisation
21/02/2020 10:55	21/02/2020 15:50	2	$PM_{2.5}$ / PM_{10}	Calibration / stabilisation
21/02/2020 12:40	21/02/2020 17:15	6	$PM_{2.5}$ / PM_{10}	Calibration / stabilisation
29/02/2020 09:05	29/02/2020 13:55	2	$PM_{2.5}$ / PM_{10}	Calibration / stabilisation
29/02/2020 10:50	29/02/2020 16:00	1	$PM_{2.5}$ / PM_{10}	Invalid data[1]

Note: 1 – In the opinion of the data reviewer

APPENDIX B

Laboratory Certificates

Queensland Government

Forensic and Scientific Services
HealthSupport Queensland

CERTIFICATE OF ANALYSIS

CLIENT:

Golder Associates
Building 7, Botanicca Corporate Park
570 - 588 Swan Street
Richmond VIC 3121

ATTN: Laurent Campbell

Laboratory Reference	: SSP68698
Client Order Number	: PO 24154
Quote Number	: n/a
Client Project	: 1789878
Client Batch Reference	: n/a
Date Received	: 13-Feb-2020
Date Commenced	: 14-Feb-2020
Laboratory Number/s	: 20KS194-195

CC: Anthony Myszka

Submitting Authority : Golder Associates

Number of Samples : Two (2) Summa canisters

Reason for Analysis : Analysis of Volatile Organic Compounds (VOCs) in air

Method/s of Analysis : QIS28237 – Identification, confirmation and quantitation of Volatile Organic Compounds (VOCs) by GCMS using an in-house method as per EPA method TO15

Remarks : Sample details and results are summarised in Table 1.

.....
David Pass
Senior Chemist, Organics Laboratory
21st February 2020

NATA Accredited
Laboratory 41
Accredited for compliance with ISO/IEC 17025 - Testing

SSP68698

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Fax (+61 7) 3096 2977
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CERTIFICATE OF ANALYSIS

Laboratory Reference: SSP68698
Laboratory Number: 20KS194-195

Table 1: Results for Summa canister analysis

Client Reference				20-339	20-340
Sample Type				Silco Canister #1748	Silco Canister #1726
Sampling Time / Date				24:00 n/a	24:00 n/a
Sample Description				ambient air	ambient air
Method	Volatile Organic Compounds (VOCs) by GCMS		Units	Reporting Limit	20KS194	20KS195
28237	Benzene		ppbv	0.5	< LOR	< LOR
28237	Toluene		ppbv	0.5	**1.3**	< LOR
28237	Ethylbenzene		ppbv	0.5	< LOR	< LOR
28237	m- & p-Xylene		ppbv	0.5	< LOR	< LOR
28237	o-Xylene		ppbv	0.5	< LOR	< LOR

Temperature and atmospheric pressure at time of sampling unavailable

Queensland Government

Forensic and Scientific Services
HealthSupport Queensland

CERTIFICATE OF ANALYSIS

CLIENT:

Golder Associates
Building 7, Botanicca Corporate Park
570 - 588 Swan Street
Richmond VIC 3121

ATTN: Laurent Campbell

Laboratory Reference	: SSP68900
Client Order Number	: PO 24154
Quote Number	: n/a
Client Project	: 1789878
Client Batch Reference	: n/a
Date Received	: 26-Feb-2020
Date Commenced	: 27-Feb-2020
Laboratory Number/s	: 20KS281-282

CC: Anthony Myszka

Submitting Authority : Golder Associates

Number of Samples : Two (2) Summa canisters

Reason for Analysis : Analysis of Volatile Organic Compounds (VOCs) in air

Method/s of Analysis : QIS28237 – Identification, confirmation and quantitation of Volatile Organic Compounds (VOCs) by GCMS using an in-house method as per EPA method TO15

Remarks : Sample details and results are summarised in Table 1.

.....
David Pass
Senior Chemist, Organics Laboratory
5th March 2020

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Laboratory 41
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Table 1: Results for Summa canister analysis

Client Reference				20-369	20-370
Sample Type				Silco Canister #5404	Silco Canister #1606
Sampling Time / Date				24:00 n/a	24:00 n/a
Sample Description				ambient air	ambient air
Method	Volatile Organic Compounds (VOCs) by GCMS	Units	Reporting Limit	20KS281	20KS282
28237	Benzene	ppbv	0.5	< LOR	< LOR
28237	Toluene	ppbv	0.5	< LOR	< LOR
28237	Ethylbenzene	ppbv	0.5	< LOR	< LOR
28237	m- & p-Xylene	ppbv	0.5	< LOR	< LOR
28237	o-Xylene	ppbv	0.5	< LOR	< LOR

Temperature and atmospheric pressure at time of sampling unavailable

CERTIFICATE OF ANALYSIS

CLIENT:

Golder Associates
Building 7, Botanicca Corporate Park
570 - 588 Swan Street
Richmond VIC 3121

ATTN: Laurent Campbell

Laboratory Reference	: SSP68950
Client Order Number	: PO24154
Quote Number	: n/a
Client Project	: 1789878
Client Batch Reference	: n/a
Date Received	: 02-Mar-2020
Date Commenced	: 02-Mar-2020
Laboratory Number/s	: 20KS297-298

CC: Anthony Myszka

Submitting Authority : Golder Associates

Number of Samples : Two (2) Summa canisters

Reason for Analysis : Analysis of Volatile Organic Compounds (VOCs) in air

Method/s of Analysis : QIS28237 – Identification, confirmation and quantitation of Volatile Organic Compounds (VOCs) by GCMS using an in-house method as per EPA method TO15

Remarks : Sample details and results are summarised in Table 1.

.....

David Pass
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6th March 2020

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Table 1: Results for Summa canister analysis

Client Reference				20-391	20-392
Sample Type				Silco Canister #1760	Silco Canister #1738
Sampling Time / Date				24:00 n/a	24:00 n/a
Sample Description				ambient air	ambient air
Method	Volatile Organic Compounds (VOCs) by GCMS	Units	Reporting Limit	20KS297	20KS298
28237	Benzene	ppbv	0.5	< LOR	< LOR
28237	Toluene	ppbv	0.5	< LOR	< LOR
28237	Ethylbenzene	ppbv	0.5	< LOR	< LOR
28237	m- & p-Xylene	ppbv	0.5	< LOR	< LOR
28237	o-Xylene	ppbv	0.5	< LOR	< LOR

Temperature and atmospheric pressure at time of sampling unavailable

APPENDIX C

Important Information Relating to this Report

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder's Client and persons acting on the Client's behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification

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