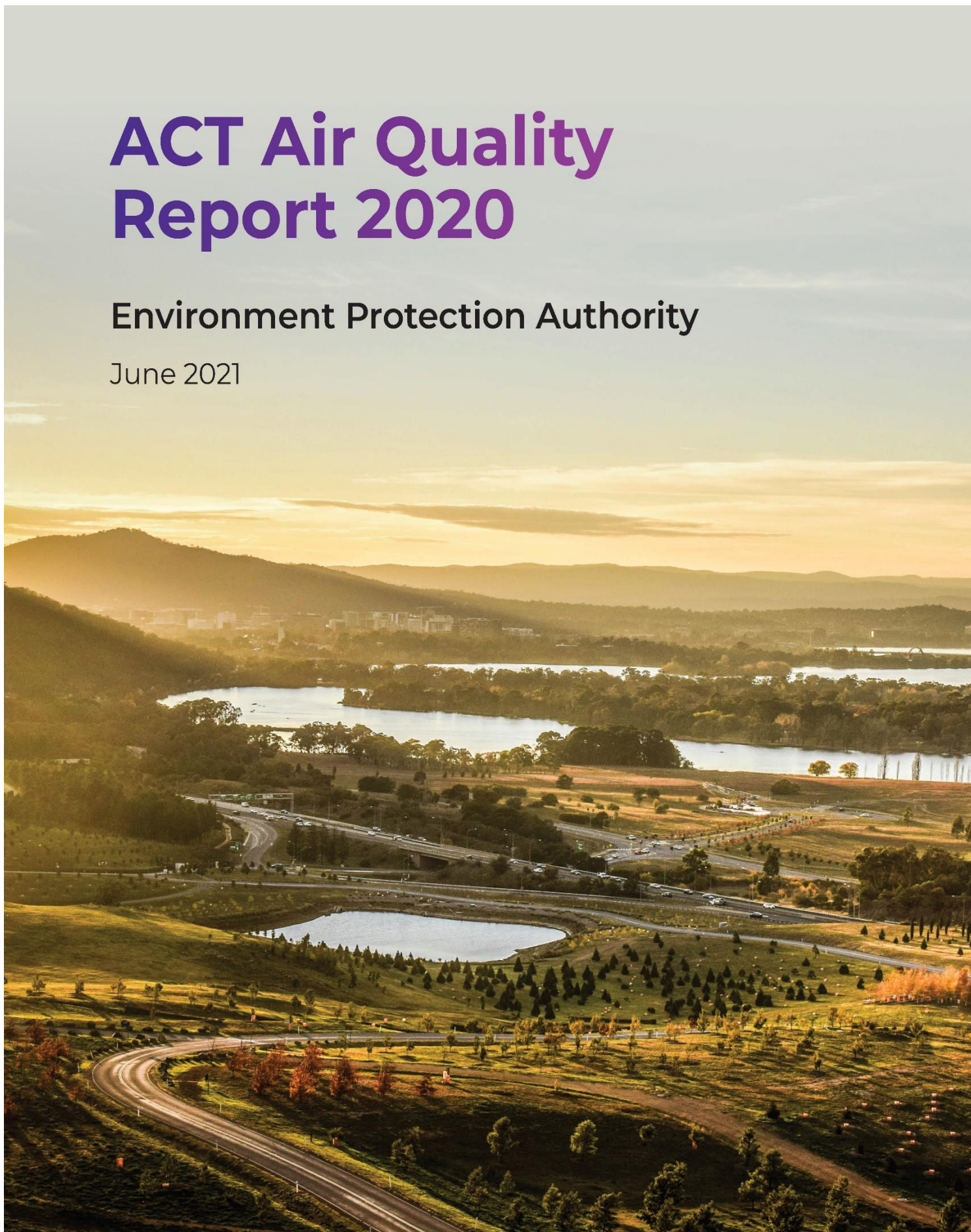


ACT Air Quality Report 2020

Environment Protection Authority

June 2021



ACT
Government

**Access
Canberra.**

TABLE OF CONTENTS

TABLE OF CONTENTS.....	i
LIST OF TABLES.....	ii
LIST OF FIGURES.....	iii
LIST OF DEFINITIONS AND ABBREVIATIONS	v
OVERVIEW.....	6
MONITORING SUMMARY	8
Performance Monitoring Stations	8
Monitoring Methods	8
NATA Accreditation Status	9
ASSESSMENT OF COMPLIANCE WITH STANDARDS AND GOALS	10
Carbon monoxide	12
Nitrogen dioxide	13
Ozone.....	15
PM ₁₀	18
PM _{2.5}	22
ANALYSIS OF AIR QUALITY MONITORING.....	26
Carbon monoxide	26
Nitrogen dioxide	26
Ozone.....	27
PM ₁₀	27
PM _{2.5}	28
ASSESSMENT OF PROGRESS TOWARDS ACHIEVING THE GOAL	29
APPENDIX A: STATISTICAL SUMMARY AND TRENDS	30
Carbon monoxide	30
Nitrogen dioxide	32
Ozone.....	35
PM ₁₀	41
PM _{2.5}	45
APPENDIX A Exceedance Summary	50

LIST OF TABLES

Table 1: Summary of stations' siting compliance with AS 3580.1.1:2008	8
Table 2: Methods used for monitoring AAQ NEPM pollutants.....	9
Table 3: AAQ NEPM standards and ACT policy position	10
Table 4: 2020 compliance summary for CO	12
Table 5: 2020 compliance summary for NO ₂	13
Table 6: 2020 compliance summary for O ₃	15
Table 7: 2020 compliance summary for PM ₁₀	18
Table 8: 2020 compliance summary for PM _{2.5}	22
Table 9: 2020 summary statistics for daily peak 8-hour CO	26
Table 10: 2020 summary statistics for daily peak 1-hour NO ₂	26
Table 11: 2020 summary statistics for daily peak 1-hour O ₃	27
Table 12: 2020 summary statistics for daily peak 4-hour O ₃	27
Table 13: 2020 summary statistics for daily PM ₁₀	28
Table 14: 2020 summary statistics for daily PM _{2.5}	28
Table 15: Statistical summary for daily maximum 8-hour CO Monash 2011 – 2020	30
Table 16: Statistical summary for daily maximum 8-hour CO Florey 2014 – 2020.....	31
Table 17: Statistical summary for daily maximum 1-hour NO ₂ Monash 2011 – 2020.....	32
Table 18: Statistical summary for daily maximum 1-hour NO ₂ Florey 2014 – 2020.....	33
Table 19: Statistical summary for daily maximum 1-hour O ₃ Monash 2011 – 2020	35
Table 20: Statistical summary for daily maximum 1-hour O ₃ Civic 2011 – 2020	36
Table 21: Statistical summary for daily maximum 1-hour O ₃ Florey 2014 – 2020	37
Table 22: Statistical summary for daily maximum 4-hour O ₃ Monash 2011 – 2020	38
Table 23: Statistical summary for daily maximum 4-hour O ₃ Civic 2011 – 2020	39
Table 24: Statistical summary for daily maximum 4-hour O ₃ Florey 2014 – 2020	40
Table 25: Statistical summary for daily maximum daily PM ₁₀ Monash 2011 – 2020	41
Table 26: Statistical summary for daily maximum daily PM ₁₀ Civic 2011 – 2020	42
Table 27: Statistical summary for daily maximum daily PM ₁₀ Florey 2014 – 2020.....	44
Table 28: Statistical summary for daily maximum daily PM _{2.5} Monash 2011 – 2020.....	45
Table 29: Statistical summary for daily maximum daily PM _{2.5} Civic 2016 – 2020	47
Table 30: Statistical summary for daily maximum daily PM _{2.5} Florey 2014 – 2020	48
Table 31: PM ₁₀ Daily Exceedances in 2020	51
Table 32: PM _{2.5} Daily Exceedances in 2020.....	52
Table 33: Carbon Monoxide 8-hour Exceedances in 2020	53
Table 34: Nitrogen Dioxide 1-hour Exceedances in 2020	53
Table 35: Ozone 1-hour and 4-hour Exceedances in 2020	53

LIST OF FIGURES

Figure 1: Daily maximum for CO 8-hour average – Monash.....	12
Figure 2: Daily maximum for CO 8-hour average – Florey.....	13
Figure 3: Daily maximum for NO ₂ 1-hour average – Monash.....	14
Figure 4: Daily maximum for NO ₂ 1-hour average – Florey	14
Figure 5: Daily maximum for O ₃ 1-hour average – Monash.....	15
Figure 6: Daily maximum for O ₃ 1-hour average – Civic	16
Figure 7: Daily maximum for O ₃ 1-hour average – Florey.....	16
Figure 8: Daily maximum for O ₃ 4-hour average – Monash	17
Figure 9: Daily maximum for O ₃ 4-hour average – Civic	17
Figure 10: Daily maximum for O ₃ 4-hour average – Florey.....	18
Figure 11: Daily maximum for PM ₁₀ – Monash.....	19
Figure 12: Daily maximum for PM ₁₀ – Monash (Excluding Bushfire Period)	19
Figure 13: Daily maximum for PM ₁₀ – Civic.....	20
Figure 14: Daily maximum for PM ₁₀ – Civic (Excluding Bushfire Period)	20
Figure 15: Daily maximum for PM ₁₀ – Florey	21
Figure 16: Daily maximum for PM ₁₀ – Florey (Excluding Bushfire Period).....	21
Figure 17: Daily maximum for PM _{2.5} – Monash	23
Figure 18: Daily maximum for PM _{2.5} – Monash (Excluding Bushfire Period).....	23
Figure 19: Daily maximum for PM _{2.5} – Civic.....	24
Figure 20: Daily maximum for PM _{2.5} – Civic (Excluding Bushfire Period)	24
Figure 21: Daily maximum for PM _{2.5} – Florey	25
Figure 22: Daily maximum for PM _{2.5} – Florey (Excluding Bushfire Period).....	25
Figure 23: Statistical summary for daily maximum 8-hour CO Monash 2011 – 2020	30
Figure 24: Statistical summary for daily maximum 8-hour CO Florey 2014 – 2020	31
Figure 25: Statistical summary for daily maximum 1-hour NO ₂ Monash 2011 – 2020	32
Figure 26: Annual average 1-hour NO ₂ Monash 2011 – 2020	33
Figure 27: Statistical summary for daily maximum 1-hour NO ₂ Florey 2014 – 2020.....	34
Figure 28: Annual average 1-hour NO ₂ Florey 2014 – 2020	34
Figure 29: Statistical summary for daily maximum 1-hour O ₃ Monash 2011 – 2020	35
Figure 30: Statistical summary for daily maximum 1-hour O ₃ Civic 2011 – 2020.....	36
Figure 31: Statistical summary for daily maximum 1-hour O ₃ Florey 2014 – 2020	37
Figure 32: Statistical summary for daily maximum 4-hour O ₃ Monash 2011 – 2020	38
Figure 33: Statistical summary for daily maximum 4-hour O ₃ Civic 2011 – 2020.....	39
Figure 34: Statistical summary for daily maximum 4-hour O ₃ Florey 2014 – 2020	40
Figure 35: Statistical summary for daily PM ₁₀ Monash 2011 – 2020.....	41
Figure 36: Annual average daily PM ₁₀ Monash 2011 – 2020.....	42
Figure 37: Statistical summary for daily PM ₁₀ Civic 2011 – 2020.....	43
Figure 38: Annual average daily PM ₁₀ Civic 2011 – 2020.....	43
Figure 39: Statistical summary for daily PM ₁₀ Florey 2014 – 2020.....	44
Figure 40: Annual average daily PM ₁₀ Florey 2014 – 2020	45
Figure 41: Statistical summary for daily PM _{2.5} Monash 2011 – 2020	46

Figure 42: Annual average daily PM _{2.5} Monash 2011 – 2020	46
Figure 43: Statistical summary for daily PM _{2.5} Civic 2016 – 2020	47
Figure 44: Annual average daily PM _{2.5} Civic 2016 – 2020	48
Figure 45: Statistical summary for daily PM _{2.5} Florey 2014 – 2020	49
Figure 46: Annual average daily PM _{2.5} Florey 2014 – 2020	49

LIST OF DEFINITIONS AND ABBREVIATIONS

Term	Definition
AAQ NEPM	National Environment Protection (Ambient Air Quality) Measure
ACT	Australian Capital Territory
CO	Carbon Monoxide
BAM	Beta Attenuation Monitor
Exceptional event	Exceptional event means a fire or dust occurrence that adversely affects air quality at a particular location and causes an exceedance of one (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
NATA	National Association of Testing Authorities
ND	Not Demonstrated
NO ₂	Nitrogen Dioxide
O ₃	Ozone
PMS	Performance Monitoring Station
PM _{2.5}	Particles with an equivalent aerodynamic diameter less than or equal to 2.5 micrometres
PM ₁₀	Particles with an equivalent aerodynamic diameter less than or equal to 10 micrometres
ppm	Parts per million by volume – parts of pollutant per million parts of air
Q	Quarter (e.g. Q1 means the first quarter of the year)
SO ₂	Sulfur Dioxide
µg/m ³	micrograms per cubic metre

OVERVIEW

The ACT Air Quality Report 2020 ('the Report') presents the results of ambient air quality monitoring in the ACT for 2020 and assesses the results in accordance with the requirements of the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) made by the National Environment Protection Council on 26 June 1998.

Air quality in this Report is assessed against the AAQ NEPM standards shown in Table 3. In accordance with its agreed policy position, the ACT assesses its compliance for the annual average for particulate matter less than 10 microns (PM_{10}) against a lower standard of $20 \mu\text{g}/\text{m}^3$ rather than the $25 \mu\text{g}/\text{m}^3$ standard introduced in 2016.

The ACT monitors four of the six NEPM pollutants:

- carbon monoxide (CO)
- nitrogen dioxide (NO_2)
- photochemical oxidants as ozone (O_3)
- particulate matter (as PM_{10} , particles less than or equal to 10 microns in diameter and $PM_{2.5}$, particles less than or equal to 2.5 microns in diameter).

The ACT does not monitor sulfur dioxide (SO_2) as it is primarily an industrial pollutant and the ACT does not have much heavy industry. In 2002, lead monitoring ceased with the phase out of leaded petrol.

A summary of the 2020 Report is:

- the major air quality issue in 2020 was particle pollution (both PM_{10} and $PM_{2.5}$) between January to early February, primarily associated with the continued impact of the 2019–2020 summer bushfires
- while concentrations of carbon monoxide and nitrogen dioxide increased during the bushfire period, the associated AAQ NEPM standards were met on 99.5% of days during the year;
- ozone remained at relatively high levels in January 2020 compared with the rest of the year, meeting the AAQ NEPM standards on 99% of days throughout the year
- though more nitrogen dioxide and ozone exceedances were recorded in the ACT, the overall levels for those two pollutants in 2020 decreased compared with 2019. This is possibly due to less vehicle traffic and other human activities as a result of the COVID-19 pandemic restrictions and the cooler temperatures in the second half of 2020
- the daily PM_{10} standard was exceeded on 27 days at one or more monitoring stations, compared to 29 days in 2019 and 6 days in 2018. All of the PM_{10} exceedances occurred outside the winter season and were due to bushfires or dust storms
- the daily $PM_{2.5}$ standard was exceeded on 39 days at one or more monitoring stations, compared to 32 days in 2019 and 5 days in 2018. Excluding the 26 exceedance days directly associated with bushfires, there were only 13 exceedance days related to wood heater emissions which occurred between mid-May and early August; and

- a possible cause of this increase in $\text{PM}_{2.5}$ may be due to people staying at home more during the COVID-19 pandemic. As a comparison, there were only 2 days in 2019 and 1 day in 2018 that exceeded the national standard in winter months.

MONITORING SUMMARY

Performance Monitoring Stations

The ACT Government has been undertaking ambient air quality monitoring in Canberra since the early 1990's. The Health Directorate is responsible for the Government's ambient air quality monitoring network. The Environment Protection Authority (EPA) within the Chief Minister, Treasury and Economic Development Directorate is responsible for annual reporting under the AAQ NEPM.

The ACT monitoring network consists of three monitoring stations located at:

- Monash – approximately 300 metres west of Cockcroft Avenue in open urban space area
- Civic – at the northern end of the carpark on the western side of the Olympic swimming pool adjacent to Allara Street
- Florey – at the end of Neumann Place, on public land.

The compliance and non-compliance criteria for the monitoring stations against the siting standard AS/NZS 3580.1.1:2008 are listed in Table 1 below.

Table 1: Summary of stations' siting compliance with AS 3580.1.1:2008

Station	Height above ground	Minimum distance to support structure	Clear sky angle of 120°	Unrestricted airflow of 270°/360°	20m from trees	No boilers or incinerators nearby	Minimum distance from road or traffic
Monash	☑	☑	☑	☑	☑	☑	☑
Civic	☑	☒	☒	☒	☒	☑	☑
Florey	☑	☑	☑	☑	☑	☑	☑

Monash and Florey stations are the ACT's two performance monitoring stations as per the requirements under Section 14 of the AAQ NEPM. In addition, the ACT Government carries out key pollutants monitoring at Civic station to better inform the community concerning ambient air quality and support formation of government policy.

The Monash and Florey stations contain instrumentation that continuously monitors carbon monoxide, nitrogen dioxide, ozone and particles as PM₁₀ and PM_{2.5}. Following the establishment of the Florey station on 28 February 2014, the Civic station only monitors key pollutants, including ozone and particles as PM₁₀ and PM_{2.5}.

Monitoring Methods

The ACT monitoring is conducted in accordance with the relevant Australian Standards as shown in Table 2. Data not meeting the requirements of these Standards are identified as invalid and not included in this report.

Table 2: Methods used for monitoring AAQ NEPM pollutants

Pollutant	Standard	Title	Method Used
Carbon monoxide	AS 3580.7.1-2011	Methods for sampling and analysis of ambient air - Determination of carbon monoxide - Direct-reading instrumental method	Gas filter correlation/ Infrared
Nitrogen dioxide	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air - Determination of oxides of nitrogen - Direct-reading instrumental method	Gas phase chemiluminescence
Photochemical oxidant (ozone)	AS 3580.6.1-2016	Methods for sampling and analysis of ambient air - Determination of ozone - Direct-reading instrumental method	Non-dispersive ultraviolet
PM ₁₀	AS/NZS 3580.9.11-2016	Method for sampling and analysis of ambient air Method – Determination of suspended particles matter – PM ₁₀ beta attenuation monitors	Beta Attenuation Monitor
PM _{2.5}	AS/NZS 3580.9.12:2013	Methods for sampling and analysis of ambient air - Method 9.12: Determination of suspended particulate matter - PM _{2.5} beta attenuation monitors	Beta Attenuation Monitor

NATA Accreditation Status

The ACT Government monitoring network is accredited by NATA for the measurement of all AAQ NEPM pollutants except sulfur dioxide and lead as required under Clause 12 of the AAQ NEPM.

ASSESSMENT OF COMPLIANCE WITH STANDARDS AND GOALS

For the purpose of this Report, air quality is assessed against the AAQ NEPM standards as specified in Schedule 2 of the AAQ NEPM and ACT policy position. The standards against which air quality is assessed are concentrations in parts per million (ppm) or micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) (refer to Table 3, column 3).

The goal of the AAQ NEPM is to achieve the NEPM standards as assessed in accordance with the monitoring protocol to the extent specified in Schedule 2 of the AAQ NEPM. The extent is expressed as a maximum allowable number of exceedances for each standard (shown in Table 3 column 4).

In accordance with its agreed policy position, the ACT assesses its compliance for the annual average for PM_{10} against a lower standard of $20 \mu\text{g}/\text{m}^3$ rather than the AAQ NEPM standard of $25 \mu\text{g}/\text{m}^3$.

There is an additional goal to further reduce $\text{PM}_{2.5}$ concentrations to below a daily concentration of $20 \mu\text{g}/\text{m}^3$ and an annual concentration of $7 \mu\text{g}/\text{m}^3$ by 2025.

Table 3: AAQ NEPM standards and ACT policy position

Pollutant	Averaging Period	Maximum concentration	Maximum allowable exceedances
Carbon monoxide	8 hours	9.0 ppm	1 day a year
Nitrogen dioxide	1 hour	0.12 ppm	1 day a year
	1 year	0.03 ppm	None
Photochemical oxidants	1 hour	0.10 ppm	1 day a year
	4 hours	0.08 ppm	1 day a year
Sulfur dioxide	1 hour	0.20 ppm	1 day a year
	1 day	0.08 ppm	1 day a year
	1 year	0.02 ppm	None
Lead	1 year	$0.50 \mu\text{g}/\text{m}^3$	None
Particles as PM_{10}	1 day	$50 \mu\text{g}/\text{m}^3$	None
	1 year	$20 \mu\text{g}/\text{m}^3$	None
Particles as $\text{PM}_{2.5}$	1 day	$25 \mu\text{g}/\text{m}^3$	None
	1 year	$8 \mu\text{g}/\text{m}^3$	None

Table 4 to Table 8 summarise compliance with the standards of the AAQ NEPM and ACT policy position. For each pollutant, the data availability (quarterly and annual), the number of days when standards were exceeded, the annual average (where an annual standard exists) and an assessment of compliance, are given for each monitoring station. Although Civic station is not a NEPM performance monitoring station, measured data from this station is included in this report to better understand ambient air quality in the ACT, especially in the city area.

Air quality is assessed as complying with the AAQ NEPM (ie '*MET*') if the number of exceedances is no more than the number specified in Table 3 and data availability was at least 75 percent in each quarter of the year.

Air quality is assessed as not complying with the AAQ NEPM (ie '*NOT MET*') if there is more than the number of exceedances specified in Table 3. For the purpose of reporting compliance against PM₁₀ and PM_{2.5} daily average standards, monitoring data that has been determined as being directly associated with an exceptional event has been excluded.

Please refer to Appendix A for detailed information regarding pollutants exceedance in 2020.

Air quality is assessed as '*NOT DEMONSTRATED*' (ie '*ND*') if there has been insufficient data collected to demonstrate that the standards and goal have been met or not met.

These categories (ie MET, NOT MET and ND) are used in Tables 4 to 8 on the following pages.

Carbon monoxide

During 2020, there were two exceedances of the carbon monoxide standard at Monash and Florey due to bushfire smoke. As a result, compliance was not met at both stations.

Table 4: 2020 compliance summary for CO

AAQ NEPM standard - 9.0 ppm (8-hour average)

Monitoring station	Data availability rates (% of hours)					Number of exceedances (days)	NEPM goal compliance
	Q1	Q2	Q3	Q4	Annual		
Monash	95.8	95.8	92.4	95.7	94.9	2	NOT MET
Florey	95.8	94.3	95.0	93.6	94.7	2	NOT MET

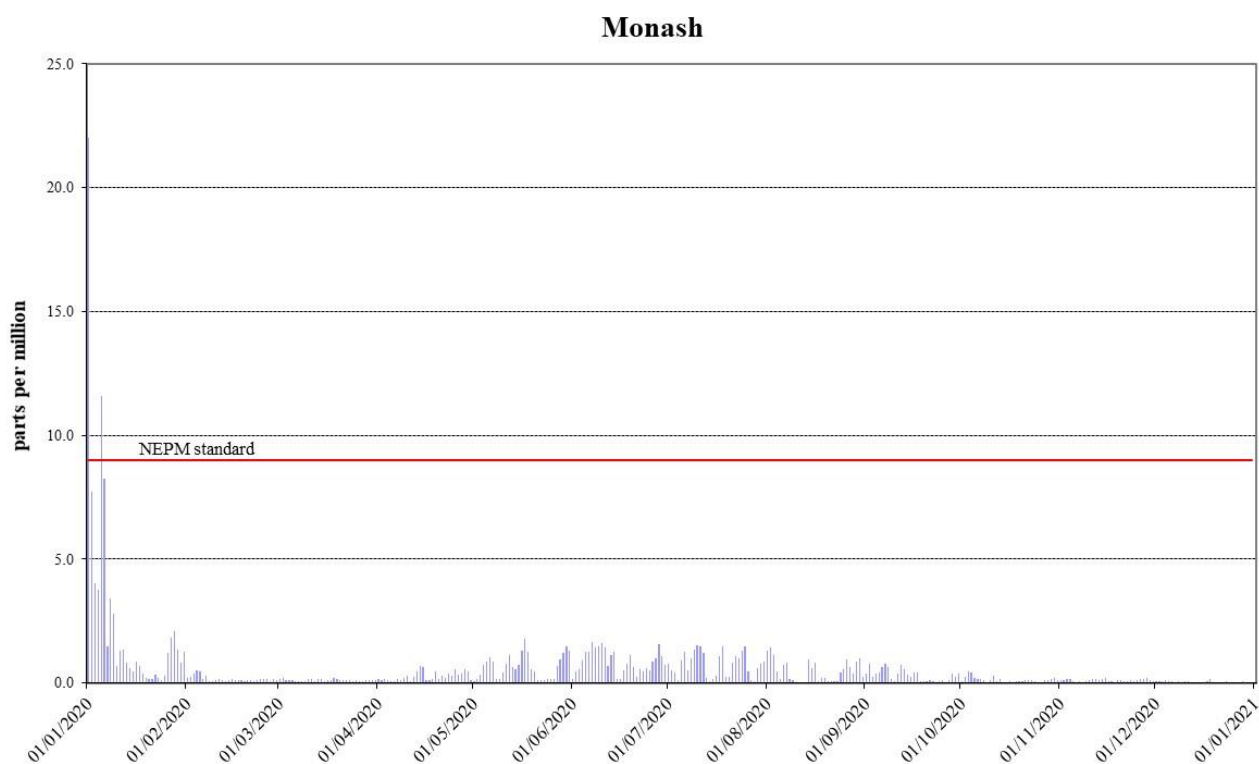


Figure 1: Daily maximum for CO 8-hour average – Monash

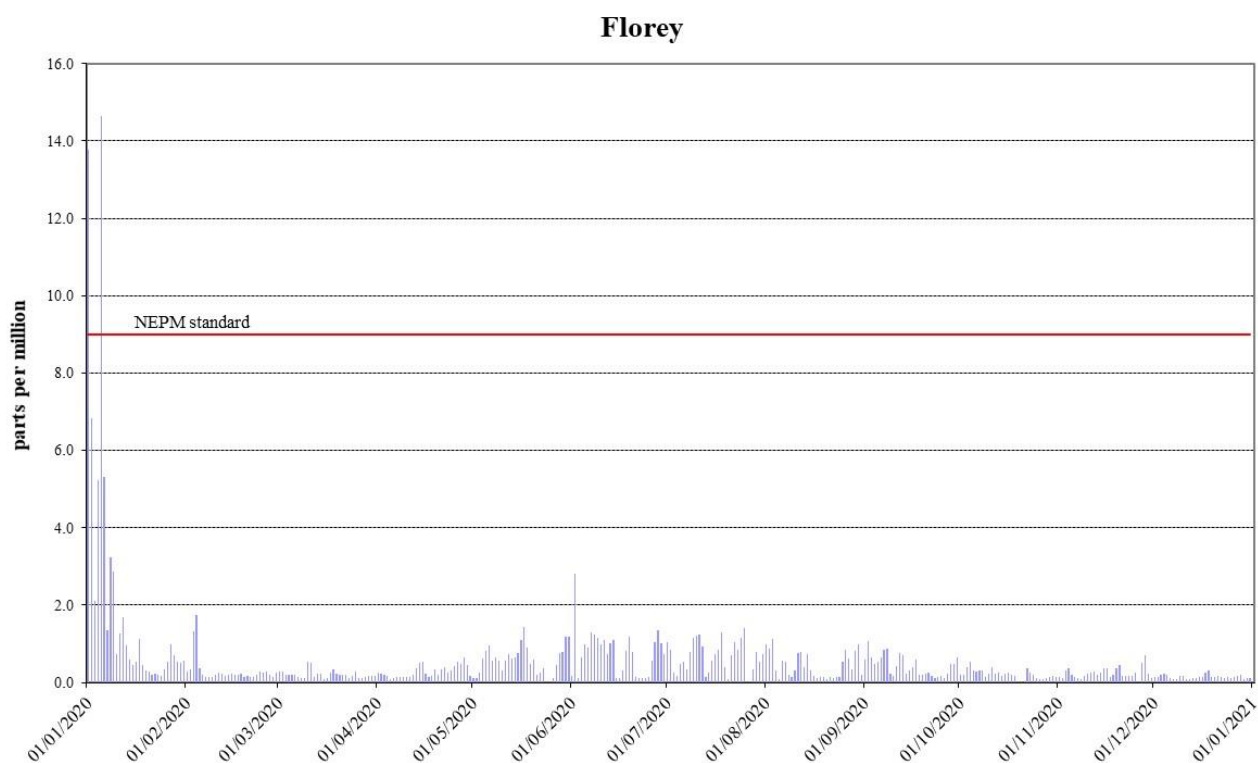


Figure 2: Daily maximum for CO 8-hour average – Florey

Nitrogen dioxide

During 2020, there were two exceedances of the nitrogen dioxide standard at Florey due to bushfire smoke. As a result, compliance was not met at Florey. No exceedances were recorded at Monash and compliance was demonstrated. The 1-year average levels remained low and met the standard at both stations.

Table 5: 2020 compliance summary for NO₂

AAQ NEPM standard – 0.12 ppm (1-hour average), 0.03 ppm (1-year average)

Monitoring station	Data availability rates (% of hours)					1 Hour		1 Year	
	Q1	Q2	Q3	Q4	Annual	Number of exceedances	NEPM goal compliance	Annual average (ppm)	NEPM goal compliance
Monash	95.8	95.8	95.7	95.7	95.7	0	MET	0.004	MET
Florey	94.3	94.3	94.2	93.6	94.1	2	NOT MET	0.004	MET

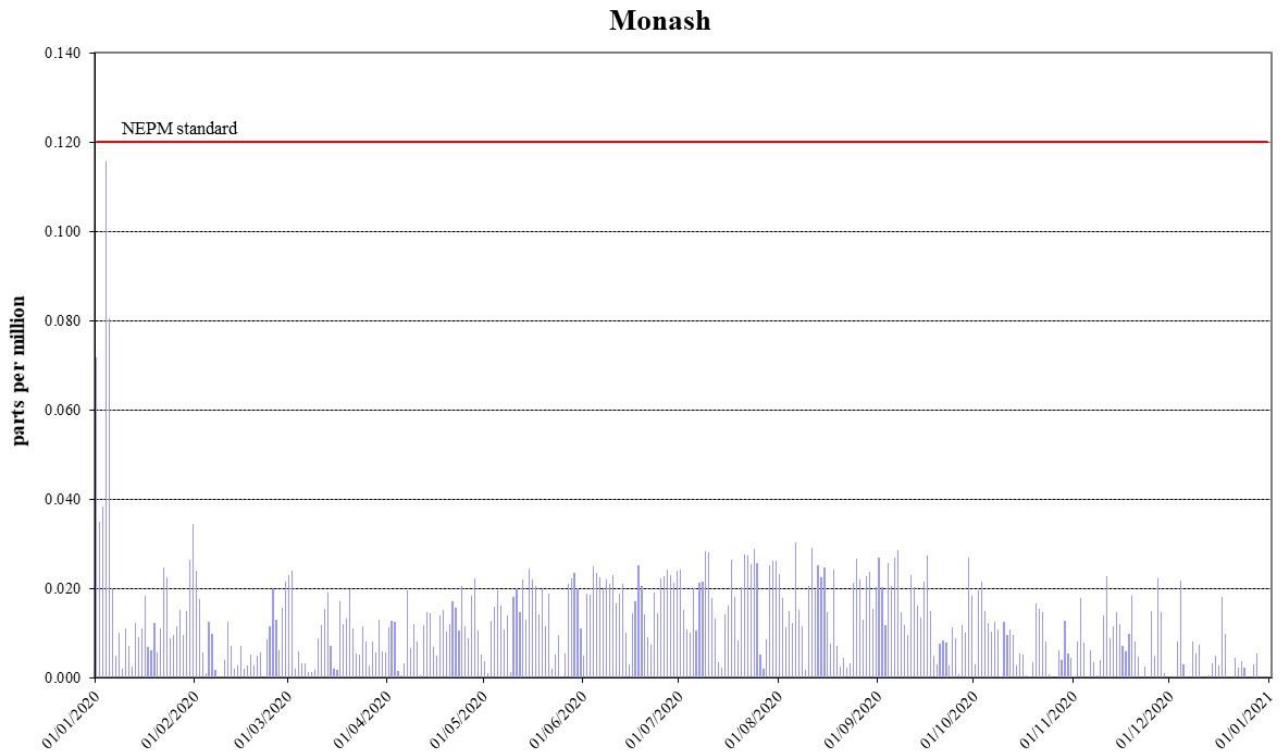


Figure 3: Daily maximum for NO₂ 1-hour average – Monash

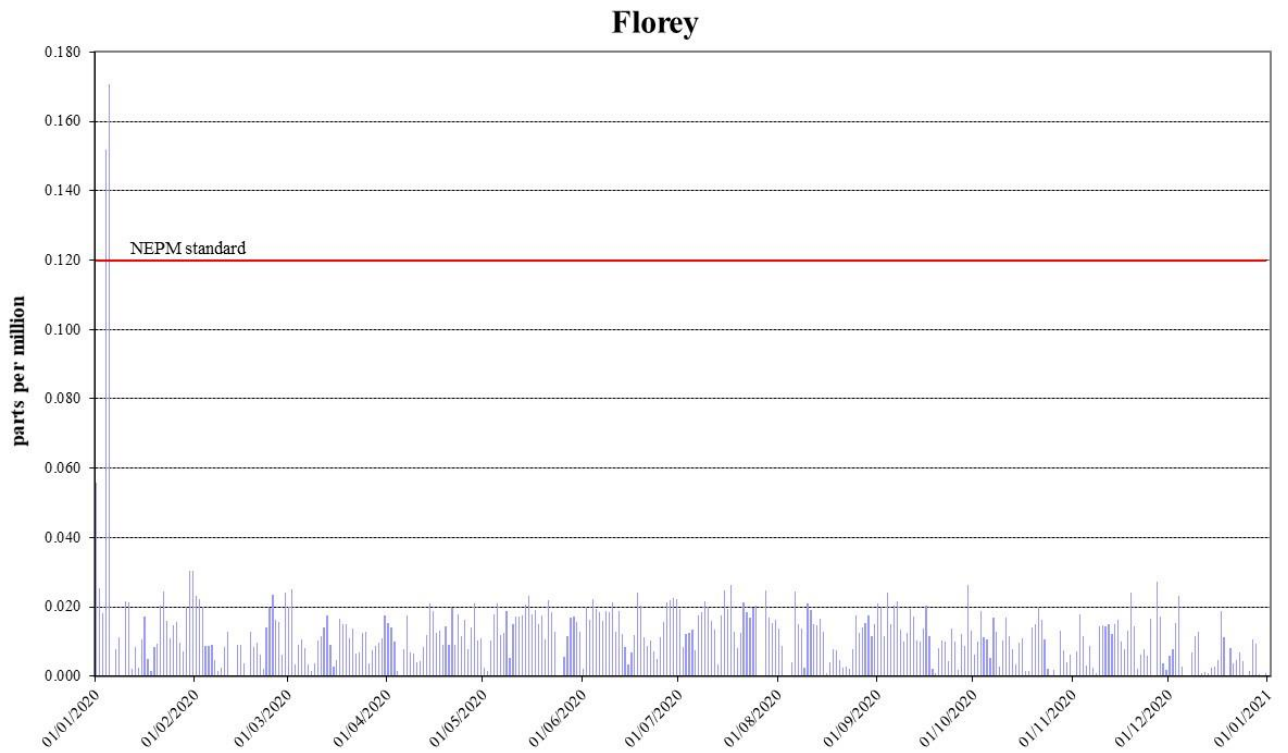


Figure 4: Daily maximum for NO₂ 1-hour average – Florey

Ozone

During 2020, compliance for 1-hour ozone standard was demonstrated at Civic with no exceedances. However, compliance for 4-hour ozone standard was not met at Civic as the standard was exceeded two times due to bushfire smoke. Ozone levels above the 1-hour and 4-hour standards were recorded four times and three times at Monash and Florey respectively, due to the same reason. As a result, compliance was not met at Monash and Florey.

Table 6: 2020 compliance summary for O₃

AAQ NEPM standard – 0.10 ppm (1-hour average), 0.08 ppm (4-hour average)

Monitoring station	Data availability rates (% of days)					1 Hour		4 Hour	
	Q1	Q2	Q3	Q4	Annual	Number of exceedances	NEPM goal compliance	Number of exceedances	NEPM goal compliance
Monash	95.8	95.8	95.7	95.8	95.8	2	NOT MET	4	NOT MET
Civic	95.8	95.8	95.7	95.8	95.8	0	MET	2	NOT MET
Florey	95.8	80.7	95.7	95.7	92.0	2	NOT MET	3	NOT MET

Monash

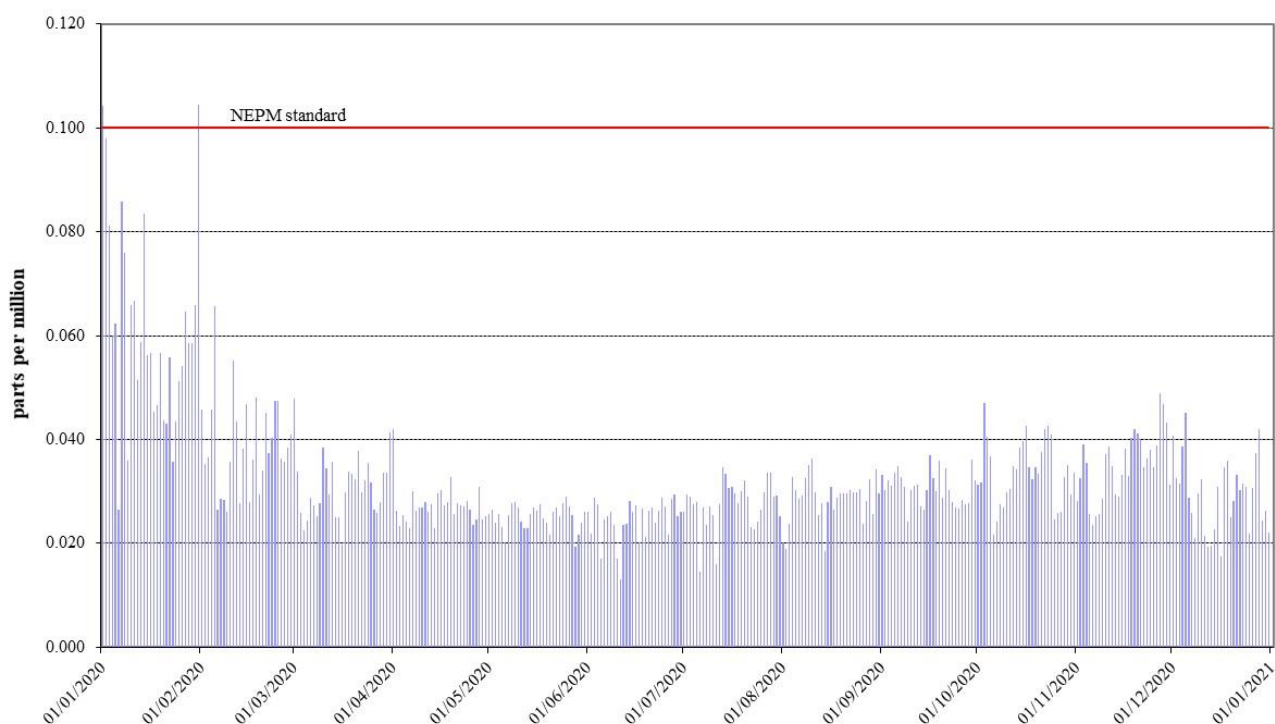


Figure 5: Daily maximum for O₃ 1-hour average – Monash

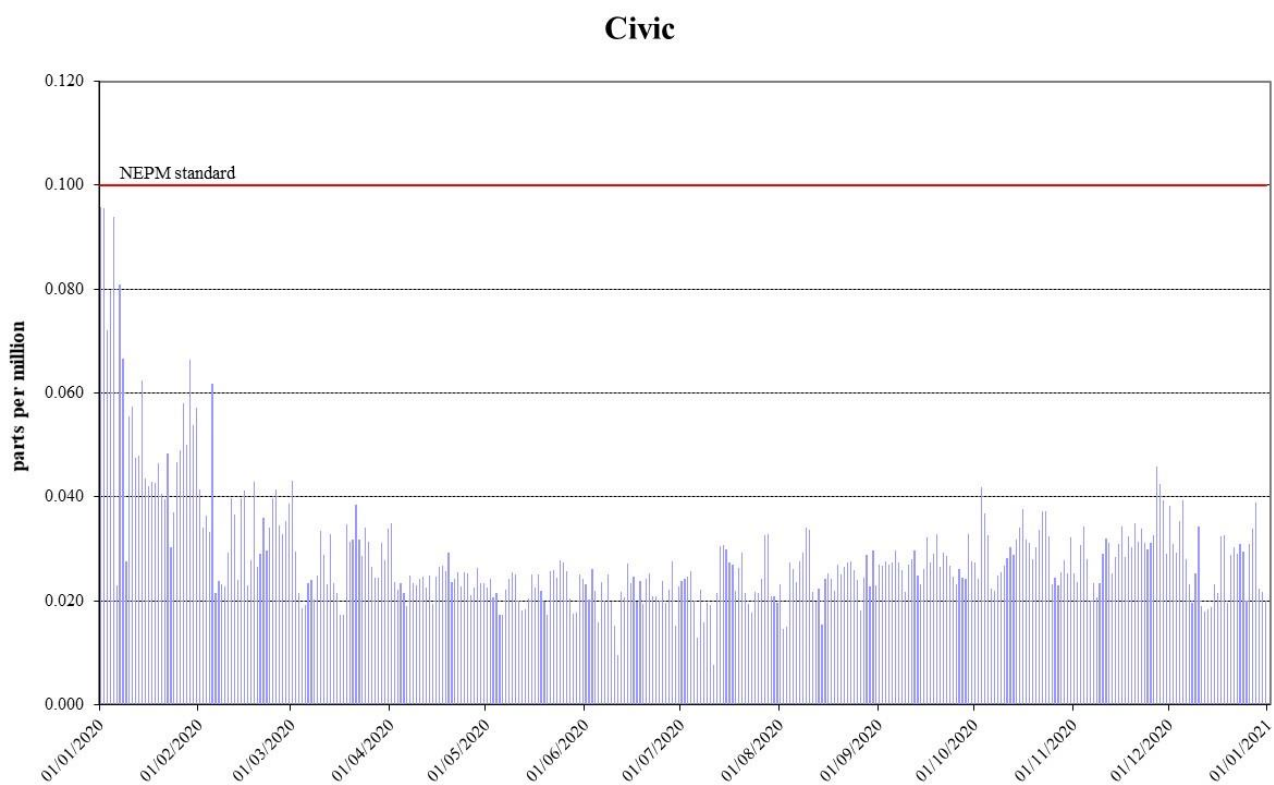


Figure 6: Daily maximum for O₃ 1-hour average – Civic

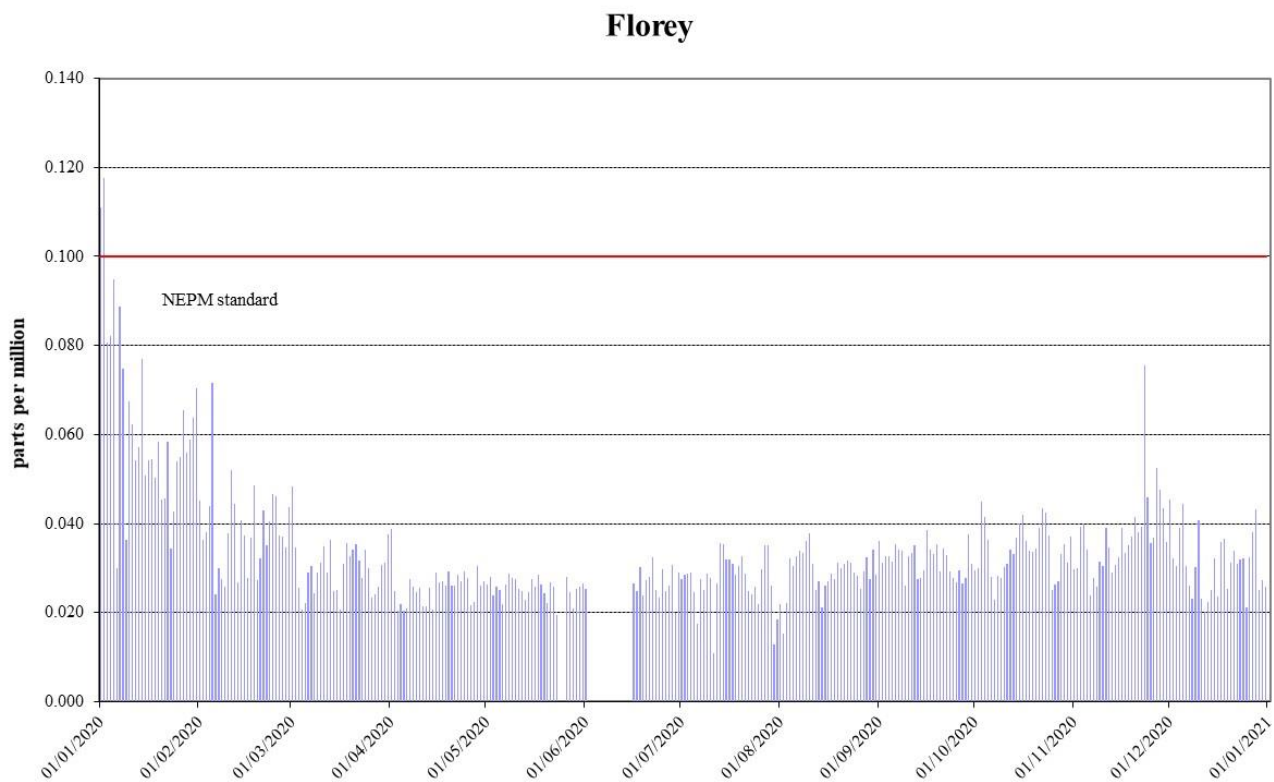


Figure 7: Daily maximum for O₃ 1-hour average – Florey

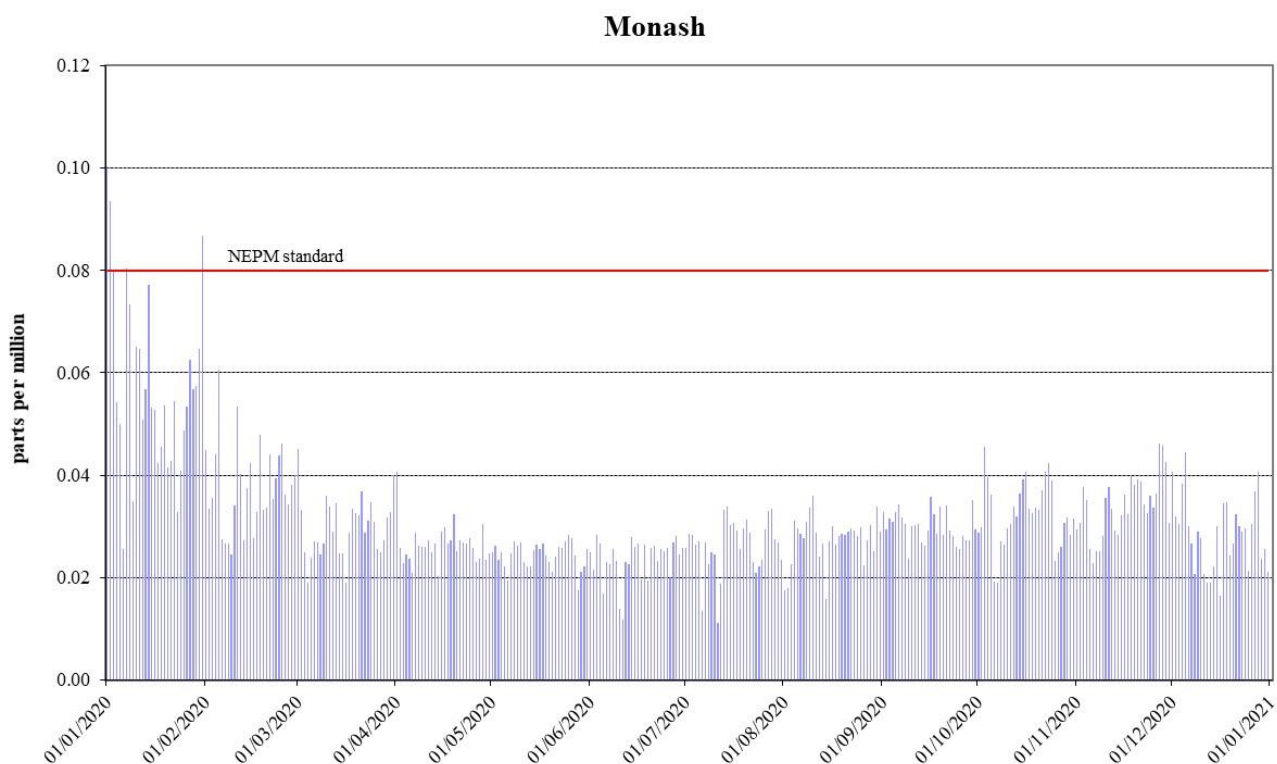


Figure 8: Daily maximum for O₃ 4-hour average – Monash

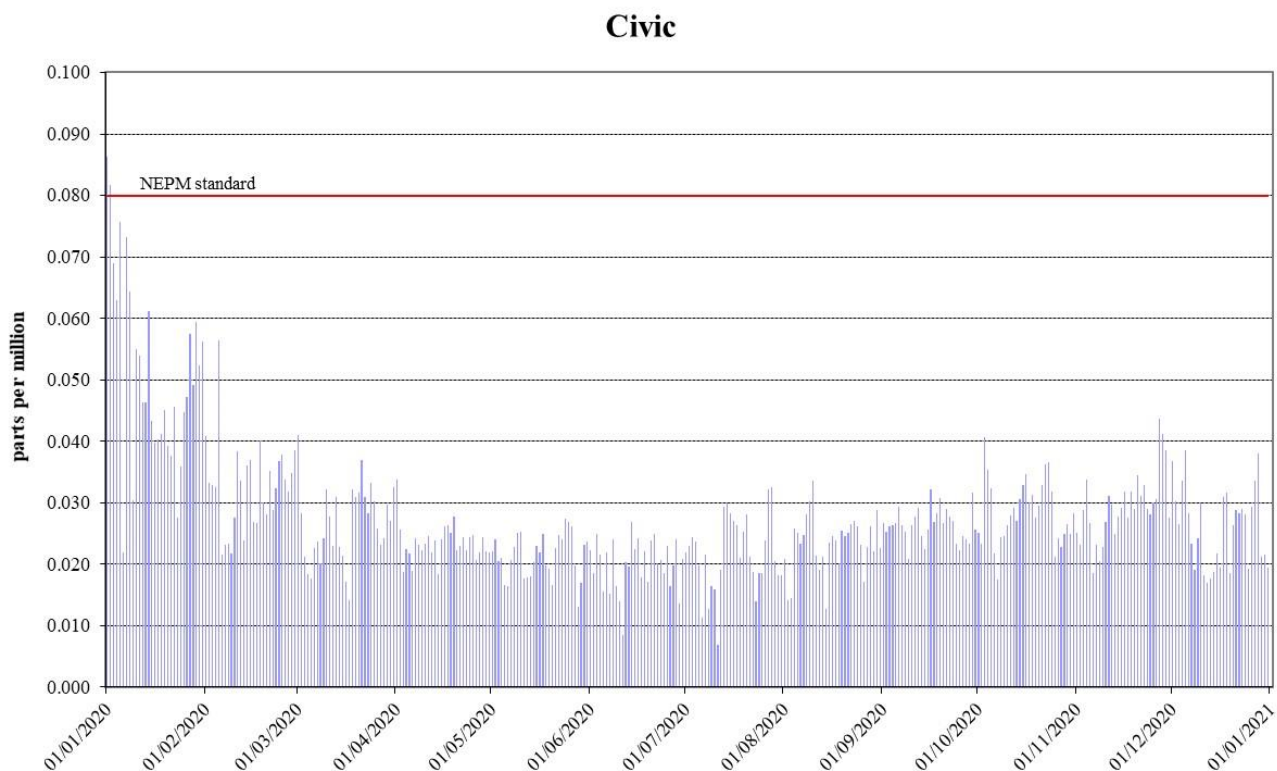


Figure 9: Daily maximum for O₃ 4-hour average – Civic

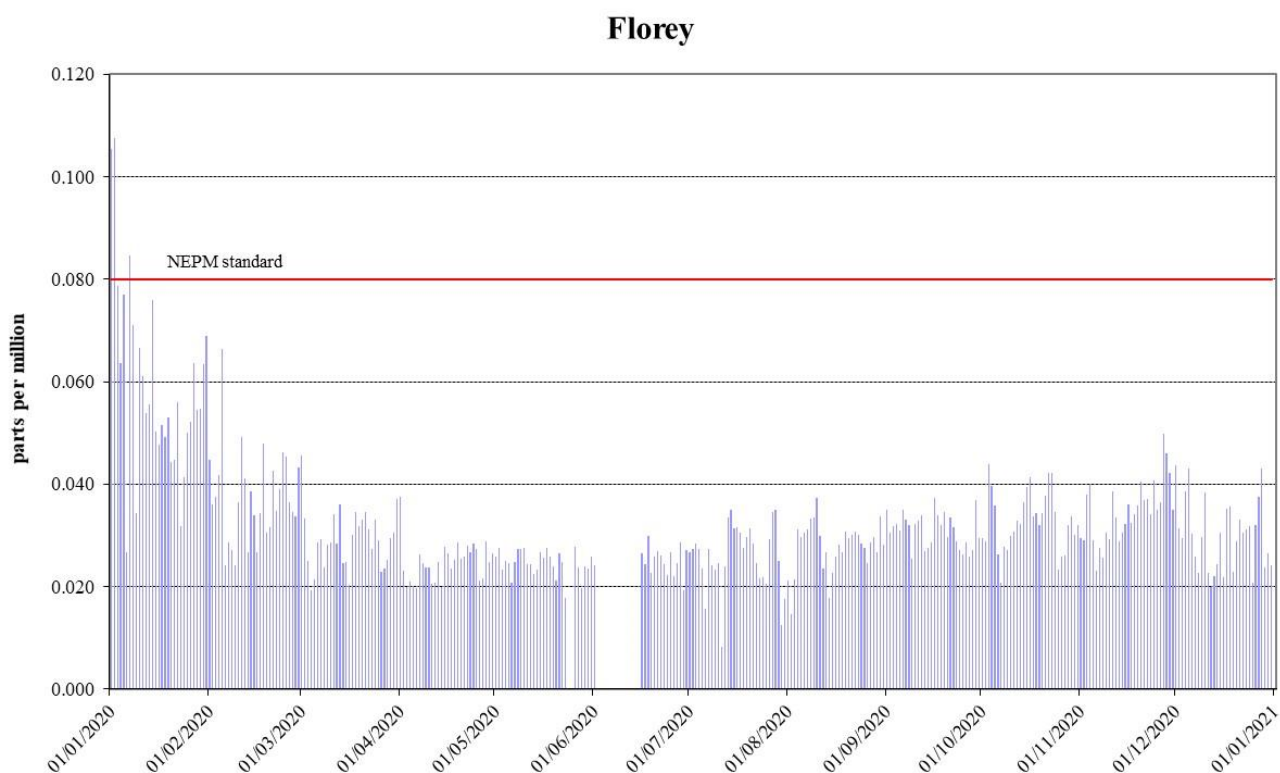


Figure 10: Daily maximum for O₃ 4-hour average – Florey

PM₁₀

During 2020, unprecedentedly high PM₁₀ levels were recorded in the ACT. There were exceedances of daily PM₁₀ standard on 27 days due to bushfires (24 days) and dust storms (3 days). Compliance against the daily PM₁₀ standard was demonstrated at all stations as these exceedances being exceptional events are removed. While annual average PM₁₀ data at all stations met the 25 µg/m³ standard, annual average levels at all stations slightly exceeded the 20 µg/m³ ACT policy position.

Table 7: 2020 compliance summary for PM₁₀

AAQ NEPM standard 50 µg/m³ 1-day average, 20 µg/m³ (1-year average)*

Monitoring station	Data availability rates (% of days)					1 Day		1 Year	
	Q1	Q2	Q3	Q4	Annual	Number of exceedances**	NEPM goal compliance	Annual average (µg/m ³)	ACT goal compliance
Monash	100	100	95.2	100	99.2	0	MET	22.4	NOT MET
Civic	100	95.6	98.4	98.4	98.4	0	MET	21.7	NOT MET
Florey	100	97.8	100	100	99.5	0	MET	22.8	NOT MET

* ACT policy position 20 µg/m³ not AAQ NEPM standard of 25 µg/m³.

** the number excludes exceptional events.

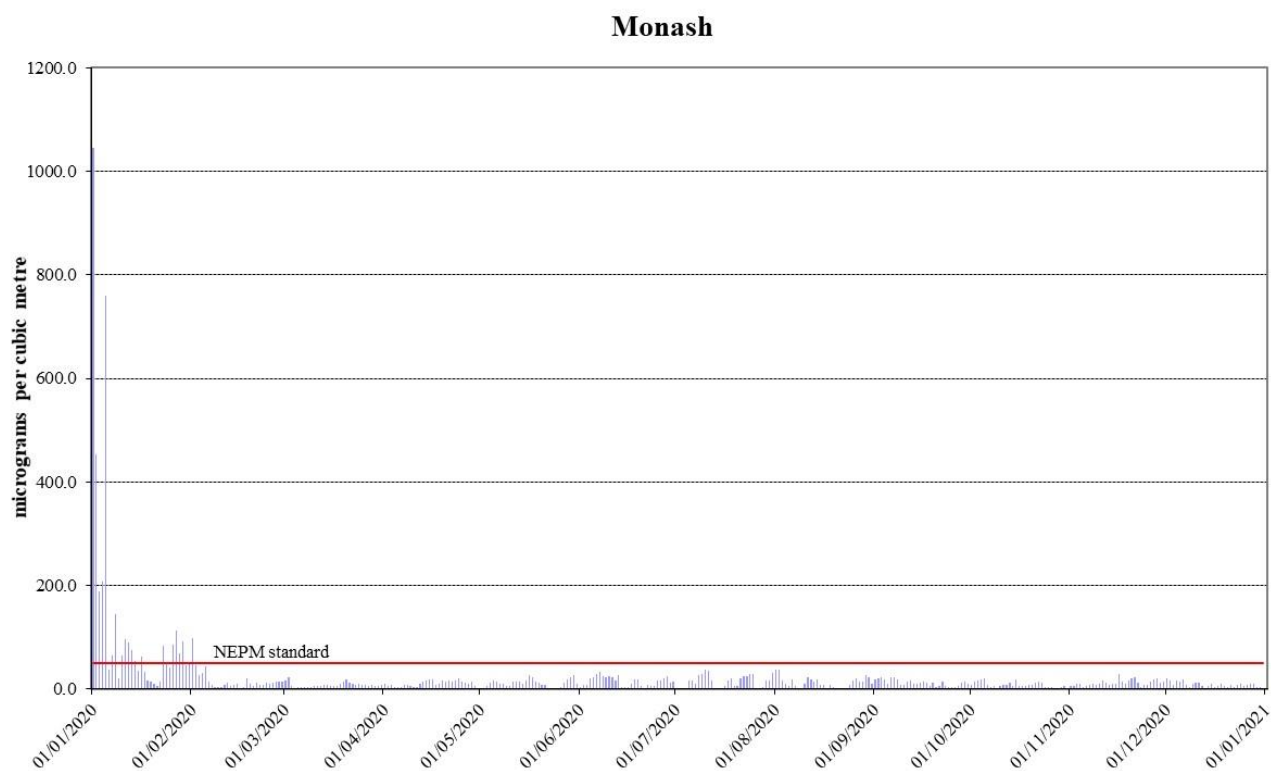


Figure 11: Daily maximum for PM₁₀ – Monash

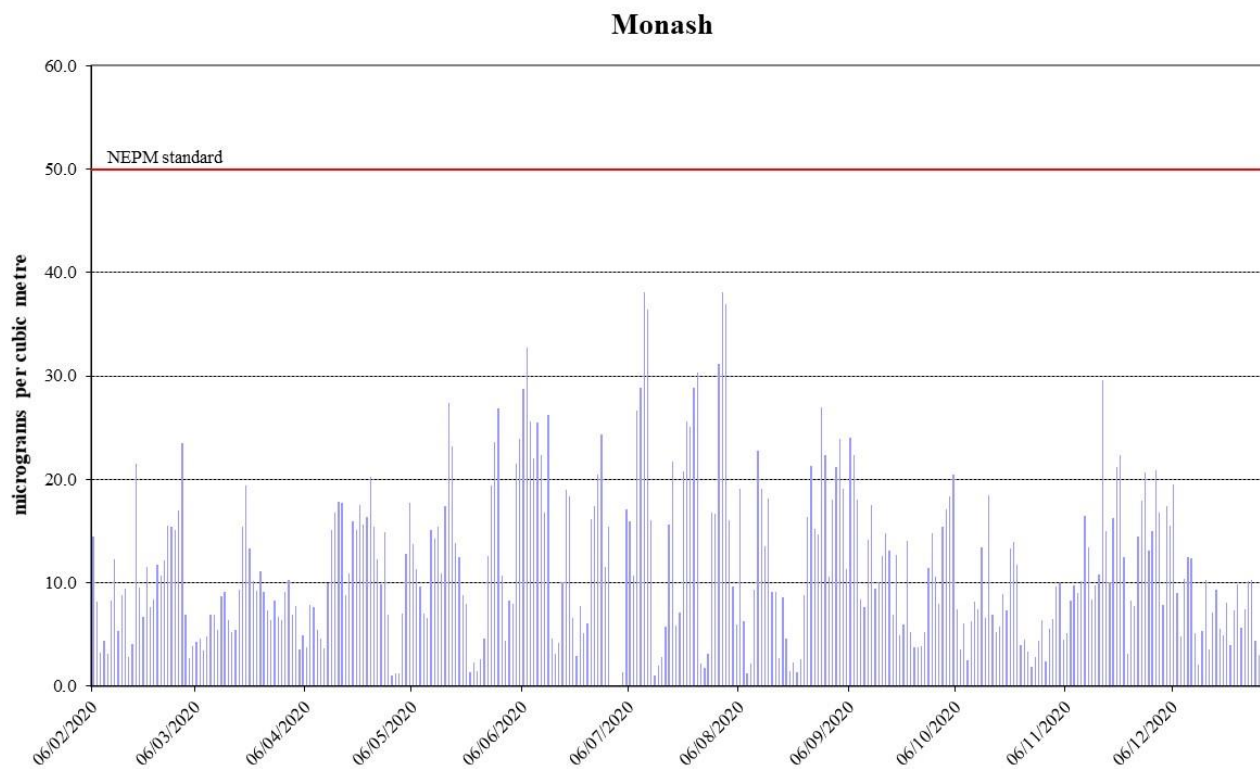


Figure 12: Daily maximum for PM₁₀ – Monash (Excluding Bushfire Period)

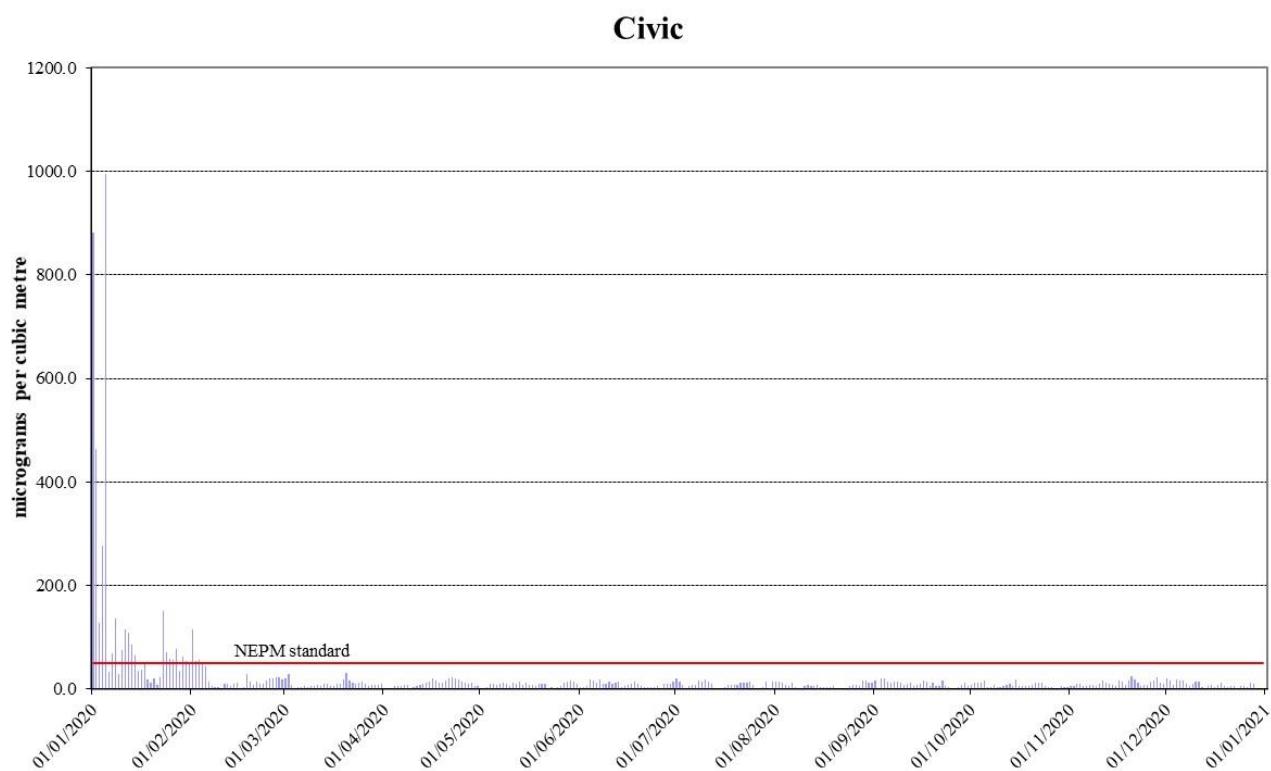


Figure 13: Daily maximum for PM₁₀ – Civic

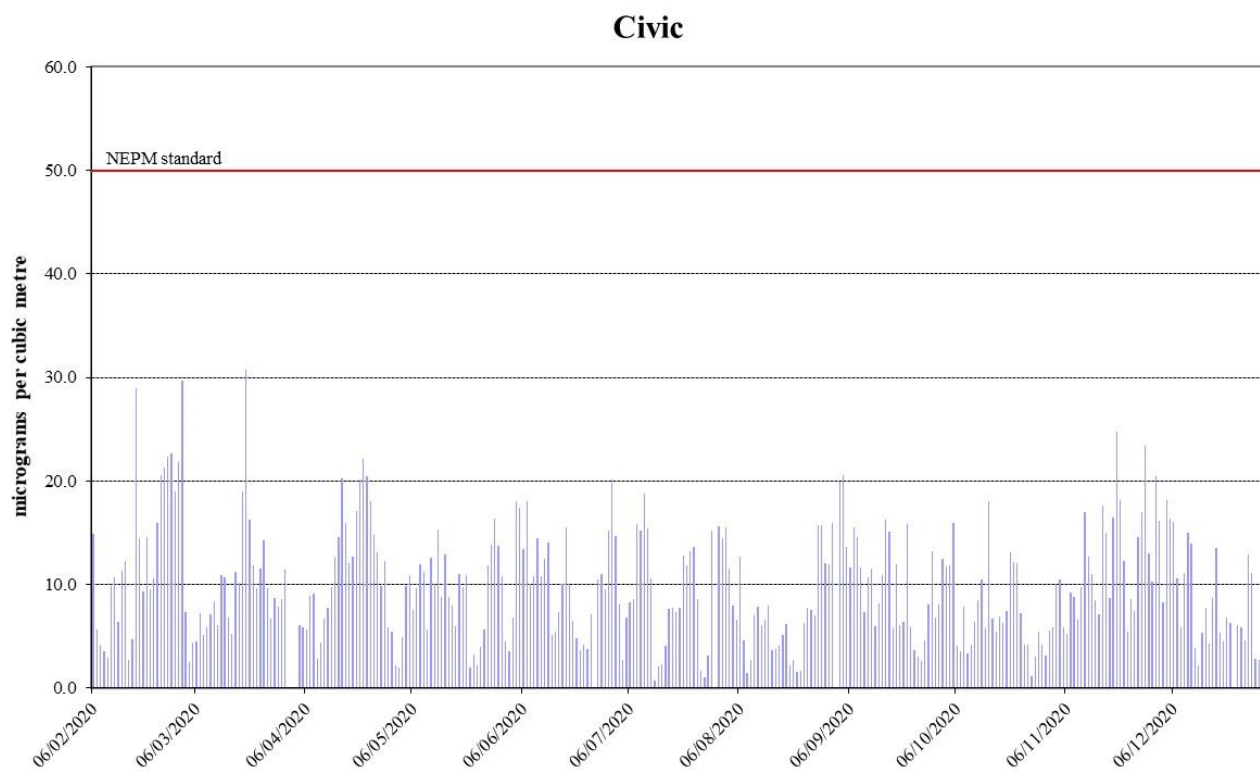


Figure 14: Daily maximum for PM₁₀ – Civic (Excluding Bushfire Period)

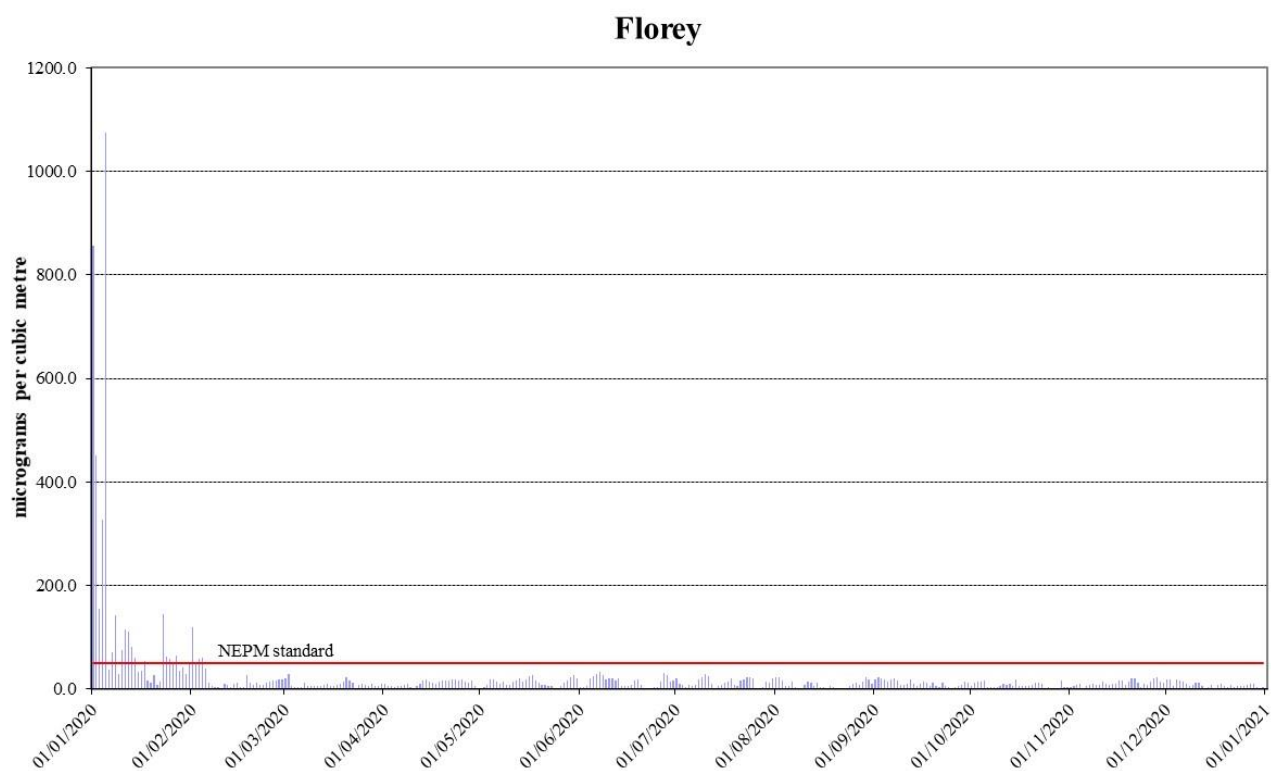


Figure 15: Daily maximum for PM₁₀ – Florey

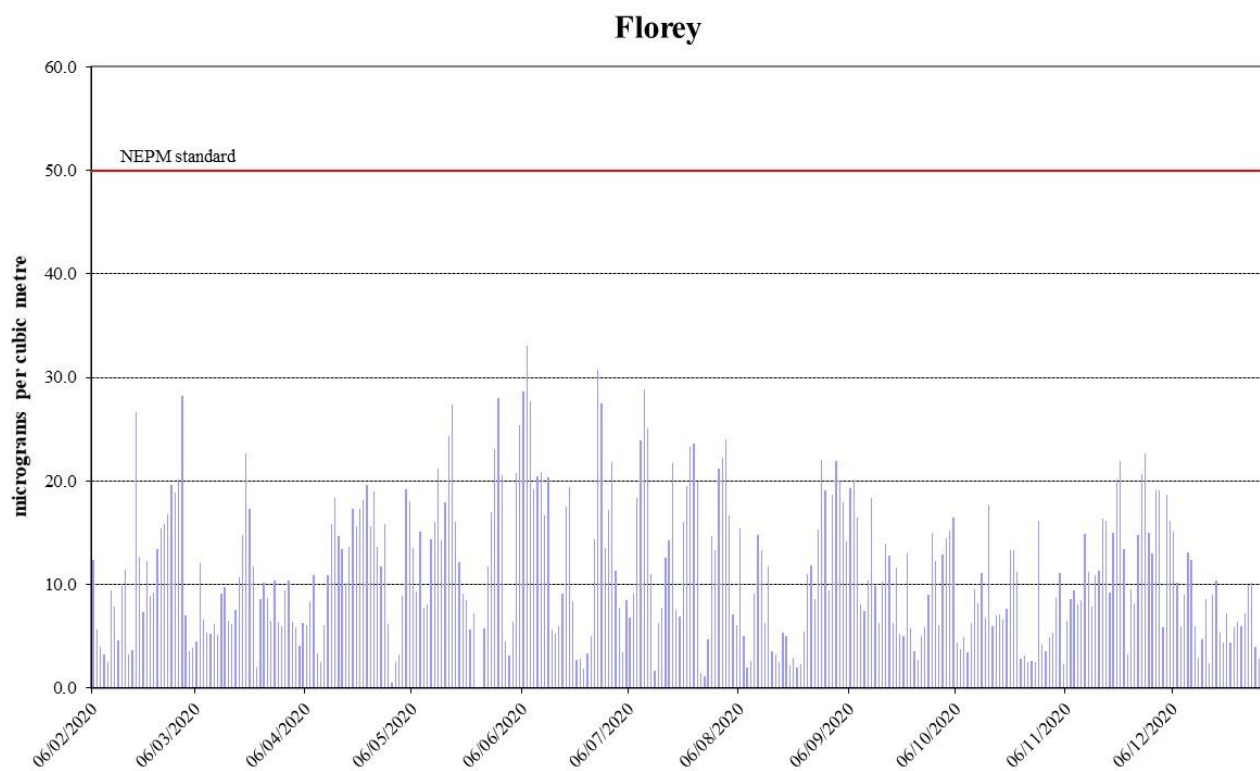


Figure 16: Daily maximum for PM₁₀ – Florey (Excluding Bushfire Period)

PM_{2.5}

During 2020, there were exceedances of daily PM_{2.5} standard on 39 days due to bushfires and wood heater emissions. Two thirds of exceedance days (26 days) occurred outside the winter season and were due to bushfires. Compliance against the daily PM_{2.5} standard was demonstrated at Civic when the exceptional events were removed. There were 13 exceedance days between mid-May and early August related to wood heater emissions at Monash and Florey. As a result, compliance against the daily PM_{2.5} standard was not met at Monash and Florey. Annual average PM_{2.5} data at all stations did not meet the 8 µg/m³ AAQ NEPM standard.

Table 8: 2020 compliance summary for PM_{2.5}
AAQ NEPM standard – 25 µg/m³ (1-day), 8 µg/m³ (1-year)

Monitoring station	Data availability rates (% of days)					1 Day		1 Year	
	Q1	Q2	Q3	Q4	Annual	Number of exceedances*	NEPM goal compliance	Annual average (µg/m ³)	NEPM goal compliance
Monash	98.9	100	96.8	98.4	98.6	12	NOT MET	17.8	NOT MET
Civic	97.8	97.8	100	100	98.9	0	MET	12.8	NOT MET
Florey	98.9	95.6	97.8	100	98.1	6	NOT MET	16.9	NOT MET

* the number excludes exceptional events.

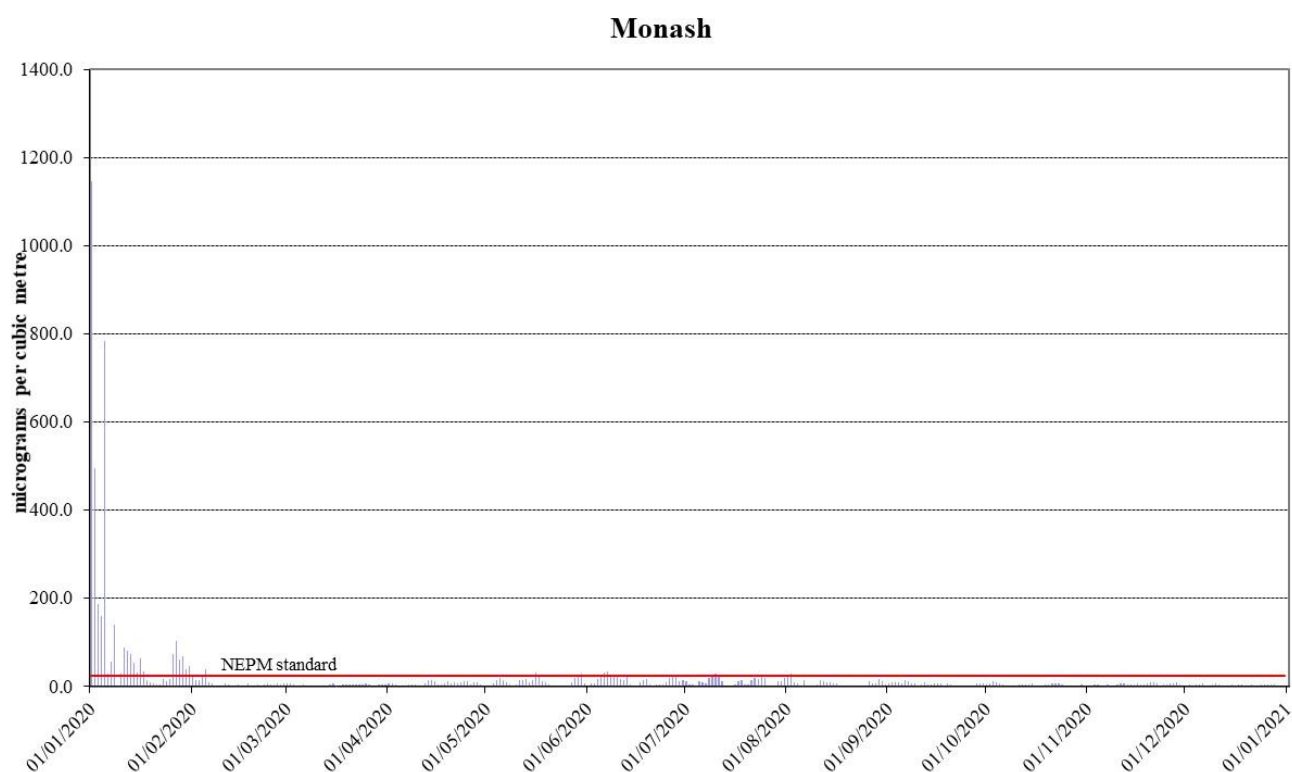


Figure 17: Daily maximum for PM_{2.5} – Monash

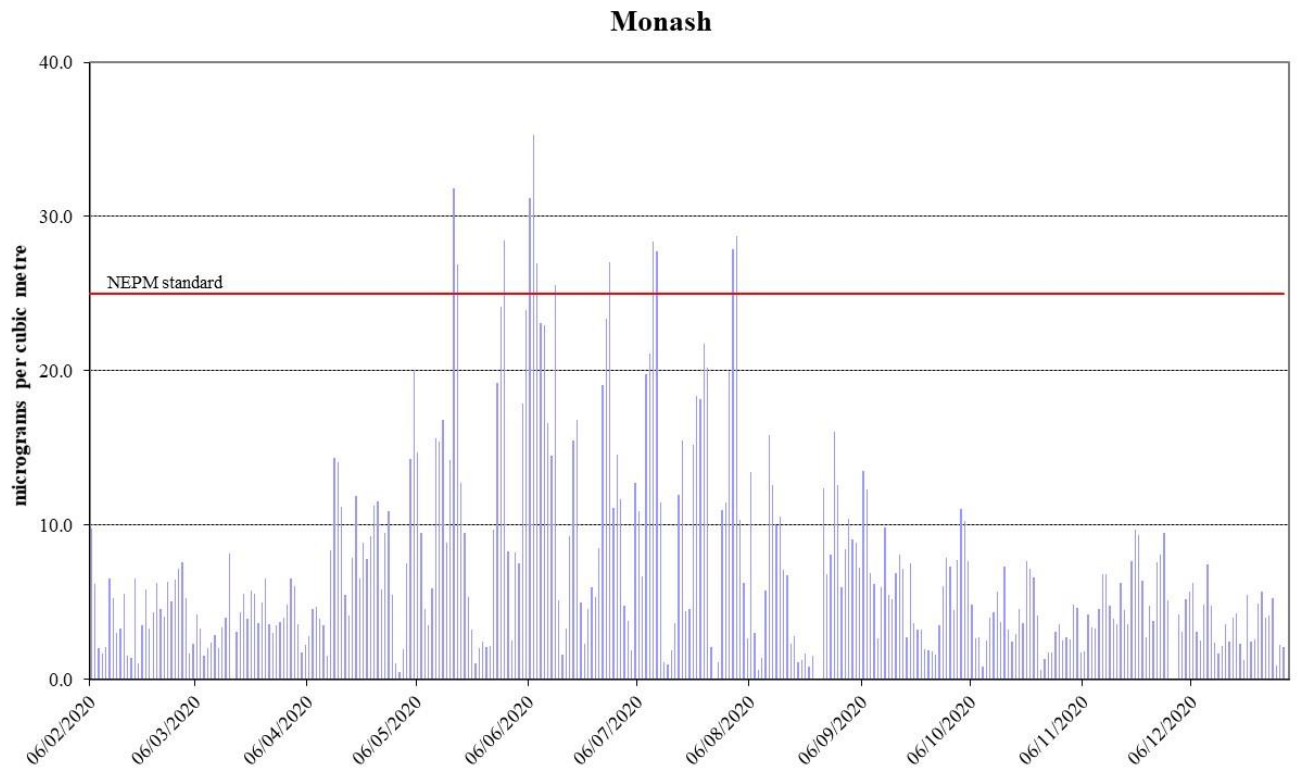


Figure 18: Daily maximum for PM_{2.5} – Monash (Excluding Bushfire Period)

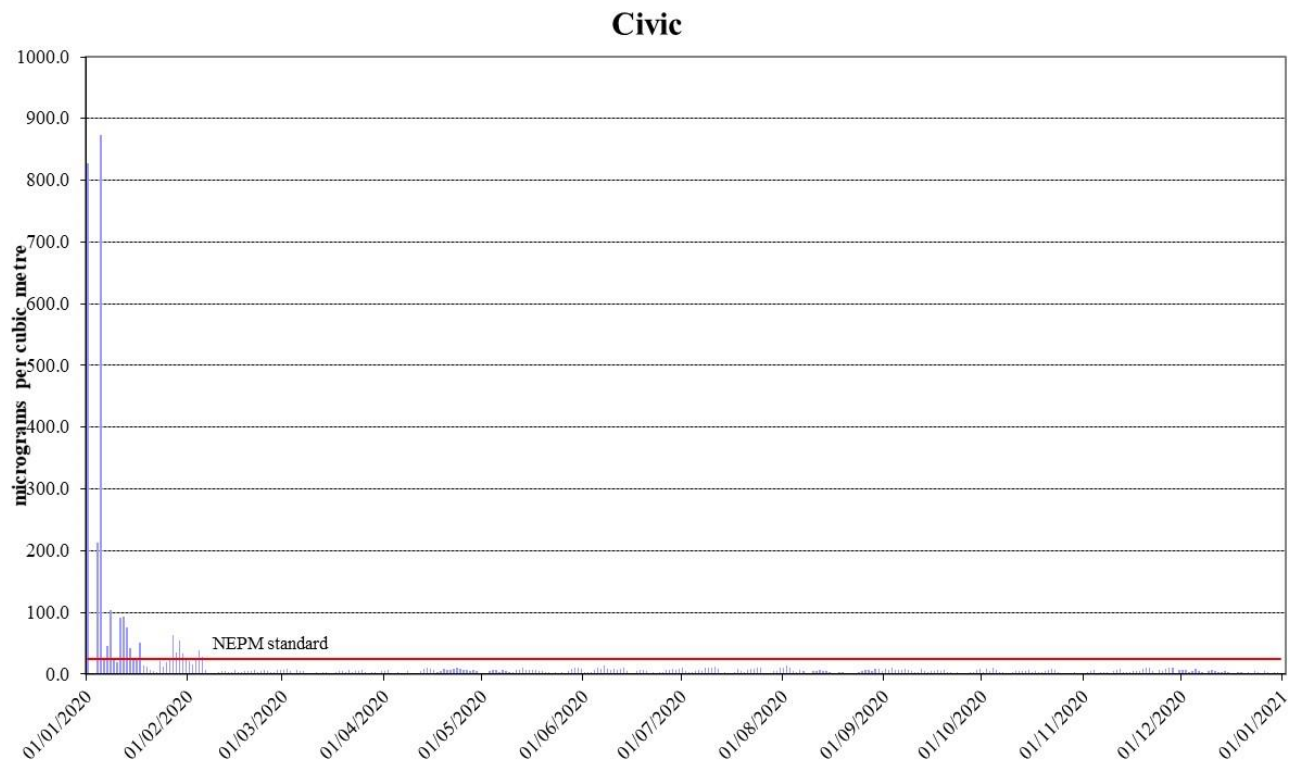


Figure 19: Daily maximum for PM_{2.5} – Civic

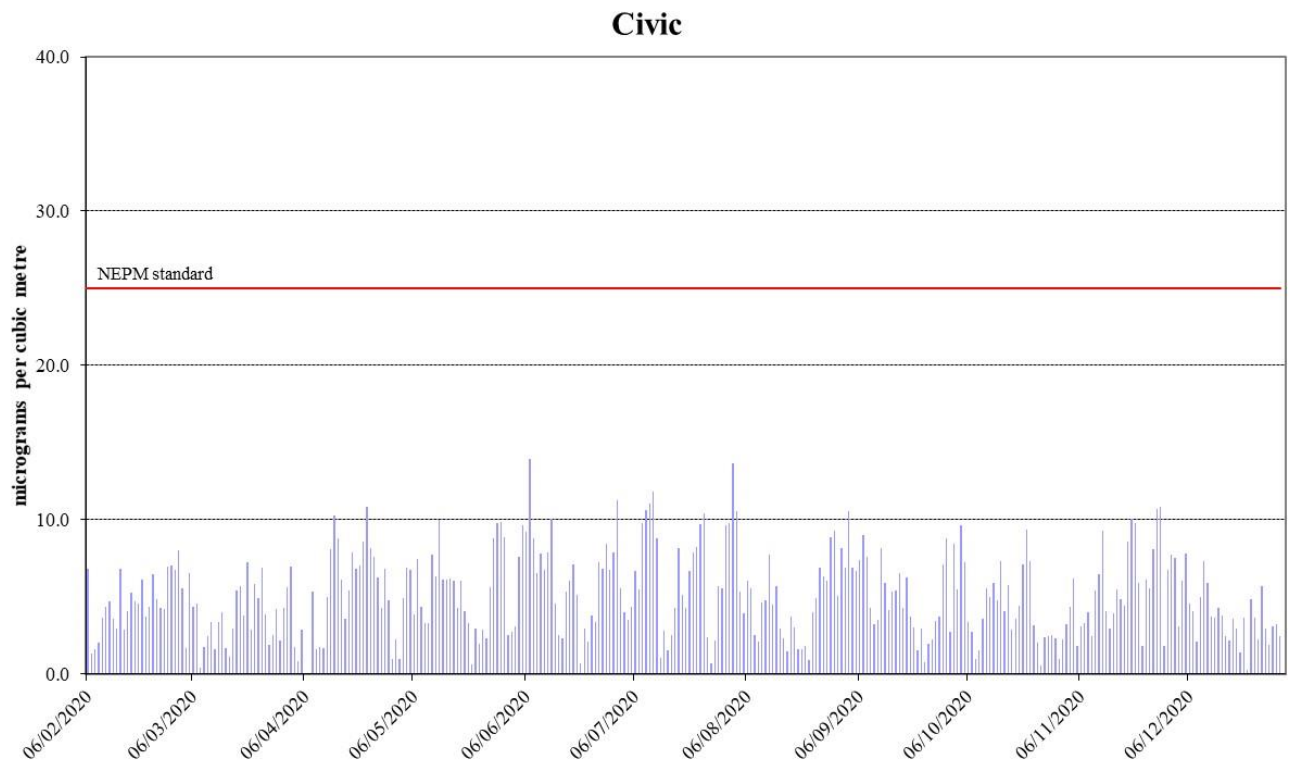


Figure 20: Daily maximum for PM_{2.5} – Civic (Excluding Bushfire Period)

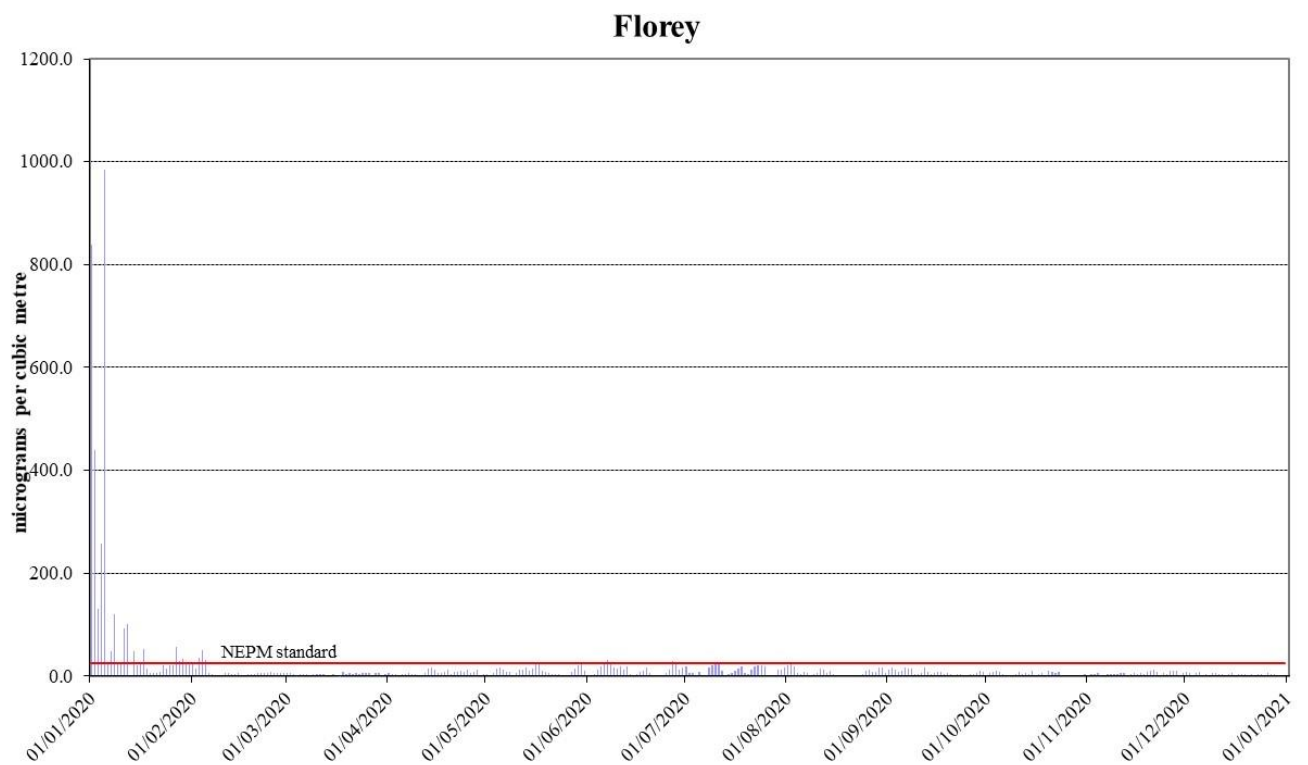


Figure 21: Daily maximum for PM_{2.5} – Florey

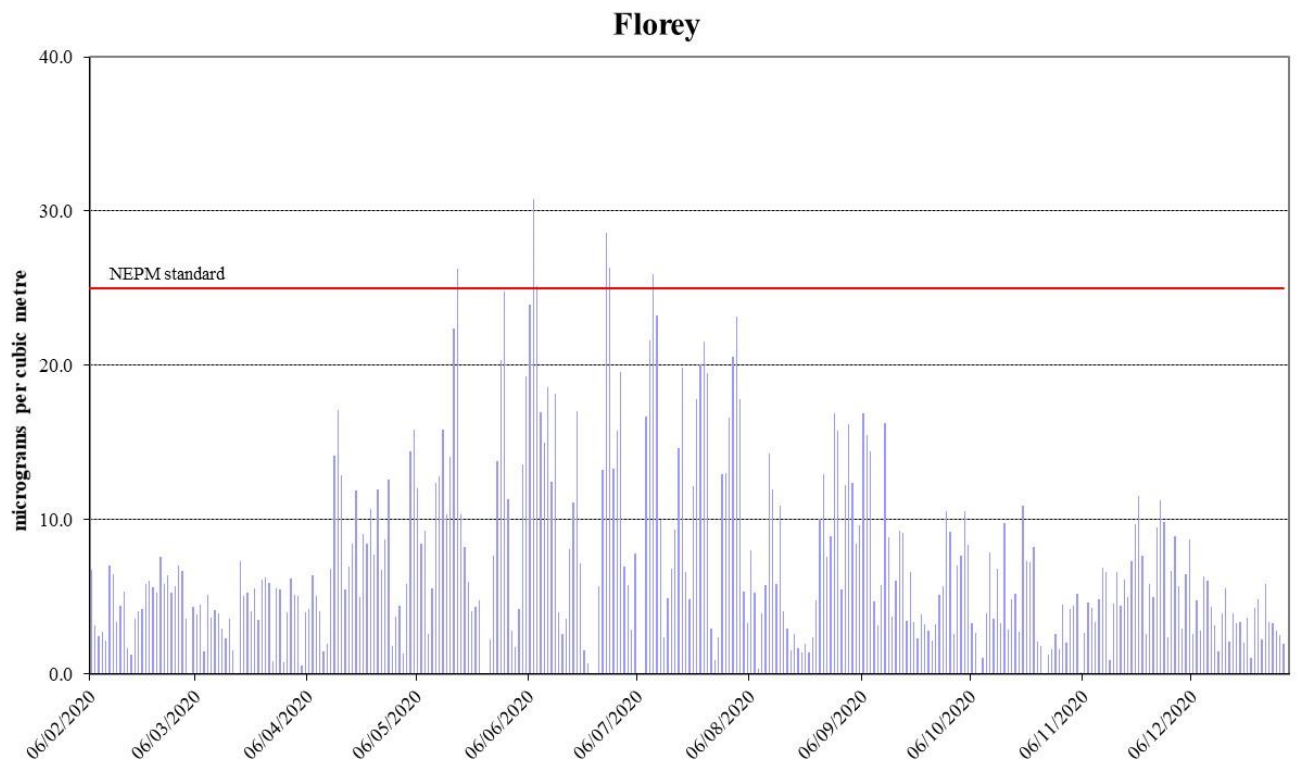


Figure 22: Daily maximum for PM_{2.5} – Florey (Excluding Bushfire Period)

ANALYSIS OF AIR QUALITY MONITORING

Annual summary statistics contained in Carbon monoxide levels remained relatively high across the ACT in January 2020 due to bushfires. Two exceedances were measured in January at both Monash and Florey, with a new record of 22.0 ppm at Monash on 1 January 2020.

Table 9 to Table 14 below assess air quality against the standards and the extent of compliance with the goal. Instances where the standard has been exceeded are highlighted in bold.

Carbon monoxide

Carbon monoxide levels remained relatively high across the ACT in January 2020 due to bushfires. Two exceedances were measured in January at both Monash and Florey, with a new record of 22.0 ppm at Monash on 1 January 2020.

Table 9: 2020 summary statistics for daily peak 8-hour CO

AAQ NEPM standard - 9.0 ppm (8-hour average)

Monitoring station	Number of valid days	Highest (ppm)	Highest (date/time)	2 nd Highest (ppm)	2 nd Highest (date/time)
Monash	362	22.0	01 Jan 05:00	11.6	05 Jan 22:00
Florey	359	14.6	05 Jan 06:00	13.8	01 Jan 07:00

Nitrogen dioxide

The bushfire smoke adversely impacted the nitrogen dioxide levels in January 2020. Two exceedances were recorded at Florey, which was the first time since the commencement of air quality monitoring in the ACT. The highest recorded 1-hour value during 2020 was 0.171 ppm at Florey. The overall nitrogen dioxide levels decreased compared with the previous year. This may be attributed to less traffic and other human activities during the COVID-19 pandemic. Annual average remained well below the standard in 2020. The annual average in 2020 was 0.004ppm at both Monash and Florey. This is 13% of the annual standard 0.03ppm.

Table 10: 2020 summary statistics for daily peak 1-hour NO₂

AAQ NEPM standard 0.12 ppm (1-hour average)

Monitoring station	Number of valid days	Highest (ppm)	Highest (date/time)	2 nd Highest (ppm)	2 nd Highest (date/time)
Monash	366	0.116	04 Jan 22:00	0.081	05 Jan 20:00
Florey	354	0.171	05 Jan 01:00	0.152	04 Jan 00:00

Ozone

Due to bushfires impacts, there were four days in 2020 when ozone levels were above the standards. On 1 and 2 January 2020, the most extensive ozone event for 2020 occurred. All monitoring stations recorded ozone levels over the 4-hour standard on those two days. Ozone levels above the 4-hour standard were recorded one more time at Monash and Florey on 7 January 2020. The 1-hour standard was also exceeded at Monash and Florey on 1 and 2 January 2020. Bushfires continued impacting the Canberra region till early February, which resulted in another exceedance day for both 1-hour and 4-hour standards on 31 January 2020 at Monash.

The highest recorded 1-hour value in the ACT during 2020 was 0.118 ppm at Florey. The highest recorded 4-hour value in the ACT during 2020 was 0.108 ppm at Florey.

Table 11: 2020 summary statistics for daily peak 1-hour O₃

AAQ NEPM standard 0.10 ppm (1-hour average)

Monitoring station	Number of valid days	Highest (ppm)	Highest (date/time)	2 nd Highest (ppm)	2 nd Highest (date/time)
Monash	366	0.104	31 Jan 10:00	0.104	01 Jan 14:00
Civic	366	0.096	01 Jan 15:00	0.095	02 Jan 17:00
Florey	350	0.118	02 Jan 17:00	0.111	01 Jan 15:00

Table 12: 2020 summary statistics for daily peak 4-hour O₃

AAQ NEPM standard 0.08 ppm (4-hour average)

Monitoring station	Number of valid days	Highest (ppm)	Highest (date/time)	2 nd Highest (ppm)	2 nd Highest (date/time)
Monash	366	0.100	01 Jan 16:00	0.093	02 Jan 17:00
Civic	366	0.086	01 Jan 16:00	0.082	02 Jan 17:00
Florey	350	0.108	02 Jan 18:00	0.105	01 Jan 16:00

PM₁₀

There were 27 days when daily PM₁₀ standard was exceeded at different stations from January till early February 2020. The daily PM₁₀ reached unprecedented high levels across the ACT.

The high number of daily PM₁₀ exceedances was attributed to the extensive bushfires throughout NSW (24 days) impacting the ACT and the increasing frequency of widespread dust storms (3 days). Under the exceptional event rule they have been excluded when assessing compliance against the daily standard.

Whilst monitoring data from exceptional events is excluded for reporting compliance for daily averaging standards it is still included for one-year averaging standards.

The highest recorded annual average in 2020 was $22.8\mu\text{g}/\text{m}^3$ at Florey (refer to Table 7) slightly less than the maximum annual average of $23.8\mu\text{g}/\text{m}^3$ (Florey) in 2019. This is below the national annual standard of $25\mu\text{g}/\text{m}^3$, but slightly over the ACT annual standard of $20\mu\text{g}/\text{m}^3$.

Table 13: 2020 summary statistics for daily PM_{10}

AAQ NEPM daily standard $50\mu\text{g}/\text{m}^3$

Monitoring station	Number of valid days	Highest ($\mu\text{g}/\text{m}^3$)	Highest (date)
Monash	363	1046.1	01 January
Civic	359	994.9	05 January
Florey	364	1075.5	05 January

$\text{PM}_{2.5}$

The daily standard for $\text{PM}_{2.5}$ was exceeded on 39 days in 2020 at one or more of the monitoring stations. 13 exceedance days, which occurred between May and August 2020, were primarily a result of domestic wood heater emissions in winter. The other exceedances were attributed to bushfire smoke (26 days). The highest daily $\text{PM}_{2.5}$ level was $1146.5\mu\text{g}/\text{m}^3$ which was recorded at Monash on 1 January 2020.

Whilst monitoring data from exceptional events is excluded for reporting compliance for daily averaging standards it is still included for one year averaging standards. Given the length of time the Canberra airshed was affected by bushfire smoke the annual average $\text{PM}_{2.5}$ levels remained relatively high in 2020. All monitoring stations recorded annual average $\text{PM}_{2.5}$ concentrations above the national standard $8\mu\text{g}/\text{m}^3$. The highest recorded annual average in 2020 was $17.8\mu\text{g}/\text{m}^3$ at Monash (refer to Table 8).

Table 14: 2020 summary statistics for daily $\text{PM}_{2.5}$

AAQ NEPM daily standard $25\mu\text{g}/\text{m}^3$

Monitoring station	Number of valid days	Highest ($\mu\text{g}/\text{m}^3$)	Highest (date)
Monash	361	1146.5	01 January
Civic	362	872.6	05 January
Florey	359	983.4	05 January

ASSESSMENT OF PROGRESS TOWARDS ACHIEVING THE GOAL

Historical monitoring results indicate that the only AAQ NEPM pollutant of concern in the ACT air shed is particulate matter, which increases significantly during winter because of emissions from domestic wood heaters. In more recent years, especially 2018 and 2019, exceedances of the particulate matter standards have also been attributed to smoke from hazard reduction burns, bushfires and dust storms.

While carbon monoxide and nitrogen dioxide concentrations increased during bushfire period, the AAQ NEPM standards were met on 99.5% of days during the year.

Ozone levels were relatively high in January 2020 compared with other months of the year, meeting the AAQ NEPM standards on 99% of all days during the year.

Canberra experienced days with extreme air pollution in early 2020 due to smoke from bushfires, dust storms or a combination of both. In early January, the particle pollution was at levels more than 20 times (PM_{10}) or 45 times ($PM_{2.5}$) the national standards. In addition, there was an increase of $PM_{2.5}$ exceedances in winter months. The COVID-19 pandemic restrictions may be a possible cause of this increase, with people staying at home more.

The ACT Government acknowledges that wood heater emissions reduce air quality during winter, and continue to implement an integrated program to address this including:

- provides public information on air quality levels in the ACT through the online Air Quality Index and AirRater App;
- the annual 'Burn Right Tonight' community education campaign which reminds ACT residents how to use wood heaters correctly to minimise air pollution;
- the regulation of firewood merchants to ensure only seasoned wood is sold;
- the regulation of wood heaters sold in the ACT to ensure they meet the current Australian Standards for emissions and efficiency;
- the prohibition of wood heaters in new developments where planning studies show that they would have an adverse impact on air quality. The ACT Government has taken this approach for the development of the Molonglo Valley (except Wright), and previously with the suburbs of Dunlop and East O'Malley;
- compliance and enforcement activities for wood heater emissions; and
- administering the Wood Heater Replacement Program to replace old inefficient wood heaters with high efficiency alternatives.

Bushfire smoke and dust storms continue to present a threat to future air quality in the ACT, particularly as climate change is set to exacerbate the frequency and intensity of bushfire events, coupled with rising temperatures and prolonged dry weather.

APPENDIX A: STATISTICAL SUMMARY AND TRENDS

The following section provides a basic statistical summary, using percentiles, for Monash, Civic and Florey stations and for each standard in the past ten years. Daily maximum values are also presented in the following tables.

Carbon monoxide

Table 15: Statistical summary for daily maximum 8-hour CO Monash 2011 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
2011	98.6	0	2.2	1.5	0.5	0.2
2012	99.7	0	1.8	1.2	0.6	0.3
2013	95.9	0	2.1	1.5	0.6	0.3
2014	94.0	0	1.8	1.4	0.7	0.4
2015	94.8	0	1.9	1.4	0.6	0.3
2016	95.8	0	1.7	1.0	0.4	0.2
2017	95.4	0	1.6	1.2	0.6	0.2
2018	92.3	0	1.5	1.2	0.5	0.2
2019	72.1	1	12.4	1.1	0.4	0.1
2020	94.9	2	22.0	1.5	0.6	0.2

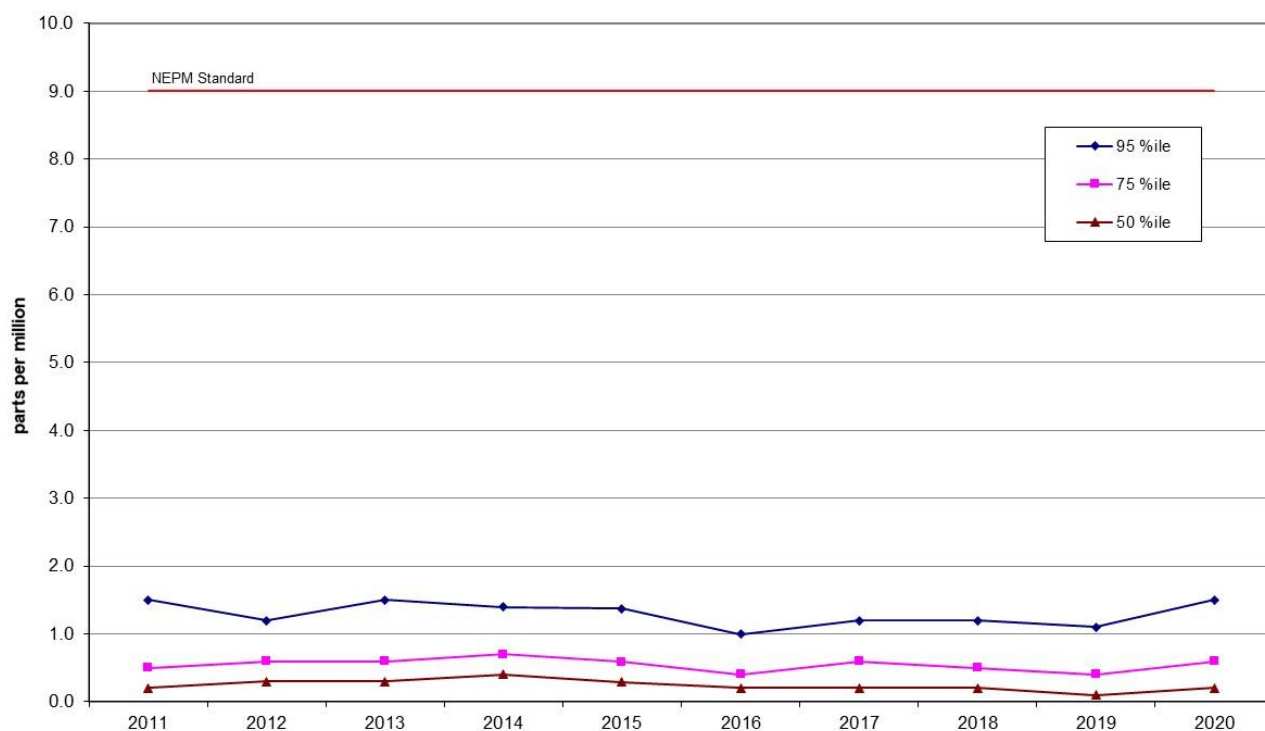


Figure 23: Statistical summary for daily maximum 8-hour CO Monash 2011 – 2020

Table 16: Statistical summary for daily maximum 8-hour CO Florey 2014 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
2014	79.2	0	2.2	1.4	0.7	0.3
2015	94.9	0	2.0	1.5	0.6	0.3
2016	95.5	0	1.9	1.2	0.5	0.3
2017	94.7	0	1.8	1.4	0.5	0.2
2018	94.7	0	1.5	1.1	0.5	0.3
2019	95.3	0	8.6	1.2	0.6	0.3
2020	94.7	2	14.6	1.3	0.6	0.3

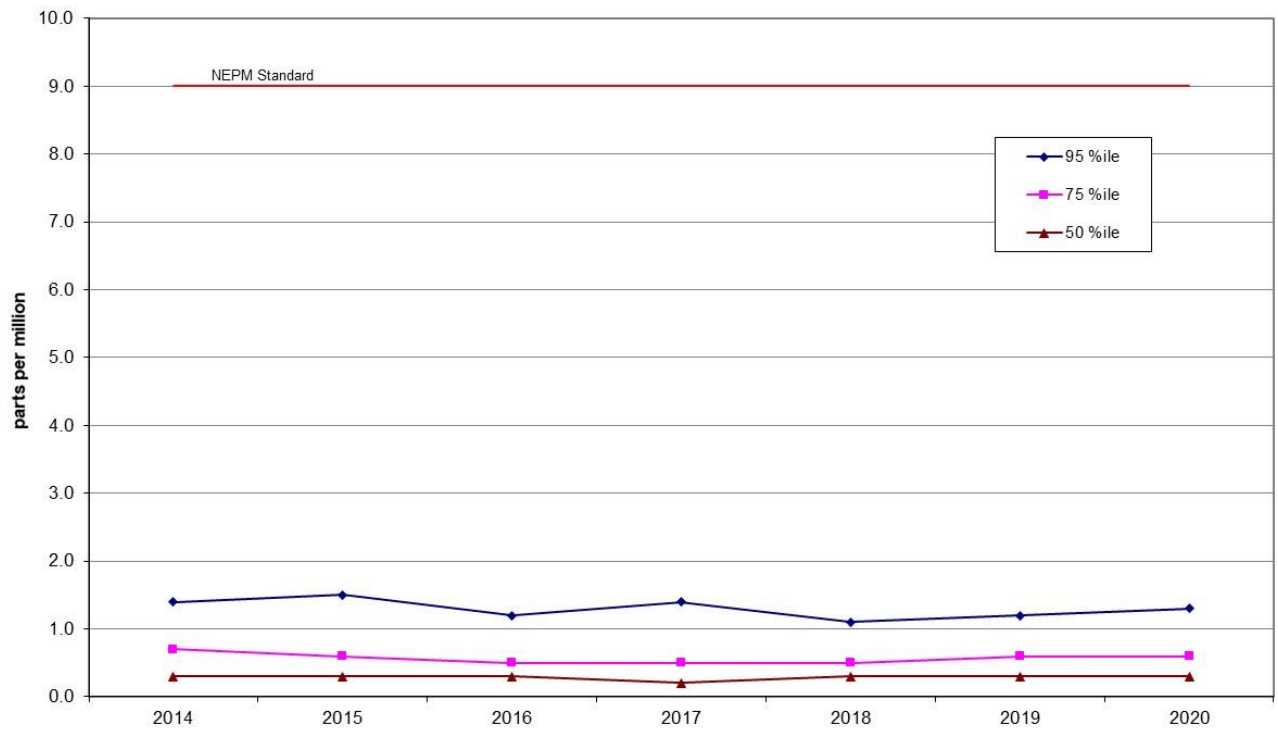


Figure 24: Statistical summary for daily maximum 8-hour CO Florey 2014 – 2020

Nitrogen dioxide

Table 17: Statistical summary for daily maximum 1-hour NO₂ Monash 2011 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	Annual average (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
2011	96.7	0	0.043	0.005	0.029	0.022	0.015
2012	97.5	0	0.033	0.006	0.026	0.021	0.014
2013	97.5	0	0.037	0.005	0.027	0.021	0.014
2014	94.1	0	0.036	0.005	0.027	0.020	0.015
2015	94.8	0	0.032	0.004	0.026	0.020	0.014
2016	95.6	0	0.036	0.004	0.027	0.019	0.012
2017	95.6	0	0.031	0.004	0.027	0.021	0.013
2020 ⁸	95.5	0	0.039	0.004	0.028	0.020	0.014
2019	94.9	0	0.084	0.005	0.027	0.021	0.014
2020	95.7	0	0.116	0.004	0.027	0.019	0.011

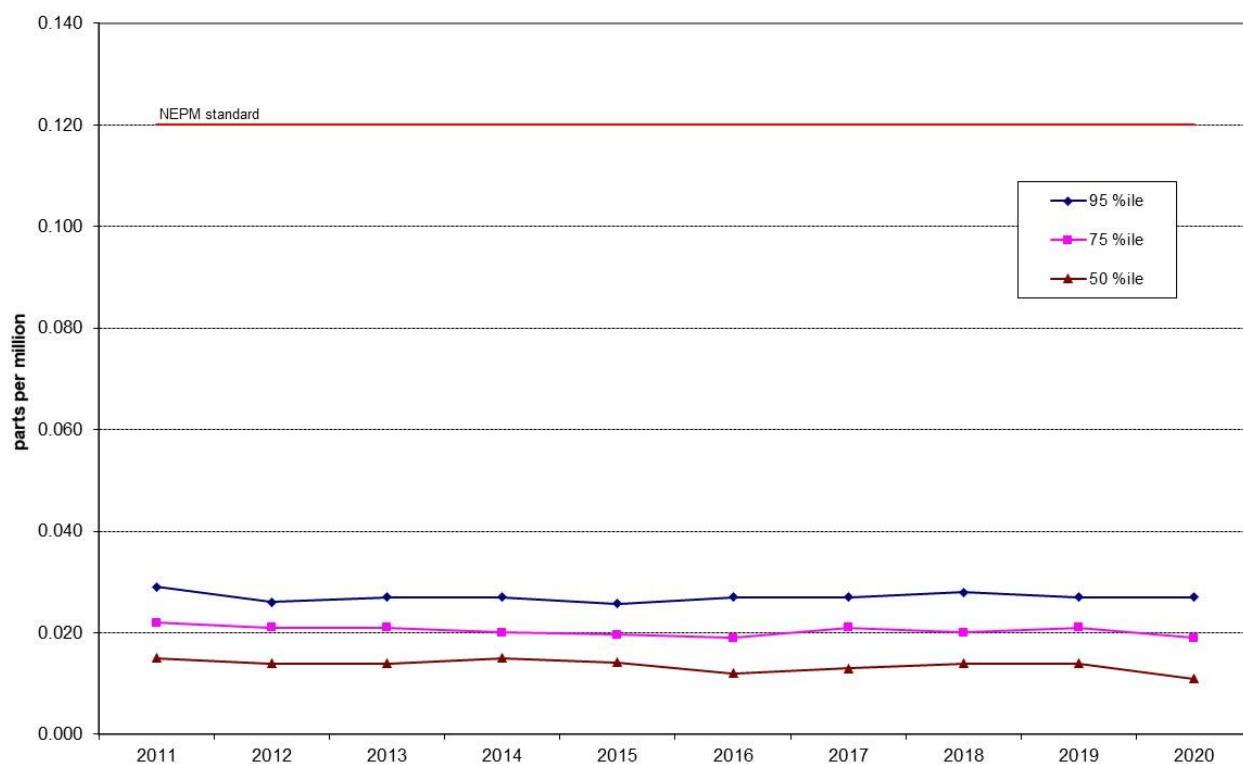


Figure 25: Statistical summary for daily maximum 1-hour NO₂ Monash 2011 – 2020

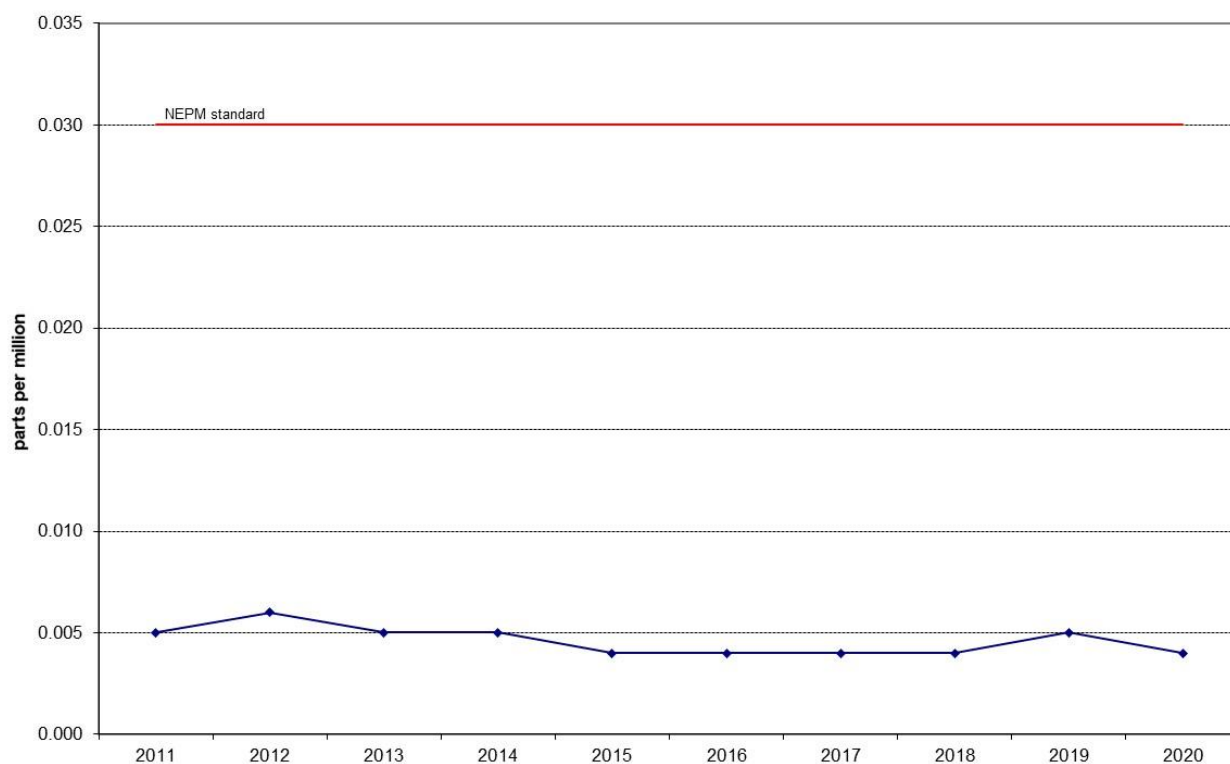


Figure 26: Annual average 1-hour NO₂ Monash 2011 – 2020

Table 18: Statistical summary for daily maximum 1-hour NO₂ Florey 2014 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	Annual average (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
2014	78.3	0	0.045	0.006	0.027	0.020	0.015
2015	91.5	0	0.033	0.005	0.027	0.020	0.014
2016	94.7	0	0.034	0.004	0.027	0.019	0.013
2017	93.7	0	0.033	0.005	0.025	0.020	0.015
2018	93.3	0	0.039	0.005	0.028	0.022	0.015
2019	92.4	0	0.062	0.005	0.027	0.020	0.014
2020	94.1	2	0.171	0.004	0.024	0.017	0.011

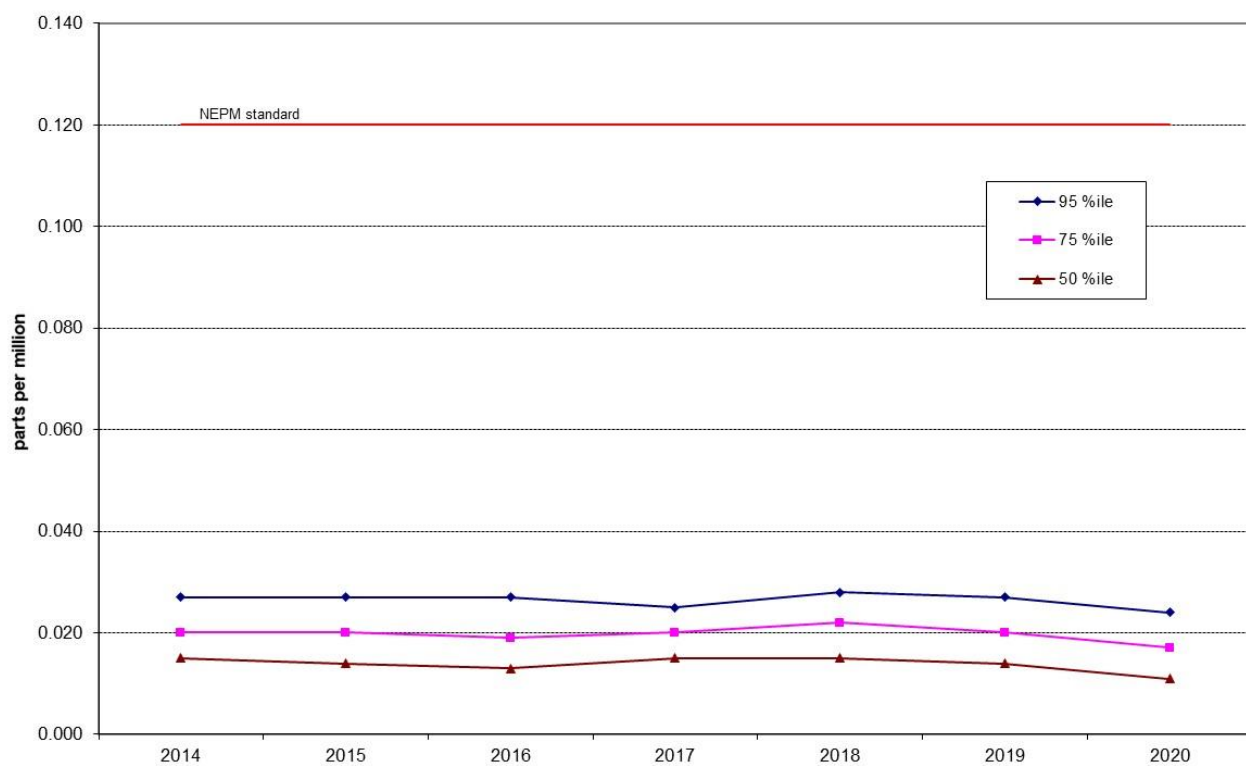


Figure 27: Statistical summary for daily maximum 1-hour NO₂ Florey 2014 – 2020

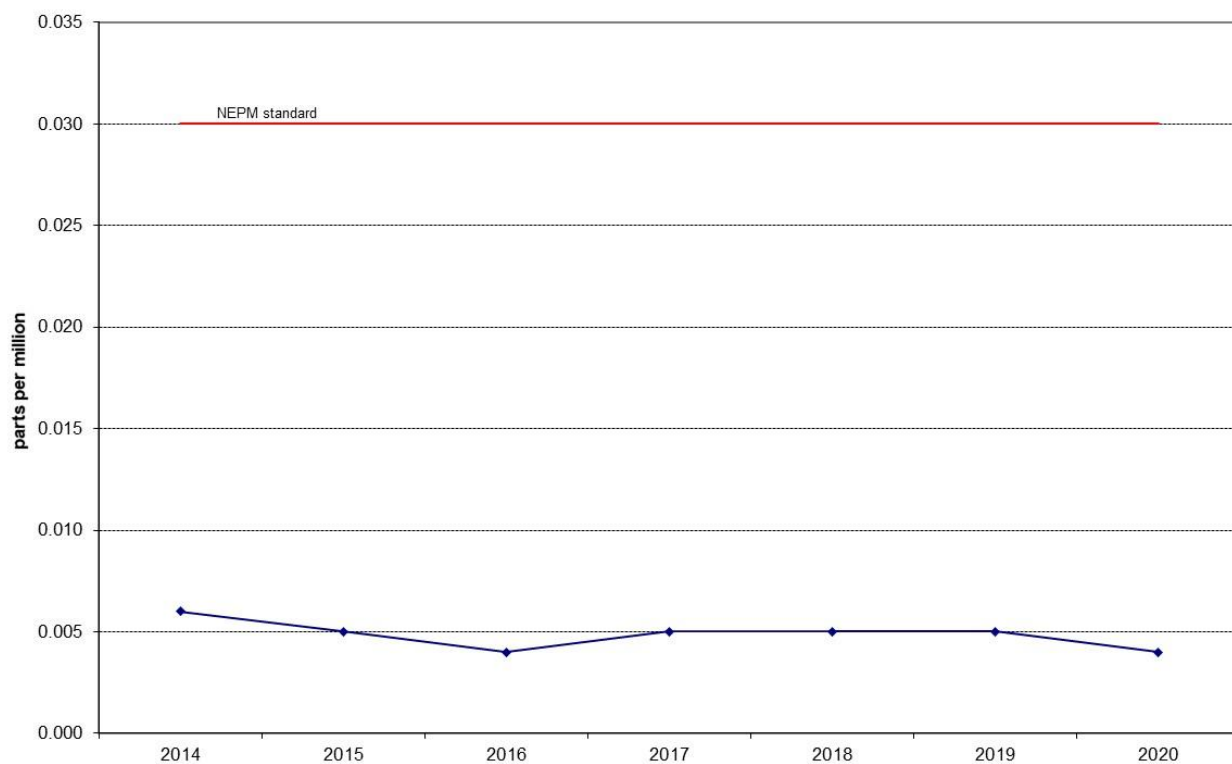


Figure 28: Annual average 1-hour NO₂ Florey 2014 – 2020

Ozone

Table 19: Statistical summary for daily maximum 1-hour O₃ Monash 2011 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
2011	99.2	0	0.056	0.044	0.033	0.028
2012	100	0	0.055	0.043	0.034	0.029
2013	97.8	0	0.062	0.045	0.035	0.029
2014	94.8	0	0.087	0.050	0.036	0.030
2015	92.8	0	0.065	0.044	0.034	0.026
2016	95.2	0	0.057	0.044	0.032	0.026
2017	95.5	0	0.060	0.049	0.038	0.032
2018	95.8	0	0.062	0.050	0.039	0.032
2019	95.8	1	0.127	0.066	0.040	0.033
2020	95.8	2	0.104	0.056	0.035	0.030

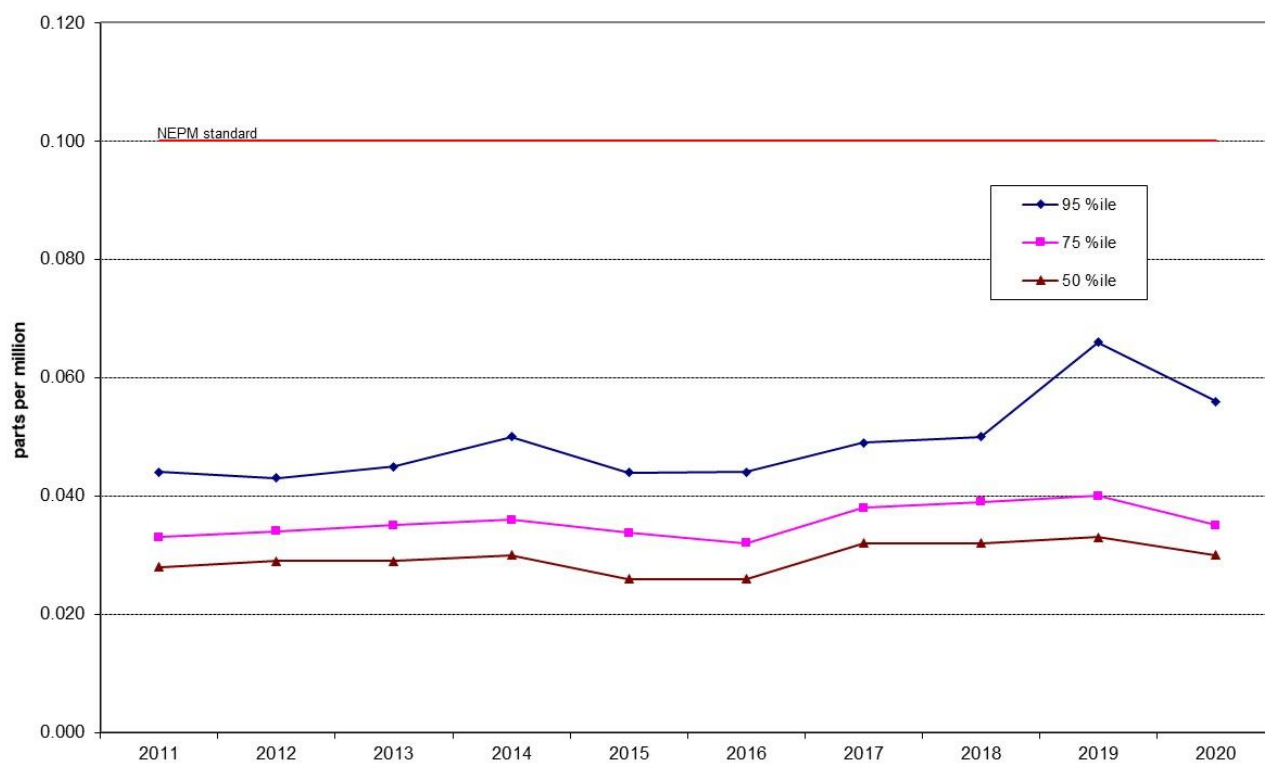


Figure 29: Statistical summary for daily maximum 1-hour O₃ Monash 2011 – 2020

Table 20: Statistical summary for daily maximum 1-hour O₃ Civic 2011 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
2011	96.4	0	0.052	0.041	0.030	0.026
2012	100	0	0.053	0.034	0.024	0.020
2013	92.1	0	0.060	0.036	0.028	0.024
2014	94.0	0	0.060	0.039	0.028	0.022
2015	89.0	0	0.042	0.034	0.026	0.022
2016	95.8	0	0.047	0.036	0.028	0.024
2017	95.8	0	0.053	0.045	0.034	0.028
2018	95.2	0	0.056	0.046	0.032	0.028
2019	95.8	4	0.169	0.065	0.037	0.029
2020	95.8	0	0.096	0.048	0.032	0.026

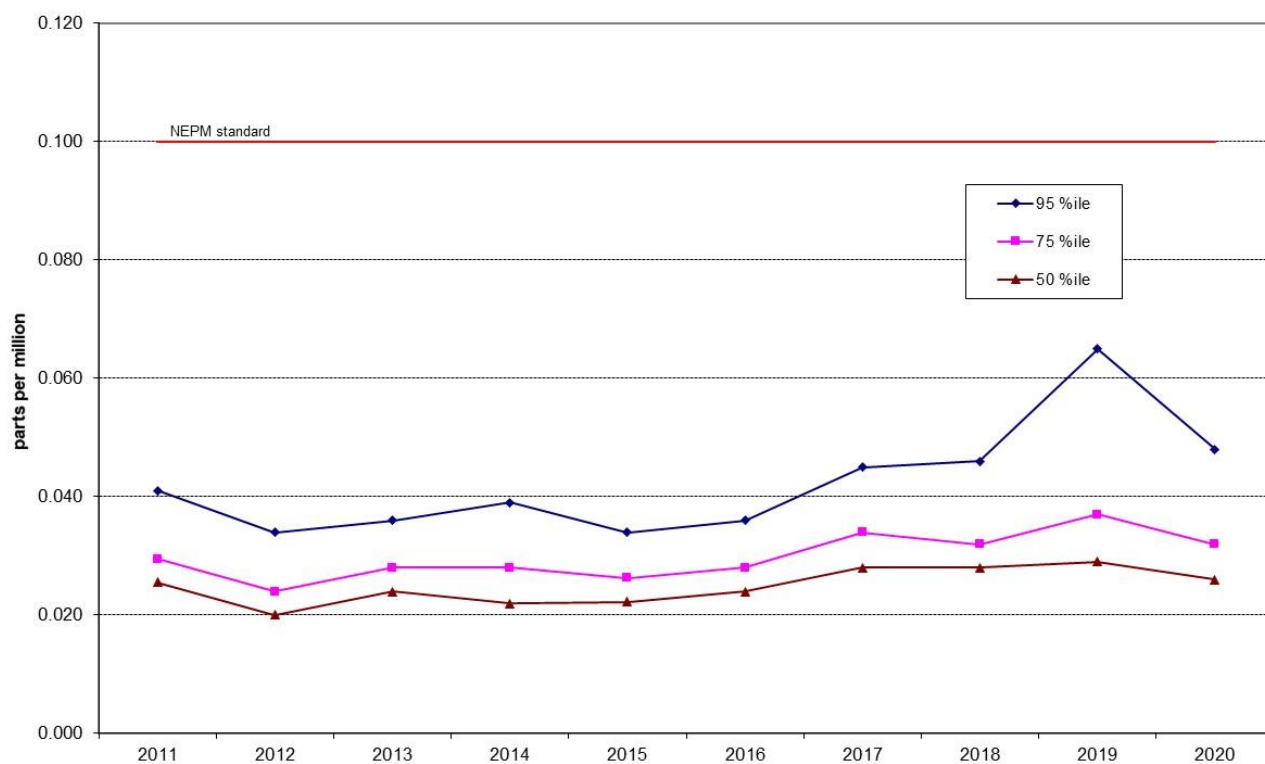


Figure 30: Statistical summary for daily maximum 1-hour O₃ Civic 2011 – 2020

Table 21: Statistical summary for daily maximum 1-hour O₃ Florey 2014 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
2014	79.4	0	0.074	0.034	0.027	0.023
2015	94.2	0	0.040	0.032	0.025	0.021
2016	95.8	0	0.050	0.040	0.031	0.027
2017	95.5	0	0.057	0.048	0.038	0.032
2018	95.2	0	0.059	0.050	0.038	0.032
2019	95.3	1	0.118	0.067	0.039	0.032
2020	92.0	2	0.118	0.058	0.036	0.030

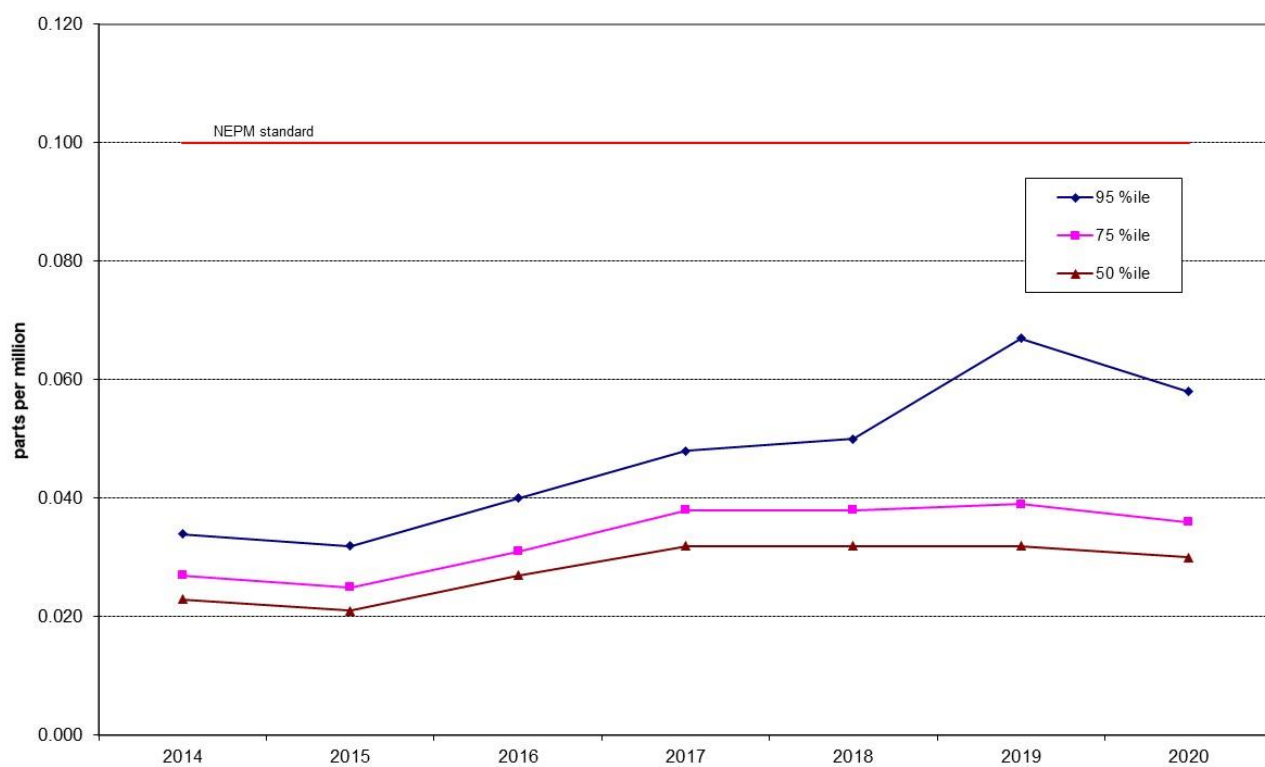


Figure 31: Statistical summary for daily maximum 1-hour O₃ Florey 2014 – 2020

Table 22: Statistical summary for daily maximum 4-hour O₃ Monash 2011 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
2011	98.9	0	0.054	0.041	0.032	0.027
2012	99.7	0	0.052	0.043	0.034	0.029
2013	97.8	0	0.059	0.042	0.033	0.028
2014	94.8	0	0.060	0.046	0.034	0.029
2015	92.8	0	0.050	0.041	0.033	0.025
2016	95.2	0	0.055	0.042	0.030	0.025
2017	95.5	0	0.055	0.047	0.036	0.031
2018	95.8	0	0.057	0.049	0.038	0.032
2019	95.8	1	0.118	0.061	0.039	0.032
2020	95.8	4	0.100	0.053	0.034	0.029



Figure 32: Statistical summary for daily maximum 4-hour O₃ Monash 2011 – 2020

Table 23: Statistical summary for daily maximum 4-hour O₃ Civic 2011 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
2011	96.4	0	0.050	0.038	0.029	0.025
2012	100	0	0.042	0.032	0.023	0.019
2013	91.8	0	0.057	0.034	0.027	0.023
2014	94.0	0	0.047	0.036	0.026	0.020
2015	89.0	0	0.041	0.031	0.025	0.021
2016	95.8	0	0.045	0.035	0.027	0.023
2017	95.8	0	0.049	0.042	0.033	0.027
2018	95.2	0	0.053	0.044	0.031	0.026
2019	95.8	1	0.098	0.060	0.036	0.029
2020	95.8	2	0.086	0.046	0.031	0.025

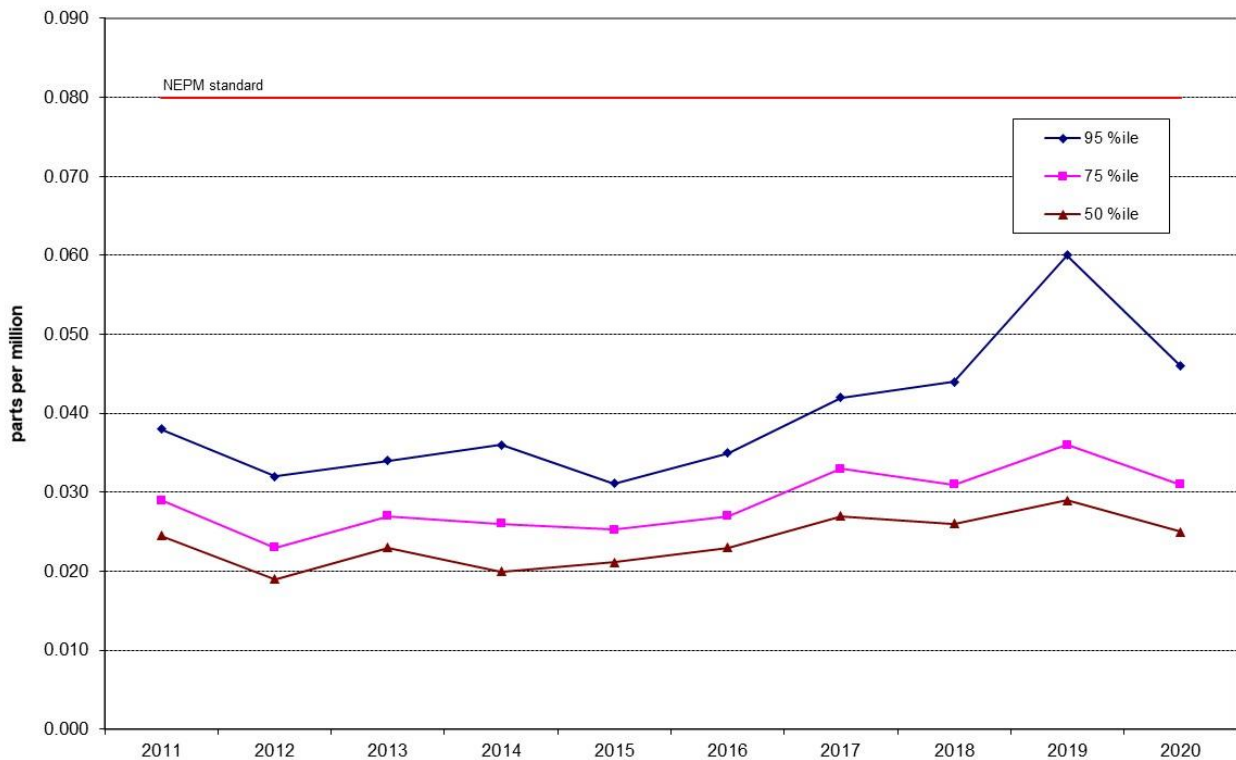


Figure 33: Statistical summary for daily maximum 4-hour O₃ Civic 2011 – 2020

Table 24: Statistical summary for daily maximum 4-hour O₃ Florey 2014 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
2014	79.4	0	0.040	0.031	0.026	0.022
2015	94.2	0	0.037	0.031	0.025	0.020
2016	95.8	0	0.050	0.038	0.029	0.026
2017	95.5	0	0.054	0.046	0.037	0.031
2018	95.2	0	0.057	0.048	0.037	0.031
2019	95.3	3	0.109	0.064	0.038	0.031
2020	92.0	3	0.108	0.054	0.035	0.029

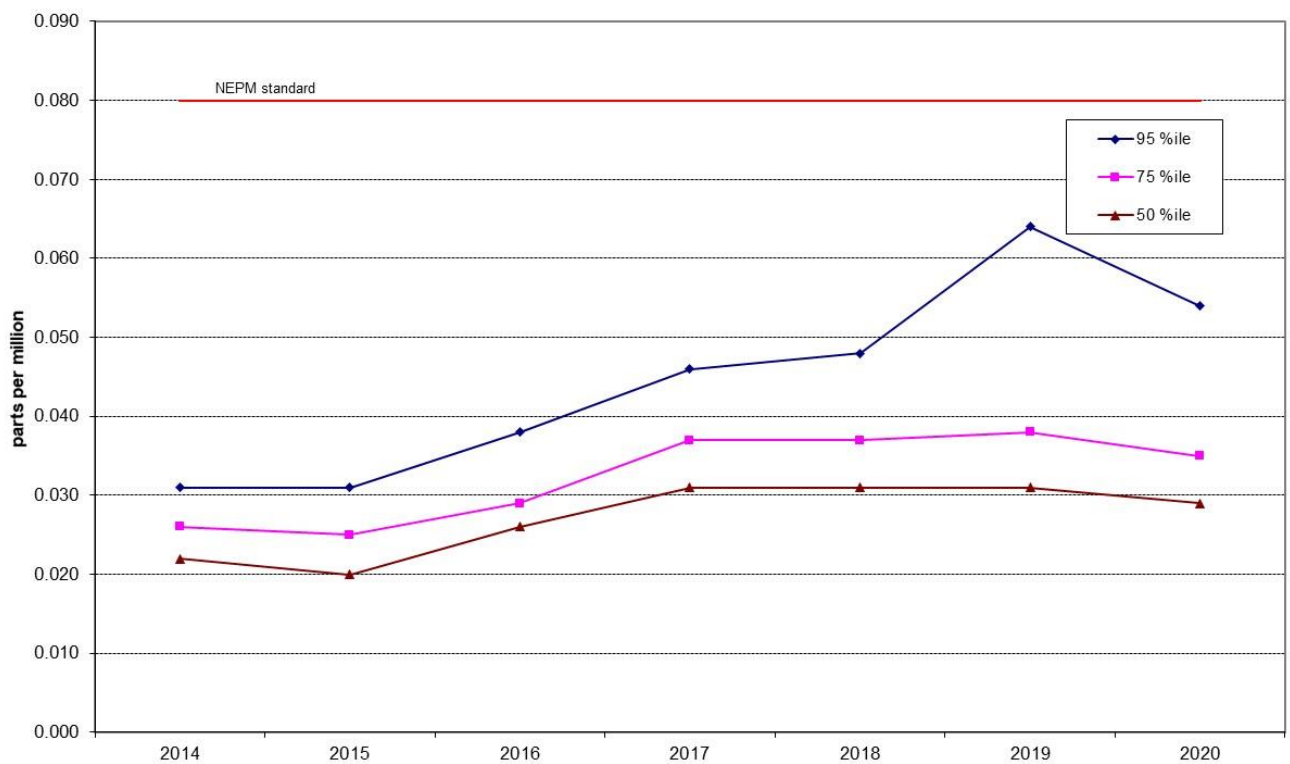


Figure 34: Statistical summary for daily maximum 4-hour O₃ Florey 2014 – 2020

PM₁₀

Table 25: Statistical summary for daily maximum daily PM₁₀ Monash 2011 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m ³)	Annual average (µg/m ³)	95 th percentile (µg/m ³)	75 th percentile (µg/m ³)	50 th percentile (µg/m ³)
2011	99.2	0	40.0	10.4	22.8	13.2	8.7
2012	98.6	0	41.0	10.4	19.7	13.7	9.7
2013	95.6	0	43.5	9.8	20.2	13.1	8.9
2014	97.8	0	39.3	10	19.1	12.9	9.6
2015	98.4	0	49.4	9.9	19.5	13.1	9.5
2016	99.5	0	31.9	9.7	21.5	12.7	9.0
2017	98.9	0	28.3	9.8	20.5	12.3	9.0
2018	99.2	4	139.2	11.8	23.0	14.8	10.4
2019	98.4	22	385.7	19.1	61.1	17.8	11.4
2020	99.2	21	1046.1	22.4	54.3	17.8	10.4

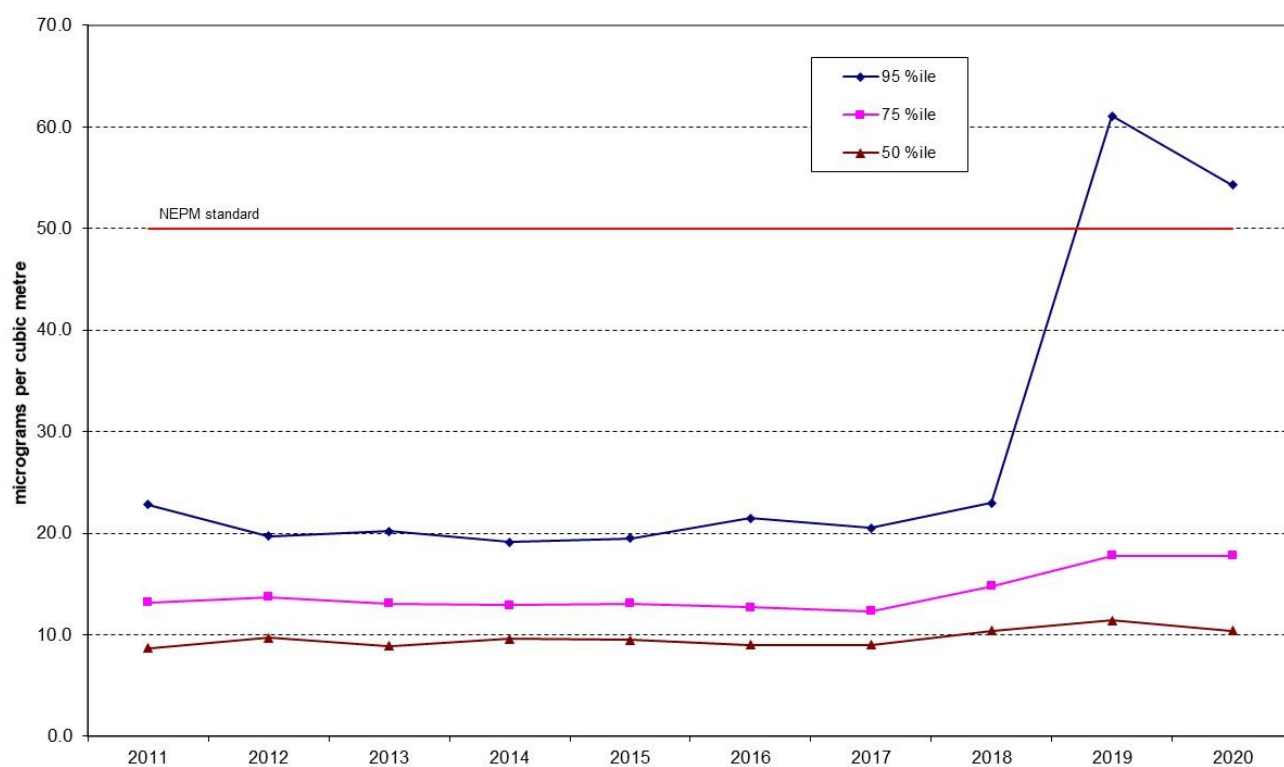


Figure 35: Statistical summary for daily PM₁₀ Monash 2011 – 2020

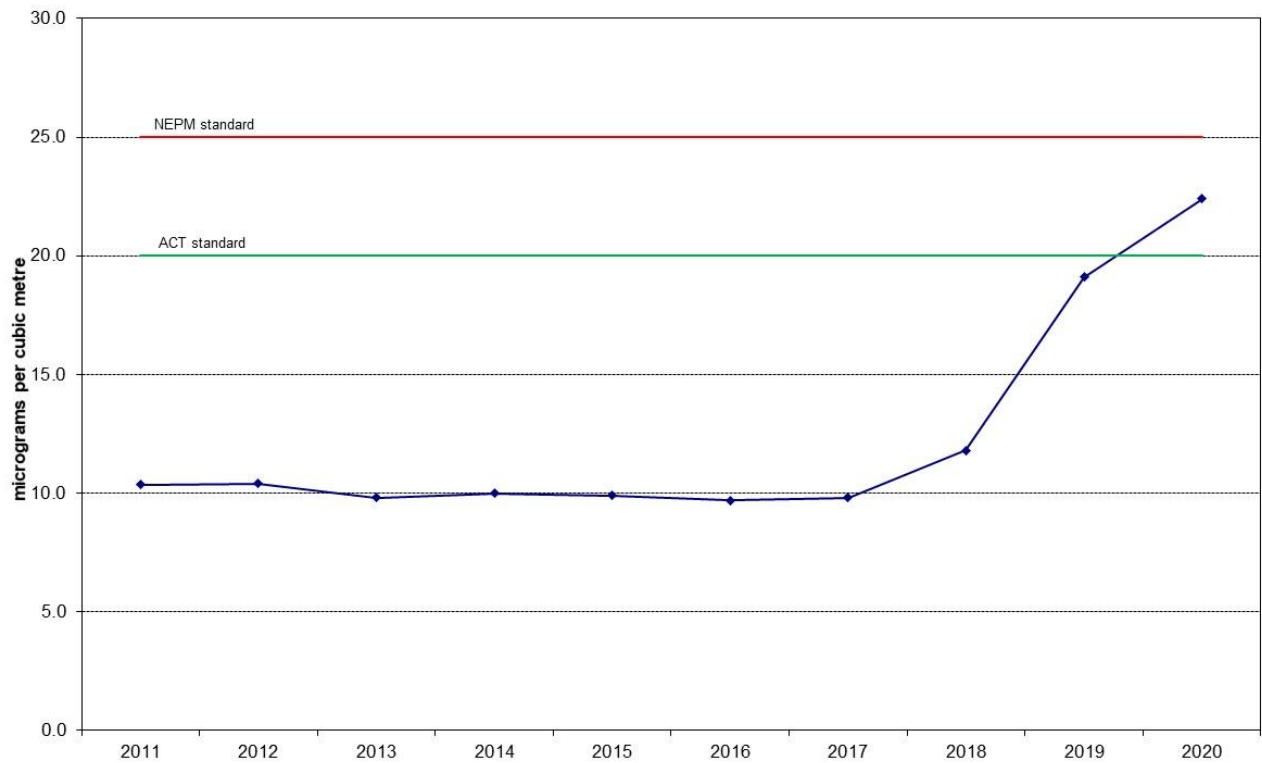


Figure 36: Annual average daily PM₁₀ Monash 2011 – 2020

Table 26: Statistical summary for daily maximum daily PM₁₀ Civic 2011 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m³)	Annual average (µg/m³)	95 th percentile (µg/m³)	75 th percentile (µg/m³)	50 th percentile (µg/m³)
2011	97.0	0	29.2	8.7	16.9	11.0	7.9
2012	95.1	0	49.5	9.4	17.0	12.1	8.7
2013	92.9	1	57.8	9.7	19.9	12.0	8.6
2014	95.1	0	31.4	9.8	17.7	12.6	9.3
2015	97.5	1	64.3	11.1	20.9	14.1	10.4
2016	100	0	36.6	10.7	20.6	14.3	9.7
2017	83.6	1	53.0	9.68	10.8	7.1	5.2
2018	97.8	1	179.8	13.5	24.1	16.1	11.3
2019	97.3	29	390.2	22.9	82.5	19.5	12.7
2020	98.4	24	994.9	21.7	56.7	15.2	10.0

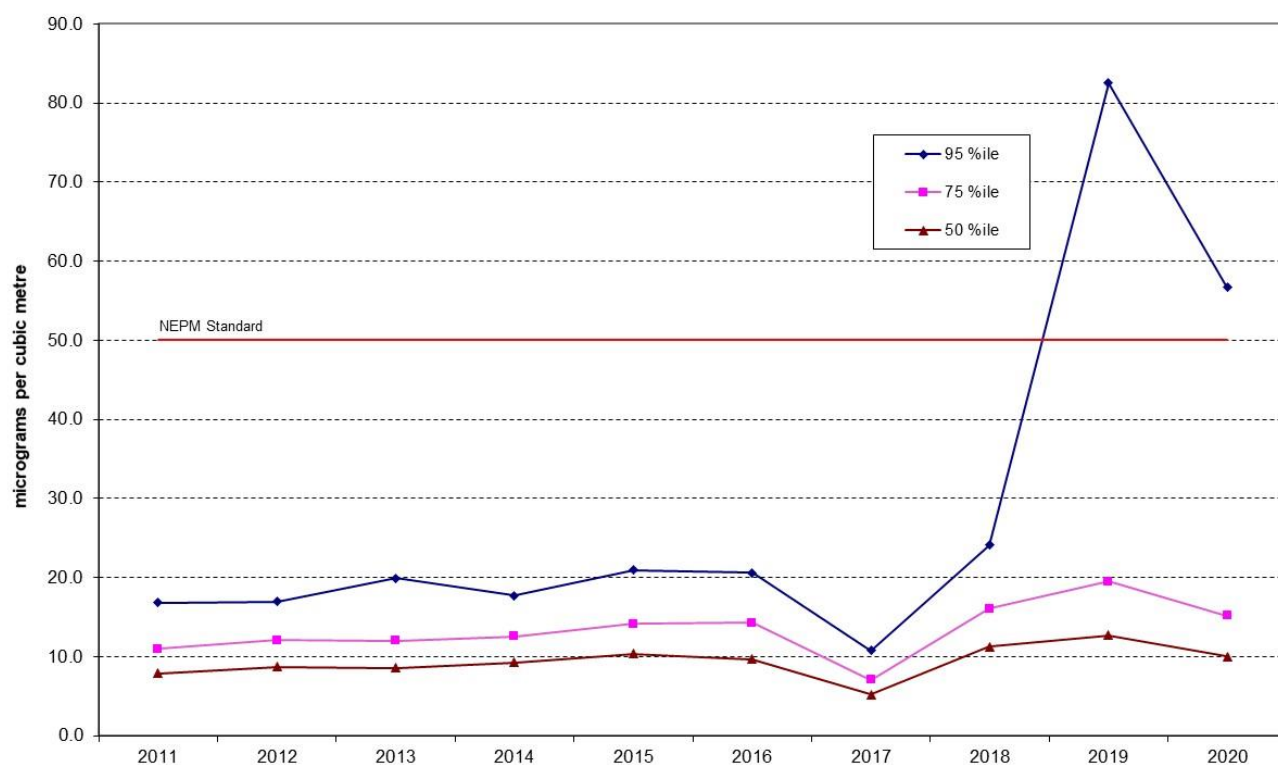


Figure 37: Statistical summary for daily PM₁₀ Civic 2011 – 2020

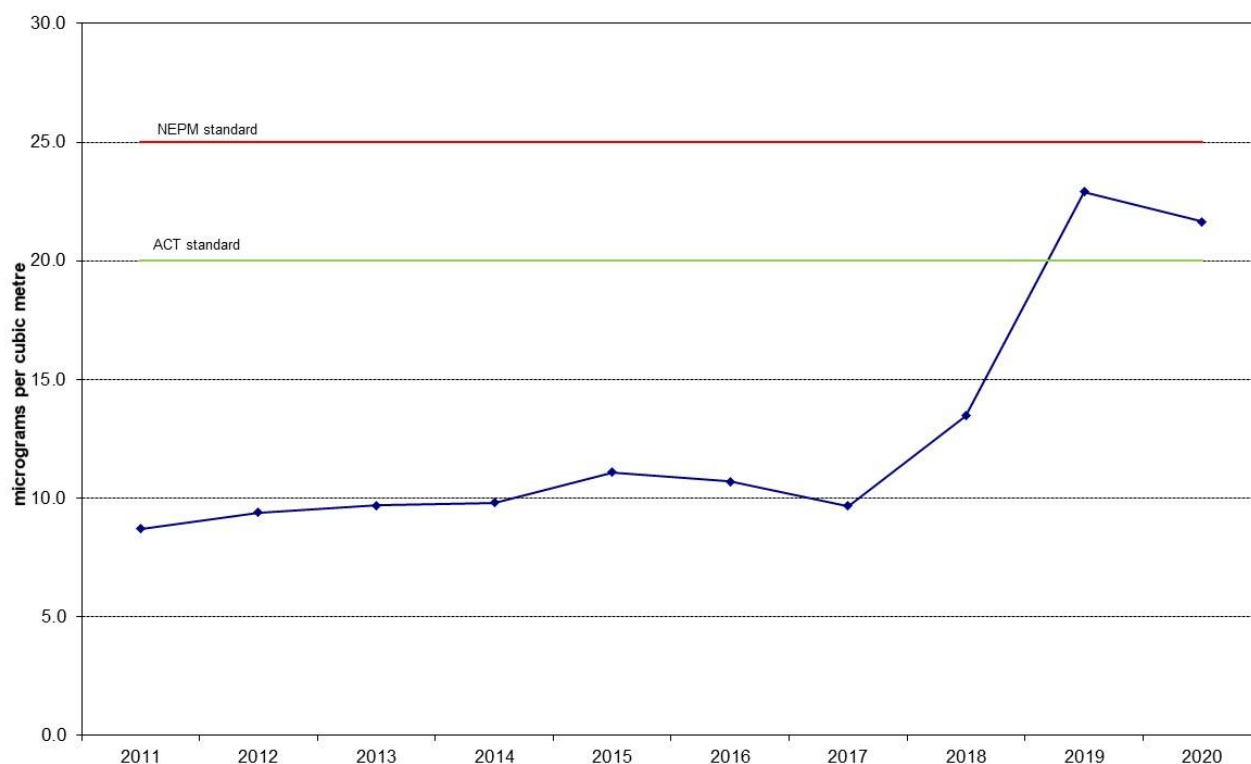


Figure 38: Annual average daily PM₁₀ Civic 2011 – 2020

Table 27: Statistical summary for daily maximum daily PM₁₀ Florey 2014 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m ³)	Annual average (µg/m ³)	95 th percentile (µg/m ³)	75 th percentile (µg/m ³)	50 th percentile (µg/m ³)
2014	83.3	0	30.2	10.4	21.5	13.0	9.4
2015	95.6	0	70.8	10.7	21.8	13.7	9.4
2016	98.9	0	28.8	10.1	20.6	13.1	9.2
2017	98.4	0	28.1	9.84	21.8	12.8	8.5
2018	89.9	3	158.6	12.0	23.8	15.3	10.1
2019	98.1	28	379.7	23.8	96.8	20.6	13.4
2020	99.5	21	1075.5	22.8	57.5	17.9	10.9

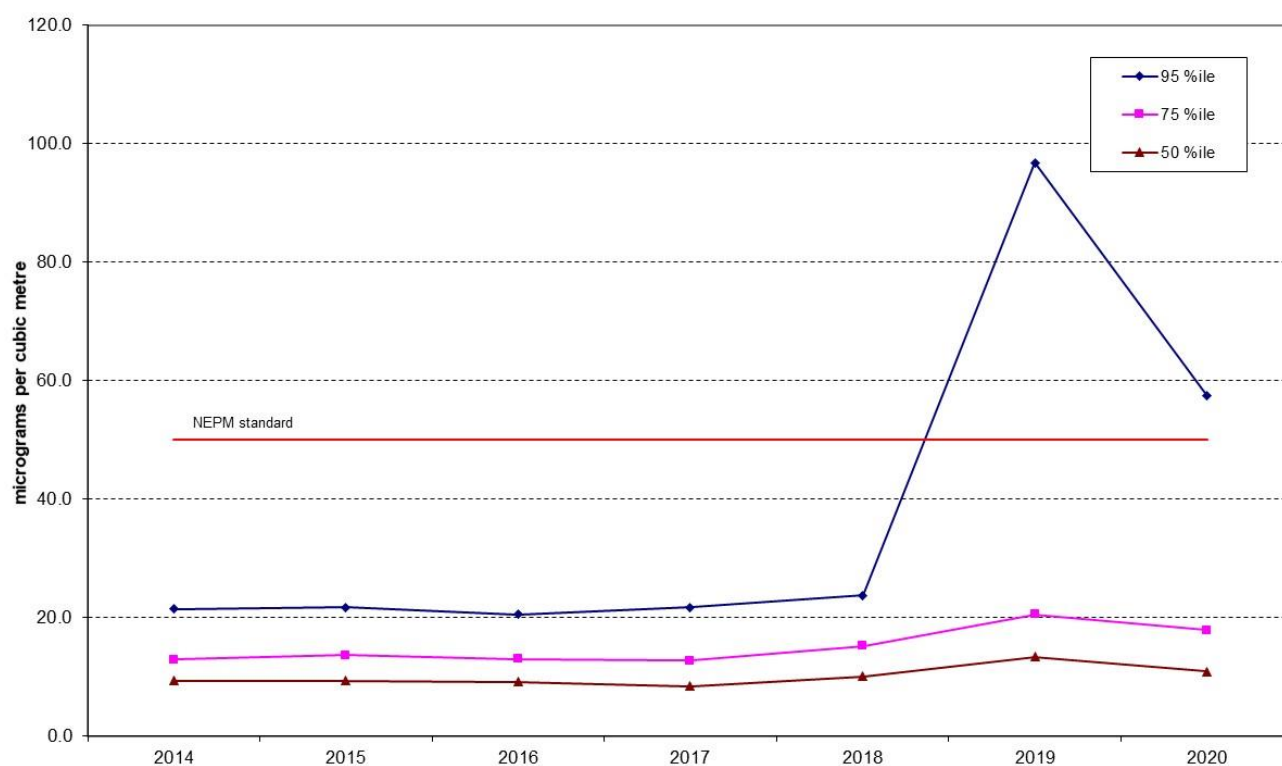


Figure 39: Statistical summary for daily PM₁₀ Florey 2014 – 2020

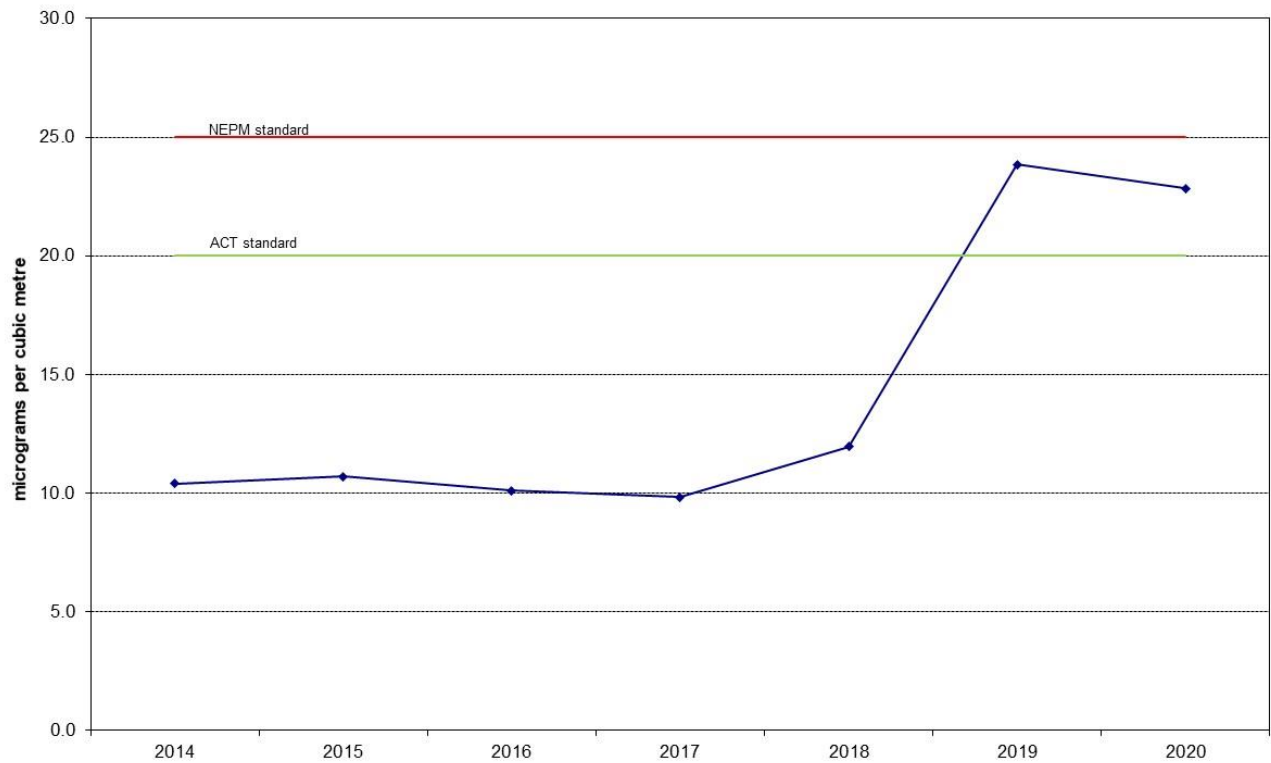


Figure 40: Annual average daily PM₁₀ Florey 2014 – 2020

PM_{2.5}

Table 28: Statistical summary for daily maximum daily PM_{2.5} Monash 2011 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m³)	Annual average (µg/m³)	95 th percentile (µg/m³)	75 th percentile (µg/m³)	50 th percentile (µg/m³)
2011	92.1	4	32.8	6.5	20.0	7.0	4.5
2012	95.1	3	29.2	7.1	16.5	8.3	5.0
2013	98.6	6	38.4	6.9	19.2	8.1	5.2
2014	87.7	4	31.5	6.8	18.7	8.6	5.6
2015	96.4	6	33.8	7.4	19.0	8.2	5.6
2016	98.1	8	32.7	7.4	20.7	8.2	5.4
2017	98.6	12	35.2	7.7	22.5	9.3	5.3
2018	99.2	2	32.0	6.8	19.2	8.6	5.3
2019	98.9	28	307.9	14.1	42.7	12.5	7.2
2020	98.6	37	1146.5	17.9	38.4	11.3	5.7

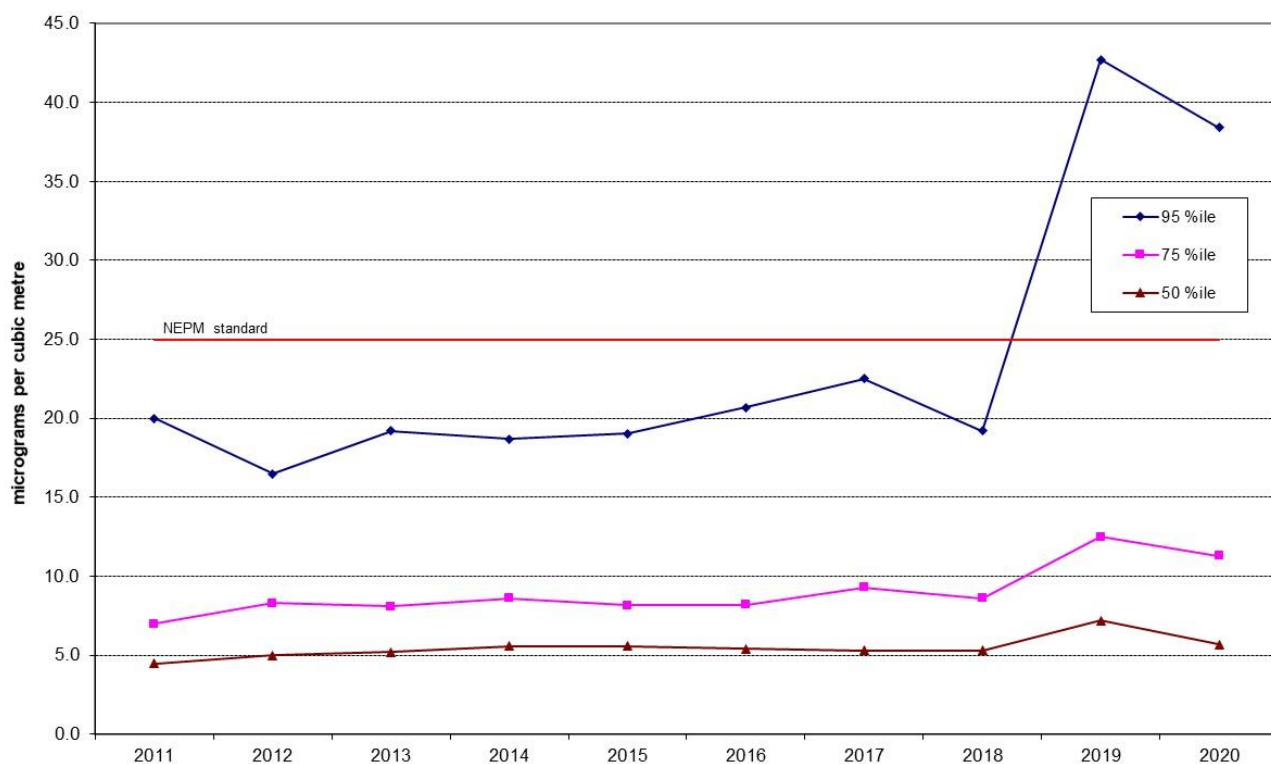


Figure 41: Statistical summary for daily PM_{2.5} Monash 2011 – 2020

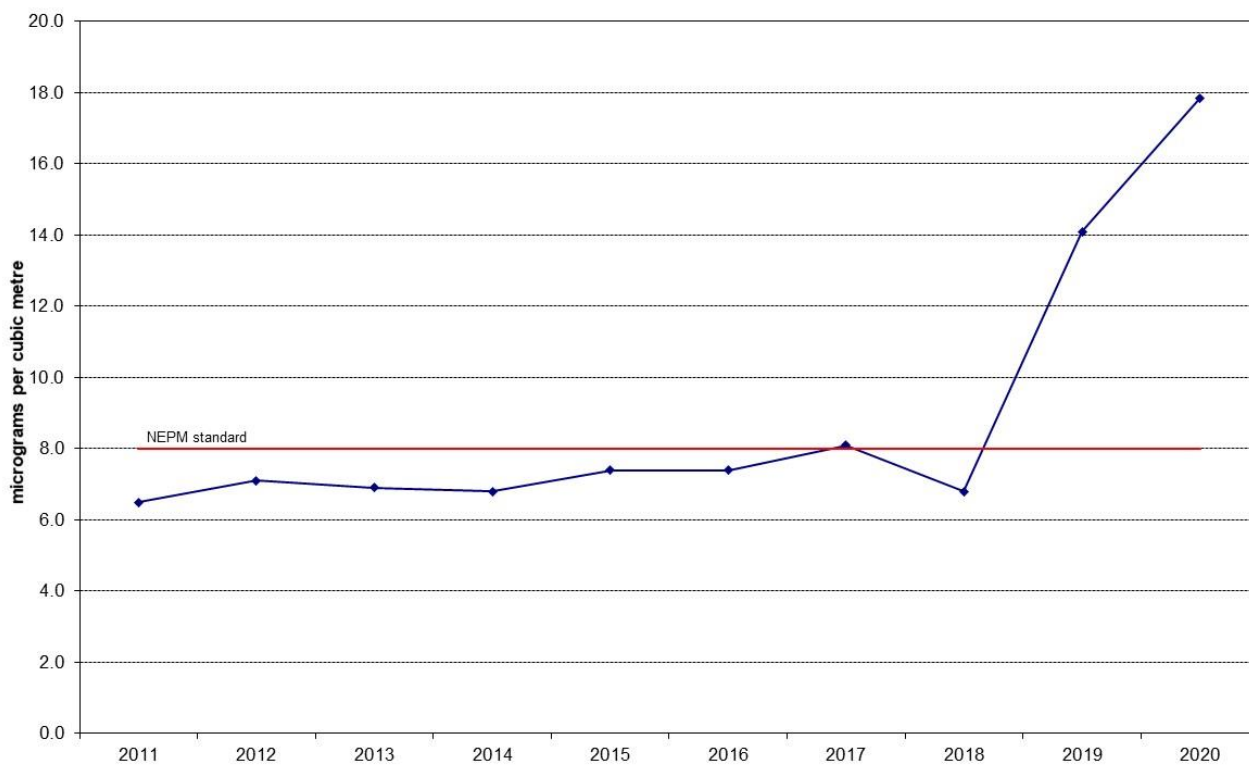


Figure 42: Annual average daily PM_{2.5} Monash 2011 – 2020

Table 29: Statistical summary for daily maximum daily PM_{2.5} Civic 2016 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m ³)	Annual average (µg/m ³)	95 th percentile (µg/m ³)	75 th percentile (µg/m ³)	50 th percentile (µg/m ³)
2016	98.6	0	22.1	5.5	11.0	7.1	4.8
2017	94.2	1	53.8	5.9	10.8	7.1	5.2
2018	98.6	1	36.1	6.5	12.1	8.1	6.1
2019	96.4	29	390.2	22.9	82.5	19.5	12.7
2020	99.2	18	872.6	12.9	24.8	7.6	5.1

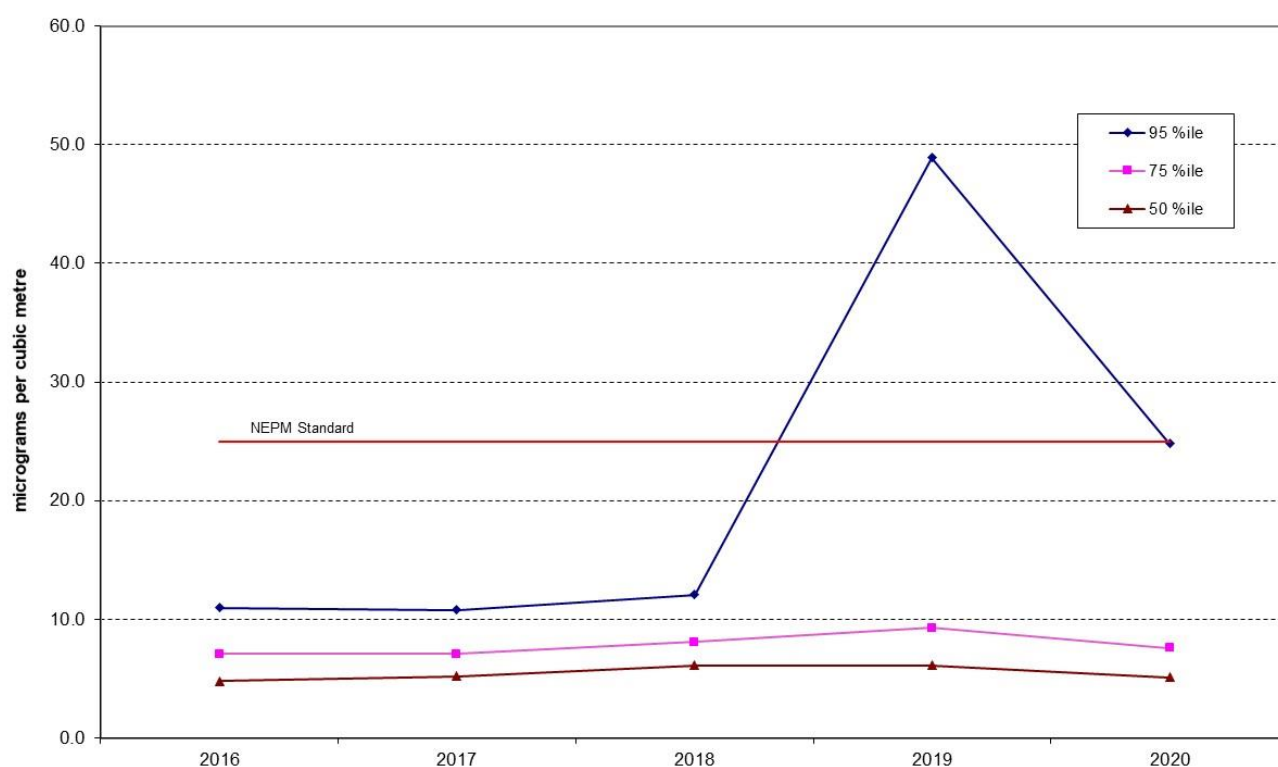


Figure 43: Statistical summary for daily PM_{2.5} Civic 2016 – 2020

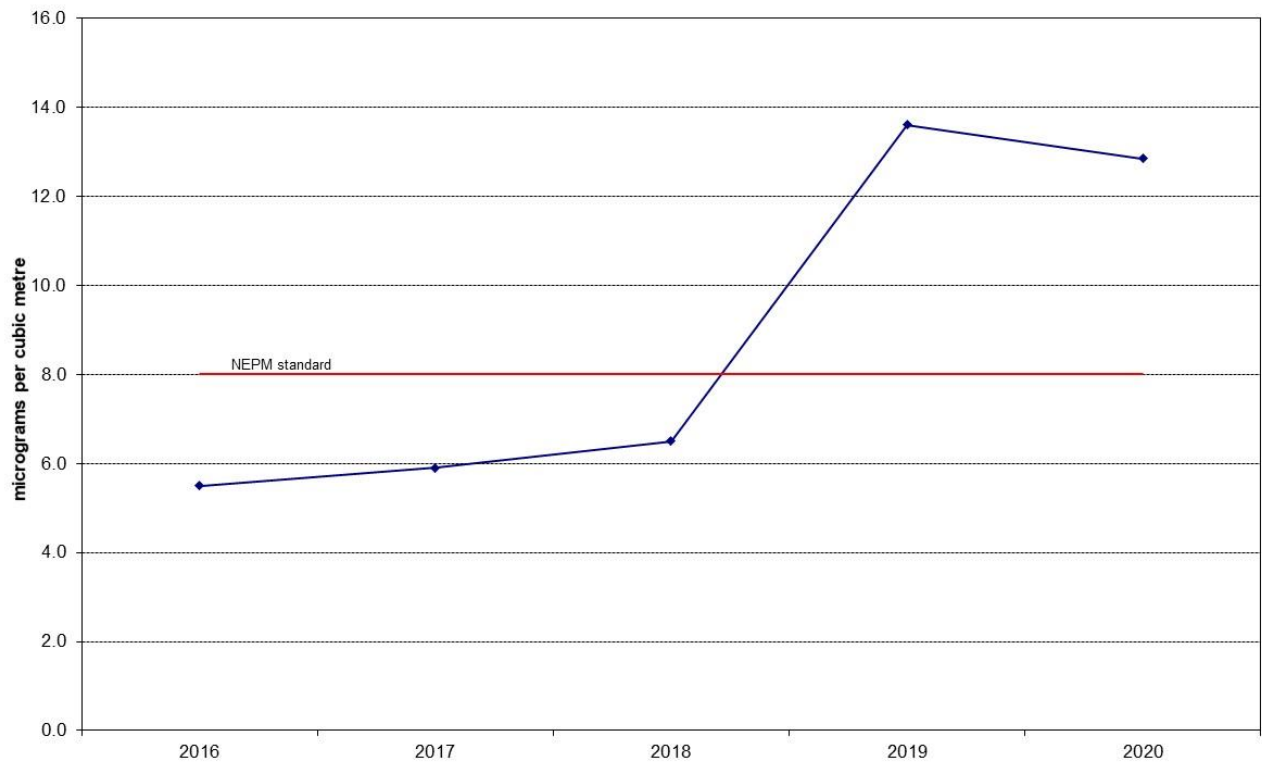


Figure 44: Annual average daily PM_{2.5} Civic 2016 – 2020

Table 30: Statistical summary for daily maximum daily PM_{2.5} Florey 2014 – 2020

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m³)	Annual average (µg/m³)	95 th percentile (µg/m³)	75 th percentile (µg/m³)	50 th percentile (µg/m³)
2014	74.2	0	22.8	5.8	15.0	7.1	4.9
2015	96.2	0	24.3	6.5	17.1	7.4	4.8
2016	98.6	1	27.2	7.3	17.4	8.6	5.8
2017	94.2	0	23.8	7.2	17.9	8.7	5.6
2018	97.3	2	26.4	7.4	17.0	8.7	5.9
2019	98.4	29	319.6	14.8	46.9	12.3	7.2
2020	97.3	25	983.4	16.9	28.8	12.2	5.9

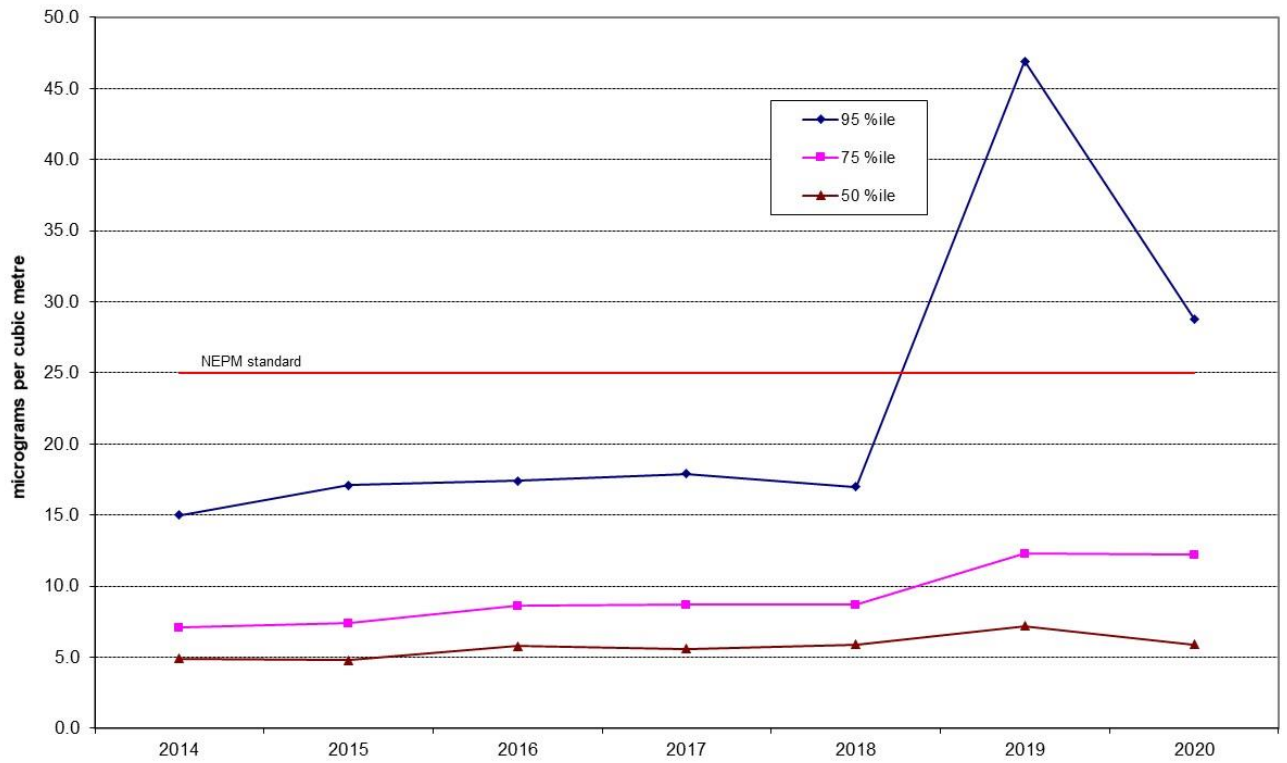


Figure 45: Statistical summary for daily PM_{2.5} Florey 2014 – 2020

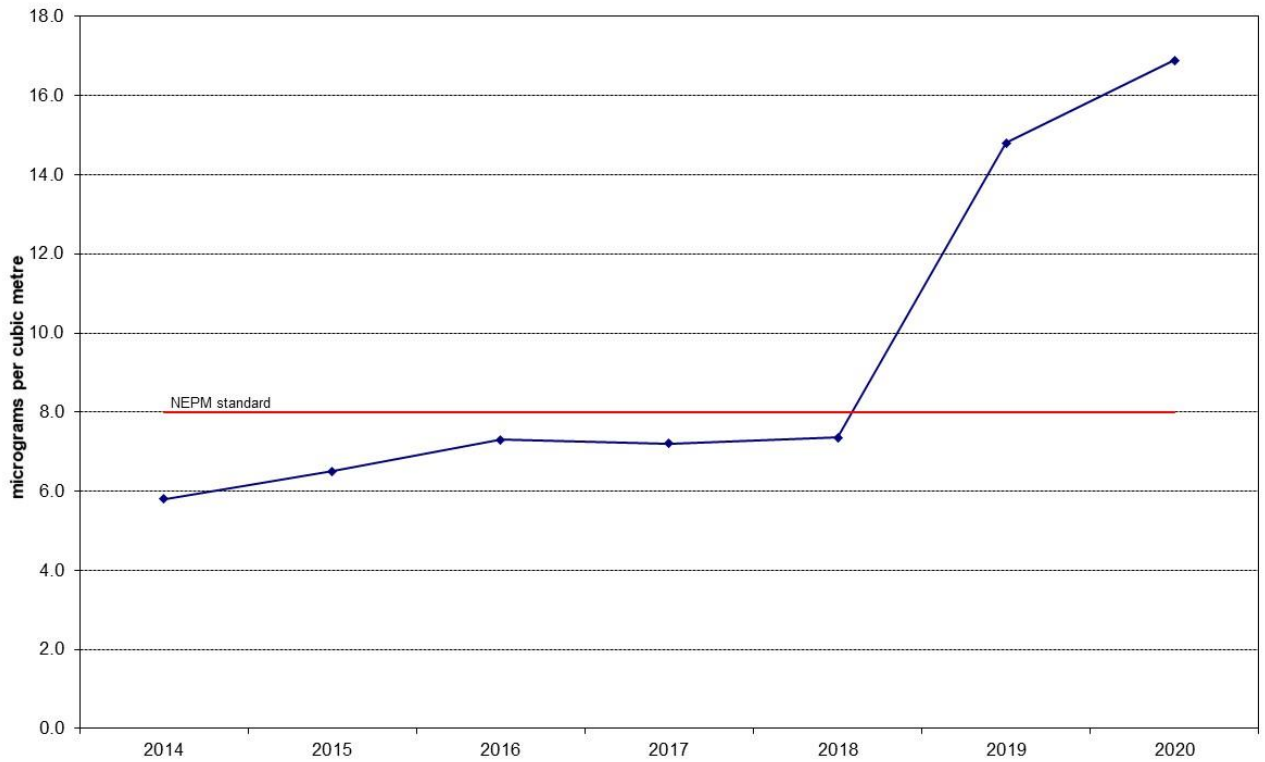


Figure 46: Annual average daily PM_{2.5} Florey 2014 – 2020

APPENDIX A Exceedance Summary

Table 31: PM₁₀ Daily Exceedances in 2020

Date	Monitoring Station			Inferred Cause	Exceptional Event
	Monash (µg/m ³)	Civic (µg/m ³)	Florey (µg/m ³)		
01/01/2020	1046.1	881.8	857.3	Bushfire	Yes
02/01/2020	453.6	462.8	451.9	Bushfire	Yes
03/01/2020	188.3	127.6	156.1	Bushfire	Yes
04/01/2020	206.7	277.5	328.1	Bushfire	Yes
05/01/2020	759.0	994.9	1075.5	Bushfire	Yes
07/01/2020	65.7	68.5	71.3	Bushfire	Yes
08/01/2020	145.2	137.3	142.7	Bushfire	Yes
10/01/2020	65.6	76.4	75.0	Bushfire	Yes
11/01/2020	96.2	115.7	115.6	Bushfire	Yes
12/01/2020	89.6	109.6	110.7	Bushfire	Yes
13/01/2020	74.8	85	82.7	Bushfire	Yes
14/01/2020	54.5	64.4	61.3	Bushfire	Yes
16/01/2020	62.6			Bushfire	Yes
17/01/2020		51.3	53.7	Bushfire	Yes
23/01/2020	84.8	150	144.4	Dust Storm	Yes
24/01/2020	52.6	70.9	63.5	Dust Storm	Yes
25/01/2020		59.4	58.2	Dust Storm	Yes
26/01/2020	86.5	56.4		Bushfire	Yes
27/01/2020	112.4	77.8	64.6	Bushfire	Yes
28/01/2020	69.3			Bushfire	Yes
29/01/2020	92.8	63		Bushfire	Yes
30/01/2020		54.4		Bushfire	Yes
31/01/2020	51.9	51.5	52.0	Bushfire	Yes
01/02/2020	98.7	114.8	119.5	Bushfire	Yes
02/02/2020		54		Bushfire Dust Storm	Yes
03/02/2020		56	58.8	Bushfire Dust Storm	Yes
04/02/2020			60.2	Bushfire Dust Storm	Yes

Table 32: PM_{2.5} Daily Exceedances in 2020

Date	Monitoring Station			Inferred Cause	Exceptional Event
	Monash (µg/m ³)	Civic (µg/m ³)	Florey (µg/m ³)		
01/01/2020	1146.5	827.1	839.1	Bushfire	Yes
02/01/2020	495.0		439.4	Bushfire	Yes
03/01/2020	188.2		130.2	Bushfire	Yes
04/01/2020	159.3	213.8	258.5	Bushfire	Yes
05/01/2020	783.6	872.6	983.4	Bushfire	Yes
06/01/2020	29.8		27.1	Bushfire	Yes
07/01/2020	56.7	46.4	48.5	Bushfire	Yes
08/01/2020	140.5	103.8	121.0	Bushfire	Yes
10/01/2020	28.6			Bushfire	Yes
11/01/2020	88.6	91.3	92.4	Bushfire	Yes
12/01/2020	82.2	92.6	102.2	Bushfire	Yes
13/01/2020	74.5	76.1		Bushfire	Yes
14/01/2020	54.7	42.4	48.1	Bushfire	Yes
15/01/2020	31.8			Bushfire	Yes
16/01/2020	64.0			Bushfire	Yes
17/01/2020	35.2	50.2	52.4	Bushfire	Yes
26/01/2020	74.8	26.0		Bushfire	Yes
27/01/2020	104.4	64.0	57.5	Bushfire	Yes
28/01/2020	61.5	34.8	30.5	Bushfire	Yes
29/01/2020	68.9	54.1	33.7	Bushfire	Yes
30/01/2020	39.9	34.1		Bushfire	Yes
31/01/2020	46.1		26.7	Bushfire	Yes
01/02/2020	27.2			Bushfire	Yes
03/02/2020		26.9	36.5	Bushfire	Yes
04/02/2020	27.9	38.2	50.1	Bushfire	Yes
05/20/2020	38.4	27.4	31.9	Bushfire	Yes
16/05/2020	31.83			Wood Heater	No
17/05/2020	26.93		26.3	Wood Heater	No
30/05/2020	28.5			Wood Heater	No
06/06/2020	31.2			Wood Heater	No
07/06/2020	35.3		30.8	Wood Heater	No
08/06/2020	27.0		25.1	Wood Heater	No
13/06/2020	25.6			Wood Heater	No
27/06/2020			28.6	Wood Heater	No
28/06/2020	27.0		26.3	Wood Heater	No
10/07/2020	28.4		25.9	Wood Heater	No
11/07/2020	27.8			Wood Heater	No
01/08/2020	27.9			Wood Heater	No
02/08/2020	28.8			Wood Heater	No

Table 33: Carbon Monoxide 8-hour Exceedances in 2020

Date	Monitoring Station		Inferred Cause
	Monash (ppm)	Florey (ppm)	
01/01/2020	22.00	13.76	Bushfire
05/01/2020	11.58	14.64	Bushfire

Table 34: Nitrogen Dioxide 1-hour Exceedances in 2020

Date	Monitoring Station	Inferred Cause
	Florey (ppm)	
04/01/2020	0.152	Bushfire
05/01/2020	0.171	Bushfire

Table 35: Ozone 1-hour and 4-hour Exceedances in 2020

Date	Monitoring Station						Inferred Cause
	Monash (ppm)		Civic (ppm)		Florey (ppm)		
	1 Hour	4 Hour	1 Hour	4 Hour	1 Hour	4 Hour	
01/01/2020	0.104	0.100		0.086	0.111	0.105	Bushfire
02/01/2020		0.093		0.082	0.118	0.108	Bushfire
07/01/2020		0.080				0.085	Bushfire
31/01/2020	0.104	0.087					Bushfire