

Australian Capital Territory  
**Air Quality Report  
2021**



**ACT**  
Government

**Access  
Canberra.**

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## 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 <sub>2</sub>	Nitrogen Dioxide
O <sub>3</sub>	Ozone
PMS	Performance Monitoring Station
PM <sub>2.5</sub>	Particles with an equivalent aerodynamic diameter less than or equal to 2.5 micrometres
PM <sub>10</sub>	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 <sub>2</sub>	Sulfur Dioxide
µg/m <sup>3</sup>	micrograms per cubic metre

## OVERVIEW

The ACT Air Quality Report 2021 ('the Report') presents the results of ambient air quality monitoring in the ACT for 2021 and assesses the results in accordance with the requirements of the National Environment Protection (Ambient Air Quality) Measure<sup>1</sup> (AAQ NEPM) made by the National Environment Protection Council on 26 June 1998.

On 18 May 2021 the AAQ NEPM was amended to update the ambient air quality pollutant concentration standards for nitrogen dioxide, sulfur dioxide and ozone. Several other changes were also made during this variation. The key amendments are detailed in the Section on "ASSESSMENT OF COMPLIANCE WITH STANDARDS AND GOAL".

Air quality in this Report is assessed against the revised 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<sub>10</sub>) against a lower standard of an annual average of 20 µg/m<sup>3</sup> rather than the 25 µg/m<sup>3</sup> standard. This means that it is reporting against a more stringent target than in the published national standard.

The ACT monitors four of the six NEPM pollutants:

- carbon monoxide (CO)
- nitrogen dioxide (NO<sub>2</sub>)
- photochemical oxidants as ozone (O<sub>3</sub>)
- particulate matter (as PM<sub>10</sub>, particles less than or equal to 10 microns in diameter and PM<sub>2.5</sub>, particles less than or equal to 2.5 microns in diameter).

The ACT does not monitor sulfur dioxide (SO<sub>2</sub>) as 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 2021 Report is:

- Canberra's air quality dramatically improved in 2021 compared to 2019 and 2020 due to the absence of bushfires and reduction of dust storms. There were no exceedances of the AAQ NEPM standards for carbon monoxide, nitrogen dioxide and ozone at any of the ACT's monitoring stations;
- Without the impacts from prolonged drought and unprecedented bushfires, the daily PM<sub>10</sub> standard was not exceeded in 2021, compared to 27 exceedance days in 2020 and 29 exceedance days in 2019;
- Annual average levels for particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) were at some of the lowest levels experienced in the past 10 years; and
- PM<sub>2.5</sub> was the only pollutant that exceeded the national standard. This was exceeded for 5 days in 2021, which were related to controlled burns in NSW and wood heater emissions in the ACT and occurred between late April and early July:

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<sup>1</sup> <http://www.nepc.gov.au/nepms/ambient-air-quality>

- Two exceedances (29 April and 30 April) were likely attributable to smoke from hazard reduction burns in NSW;
- One exceedance (1 May) was likely attributable to a combination of smoke from hazard reduction burns in NSW and wood heater use; and
- Two exceedances (21 May and 8 July) were likely attributable to smoke from wood heater use.

# 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 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; and
- 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 3580.1.1:2016 are listed in Table 1 below.

**Table 1: Summary of stations' siting compliance with AS 3580.1.1:2016**

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 and they fully comply with relevant standards.

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 PM<sub>10</sub> and PM<sub>2.5</sub>. Following the establishment of the Florey station on 28 February 2014, the Civic station only monitors selected, key pollutants, including ozone and particles as PM<sub>10</sub> and PM<sub>2.5</sub>.

## 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**

<b>Pollutant</b>	<b>Standard</b>	<b>Title</b>	<b>Method Used</b>
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 <sub>10</sub>	AS/NZS 3580.9.11-2016	Method for sampling and analysis of ambient air Method – Determination of suspended particles matter – PM <sub>10</sub> beta attenuation monitors	Beta Attenuation Monitor
PM <sub>2.5</sub>	AS/NZS 3580.9.12:2013	Methods for sampling and analysis of ambient air - Method 9.12: Determination of suspended particulate matter - PM <sub>2.5</sub> 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 GOAL

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 4).

On 18 May 2021, the AAQ NEPM was amended to introduce the new national standards for  $\text{NO}_2$ ,  $\text{SO}_2$  and  $\text{O}_3$ <sup>2</sup>. The amendment, taking into account the latest scientific evidence about the health impacts, primarily includes:

- significantly strengthen  $\text{NO}_2$  reporting standards for 1-hour and 1-year averaging periods;
- establish a new  $\text{O}_3$  standard with an 8-hour averaging period that reflects the health evidence;
- significantly strengthen  $\text{SO}_2$  reporting standards for 1-hour and 24-hour averaging periods;
- remove annual  $\text{SO}_2$  and 1-hour and 4-hour  $\text{O}_3$  averaging periods to align the standards with the recent health evidence;
- remove single day exceedances allowed for all gaseous pollutants; and
- apply the existing exceptional events rule  $\text{O}_3$  given the linkages between elevated  $\text{O}_3$  levels and fire events.

While the amended AAQ NEPM took effect partway through the year during 2021, air quality in this Report is assessed against the new and more stringent national standards for the whole year. The goal of the AAQ NEPM is to achieve the NEPM standards specified in Schedule 2 of the AAQ NEPM.

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<sup>2</sup> <http://www.nepc.gov.au/nepms/ambient-air-quality/variation-ambient-air-quality-nepm-ozone-nitrogen-dioxide-and-sulfur>

**Table 3: AAQ NEPM standards in 2021**

<b>Pollutant</b>	<b>Averaging Period</b>	<b>Old NEPM Standards</b>	<b>New NEPM Standards</b>	<b>Change</b>
Carbon monoxide	8 hours	9.0 ppm	<b>9.0 ppm</b>	No change
Nitrogen dioxide	1 hour	0.12 ppm	<b>0.08 ppm</b>	Strengthened
	1 year	0.03 ppm	<b>0.015 ppm</b>	Strengthened
Photochemical oxidants (as ozone)	1 hour	0.10 ppm	-	Removed
	4 hours	0.08 ppm	-	Removed
	8 hours		<b>0.065 ppm</b>	Established
Sulfur dioxide	1 hour	0.20 ppm	<b>0.10 ppm</b>	Strengthened
	1 day	0.08 ppm	<b>0.02 ppm</b>	Strengthened
	1 year	0.02 ppm		Removed
Lead	1 year	0.50 µg/m <sup>3</sup>	<b>0.50 µg/m<sup>3</sup></b>	No change
Particles as PM <sub>10</sub>	1 day	50 µg/m <sup>3</sup>	<b>50 µg/m<sup>3</sup></b>	No change
	1 year	25 µg/m <sup>3</sup>	<b>25 µg/m<sup>3</sup></b>	No change
Particles as PM <sub>2.5</sub>	1 day	25 µg/m <sup>3</sup>	<b>25 µg/m<sup>3</sup></b>	No change
	1 year	8 µg/m <sup>3</sup>	<b>8 µg/m<sup>3</sup></b>	No change

In accordance with its agreed policy position, the ACT assesses its compliance for the annual average for PM<sub>10</sub> against a lower standard of 20 µg/m<sup>3</sup> rather than the AAQ NEPM standard of 25 µg/m<sup>3</sup>. There is an additional goal to further reduce PM<sub>2.5</sub> concentrations to below a daily concentration of 20 µg/m<sup>3</sup> and an annual concentration of 7 µg/m<sup>3</sup> by 2025.

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 (i.e. '*MET*') if the maximum recorded concentration is no more than the standard 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 (i.e. '*NOT MET*') if the maximum recorded concentration is more than the standard specified in Table 3.

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

For the purpose of reporting compliance against PM<sub>10</sub> and PM<sub>2.5</sub> daily average standards, monitoring data that has been determined as being directly associated with an exceptional event has been excluded in accordance with the AAQ NEPM.

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

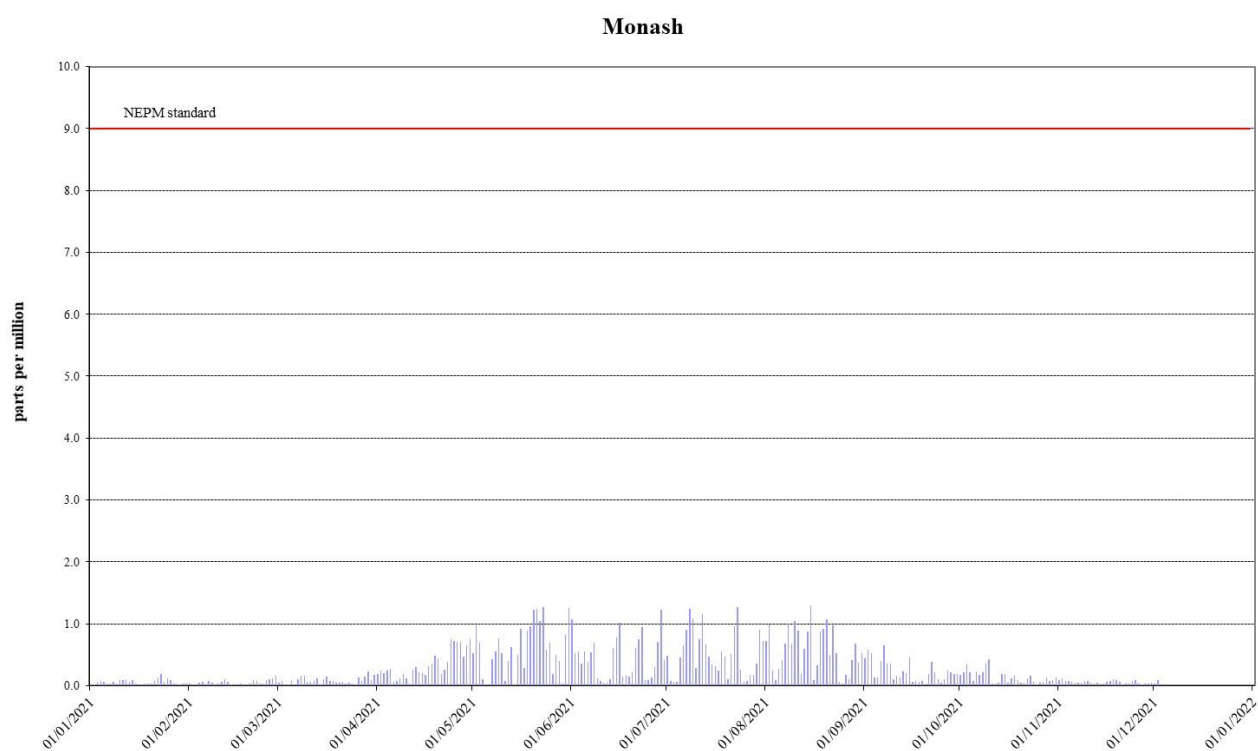
## Carbon monoxide

During 2021, no exceedances of the carbon monoxide standard were recorded and compliance was demonstrated at Florey. Due to instrument failure, there was insufficient data collected in the fourth quarter at Monash. As a result, compliance was not demonstrated at Monash.

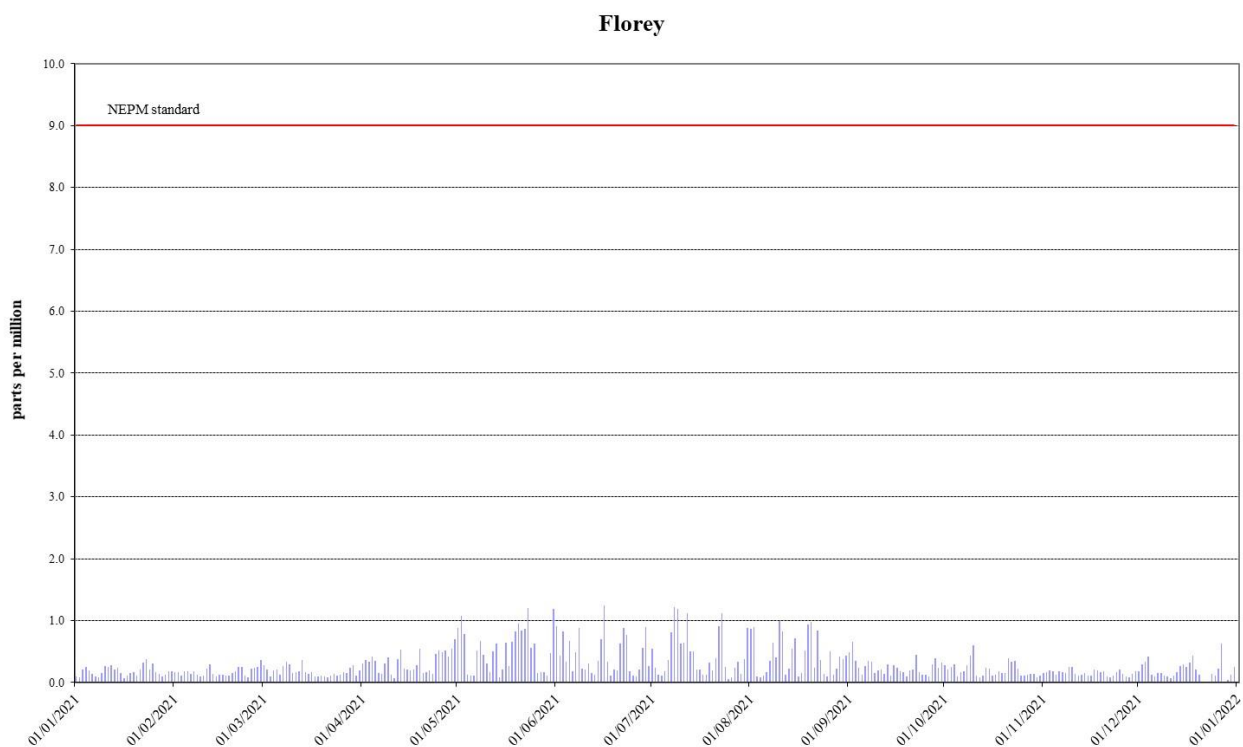
**Table 4: 2021 compliance summary for CO**

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	95.7	95.7	95.6	66.0	88.2	0	ND
Florey	95.8	95.8	95.7	93.4	95.2	0	MET



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



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

## Nitrogen dioxide

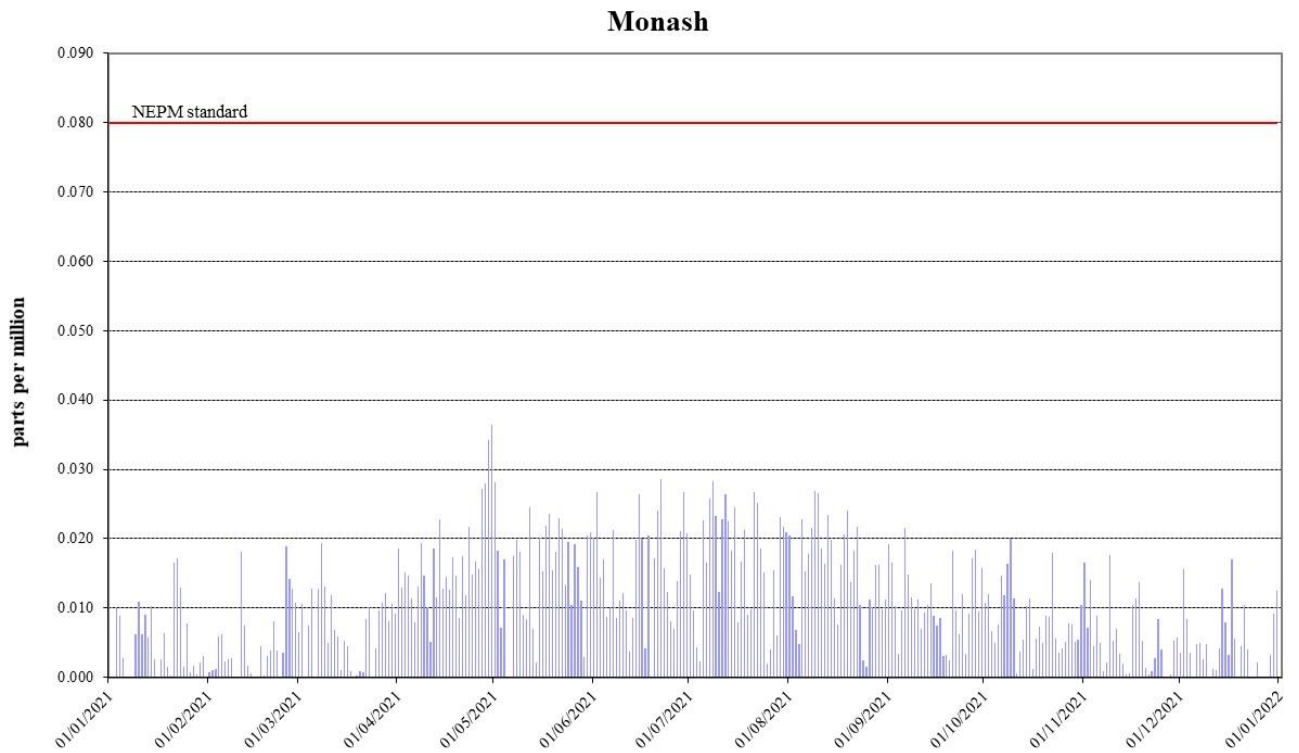
During 2021, no exceedances of the nitrogen dioxide standards were recorded and compliance was demonstrated at Monash and Florey.

The annual average levels remained low and met the standard at Monash and Florey.

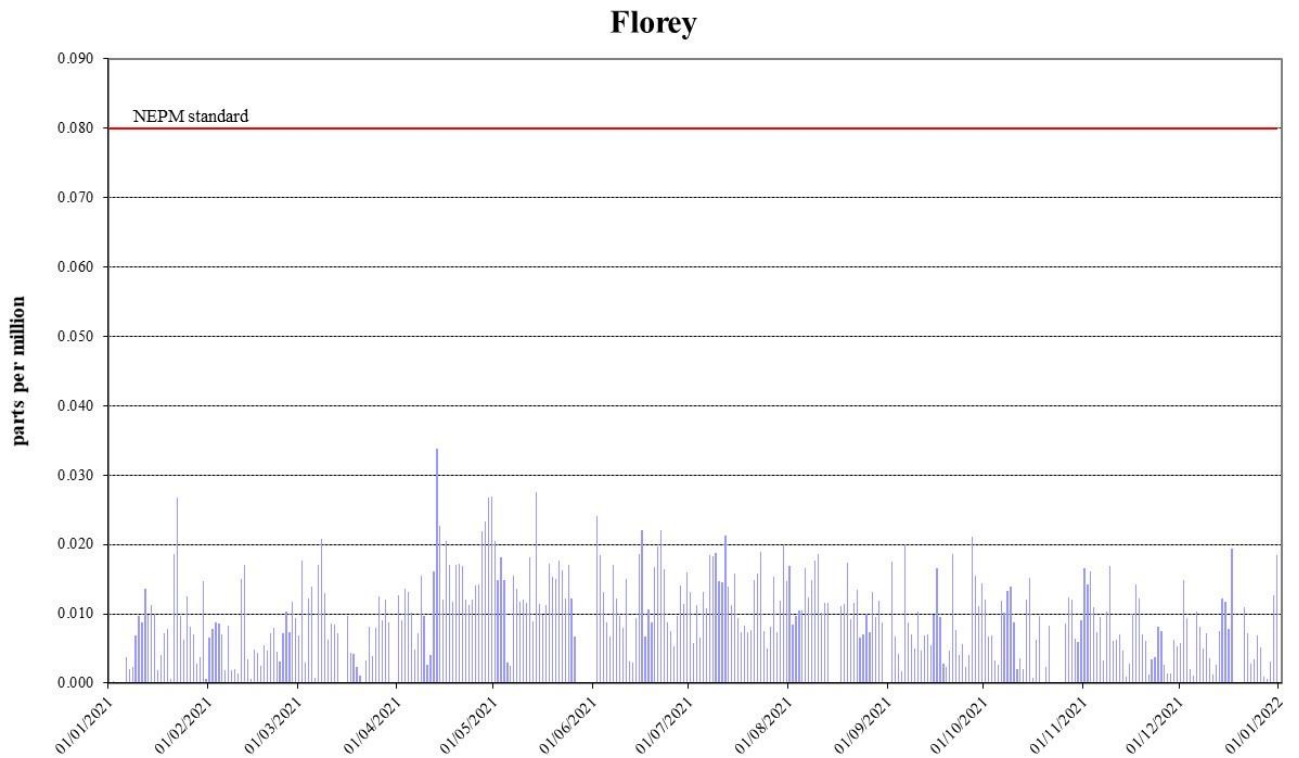
**Table 5: 2021 compliance summary for NO<sub>2</sub>**

AAQ NEPM standard – 0.08 ppm (1-hour average), 0.015 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	95.7	95.7	95.6	95.7	95.7	0	MET	0.003	MET
Florey	92.1	92.3	91.9	90.2	91.6	0	MET	0.004	MET



**Figure 3: Daily maximum for NO<sub>2</sub> 1-hour average – Monash**



**Figure 4: Daily maximum for NO<sub>2</sub> 1-hour average – Florey**



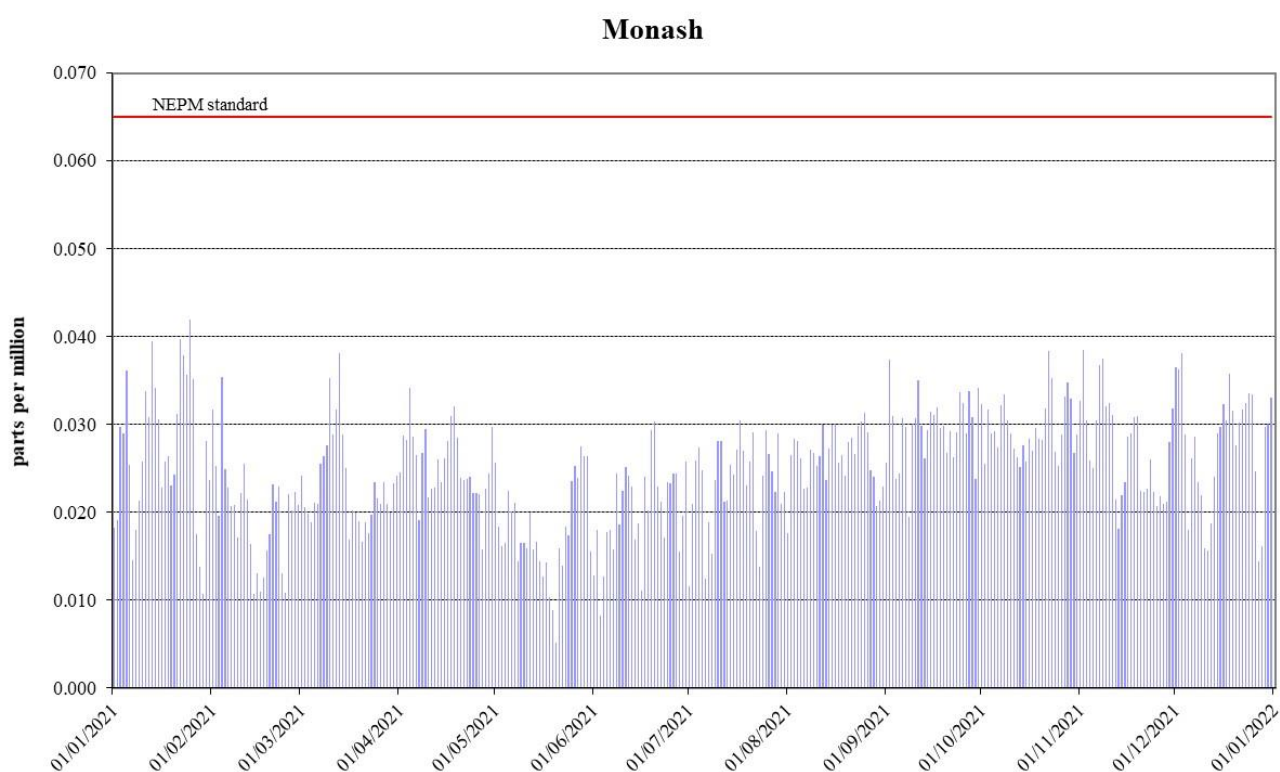
## Ozone

During 2021, no exceedances of the 8-hour standard for ozone were recorded and compliance was demonstrated at all monitoring stations.

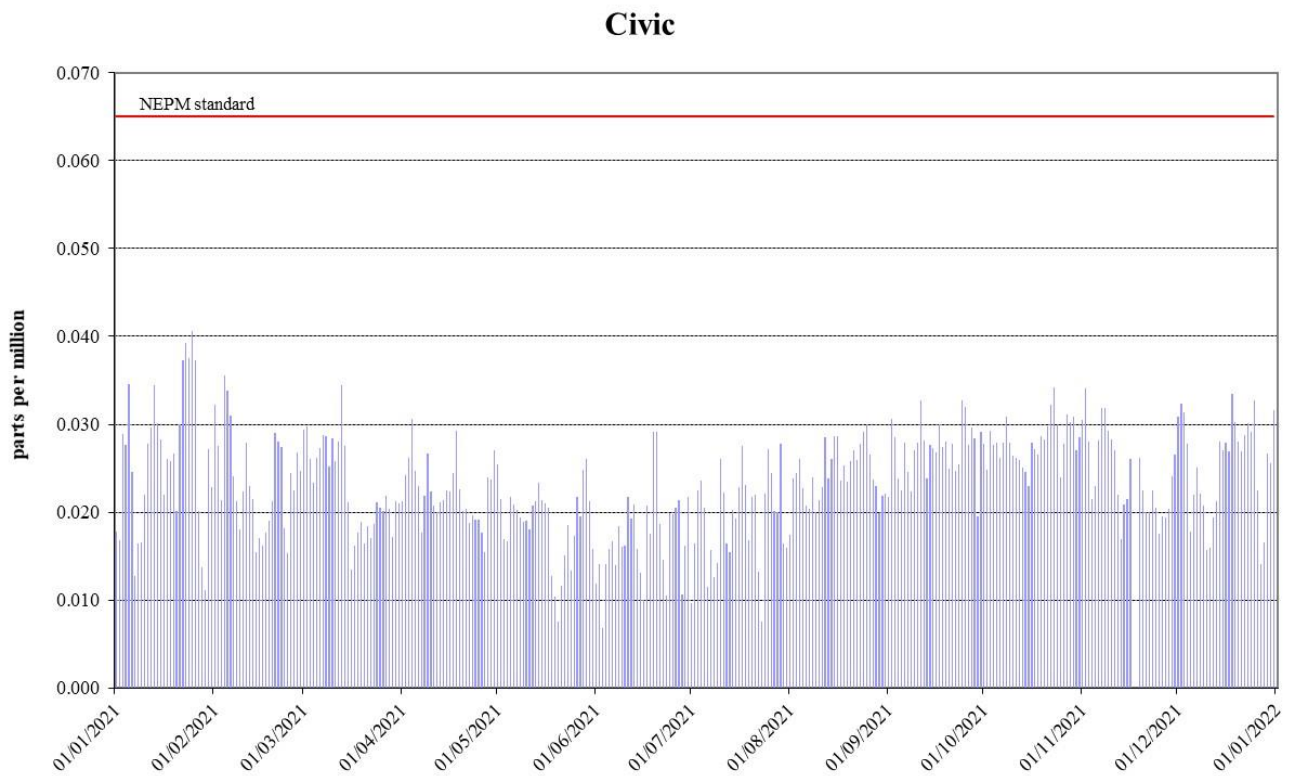
**Table 6: 2021 compliance summary for O<sub>3</sub>**

AAQ NEPM standard – 0.065 ppm (8-hour average)

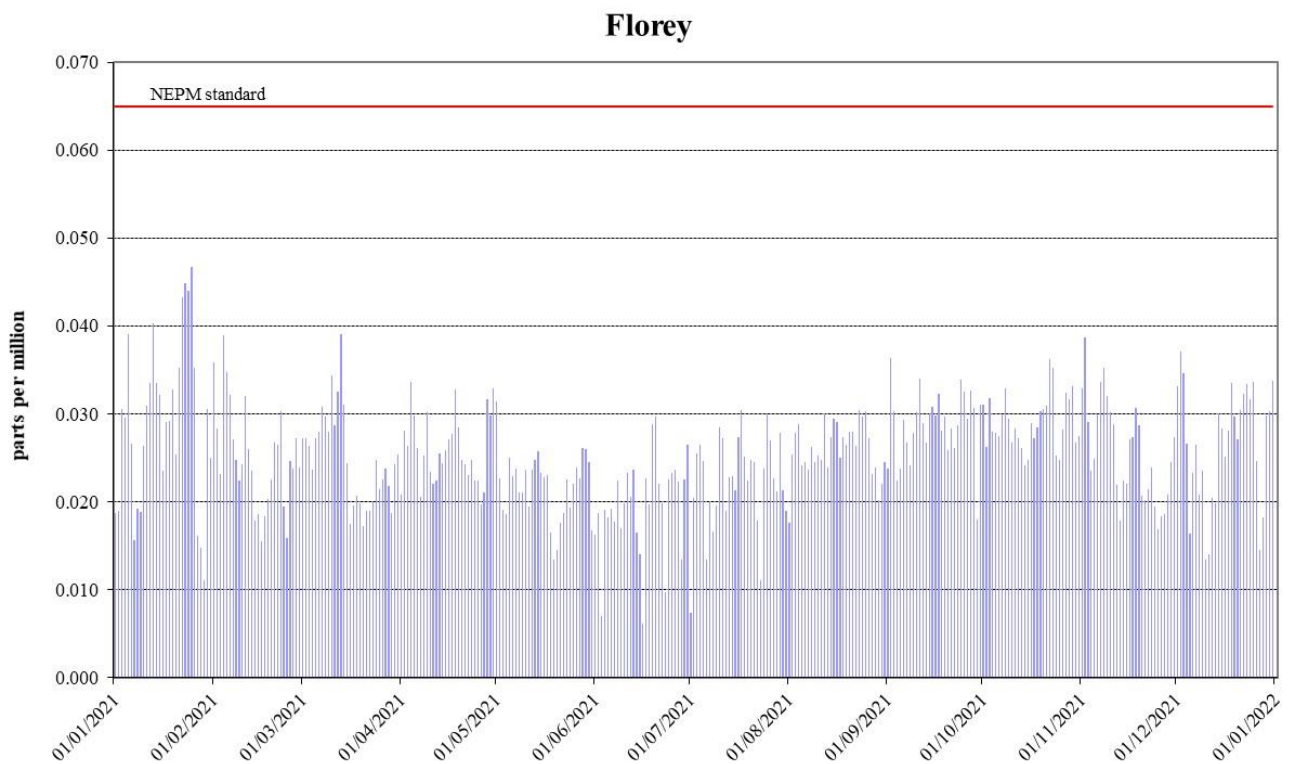
Monitoring station	Data availability rates (% of hours)					Number of exceedances	NEPM goal compliance
	Q1	Q2	Q3	Q4	Annual		
Monash	95.7	95.7	95.8	95.7	95.7	0	MET
Civic	95.8	95.8	95.8	94.6	95.5	0	MET
Florey	95.8	95.8	95.8	95.8	95.8	0	MET



**Figure 5: Daily maximum for O<sub>3</sub> 8-hour average – Monash**



**Figure 6: Daily maximum for O<sub>3</sub> 8-hour average – Civic**



**Figure 7: Daily maximum for O<sub>3</sub> 8-hour average – Florey**

## PM<sub>10</sub>

During 2021, no exceedances of the daily PM<sub>10</sub> standard were recorded and compliance was demonstrated at all monitoring stations.

The annual average PM<sub>10</sub> levels at all stations met the ACT policy position of 20 µg/m<sup>3</sup>.

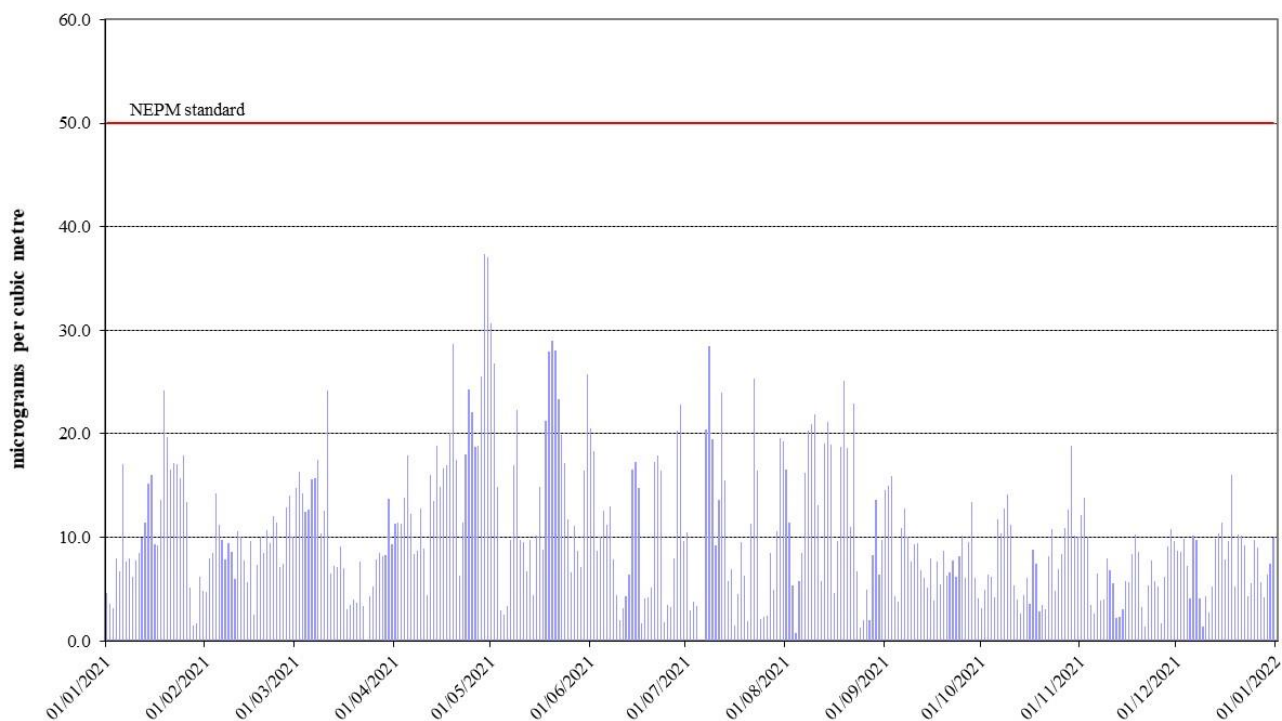
**Table 7: 2021 compliance summary for PM<sub>10</sub>**

AAQ NEPM standard 50 µg/m<sup>3</sup> 1-day average, 20 µg/m<sup>3</sup> (1-year average)\*

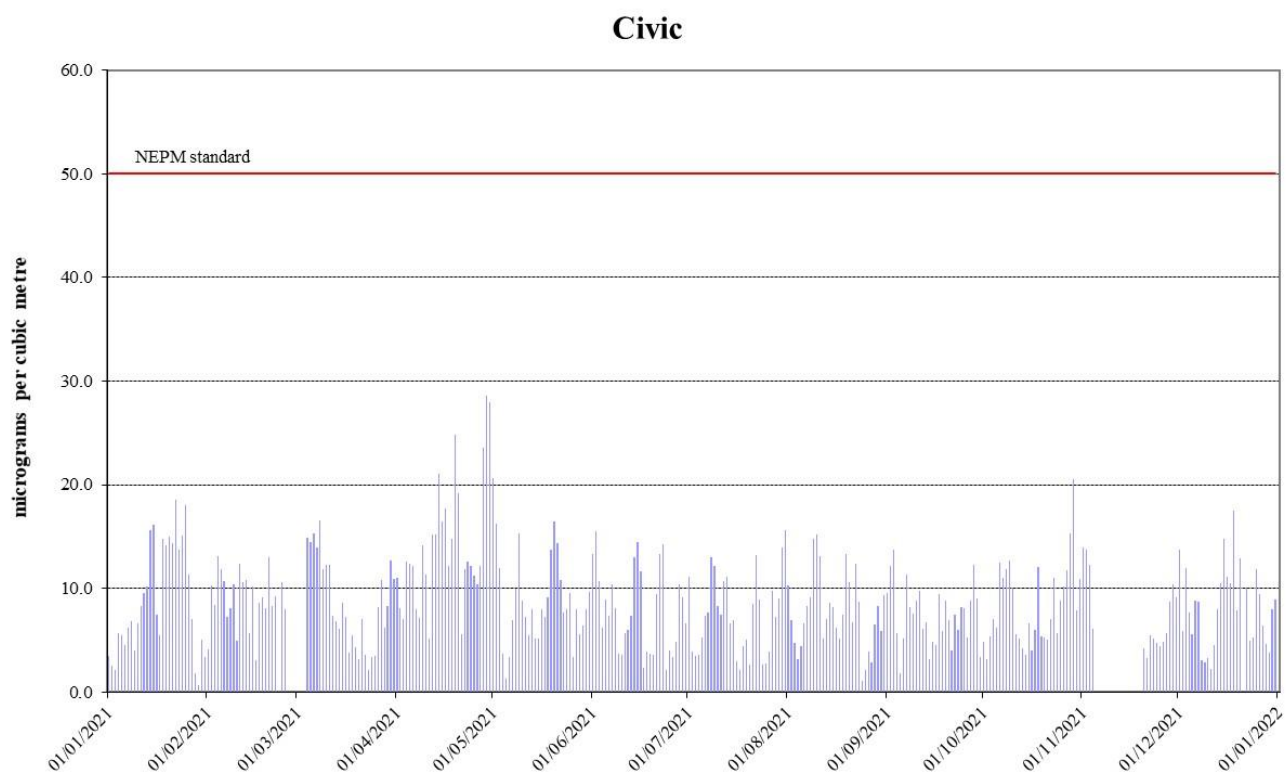
Monitoring station	Data availability rates (% of days)					1 Day		1 Year	
	Q1	Q2	Q3	Q4	Annual	Number of exceedances	NEPM goal compliance	Annual average (µg/m <sup>3</sup> )	ACT goal compliance
Monash	100	100	97.8	100	99.5	0	MET	10.3	MET
Civic	92.2	100	100	82.6	93.7	0	MET	8.7	MET
Florey	97.8	100	97.8	100	99.5	0	MET	9.6	MET

\* ACT policy position 20 µg/m<sup>3</sup> not AAQ NEPM standard of 25 µg/m<sup>3</sup>.

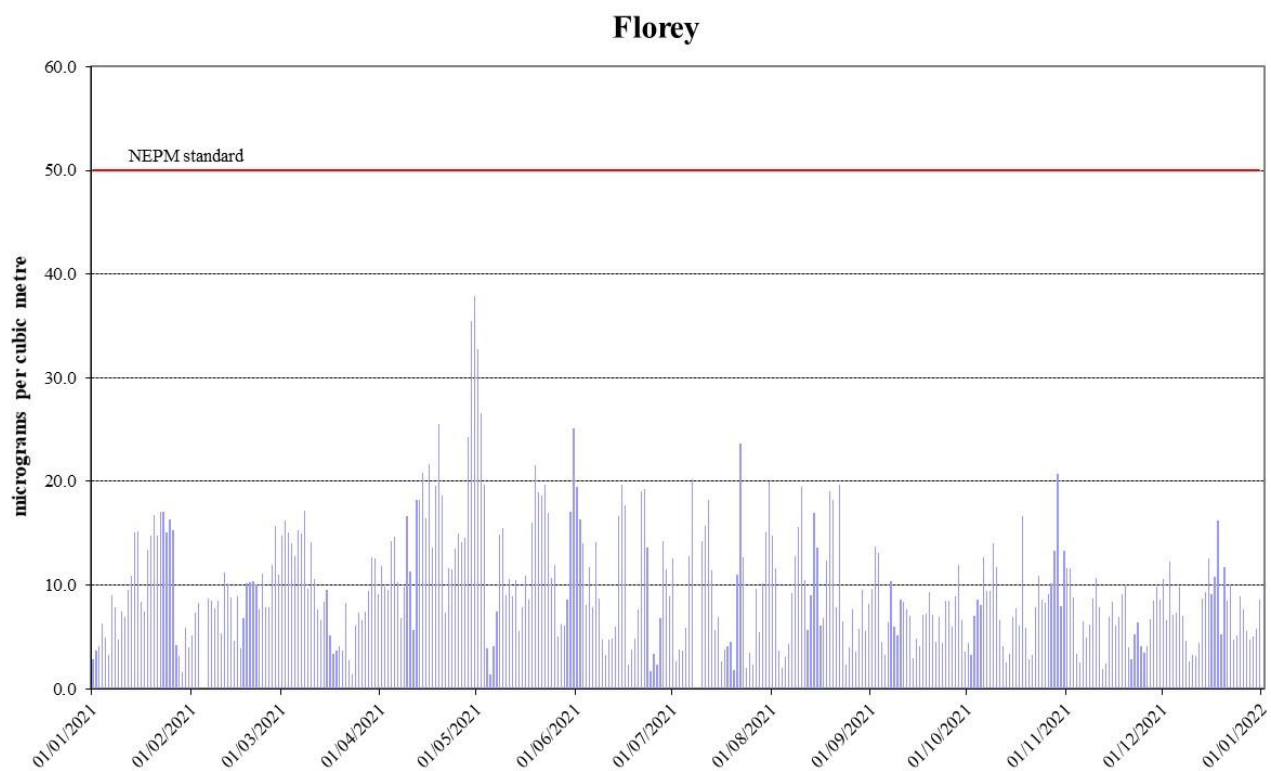
### Monash



**Figure 8: Daily maximum for PM<sub>10</sub> – Monash**



**Figure 9: Daily maximum for PM<sub>10</sub> – Civic**



**Figure 10: Daily maximum for PM<sub>10</sub> – Florey**

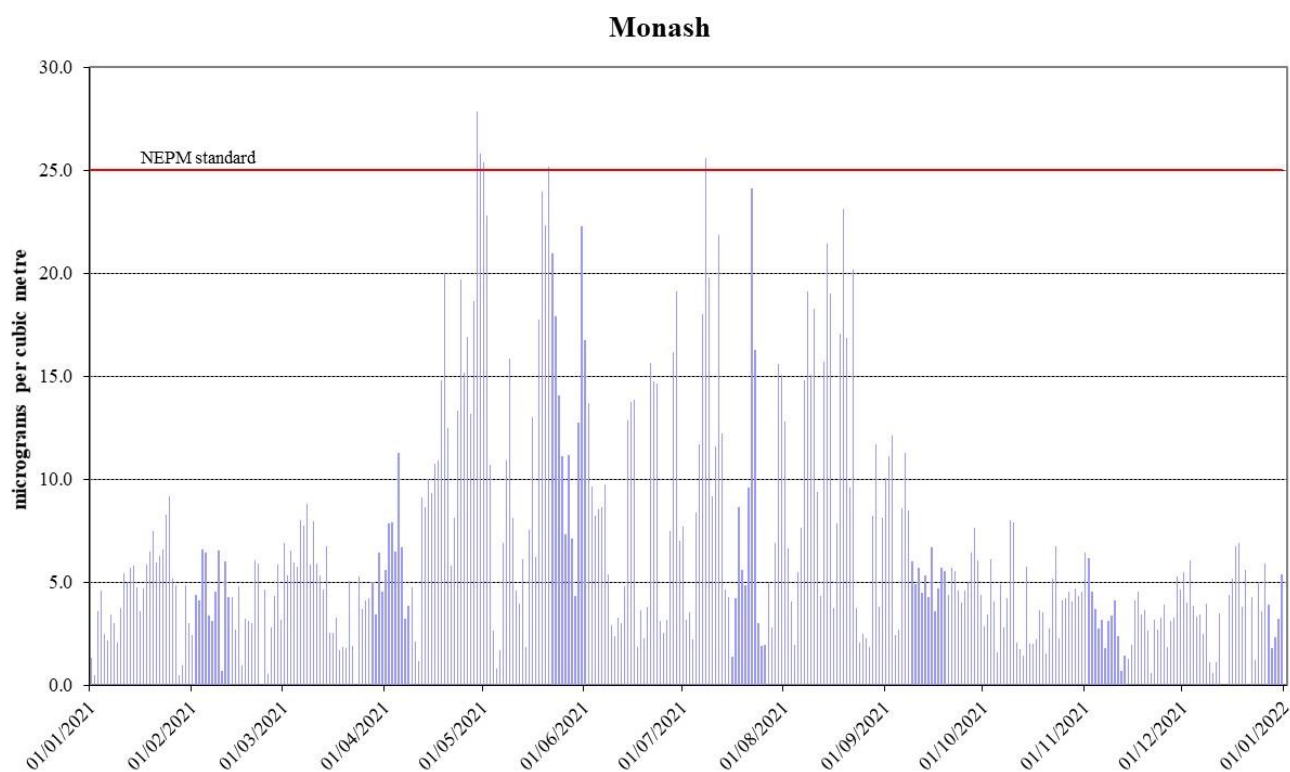
## PM<sub>2.5</sub>

During 2021, there were exceedances of daily PM<sub>2.5</sub> standard on 5 days at Monash (5 days) and Florey (3 days). Two exceedance days (April 29 and 30 April) were likely attributable to smoke from hazard reduction burns in NSW. Under the exceptional event rule they have been excluded when assessing compliance against the daily standard. Compliance against the daily PM<sub>2.5</sub> standard was not met at Monash and Florey. No daily exceedances against the daily PM<sub>2.5</sub> standard were recorded at Civic. Annual average PM<sub>2.5</sub> data at all stations met the 8 µg/m<sup>3</sup> AAQ NEPM standard.

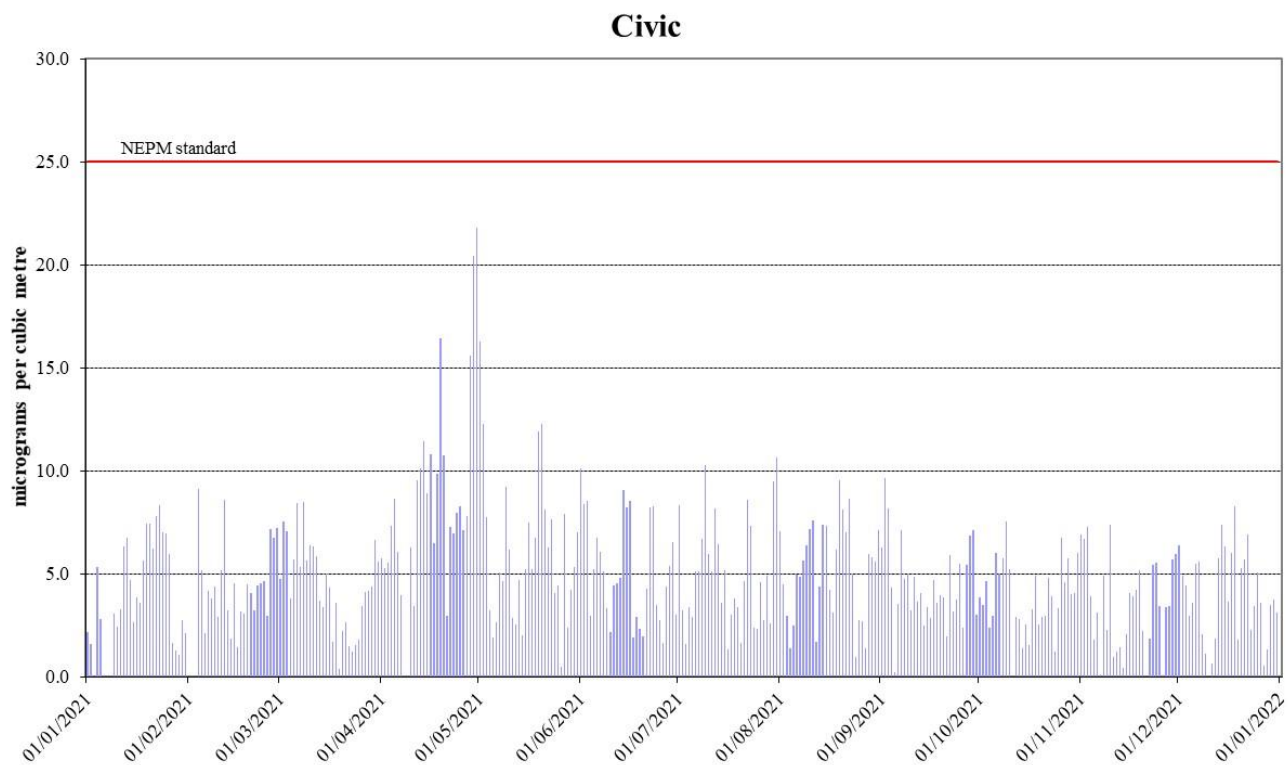
**Table 8: 2021 compliance summary for PM<sub>2.5</sub>**  
AAQ NEPM standard – 25 µg/m<sup>3</sup> (1-day), 8 µg/m<sup>3</sup> (1-year)

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 <sup>3</sup> )	NEPM goal compliance
Monash	97.8	100	100	96.7	98.6	3	NOT MET	6.8	MET
Civic	93.3	97.8	100	95.7	96.7	0	MET	5.0	MET
Florey	98.9	100	98.9	95.7	98.4	1	NOT MET	6.2	MET

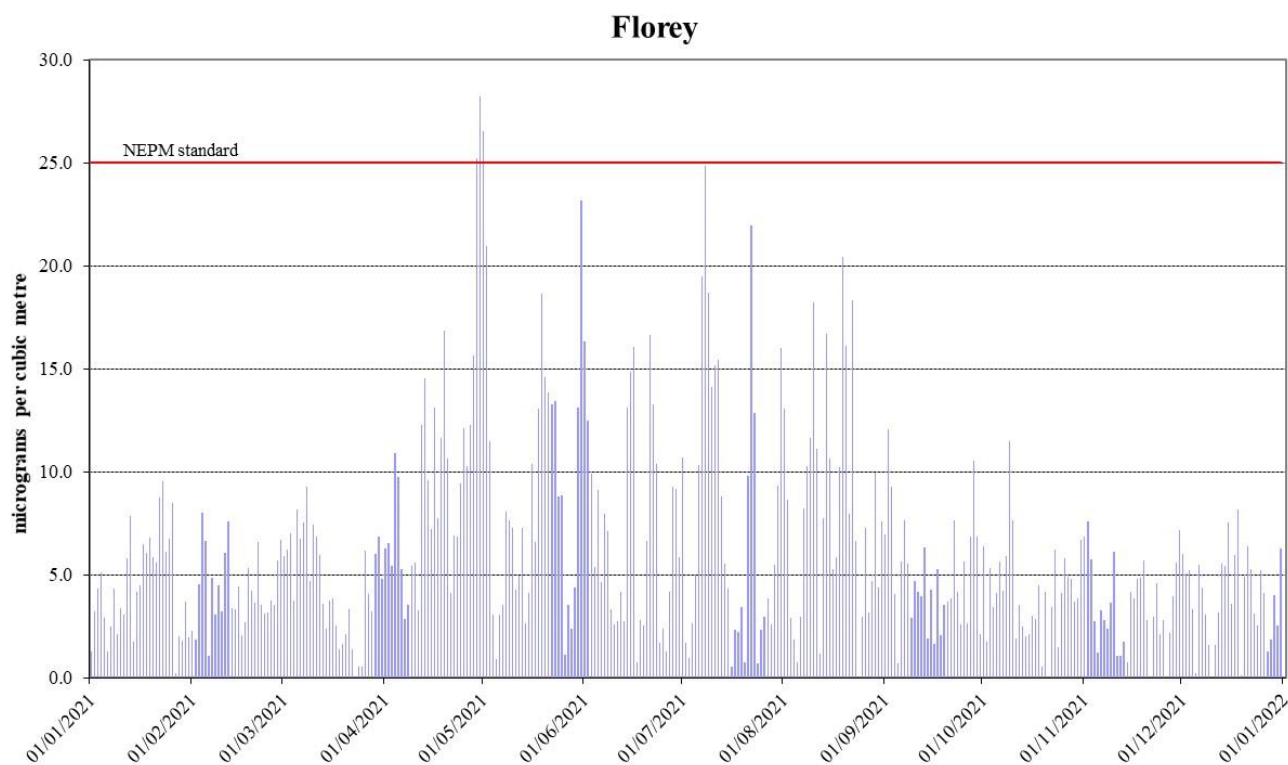
\* the number excludes exceptional events.



**Figure 11: Daily maximum for PM<sub>2.5</sub> – Monash**



**Figure 12: Daily maximum for PM<sub>2.5</sub> – Civic**



**Figure 13: Daily maximum for PM<sub>2.5</sub> – Florey**



## ANALYSIS OF AIR QUALITY MONITORING

Annual summary statistics contained in Table 9 to Table 13 below assess air quality against the standards and the extent of compliance with the goal. In each case a result of 'below the standard' indicates that compliance is achieved. Instances where the standard has been exceeded are highlighted in bold.

### Carbon monoxide

Carbon monoxide levels in 2021 dropped back to a level well below the standard at all monitoring stations, compared to 2019 and 2020. The highest recorded value in the ACT during 2021 was 1.3 ppm at Monash, which was the lowest level in the past ten years.

**Table 9: 2021 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)
Monash	336	1.3	15 Aug 07:00
Florey	362	1.2	16 Jun 09:00

### Nitrogen dioxide

Similar to carbon monoxide, nitrogen dioxide levels dropped back to a level well below the standard. The highest recorded 1-hour value during 2021 was 0.036 ppm at Monash, which is only 45% of the new standard. The highest recorded annual average in 2021 was 0.004ppm at Florey (refer to Table 5). This is 27% of the new annual standard 0.015ppm.

**Table 10: 2021 summary statistics for daily peak 1-hour NO<sub>2</sub>**

AAQ NEPM standard 0.08 ppm (1-hour average)

Monitoring station	Number of valid days	Highest (ppm)	Highest (date/time)
Monash	365	0.036	30 Apr 19:00
Florey	339	0.034	13 Apr 10:00

### Ozone

Ozone levels in 2021 were below the new 8-hour standard. The highest recorded value in the ACT during 2021 was 0.047 ppm at Florey, which is 72% of the standard.

**Table 11: 2021 summary statistics for daily peak 8-hour O<sub>3</sub>**

AAQ NEPM standard 0.065 ppm (8-hour average)

Monitoring station	Number of valid days	Highest (ppm)	Highest (date/time)
Monash	365	0.042	25 Jan 20:00
Civic	363	0.041	25 Jan 20:00
Florey	365	0.047	25 Jan 19:00

## PM<sub>10</sub>

PM<sub>10</sub> levels were significantly reduced in 2021 without the impacts from prolonged drought and unprecedented bushfires. The highest daily PM<sub>10</sub> level was recorded at Florey on 30 April 2021, with the concentration of 37.9µg/m<sup>3</sup>. The highest recorded annual average in 2021 was 10.3µg/m<sup>3</sup> at Monash (refer to Table 7), which is 52% of the ACT policy standard of 20µg/m<sup>3</sup>.

**Table 12: 2021 summary statistics for daily PM<sub>10</sub>**AAQ NEPM daily standard 50 µg/m<sup>3</sup>

Monitoring station	Number of valid days	Highest (µg/m <sup>3</sup> )	Highest (date)
Monash	363	37.3	29 April
Civic	342	28.6	29 April
Florey	361	37.9	30 April

## PM<sub>2.5</sub>

The daily standard for PM<sub>2.5</sub> was only exceeded on 5 days in 2021 at one or more of the monitoring stations, compared to 29 days in 2019 and 39 days in 2020.

Two exceedance days in April were likely attributable to smoke from hazard reduction burns in NSW. One exceedance (1 May) was likely attributable to a combination of smoke from hazard reduction burns in NSW and wood heater use at night. Two exceedances (21 May and 8 July) were likely attributable to smoke from wood heater use.

The highest daily PM<sub>2.5</sub> level was 28.2µg/m<sup>3</sup> which was recorded at Florey on 30 April 2021. The highest recorded annual average in 2021 was 6.8µg/m<sup>3</sup> at Monash (refer to Table 8).

**Table 13: 2021 summary statistics for daily PM<sub>2.5</sub>**

AAQ NEPM daily standard 25 µg/m<sup>3</sup>

Monitoring station	Number of valid days	Highest (µg/m <sup>3</sup> )	Highest (date)
Monash	360	<b>27.9</b>	29 April
Civic	353	21.8	30 April
Florey	359	<b>28.2</b>	30 April

**Table 14: 2021 PM<sub>2.5</sub> exceedances**

Date	Monitoring Station			Inferred Cause	Exceptional Event
	Monash (µg/m <sup>3</sup> )	Civic (µg/m <sup>3</sup> )	Florey (µg/m <sup>3</sup> )		
29 April 2021	<b>27.9</b>		<b>25.2</b>	Controlled Burn	Yes
30 April 2021	<b>25.8</b>		<b>28.2</b>	Controlled Burn	Yes
01 May 2021	<b>25.4</b>		<b>26.6</b>	Controlled Burn Wood Heater	No
21 May 2021	<b>25.2</b>			Wood Heater	No
08 July 2021	<b>25.6</b>			Wood Heater	No

## 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 to 2020, exceedances of the particulate matter standards have also been attributed to smoke from hazard reduction burns, bushfires and dust storms.

Compared to 2019 and 2020, carbon monoxide, nitrogen dioxide and ozone concentrations dropped back to pre-bushfire levels. The AAQ NEPM standards for these pollutants were met during the whole year. PM<sub>10</sub> levels were also significantly reduced in 2021 in the absence of prolonged drought and bushfires.

PM<sub>2.5</sub> levels increase significantly during the cooler months of the year which can be seen in Figure 11 to Figure 13. PM<sub>2.5</sub> is the pollutant most affected by woodsmoke as the majority of combustion particles are less than 1 micron in diameter.

The ACT Government acknowledges that wood heater emissions have an adverse effect on 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<sup>3</sup> 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<sup>4</sup>;
- The regulation of firewood merchants to ensure only seasoned wood is sold<sup>5</sup>;
- 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)<sup>6</sup>, and previously with the suburbs of Dunlop and East O'Malley;
- Compliance and enforcement activities for wood heater emissions with a focus on correct wood heater operation<sup>7</sup>;

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<sup>3</sup> <https://www.health.act.gov.au/about-our-health-system/population-health/environmental-monitoring/monitoring-and-regulating-air>

<sup>4</sup> <https://www.accesscanberra.act.gov.au/s/article/air-pollution-tab-domestic>

<sup>5</sup> <https://www.accesscanberra.act.gov.au/s/article/air-pollution-tab-business-and-industry>

<sup>6</sup> <https://files.accesscanberra.act.gov.au/legacy/3224/Molonglo%20Valley%20air%20quality%20assessment.pdf>

<sup>7</sup> <https://files.accesscanberra.act.gov.au/legacy/3371/Your-guide-to-using-a-wood-heater.pdf>

- Administering the Wood Heater Replacement Program to replace old inefficient wood heaters with high efficiency alternatives<sup>8</sup>; and
- Releasing the “*Bushfire Smoke and Air Quality Strategy 2021-25*” which will guide the ACT Government’s approach to prevent, prepare for, respond to, and recover from significant bushfire smoke events and management of the smoke from wood heaters<sup>9</sup>.

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<sup>8</sup> <https://www.climatechoices.act.gov.au/policy-programs/wood-heater-replacement-program>

<sup>9</sup> <https://www.act.gov.au/bushfire-smoke-and-air-quality-strategy>

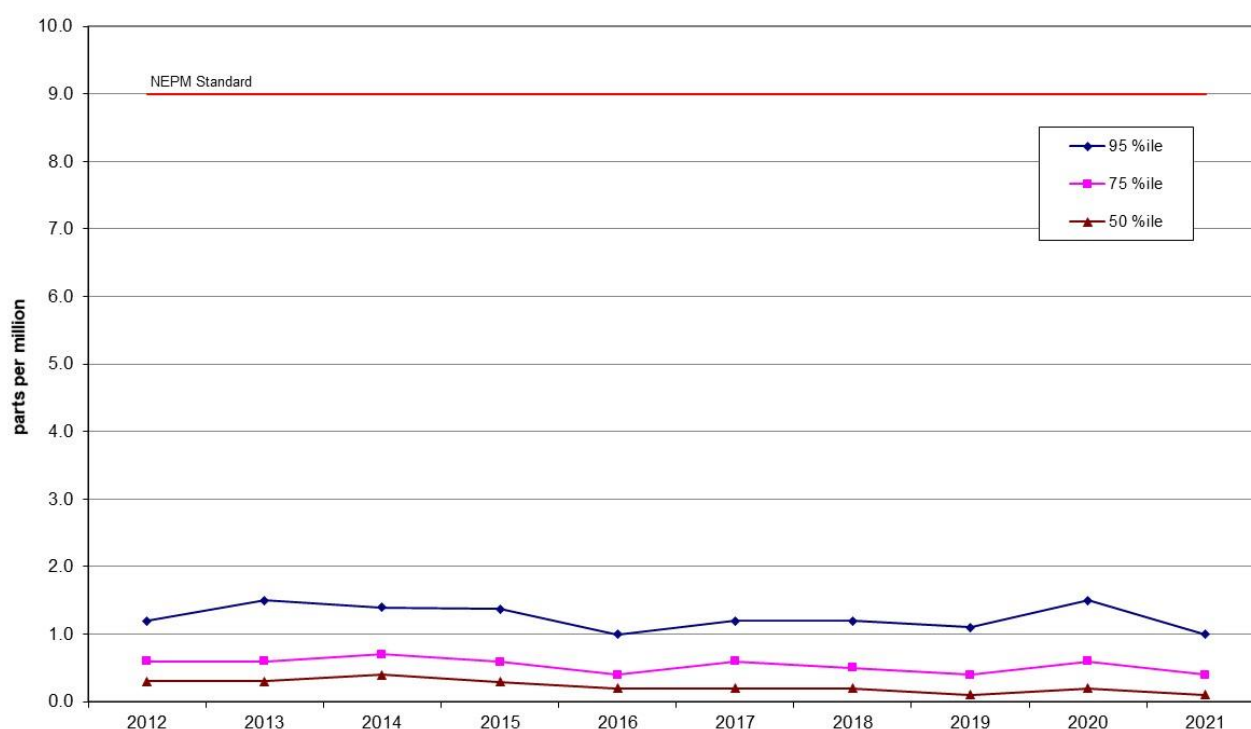
## APPENDIX A: STATISTICAL SUMMARY AND TRENDS

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. While the 8-hour O<sub>3</sub> standard was only established in 2021, the long-term data for this new standard is back-calculated and present below. Daily maximum values are also presented in the following tables.

### Carbon monoxide

**Table 15: Statistical summary for daily maximum 8-hour CO Monash 2012 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 <sup>th</sup> percentile (ppm)	75 <sup>th</sup> percentile (ppm)	50 <sup>th</sup> percentile (ppm)
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
2021	88.2	0	1.3	1.0	0.4	0.1

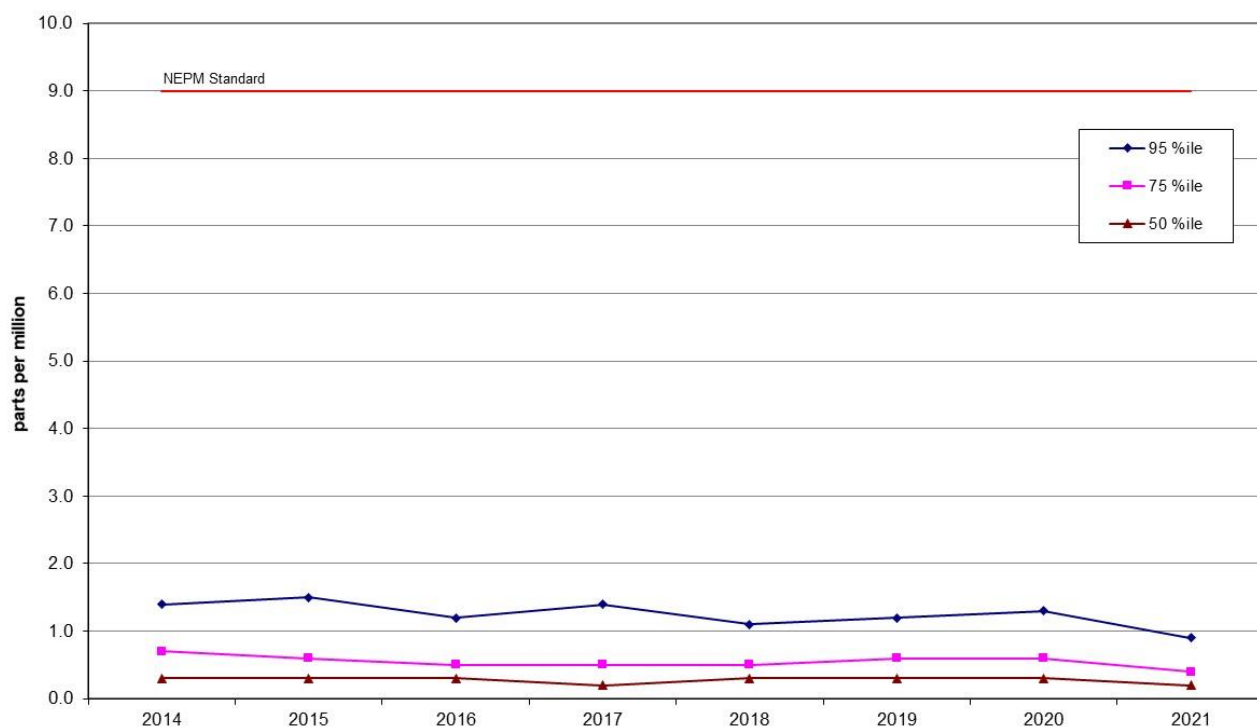


**Figure 14: Statistical summary for daily maximum 8-hour CO Monash 2012 – 2021**



**Table 16: Statistical summary for daily maximum 8-hour CO Florey 2014 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 <sup>th</sup> percentile (ppm)	75 <sup>th</sup> percentile (ppm)	50 <sup>th</sup> 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
2021	95.2	0	1.2	0.9	0.4	0.2



**Figure 15: Statistical summary for daily maximum 8-hour CO Florey 2014 – 2021**

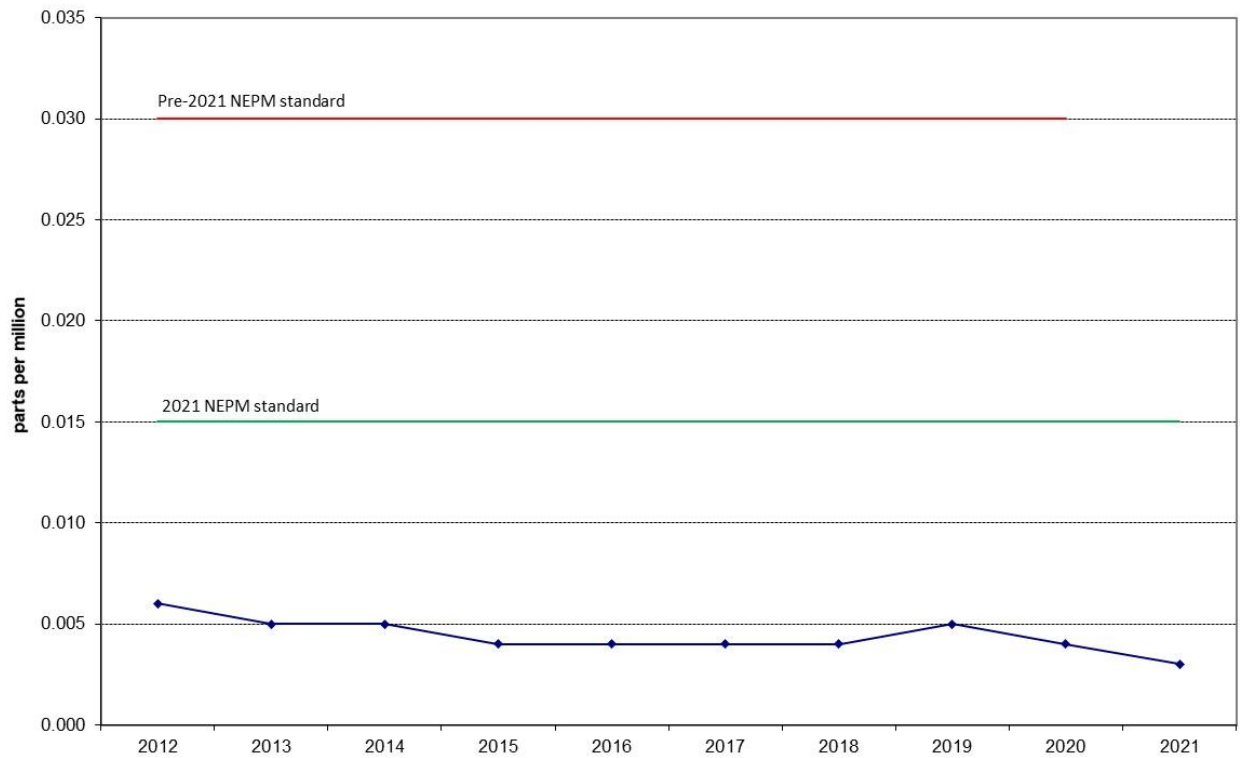
## Nitrogen dioxide

**Table 17: Statistical summary for daily maximum 1-hour NO<sub>2</sub> Monash 2012 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	Annual average (ppm)	95 <sup>th</sup> percentile (ppm)	75 <sup>th</sup> percentile (ppm)	50 <sup>th</sup> percentile (ppm)
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
2018	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
2021	95.7	0	0.036	0.003	0.024	0.016	0.010



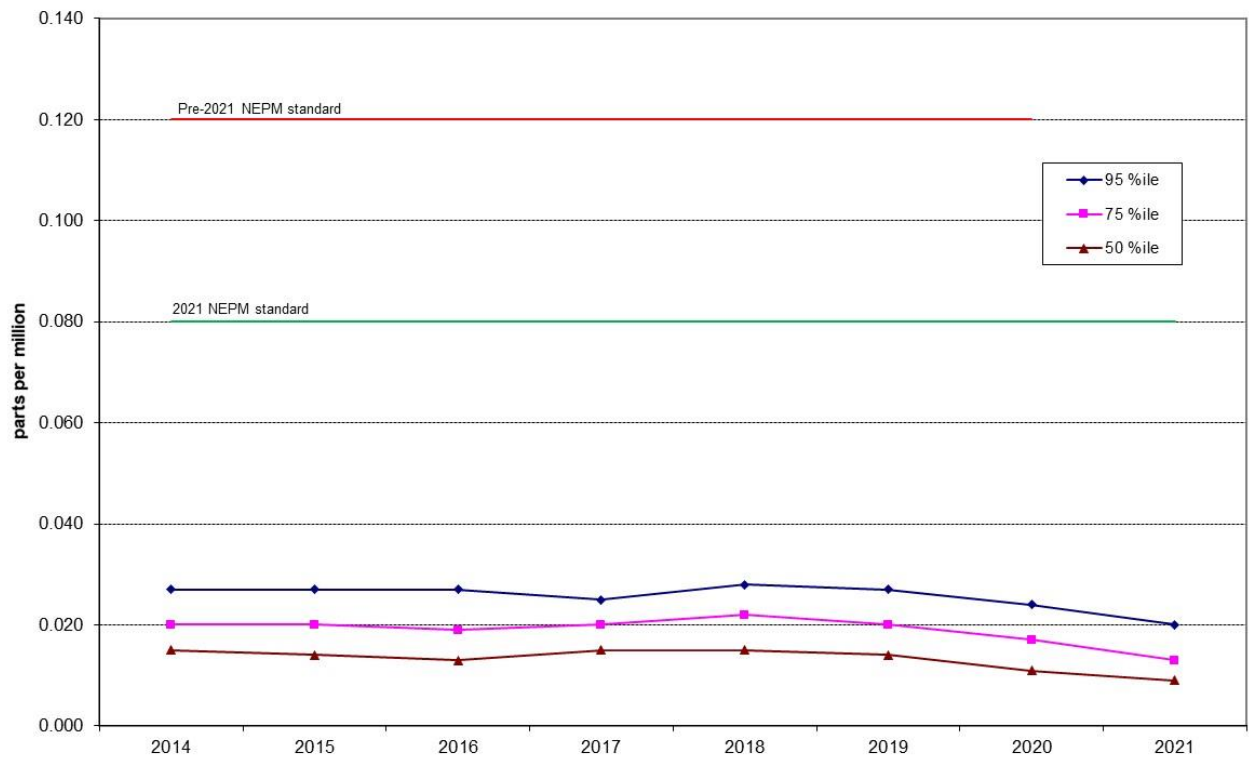
**Figure 16: Statistical summary for daily maximum 1-hour NO<sub>2</sub> Monash 2012 – 2021**



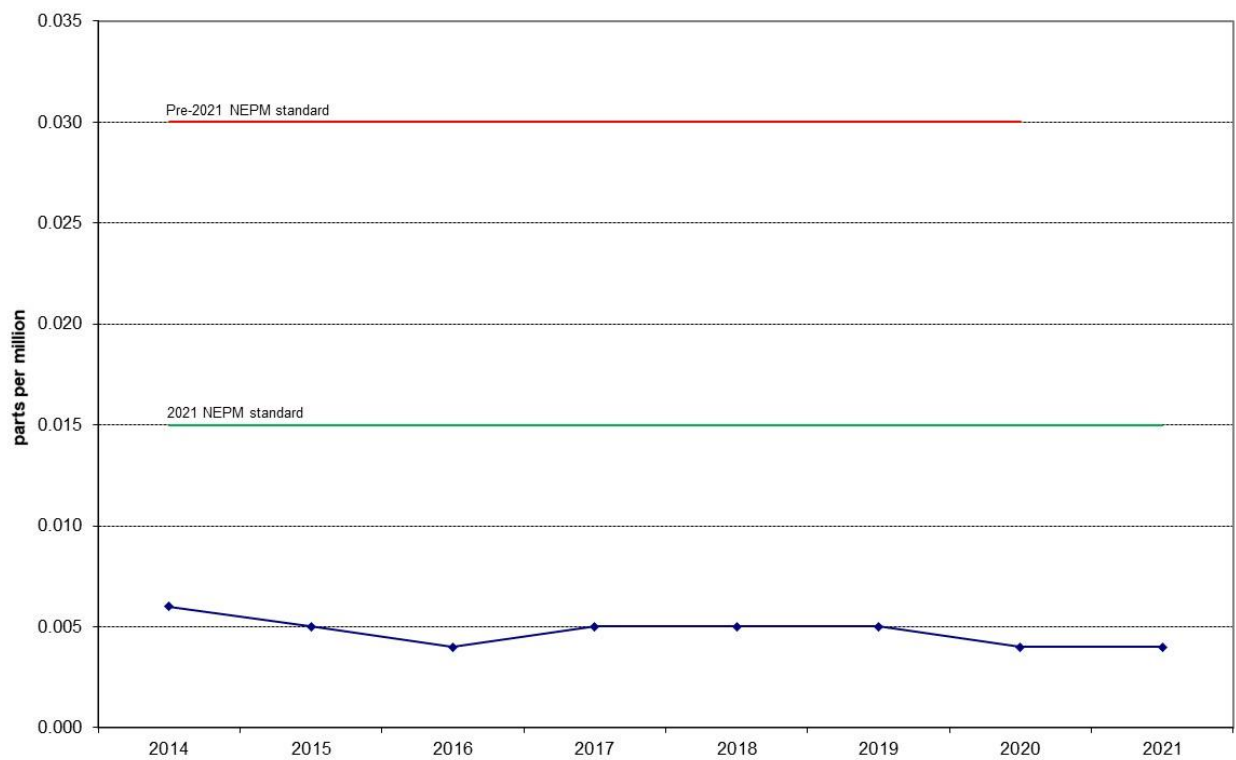
**Figure 17: Annual average 1-hour NO<sub>2</sub> Monash 2012 – 2021**

**Table 18: Statistical summary for daily maximum 1-hour NO<sub>2</sub> Florey 2014 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	Annual average (ppm)	95 <sup>th</sup> percentile (ppm)	75 <sup>th</sup> percentile (ppm)	50 <sup>th</sup> 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
2021	91.6	0	0.034	0.004	0.020	0.013	0.009



**Figure 18: Statistical summary for daily maximum 1-hour NO<sub>2</sub> Florey 2014 – 2021**

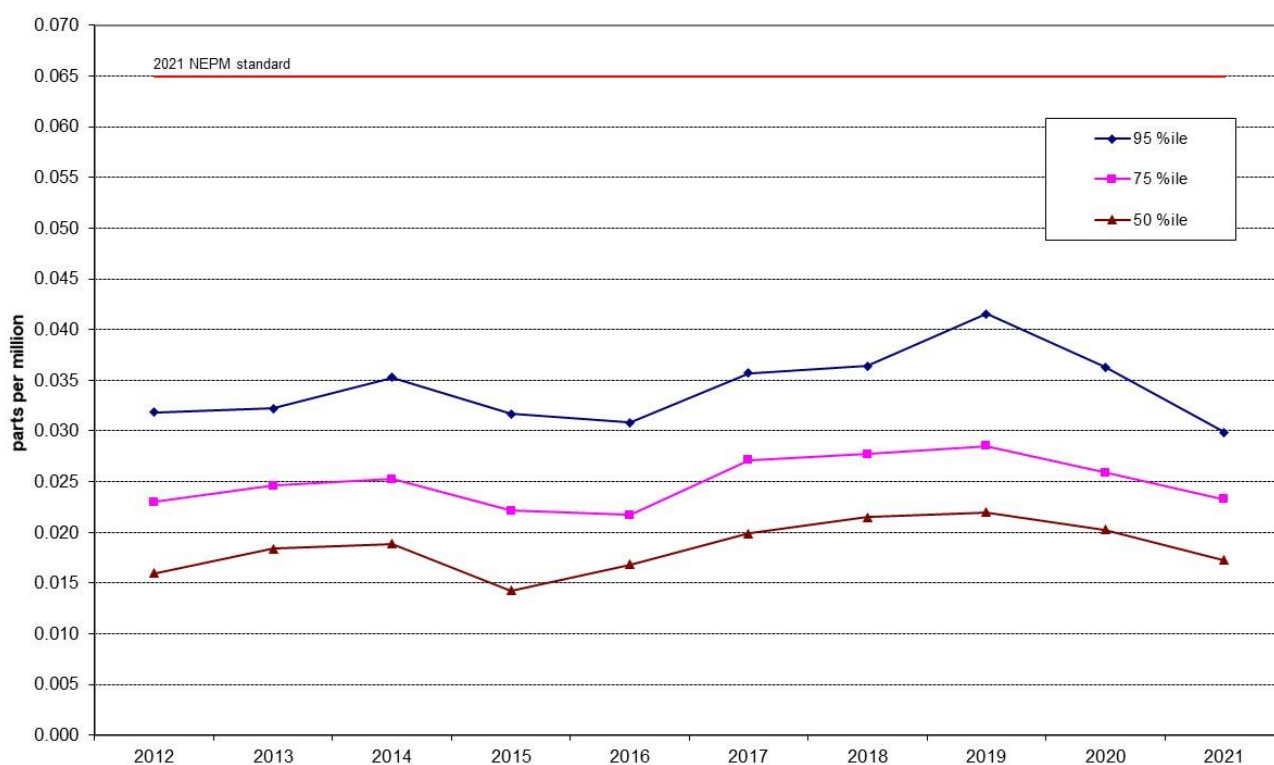


**Figure 19: Annual average 1-hour NO<sub>2</sub> Florey 2014 – 2021**

## Ozone

**Table 19: Statistical summary for daily maximum 8-hour O<sub>3</sub> Monash 2012 – 2021**

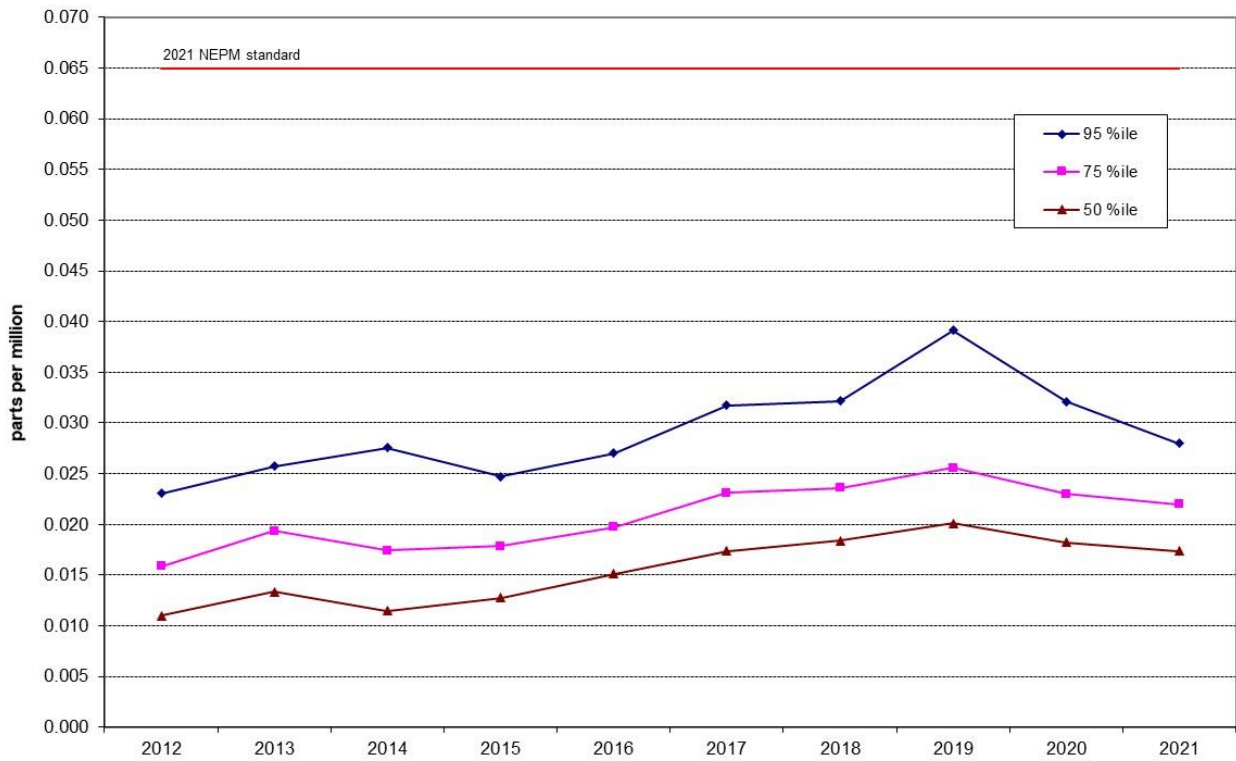
Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 <sup>th</sup> percentile (ppm)	75 <sup>th</sup> percentile (ppm)	50 <sup>th</sup> percentile (ppm)
2012	100	0	0.050	0.032	0.023	0.016
2013	97.8	0	0.054	0.032	0.025	0.018
2014	94.8	0	0.057	0.035	0.025	0.019
2015	92.8	0	0.047	0.032	0.022	0.014
2016	95.2	0	0.049	0.031	0.022	0.017
2017	95.5	0	0.052	0.036	0.027	0.020
2018	95.8	0	0.053	0.036	0.028	0.022
2019	95.8	10	0.107	0.042	0.029	0.022
2020	95.8	6	0.093	0.036	0.026	0.020
2021	95.7	0	0.042	0.030	0.023	0.017



**Figure 20: Statistical summary for daily maximum 8-hour O<sub>3</sub> Monash 2012 – 2021**

**Table 20: Statistical summary for daily maximum 8-hour O<sub>3</sub> Civic 2012 – 2021**

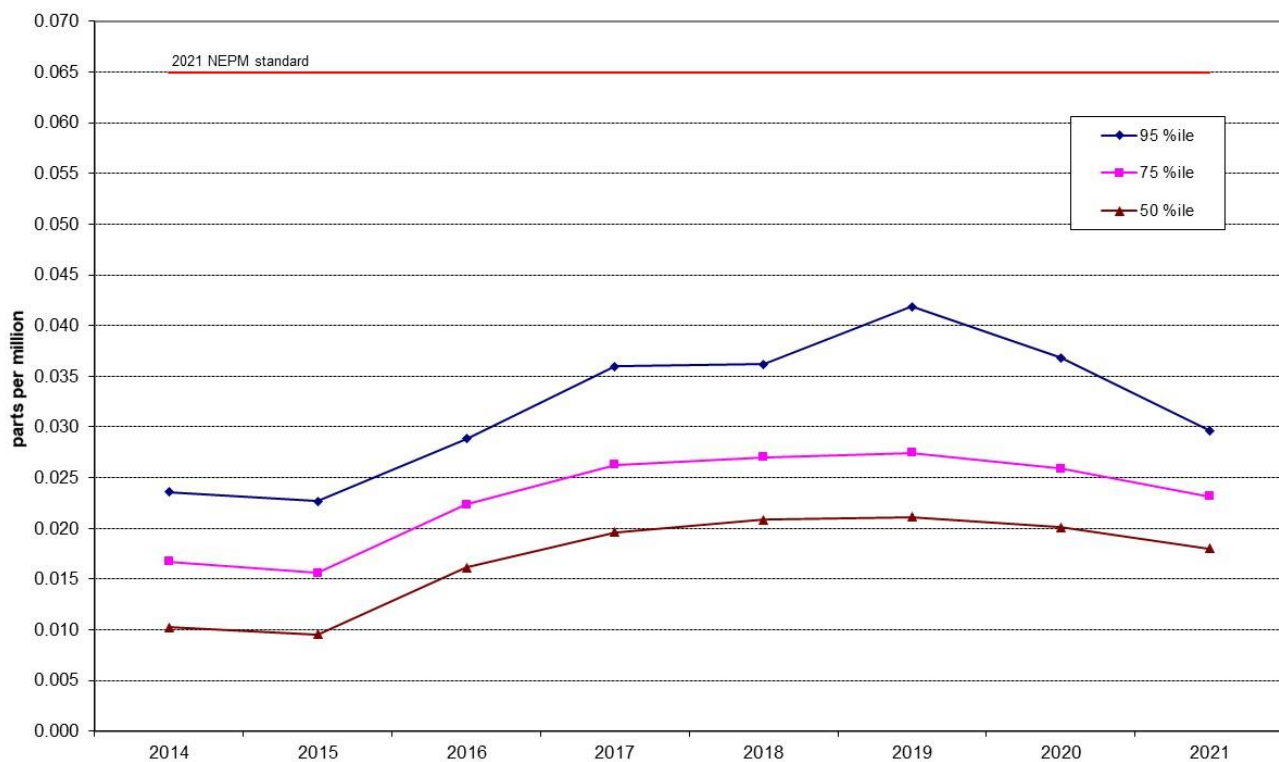
Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 <sup>th</sup> percentile (ppm)	75 <sup>th</sup> percentile (ppm)	50 <sup>th</sup> percentile (ppm)
2012	100	0	0.040	0.023	0.016	0.011
2013	92.1	0	0.050	0.026	0.019	0.013
2014	94.0	0	0.044	0.028	0.017	0.012
2015	89.0	0	0.040	0.025	0.018	0.013
2016	95.8	0	0.042	0.027	0.020	0.015
2017	95.8	0	0.046	0.032	0.023	0.017
2018	95.2	0	0.050	0.032	0.024	0.018
2019	95.8	4	0.088	0.039	0.026	0.020
2020	95.8	3	0.076	0.032	0.023	0.018
2021	95.5	0	0.041	0.028	0.022	0.017



**Figure 21: Statistical summary for daily maximum 8-hour O<sub>3</sub> Civic 2012 – 2021**

**Table 21: Statistical summary for daily maximum 8-hour O<sub>3</sub> Florey 2014 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 <sup>th</sup> percentile (ppm)	75 <sup>th</sup> percentile (ppm)	50 <sup>th</sup> percentile (ppm)
2014	79.4	0	0.037	0.024	0.017	0.010
2015	94.2	0	0.034	0.023	0.016	0.010
2016	95.8	0	0.046	0.029	0.022	0.016
2017	95.5	0	0.052	0.036	0.026	0.020
2018	95.2	0	0.054	0.036	0.027	0.021
2019	95.3	10	0.099	0.042	0.027	0.021
2020	92.0	6	0.089	0.037	0.026	0.020
2021	95.8	0	0.047	0.030	0.023	0.018

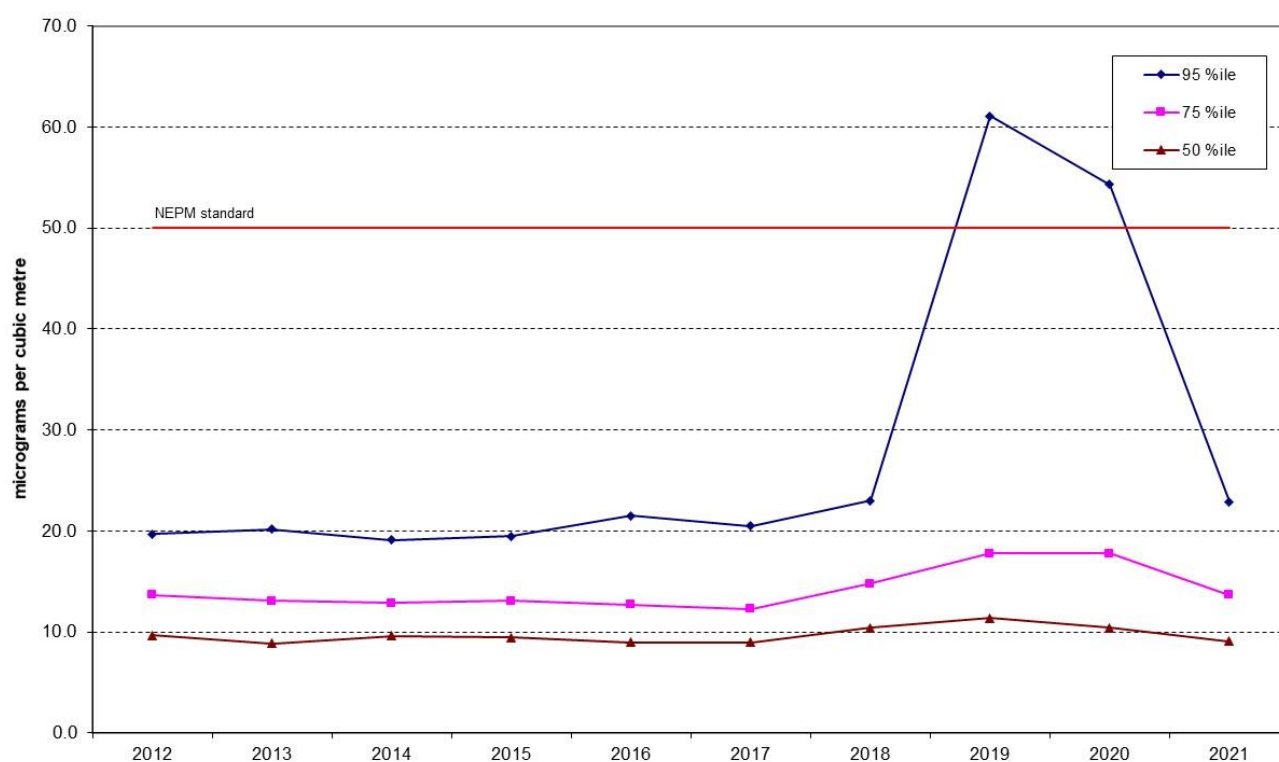


**Figure 22: Statistical summary for daily maximum 1-hour O<sub>3</sub> Florey 2014 – 2021**

## PM<sub>10</sub>

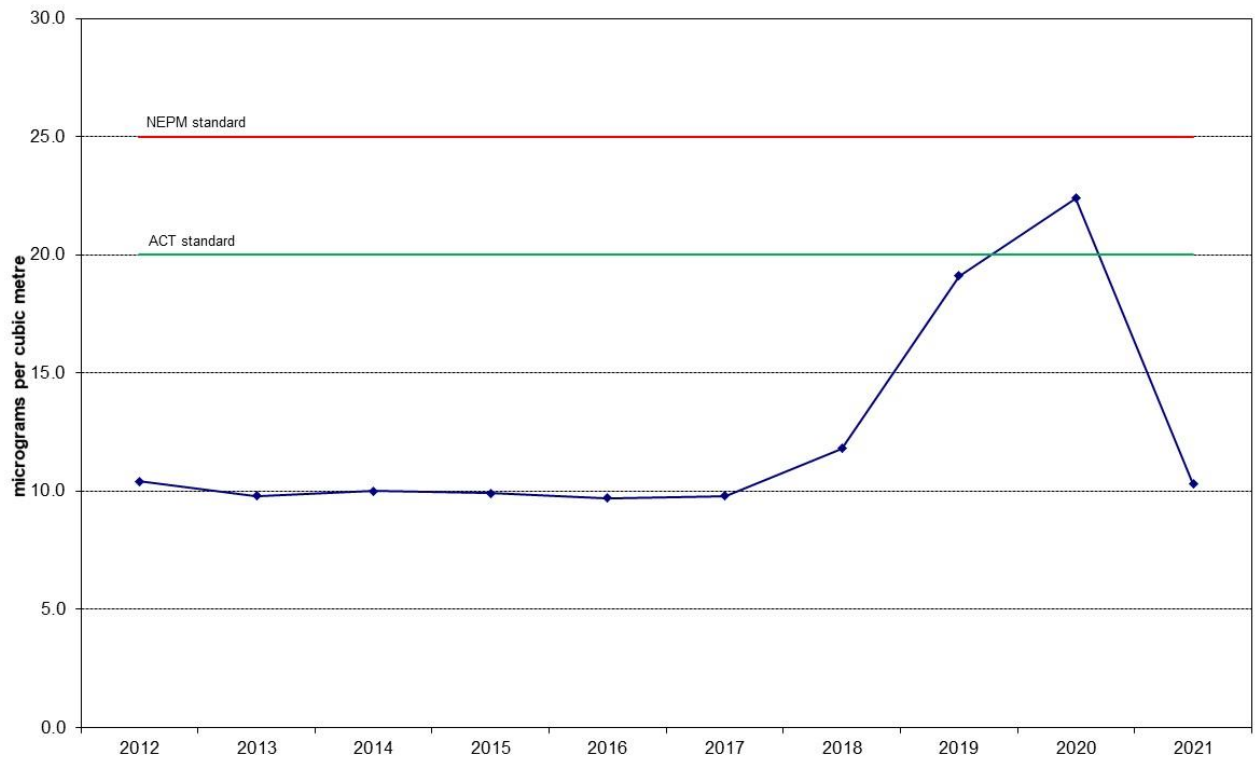
**Table 22: Statistical summary for daily maximum daily PM<sub>10</sub> Monash 2012 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m <sup>3</sup> )	Annual average (µg/m <sup>3</sup> )	95 <sup>th</sup> percentile (µg/m <sup>3</sup> )	75 <sup>th</sup> percentile (µg/m <sup>3</sup> )	50 <sup>th</sup> percentile (µg/m <sup>3</sup> )
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
2021	99.5	0	37.3	10.3	22.9	13.7	9.1



**Figure 23: Statistical summary for daily PM<sub>10</sub> Monash 2012 – 2021**





**Figure 24: Annual average daily PM<sub>10</sub> Monash 2012 – 2021**

**Table 23: Statistical summary for daily maximum daily PM<sub>10</sub> Civic 2012 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m³)	Annual average (µg/m³)	95 <sup>th</sup> percentile (µg/m³)	75 <sup>th</sup> percentile (µg/m³)	50 <sup>th</sup> percentile (µg/m³)
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
2021	93.7	0	28.6	8.7	15.6	11.5	8.1

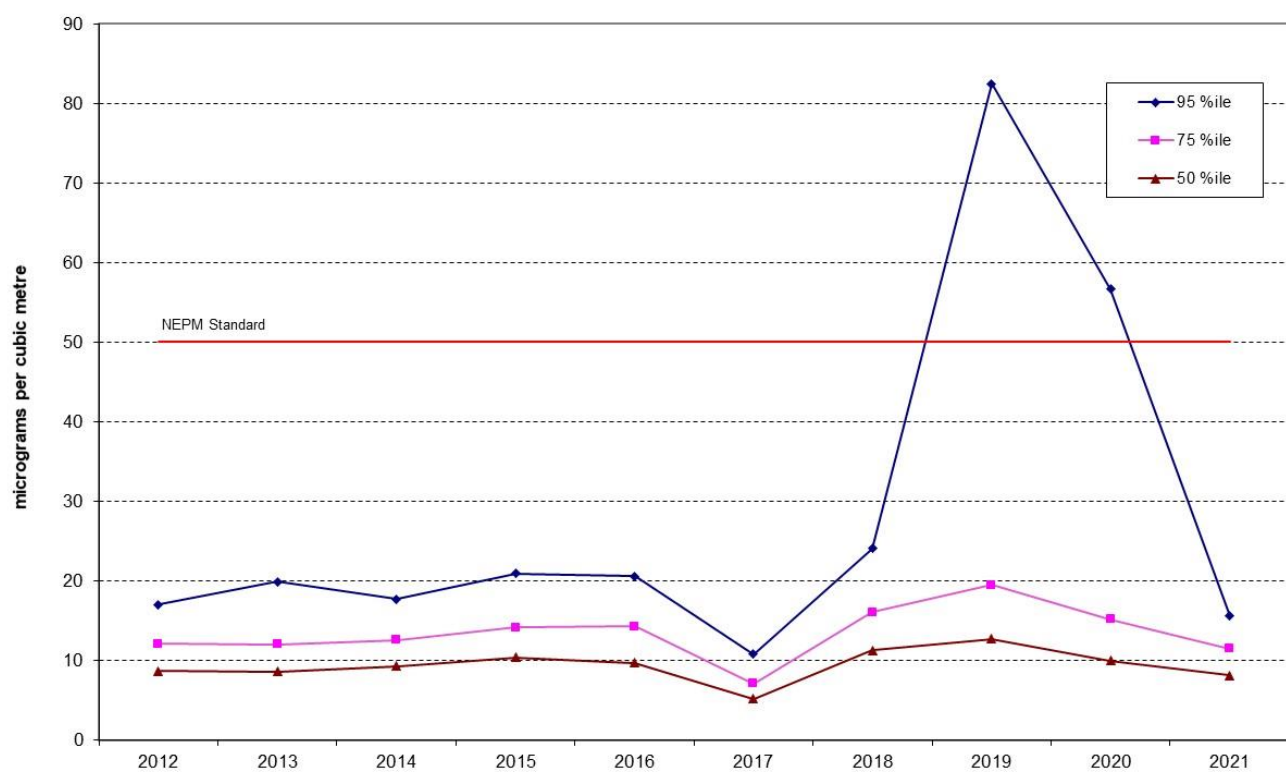


Figure 25: Statistical summary for daily PM<sub>10</sub> Civic 2012 – 2021

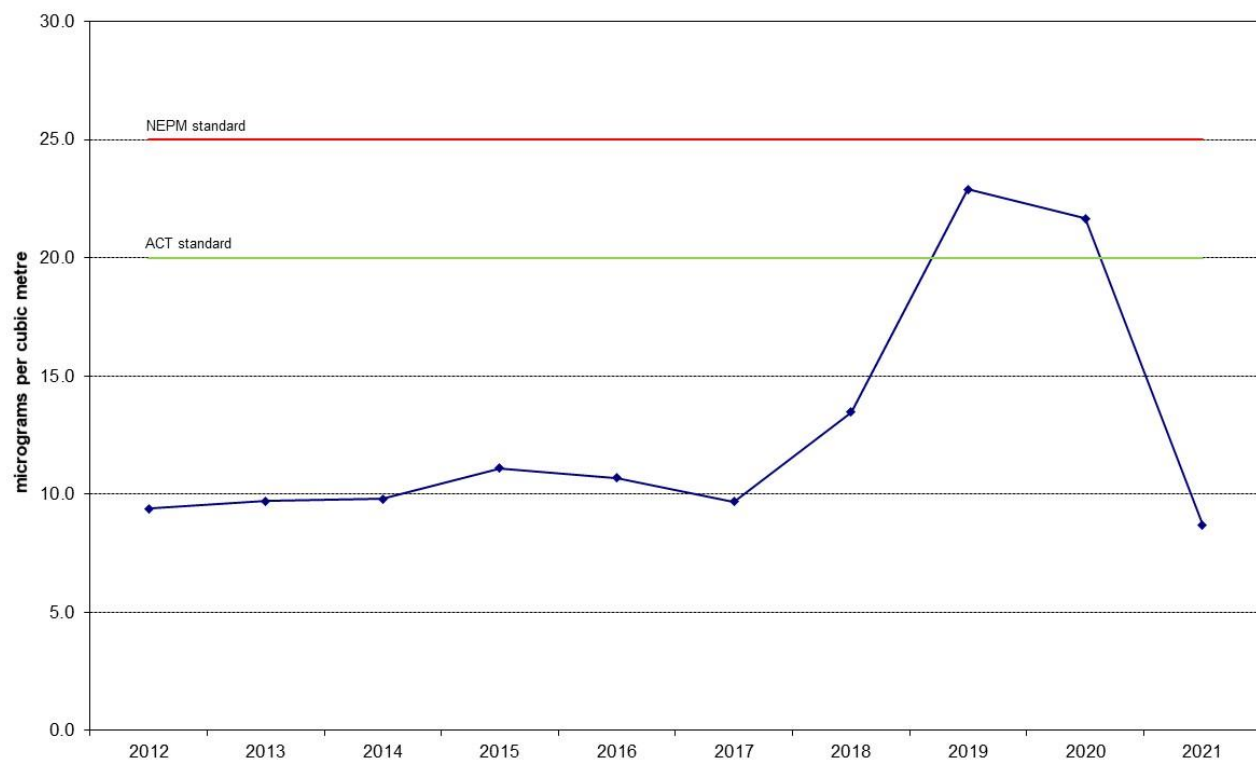
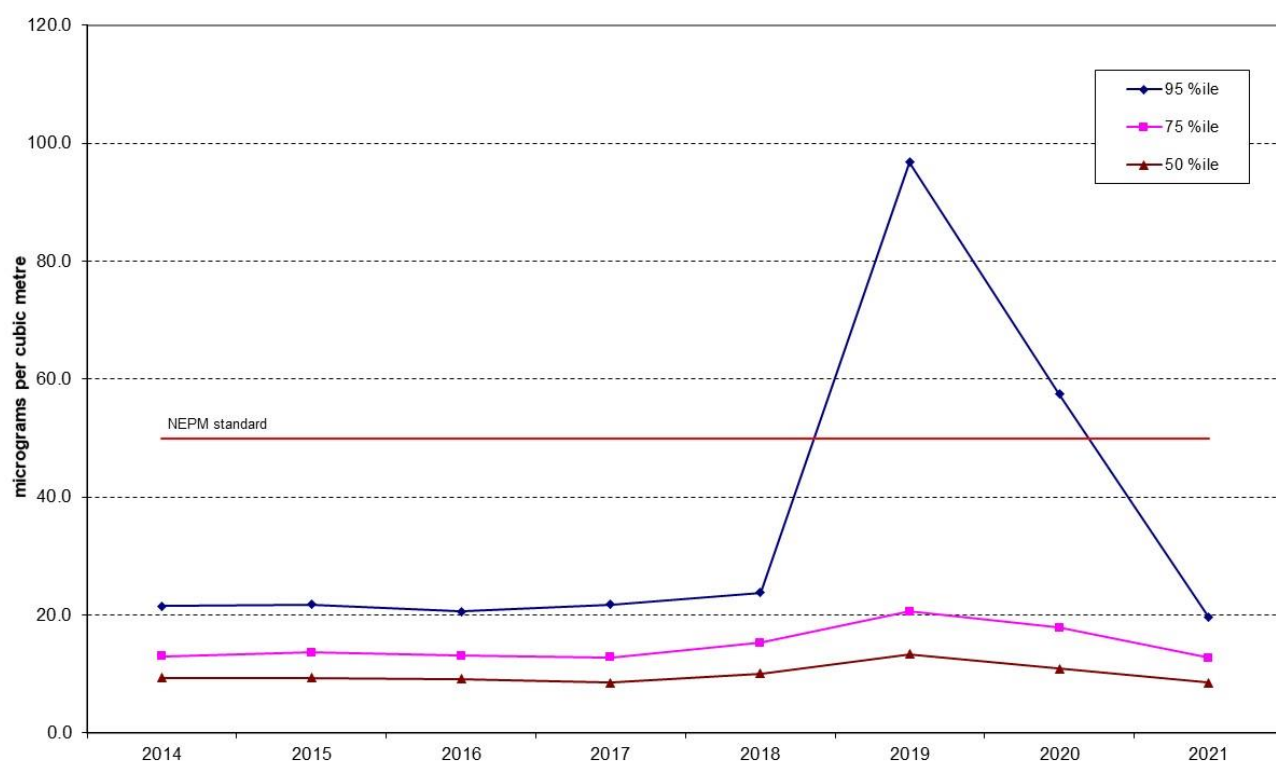


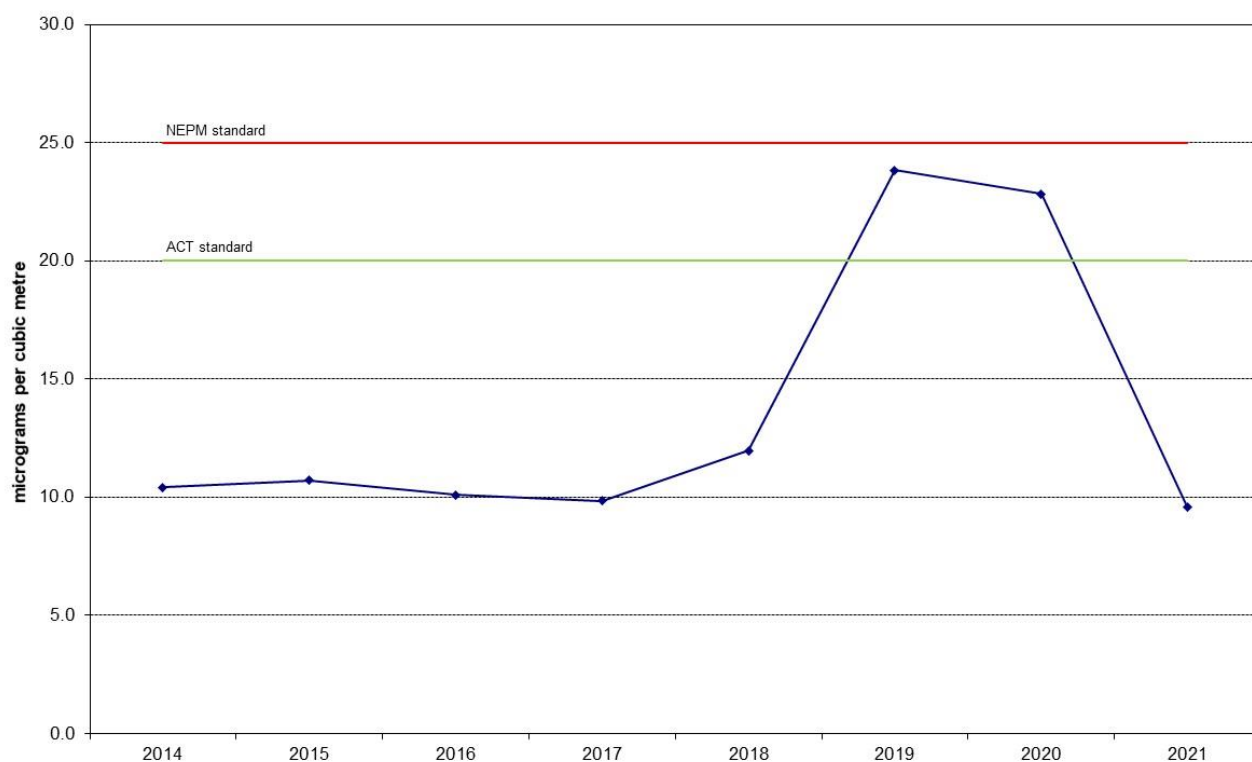
Figure 26: Annual average daily PM<sub>10</sub> Civic 2012 – 2021

**Table 24: Statistical summary for daily maximum daily PM<sub>10</sub> Florey 2014 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m <sup>3</sup> )	Annual average (µg/m <sup>3</sup> )	95 <sup>th</sup> percentile (µg/m <sup>3</sup> )	75 <sup>th</sup> percentile (µg/m <sup>3</sup> )	50 <sup>th</sup> percentile (µg/m <sup>3</sup> )
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
2021	99.5	0	37.9	9.6	19.6	12.7	8.5



**Figure 27: Statistical summary for daily PM<sub>10</sub> Florey 2014 – 2021**

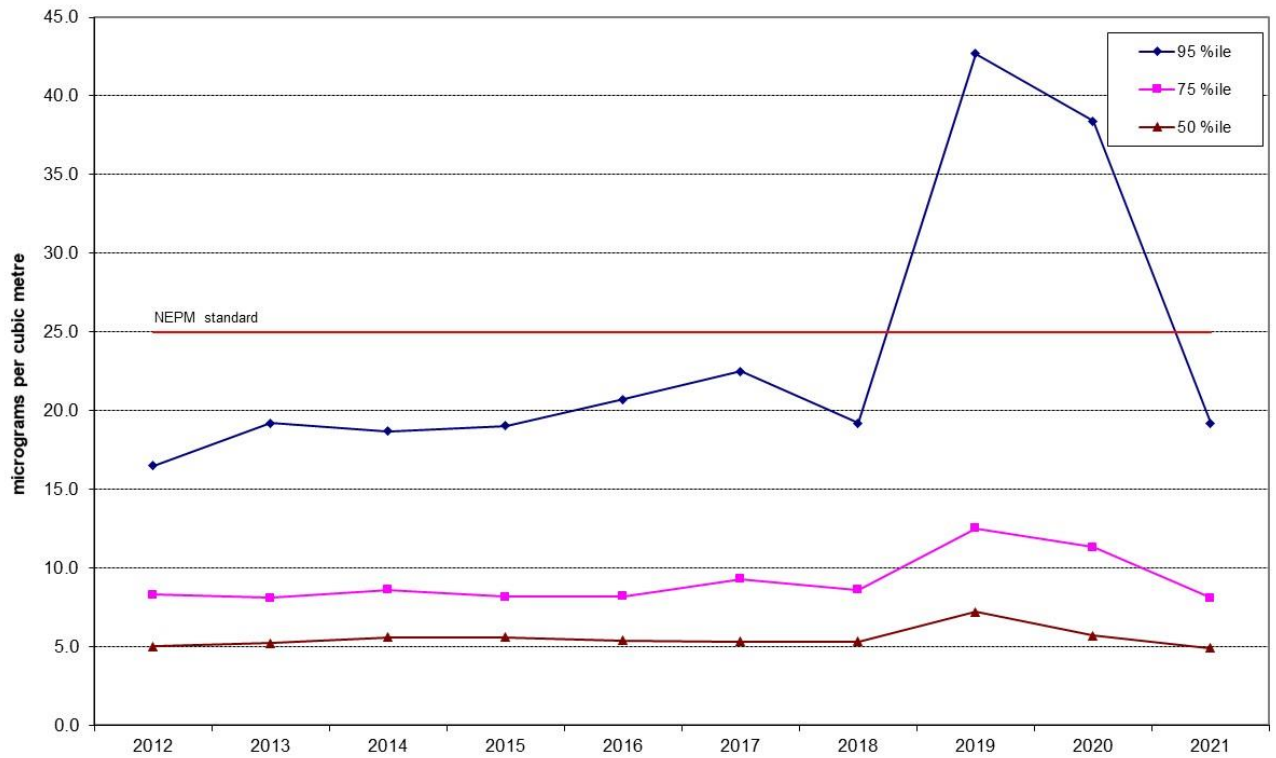


**Figure 28: Annual average daily PM<sub>10</sub> Florey 2014 – 2021**

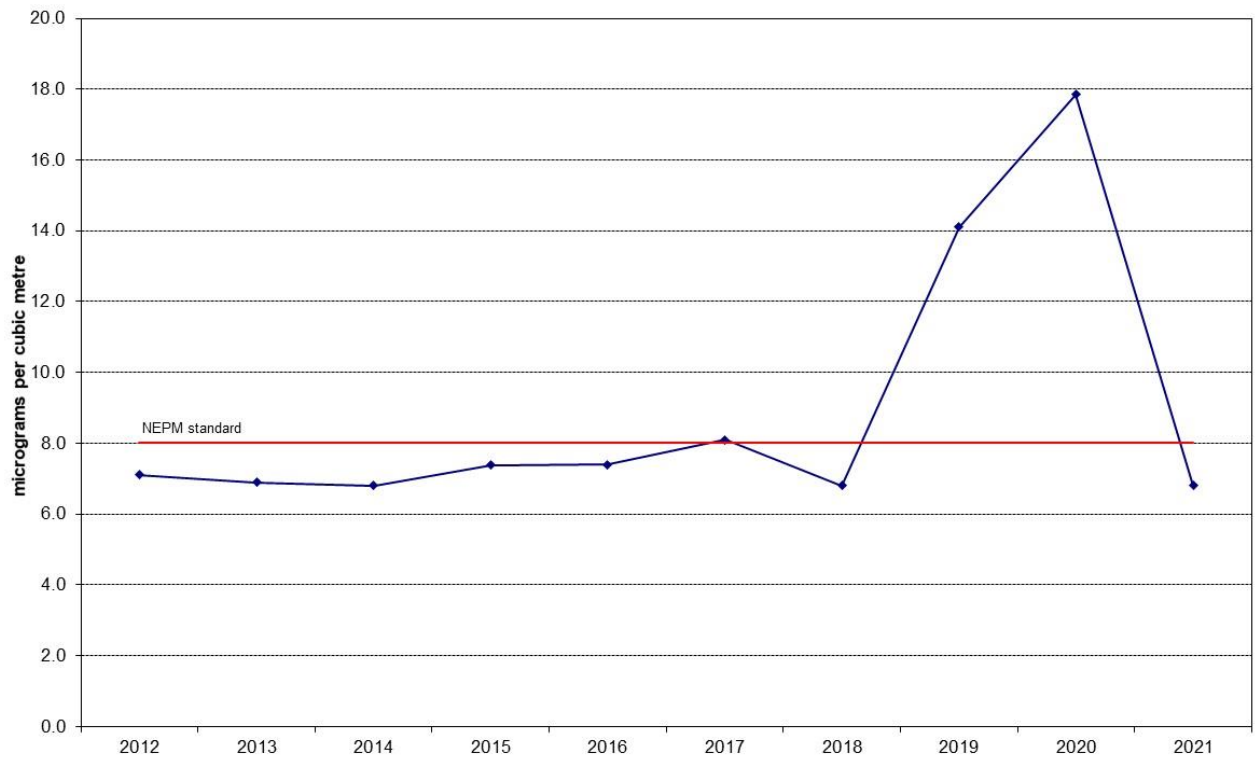
## PM<sub>2.5</sub>

**Table 25: Statistical summary for daily maximum daily PM<sub>2.5</sub> Monash 2012 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m³)	Annual average (µg/m³)	95 <sup>th</sup> percentile (µg/m³)	75 <sup>th</sup> percentile (µg/m³)	50 <sup>th</sup> percentile (µg/m³)
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
2021	98.6	5	27.9	6.8	19.2	8.1	4.9



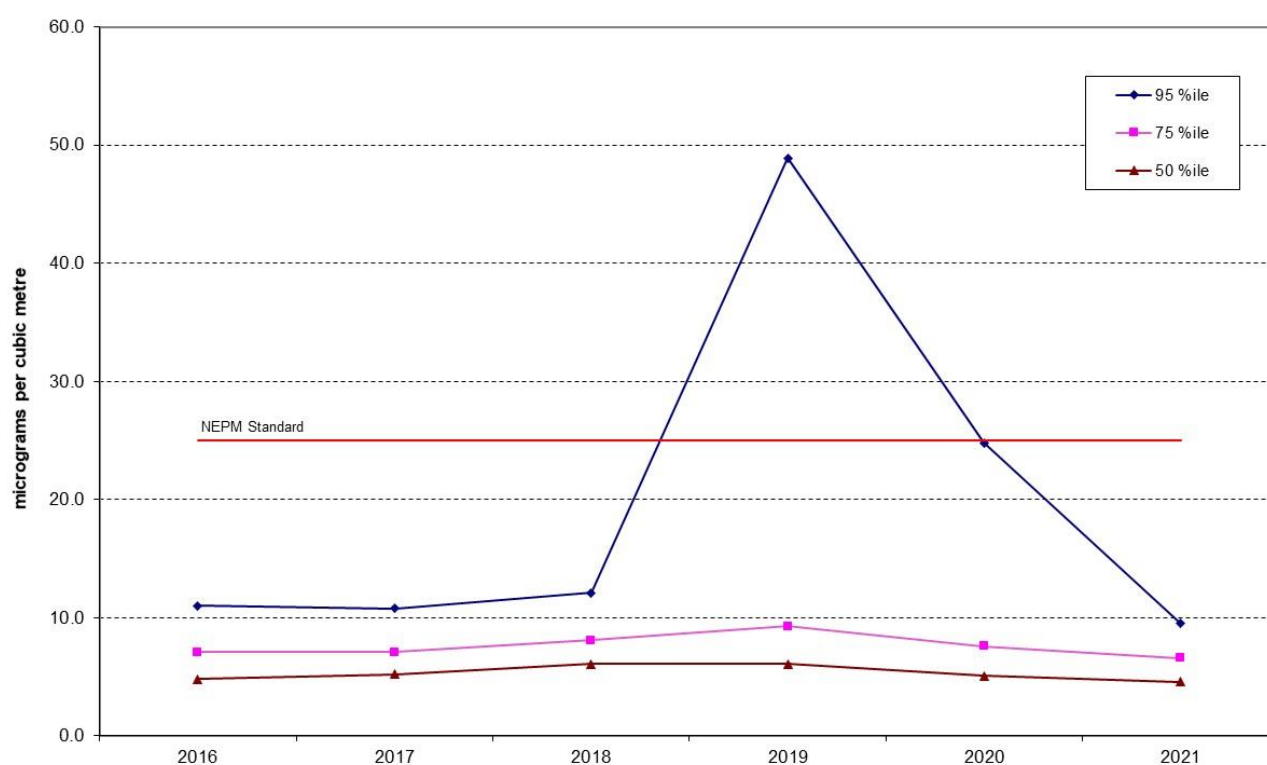
**Figure 29: Statistical summary for daily PM<sub>2.5</sub> Monash 2012 – 2021**



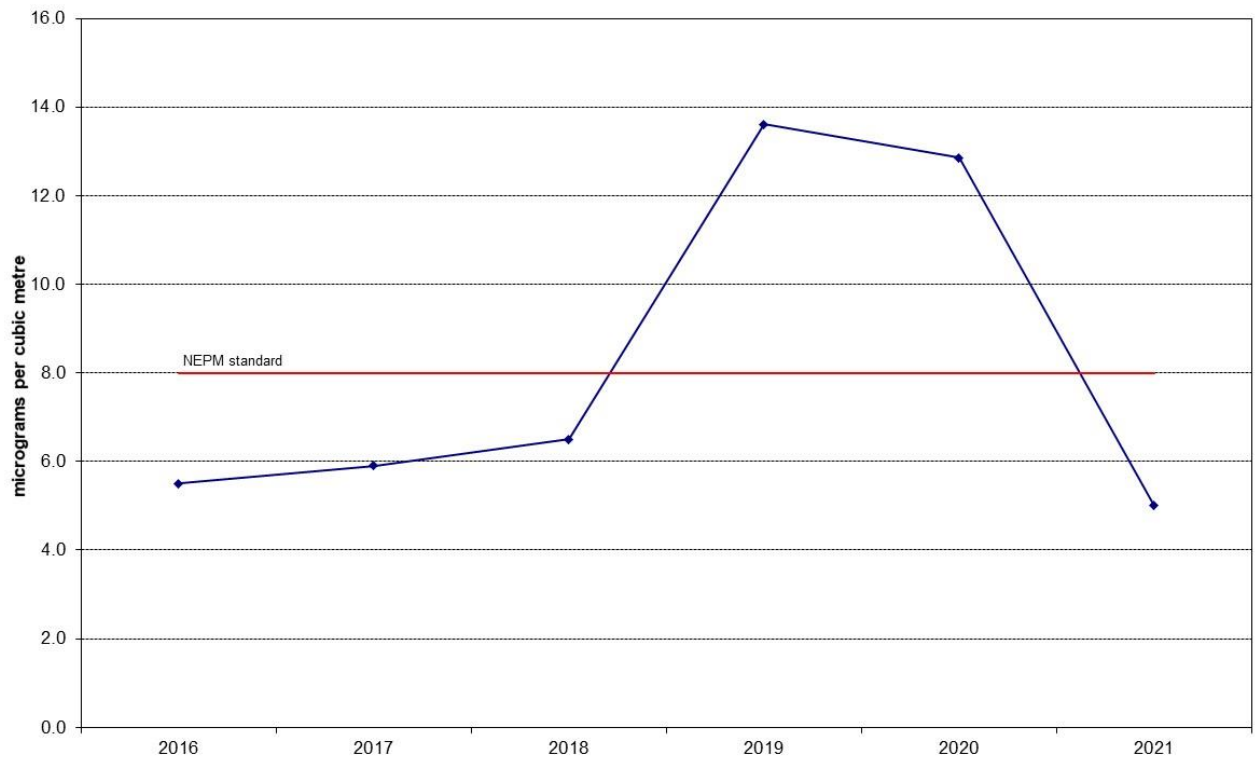
**Figure 30: Annual average daily PM<sub>2.5</sub> Monash 2012 – 2021**

**Table 26: Statistical summary for daily maximum daily PM<sub>2.5</sub> Civic 2016 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m <sup>3</sup> )	Annual average (µg/m <sup>3</sup> )	95 <sup>th</sup> percentile (µg/m <sup>3</sup> )	75 <sup>th</sup> percentile (µg/m <sup>3</sup> )	50 <sup>th</sup> percentile (µg/m <sup>3</sup> )
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
2021	96.7	0	21.8	5.0	9.5	6.6	4.6



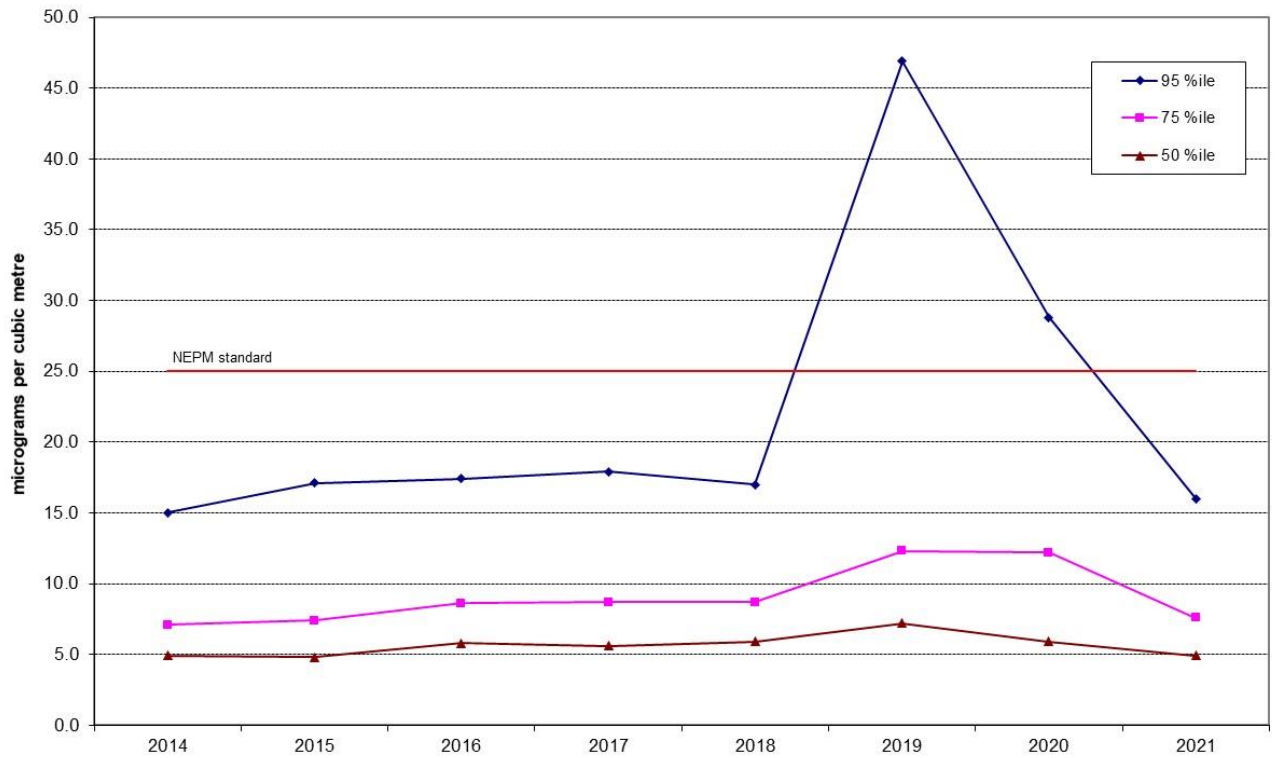
**Figure 31: Statistical summary for daily PM<sub>2.5</sub> Civic 2016 – 2021**



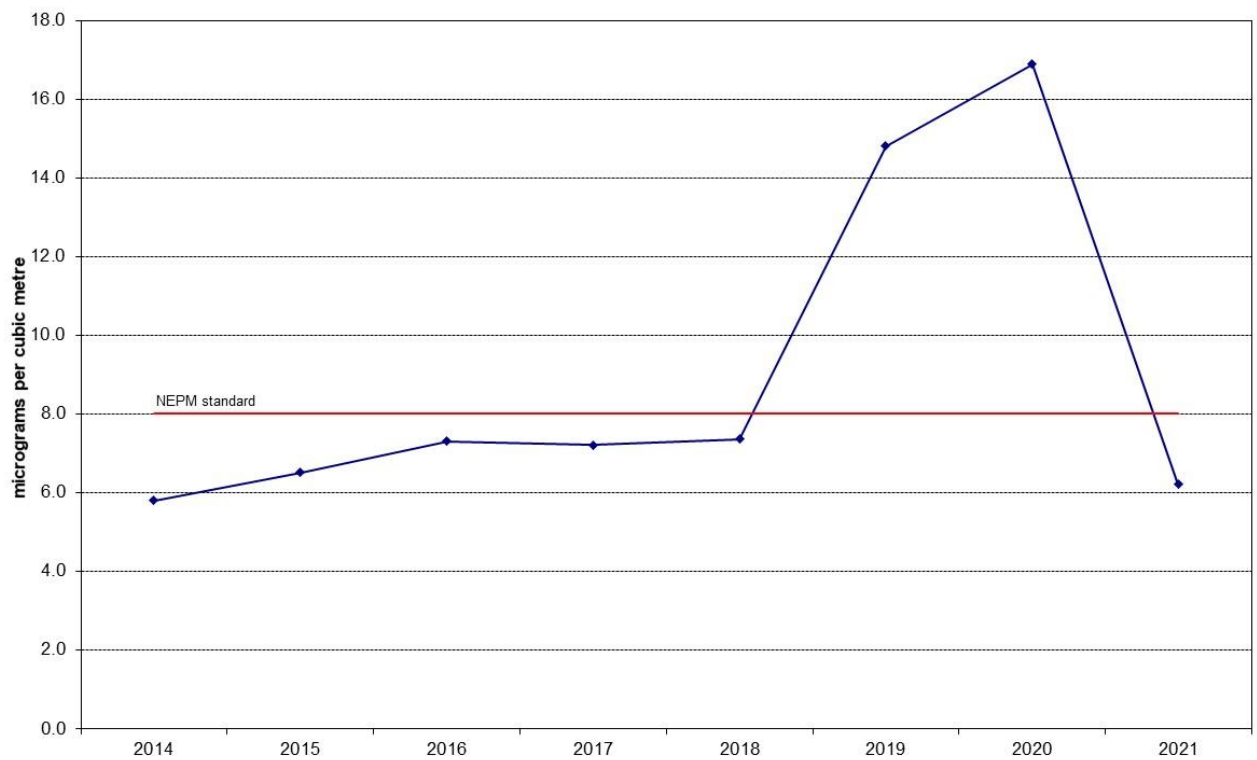
**Figure 32: Annual average daily PM<sub>2.5</sub> Civic 2016 – 2021**

**Table 27: Statistical summary for daily maximum daily PM<sub>2.5</sub> Florey 2014 – 2021**

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (µg/m <sup>3</sup> )	Annual average (µg/m <sup>3</sup> )	95 <sup>th</sup> percentile (µg/m <sup>3</sup> )	75 <sup>th</sup> percentile (µg/m <sup>3</sup> )	50 <sup>th</sup> percentile (µg/m <sup>3</sup> )
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
2021	98.4	3	28.2	6.2	16.0	7.6	4.9



**Figure 33: Statistical summary for daily PM<sub>2.5</sub> Florey 2014 – 2021**



**Figure 34: Annual average daily PM<sub>2.5</sub> Florey 2014 – 2021**