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Australian Capital Territory

Air Quality Report 2022



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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 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 2022 ('the Report') presents the results of ambient air quality monitoring in the ACT for 2022 and assesses the results in accordance with the requirements of the National Environment Protection (Ambient Air Quality) Measure¹ (AAQ NEPM) made by the National Environment Protection Council on 26 June 1998.

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 (PM₁₀) against a lower standard of an annual average of 20 µg/m³ rather than the 25 µg/m³ 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 (NO₂)
- photochemical oxidants as ozone (O₃)
- particulate matter (as PM₁₀, 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 (SO₂) 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 2022 Report is:

- The ACT experienced the best air quality on record in 2022, with no exceedances of any of the AAQ NEPM standards at any of the ACT's monitoring stations;
- The daily PM_{2.5} standard was not exceeded for the first time since 2004 due to the wet weather in 2022; and
- Annual average levels for particulate matters (PM₁₀ and PM_{2.5}) were at the lowest levels experienced in the past 10 years.

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

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 PM₁₀ and PM_{2.5}. Following the establishment of the Florey station on 28 February 2014, the Civic station only monitors selected, 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 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 3).

The goal of the AAQ NEPM is to achieve the NEPM standards specified in Schedule 2 of the AAQ NEPM.

Table 3: AAQ NEPM standards in 2022

Pollutant	Averaging Period	NEPM Standard
Carbon monoxide	8 hours	9.0 ppm
Nitrogen dioxide	1 hour	0.08 ppm
	1 year	0.015 ppm
Photochemical oxidants (as ozone)	8 hours	0.065 ppm
Sulfur dioxide	1 hour	0.10 ppm
	1 day	0.02 ppm
Lead	1 year	0.50 $\mu\text{g}/\text{m}^3$
Particles as PM ₁₀	1 day	50 $\mu\text{g}/\text{m}^3$
	1 year	25 $\mu\text{g}/\text{m}^3$
Particles as PM _{2.5}	1 day	25 $\mu\text{g}/\text{m}^3$
	1 year	8 $\mu\text{g}/\text{m}^3$

In accordance with its agreed policy position, the ACT assesses its compliance for the annual average for PM₁₀ 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 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 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 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 in accordance with the AAQ NEPM.

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

Carbon monoxide

During 2022, 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 second quarter at Monash. As a result, compliance was not demonstrated at Monash.

Table 4: 2022 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	89.8	55.4	94.7	94.7	83.7	0	ND
Florey	89.8	95.8	95.5	90.3	92.9	0	MET

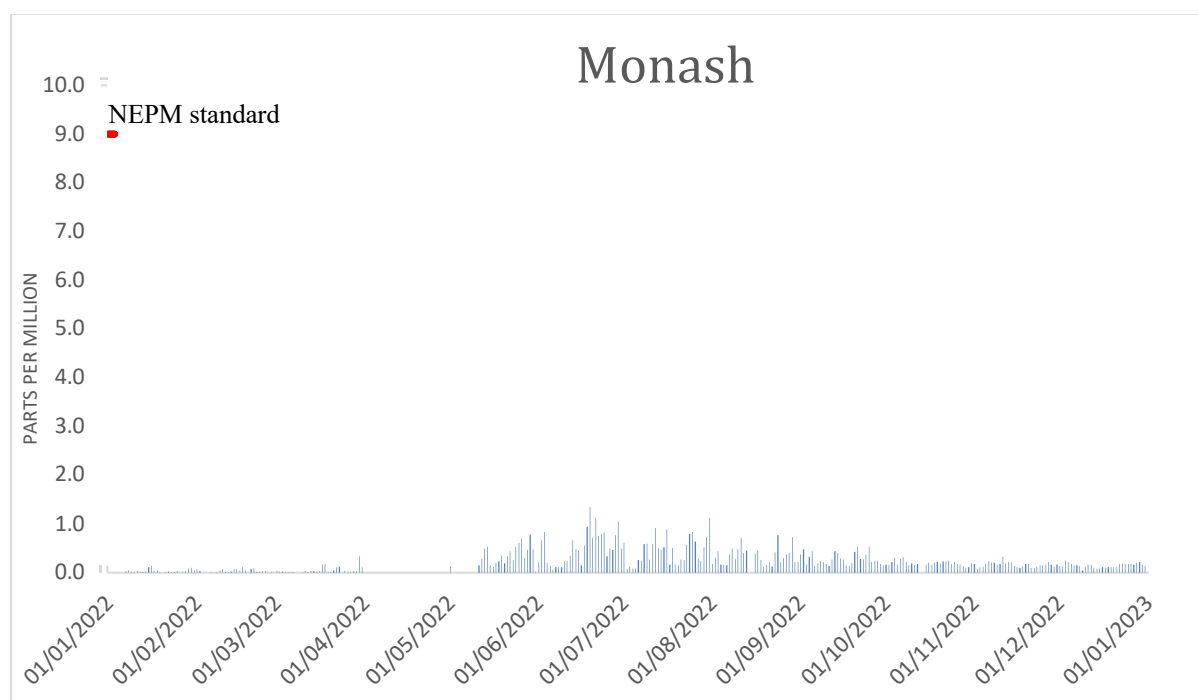


Figure 1: Daily maximum for CO 8-hour average – Monash

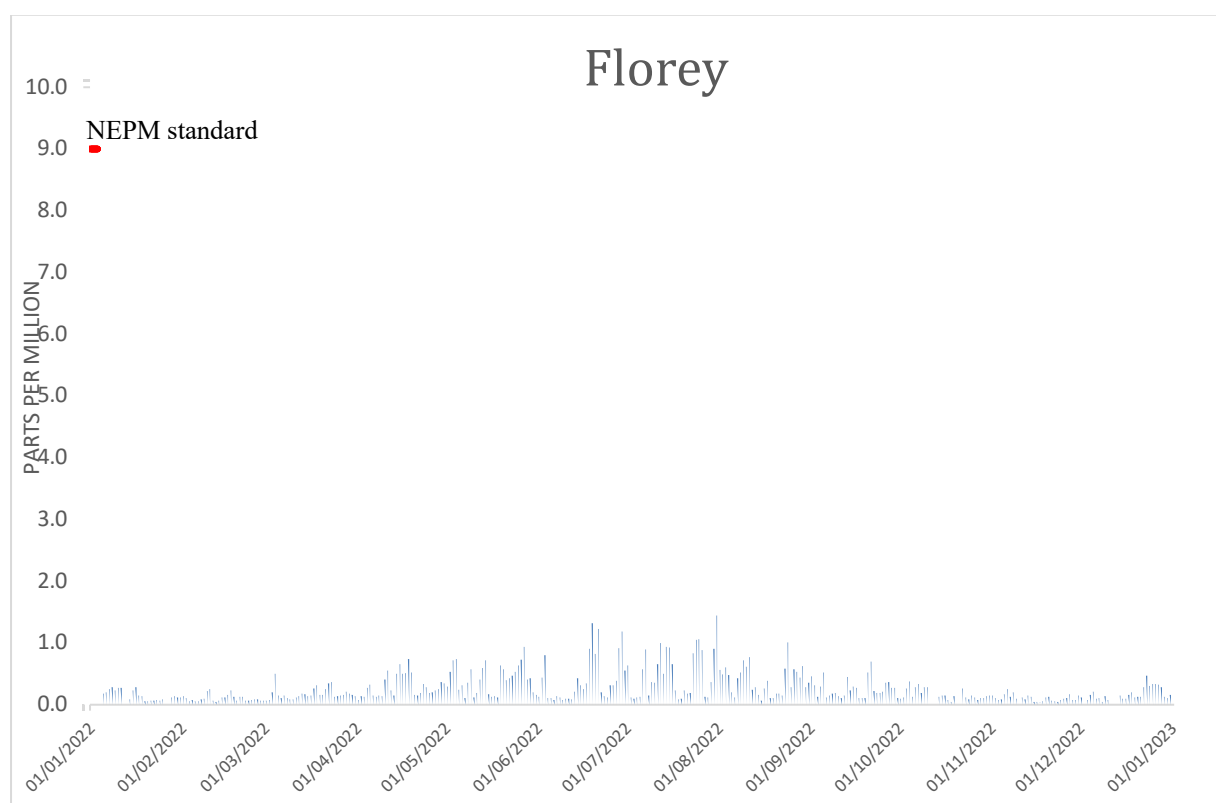


Figure 2: Daily maximum for CO 8-hour average – Florey

Nitrogen dioxide

During 2022, 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: 2022 compliance summary for NO₂

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	95.8	88.0	95.6	95.7	93.8	0	MET	0.003	MET
Florey	93.4	93.4	95.5	90.3	92.9	0	MET	0.004	MET

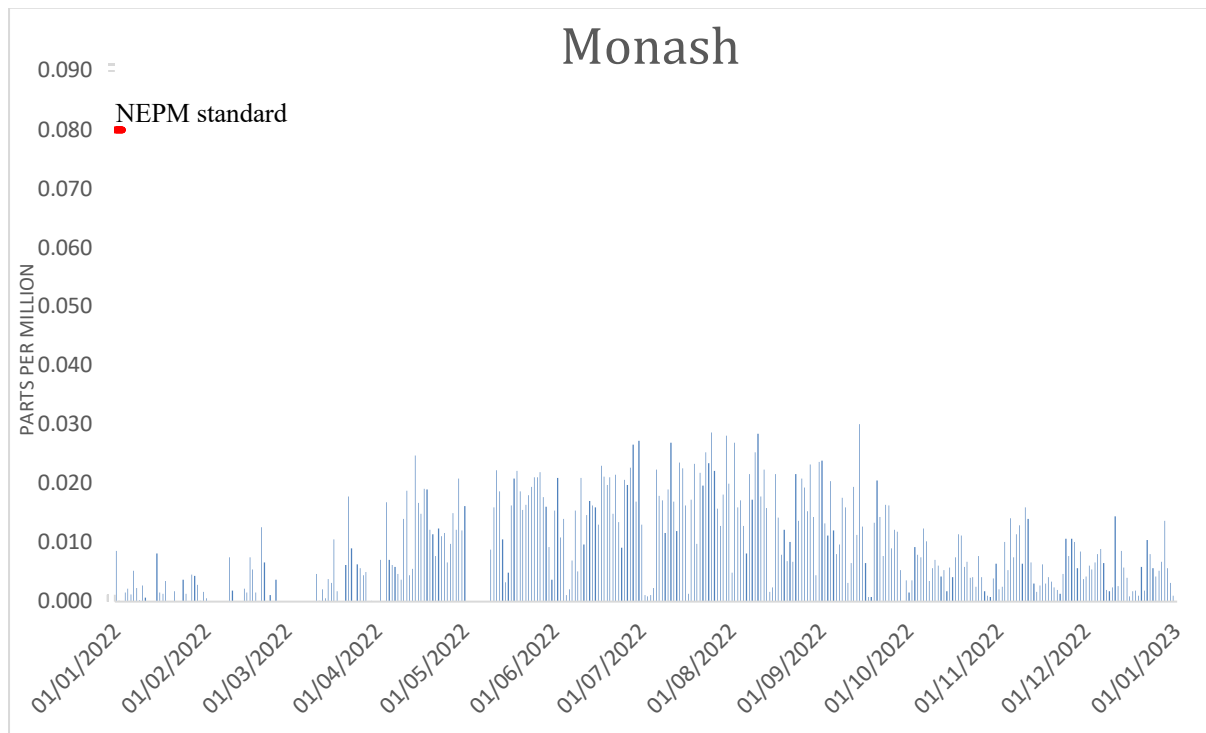


Figure 3: Daily maximum for NO₂ 1-hour average – Monash

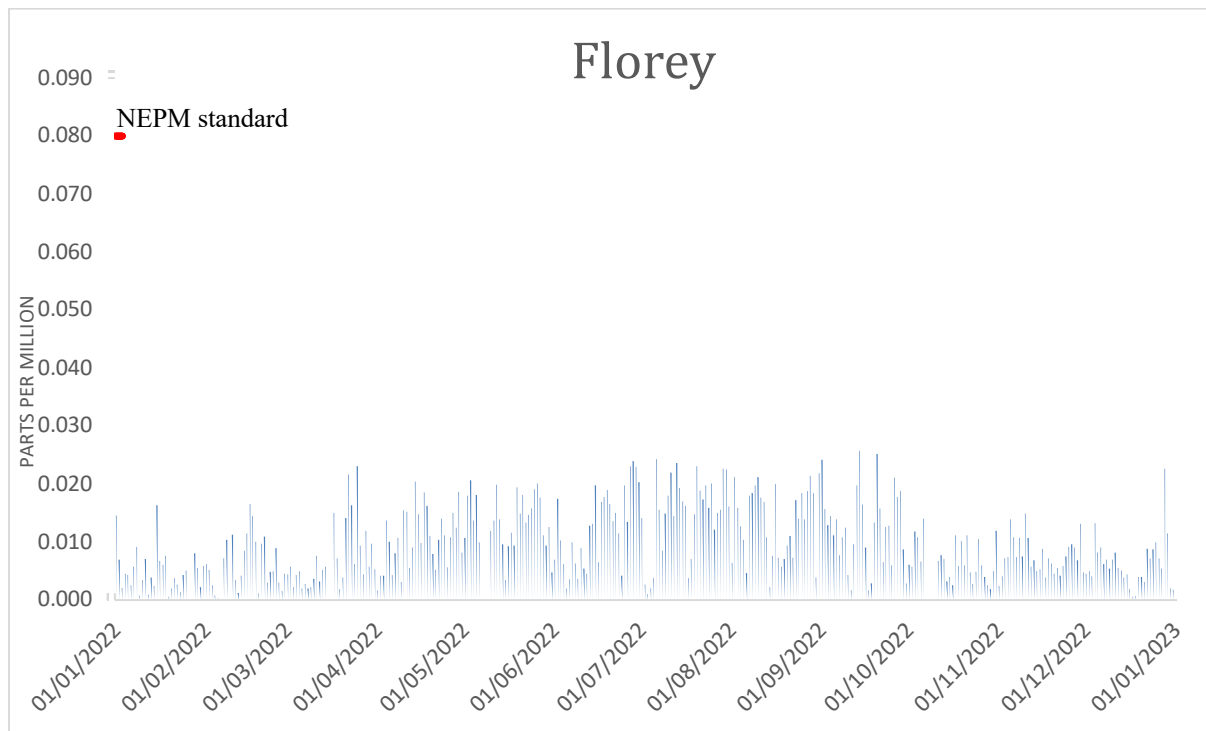


Figure 4: Daily maximum for NO₂ 1-hour average – Florey

Ozone

During 2022, no exceedances of the 8-hour standard for ozone were recorded and compliance was demonstrated at all monitoring stations.

Table 6: 2022 compliance summary for O₃

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	95.8	84.0	95.7	95.7	92.8	0	MET
Civic	95.8	94.8	94.7	95.7	95.3	0	MET
Florey	94.4	95.7	95.8	95.7	95.4	0	MET

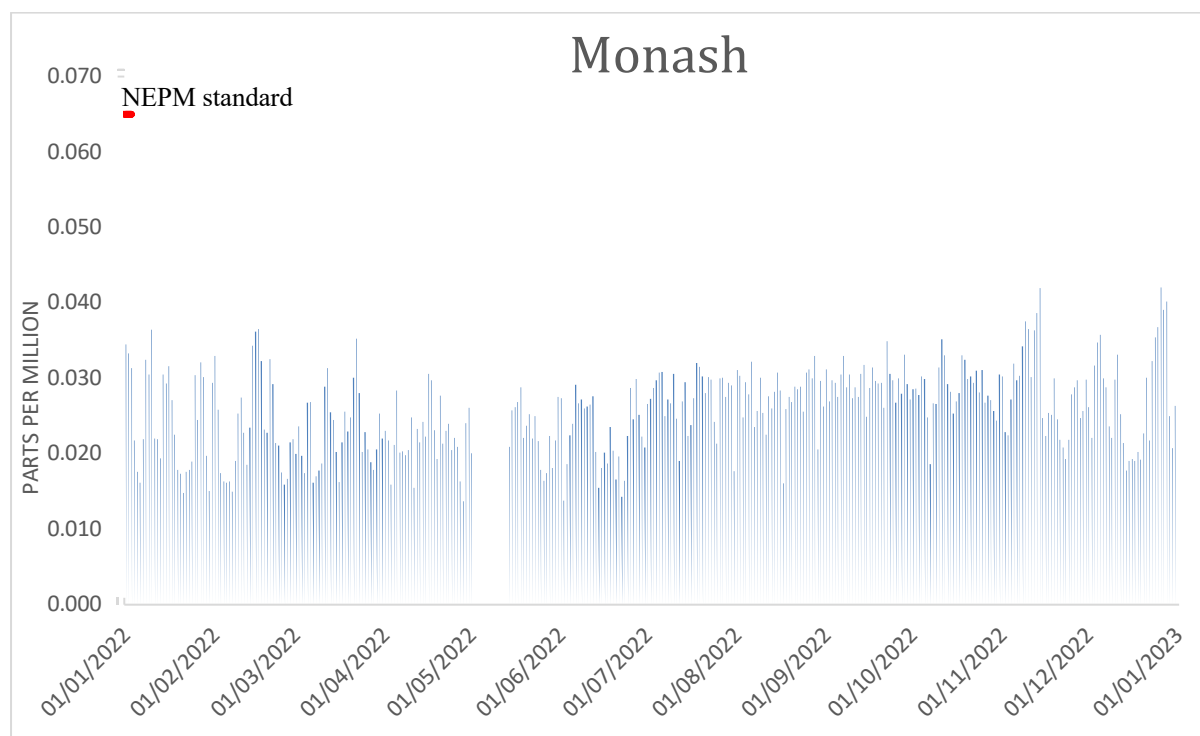


Figure 5: Daily maximum for O₃ 8-hour average – Monash

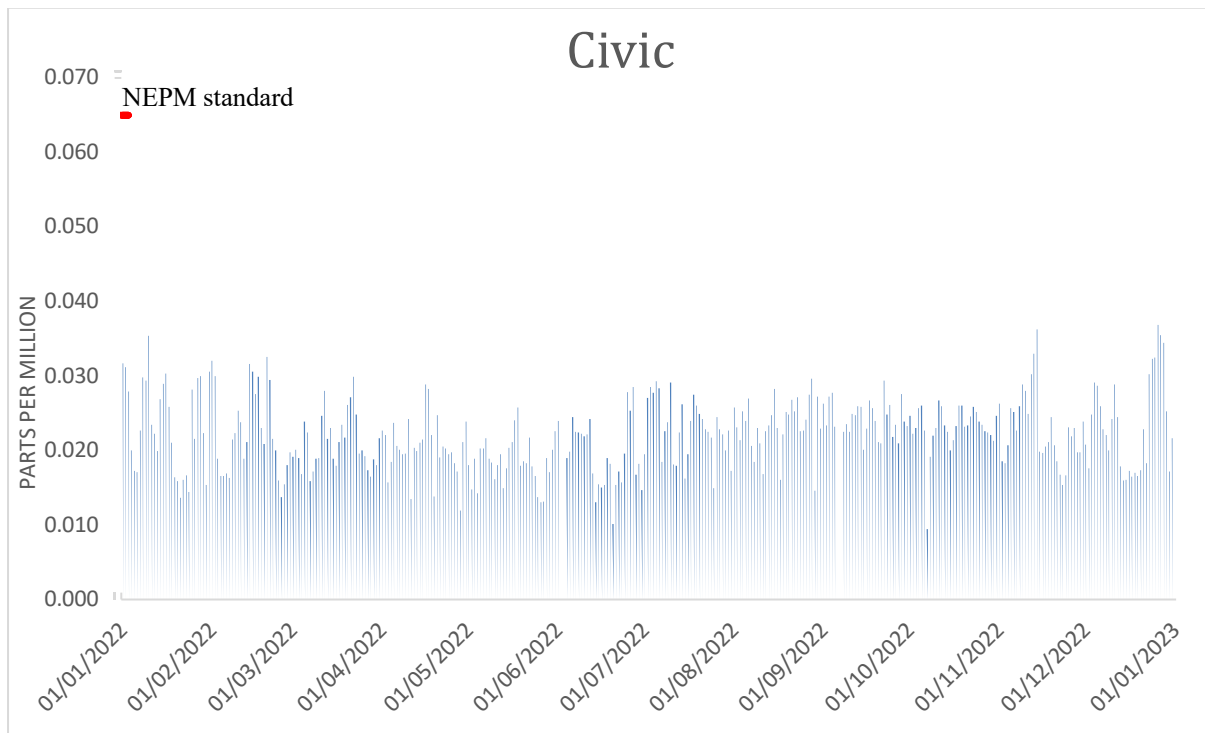


Figure 6: Daily maximum for O₃ 8-hour average – Civic

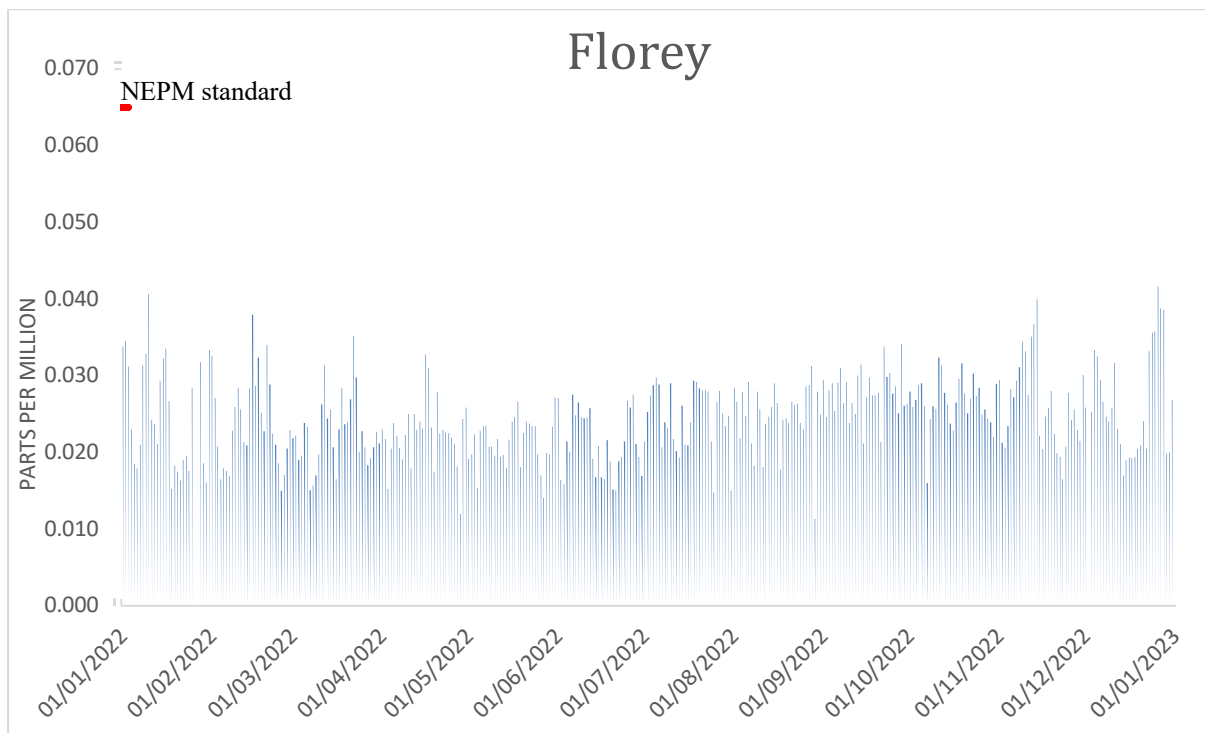


Figure 7: Daily maximum for O₃ 8-hour average – Florey

PM₁₀

During 2022, no exceedances of the daily PM₁₀ standard were recorded and compliance was demonstrated at all monitoring stations.

The annual average PM₁₀ levels at all stations met the ACT policy position of 20 µg/m³.

Table 7: 2022 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	91.2	100	95.7	96.7	0	MET	7.5	MET
Civic	98.9	97.8	100	96.7	98.4	0	MET	6.6	MET
Florey	97.8	100	97.8	98.9	98.6	0	MET	7.5	MET

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

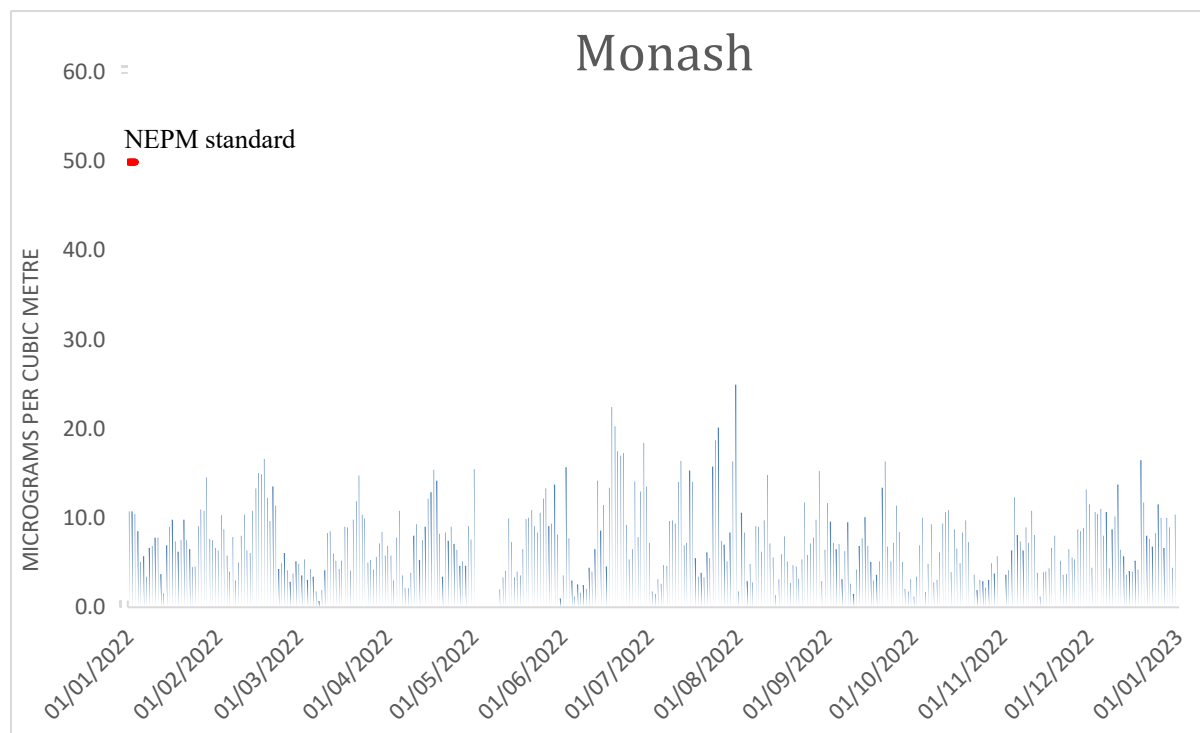


Figure 8: Daily maximum for PM₁₀ – Monash

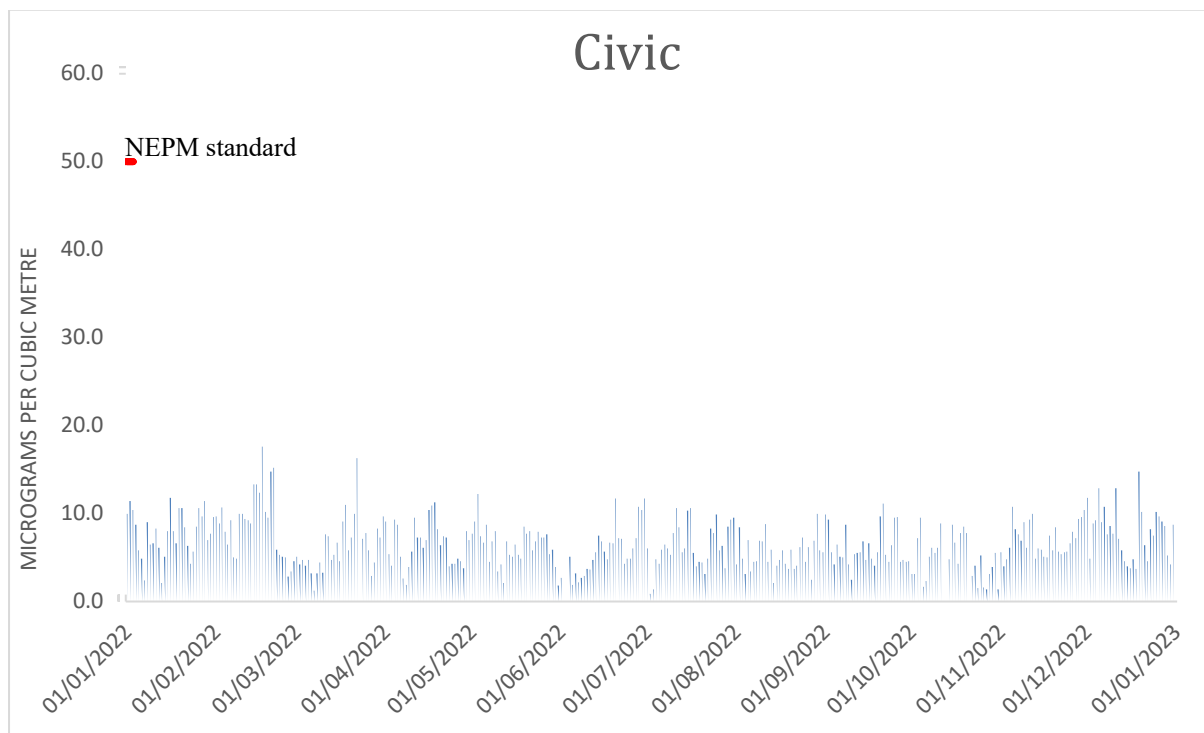


Figure 9: Daily maximum for PM₁₀ – Civic

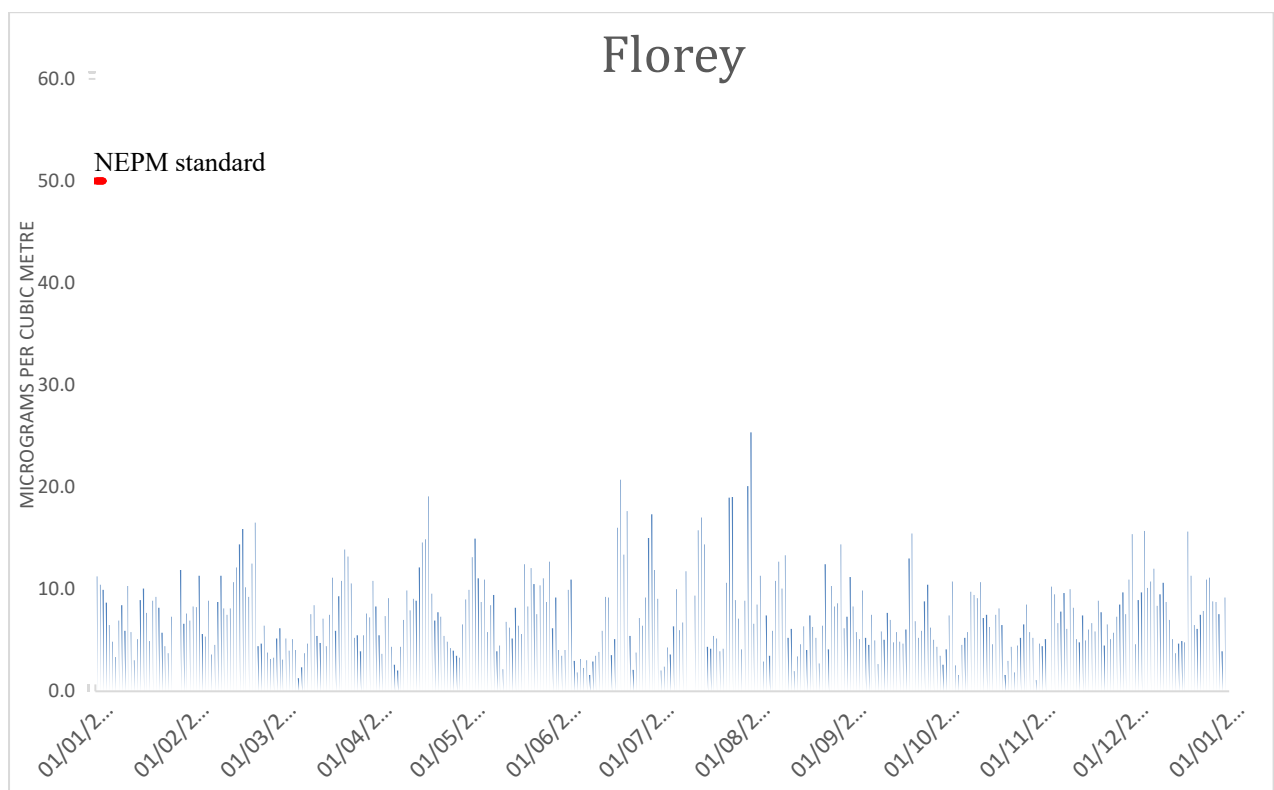


Figure 10: Daily maximum for PM₁₀ – Florey

PM_{2.5}

During 2022, no exceedances of the daily PM_{2.5} standard were recorded and compliance was demonstrated at all monitoring stations.

Annual average PM_{2.5} data at all stations met the 8 µg/m³ AAQ NEPM standard.

Table 8: 2022 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	83.5	98.9	89.1	92.6	0	MET	5.3	MET
Civic	95.6	93.4	100	96.7	96.4	0	MET	4.1	MET
Florey	90.0	100	100	96.7	96.7	0	MET	5.0	MET

* the number excludes exceptional events.

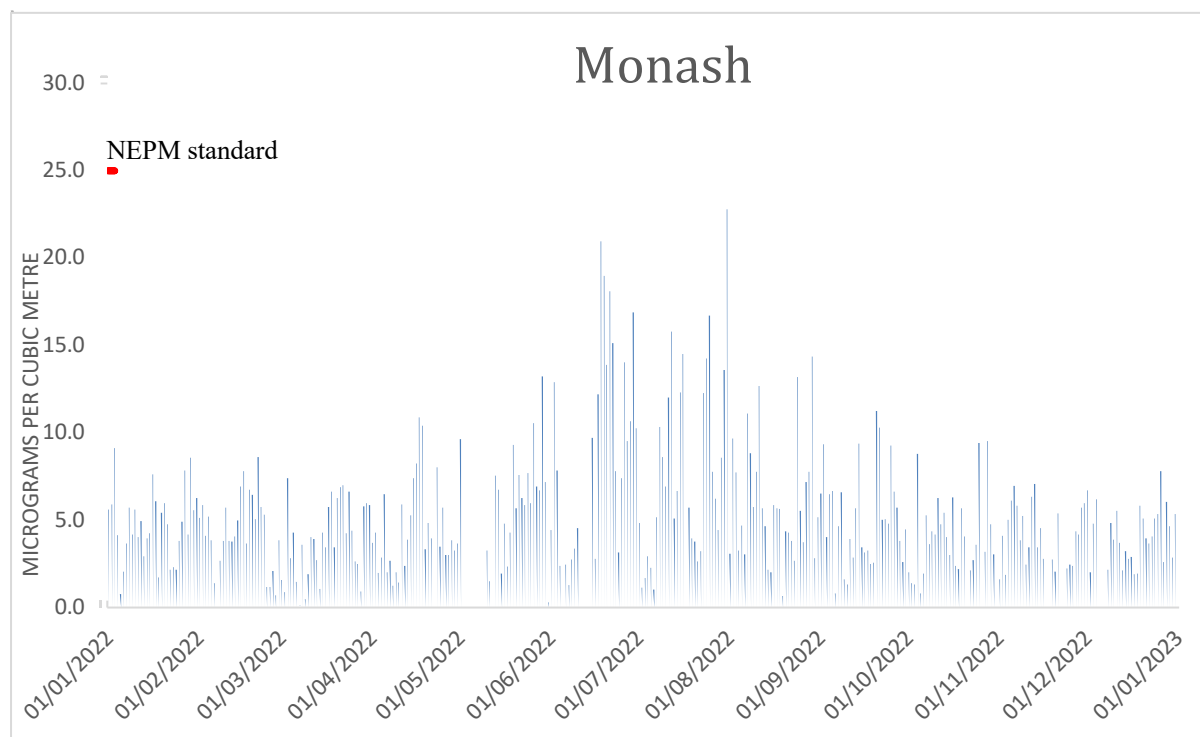


Figure 11: Daily maximum for PM_{2.5} – Monash

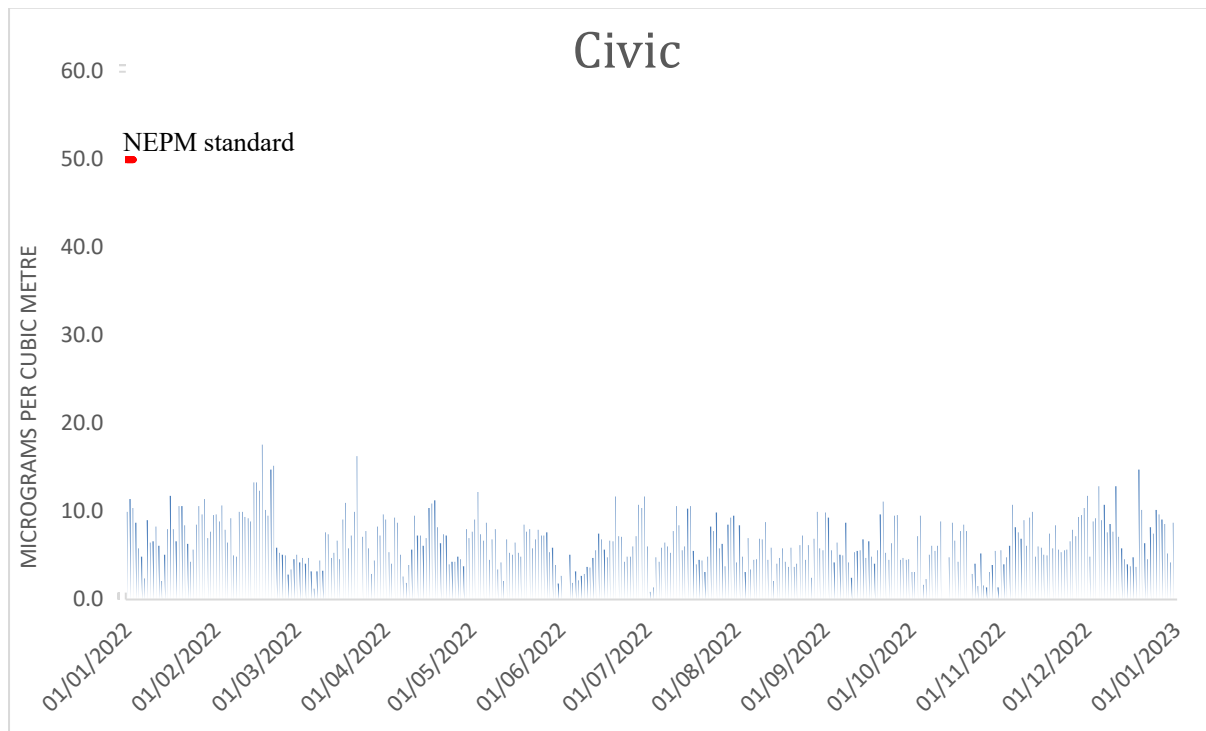


Figure 12: Daily maximum for PM_{2.5} – Civic

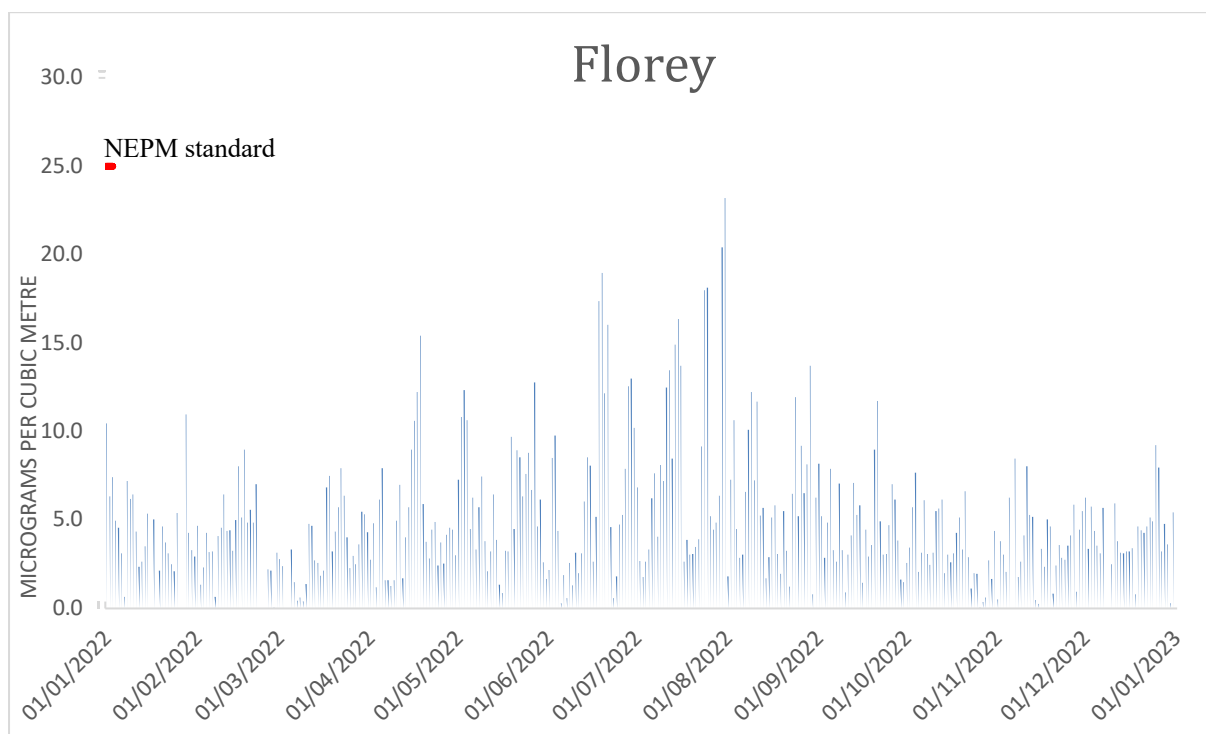


Figure 13: Daily maximum for PM_{2.5} – Florey

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 are well below the AAQ NEPM standard at all monitoring stations. The highest recorded value in the ACT during 2022 was 1.4 ppm at Monash, which is 16% of the standard.

Table 9: 2022 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	316	1.3	19 Jun 04:00
Florey	352	1.4	31 Jul 04:00

Nitrogen dioxide

Similar to carbon monoxide, nitrogen dioxide levels are well below the AAQ NEPM standard. The highest recorded 1-hour value during 2022 was 0.030 ppm at Monash, which is only 37.5% of the standard. The highest recorded annual average in 2022 was 0.004 ppm at Florey (refer to Table 5). This is 27% of the annual standard 0.015 ppm.

Table 10: 2022 summary statistics for daily peak 1-hour NO₂

AAQ NEPM standard 0.08 ppm (1-hour average)

Monitoring station	Number of valid days	Highest (ppm)	Highest (date/time)
Monash	357	0.030	14 Sep 20:00
Florey	354	0.026	14 Sep 20:00

Ozone

Ozone levels in 2022 were below the 8-hour standard. The highest recorded value in the ACT during 2022 was 0.042 ppm at Florey and Florey, which is 65% of the standard.

Table 11: 2022 summary statistics for daily peak 8-hour O₃

AAQ NEPM standard 0.065 ppm (8-hour average)

Monitoring station	Number of valid days	Highest (ppm)	Highest (date/time)
Monash	353	0.042	26 Dec 16:00
Civic	361	0.037	26 Dec 16:00
Florey	363	0.042	26 Dec 16:00

PM₁₀

PM₁₀ levels were significantly reduced in 2022. The highest daily PM₁₀ level was recorded at Florey on 31 July 2022, with the concentration of 25.0 µg/m³. The highest recorded annual average in 2022 was only 7.5 µg/m³ at Monash and Florey (refer to Table 7), which is 37.5% of the ACT policy standard of 20 µg/m³.

Table 12: 2022 summary statistics for daily PM₁₀AAQ NEPM daily standard 50 µg/m³

Monitoring station	Number of valid days	Highest (µg/m ³)	Highest (date)
Monash	353	25.0	31 July
Civic	359	17.6	17 Feb
Florey	360	25.3	31 July

PM_{2.5}

PM_{2.5} levels were below the standard for the first time since 2004. The highest daily PM_{2.5} level was 23.2 µg/m³ which was recorded at Florey on 31 July 2022. The highest recorded annual average in 2022 was 5.3 µg/m³ at Monash (refer to Table 8), which is 66% of the standard.

Table 13: 2022 summary statistics for daily PM_{2.5}AAQ NEPM daily standard 25 µg/m³

Monitoring station	Number of valid days	Highest (µg/m ³)	Highest (date)
Monash	338	22.8	31 Jul
Civic	352	10.1	29 Aug
Florey	353	23.2	31 Jul

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. During periods of drier weather exceedances of the particulate matter standards have also been attributed to smoke from hazard reduction burns, bushfires and dust storms.

In 2022, the AAQ NEPM standards for all pollutants were not exceeded during the whole year.

While PM_{2.5} levels increase during the cooler months of the year which can be seen in Figure 11 to Figure 13, the daily PM_{2.5} standard was not exceeded for the first time since 2004. This is understood to be due to the wet weather and associated lack of any significant bushfire events, combined with the implementation of Government programs to minimise emissions from wood heaters and transition to renewable energy.

Notwithstanding there were no exceedances of the PM_{2.5} standard the ACT Government acknowledges that wood heater emissions have an adverse effect on air quality during winter, and will 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 Index² and AirRater App;
- Advice is provided about how to burn better by using wood heaters correctly to improve air quality, save money and keep homes warm during winter³;
- The regulation of firewood merchants to ensure only seasoned wood is sold⁴;
- 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)⁵, 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, including both proactive and reactive inspections⁶;

² <https://www.health.act.gov.au/about-our-health-system/population-health/environmental-monitoring/monitoring-and-regulating-air>

³ <https://www.environment.act.gov.au/environment/wood-fire-heating>

⁴ <https://www.accesscanberra.act.gov.au/s/article/air-pollution-tab-business-and-industry>

⁵ <https://files.accesscanberra.act.gov.au/legacy/3224/Molonglo%20Valley%20air%20quality%20assessment.pdf>

⁶ <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 alternatives⁷;
- Administering the Sustainable Households Loan Scheme which provided loans of between \$2,000 to 15,000 to buy energy-efficient products⁸; and
- Implementing the first action plan 2021-23 under “*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 heaters⁹.

⁷ <https://www.climatechoices.act.gov.au/policy-programs/wood-heater-replacement-program>

⁸ <https://www.climatechoices.act.gov.au/policy-programs/sustainable-household-scheme>

⁹ <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 O₃ 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 14: Statistical summary for daily maximum 8-hour CO Monash 2013 – 2022

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
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
2022	83.7	0	1.3	0.7	0.3	0.2

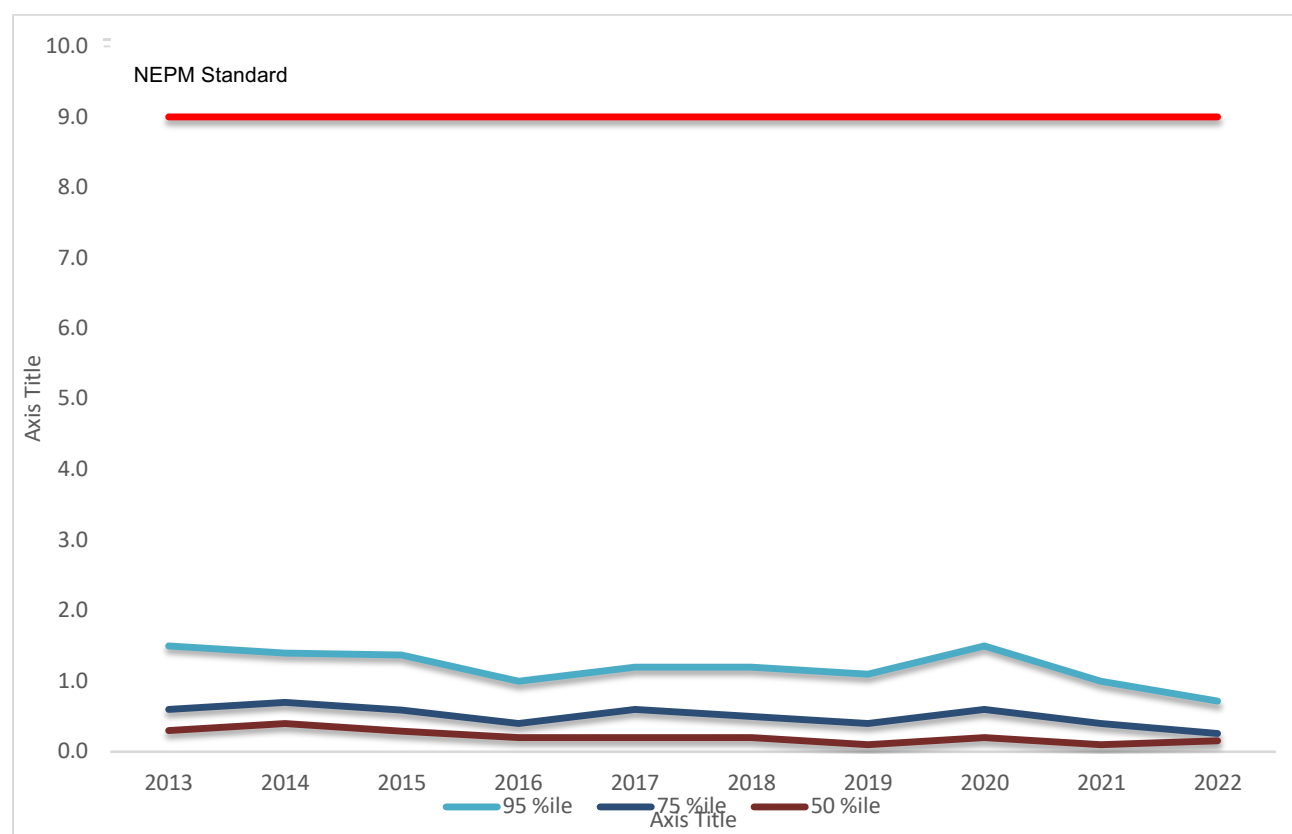
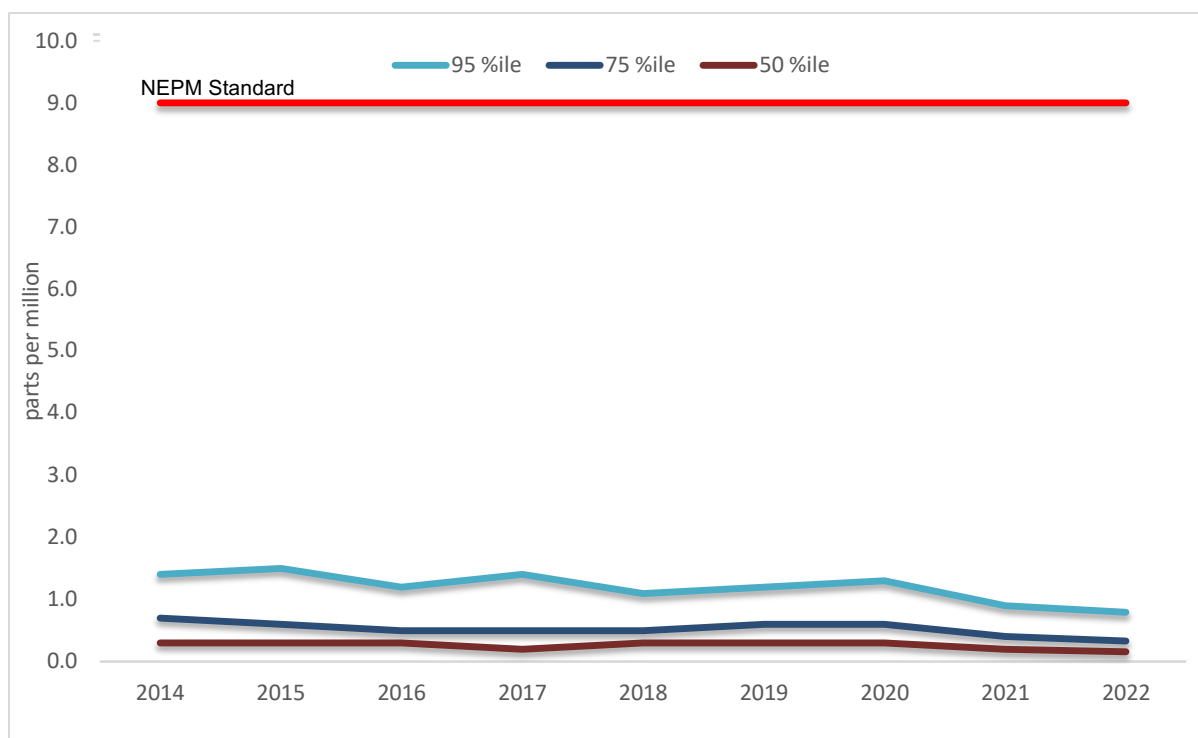


Figure 14: Statistical summary for daily maximum 8-hour CO Monash 2013 – 2022**Table 15: Statistical summary for daily maximum 8-hour CO Florey 2014 – 2022**

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
2021	95.2	0	1.2	0.9	0.4	0.2
2022	92.9	0	1.4	0.8	0.3	0.2

**Figure 15: Statistical summary for daily maximum 8-hour CO Florey 2014 – 2022**

Nitrogen dioxide

Table 16: Statistical summary for daily maximum 1-hour NO₂ Monash 2013 – 2022

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)
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
2022	93.8	0	0.030	0.003	0.023	0.015	0.007

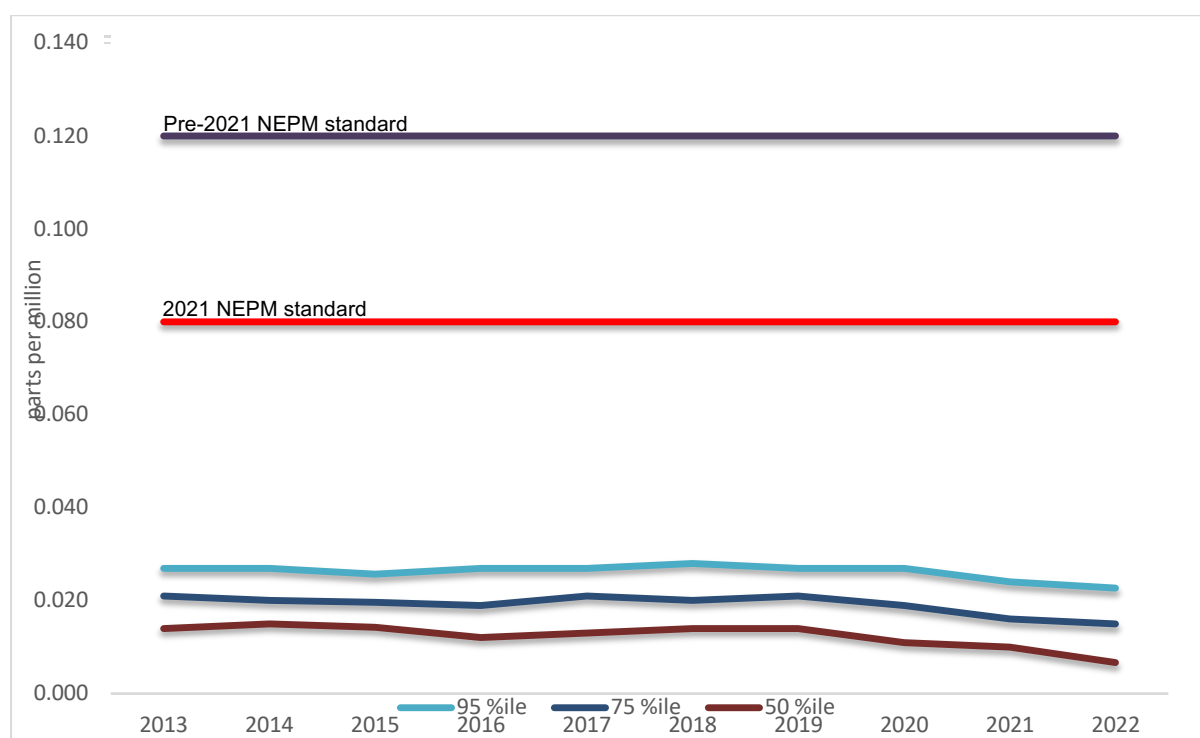


Figure 16: Statistical summary for daily maximum 1-hour NO₂ Monash 2013 – 2022

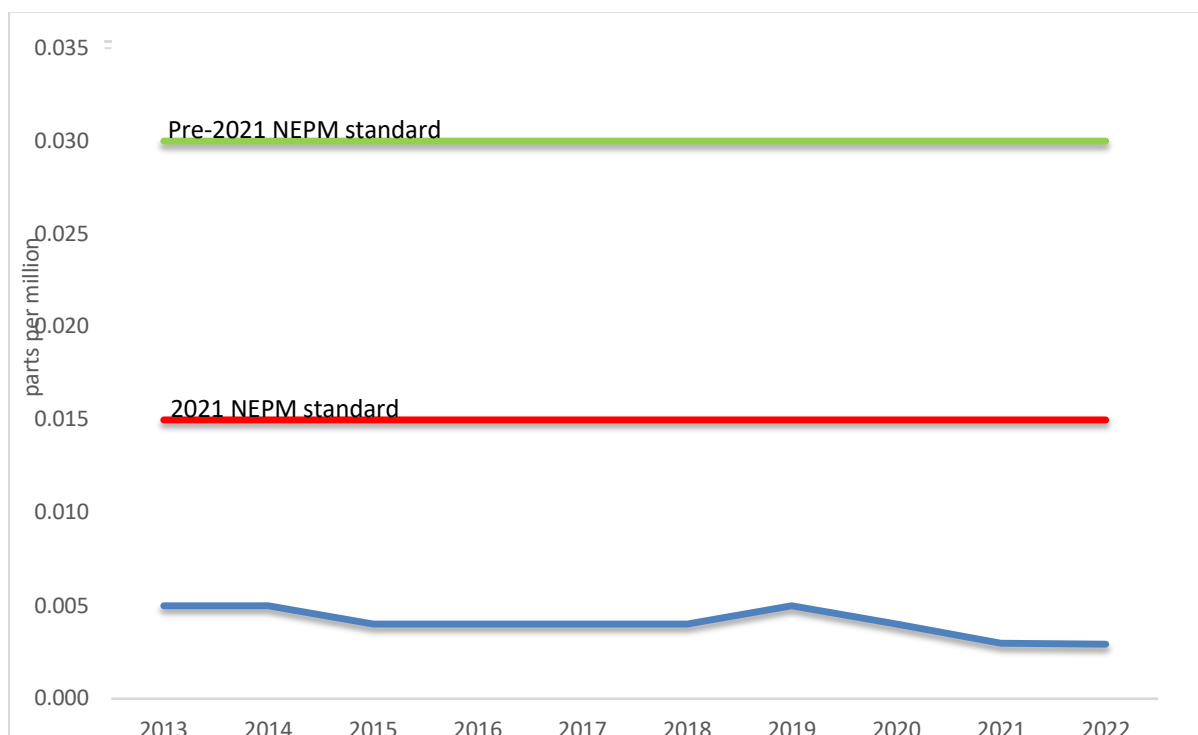


Figure 17: Annual average 1-hour NO₂ Monash 2013 – 2022

Table 17: Statistical summary for daily maximum 1-hour NO₂ Florey 2014 – 2022

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
2021	91.6	0	0.034	0.004	0.020	0.013	0.009
2022	93.7	0	0.026	0.004	0.021	0.014	0.009

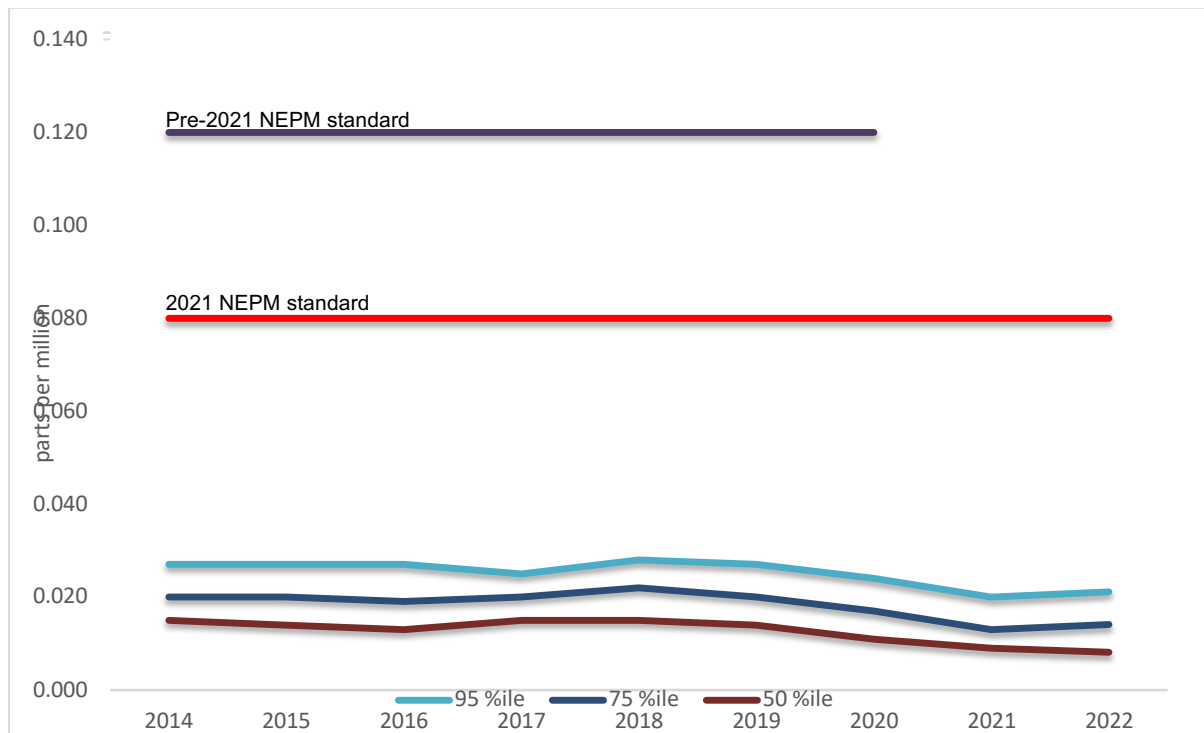


Figure 18: Statistical summary for daily maximum 1-hour NO₂ Florey 2014 – 2022

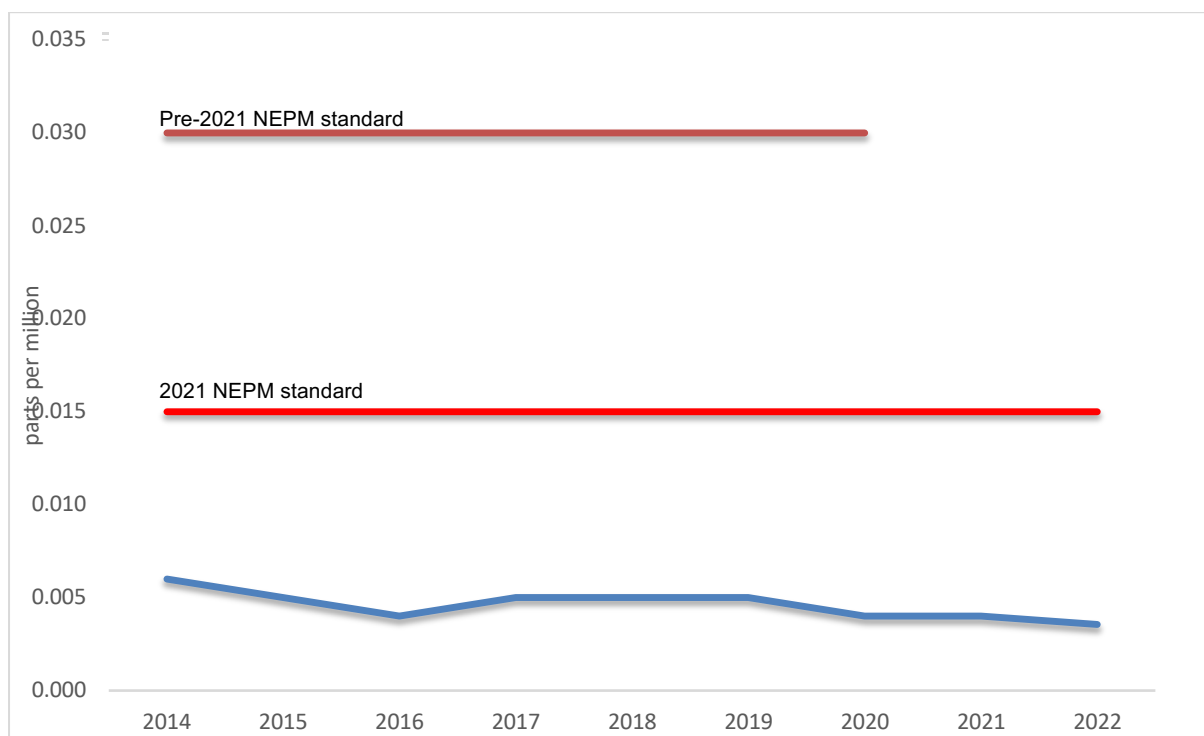


Figure 19: Annual average 1-hour NO₂ Florey 2014 – 2022

Ozone

Table 18: Statistical summary for daily maximum 8-hour O₃ Monash 2013 – 2022

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
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
2022	92.8	0	0.042	0.035	0.030	0.026

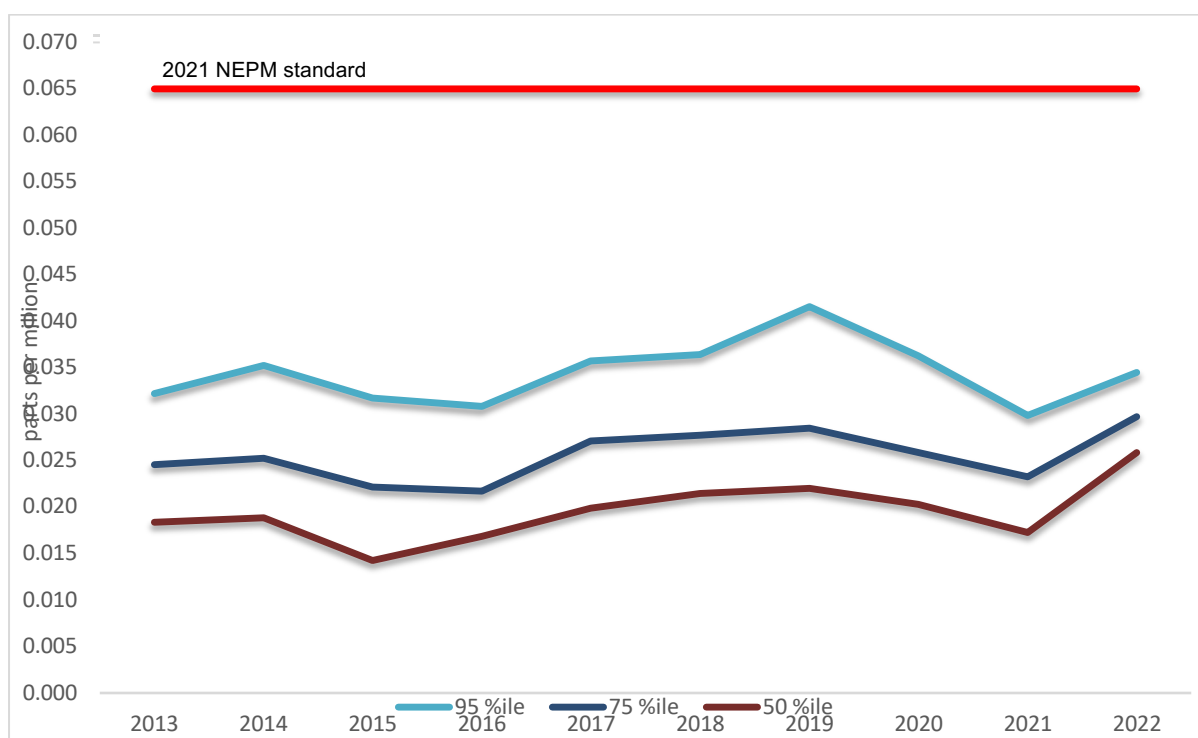


Figure 20: Statistical summary for daily maximum 8-hour O₃ Monash 2012 – 2022

Table 19: Statistical summary for daily maximum 8-hour O₃ Civic 2012 – 2022

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. (ppm)	95 th percentile (ppm)	75 th percentile (ppm)	50 th percentile (ppm)
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
2022	95.3	0	0.037	0.030	0.025	0.022

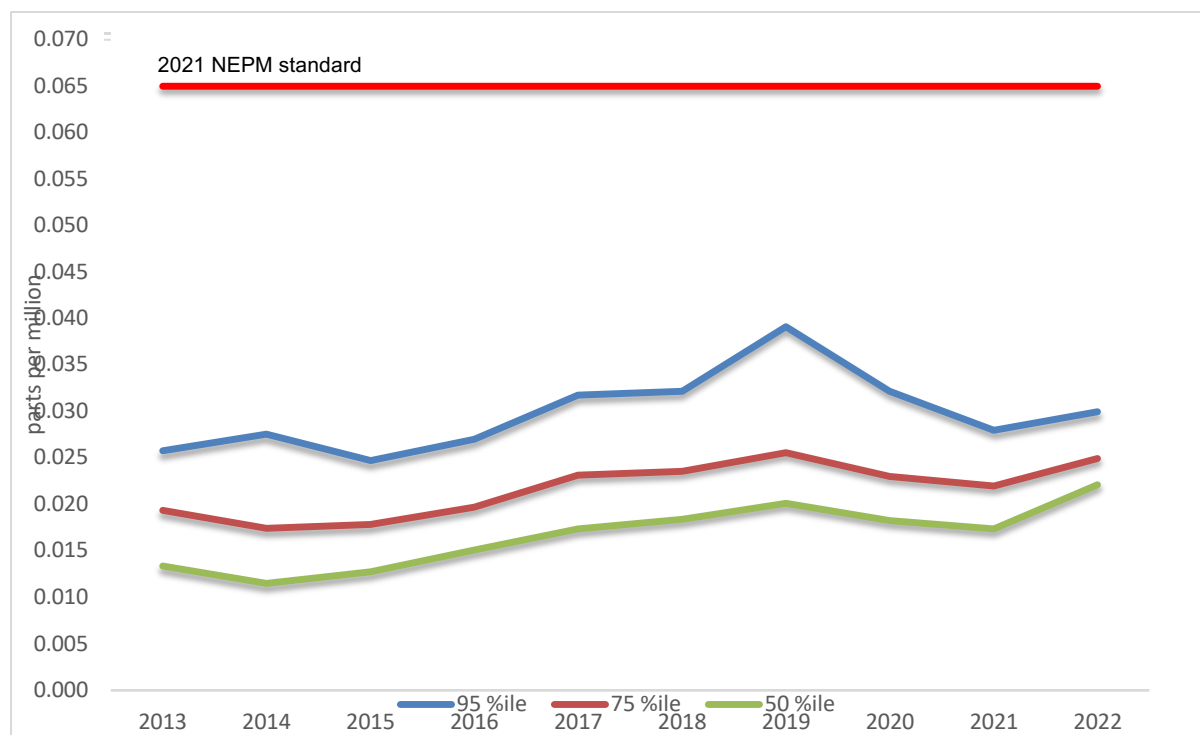
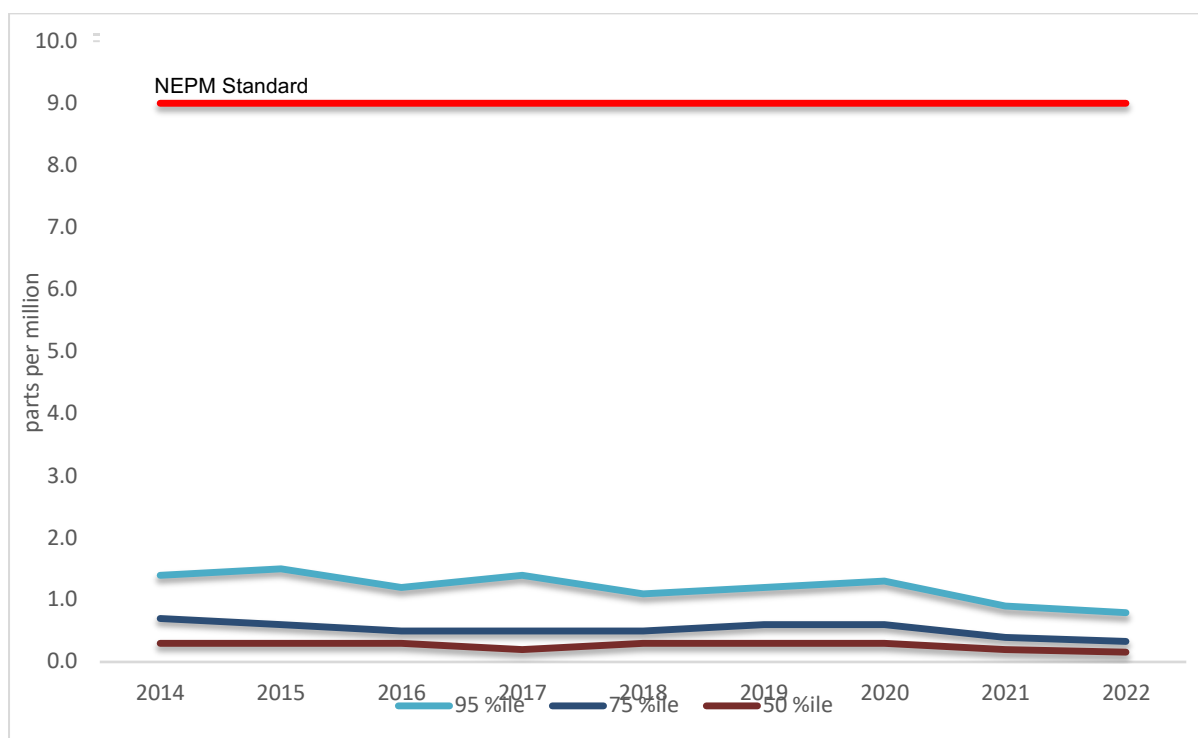


Figure 21: Statistical summary for daily maximum 8-hour O₃ Civic 2013 – 2022

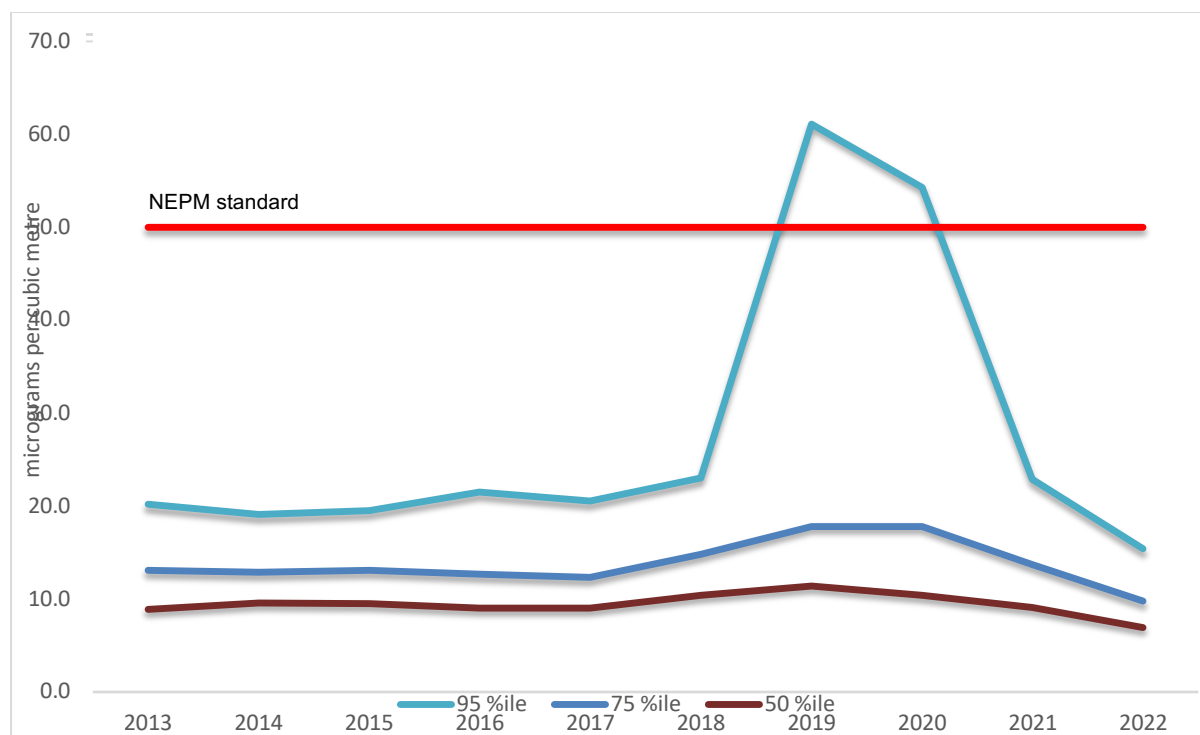
Table 20: Statistical summary for daily maximum 8-hour O₃ Florey 2014 – 2022

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	0.037	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
2022	95.4	0	0.042	0.033	0.028	0.024

**Figure 22: Statistical summary for daily maximum 1-hour O₃ Florey 2014 – 2022**

PM₁₀**Table 21: Statistical summary for daily maximum daily PM₁₀ Monash 2012 – 2022**

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)
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
2022	96.7	0	25.0	7.5	15.4	9.8	6.9

**Figure 23: Statistical summary for daily PM₁₀ Monash 2013 – 2022**

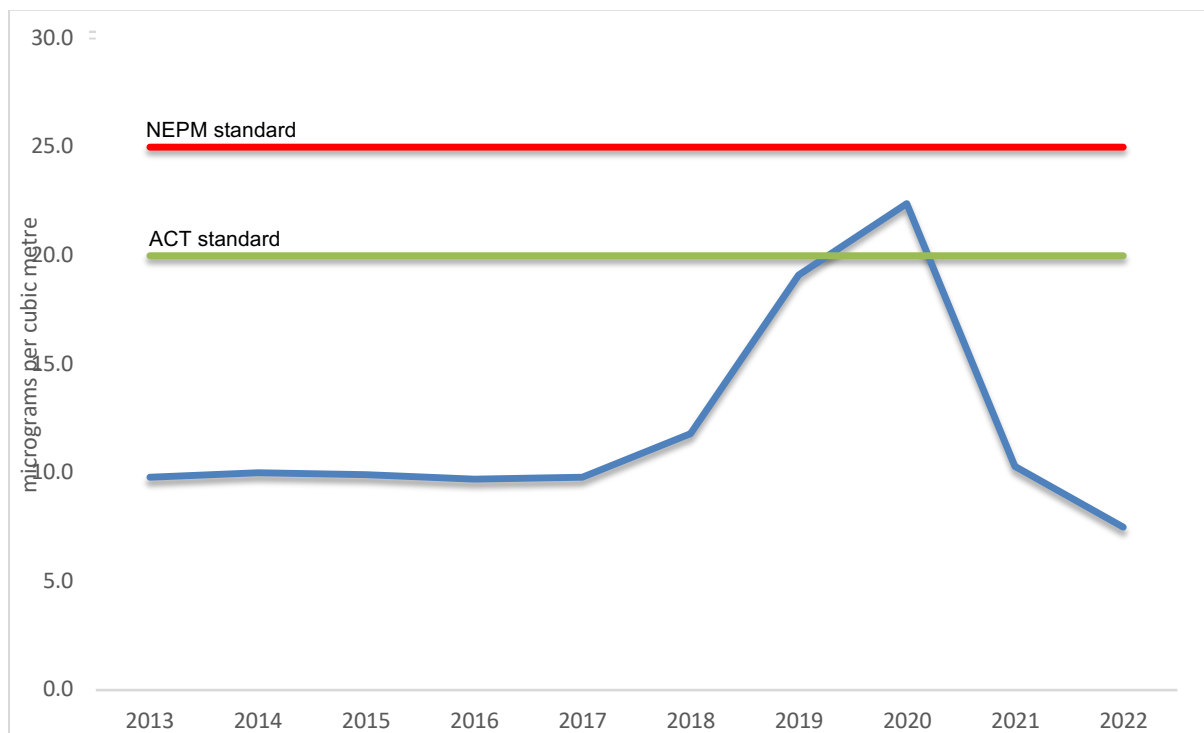


Figure 24: Annual average daily PM₁₀ Monash 2013 – 2022

Table 22: Statistical summary for daily maximum daily PM₁₀ Civic 2013 – 2022

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)
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
2022	98.4	0	17.6	6.6	11.1	8.5	6.1

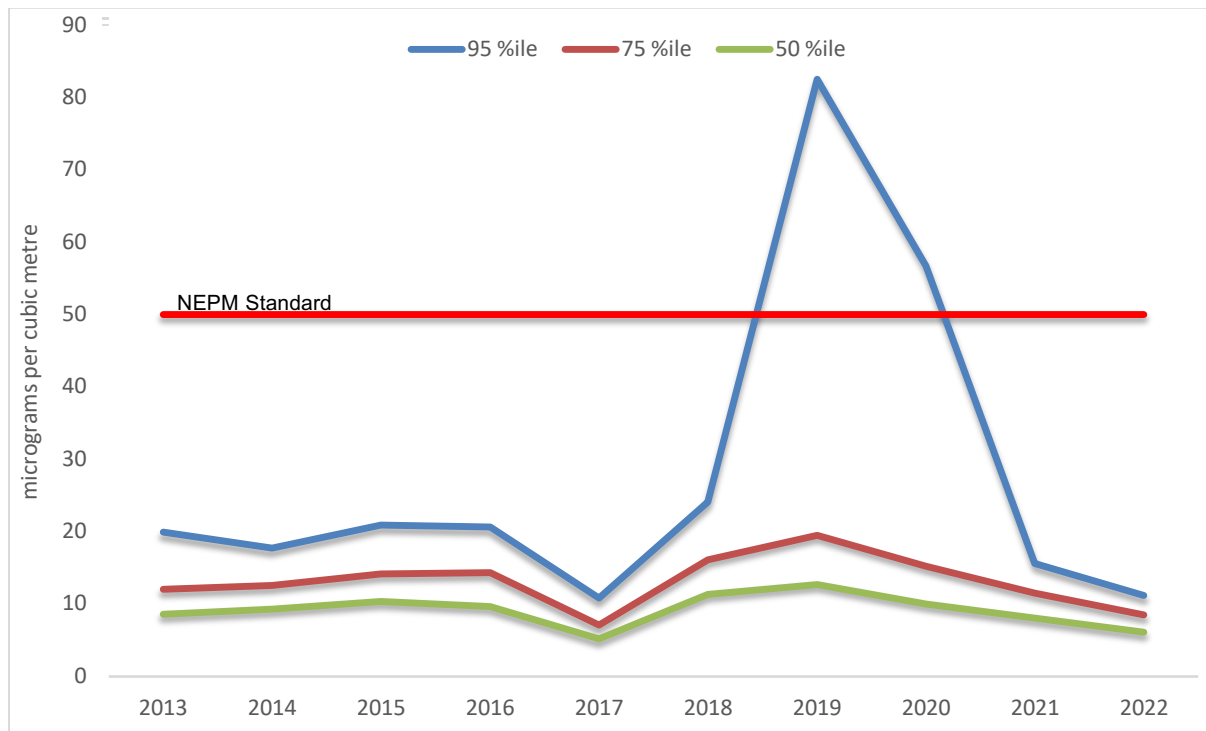


Figure 25: Statistical summary for daily PM₁₀ Civic 2013 – 2022

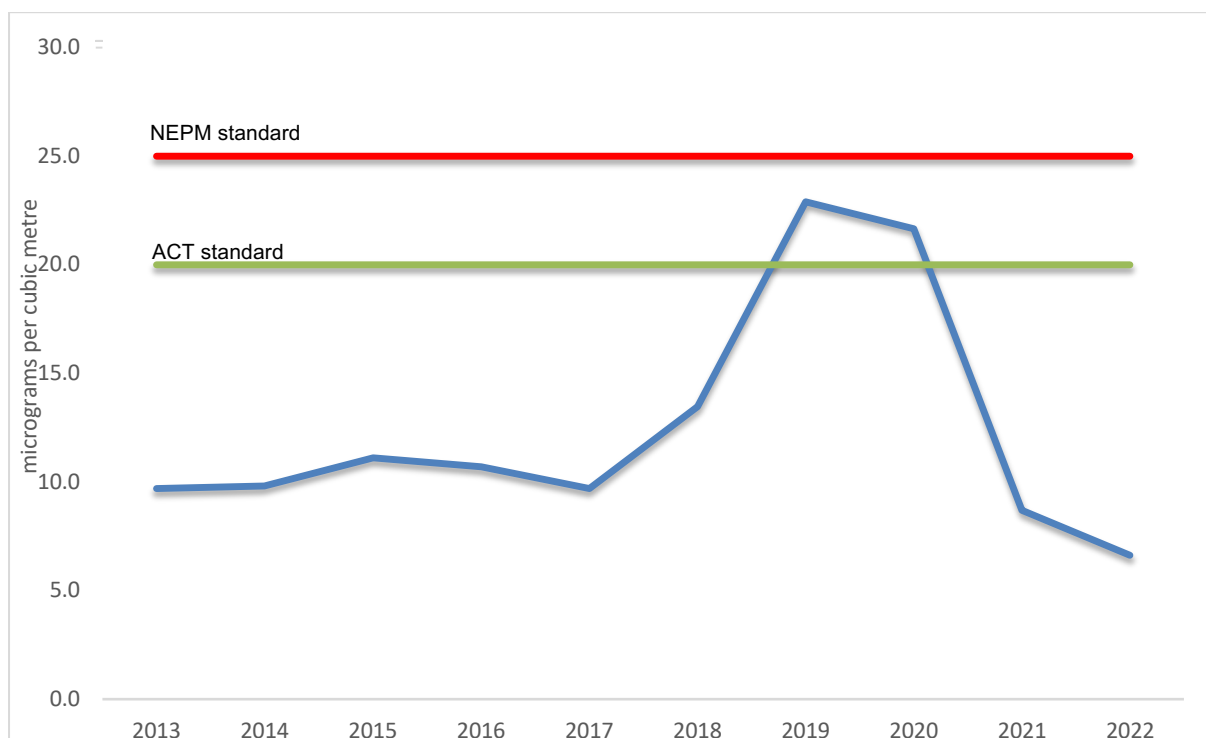


Figure 26: Annual average daily PM₁₀ Civic 2013 – 2022

Table 23: Statistical summary for daily maximum daily PM₁₀ Florey 2014 – 2022

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. ($\mu\text{g}/\text{m}^3$)	Annual average ($\mu\text{g}/\text{m}^3$)	95 th percentile ($\mu\text{g}/\text{m}^3$)	75 th percentile ($\mu\text{g}/\text{m}^3$)	50 th percentile ($\mu\text{g}/\text{m}^3$)
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
2021	99.5	0	37.9	9.6	19.6	12.7	8.5
2022	98.6	0	25.3	7.5	15.0	9.5	6.9

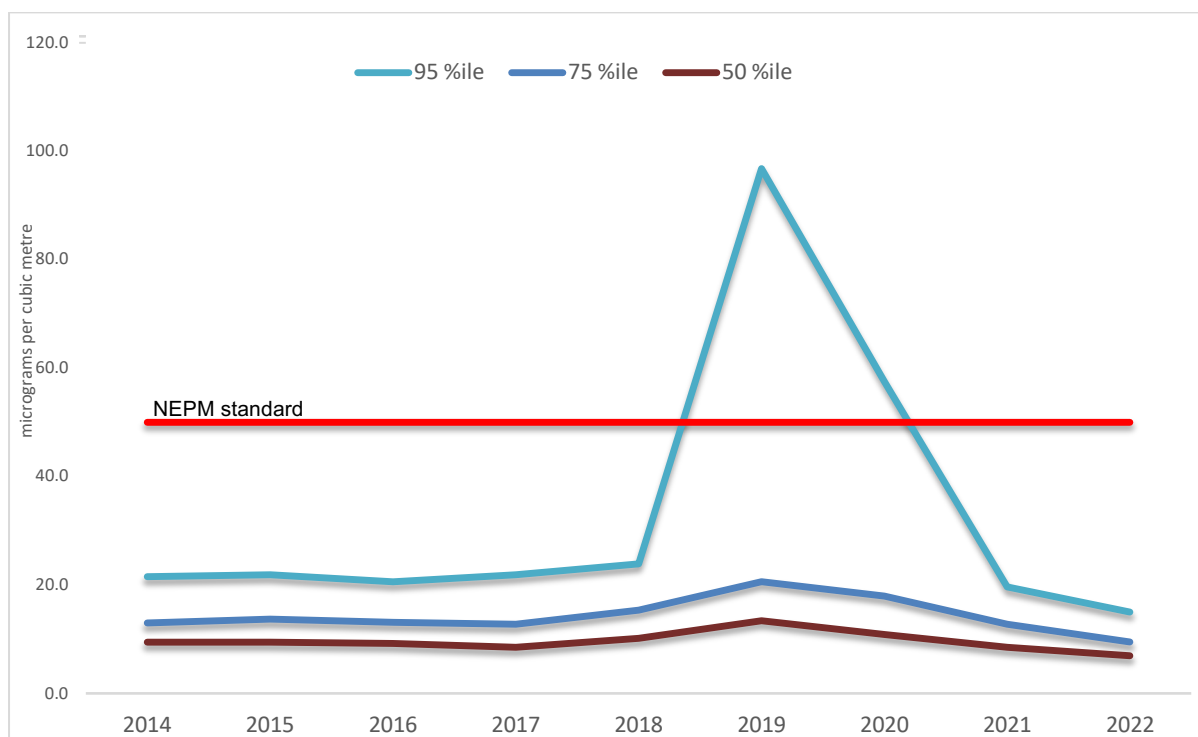


Figure 27: Statistical summary for daily PM₁₀ Florey 2014 – 2022

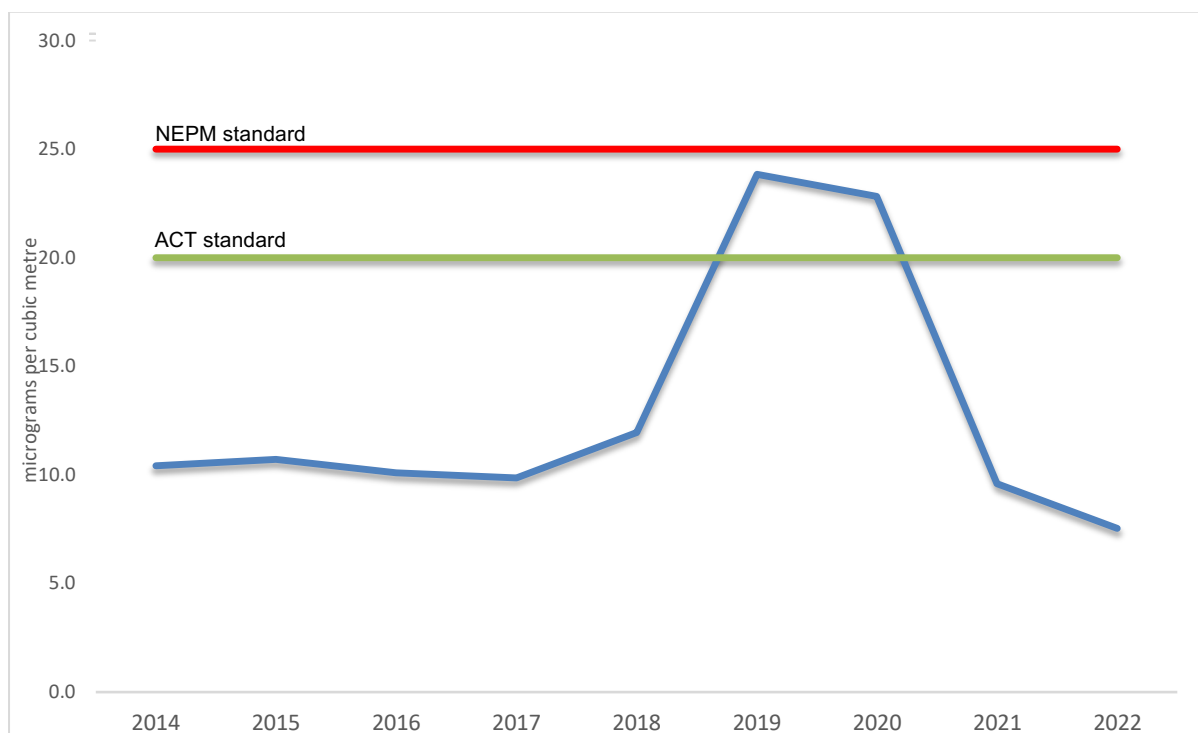


Figure 28: Annual average daily PM₁₀ Florey 2014 – 2022

PM_{2.5}

Table 24: Statistical summary for daily maximum daily PM_{2.5} Monash 2013 – 2022

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)
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
2022	92.6	0	22.8	5.3	12.7	6.6	4.6

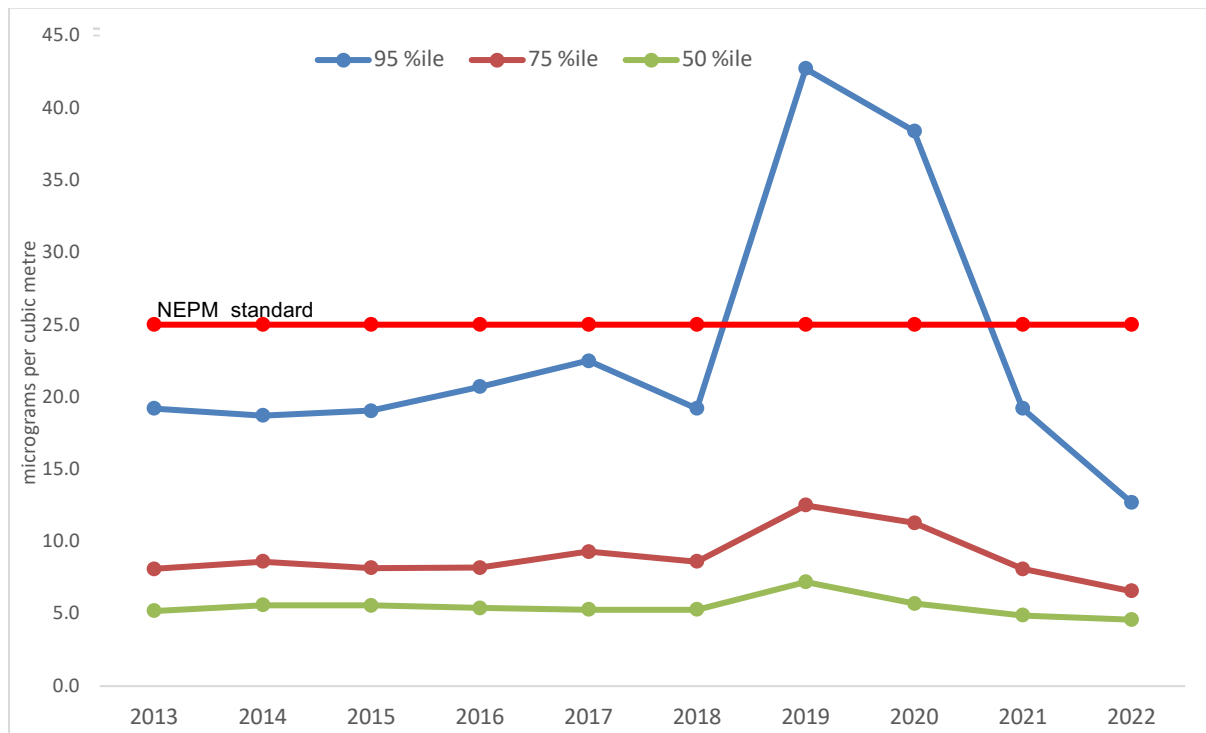


Figure 29: Statistical summary for daily PM_{2.5} Monash 2013 – 2022

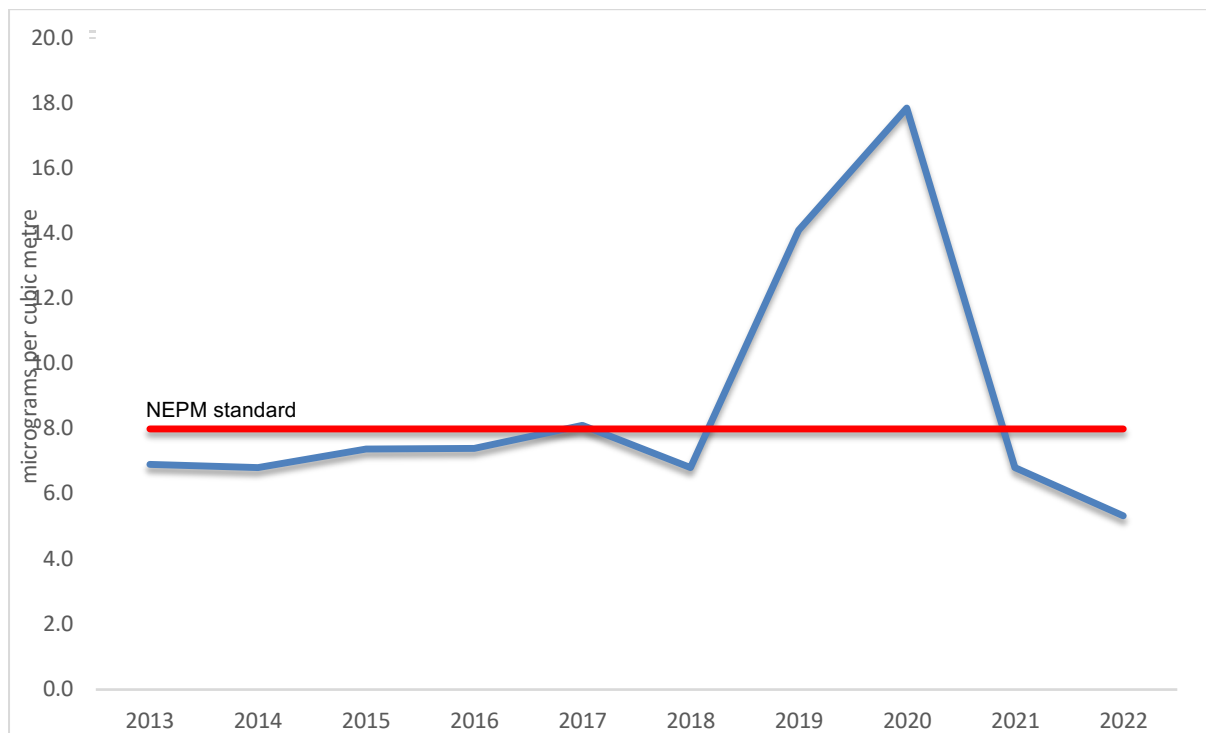


Figure 30: Annual average daily PM_{2.5} Monash 2013 – 2022

Table 25: Statistical summary for daily maximum daily PM_{2.5} Civic 2016 – 2022

Year	Data Availability (%)	No. of Exceedances (days)	Max conc. ($\mu\text{g}/\text{m}^3$)	Annual average ($\mu\text{g}/\text{m}^3$)	95 th percentile ($\mu\text{g}/\text{m}^3$)	75 th percentile ($\mu\text{g}/\text{m}^3$)	50 th percentile ($\mu\text{g}/\text{m}^3$)
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
2021	96.7	0	21.8	5.0	9.5	6.6	4.6
2022	96.4	0	10.1	4.1	7.5	5.3	3.8

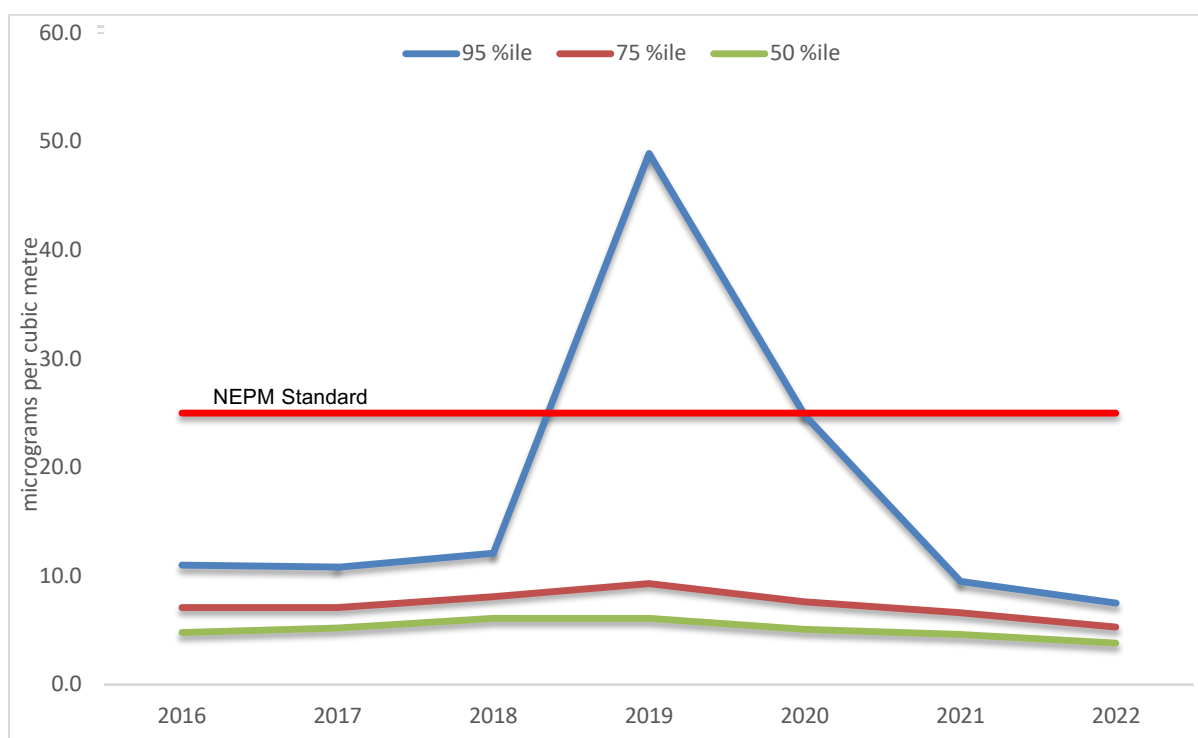


Figure 31: Statistical summary for daily PM_{2.5} Civic 2016 – 2022

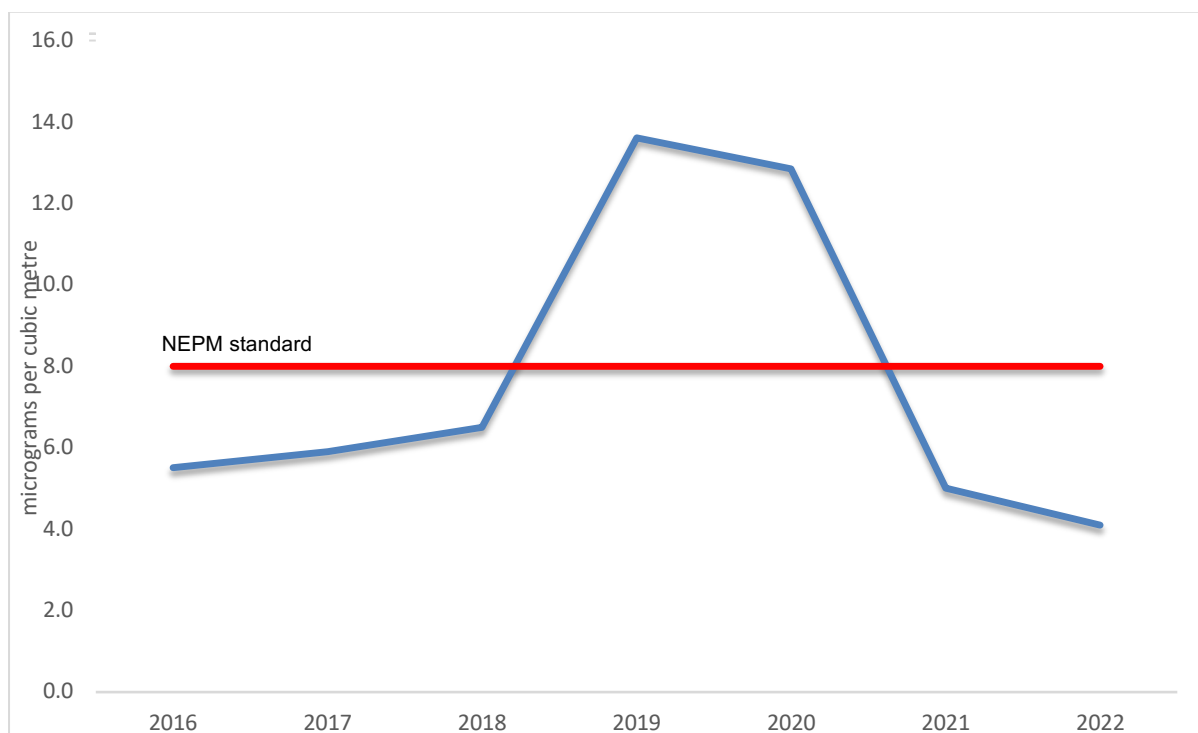


Figure 32: Annual average daily PM_{2.5} Civic 2016 – 2022

Table 26: Statistical summary for daily maximum daily PM_{2.5} Florey 2014 – 2021

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
2021	98.4	3	28.2	6.2	16.0	7.6	4.9
2022	96.7	0	23.2	5.0	12.3	6.3	4.4

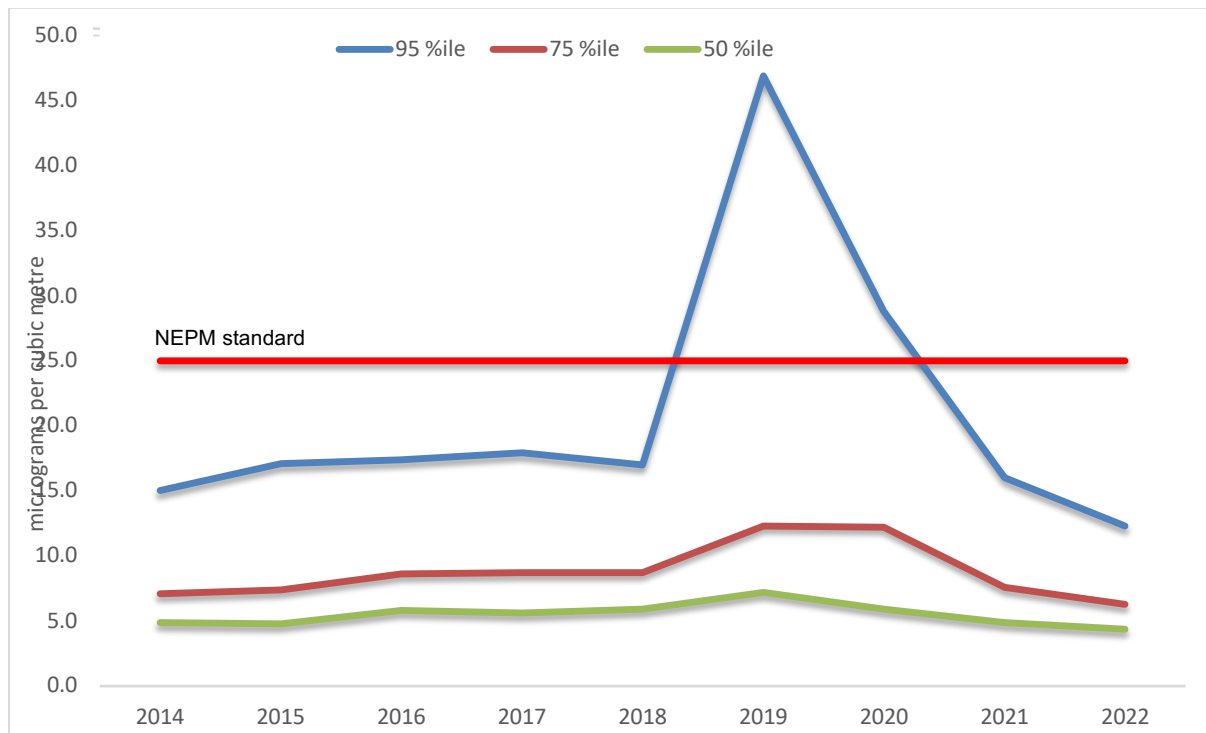


Figure 33: Statistical summary for daily PM_{2.5} Florey 2014 – 2022

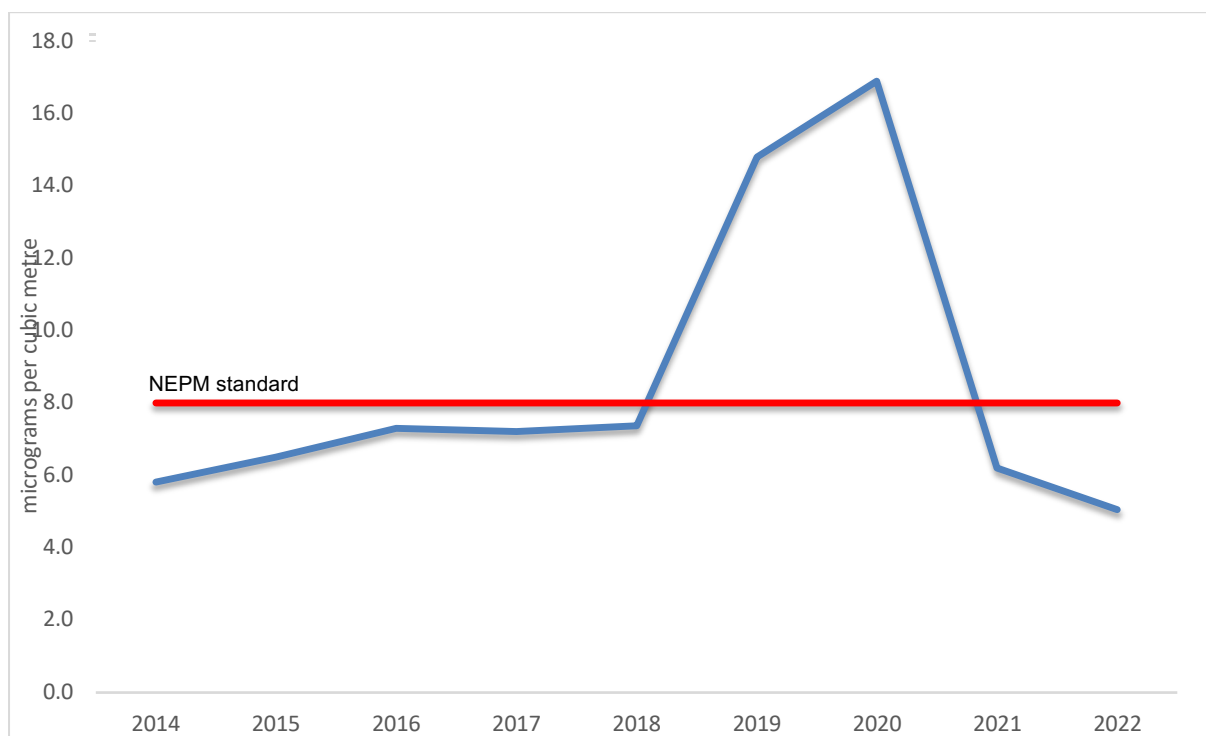


Figure 34: Annual average daily PM_{2.5} Florey 2014 – 2022