



New South Wales Annual Compliance Report 2017

National Environment
Protection (Ambient Air Quality)
Measure



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ISBN 978-1-925755-19-0
OEH 2018/0635
February 2019

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Acronyms, abbreviations and glossary

Following is a list of acronyms, abbreviations and terms used in this report.

AAQ NEPM	Ambient Air Quality National Environment Protection Measure
Ambient air	The external air environment (does not include the air environment inside buildings or structures)
AQMN	Air Quality Monitoring Network
ARS	Advisory Reporting Standard
AS	Australian Standards
BAM	Beta attenuation monitor
CO	Carbon monoxide
EPA	Environment Protection Authority
FRM	Federal Reference Method (USEPA)
GMR	Greater Metropolitan Region
ICP-AES	Inductively coupled plasma – atomic emission spectroscopy
LBL	Load Based Licensing
Monitoring station	A facility for measuring the concentration of one or more pollutants in the ambient air in a region or sub-region
NATA	National Association of Testing Authorities
ND	Greater than 75% availability of data in any quarter was not demonstrated a monitoring station
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NLAQMN	Newcastle Local Air Quality Monitoring Network
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
O ₃	Ozone
OEH	Office of Environment and Heritage (NSW)
Pb	Lead
PM _{2.5}	Particulate matter with an aerodynamic diameter of 2.5 microns or less
PM ₁₀	Particulate matter with an aerodynamic diameter of 10 microns or less
ppm	Parts per million– parts of pollutant per million parts of air by volume
RAAS™	Reference Ambient Air Sampler
SO ₂	Sulfur dioxide
TEOM	Tapered Element Oscillating Microbalance
USEPA	United States Environmental Protection Agency
µg/m ³	Microgram of pollutant (1 millionth of a gram) per cubic metre of air, referenced to temperature of 0°C and absolute pressure of 101.325 kPa
UHAQMN	Upper Hunter Air Quality Monitoring Network
VOCs	Volatile organic compounds – compounds that vapourise (i.e. become a gas) at normal atmospheric temperatures

Overview

This report is required under clause 18 of the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM or NEPM). It presents and assesses NSW air quality monitoring data for 2017, against the requirements of the AAQ NEPM. The data are available on the NSW Office of Environment and Heritage (OEH) public website.

The AAQ NEPM (amended, February 2016) sets requirements for the monitoring and reporting of air quality, including:

- air quality standards as levels of pollutants against which air quality can be assessed
- goals for air pollutants to achieve the air quality standards specified in the AAQ NEPM
- requirements for reporting exceedances of air quality standards, recognising that natural events can affect air quality
- a requirement to report population exposures to PM_{2.5} annually from June 2018.

In 2017, the NSW AAQ NEPM Monitoring Network (the network) comprised 22 air quality monitoring stations. The network is a part of the NSW Government's ambient air quality monitoring network.

Air quality monitoring in the network was performed by OEH in accordance with the NSW AAQ NEPM Monitoring Plan, AAQ NEPM Technical Papers and the OEH's NATA (National Association of Testing Authorities) accreditation. Monitoring for lead (Pb) ceased in 2004 because ambient Pb concentrations fell to very low levels, following the introduction of unleaded motor fuel.

During 2017:

- all stations monitoring carbon monoxide (CO), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) complied with NEPM standards and goals:
 - Carbon monoxide (9 stations) (Table 5)
 - Nitrogen dioxide (13 stations) (Table 6)
 - Sulfur dioxide (10 stations) (Table 8)
- 12 of 16 monitoring stations met the NEPM goal for 1-hour average ozone (O₃) levels (Table 7)
- 5 of 16 stations met the NEPM goal for 4-hour average ozone levels (Table 7)
- 13 of 19 stations met the NEPM goal for the 1-day average PM₁₀ level (Table 9)
- all 19 stations met the NEPM goal for the annual average PM₁₀ level (Table 9)
- 17 of 20 stations met the NEPM goal for the 1-day average PM_{2.5} level (Table 10)
- 17 of 20 stations met the NEPM goal for the annual average PM_{2.5} level (Table 10)
- data were not reported for two stations with less than 75% available data in any three-month period.

Non-compliant stations are listed in Compliance status for 2017 is described below, with non-compliant stations listed in Table 0.1

What is new in this report

- The report also includes analyses for significant typical air pollution episodes and an assessment of population exposures to PM_{2.5} in the NSW Greater Metropolitan Area for the calendar year 2017.
- PM_{2.5} data for all 22 stations in the NSW NEPM air quality monitoring network are reported for 2017.

Compliance with NEPM standards and goals

Compliance status for 2017 is described below, with non-compliant stations listed in Table 0.1.

Table 0. 1 Non-compliances with AAQ NEPM goals in the NSW NEPM network during 2017

AAQ NEPM standard	Region	Non-compliant station
1-hour average ozone	Sydney	1. Liverpool
	Illawarra	2. Albion Park South 3. Kembla Grange 4. Wollongong
4-hour rolling average ozone	Sydney	1. Camden 2. Liverpool 3. Prospect 4. Richmond 5. St Marys 6. Chullora
	Illawarra	7. Albion Park South 8. Kembla Grange 9. Wollongong
	Central Coast	10. Wyong
	Lower Hunter	11. Wallsend
24-hour average PM₁₀	Sydney	1. Bringelly 2. Chullora 3. Rozelle
	Illawarra	4. Kembla Grange 5. Wollongong
	Regional NSW	6. Wagga Wagga North
24-hour average PM_{2.5}	Sydney	1. Chullora 2. Liverpool
	Regional NSW	3. Wagga Wagga North
Annual average PM_{2.5}	Sydney	1. Chullora 2. Liverpool
	Regional NSW	3. Wagga Wagga North

Source:

Table A. 6, Table A. 7

Further details in Appendix

A1. Summary of compliance with AAQ NEPM standards and goals

Ozone

1-hour ozone

Sixteen stations in the NEPM network monitored 1-hour average ozone levels in 2017.

Ozone 1-hour standard

The 1-hour standard (0.1 ppm) was exceeded on four calendar days (11 January, 10-11 February and 19 December 2017) (Table 15).

Eleven stations exceeded the 1-hour ozone standard: seven stations with one allowable exceedance day and four stations with more than one exceedance day.

Ozone 1-hour goal

The NEPM goal for the 1-hour ozone standard allows one exceedance day per year.

Twelve stations met the NEPM 1-hour ozone goal: five stations with no exceedances of the 1-hour ozone standard and seven stations with one allowable exceedance day.

Four stations did not comply with the NEPM 1-hour ozone goal (due to more than one exceedance day):

- Sydney South-west region – Liverpool
- Illawarra region – Albion Park South, Kembla Grange and Wollongong.

4-hour ozone

Sixteen stations in the NEPM network monitored 4-hour average ozone levels in 2017.

Ozone 4-hour standard

The 4-hour ozone standard (0.08 ppm) was exceeded on 10 calendar days (9, 7, 11 January; 6, 10-11, 23 February and 13, 16, 19 December 2017) (Table 16).

Fourteen stations exceeded the 4-hour ozone standard: three stations with one allowable exceedance day and 11 stations with more than one exceedance day,

Ozone 4-hour goal

The NEPM goal for the 4-hour ozone standard allows one exceedance day per year for a monitoring station to comply.

Five stations met the NEPM 4-hour ozone goal: two stations with no exceedances of the 4-hour standard and three stations with one allowable exceedance day.

Eleven stations did not comply with the NEPM 4-hour ozone goal due to more than one exceedance day:

- Sydney region – Camden, Liverpool, Prospect, Richmond, St Marys, Chullora
- Illawarra region – Albion Park South, Kembla Grange, Wollongong
- Central Coast region – Wyong
- Lower Hunter region – Wallsend.

Ozone episode analysis

An analysis of a typical ozone exceedance event in coastal New South Wales, during an extreme heatwave on 10-11 February 2017, demonstrates how weather and local emission sources may affected air quality in New South Wales (Section E).

Particles

The AAQ NEPM (amended, February 2016) introduced two requirements for evaluating particle pollution.

Evaluating PM₁₀ and PM_{2.5} 1-day average standards against the exceptional event rule

Clause 2 of the AAQ NEPM defines an exceptional event as:

‘a fire or dust occurrence that adversely affects air quality at a particular location and causes an exceedance of 1-day average standards in excess of normal historical fluctuations and background levels and is directly related to: bushfire; jurisdiction authorised hazard reduction burning; or continental scale windblown dust.’

The exceptional event rule requires annual NEPM reporting to:

- classify exceedances of 24-hour (1-day) PM₁₀ and PM_{2.5} standards as either exceptional or non-exceptional exceedance days
- identify and describe exceptional events when reporting against PM₁₀ and PM_{2.5} 24-hour averages.

An air quality monitoring station complies with NEPM goals, when either:

- no exceedances are recorded
- no exceedance days are recorded other than days defined as exceptional events.

An air quality monitoring station does not comply with NEPM goals, when:

- one or more exceedance days are defined as non-exceptional events.

Evaluating population exposures to particles as PM_{2.5}

Clause 17 of the AAQ NEPM requires that:

‘each participating jurisdiction must evaluate and report population exposures to particles as PM_{2.5} annually from June 2018.’

The report includes an assessment of population exposure to PM_{2.5} particles in 2017 (Section E. New South Wales’ approach to PM_{2.5} exposure assessment).

Particles as PM₁₀

Nineteen stations in the NSW NEPM air quality monitoring network monitored PM₁₀ levels in 2017.

PM₁₀ 24-hour standard

The 24-hour PM₁₀ standard (50.0 µg/m³) was exceeded on 22 calendar days in 2017 (Table 20):

- Seven exceedance days were exceptional events, due to hazard reduction burning (HRB), bushfire or windblown dust (2 February (fire), 10 April (dust), 14 August (HRB), 12 September (fire), 22-24 September (dust) 2017)
- 15 exceedance days were non-exceptional events, due to local particle sources. Non-exceptional exceedance days were recorded at the following monitoring stations:
 - eight days at Wagga Wagga North (NSW South West Slopes, agricultural activities)
 - two days at Chullora (Sydney East, one day due to a fire at a recycling plant)
 - two days at Bringelly (Sydney South West)
 - one day at Rozelle (Sydney East)
 - one day at Kembla Grange (Illawarra) and Wagga Wagga North (South West Slopes)
 - one day at Kembla Grange, Wollongong (Illawarra) and Wagga Wagga North (South West Slopes).

PM₁₀ 24-hour goal

Thirteen stations met the NEPM 24-hour PM₁₀ goal: six stations with no exceedances and seven stations with exceedance days only due to exceptional events.

Six stations did not comply with the 24-hour PM₁₀ goal, due to at least one exceedance day related to a non-exceptional event:

- Sydney region – Bringelly, Chullora, Rozelle
- Illawarra region – Kembla Grange, Wollongong
- Regional NSW – Wagga Wagga North.

PM₁₀ annual goal

All monitoring stations met the NEPM annual goal for PM₁₀, recording annual average concentration below 25.0 µg/m³.

PM₁₀ episode analysis

An analysis of a typical PM₁₀ exceedance event in Sydney, associated with long-range transport of windblown dust, during 22-24 September 2017, demonstrates how weather and regional particle sources may affected air quality in New South Wales (Section E).

Particles as PM_{2.5}

Twenty-two stations in the NSW NEPM air quality monitoring network monitored PM_{2.5} levels in 2017. Twenty of 22 sites reported 75% data availability, with results reported below.

PM_{2.5} 24-hour standard

The 24-hour PM_{2.5} standard (25.0 µg/m³) was exceeded on 18 calendar days in 2017 (Table 22):

- Eleven exceedance days were exceptional events, due to hazard reduction burning or bushfires (11-12, 16 May; 14-15, 23, 27 August; 2-3 September, 10, 12 September 2017).
- Seven exceedance days were non-exceptional events, due to local particle sources. Non-exceptional exceedance days were recorded the following monitoring stations (counting calendar days)
 - two days at Chullora (Sydney East, fire at recycling plant)

- two days at Wagga Wagga North (Illawarra)
- one day at Liverpool (Sydney South West).

PM_{2.5} 24-hour goal

Seventeen stations met the NEPM 24-hour PM_{2.5} goal: eight stations with no exceedances and nine stations with exceedance days only due to exceptional events (Table 10).

Three stations did not comply with the 24-hour PM_{2.5} goal, due to at least one exceedance day that was a non-exceptional event:

- four days at Chullora (Sydney East, fire at recycling plant)
- two days at Wagga Wagga North (Illawarra)
- one day at Liverpool (Sydney South West).

PM_{2.5} annual goal

Seventeen of 20 monitoring stations met the NEPM annual goal for PM_{2.5}, recording annual average concentration below 8.0 µg/m³.

Three stations did not comply: Chullora (Sydney East), Liverpool (Sydney West) and Wagga Wagga North (NSW South West Slopes).

PM_{2.5} episode analysis

An analysis of a typical PM_{2.5} pollution event in Sydney, associated with hazard reduction burning, during 2-3 September 2017, demonstrates how weather and smoke emissions may affected air quality and visibility across the city (Section E).

Assessment of population exposures to PM_{2.5}

OEH developed the Clean Air Metric (CAM) in 2017, to evaluate population exposure to PM_{2.5}. The CAM is based on a calculation of population-weighted exposure to annual concentrations of PM_{2.5} across the NSW Greater Metropolitan Region (GMR).

Population-weighted exposure to PM_{2.5}

The findings of a population exposure analysis, for PM_{2.5} in the NSW GMR (shown in Figure 2) in 2017, are summarised below:

- The greatest population exposure to PM_{2.5} pollution in the NSW GMR during 2017 was in Sydney's Central Business District (CBD) and along inner Sydney transport corridors (Figure 30).
- Annual average population exposure to PM_{2.5} was generally two times lower in central Sydney, outside the Sydney CBD and transport corridors (Figure 30).
- Population exposure to PM_{2.5} in western Sydney, the Central Coast and Lower Hunter was more than seven times lower than in the Sydney CBD and inner Sydney transport corridors (Figure 30).

The Clean Air Metric

- The CAM for the Sydney Region in 2017 was 95. This means that the population-weighted average exposure of residents to PM_{2.5}, in the Greater Sydney Region, was 95% of the NEPM annual PM_{2.5} standard (Table 163).

- The CAM for the NSW GMR in 2017 was 93. This means that the population-weighted average exposure of residents to PM_{2.5}, in the NSW GMR, was 93% of the annual PM_{2.5} standard (Table 163).

Comparison with previous years

An assessment of population exposures to PM_{2.5} in 2017, compared to previous years in the Greater Sydney Region and the NSW GMR found the following (Figure 31, Figure 32):

- The population-weighted average exposure of residents to PM_{2.5}, in the Sydney region, fell from 98% in 2016 to 95% of the NEPM standard in 2017.
- The level of exposure to PM_{2.5} in 2017 was similar to levels in 2012 to 2015.
- The population-weighted average exposure of residents to PM_{2.5}, in the NSW GMR, fell from 96% in 2016 to 93% of the NEPM standard in 2017.
- The level of exposure to PM_{2.5} in 2017 was similar to levels in 2014, 2015 and 2010, and marginally higher than those in 2011 to 2013.

The CAM method provides a means to track whether air quality management is delivering the greatest positive health outcomes for the people of New South Wales.

A detailed assessment of population exposures to PM_{2.5} in 2017, in the NSW Greater Metropolitan Region, is presented in Section E.

NSW AAQ NEPM network data availability

In 2017, 20 monitoring stations in the 22-station NSW AAQ NEPM network met the requirement for greater than 75% data availability.

Two stations did not demonstrate 75% data availability for PM_{2.5}:

- Albury: data loss due to the invalidation of large negative readings during the second quarter.
- Albion Park South: was commissioned during the first quarter (7 February 2017).

Section A – Monitoring summary

Current AAQ NEPM Monitoring network

The [NSW AAQ NEPM Monitoring Plan](#) gives details of the monitoring that New South Wales performs to assess compliance with the AAQ NEPM. Monitoring mostly occurs in the highly populated regions of Sydney, Newcastle and Wollongong, which comprise over 60% of the NSW population. In 2017, campaign monitoring was performed in regional population centres in the NSW North West Slopes, Central Tablelands and the South West Slopes.

In 2017, the AAQ NEPM monitoring network was part of an overall 45-station air quality monitoring network (AQMN), operated by the NSW Office of Environment and Heritage (OEHAQMN). The AAQ NEPM network was designed to characterise general air quality and pollutant events affecting population centres. This approach provided adequate coverage of populated areas, considering the broad differences in pollutant distribution within a region. The choice of stations in each region was made to optimise both population coverage and representation of the occurrences of higher pollutant concentrations.

Types of monitoring stations

The OEH characterises the air quality to which the general population is exposed in a region by monitoring all air pollutants of interest at a network of stations. The AAQ NEPM clause 14 allows for fewer monitoring stations where it can be demonstrated that pollutant levels are reasonably expected to be consistently lower than the AAQ NEPM standards. These screening criteria were used for carbon monoxide, nitrogen dioxide, ozone and sulfur dioxide at several regions in New South Wales and determined the AAQ NEPM network design. Detailed information on screening pollutants for specific regions is found in the [NSW AAQ NEPM Monitoring Plan](#).

In 2017, the NSW AAQ NEPM network monitored pollutants at 22 stations (Table 1 and Figure 2). In the network, trend stations capture most pollution events that occur from time to time. Their role is supplemented by additional permanent upper bound stations (performance stations) where selected pollutants are monitored to ensure that all major pollutant events are captured and reported. Campaign monitoring was also done in regional centres at Albury and Wagga Wagga North (South West Slopes), Bathurst (Central Tablelands) and Tamworth (North West Slopes).

The OEH maintains many air quality monitoring stations that are not designated for NEPM reporting, and some stations designated as NEPM stations for some pollutants are not designated for other pollutants. For instance, St Marys is designated as a NEPM station for ozone, but nitrogen dioxide and PM₁₀ are also measured at this station.

The Upper Hunter Air Quality Monitoring Network (UHAQMN) was established in 2010 through government and industry collaboration. It has 14 monitoring stations in strategic locations, including the major population centres Singleton and Muswellbrook. All stations measure particulates (PM₁₀); some also measure PM_{2.5}, sulfur dioxide (SO₂) and oxides of nitrogen (NO_x).

The Newcastle Local Air Quality Monitoring Network (NLAQMN) started operation in October 2014. Three monitoring sites (Carrington, Mayfield and Stockton) were established in the immediate vicinity of the Newcastle industrial precinct.

The UHAQMN and the NLAQMN are established in legislation and funded by industry for industry-related purposes. While operated and maintained by the OEH, these are not designed for NEPM reporting purposes and data are freely available from the OEH website:

- [Upper Hunter Air Quality Monitoring Network Map](#)
- [Newcastle Local Air Quality Monitoring Network Map](#)

This report does not present data from stations designated as non-NEPM for a pollutant.

New sites, new pollutants and site closures during 2017

The AAQ NEPM network is subset of the NSW AQMN, as noted above. For the purposes of AAQ NEPM reporting, no stations in the network were added or closed in 2017, however, PM_{2.5} monitoring was enhanced to include all 22 stations in the network (Table 1).

The OEH commissioned new air quality monitoring stations (non-NEPM) during 2017. These are listed below and included in Figure 2:

- Sydney: Macquarie Park (August) and Parramatta North (December).
- NSW North West Slopes, Narrabri (November) and Gunnedah (December).
- The Rural Air Quality Monitoring Network was incorporated into the OEH AQMN. The network comprises over 30 stations from the Community DustWatch network. For more information, refer to [Air Quality Monitoring in Regional and Rural New South Wales](#).

Table 1 NSW AAQ NEPM Monitoring Network

Region/monitoring station	Station type ¹	Year est.	No. of NEPM-reporting parameters	Ozone	NO ₂	PM ₁₀	PM _{2.5}	CO	SO ₂
Sydney									
Bringelly	T	1992	5	X	X	X	X		X
Camden	P	2012	5	X	X	X	X	X	
Campbelltown West ²	T	2012	6	X	X	X	X	X	X
Chullora	T	2003	6	X	X	X	X	X	X
Earlwood	C	1998	1				X		
Liverpool	C	1990	5	X	X	X	X	X	
Oakdale	P	1996	3	X		X	X		
Prospect ³	T	2007	6	X	X	X	X	X	X
Richmond	T	1992	5	X	X	X	X		X
Rozelle	T	1978	5	X	X	X	X	X	
St Marys	P	1992	2	X			X		
Central Coast									
Wyong	P	2012	6	X	X	X	X	X	X
Lower Hunter									
Beresfield	C	1993	2			X	X		
Newcastle	T	1992	6	X	X	X	X	X	X
Wallsend	C	1992	4	X	X		X		X
Illawarra									
Albion Park South	P	2005	5	X	X	X	X		X
Kembla Grange	P	1994	3	X		X	X		
Wollongong	T	1993	6	X	X	X	X	X	X
Regional NSW									
Albury	C	2000	2			X	X		
Bathurst ⁴	C	2000	2			X	X		
Tamworth	C	2000	2			X	X		
Wagga Wagga North	C	2011	2			X	X		

Notes

¹ P denotes performance; T denotes trend; C denotes campaign

² Replaced the Macarthur trend station from September 2012

³ Replaced Blacktown station from 2007

⁴ Bathurst ozone analyser removed on completion of ozone campaign monitoring program in August 2007

Station siting and exposure

All stations within the network, except for Chullora, Earlwood and Rozelle meet AAQ NEPM siting and exposure criteria (see Table 2 for further details).

Table 2 Stations not complying with all siting and exposure criteria

Station	Siting criteria not met	Comments
Chullora	Clear sky angle $\geq 120^\circ$. Distance to nearby tree ≥ 10 m	Trees have grown since establishment of station
Earlwood	Greater than 50 m from road	Site is in a car park and approximately 35m from the road
Rozelle	Clear sky angle $\geq 120^\circ$. Distance to nearby tree ≥ 10 m	Established trees in a heritage area

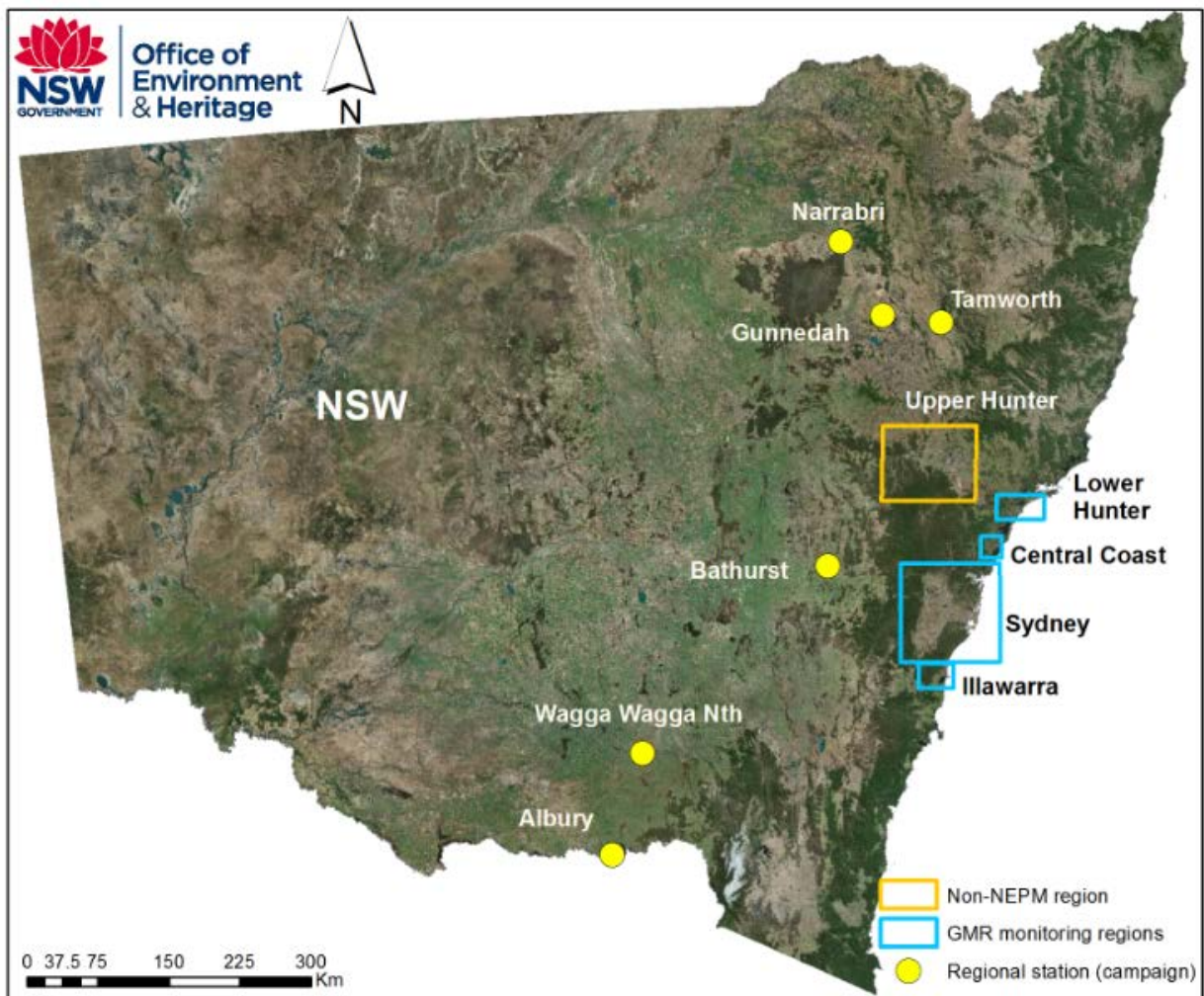


Figure 1 Ambient air quality monitoring regions, including regional NSW (six campaign stations) and the Greater Metropolitan Region or GMR (Sydney, Illawarra, Central Coast, Lower Hunter and the Upper Hunter). All regions except for the Upper Hunter include NEPM-designated stations.

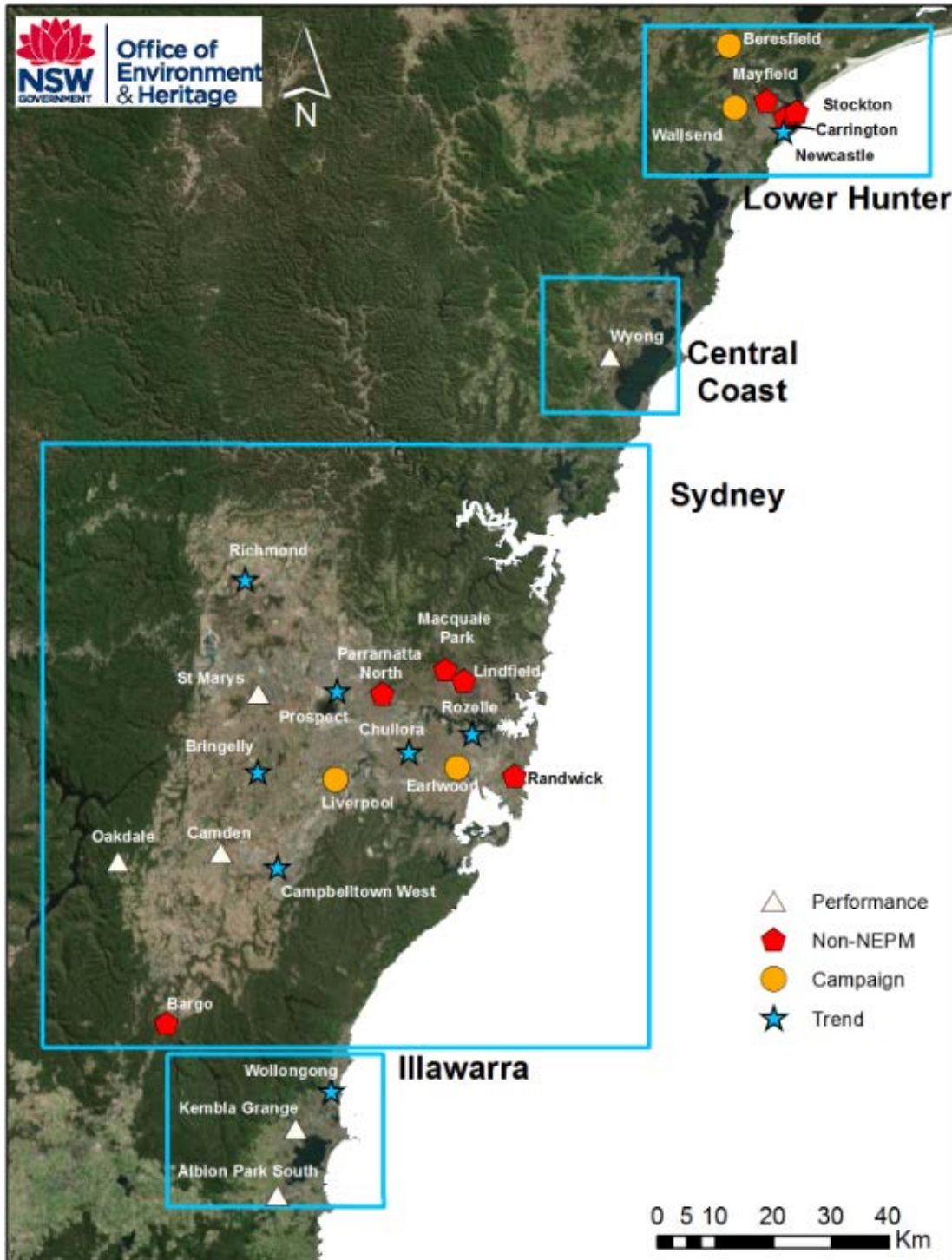


Figure 2 Ambient air quality monitoring stations in the NSW Greater Metropolitan Region, including NEPM reporting stations

Monitoring methods

The OEH network uses instruments in accordance with the relevant Australian standard (see Table 3 for further details). Beta Attenuation Monitor (BAM) are used to measure PM_{2.5}. In the case of PM₁₀, the tapered element oscillating microbalance (TEOM) method is used for NEPM monitoring and reporting. PM₁₀ data from the TEOM are presented as measurements, incorporating the United States Environment Protection Agency (USEPA) equivalent correction factors and unadjusted for temperature.

Table 3 Instruments used in NSW for NEPM monitoring

Pollutant	Standard	Title	Method used
Carbon monoxide	AS3580.7.1	Ambient Air – Determination of Carbon Monoxide – Direct Reading Instrument Method	Gas filter correlation/ infra-red
Nitrogen dioxide	AS3580.5.1	Ambient Air – Determination of Oxides of Nitrogen – Chemiluminescence Method	Gas-phase chemiluminescence
Photochemical oxidant (ozone)	AS3580.6.1	Ambient Air – Determination of Ozone – Direct Reading Instrument Method	Non-dispersive ultra-violet
Sulfur dioxide	AS3580.4.1	Ambient Air – Determination of Sulfur Dioxide – Direct Reading Instrument Method	Pulsed fluorescence
Lead ¹	AS2800	Ambient Air – Determination of Particulate Lead – High Volume Sampler – Gravimetric Method	Atomic absorption
Particles as PM ₁₀	AS3580.9.8	Determination of Suspended Particulate Matter – PM ₁₀ continuous direct mass method using a TEOM	Tapered element oscillating microbalance (TEOM) ²
Particles as PM _{2.5}	AS/NZS 3580.9.12	Determination of Suspended Particulate Matter – PM _{2.5} Beta Attenuation Monitors	Beta attenuation monitor (BAM) ³
	AS/NZS 3580.9.10	Determination of Suspended Particulate Matter – PM _{2.5} low volume sampler – Gravimetric method	FRM Partisol ⁴ FRM Reference Ambient Air Sampler (RAAS) ^{TM4}

1 No longer measured in NSW

2 Instrument output conforms to USEPA equivalence designation (offset 3.0, scaling factor 1.03)

3 TEOM monitors at all sites were replaced by BAM PM_{2.5} monitors (Federal Equivalent Method) during 2012. Before this, TEOMs were modified for use in the PM_{2.5} Equivalence Program and at the monitoring stations, in accordance with NEPM Technical Paper on Monitoring for Particles as PM_{2.5}

4 Both Partisol and RAASTM are Federal Reference Monitors:
<https://www3.epa.gov/ttn/amtic/files/ambient/criteria/reference-equivalent-methods-list.pdf>

NATA accreditation

As required under Clause 12 of the AAQ NEPM, OEH is accredited by NATA for the measurement of all AAQ NEPM parameters (accreditation number 14209). The last reassessment of the Air Quality Monitoring Laboratory and associated monitoring stations by NATA was completed in February 2018.

Section B – Assessment of compliance with standards and goals

Assessment against standards and goals

Air quality is assessed against the standards and goals as specified in Schedule 2 of the AAQ NEPM. The **standards** (column 3, Table 4) against which air quality is assessed are concentrations in parts per million (ppm) or micrograms per cubic metre ($\mu\text{g}/\text{m}^3$).

The **goal** of the AAQ NEPM is to achieve the standards as assessed in accordance with the monitoring protocol within 10 years of commencement (i.e. 2008) to the extent specified in Schedule 2 of the AAQ NEPM. The extent is expressed as a maximum allowable number of exceedances per year, for each standard (column 4, Table 4).

Table 4 NEPM standards and goals specified in Schedule 2 of the AAQ NEPM

Pollutant	Averaging period	AAQ NEPM standard (maximum concentration)	AAQ NEPM goal (maximum number of allowable exceedances)
Carbon monoxide	8-hour rolling average	9.0 ppm	1 day a year
Nitrogen dioxide	1-hour average	0.12 ppm	1 day a year
	1-year average	0.03 ppm	None
Photochemical oxidants – as ozone	1-hour average	0.10 ppm	1 day a year
	4-hour rolling average	0.08 ppm	1 day a year
Sulfur dioxide	1-hour average	0.20 ppm	1 day a year
	1-day average	0.08 ppm	1 day a year
	1-year average	0.02 ppm	None
Particles as PM ₁₀	1-day average	50 $\mu\text{g}/\text{m}^3$	None
	1-year average	25 $\mu\text{g}/\text{m}^3$	None
Particles as PM _{2.5}	1-day average	25 $\mu\text{g}/\text{m}^3$	None
	1-year average	8 $\mu\text{g}/\text{m}^3$	None
Lead	1-year average	0.50 $\mu\text{g}/\text{m}^3$	None

Tables 5 to 10a summarise compliance with the AAQ NEPM standards and goals. The following are given for each pollutant monitored at each monitoring station:

- data availability rate (quarterly and annual)
- the annual mean (where an annual standard exists)
- an assessment of compliance, including the number of days when standards were exceeded.

Categories used to assess compliance

The categories Met, Not Met and ND are used to indicate assessment of compliance.

A station's performance is assessed as **complying with the NEPM (i.e. 'Met')** if the number of exceedances is no more than the number specified in Schedule 2 of the AAQ NEPM and data availability was at least 75% in each quarter.

The station is assessed as **not compliant with the NEPM (i.e. 'Not Met')** if there are more than the number of exceedances specified in Schedule 2 of the AAQ NEPM, even if the data availability rates meet the 75% requirement.

A station's performance is assessed as '**not demonstrated (ND)**' if it has data availability rates less than 75% in any quarter, even if it records no exceedances or the number of exceedance days is allowable. This may be due to instrument failures, temporary closures for upgrading, or closures to allow relocation of the station.

A region demonstrates compliance with the NEPM either when all stations in the region demonstrate compliance or when the region meets approved **pollutant screening criteria**.

Calculation and reporting methods

The calculation and reporting methods used to comply with the requirements described in the *National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 8: Annual Reports* (NEPC Peer Review Committee 2002).

Daily averages are calculated by using hours 1 to 24, as described in *National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 5: Data Collection and Handling* (NEPC Peer Review Committee 2001).

An internal correction factor for USEPA equivalency has been applied to PM₁₀ TEOM data, but there has been no subsequent treatment or temperature adjustment. PM_{2.5} measurements were made by using BAMs (a Federal Equivalent Method). In this report, pre-2012 PM_{2.5} data collected by using TEOMs do not include the internal correction for USEPA PM₁₀ equivalency or any subsequent treatment or adjustment for temperature.

All days where a pollutant standard was exceeded are listed. Also listed are the stations that recorded exceedances of the standard on that day and (for averaging periods of less than 24 hours) the number of daily averaging periods in which the standard was exceeded.

Exceptional particulate events

Exceptional event means a fire or dust occurrence that adversely affects air quality at a particular location and causes an exceedance of 1-day average standards in excess of normal historical fluctuations and background levels and is directly related to bushfire; jurisdiction authorised hazard reduction burning; or continental scale windblown dust. (*National Environment Protection (Ambient Air Quality) Measure, February 2016*)

For goal compliance assessment against PM₁₀ and PM_{2.5} 1-day average standards, the AAQ NEPM cl.18 (3), requires that jurisdictions exclude monitoring data that has been determined as being directly associated with an exceptional event. For reporting compliance against 1-year average standards, however, all measured data are included, including that directly associated with an exceptional event.

In this report, 1-day particulate exceedances clearly influenced by exceptional events such as natural bushfires, hazard reduction burning and dust storms, are defined as exceptional pollution events. A brief comment describing cause of events is given where possible, noting that the absence of a comment does not necessarily indicate the absence of such influences; instead, no clear information may be available. In some cases, it is likely that there has been an influence of a pollution event, however, this cannot be established. Detailed episode analyses for selected exceptional events are included in Section E.

Population exposure to PM_{2.5}

The AAQ NEPM cl 17 (2A) requires each participating jurisdiction to evaluate and report population exposures to particles as PM_{2.5} annually from June 2018. The New South Wales approach to PM_{2.5} exposure mapping is included in Section E.

We note that a nationally consistent agreement between participating jurisdictions does not yet exist on the population exposure evaluation and reporting procedure or method.

Data losses during 2017

With the following exceptions, most monitoring stations with continuous real-time monitors complied with the data coverage requirement (at least 75% per quarter):

- Albion Park South (Illawarra) did not meet the criteria for PM_{2.5} during the second quarter due to the invalidation of large negative readings.
- Albury (Regional NSW) did not meet the criteria for PM_{2.5} during the first quarter, as the instrument was not commissioned until 7 February 2017.

Also, the Federal Reference Monitor at Chullora did not meet this criterion due to a faulty instrument pump during early 2017 and refurbishment of the filter facility at Lidcombe later.

Carbon monoxide

Table 5 2017 Compliance summary for CO in NSW

Region/ monitoring station	Data availability rate (% of hours)					Number of exceedances (days)	Performance against the standard and goal
	Q1	Q2	Q3	Q4	Annual		
Sydney							
Camden	94.6	88.8	94.8	90.7	92.3	0	Met
Campbelltown West	92.9	92.5	95.5	90.9	93.0	0	Met
Chullora	91.6	94.0	93.5	93.6	93.2	0	Met
Liverpool	93.8	95.6	95.2	95.3	95.0	0	Met
Prospect	93.8	95.7	93.8	95.3	94.6	0	Met
Rozelle	89.6	79.1	95.6	89.6	88.6	0	Met
Central Coast							
Wyong	95.0	93.8	95.0	93.5	94.3	0	Met
Illawarra							
Wollongong	92.7	95.5	93.6	92.1	93.5	0	Met
Lower Hunter							
Newcastle	85.8	95.6	94.0	94.4	92.5	0	Met

AAQ NEPM standard and goal:

9.0 ppm (8-hour average, 1 day/year)

During 2017, no exceedances of the carbon monoxide standard were recorded in New South Wales (Table 5). Compliance with the AAQ NEPM goal for carbon monoxide was demonstrated at all sites in the Sydney, Central Coast, Illawarra and Lower Hunter regions.

Nitrogen dioxide

Table 6 2017 Compliance summary for NO₂ in NSW

Region/ monitoring station	Data availability rate (% of hours)					Number of exceedances (days)	Annual mean (ppm)	Performance against standards and goals	
	Q1	Q2	Q3	Q4	Annual			1-hour	1-year
Sydney									
Bringelly	91.5	91.5	90.1	93.7	91.4	0	0.005	Met	Met
Camden	95.1	91.9	93.3	94.8	94.2	0	0.005	Met	Met
Campbelltown West	92.8	92.5	94.8	93.0	93.5	0	0.011	Met	Met
Chullora	90.2	94.0	94.6	93.6	93.3	0	0.012	Met	Met
Liverpool	92.8	95.6	95.4	95.3	94.7	0	0.012	Met	Met
Prospect	92.7	95.6	94.4	95.2	94.2	0	0.010	Met	Met
Richmond	90.2	87.5	90.8	92.8	91.3	0	0.005	Met	Met
Rozelle	91.1	91.9	93.7	94.4	93.3	0	0.011	Met	Met
Central Coast									
Wyong	95.1	93.8	94.4	93.5	94.3	0	0.005	Met	Met
Illawarra									
Albion Park South	94.5	94.0	94.1	89.0	93.0	0	0.004	Met	Met
Wollongong	90.5	95.5	94.7	95.0	93.8	0	0.006	Met	Met
Lower Hunter									
Newcastle	93.6	95.6	94.7	94.2	94.3	0	0.007	Met	Met
Wallsend	95.6	95.0	95.2	92.0	94.5	0	0.008	Met	Met

AAQ NEPM standards and goals:

0.120 ppm (1-hour average, 1 day/year)

0.030 ppm (Annual average)

During 2017, no exceedances of the nitrogen dioxide 1-hour and annual standards were recorded in NSW (Table 6). Compliance with the AAQ NEPM goal for nitrogen dioxide was demonstrated at all sites in the Sydney, Central Coast, Illawarra and Lower Hunter regions.

Ozone

Table 7 2017 Compliance summary for O₃ (ozone) in NSW

Region/ monitoring station	Data availability rate (% of hours)					Number of exceedances (days)		Performance against standards and goals	
	Q1	Q2	Q3	Q4	Annual	1-hour	4-hour	1-hour	4-hour
Sydney									
Bringelly	93.7	84.7	94.2	95.0	92.0	0	1	Met	Met
Camden	94.5	93.1	94.4	93.0	93.8	1	3	Met	Not Met
Campbelltown West	93.8	92.5	95.5	92.0	93.5	0	1	Met	Met
Chullora	92.0	94.0	95.2	93.6	93.7	1	3	Met	Not Met
Liverpool	92.1	95.4	95.1	95.2	94.5	2	2	Not Met	Not Met
Oakdale	95.1	95.6	94.7	95.4	95.2	0	0	Met	Met
Prospect	93.7	95.6	93.8	95.3	94.6	1	2	Met	Not Met
Richmond	91.2	90.6	95.4	94.2	92.9	0	2	Met	Not Met
Rozelle	92.6	91.9	95.5	93.1	93.3	1	1	Met	Met
St Marys	93.9	92.9	94.9	95.0	94.2	1	4	Met	Not Met
Central Coast									
Wyong	94.8	93.8	94.6	93.4	94.2	1	2	Met	Not Met
Illawarra									
Albion Park South	95.5	95.3	95.3	90.0	94.1	2	2	Not Met	Not Met
Kembla Grange	94.6	93.8	95.1	95.0	94.6	2	4	Not Met	Not Met
Wollongong	92.6	95.6	91.9	88.1	92.1	2	2	Not Met	Not Met
Lower Hunter									
Newcastle	93.7	95.6	92.3	94.2	94.0	0	0	Met	Met
Wallsend	95.6	95.1	95.2	93.6	94.9	1	2	Met	Not Met

AAQ NEPM standards and goals:

0.100 ppm (1-hour average, 1 day/year)

0.080 ppm (4-hour average, 1 day/year)

During 2017, ozone levels above the 1-hour AAQ NEPM ozone standard was observed across 11 stations in the network. Four stations did not meet the 1-hour AAQ NEPM goal for ozone due to exceeding the 1-day allowance: Albion Park South, Kembla Grange, Liverpool and Wollongong.

During 2017, ozone levels above the 4-hour AAQ NEPM ozone standard were observed across 14 stations in the network. Eleven stations did not meet the 4-hour AAQ NEPM goal due to exceeding the 1-day allowance: Albion Park South, Camden, Chullora, Kembla Grange, Liverpool, Prospect, Richmond, St Marys, Wyong, Wollongong and Wallsend.

With respect to both the 1-hour and 4-hour ozone standards, four stations did not comply with AAQ NEPM goals: Liverpool, and the three Illawarra stations (Albion Park South, Kembla Grange and Wollongong).

Details of the individual days when the 1-hour and 4-hour ozone standards were exceeded are at Tables 13-16. An episode analysis is included for 10-12 February 2017 when the maximum 1-hour and 4-hour ozone concentrations were recorded in Section E.

Sulfur dioxide

Table 8 2017 Compliance summary for SO₂ in NSW

Region/ monitoring station	Data availability rate (% of hours)					Number of Exceedances (days)		Annual mean (ppm)	Performance against standards and goals		
	Q1	Q2	Q3	Q4	Annual	1-hour	24-hour		1-hour	24-hour	1-year
Sydney											
Bringelly	91.8	92.5	93.1	94.9	93.1	0	0	0.000	Met	Met	Met
Campbelltown West	92.9	89.0	95.5	92.7	92.6	0	0	0.001	Met	Met	Met
Chullora	91.5	94.0	95.2	93.6	93.6	0	0	0.001	Met	Met	Met
Prospect	92.9	95.7	93.8	95.3	94.5	0	0	0.001	Met	Met	Met
Richmond	91.1	89.4	95.3	91.3	91.9	0	0	0.000	Met	Met	Met
Central Coast											
Wyong	87.7	93.8	94.8	94.9	92.9	0	0	0.001	Met	Met	Met
Illawarra											
Albion Park South	95.6	94.0	94.9	93.8	94.6	0	0	0.001	Met	Met	Met
Wollongong	92.6	95.6	93.9	95.0	94.3	0	0	0.001	Met	Met	Met
Lower Hunter											
Newcastle	93.6	95.6	93.9	94.4	94.4	0	0	0.002	Met	Met	Met
Wallsend	95.7	95.2	95.2	91.9	94.5	0	0	0.001	Met	Met	Met

AAQ NEPM standards and goals:

0.200 ppm (1-hour average, 1 day/year)

0.080 ppm (24-hour average, 1 day/year)

0.020 ppm (1-year average)

During 2017 no exceedances of the sulfur dioxide 1-hour, 24-hour and annual standards were recorded in New South Wales (Table 8). Compliance with the AAQ NEPM goal for sulfur dioxide was demonstrated at all sites in the Sydney, Central Coast, Illawarra and Lower Hunter regions.

Particles as PM₁₀

Table 9 2017 Compliance summary for PM₁₀ in NSW

Region/ monitoring station	Data availability rate (% of days)					Number of exceedances (days)		Annual mean (µg/m ³)	Performance against standards and goals	
	Q1	Q2	Q3	Q4	Annual	Non- exceptional events	Except ional events		24- hour	1- year
Sydney										
Bringelly	94.8	97.1	99.2	98.1	97.0	2	4	19.8	Not Met	Met
Camden	98.6	96.3	99.6	99.4	98.4	0	0	14.7	Met	Met
Campbelltown West	98.2	97.4	99.7	96.9	98.1	0	1	15.7	Met	Met
Chullora	99.0	99.8	99.5	98.2	99.5	2	2	20.1	Not Met	Met
Liverpool	97.5	99.4	99.1	97.3	98.9	0	2	20.8	Met	Met
Oakdale	99.1	99.8	98.8	97.4	98.6	0	0	12.1	Met	Met
Prospect	98.0	99.8	99.5	98.6	98.4	0	1	18.9	Met	Met
Richmond	94.3	94.9	99.6	97.1	95.9	0	1	16.0	Met	Met
Rozelle	96.4	98.6	99.7	99.4	98.6	1	0	18.1	Not Met	Met
Central Coast										
Wyong	99.3	98.3	98.5	98.5	98.4	0	1	16.1	Met	Met
Illawarra										
Albion Park South	99.4	98.7	99.7	98.1	98.9	0	0	15.3	Met	Met
Kembla Grange	98.5	99.2	99.2	98.2	98.4	2	2	20.5	Not Met	Met
Wollongong	96.2	99.7	96.8	99.2	98.4	1	0	18.1	Not Met	Met
Lower Hunter										
Beresfield	99.7	98.8	99.5	98.5	98.9	0	0	19.6	Met	Met
Newcastle	98.2	99.6	99.5	97.8	98.6	0	1	22.4	Met	Met
Regional										
Albury	98.6	99.7	99.5	93.9	97.5	0	0	15.8	Met	Met
Bathurst	96.5	95.0	98.2	98.8	97.3	0	0	14.1	Met	Met
Tamworth	99.5	99.8	99.5	97.3	99.2	0	2	15.3	Met	Met
Wagga Wagga North	99.1	97.9	97.1	99.7	98.4	10	0	20.6	Not Met	Met

AAQ NEPM standards and goal:

50.0 µg/m³ (24-hour average, 0 days/year)

25.0 µg/m³ (Annual average)

Bold font indicates that the AAQ NEPM goal was not met. See Table 20 for details of exceptional events.

During 2017, 13 stations exceeded the AAQ NEPM 24-hour PM₁₀ standard. Six stations did not meet the 24-hour AAQ NEPM goal for PM₁₀ due to one or more exceedances that were not exceptional events: Bringelly, Chullora, Rozelle, Kembla Grange, Wollongong and Wagga Wagga North. Table 20 presents a summary of exceptional events. Episode 2. Analysis of a typical PM₁₀ exceedance event in Sydney associated with long-range transport of windblown dust, 22-24 September 2017. All stations met the AAQ NEPM annual PM₁₀ goal.

Particles as PM_{2.5}

Table 10 2017 Compliance summary for PM_{2.5} in NSW

Region/ monitoring station	Data availability rate (% of days)					Number of exceedance days		Annual mean (µg/m ³)	Performance against standards and goals	
	Q1	Q2	Q3	Q4	Annual	Non- excepti onal days	Except ional days		24-hour	1-year
Sydney										
Bringelly	84.4	96.7	98.9	97.8	94.5	0	2	7.5	Met	Met
Camden	96.7	93.4	100	96.7	96.7	0	2	6.7	Met	Met
Campbelltown West	96.7	94.5	98.9	91.3	95.3	0	0	7.4	Met	Met
Chullora	97.8	98.9	98.9	93.5	97.3	4	4	9.5	Not Met	Not Met
Earlwood	100	100	100	97.8	99.5	0	2	7.3	Met	Met
Liverpool	95.6	93.4	94.6	97.8	95.3	1	2	8.9	Not Met	Not Met
Oakdale	88.9	98.9	98.9	92.4	94.8	0	1	6.0	Met	Met
Prospect	97.8	100	100	90.2	97.0	0	3	7.7	Met	Met
Richmond	91.1	94.5	94.6	92.4	93.2	0	3	7.0	Met	Met
Rozelle	93.3	97.8	100	98.9	97.5	0	2	7.2	Met	Met
St Marys	97.8	97.8	98.9	100	98.6	0	3	7.0	Met	Met
Central Coast										
Wyong	98.9	97.8	97.8	96.7	97.8	0	1	5.8	Met	Met
Illawarra										
Albion Park South	82.2	73.6	90.2	96.7	85.8	0	0	6.6	ND	ND
Kembla Grange	90.0	86.8	97.8	97.8	93.2	0	0	6.9	Met	Met
Wollongong	94.4	90.1	94.6	100	94.8	0	0	7.1	Met	Met
Lower Hunter										
Beresfield	100	97.8	100	96.7	98.6	0	0	7.6	Met	Met
Newcastle	96.7	98.9	97.8	95.7	97.3	0	0	7.4	Met	Met
Wallsend	98.9	100	97.8	97.8	98.6	0	0	7.3	Met	Met
Regional										
Albury	51.1	100	98.9	91.3	85.5	0	0	7.3	ND	ND
Bathurst	94.4	100	98.9	95.7	97.3	0	0	6.1	Met	Met
Tamworth	94.4	95.6	97.8	91.3	94.8	0	0	7.8	Met	Met
Wagga Wagga North	96.7	97.8	97.8	100	98.1	2	3	8.1	Not Met	Not Met

AAQ NEPM standards and goal:

25.0 µg/m³ (24-hour average, 0 days/year)

8.0 µg/m³ (Annual average)

Bold font indicates that the AAQ NEPM goal was not met. See Table 20 for details of exceptional events.

ND means performance at the site was not assessed because greater than 75% availability of data in any quarter was not demonstrated.

During 2017, 12 stations exceeded the AAQ NEPM 24-hour PM_{2.5} standard, but only three stations did not meet the 24-hour AAQ NEPM goal due to one or more exceedances that were not exceptional events: Chullora, Liverpool and Wagga Wagga North. Table 22 presents a summary of exceptional events. Section E includes a detailed episode analysis for a typical PM_{2.5} exceedance event.

Three stations (Chullora, Liverpool and Wagga Wagga North) did not meet the AAQ NEPM annual PM_{2.5} goal. Chullora had the highest annual average (9.5 µg/m³).

Whereas the above data (Table 10) were collected using BAM, Table 10a presents PM_{2.5} data that were measured using a Federal Reference Method (FRM). NSW OEH performs FRM measurements at Chullora station only. The differences in PM_{2.5} annual averages between BAM and FRM reflect inter-method differences, as FRM provides only one sample in three days where BAM provides continuous data.

During 2017, there were two prolonged periods when the FRM sampling program was disrupted:

- January to May: delays due to the replacement of a faulty pump on the FRM monitor.
- October to December: filter preparations/handling facility was unavailable due to laboratory refurbishment.

Due to these reasons, data from the FRM monitoring program did not meet the reporting criterion for data availability (at least 75% per quarter) for the second and fourth quarters of 2017.

Table 10a Summary of PM_{2.5} concentrations in NSW (2017) – FRM method

Region/ monitoring station	Data availability rate ¹ (% of days)					Number of exceedances (days)	Annual mean (µg/m ³)
	Q1	Q2	Q3	Q4	Annual		
Sydney							
Chullora	76.7	<u>66.7</u>	95.6	<u>72.5</u>	77.9	1	7.4

¹ Data availability rates are based on a 1-day-in-3 sampling regime.

Lead

The primary source of lead in the air was eliminated with the complete ban on lead in petrol. Changes to fuel formulation brought marked reductions in the levels of lead in the atmosphere. Annual averages throughout New South Wales were typically less than 0.03 µg/m³, with many 24-hour average samples below the minimum detection limit for lead (0.007 µg/m³ using ICP-AES (inductively coupled plasma – atomic emission spectroscopy)). Since 2002 the highest annual average recorded in New South Wales has been only 18% of the standard (e.g., 0.09 µg/m³ at Wallsend in 2003).

OEH phased out ambient lead monitoring for the AAQ NEPM during 2004. The case for cessation of lead monitoring was approved by the National Environment Protection Council (NEPC).

Section C – Analysis of air quality

Data availability rates

Data availability rates are presented as either percentages of valid data or numbers of valid days.

When presented as a percentage, the value is the number of averaging periods in which the data are valid, divided by the total number of averaging periods in the year (or quarter, as appropriate).

When presented as the number of valid days, the value represents the number of days during the year when at least 75% of averaging periods during the day are valid. A valid day has at least 18 valid hours. If we hypothesize that on each day throughout the year we had **exactly** 18 valid hours, then annual hourly data availability would be 75%. The number of valid days would be 365.

Calibration hour

For gaseous pollutants, the calibration hour is included in the calculation of data availability rates.

OEH does daily automated instrument calibration checks for carbon monoxide, nitrogen dioxide, ozone and sulfur dioxide during the early morning; hourly data obtained during the calibration check are considered invalid for reporting purposes. Hence for these pollutants the maximum number of valid 1-hour averages in a day is 23. However, all calculations for data availability given in this report **include** the invalid calibration hour (i.e. calculations assume that there are 24 **possible** valid hours in a day). Therefore, for gaseous pollutants, the maximum annual 1-hour data availability can be only 96%.

Data availability rates and reporting periods

Each reporting period (e.g. quarter) and NEPM standard averaging period has at least a 75% data availability rate.

For example, the carbon monoxide NEPM standard is based on 8-hour rolling averages. A valid 8-hour rolling average is calculated as the average of the valid 1-hour averages over the preceding 8 hours, when at least six of those hours (75%) hold valid data.

Data availability rates for pollutants reported against more than one standard

For pollutants reported against more than one AAQ NEPM standard, data availability rates may not be the same for each standard.

For instance, when ozone is measured, one hour of each day is lost during calibration checks. This affects data availability rates for reporting against the 1-hour standard for the associated hour, but it may not affect data availability rates for reporting against the 4-hour standard. Thus, the maximum data availability rate is only 96% for the 1-hour standard, but it can be 100% for the 4-hour standard.

Daily maxima

As a NEPM requirement for standards with averaging periods of less than 24 hours, the daily maxima are reported regardless of the number of valid hours in the day.

As an example, the daily highest 1-hour average for NO₂ during a given year at a site may have occurred on a day on which the 75% data requirement was not met. In reporting percentile distributions of the daily 1-hour maxima for the site for the year, however, at least 75% of valid hours must be available for the associated day. If not, the subsequent day that has the highest 1-hour daily average from the year's dataset and meets the 75% data requirement will be used.

Air quality data tables

Tables 11 to 21a summarise the air quality data for each indicator and their relationships to the AAQ NEPM standards.

Carbon monoxide

Table 11 Summary for CO: Daily maximum rolling 8-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Number of valid days	Maximum values (ppm)				
			Highest	Date, time of highest	2 nd highest	Date, time of 2 nd highest	
Sydney							
Camden	96.0	342	0.5	21/08/2017 10:00	0.5	22/09/2017 04:00	
Campbelltown West	97.0	349	0.8	14/07/2017 01:00	0.7	13/07/2017 23:00	
Chullora	97.2	348	1.2	03/07/2017 03:00	1.2	23/06/2017 04:00	
Liverpool	99.1	360	1.8	18/07/2017 02:00	1.7	24/06/2017 02:00	
Prospect	98.7	356	1.1	06/06/2017 02:00	1.1	28/06/2017 02:00	
Rozelle	92.0	328	0.9	28/06/2017 02:00	0.8	27/06/2017 23:00	
Central Coast							
Wyang	98.3	355	0.6	08/09/2017 08:00	0.6	03/09/2017 09:00	
Illawarra							
Wollongong	97.6	352	0.7	12/02/2017 02:00	0.7	18/05/2017 01:00	
Lower Hunter							
Newcastle	96.2	343	1.1	03/07/2017 02:00	1.0	28/06/2017 02:00	

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

Carbon monoxide (CO) levels in all regions were substantially below the AAQ NEPM carbon monoxide 8-hour rolling average standard (Table 11). The highest recorded reading was at Liverpool (1.9 ppm) which was 20% of the NEPM standard.

Nitrogen dioxide

Table 12 Summary for NO₂: Daily maximum 1-hour average concentrations (2017)

Region/ monitoring station	Data availabilit y rate (%)	Number of valid days	Maximum values (ppm)				
			Highest	Date, time of highest	2 nd highest	Date, time of 2 nd highest	
Sydney							
Bringelly	91.4	347	0.036	22/09/2017 21:00	0.035	21/09/2017 20:00	
Camden	94.2	355	0.044	05/06/2017 16:00	0.037	21/09/2017 20:00	
Campbelltown West	93.5	355	0.061	22/09/2017 21:00	0.050	12/09/2017 21:00	
Chullora	93.3	355	0.060	12/09/2017 20:00	0.057	11/09/2017 23:00	
Liverpool	94.7	360	0.064	12/09/2017 19:00	0.060	22/09/2017 19:00	
Prospect	94.2	357	0.060	22/09/2017 20:00	0.055	22/09/2017 24:00	
Richmond	91.3	344	0.026	11/09/2017 20:00	0.024	21/09/2017 21:00	
Rozelle	93.3	351	0.061	04/04/2017 11:00	0.058	14/12/2017 11:00	
Central Coast							
Wyong	94.3	359	0.051	29/03/2017 22:00	0.030	22/09/2017 22:00	
Illawarra							
Albion Park South	93.0	352	0.038	23/09/2017 19:00	0.038	22/09/2017 18:00	
Wollongong	93.8	357	0.057	22/09/2017 20:00	0.042	12/09/2017 19:00	
Lower Hunter							
Newcastle	94.3	358	0.037	27/07/2017 08:00	0.037	14/08/2017 19:00	
Wallsend	94.5	360	0.037	02/05/2017 20:00	0.034	14/08/2017 20:00	

AAQ NEPM standard: 0.12 ppm (1-hour average)

Nitrogen dioxide (NO₂) levels in all regions were below the AAQ NEPM 1-hour nitrogen dioxide standard (Table 12). The highest recorded reading was at Liverpool (0.064 ppm).

Ozone

Table 13 Summary for O₃: Daily maximum 1-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Number of valid days	Maximum values (ppm)				
			Highest	Date of highest	2 nd highest	Date of 2 nd highest	
Sydney							
Bringelly	92.0	348	0.098	13/12/2017 14:00	0.094	19/12/2017 15:00	
Camden	93.8	352	0.122	19/12/2017 16:00	0.089	13/12/2017 15:00	
Campbelltown West	93.5	355	0.094	16/12/2017 15:00	0.092	11/02/2017 14:00	
Chullora	93.7	357	0.114	11/02/2017 16:00	0.099	10/02/2017 13:00	
Liverpool	94.5	359	0.135	11/02/2017 15:00	0.101	19/12/2017 15:00	
Oakdale	95.2	363	0.095	23/02/2017 17:00	0.093	18/12/2017 16:00	
Prospect	94.6	358	0.123	11/02/2017 15:00	0.093	10/02/2017 13:00	
Richmond	92.9	353	0.093	06/02/2017 14:00	0.090	23/01/2017 18:00	
Rozelle	93.3	352	0.114	10/02/2017 12:00	0.083	19/12/2017 14:00	
St Marys	94.2	358	0.110	10/02/2017 12:00	0.100	11/02/2017 14:00	
Central Coast							
Wyong	94.2	358	0.121	10/02/2017 14:00	0.087	11/02/2017 14:00	
Illawarra							
Albion Park South	94.1	357	0.117	11/01/2017 14:00	0.109	10/02/2017 15:00	
Kembla Grange	94.6	357	0.122	11/01/2017 14:00	0.113	10/02/2017 16:00	
Wollongong	92.1	348	0.107	11/01/2017 13:00	0.102	10/02/2017 16:00	
Lower Hunter							
Newcastle	94.0	356	0.086	11/02/2017 12:00	0.069	24/12/2017 13:00	
Wallsend	94.9	362	0.106	11/02/2017 13:00	0.092	10/02/2017 15:00	

AAQ NEPM standard: 0.10 ppm (1-hour average)

Bold font indicates values that exceed the AAQ NEPM standard

During 2017, the maximum 1-hour average ozone level occurred at Liverpool, Sydney South West on 11 February 2017 (0.135 ppm; Table 13). On the same day, Prospect in Sydney North West recorded the second highest 1-hour average ozone (0.123 ppm). These maxima occurred during south-east Australia's most severe summer heatwave in 2017. Section E includes an analysis of the ozone exceedance event during 10-11 February 2017. The 1-hour NEPM ozone standard was exceeded on four distinct days (Table 15).

Table 14 Summary for O₃: Daily maximum rolling 4-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Number of valid days	Maximum values (ppm)				
			Highest	Date, time of highest	2 nd highest	Date, time of 2 nd highest	
Sydney							
Bringelly	95.6	348	0.089	13/12/2017 16:00	0.080	11/02/2017 15:00	
Camden	97.6	351	0.108	19/12/2017 18:00	0.084	13/12/2017 16:00	
Campbelltown West	97.1	354	0.091	16/12/2017 16:00	0.079	11/02/2017 15:00	
Chullora	97.7	355	0.110	11/02/2017 16:00	0.086	19/12/2017 16:00	
Liverpool	98.5	359	0.117	11/02/2017 16:00	0.091	19/12/2017 17:00	
Oakdale	99.3	363	0.080	09/01/2017 15:00	0.079	23/02/2017 18:00	
Prospect	98.7	358	0.106	11/02/2017 16:00	0.083	10/02/2017 14:00	
Richmond	96.7	353	0.085	06/02/2017 15:00	0.082	09/01/2017 15:00	
Rozelle	96.8	352	0.109	10/02/2017 15:00	0.076	19/12/2017 16:00	
St Marys	98.2	357	0.096	10/02/2017 14:00	0.086	09/01/2017 15:00	
Central Coast							
Wyong	98.0	358	0.105	10/02/2017 17:00	0.084	11/02/2017 16:00	
Illawarra							
Albion Park South	98.0	357	0.102	10/02/2017 16:00	0.089	11/01/2017 15:00	
Kembla Grange	98.6	357	0.098	11/01/2017 15:00	0.094	10/02/2017 16:00	
Wollongong	96.0	348	0.094	11/01/2017 15:00	0.093	10/02/2017 16:00	
Lower Hunter							
Newcastle	97.8	355	0.073	11/02/2017 14:00	0.064	19/12/2017 15:00	
Wallsend	99.0	362	0.097	11/02/2017 15:00	0.081	10/02/2017 15:00	

AAQ NEPM standard: 0.08 ppm (rolling 4-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

During 2017, the maximum 4-hour ozone average occurred at Liverpool in Sydney South West on 11 February 2017 (0.117 ppm; Table 14). On the same day, Chullora in Sydney East recorded the second highest 1-hour average ozone (0.110 ppm). These maxima occurred during south-east Australia's most severe summer heatwave in 2017. Section E includes an analysis of the ozone exceedance event during 10-11 February 2017. The 4-hour NEPM ozone standard was exceeded on ten distinct calendar days (Table 16).

Ozone events in the Sydney and Illawarra regions are highly variable in terms of both frequency and severity. This is largely due to the annual variability in meteorological conditions, which strongly affect the frequency events and the magnitude of peak concentrations. In the Sydney region, emissions of ozone precursors (nitrogen oxides [NO_x] and volatile organic compounds [VOCs]) generate concentrations of ozone well above the AAQ NEPM standards (EPA Emissions Inventory 2008).

Table 15 Days when O₃ 1-hour AAQ NEPM standard was exceeded.

Day count	Date	Stations where standard exceeded	Comments ¹
1	11/01/2017	Albion Park South, Kembla Grange, Wollongong	High temperatures (Albion Park South 35.6 °C, Kembla Grange 35.8 °C)
2	10/02/2017	Wyong, Rozelle, St Marys, Albion Park South, Kembla Grange, Wollongong	Two-day event during the most severe summer 2017 heatwave period recorded in south-east Australia
3	11/02/2017	Wallsend, Chullora, Liverpool, Prospect	Two-day event during the most severe summer 2017 heatwave period recorded in south-east Australia
4	19/12/2017	Camden, Liverpool	High temperatures (Liverpool 38 °C & Camden 41.9 °C)

¹ Events that can be clearly identified as influencing pollution levels

Table 16 Days when O₃ 4-hour AAQ NEPM standard was exceeded.

Day count	Date	Stations where standard exceeded	Comments ¹
1	09/01/2017	Richmond, St Marys	High temperatures (Richmond 36 °C & St Marys 34 °C)
2	11/01/2017	Albion Park South, Kembla Grange, Wollongong	High temperatures (Albion Park South 36 °C, Kembla Grange 36 °C, Wollongong 31 °C)
3	17/01/2017	Kembla Grange	High temperatures (Kembla Grange 34 °C)
4	06/02/2017	Richmond	High temperatures (Richmond 38 °C)
5	10/02/2017	Wallsend, Wyong, Chullora, Prospect, Rozelle, St Marys, Kembla Grange, Albion Park South, Wollongong	Two consecutive days during the most severe heatwave period recorded in south-east Australia during summer 2017
6	11/02/2017	Wallsend, Wyong, Chullora, Liverpool, Prospect, St Marys,	Two consecutive days during the most severe heatwave period recorded in south-east Australia during summer 2017
7	23/02/2017	St Marys	High temperatures (St Marys 35 °C)
8	13/12/2017	Bringelly, Camden	High temperatures (Camden 38 °C, Bringelly 35 °C)
9	16/12/2017	Camden, Campbelltown West	High temperatures (Camden 38 °C, Campbelltown West 36 °C)
10	19/12/2017	Camden, Chullora, Kembla Grange, Liverpool	Severe heatwave (Penrith 43 °C)

¹ Events that can be clearly identified as influencing pollution levels

Sulfur dioxide

Table 17 Summary for SO₂: Daily maximum 1-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Number of valid days	Maximum values (ppm)				
			Highest	Date, time of highest	2 nd highest	Date, time of 2 nd highest	
Sydney							
Bringelly	93.1	353	0.009	22/02/2017 09:00	0.008	16/08/2017 12:00	
Campbelltown West	92.6	351	0.011	16/01/2017 05:00	0.010	23/12/2017 08:00	
Chullora	93.6	356	0.014	07/12/2017 23:00	0.012	17/05/2017 14:00	
Prospect	94.5	358	0.023	28/01/2017 24:00	0.020	28/01/2017 23:00	
Richmond	91.9	346	0.034	05/12/2017 08:00	0.032	16/10/2017 24:00	
Central Coast							
Wyong	92.9	351	0.047	13/12/2017 18:00	0.032	28/12/2017 19:00	
Illawarra							
Albion Park South	94.6	357	0.030	29/12/2017 10:00	0.026	23/09/2017 18:00	
Wollongong	94.3	359	0.047	16/12/2017 22:00	0.032	20/12/2017 13:00	
Lower Hunter							
Newcastle	94.4	358	0.050	03/09/2017 12:00	0.035	12/03/2017 09:00	
Wallsend	94.5	360	0.056	26/05/2017 13:00	0.038	07/06/2017 14:00	

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 18 Summary for SO₂: Maximum 24-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Number of valid days	Maximum value (ppm)				
			Highest	Date of highest	2 nd highest	Date of 2 nd highest	
Sydney							
Bringelly	96.7	353	0.002	03/10/2017	0.002	29/12/2017	
Campbelltown West	96.2	351	0.003	23/12/2017	0.003	03/10/2017	
Chullora	97.5	356	0.003	23/01/2017	0.003	08/01/2017	
Prospect	98.1	358	0.004	29/12/2017	0.003	13/03/2017	
Richmond	94.8	346	0.004	17/10/2017	0.003	29/12/2017	
Central Coast							
Wyong	96.2	351	0.007	23/12/2017	0.006	28/12/2017	
Illawarra							
Albion Park South	97.8	357	0.008	28/01/2017	0.008	19/12/2017	
Wollongong	98.4	359	0.005	17/12/2017	0.005	16/12/2017	
Lower Hunter							
Newcastle	98.1	358	0.006	22/04/2017	0.006	21/03/2017	
Wallsend	98.6	360	0.010	26/05/2017	0.007	28/04/2017	

AAQ NEPM standard: 0.08 ppm (24-hour average)

Sulfur Dioxide (SO₂) levels in all regions were substantially below the AAQ NEPM 1-hour and 24-hour sulfur dioxide standards (Tables 17 and 18). The highest recorded 1-hour reading

was at Wallsend (0.056 ppm). The highest recorded 24-hour average was also at Wallsend (0.010 ppm).

Annual average levels were similar across all stations (Table 8).

Particles as PM₁₀

Table 19 Summary for PM₁₀: Maximum 24-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Number of valid days	Maximum values (µg/m ³)			
			Highest	Date of highest	6 th highest	Date of 6 th highest
Sydney						
Bringelly	97.0	354	83.7	11/07/2017	51.0	20/12/2017
Camden	98.4	359	48.4	24/09/2017	32.0	15/01/2017
Campbelltown West	98.1	358	53.1	24/09/2017	32.0	13/01/2017
Chullora	99.5	363	63.0	12/10/2017	47.2	12/03/2017
Liverpool	98.9	361	74.0	14/08/2017	38.7	31/01/2017
Oakdale	98.6	360	46.8	24/09/2017	26.9	15/01/2017
Prospect	98.4	359	61.1	24/09/2017	37.2	03/09/2017
Richmond	95.9	350	51.5	24/09/2017	34.3	21/08/2017
Rozelle	98.6	360	54.1	06/02/2017	36.8	31/12/2017
Central Coast						
Wyong	98.4	359	63.4	24/09/2017	33.9	11/09/2017
Illawarra						
Albion Park South	98.9	361	44.6	14/12/2017	36.3	01/12/2017
Kembla Grange	98.4	359	67.7	24/09/2017	47.4	17/01/2017
Wollongong	98.4	359	55.2	14/12/2017	45.5	09/01/2017
Lower Hunter						
Beresfield	98.9	361	49.4	24/09/2017	38.4	19/09/2017
Newcastle	98.6	360	55.0	24/09/2017	44.7	06/02/2017
Regional						
Albury	97.5	356	48.8	06/03/2017	34.6	11/03/2017
Bathurst	97.3	355	49.9	23/09/2017	31.9	23/02/2017
Tamworth	99.2	362	54.1	10/04/2017	34.1	13/02/2017
Wagga Wagga North	98.4	359	171.6	31/03/2017	54.5	18/04/2017

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

During 2017, 13 of the 19 stations exceeded the AAQ NEPM 24-hour PM₁₀ standard of 50 µg/m³ (Table 19). Six of these stations did not meet the AAQ NEPM 24-hour PM₁₀ goal (see Table 9). The maximum 24-hour PM₁₀ was recorded at Wagga Wagga North station in regional New South Wales on 31 March (171.6 µg/m³). Bringelly in south-west Sydney had the second highest 24-hour average PM₁₀ on 11 July (83.7 µg/m³).

In accordance with the AAQ NEPM cl 18(3), Table 20 includes a determination on each PM₁₀ exceedance event, as exceptional or non-exceptional, and describes the natural events or fire management activity which led to the determination of an exceptional event. A detailed episode analysis is included in Section E describing the exceptional exceedance event

during 22-24 September 2017 when nine stations in the network recorded their maximum 24-hour PM₁₀ concentrations.

The 24-hour NEPM PM₁₀ standard was exceeded on 22 distinct calendar days (Table 20), of which seven days were deemed exceptional. Eight out of the 15 non-exceptional days occurred exclusively at Wagga Wagga North, which had a total of 10 non-exceptional days. Dust storms, extensive hazard reduction burns (HRBs) throughout the Greater Metropolitan Region and agricultural activities at Wagga Wagga North were the major influences on elevated PM₁₀ levels throughout New South Wales. All stations met the AAQ NEPM annual PM₁₀ goal.

Table 20 Days when PM₁₀ 24-hour AAQ NEPM standard was exceeded

Day count	Date	Stations where standard exceeded	Comments ¹
1	13/01/2017	Wagga Wagga North	Non-exceptional event
2	17/01/2017	Wagga Wagga North	Non-exceptional event
3	30/01/2017	Wagga Wagga North	Non-exceptional event
4	31/01/2017	Wagga Wagga North	Non-exceptional event
5	06/02/2017	Rozelle	Non-exceptional event
6	12/02/2017	Tamworth	A few small fires or smoke reported within 6km to the west and south
7	08/03/2017	Chullora	Non-exceptional event
8	12/03/2017	Wagga Wagga North	Non-exceptional event
9	29/03/2017	Wagga Wagga North	Non-exceptional event
10	31/03/2017	Wagga Wagga North	Non-exceptional event
11	10/04/2017	Tamworth	Dust storm (Upper Hunter Autumn Seasonal Report 2017)
12	18/04/2017	Wagga Wagga North	Non-exceptional event
13	11/07/2017	Bringelly	Non-exceptional event
14	14/08/2017	Bringelly, Chullora, Liverpool	Hazard reduction burns affected most Sydney sites with significant smoke levels
15	12/09/2017	Bringelly	Smoke from small burn (<20 ha)
16	22/09/2017	Bringelly	First day of dust storm when most Sydney sites had elevated PM ₁₀ due to dust blown by NW winds from the desert
17	23/09/2017	Kembla Grange	Elevated PM ₁₀ due to desert dust blown by NW winds
18	24/09/2017	Bringelly, Chullora, Campbelltown West, Kembla Grange, Wyong, Liverpool, Prospect, Richmond, Newcastle	Most Sydney sites had elevated PM ₁₀ due to dust blown by north-west winds from the desert Combination of desert dust under strong north-west winds and 1115 ha fire (Old Inn Rd, Bulahdelah) to the north
19	12/10/2017	Chullora	Non-exceptional event
20	14/12/2017	Kembla Grange, Wagga Wagga North, Wollongong	Non-exceptional event
21	19/12/2017	Kembla Grange, Wagga Wagga North	Non-exceptional event
22	20/12/2017	Bringelly	Non-exceptional event

¹ All comments describe exceptional events unless otherwise identified.

An exceptional event can be clearly identified as influencing pollution levels and is **not included** as an exceedance day when assessing compliance against the daily PM₁₀ standard and goal. An **exceptional event** means a fire or dust occurrence that adversely affects air quality at a particular location and causes an exceedance of 1-day average standard 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.

A **non-exceptional event** is **highlighted yellow** and is **included** when assessing against daily PM₁₀ standard and goal.

Particles as PM_{2.5}

Table 21 Summary of PM_{2.5}: Maximum 24-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Number of valid days	Maximum values (µg/m ³)				
			Highest	Date of highest	2 nd highest	Date of 2 nd highest	
Sydney							
Bringelly	94.5	345	52.5	14/08/2017	29.2	15/08/2017	
Camden	96.7	353	27.7	14/08/2017	25.5	15/08/2017	
Campbelltown West	95.3	348	25.0	14/08/2017	17.8	03/09/2017	
Chullora	97.3	355	44.6	08/03/2017	39.0	14/08/2017	
Earlwood	99.5	363	50.9	14/08/2017	26.7	02/09/2017	
Liverpool	95.3	348	56.4	14/08/2017	29.7	15/08/2017	
Oakdale	94.8	346	25.5	02/09/2017	21.2	15/08/2017	
Prospect	97.0	354	30.1	02/09/2017	29.3	03/09/2017	
Richmond	93.2	340	34.3	10/09/2017	27.9	27/08/2017	
Rozelle	97.5	356	36.3	14/08/2017	25.7	02/09/2017	
St Marys	98.6	360	38.2	15/08/2017	26.0	03/09/2017	
Central Coast							
Wyong	97.8	357	27.2	12/09/2017	19.7	03/09/2017	
Illawarra							
Albion Park South	85.8	313	19.3	19/12/2017	16.6	12/05/2017	
Kembla Grange	93.2	340	21.3	11/05/2017	19.4	19/12/2017	
Wollongong	94.8	346	24.7	03/09/2017	18.3	02/05/2017	
Lower Hunter							
Beresfield	98.6	360	18.7	12/05/2017	17.4	11/02/2017	
Newcastle	97.3	355	18.0	10/09/2017	17.9	11/02/2017	
Wallsend	98.6	360	20.4	02/07/2017	20.0	22/07/2017	
Regional							
Albury	85.5	312	18.7	08/04/2017	18.1	13/05/2017	
Bathurst	97.3	355	17.5	16/06/2017	16.0	17/06/2017	
Tamworth	94.8	346	21.6	23/08/2017	21.5	13/02/2017	
Wagga Wagga North	98.1	358	32.5	16/05/2017	28.3	12/05/2017	

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

Table 21a presents FRM data for Chullora, the only station where these measurements are performed. Data from BAM and FRM may demonstrate inter-method differences owing to differences in sampling strategies.

Table 21a Summary of PM_{2.5}: Maximum 24-hour average concentrations (2017) – FRM method

Region/ monitoring station	Data availability rate ¹ (%)	Number of valid days	Maximum values (µg/m ³)			
			Highest	Date of highest	2 nd highest	Date of 2 nd highest
Sydney						
Chullora	77.9	94	27.9	7/03/2017	23.3	12/09/2017

1 Data availability rates are based on a 1-day-in-3 sampling regime.

During 2017, 12 stations exceeded the AAQ NEPM 24-hour PM_{2.5} standard of 25.0 µg/m³ (Table 21). Of these, three stations did not meet the AAQ NEPM goal for 24-hour PM_{2.5} (see Table 10). The maximum 24-hour PM_{2.5} was at Liverpool station in south-west Sydney (56.4 µg/m³ on 14 Aug), followed closely by Bringelly (52.5 µg/m³) also in south-west Sydney.

In accordance with the AAQ NEPM cl 18(3), Table 22 includes a determination on each PM_{2.5} exceedance event as exceptional or not, and describes the circumstances, including the influence of natural events and fire management which led to events determined as exceptional. Further, a detailed episode analysis is also included in Section E describing the exceptional exceedance event during 2-3 September 2017 when three Sydney stations recorded their maximum 24-hour PM_{2.5} concentrations.

The 24-hour NEPM PM_{2.5} standard was exceeded on 18 distinct calendar days (Table 22), of which 11 were exceptional events. Generally, extensive hazard reduction burning (HRBs) throughout the Sydney Greater Metropolitan Region and agricultural activities at Wagga Wagga North were the major influences on elevated PM_{2.5} levels. Four out of the seven non-exceptional days occurred at Chullora (7-12 March) due to a fire at a nearby recycling plant. Three stations did not meet the AAQ NEPM annual PM_{2.5} goal: Chullora, Liverpool, Wagga Wagga North.

Table 22 Days above the 24-hour PM_{2.5} AAQ NEPM standard (2017)

Day count	Date	Stations where standard exceeded	Comments ¹
1	07/03/2017	Chullora	Non-exceptional event
2	08/03/2017	Chullora	Non-exceptional event
3	09/03/2017	Chullora	Non-exceptional event
4	12/03/2017	Chullora	Non-exceptional event
5	11/05/2017	St Marys, Wagga Wagga North	HRB at Wentworth Falls, 40 km north-west of St Marys. HRB advisory for Wagga Wagga North
6	12/05/2017	Wagga Wagga North	HRB according to HR advisory
7	16/05/2017	Wagga Wagga North	HRB according to HR advisory
8	03/06/2017	Wagga Wagga North	Non-exceptional event
9	12/06/2017	Wagga Wagga North	Non-exceptional event
10	03/07/2017	Liverpool	Non-exceptional event
11	14/08/2017	Bringelly, Camden, Chullora, Rozelle, Earlwood, Liverpool, Prospect	HRBs affected most Sydney sites with significant smoke levels
12	15/08/2017	Bringelly, Camden, Liverpool, St	Effects of HRB from 14/08/2017
13	23/08/2017	Richmond	Possibly due to HRBs (226 & 198 ha) in
14	27/08/2017	Chullora, Richmond	Blue Mountains HRB (464 ha) on 26/08/2017
15	02/09/2017	Chullora, Earlwood, Oakdale, Prospect, Rozelle	Large number of HRBs around Sydney
16	03/09/2017	Prospect, St Marys	Smoke from previous day still in Sydney
17	10/09/2017	Richmond	Smoke near Richmond
18	12/09/2017	Chullora, Wyong	Smoke from small burn (< 20 ha) at Chullora. A number of fires near Wyong; likely from 52ha fire ~8 km north-east

¹ All comments describe exceptional events unless otherwise identified.

An exceptional event can be clearly identified as influencing pollution levels and is **not included** as an exceedance day when assessing compliance against the daily PM_{2.5} standard and goal. An **exceptional event** means a fire or dust occurrence that adversely affects air quality at a particular location and causes an exceedance of 1-day average standard 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.

A **non-exceptional event** is **highlighted yellow** and is **included** when assessing against daily PM_{2.5} standard and goal.

Assessment of progress towards achieving the goal

The Ambient Air Quality NEPM goal is a driver for NSW air quality improvement strategies and a benchmark against which progress in managing air quality can be assessed.

In New South Wales, the Office of Environment and Heritage (OEH) operates the NSW Air Quality Monitoring Network. The NSW Environment Protection Authority (EPA) develops and implements regulation, policies and programs to achieve Air NEPM goals and protect public health.

Air quality management in the Sydney Greater Metropolitan Region and regional NSW

The EPA delivers numerous actions that target the pollutants of most concern in New South Wales, namely particles in the Greater Metropolitan Region (GMR) and some regional centres, and ground level ozone by reducing precursor emissions. These actions are designed to improve knowledge about air emissions, air quality and the impacts of air pollution, inform and engage the community and other stakeholders, and reduce air quality impacts from industry, vehicles and commercial and domestic activities.

The OEH operates the NSW Air Quality Monitoring Network, which includes 45 monitoring stations across several networks. Air quality data and information are made publicly available on the OEH website, updated on an hourly basis, and subscribers are sent automated text messages when air quality is measured or forecast to exceed national air quality standards. OEH also collaborates with the EPA, other agencies and science partners to deliver research to inform air policies and programs.

The following is an outline of the key mechanisms for managing air quality and the activities implemented in 2017.

Clean Air for NSW Strategy

As part of developing a Clean Air for NSW policy framework, the EPA released the [Clean Air for NSW Consultation Paper](#) from October 2016 to January 2017. The EPA also consulted via the Clean Air Summit in June 2017, which was attended by more than 300 air quality stakeholders. Public submissions on the consultation paper, summit background papers and presentations are available on the EPA's [Clean Air for NSW webpage](#).

Air quality monitoring

Fine particle monitoring was extended across the NSW Air Quality Monitoring Network in 2017. This monitoring supports air quality and health analysis and compliance assessments against national PM_{2.5} standards.

Air incident monitoring and modelling capabilities were established for incidents where air quality impacts may be experienced by the community for a period of several days or longer. This included two portable monitoring pods equipped with seven compliance air quality monitors that meet Australian Standards and the National Environment Protection (Ambient Air Quality) Measure requirements, and other non-compliance instruments and meteorological monitors. The pods are fitted with telemetry and communications systems coupled with web reporting capabilities for rapid transfer of information to a publicly accessible website.

Air emissions and health impacts research

Broken Hill Environmental Lead Study

The Broken Hill Environmental Lead Study was commissioned by the EPA in 2016 to inform remediation efforts underway as part of the Broken Hill Environmental Lead Program to address lead contamination and exposures. This collaborative study by EPA, OEH and Macquarie University aims to monitor airborne and deposited lead and assess contributions of current emissions from Line of Lode mining leases and emissions from areas affected by historic emissions ('legacy lead'). The first study report will document findings from the analysis of data from the first year of sampling, and from the pilot study into particle morphology and chemistry.

Sydney Particle Characterisation Study

The EPA and OEH commissioned the Australian Nuclear Science and Technology Organisation (ANSTO) to carry out the Sydney Particle Characterisation Study. ANSTO analysed PM_{2.5} data from four sites at Lucas Heights, Richmond, Mascot and Liverpool from 2000-14.

The study found: wood smoke, industry, vehicles, sea salt and soil contribute to fine particle concentrations in Sydney's air. Smoke, including from domestic wood burning, was a significant source of wintertime fine particle pollution at western Sydney sites. Secondary sulfate, from coal-fired power stations and industry, contributed significantly to fine particles in summer. Particles from motor vehicles reduced over the study period but remain a significant source of fine particle pollution. The report was released in June 2017.

Sydney Air Quality Study

This multi-year study commenced in 2016 to improve the understanding of air quality and the impacts of air pollution in the Greater Sydney Region. The study will extend the evidence base for air policies and programs, providing information on past, current and future air quality and its impacts on public health and the environment in the Greater Sydney Region.

The study will support evidence-based air policies and programs by identifying persistent and emerging issues, and highlighting opportunities to improve air quality and realise public health and economic benefits. The first study report will be delivered in 2019.

Enhancing air quality forecasting in NSW

This program was established to progressively expand the scope and enhance the accuracy of air quality forecasting capabilities in New South Wales. The OEH issues a daily air quality forecast for the Greater Sydney Region, and the overall accuracy of forecasts is currently considered to be moderate. Through this program, OEH will work towards more accurately forecasting air quality for Greater Sydney and its sub-regions and will progressively expand forecasting to the whole of the GMR (Greater Metropolitan Region) and major regional areas. The program involves several projects to develop specific advanced tools and capabilities, some involving collaboration with science partners.

Industry emissions

In 2017 the EPA continued to implement its regulatory responsibilities, including licensing scheduled industry activities and conducting compliance and enforcement

programs. The *Protection of the Environment Operations Act 1997*, the Protection of the Environment Operations (Clean Air) Regulation 2010 and the Protection of the Environment Operations (General) Regulation 2009 set the framework for managing air pollution from major industries in New South Wales.

Coal mine non-road diesel emissions

Following consultation on best practice measures to reduce non-road diesel exhaust emissions, in early 2017 the EPA released a draft Pollution Reduction Study (PRS) and draft Special Licence Condition (SLC) for consultation with the coal mining industry. The draft PRS would require operating open-cut coal mines to provide information on the emission performance of the existing non-road diesel fleet, measures already adopted, and investigation of any further reasonable and feasible emission reduction measures that could be implemented. The draft SLC would also require new non-road diesel equipment commissioned at NSW coal mines to meet the US EPA Tier 4 final emission standard.

Locomotives

In February 2017 the EPA published the Diesel Locomotive - Fuel Efficiency and Emissions Testing report. Together with the 2015 Diesel locomotive emissions reduction technology study, this demonstrated that PM emission reductions conforming to US Tier 0+ emission standards can be achieved through emission upgrade kits or other locomotive upgrade programs. Results of these studies will inform policy development for management of emissions from locomotives operating in New South Wales.

Vehicle and fuel emissions

Smoky vehicle program

The EPA operates a smoky vehicle compliance program that targets vehicles emitting excessive air impurities. In 2017, EPA officers issued 37 penalty notices to the owners of vehicles found to be emitting excessive air impurities. In addition, the EPA issued 872 letters to vehicle owners reported by members of the community, advising the vehicle owners to have the vehicles inspected and repaired if necessary.

M5 East tunnel smoky vehicle detection system

In 2017, NSW Roads and Maritime Services continued its Smoky Vehicle Enforcement Project in the M5 East tunnel. The camera system detects, identifies, and records smoky vehicles, and includes fines for the operators of smoky vehicles. In 2017 the EPA issued 33 penalty notices to vehicle owners referred by the Roads and Maritime Services (RMS) camera detection system.

Vapour recovery at service stations

Vapour Recovery stage 1 (VR1) equipment captures displaced vapours from **storage tanks** when a tanker delivers fuel to a service station, while VR2 captures vapours displaced at the **bowser** when a motorist refuels. Medium to large service stations with a petrol throughput of 3.5 to 12 million litres per year, located in the Sydney metropolitan area, and any 'new or modified' service stations, were required to install VR2 equipment, which captures vapours when vehicles are re-filled at the dispenser, by 1 January 2017.

Data for the 2016-17 reporting period show that approximately 98% of petrol service stations required to have VR1 equipment installed and operating are compliant, and 92%

of petrol service stations required to install VR2 equipment have done so. Once fully implemented, vapour recovery is expected to reduce VOC emissions in the GMR by approximately 5000 tonnes per year.

National vehicle and fuel standards

Fuel quality and vehicle emission standards for new road vehicles are managed by the Commonwealth Government. A review of vehicle emission and fuel standards is in progress. In 2017, New South Wales made submissions to the Commonwealth supporting early introduction of tighter national vehicle emission and fuel standards. These proposed standards would more closely harmonise with international best practice for national vehicle emissions and fuel quality standards and will improve health outcomes.

Wood smoke management

In 2016 the NSW Government adopted new national standards for wood heaters, which set lower emission limits and new efficiency limits for heaters sold in New South Wales. During April-June 2017 the EPA undertook a domestic wood heater compliance audit program, to assess industry compliance with the certification and labelling requirements and improve manufacturers' and retailers' awareness of the legislative requirements and relevant standards. The EPA audited 30 businesses representing all major manufacturers and distributors/wholesalers in New South Wales. Audit results indicated that most wood heaters currently sold in New South Wales are certified as compliant with the new standards.

Based on recommendations in the 2016 Upper Hunter Wood Smoke Community Research Project, the EPA developed a new package of education materials to raise awareness about wood smoke impacts on people's health and environment. During winter 2017 the EPA trialled the education package in two regional centres in the Upper Hunter – Singleton and Muswellbrook, ahead of statewide roll out in 2018.

Hunter region air quality management

Upper Hunter Dust Risk Forecasting Scheme

The Upper Hunter Valley Dust Risk Forecasting Scheme was trialled from September to November 2017. The system aims to predict weather that will increase dust generation so that mines can take extra precautions at those critical times. During the trial, mines were required by the EPA to record the mass of material moved each day as a measure of their activity. The development of the scheme is documented in the report Upper Hunter Dust Risk Forecasting Scheme Development. EPA and OEH are now completing analysis of the results and considering the next steps in consultation with stakeholders.

Lower Hunter Particle Characterisation Study

A supplementary study to the Lower Hunter Particle Characterisation Study was commenced in 2016 to investigate the amount of coal present in particulate matter at Stockton, which is near coal loading facilities around the Port of Newcastle. The CSIRO study, Quantifying the coal component of airborne particulate matter at Stockton was released in 2017. It found that, while coal makes up 12% of total suspended particles, it accounts for less than 2% of finer PM_{2.5} particles.

Section D – Data analysis

The following section (Tables 23 to 149) provides a **basic statistical summary**, using percentiles, for each station and for each AAQ NEPM standard. Percentiles for daily maximum values are presented by using valid days only to calculate these statistics.

Stations with two years or more of data, **trend data**, in the form of annual maxima, are provided for each standard for each pollutant. Trend data are presented if any monitoring of a pollutant occurred at a station in a given year and the annual data availability rate for the pollutant was at least 15% at that station.

Carbon monoxide

Statistical summary for 2017

Table 23 Statistical summary for CO: Daily maximum rolling 8-hour average concentrations

Region/ monitoring station	Data availability rate (%)	Maximum (ppm)	Percentile (ppm)							
			99 th	98 th	95 th	90 th	75 th	50 th	25 th	
Sydney										
Camden	96.0	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.1	0.1
Campbelltown West	97.0	0.8	0.7	0.7	0.6	0.6	0.6	0.4	0.3	0.3
Chullora	97.2	1.2	1.1	1.0	0.8	0.7	0.7	0.5	0.3	0.3
Liverpool	99.1	1.8	1.6	1.5	1.1	0.9	0.9	0.6	0.4	0.3
Prospect	98.7	1.1	1.0	0.9	0.8	0.6	0.6	0.4	0.2	0.1
Rozelle	92.0	0.9	0.7	0.6	0.6	0.5	0.5	0.3	0.2	0.1
Central Coast										
Wyong	98.3	0.6	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1
Illawarra										
Wollongong	97.6	0.7	0.7	0.7	0.6	0.5	0.5	0.4	0.3	0.2
Lower Hunter										
Newcastle	96.2	1.1	0.9	0.9	0.8	0.6	0.6	0.4	0.3	0.2

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

Trend analysis

Table 24 Annual maximum rolling 8-hour average concentrations for CO (ppm)

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Camden	-	-	-	-	0.3	1.9	0.6	0.5	0.5	0.5
Chullora	1.6	2.6	2.3	1.5	2.0	2.5	1.7	1.4	1.6	1.2
Liverpool	2.4	2.2	2.1	2.4	1.9	2.1	2.2	1.8	1.9	1.8
Macarthur/ Campbelltown West*	0.9	0.8	0.9	1.1	0.6	3.0	0.9	1.0	1.2	0.8
Prospect	1.5	2.3	1.9	1.7	1.8	1.6	1.3	1.5	1.5	1.1
Rozelle	1.5	2.3	1.8	1.4	2.2	1.8	1.1	1.1	1.2	0.9
Central Coast										
Wyong	-	-	-	-	0.4	0.8	0.5	0.4	0.6	0.6
Illawarra										
Wollongong	1.3	1.3	1.5	1.2	1.2	2.7	0.9	0.8	0.9	0.7
Lower Hunter										
Newcastle	2.0	1.9	1.4	1.5	1.3	1.4	2.4	1.5	1.4	1.1

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

* Campbelltown West has replaced Macarthur as the active station since 2012.

Statistical summaries for multiple years, by station

Table 25 Statistical summary for CO: Daily maximum rolling 8-hour average concentrations. Station: Prospect

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	91.7	0	1.5	1.3	1.2	1.0	0.9	0.6	0.3	0.1	
2009	97.5	0	2.3	2.1	1.8	1.3	1.1	0.7	0.5	0.3	
2010	95.8	0	1.9	1.7	1.4	1.2	1.0	0.7	0.5	0.4	
2011	95.6	0	1.7	1.5	1.4	1.1	1.0	0.6	0.4	0.3	
2012	96.8	0	1.8	1.7	1.4	1.0	0.8	0.6	0.4	0.3	
2013	94.7	0	1.6	1.4	1.2	0.9	0.7	0.4	0.2	0.1	
2014	96.8	0	1.3	1.1	1.0	0.8	0.6	0.4	0.2	0.1	
2015	98.4	0	1.5	1.3	1.3	0.9	0.7	0.3	0.2	0.1	
2016	98.5	0	1.5	1.0	0.9	0.8	0.6	0.3	0.2	0.1	
2017	98.7	0	1.1	1.0	0.9	0.8	0.6	0.4	0.2	0.1	

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

Table 26 Statistical summary for CO: Daily maximum rolling 8-hour average concentrations. Station: Camden

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2012	21.0	0	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	
2013	99.0	0	1.9	0.9	0.6	0.4	0.4	0.2	0.2	0.1	
2014	98.2	0	0.6	0.4	0.4	0.4	0.3	0.2	0.2	0.1	
2015	97.6	0	0.5	0.4	0.4	0.3	0.3	0.2	0.1	0.1	
2016	94.8	0	0.5	0.4	0.3	0.3	0.2	0.2	0.1	0.1	
2017	96.0	0	0.5	0.4	0.3	0.3	0.3	0.2	0.1	0.1	

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

Table 27 Statistical summary for CO: Daily maximum rolling 8-hour average concentrations. Station: Chullora

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	92.9	0	1.6	1.3	1.2	1.0	0.8	0.5	0.3	0.2	
2009	96.1	0	2.6	2.2	1.6	1.3	1.0	0.7	0.4	0.3	
2010	98.0	0	2.3	1.8	1.5	1.2	0.9	0.7	0.5	0.4	
2011	98.3	0	1.5	1.4	1.3	1.2	1.0	0.6	0.4	0.3	
2012	97.7	0	2.0	1.6	1.2	1.1	0.9	0.6	0.5	0.4	
2013	97.3	0	2.5	1.7	1.2	1.1	0.9	0.6	0.4	0.3	
2014	97.9	0	1.7	1.3	1.1	0.9	0.8	0.5	0.4	0.3	
2015	97.4	0	1.4	1.3	1.2	1.0	0.8	0.5	0.4	0.3	
2016	96.9	0	1.6	1.2	1.1	0.9	0.7	0.5	0.3	0.3	
2017	97.2	0	1.2	1.1	1.0	0.8	0.7	0.5	0.3	0.3	

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

Table 28 Statistical summary for CO: Daily maximum rolling 8-hour average concentrations. Station: Liverpool

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	88.0	0	2.4	2.1	1.8	1.6	1.3	0.7	0.4	0.2	
2009	92.4	0	2.2	1.9	1.7	1.5	1.2	0.8	0.5	0.3	
2010	98.6	0	2.1	1.9	1.7	1.4	1.1	0.7	0.5	0.4	
2011	97.9	0	2.4	2.1	1.8	1.5	1.2	0.7	0.5	0.4	
2012	97.4	0	1.9	1.7	1.6	1.3	1.1	0.7	0.5	0.4	
2013	98.7	0	2.1	1.9	1.8	1.4	1.1	0.7	0.5	0.3	
2014	96.9	0	2.2	1.9	1.7	1.4	1.0	0.6	0.4	0.3	
2015	90.8	0	1.8	1.6	1.4	1.2	0.9	0.6	0.4	0.3	
2016	95.5	0	1.9	1.6	1.4	1.3	1.0	0.6	0.4	0.3	
2017	99.1	0	1.8	1.6	1.5	1.1	0.9	0.6	0.4	0.3	

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

Table 29 Statistical summary for CO: Daily maximum rolling 8-hour average concentrations. Station: Macarthur/Campbelltown West*

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	97.3	0	0.9	0.6	0.6	0.5	0.4	0.3	0.2	0.1	
2009	95.1	0	0.8	0.8	0.7	0.6	0.6	0.4	0.4	0.2	
2010	96.1	0	0.9	0.8	0.8	0.6	0.5	0.4	0.4	0.3	
2011	95.3	0	1.1	0.8	0.7	0.6	0.5	0.4	0.3	0.3	
2012	94.0	0	0.6	0.6	0.5	0.5	0.3	0.1	0.0	0.0	
2013	98.6	0	3.0	0.8	0.7	0.5	0.5	0.3	0.1	0.0	
2014	97.9	0	0.9	0.9	0.8	0.7	0.6	0.4	0.3	0.3	
2015	96.2	0	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	
2016	98.7	0	1.2	0.9	0.8	0.7	0.6	0.5	0.4	0.3	
2017	97.0	0	0.8	0.7	0.7	0.6	0.6	0.4	0.3	0.3	

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

* Replaced the Macarthur trend station from September 2012

Table 30 Statistical summary for CO: Daily maximum rolling 8-hour average concentrations. Station: Rozelle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	94.4	0	1.5	1.3	1.2	1.1	0.9	0.5	0.3	0.2	
2009	95.6	0	2.3	1.5	1.4	1.2	1.0	0.7	0.5	0.4	
2010	93.6	0	1.8	1.5	1.4	1.1	0.9	0.7	0.5	0.4	
2011	96.6	0	1.4	1.2	1.1	0.9	0.8	0.5	0.4	0.3	
2012	96.9	0	2.2	1.3	1.2	1.0	0.8	0.6	0.5	0.4	
2013	93.8	0	1.8	1.2	1.1	0.9	0.7	0.5	0.3	0.2	
2014	99.0	0	1.1	1.0	0.9	0.8	0.6	0.4	0.3	0.2	
2015	94.9	0	1.1	1.1	1.0	0.8	0.7	0.5	0.3	0.2	
2016	97.8	0	1.2	1.1	1.0	0.8	0.6	0.4	0.3	0.2	
2017	92.0	0	0.9	0.7	0.6	0.6	0.5	0.3	0.2	0.1	

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

Table 31 Statistical summary for CO: Daily maximum rolling 8-hour average concentrations. Station: Wyong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2012	20.1	0	0.4	0.4	0.4	0.3	0.2	0.2	0.1	0.1	
2013	98.7	0	0.8	0.4	0.3	0.3	0.3	0.2	0.1	0.1	
2014	97.8	0	0.5	0.4	0.4	0.3	0.3	0.2	0.1	0.1	
2015	98.5	0	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.1	
2016	98.2	0	0.6	0.4	0.4	0.3	0.3	0.2	0.2	0.1	
2017	98.3	0	0.6	0.4	0.3	0.3	0.2	0.2	0.1	0.1	

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

Table 32 Statistical summary for CO: Daily maximum rolling 8-hour average concentrations. Station: Wollongong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	94.0	0	1.3	0.9	0.9	0.8	0.7	0.5	0.3	0.2	
2009	82.1	0	1.3	1.1	1.1	1.0	0.8	0.5	0.4	0.2	
2010	98.4	0	1.5	1.2	1.1	0.9	0.8	0.6	0.5	0.4	
2011	97.2	0	1.2	1.1	1.0	0.9	0.7	0.6	0.4	0.3	
2012	96.5	0	1.2	1.1	1.0	0.8	0.7	0.5	0.4	0.3	
2013	97.3	0	2.7	0.8	0.8	0.7	0.5	0.4	0.3	0.2	
2014	98.4	0	0.9	0.8	0.8	0.7	0.6	0.4	0.3	0.2	
2015	97.9	0	0.8	0.7	0.7	0.6	0.5	0.4	0.3	0.2	
2016	98.8	0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	
2017	97.6	0	0.7	0.7	0.7	0.6	0.5	0.4	0.3	0.2	

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

Table 33 Statistical summary for CO: Daily maximum rolling 8-hour average concentrations. Station: Newcastle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	96.1	0	2.0	1.5	1.4	1.2	1.0	0.6	0.4	0.3	
2009	84.3	0	1.9	1.6	1.4	1.1	0.9	0.6	0.4	0.3	
2010	87.5	0	1.4	1.2	1.1	0.9	0.6	0.4	0.3	0.2	
2011	98.8	0	1.5	1.2	1.0	0.7	0.5	0.3	0.1	0.1	
2012	94.3	0	1.3	1.3	1.1	0.8	0.6	0.3	0.1	0.0	
2013	98.3	0	1.4	1.0	1.0	0.8	0.5	0.3	0.1	0.1	
2014	89.4	0	2.4	1.6	1.1	0.9	0.7	0.4	0.3	0.1	
2015	92.0	0	1.5	1.3	1.2	1.0	0.9	0.6	0.5	0.3	
2016	97.4	0	1.4	1.1	0.9	0.8	0.7	0.4	0.2	0.1	
2017	96.2	0	1.1	0.9	0.9	0.8	0.6	0.4	0.3	0.2	

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

Nitrogen dioxide

Statistical summary for 2017

Table 34 Statistical summary for NO₂: Daily maximum 1-hour average concentrations

Region/ monitoring station	Data availability rate (%)	Maximum (ppm)		Percentile (ppm)						
		99 th	98 th	95 th	90 th	75 th	50 th	25 th		
Sydney										
Bringelly	91.4	0.036	0.027	0.024	0.021	0.017	0.015	0.010	0.008	
Camden	94.2	0.044	0.027	0.022	0.019	0.017	0.013	0.011	0.007	
Campbelltown West	93.5	0.061	0.046	0.045	0.040	0.036	0.030	0.024	0.017	
Chullora	93.3	0.060	0.049	0.046	0.040	0.036	0.031	0.025	0.019	
Liverpool	94.7	0.064	0.046	0.045	0.040	0.036	0.031	0.025	0.019	
Prospect	94.2	0.060	0.045	0.041	0.037	0.034	0.029	0.023	0.016	
Richmond	91.3	0.026	0.023	0.023	0.020	0.018	0.015	0.011	0.008	
Rozelle	93.3	0.061	0.057	0.047	0.038	0.034	0.030	0.023	0.017	
Central Coast										
Wyong	94.3	0.051	0.027	0.026	0.024	0.022	0.018	0.014	0.010	
Illawarra										
Albion Park South	93.0	0.038	0.031	0.027	0.023	0.020	0.014	0.009	0.005	
Wollongong	93.8	0.057	0.039	0.037	0.033	0.029	0.025	0.017	0.011	
Lower Hunter										
Newcastle	94.3	0.037	0.037	0.034	0.032	0.030	0.025	0.018	0.010	
Wallsend	94.5	0.037	0.032	0.031	0.029	0.027	0.022	0.016	0.012	

AAQ NEPM standard: 0.120 ppm (1-hour average)

Trend analysis

Table 35 Annual maximum 1-hour average concentrations for NO₂ (ppm)

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Bringelly	0.033	0.034	0.037	0.029	0.038	0.037	0.025	0.027	0.030	0.036
Camden	--	--	--	--	0.022	0.036	0.032	0.026	0.029	0.044
Chullora	0.044	0.052	0.057	0.051	0.059	0.055	0.064	0.054	0.046	0.060
Liverpool	0.046	0.053	0.053	0.046	0.046	0.056	0.044	0.060	0.047	0.064
Prospect	0.048	0.051	0.043	0.039	0.050	0.049	0.047	0.053	0.053	0.060
Macarthur/ Campbelltown West*	0.044	0.048	0.042	0.045	0.049	0.054	0.055	0.062	0.054	0.061
Richmond	0.027	0.030	0.033	0.029	0.046	0.032	0.028	0.024	0.030	0.026
Rozelle	0.040	0.049	0.049	0.050	0.062	0.070	0.055	0.060	0.050	0.061
Central Coast										
Wyong	--	--	--	--	0.029	0.041	0.034	0.032	0.046	0.051
Illawarra										
Albion Park South	0.029	0.052	0.041	0.040	0.037	0.039	0.038	0.047	0.043	0.038
Wollongong	0.046	0.048	0.052	0.043	0.049	0.050	0.038	0.060	0.043	0.057
Lower Hunter										
Newcastle	0.033	0.043	0.038	0.038	0.038	0.042	0.046	0.044	0.038	0.037
Wallsend	0.031	0.040	0.038	0.037	0.034	0.043	0.034	0.042	0.037	0.037

* Replaced the Macarthur trend station from September 2012
AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 36 Annual average concentrations for NO₂ (ppm)

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Bringelly	0.005	0.004	0.005	0.005	0.005	0.005	0.004	0.004	0.005	0.005
Camden	--	--	--	--	0.005	0.004	0.004	0.004	0.004	0.005
Chullora	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.012
Liverpool	0.011	0.010	0.011	0.010	0.009	0.011	0.010	0.010	0.012	0.012
Prospect	0.010	0.011	0.012	0.010	0.010	0.011	0.010	0.011	0.010	0.010
Macarthur/ Campbelltown West*	0.010	0.009	0.009	0.008	0.008	0.010	0.010	0.010	0.010	0.011
Richmond	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.005
Rozelle	0.011	0.011	0.011	0.011	0.012	0.011	0.011	0.011	0.011	0.011
Central Coast										
Wyong	--	--	--	--	0.004	0.005	0.005	0.005	0.005	0.005
Illawarra										
Albion Park South	0.004	0.003	0.003	0.002	0.004	0.004	0.004	0.003	0.004	0.004
Wollongong	0.009	0.010	0.009	0.008	0.009	0.008	0.008	0.008	0.006	0.006
Lower Hunter										
Newcastle	0.007	0.008	0.008	0.007	0.008	0.008	0.007	0.007	0.008	0.007
Wallsend	0.007	0.008	0.009	0.008	0.008	0.008	0.008	0.008	0.007	0.008

* Replaced the Macarthur trend station from September 2012
AAQ NEPM standard: 0.03 ppm (Annual average)

Statistical summaries for multiple years, by station

Table 37 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Prospect

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	59.5	0	0.048	0.037	0.036	0.034	0.031	0.026	0.019	0.015	
2009	84.6	0	0.051	0.040	0.039	0.035	0.032	0.027	0.022	0.017	
2010	82.0	0	0.043	0.039	0.038	0.033	0.031	0.027	0.023	0.017	
2011	94.6	0	0.039	0.038	0.035	0.032	0.029	0.025	0.020	0.015	
2012	92.7	0	0.050	0.043	0.037	0.034	0.030	0.026	0.021	0.015	
2013	88.8	0	0.049	0.044	0.041	0.037	0.033	0.029	0.022	0.014	
2014	92.2	0	0.047	0.045	0.040	0.034	0.032	0.027	0.022	0.017	
2015	93.8	0	0.053	0.043	0.039	0.036	0.034	0.028	0.022	0.016	
2016	94.3	0	0.053	0.046	0.042	0.037	0.033	0.028	0.021	0.015	
2017	94.2	0	0.060	0.045	0.041	0.037	0.034	0.029	0.023	0.016	

AAQ NEPM standard: 0.12 ppm (1-hour average); *Blacktown station closed pending relocation to Prospect.

Table 38 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Bringelly

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	86.3	0	0.033	0.027	0.024	0.020	0.018	0.014	0.011	0.007	
2009	77.9	0	0.034	0.027	0.025	0.022	0.018	0.013	0.010	0.006	
2010	87.4	0	0.037	0.029	0.027	0.022	0.019	0.015	0.011	0.009	
2011	87.4	0	0.029	0.024	0.023	0.019	0.017	0.013	0.010	0.007	
2012	89.7	0	0.038	0.027	0.025	0.022	0.018	0.015	0.011	0.007	
2013	92.9	0	0.037	0.025	0.022	0.019	0.016	0.013	0.010	0.007	
2014	91.2	0	0.025	0.025	0.023	0.020	0.016	0.013	0.009	0.007	
2015	92.8	0	0.027	0.023	0.021	0.017	0.015	0.012	0.009	0.006	
2016	94.3	0	0.030	0.025	0.023	0.020	0.019	0.014	0.010	0.007	
2017	91.4	0	0.036	0.027	0.024	0.021	0.017	0.015	0.010	0.008	

AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 39 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Camden

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2012	20.0	0	0.022	0.022	0.022	0.020	0.017	0.012	0.009	0.007	
2013	94.1	0	0.036	0.024	0.020	0.018	0.015	0.013	0.010	0.007	
2014	92.8	0	0.032	0.024	0.022	0.018	0.016	0.013	0.010	0.007	
2015	92.6	0	0.026	0.021	0.021	0.018	0.016	0.012	0.009	0.006	
2016	91.9	0	0.029	0.025	0.023	0.019	0.016	0.013	0.010	0.006	
2017	94.2	0	0.044	0.027	0.022	0.019	0.017	0.013	0.011	0.007	

AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 40 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Chullora

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	88.9	0	0.044	0.041	0.040	0.037	0.034	0.029	0.024	0.018
2009	90.5	0	0.052	0.044	0.041	0.036	0.033	0.028	0.023	0.018
2010	86.5	0	0.057	0.042	0.040	0.036	0.032	0.028	0.023	0.017
2011	93.2	0	0.051	0.046	0.043	0.037	0.034	0.029	0.024	0.018
2012	93.6	0	0.059	0.049	0.047	0.041	0.037	0.030	0.024	0.019
2013	92.2	0	0.055	0.051	0.047	0.043	0.038	0.031	0.026	0.019
2014	92.9	0	0.064	0.050	0.044	0.040	0.036	0.030	0.025	0.019
2015	94.0	0	0.054	0.051	0.042	0.037	0.034	0.029	0.024	0.018
2016	94.6	0	0.046	0.046	0.045	0.040	0.037	0.030	0.024	0.018
2017	93.3	0	0.060	0.049	0.046	0.040	0.036	0.031	0.025	0.019

AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 41 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Liverpool

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	84.7	0	0.046	0.040	0.037	0.033	0.030	0.027	0.021	0.016
2009	85.3	0	0.053	0.044	0.042	0.034	0.030	0.025	0.020	0.015
2010	92.0	0	0.053	0.044	0.041	0.035	0.030	0.026	0.022	0.017
2011	92.0	0	0.046	0.039	0.038	0.032	0.030	0.025	0.020	0.015
2012	90.1	0	0.046	0.039	0.036	0.032	0.030	0.025	0.020	0.014
2013	92.2	0	0.056	0.047	0.040	0.037	0.034	0.028	0.024	0.017
2014	91.0	0	0.044	0.041	0.038	0.034	0.031	0.027	0.022	0.017
2015	90.4	0	0.060	0.046	0.038	0.034	0.031	0.026	0.021	0.015
2016	94.4	0	0.047	0.045	0.044	0.038	0.035	0.029	0.023	0.017
2017	94.7	0	0.064	0.046	0.045	0.040	0.036	0.031	0.025	0.019

AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 42 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Macarthur/Campbelltown West*

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	89.0	0	0.044	0.041	0.039	0.035	0.032	0.026	0.021	0.016
2009	91.0	0	0.048	0.044	0.040	0.035	0.031	0.025	0.020	0.016
2010	90.4	0	0.042	0.039	0.036	0.032	0.029	0.025	0.020	0.015
2011	92.9	0	0.045	0.039	0.037	0.033	0.029	0.024	0.019	0.014
2012	52.2	0	0.049	0.048	0.043	0.041	0.038	0.029	0.024	0.019
2013	94.9	0	0.054	0.043	0.042	0.038	0.035	0.029	0.023	0.017
2014	93.8	0	0.055	0.044	0.041	0.038	0.032	0.027	0.022	0.017
2015	91.8	0	0.062	0.048	0.043	0.036	0.033	0.027	0.021	0.016
2016	93.3	0	0.054	0.049	0.043	0.038	0.035	0.029	0.022	0.016
2017	93.5	0	0.061	0.046	0.045	0.040	0.036	0.030	0.024	0.017

* Replaced the Macarthur trend station from September 2012
AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 43 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Richmond

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	86.9	0	0.027	0.024	0.023	0.021	0.019	0.015	0.011	0.008	
2009	91.4	0	0.030	0.027	0.026	0.023	0.020	0.016	0.012	0.009	
2010	87.9	0	0.033	0.025	0.024	0.021	0.020	0.015	0.012	0.008	
2011	94.4	0	0.029	0.026	0.024	0.021	0.019	0.015	0.011	0.008	
2012	93.1	0	0.046	0.042	0.028	0.021	0.019	0.015	0.011	0.007	
2013	92.5	0	0.032	0.024	0.023	0.021	0.018	0.015	0.011	0.007	
2014	93.3	0	0.028	0.022	0.021	0.020	0.017	0.013	0.009	0.007	
2015	90.8	0	0.024	0.022	0.021	0.019	0.017	0.012	0.009	0.007	
2016	93.9	0	0.030	0.024	0.023	0.020	0.018	0.014	0.010	0.007	
2017	91.3	0	0.026	0.023	0.023	0.020	0.018	0.015	0.011	0.008	

AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 44 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Rozelle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	79.1	0	0.040	0.037	0.036	0.033	0.031	0.027	0.022	0.015	
2009	86.1	0	0.049	0.039	0.036	0.033	0.031	0.026	0.021	0.015	
2010	79.6	0	0.049	0.039	0.037	0.034	0.031	0.028	0.022	0.015	
2011	90.9	0	0.050	0.043	0.041	0.035	0.031	0.028	0.022	0.014	
2012	92.1	0	0.062	0.049	0.046	0.038	0.034	0.028	0.022	0.017	
2013	91.5	0	0.070	0.048	0.045	0.038	0.035	0.029	0.023	0.016	
2014	93.9	0	0.055	0.042	0.037	0.033	0.032	0.027	0.022	0.016	
2015	91.3	0	0.060	0.045	0.038	0.034	0.031	0.027	0.021	0.014	
2016	93.8	0	0.050	0.044	0.039	0.036	0.033	0.029	0.022	0.015	
2017	93.3	0	0.061	0.057	0.047	0.038	0.034	0.030	0.023	0.017	

AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 45 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Wyong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2012	18.9	0	0.029	0.028	0.025	0.023	0.018	0.015	0.012	0.009	
2013	94.7	0	0.041	0.037	0.029	0.026	0.024	0.019	0.014	0.010	
2014	94.3	0	0.034	0.032	0.029	0.025	0.023	0.019	0.013	0.010	
2015	93.8	0	0.032	0.027	0.026	0.024	0.022	0.018	0.013	0.009	
2016	93.4	0	0.046	0.032	0.029	0.024	0.021	0.017	0.013	0.009	
2017	94.3	0	0.051	0.027	0.026	0.024	0.022	0.018	0.014	0.010	

AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 46 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Albion Park South

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	55.9	0	0.029	0.026	0.025	0.021	0.018	0.014	0.009	0.004	
2009	91.3	0	0.052	0.038	0.033	0.024	0.022	0.014	0.009	0.004	
2010	87.5	0	0.041	0.030	0.027	0.023	0.019	0.013	0.008	0.004	
2011	89.1	0	0.040	0.030	0.027	0.021	0.016	0.012	0.007	0.003	
2012	86.1	0	0.037	0.034	0.028	0.023	0.020	0.014	0.008	0.004	
2013	92.4	0	0.039	0.036	0.030	0.025	0.019	0.013	0.010	0.006	
2014	95.1	0	0.038	0.028	0.026	0.021	0.018	0.013	0.009	0.006	
2015	91.6	0	0.047	0.032	0.026	0.022	0.016	0.012	0.008	0.004	
2016	91.5	0	0.043	0.035	0.031	0.024	0.018	0.014	0.008	0.004	
2017	93.0	0	0.038	0.031	0.027	0.023	0.020	0.014	0.009	0.005	

AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 47 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Wollongong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	83.1	0	0.046	0.037	0.036	0.033	0.030	0.026	0.020	0.014	
2009	70.1	0	0.048	0.044	0.037	0.034	0.030	0.025	0.019	0.013	
2010	87.1	0	0.052	0.042	0.037	0.033	0.028	0.024	0.020	0.015	
2011	90.8	0	0.043	0.039	0.037	0.031	0.029	0.024	0.019	0.013	
2012	90.5	0	0.049	0.040	0.039	0.034	0.030	0.025	0.018	0.013	
2013	89.2	0	0.050	0.048	0.043	0.035	0.031	0.026	0.020	0.014	
2014	92.6	0	0.038	0.037	0.036	0.032	0.029	0.024	0.018	0.014	
2015	92.7	0	0.060	0.036	0.035	0.032	0.029	0.024	0.018	0.013	
2016	93.9	0	0.043	0.040	0.037	0.033	0.030	0.024	0.017	0.011	
2017	93.8	0	0.057	0.039	0.037	0.033	0.029	0.025	0.017	0.011	

AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 48 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Newcastle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	82.8	0	0.033	0.030	0.029	0.027	0.026	0.021	0.016	0.010	
2009	89.5	0	0.043	0.037	0.032	0.029	0.027	0.022	0.016	0.010	
2010	85.9	0	0.038	0.032	0.031	0.029	0.028	0.023	0.017	0.011	
2011	90.7	0	0.038	0.034	0.033	0.029	0.027	0.023	0.017	0.010	
2012	92.6	0	0.038	0.035	0.033	0.031	0.029	0.025	0.018	0.011	
2013	95.0	0	0.042	0.039	0.036	0.033	0.029	0.025	0.019	0.011	
2014	93.4	0	0.046	0.037	0.035	0.031	0.028	0.023	0.017	0.010	
2015	93.8	0	0.044	0.034	0.033	0.030	0.027	0.023	0.018	0.010	
2016	90.9	0	0.038	0.036	0.034	0.032	0.029	0.025	0.018	0.011	
2017	94.3	0	0.037	0.037	0.034	0.032	0.030	0.025	0.018	0.010	

AAQ NEPM standard: 0.12 ppm (1-hour average)

Table 49 Statistical summary for NO₂: Annual daily maximum 1-hour average concentrations. Station: Wallsend

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	87.1	0	0.031	0.029	0.028	0.026	0.023	0.020	0.015	0.010
2009	83.8	0	0.040	0.033	0.031	0.027	0.025	0.021	0.016	0.011
2010	86.1	0	0.038	0.033	0.032	0.028	0.026	0.022	0.017	0.012
2011	90.7	0	0.037	0.032	0.029	0.027	0.026	0.021	0.016	0.011
2012	94.1	0	0.034	0.030	0.029	0.027	0.025	0.021	0.016	0.012
2013	91.8	0	0.043	0.033	0.030	0.027	0.024	0.021	0.016	0.012
2014	94.6	0	0.034	0.033	0.030	0.027	0.025	0.021	0.015	0.012
2015	93.4	0	0.042	0.033	0.031	0.027	0.025	0.020	0.016	0.012
2016	93.4	0	0.037	0.033	0.029	0.027	0.024	0.020	0.015	0.011
2017	94.5	0	0.037	0.032	0.031	0.029	0.027	0.022	0.016	0.012

AAQ NEPM standard: 0.12 ppm (1-hour average)

Ozone

Statistical summary for 2017

Table 50 Statistical summary for O₃: Daily maximum 1-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Maximum (ppm)	Percentile (ppm)						
			99 th	98 th	95 th	90 th	75 th	50 th	25 th
Sydney									
Bringelly	92.0	0.098	0.088	0.081	0.071	0.054	0.041	0.032	0.027
Camden	93.8	0.122	0.085	0.080	0.068	0.054	0.042	0.032	0.028
Campbelltown West	93.5	0.094	0.090	0.081	0.066	0.053	0.039	0.031	0.026
Chullora	93.7	0.114	0.085	0.072	0.055	0.048	0.035	0.030	0.025
Liverpool	94.5	0.135	0.085	0.076	0.062	0.051	0.037	0.030	0.025
Oakdale	95.2	0.095	0.093	0.080	0.065	0.055	0.043	0.033	0.028
Prospect	94.6	0.123	0.078	0.075	0.061	0.050	0.038	0.030	0.025
Richmond	92.9	0.093	0.089	0.081	0.060	0.053	0.041	0.034	0.029
Rozelle	93.3	0.114	0.076	0.057	0.045	0.040	0.032	0.027	0.021
St Marys	94.2	0.110	0.092	0.081	0.067	0.056	0.043	0.034	0.029
Central Coast									
Wyong	94.2	0.121	0.074	0.067	0.053	0.046	0.037	0.031	0.027
Illawarra									
Albion Park South	94.1	0.117	0.086	0.074	0.047	0.040	0.034	0.031	0.027
Kembla Grange	94.6	0.122	0.087	0.073	0.051	0.043	0.034	0.031	0.027
Wollongong	92.1	0.107	0.084	0.070	0.051	0.044	0.035	0.031	0.027
Lower Hunter									
Newcastle	94.0	0.086	0.067	0.057	0.049	0.042	0.034	0.030	0.026
Wallsend	94.9	0.106	0.073	0.066	0.058	0.047	0.036	0.031	0.026

Bold font indicates values that exceed the AAQ NEPM standard.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 51 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Maximum m (ppm)	Percentile (ppm)						
			99 th	98 th	95 th	90 th	75 th	50 th	25 th
Sydney									
Bringelly	95.6	0.089	0.077	0.070	0.063	0.050	0.038	0.031	0.026
Camden	97.6	0.108	0.076	0.072	0.058	0.048	0.038	0.031	0.027
Campbelltown West	97.1	0.091	0.078	0.069	0.058	0.049	0.036	0.030	0.024
Chullora	97.7	0.110	0.079	0.064	0.050	0.044	0.033	0.028	0.024
Liverpool	98.5	0.117	0.075	0.066	0.056	0.047	0.035	0.029	0.023
Oakdale	99.3	0.080	0.076	0.070	0.057	0.051	0.040	0.032	0.027
Prospect	98.7	0.106	0.073	0.066	0.055	0.046	0.036	0.029	0.024
Richmond	96.7	0.085	0.077	0.067	0.055	0.048	0.039	0.032	0.027
Rozelle	96.8	0.109	0.069	0.054	0.040	0.036	0.030	0.025	0.019
St Marys	98.2	0.096	0.082	0.073	0.059	0.050	0.040	0.032	0.027
Central Coast									
Wyong	98.0	0.105	0.064	0.059	0.049	0.042	0.035	0.030	0.026
Illawarra									
Albion Park South	98.0	0.102	0.076	0.063	0.042	0.037	0.033	0.029	0.026
Kembla Grange	98.6	0.098	0.081	0.063	0.047	0.040	0.033	0.030	0.026
Wollongong	96.0	0.094	0.080	0.063	0.047	0.041	0.034	0.030	0.026
Lower Hunter									
Newcastle	97.8	0.073	0.058	0.051	0.044	0.039	0.033	0.028	0.024
Wallsend	99.0	0.097	0.066	0.060	0.051	0.043	0.034	0.029	0.024

Bold font indicates values that exceed the AAQ NEPM standard.
AAQ NEPM Standard: 0.08 ppm (rolling 4-hour average)

Trend analysis

Table 52 Maximum 1-hour average concentrations for O₃ (ppm)

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Bringelly	0.093	0.120	0.104	0.125	0.088	0.108	0.124	0.087	0.094	0.098
Camden	--	--	--	--	0.095	0.110	0.123	0.086	0.097	0.122
Chullora	0.080	0.154	0.083	0.114	0.080	0.105	0.079	0.093	0.090	0.114
Liverpool	0.098	0.151	0.091	0.103	0.079	0.117	0.103	0.087	0.095	0.135
Macarthur/ Campbelltown West*	0.085	0.116	0.119	0.131	0.080	0.094	0.124	0.086	0.091	0.094
Oakdale	0.093	0.128	0.099	0.126	0.089	0.095	0.110	0.084	0.083	0.095
Prospect	0.107	0.126	0.104	0.126	0.080	0.111	0.103	0.085	0.104	0.123
Richmond	0.078	0.102	0.089	0.116	0.085	0.095	0.090	0.094	0.081	0.093
Rozelle	0.056	0.083	0.073	0.093	0.069	0.073	0.067	0.099	0.089	0.114
St Marys	0.096	0.132	0.095	0.136	0.085	0.110	0.100	0.082	0.101	0.110
Central Coast										
Wyang	--	--	--	--	0.078	0.079	0.076	0.097	0.086	0.121
Illawarra										
Albion Park South	0.062	0.102	0.093	0.118	0.067	0.120	0.094	0.079	0.104	0.117
Kembla Grange	0.072	0.103	0.081	0.121	0.068	0.126	0.094	0.104	0.114	0.122
Wollongong	0.067	0.083	0.082	0.084	0.065	0.112	0.077	0.092	0.095	0.107
Lower Hunter										
Newcastle	0.064	0.073	0.086	0.066	0.071	0.081	0.065	0.074	0.077	0.086
Wallsend	0.057	0.086	0.067	0.071	0.080	0.084	0.087	0.071	0.086	0.106

* Replaced the Macarthur trend station from September 2012

Bold font indicates values that exceed the AAQ NEPM standard.

AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 53 Maximum rolling 4-hour average concentrations for O₃ (ppm)

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Bringelly	0.078	0.108	0.089	0.118	0.072	0.102	0.113	0.078	0.080	0.089
Camden	--	--	--	--	0.084	0.090	0.110	0.072	0.075	0.108
Chullora	0.074	0.112	0.072	0.096	0.068	0.094	0.073	0.078	0.077	0.110
Liverpool	0.089	0.103	0.081	0.095	0.071	0.110	0.087	0.077	0.086	0.117
Macarthur/ Campbelltown West*	0.070	0.097	0.103	0.122	0.071	0.082	0.111	0.079	0.077	0.091
Oakdale	0.075	0.108	0.088	0.098	0.081	0.081	0.088	0.070	0.067	0.080
Prospect	0.096	0.100	0.097	0.114	0.073	0.104	0.097	0.070	0.078	0.106
Richmond	0.067	0.090	0.082	0.088	0.070	0.076	0.073	0.074	0.070	0.085
Rozelle	0.048	0.073	0.067	0.080	0.054	0.063	0.060	0.079	0.075	0.109
St Marys	0.082	0.106	0.083	0.121	0.072	0.101	0.085	0.071	0.081	0.096
Central Coast										
Wyong	--	--	--	--	0.066	0.072	0.069	0.091	0.079	0.105
Illawarra										
Albion Park South	0.055	0.083	0.073	0.099	0.064	0.100	0.079	0.075	0.098	0.102
Kembla Grange	0.066	0.090	0.078	0.105	0.061	0.103	0.080	0.079	0.102	0.098
Wollongong	0.063	0.074	0.073	0.078	0.061	0.091	0.068	0.083	0.085	0.094
Lower Hunter										
Newcastle	0.058	0.067	0.076	0.063	0.057	0.075	0.056	0.066	0.069	0.073
Wallsend	0.054	0.076	0.063	0.059	0.070	0.078	0.065	0.062	0.078	0.097

* Replaced the Macarthur trend station from September 2012

Bold font indicates values that exceed the AAQ NEPM standard.

AAQ NEPM standard: 0.08 ppm (rolling 4-hour average)

Statistical summaries for multiple years, by station

Table 54 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Prospect

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	89.5	1	0.107	0.084	0.063	0.052	0.045	0.035	0.027	0.023	
2009	93.3	3	0.126	0.099	0.086	0.070	0.061	0.041	0.032	0.026	
2010	88.7	2	0.104	0.082	0.072	0.062	0.050	0.038	0.030	0.023	
2011	95.2	1	0.126	0.086	0.068	0.057	0.046	0.034	0.028	0.023	
2012	91.8	0	0.080	0.076	0.069	0.061	0.050	0.039	0.028	0.023	
2013	91.5	1	0.111	0.084	0.070	0.062	0.053	0.042	0.031	0.026	
2014	93.4	1	0.103	0.088	0.079	0.065	0.053	0.041	0.031	0.027	
2015	94.2	0	0.085	0.075	0.071	0.062	0.052	0.039	0.028	0.025	
2016	93.4	1	0.104	0.086	0.070	0.059	0.052	0.039	0.030	0.025	
2017	94.6	1	0.123	0.078	0.075	0.061	0.050	0.038	0.030	0.025	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 55 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Bringelly

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	89.8	0	0.093	0.083	0.071	0.055	0.051	0.039	0.030	0.026	
2009	90.8	4	0.120	0.102	0.089	0.072	0.062	0.041	0.030	0.026	
2010	89.2	2	0.104	0.081	0.075	0.061	0.052	0.040	0.031	0.026	
2011	88.5	2	0.125	0.087	0.080	0.065	0.055	0.038	0.030	0.026	
2012	93.0	0	0.088	0.075	0.072	0.060	0.049	0.040	0.030	0.026	
2013	94.8	1	0.108	0.085	0.081	0.062	0.053	0.040	0.031	0.026	
2014	93.4	2	0.124	0.089	0.080	0.064	0.056	0.041	0.032	0.028	
2015	93.1	0	0.087	0.078	0.072	0.065	0.055	0.040	0.029	0.026	
2016	90.7	0	0.094	0.080	0.076	0.065	0.054	0.042	0.030	0.027	
2017	92.0	0	0.098	0.088	0.081	0.071	0.054	0.041	0.032	0.027	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 56 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Camden

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2012	20.3	0	0.095	0.094	0.091	0.078	0.068	0.053	0.041	0.031	
2013	93.1	1	0.110	0.098	0.079	0.069	0.056	0.042	0.031	0.027	
2014	94.4	2	0.123	0.099	0.085	0.067	0.056	0.042	0.033	0.028	
2015	94.3	0	0.086	0.075	0.074	0.067	0.054	0.040	0.030	0.027	
2016	91.1	0	0.097	0.083	0.077	0.066	0.056	0.043	0.031	0.027	
2017	93.8	1	0.122	0.085	0.080	0.068	0.054	0.042	0.032	0.028	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 57 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Chullora

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	93.9	0	0.080	0.064	0.057	0.049	0.042	0.032	0.027	0.022	
2009	92.7	2	0.154	0.089	0.077	0.061	0.050	0.035	0.027	0.023	
2010	93.1	0	0.083	0.067	0.062	0.050	0.043	0.031	0.026	0.023	
2011	94.2	1	0.114	0.073	0.061	0.052	0.043	0.032	0.025	0.021	
2012	94.2	0	0.080	0.065	0.055	0.047	0.040	0.031	0.026	0.021	
2013	94.8	1	0.105	0.072	0.066	0.052	0.045	0.035	0.028	0.023	
2014	94.7	0	0.079	0.071	0.061	0.055	0.045	0.033	0.027	0.024	
2015	93.8	0	0.093	0.085	0.072	0.056	0.047	0.035	0.028	0.024	
2016	94.6	0	0.090	0.084	0.080	0.059	0.050	0.035	0.029	0.024	
2017	93.7	1	0.114	0.085	0.072	0.055	0.048	0.035	0.030	0.025	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 58 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Liverpool

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	87.1	0	0.098	0.074	0.065	0.057	0.046	0.035	0.028	0.023	
2009	88.9	2	0.151	0.092	0.088	0.068	0.052	0.038	0.029	0.024	
2010	94.2	0	0.091	0.078	0.069	0.057	0.047	0.035	0.028	0.023	
2011	94.1	1	0.103	0.080	0.071	0.057	0.046	0.032	0.025	0.022	
2012	92.4	0	0.079	0.068	0.065	0.054	0.047	0.035	0.028	0.022	
2013	94.2	1	0.117	0.086	0.074	0.060	0.050	0.040	0.030	0.025	
2014	93.6	1	0.103	0.084	0.073	0.062	0.052	0.038	0.030	0.026	
2015	91.5	0	0.087	0.079	0.072	0.062	0.052	0.037	0.027	0.023	
2016	93.1	0	0.095	0.078	0.075	0.064	0.055	0.038	0.028	0.024	
2017	94.5	2	0.135	0.085	0.076	0.062	0.051	0.037	0.030	0.025	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 59 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Macarthur/Campbelltown West*

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	93.6	0	0.085	0.081	0.072	0.059	0.052	0.037	0.031	0.027	
2009	92.3	7	0.116	0.108	0.102	0.078	0.062	0.043	0.032	0.028	
2010	93.9	1	0.119	0.090	0.083	0.065	0.054	0.040	0.032	0.028	
2011	93.6	2	0.131	0.096	0.084	0.067	0.054	0.037	0.030	0.026	
2012	32.5	0	0.080	0.079	0.076	0.066	0.056	0.040	0.035	0.029	
2013	93.9	0	0.094	0.085	0.076	0.061	0.049	0.037	0.029	0.025	
2014	91.8	1	0.124	0.087	0.076	0.060	0.052	0.038	0.030	0.026	
2015	92.0	0	0.086	0.077	0.073	0.062	0.053	0.037	0.028	0.025	
2016	94.0	0	0.091	0.087	0.073	0.066	0.055	0.039	0.029	0.026	
2017	93.5	0	0.094	0.090	0.081	0.066	0.053	0.039	0.031	0.026	

* Replaced the Macarthur trend station from September 2012

Bold font indicates AAQ NEPM standard and goal exceedances.

AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 60 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Oakdale

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	92.5	0	0.093	0.070	0.065	0.058	0.050	0.039	0.032	0.027	
2009	85.9	6	0.128	0.106	0.093	0.078	0.058	0.042	0.032	0.029	
2010	94.2	0	0.099	0.090	0.080	0.066	0.055	0.039	0.033	0.029	
2011	95.0	3	0.126	0.084	0.075	0.063	0.051	0.039	0.031	0.027	
2012	92.7	0	0.089	0.078	0.072	0.056	0.048	0.039	0.030	0.027	
2013	94.0	0	0.095	0.085	0.078	0.063	0.055	0.041	0.032	0.027	
2014	94.5	1	0.110	0.090	0.079	0.066	0.054	0.042	0.032	0.028	
2015	93.7	0	0.084	0.079	0.072	0.060	0.053	0.040	0.030	0.026	
2016	93.3	0	0.083	0.074	0.072	0.061	0.054	0.041	0.031	0.028	
2017	95.2	0	0.095	0.093	0.080	0.065	0.055	0.043	0.033	0.028	

Bold font indicates AAQ NEPM standard and goal exceedances.

AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 61 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Richmond

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	90.6	0	0.078	0.066	0.061	0.053	0.045	0.036	0.030	0.026
2009	90.1	1	0.102	0.086	0.078	0.066	0.058	0.043	0.034	0.029
2010	93.2	0	0.089	0.078	0.071	0.060	0.052	0.040	0.032	0.028
2011	94.3	1	0.116	0.077	0.067	0.058	0.048	0.037	0.031	0.026
2012	92.9	0	0.085	0.070	0.065	0.056	0.047	0.039	0.031	0.026
2013	94.3	0	0.095	0.071	0.070	0.061	0.054	0.043	0.034	0.027
2014	94.3	0	0.090	0.085	0.074	0.062	0.054	0.042	0.033	0.029
2015	93.2	0	0.094	0.083	0.066	0.056	0.050	0.040	0.030	0.027
2016	94.4	0	0.081	0.069	0.066	0.06	0.052	0.042	0.033	0.028
2017	92.9	0	0.093	0.089	0.081	0.060	0.053	0.041	0.034	0.029

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 62 Statistical summary for O₃: Annual daily maximum 1-hour average concentration. Station: Rozelle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	92.8	0	0.056	0.050	0.046	0.042	0.038	0.030	0.026	0.022
2009	92.6	0	0.083	0.068	0.060	0.050	0.042	0.032	0.028	0.023
2010	89.1	0	0.073	0.057	0.055	0.047	0.040	0.033	0.029	0.025
2011	93.3	0	0.093	0.066	0.053	0.044	0.038	0.031	0.026	0.023
2012	94.8	0	0.069	0.057	0.052	0.045	0.042	0.034	0.029	0.024
2013	92.4	0	0.073	0.063	0.054	0.046	0.041	0.033	0.029	0.025
2014	94.8	0	0.067	0.065	0.055	0.046	0.040	0.033	0.028	0.025
2015	92.9	0	0.099	0.068	0.057	0.051	0.040	0.031	0.027	0.023
2016	94.6	0	0.089	0.078	0.063	0.049	0.040	0.032	0.027	0.023
2017	93.3	1	0.114	0.076	0.057	0.045	0.040	0.032	0.027	0.021

AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 63 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: St Marys

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	92.7	0	0.096	0.076	0.060	0.053	0.048	0.038	0.031	0.026	
2009	93.0	5	0.132	0.102	0.082	0.073	0.062	0.041	0.032	0.028	
2010	93.5	0	0.095	0.083	0.073	0.064	0.053	0.040	0.032	0.027	
2011	94.8	3	0.136	0.094	0.074	0.060	0.051	0.037	0.030	0.026	
2012	93.3	0	0.085	0.074	0.069	0.058	0.049	0.038	0.030	0.025	
2013	93.7	1	0.110	0.076	0.073	0.063	0.054	0.043	0.032	0.027	
2014	94.2	0	0.100	0.089	0.078	0.066	0.055	0.043	0.033	0.029	
2015	93.0	0	0.082	0.078	0.073	0.061	0.055	0.041	0.030	0.026	
2016	93.8	1	0.101	0.085	0.074	0.065	0.055	0.042	0.033	0.028	
2017	94.2	1	0.110	0.092	0.081	0.067	0.056	0.043	0.034	0.029	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.100 ppm (1-hour average)

Table 64 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Wyong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2012	19.3	0	0.078	0.077	0.071	0.060	0.056	0.041	0.032	0.028	
2013	92.2	0	0.079	0.070	0.061	0.053	0.044	0.037	0.030	0.026	
2014	94.2	0	0.076	0.062	0.060	0.049	0.043	0.036	0.030	0.026	
2015	92.0	0	0.097	0.068	0.060	0.051	0.042	0.034	0.029	0.025	
2016	93.9	0	0.086	0.079	0.061	0.053	0.046	0.035	0.029	0.026	
2017	94.2	1	0.121	0.074	0.067	0.053	0.046	0.037	0.031	0.027	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 65 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Albion Park South

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	90.5	0	0.062	0.058	0.056	0.047	0.040	0.034	0.030	0.025	
2009	93.2	1	0.102	0.075	0.070	0.053	0.044	0.037	0.034	0.030	
2010	90.3	0	0.093	0.061	0.059	0.049	0.041	0.031	0.028	0.026	
2011	89.6	1	0.118	0.071	0.059	0.046	0.038	0.032	0.028	0.024	
2012	93.8	0	0.067	0.058	0.051	0.044	0.041	0.032	0.029	0.025	
2013	93.2	3	0.120	0.094	0.064	0.053	0.044	0.035	0.031	0.027	
2014	93.2	0	0.094	0.064	0.058	0.050	0.042	0.035	0.031	0.029	
2015	91.8	0	0.079	0.065	0.060	0.048	0.041	0.033	0.029	0.026	
2016	94.6	1	0.104	0.075	0.067	0.051	0.043	0.033	0.030	0.027	
2017	94.1	2	0.117	0.086	0.074	0.047	0.040	0.034	0.031	0.027	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 66 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Kembla Grange

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	93.6	0	0.072	0.063	0.055	0.048	0.042	0.032	0.029	0.025
2009	87.5	1	0.103	0.083	0.070	0.052	0.044	0.035	0.031	0.027
2010	89.7	0	0.081	0.061	0.056	0.049	0.043	0.033	0.029	0.025
2011	94.4	1	0.121	0.073	0.063	0.052	0.042	0.034	0.030	0.026
2012	94.3	0	0.068	0.057	0.052	0.045	0.041	0.032	0.029	0.025
2013	93.8	2	0.126	0.081	0.063	0.048	0.043	0.034	0.030	0.025
2014	94.4	0	0.094	0.064	0.062	0.051	0.042	0.034	0.030	0.027
2015	94.7	1	0.104	0.073	0.065	0.051	0.040	0.032	0.028	0.025
2016	92.9	1	0.114	0.071	0.065	0.052	0.042	0.033	0.029	0.026
2017	94.6	2	0.122	0.087	0.073	0.051	0.043	0.034	0.031	0.027

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 67 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Wollongong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	94.0	0	0.067	0.062	0.056	0.048	0.043	0.033	0.029	0.025
2009	90.7	0	0.083	0.074	0.056	0.046	0.041	0.034	0.030	0.026
2010	91.8	0	0.082	0.067	0.062	0.052	0.043	0.034	0.029	0.025
2011	93.1	0	0.084	0.069	0.055	0.048	0.040	0.034	0.028	0.024
2012	94.9	0	0.065	0.062	0.054	0.047	0.039	0.031	0.027	0.024
2013	92.7	2	0.112	0.085	0.066	0.052	0.043	0.034	0.029	0.024
2014	94.3	0	0.077	0.061	0.055	0.048	0.041	0.033	0.029	0.026
2015	94.8	0	0.092	0.075	0.070	0.050	0.042	0.033	0.028	0.024
2016	94.6	0	0.095	0.083	0.069	0.051	0.043	0.035	0.030	0.027
2017	92.1	2	0.107	0.084	0.070	0.051	0.044	0.035	0.031	0.027

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 68 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Newcastle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	89.9	0	0.064	0.054	0.049	0.044	0.039	0.034	0.028	0.024
2009	86.3	0	0.073	0.068	0.062	0.050	0.043	0.037	0.032	0.027
2010	89.1	0	0.086	0.069	0.060	0.049	0.041	0.036	0.031	0.027
2011	90.7	0	0.066	0.057	0.053	0.047	0.041	0.035	0.029	0.024
2012	94.3	0	0.071	0.057	0.052	0.046	0.041	0.033	0.028	0.024
2013	93.9	0	0.081	0.059	0.057	0.048	0.042	0.035	0.028	0.024
2014	93.7	0	0.065	0.060	0.054	0.046	0.040	0.034	0.030	0.026
2015	94.0	0	0.074	0.061	0.055	0.048	0.043	0.033	0.028	0.024
2016	93.5	0	0.077	0.064	0.058	0.050	0.041	0.034	0.029	0.025
2017	94.0	0	0.086	0.067	0.057	0.049	0.042	0.034	0.030	0.026

AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 69 Statistical summary for O₃: Annual daily maximum 1-hour average concentrations. Station: Wallsend

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	91.9	0	0.057	0.054	0.052	0.044	0.040	0.033	0.028	0.023
2009	85.7	0	0.086	0.068	0.063	0.054	0.044	0.036	0.030	0.024
2010	88.3	0	0.067	0.065	0.056	0.047	0.040	0.034	0.029	0.024
2011	94.0	0	0.071	0.056	0.055	0.049	0.040	0.033	0.027	0.022
2012	94.7	0	0.080	0.064	0.055	0.050	0.043	0.034	0.028	0.023
2013	92.2	0	0.084	0.071	0.065	0.055	0.046	0.038	0.030	0.025
2014	94.7	0	0.087	0.064	0.057	0.050	0.044	0.036	0.030	0.026
2015	94.2	0	0.071	0.065	0.061	0.050	0.044	0.034	0.027	0.024
2016	94.4	0	0.086	0.073	0.066	0.056	0.046	0.036	0.029	0.024
2017	94.9	1	0.106	0.073	0.066	0.058	0.047	0.036	0.031	0.026

AAQ NEPM standard: 0.10 ppm (1-hour average)

Table 70 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Prospect

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	93.1	1	0.096	0.069	0.058	0.047	0.042	0.033	0.026	0.022
2009	95.7	6	0.100	0.087	0.074	0.063	0.053	0.039	0.030	0.024
2010	85.9	2	0.097	0.072	0.068	0.056	0.046	0.035	0.028	0.022
2011	99.3	3	0.114	0.077	0.061	0.051	0.043	0.032	0.026	0.022
2012	95.6	0	0.073	0.064	0.061	0.053	0.045	0.036	0.027	0.022
2013	95.2	1	0.104	0.072	0.064	0.056	0.048	0.038	0.030	0.024
2014	97.3	1	0.097	0.076	0.068	0.056	0.049	0.038	0.029	0.025
2015	98.2	0	0.070	0.063	0.061	0.056	0.048	0.036	0.027	0.023
2016	97.2	0	0.078	0.067	0.062	0.054	0.048	0.036	0.029	0.024
2017	98.7	2	0.106	0.073	0.066	0.055	0.046	0.036	0.029	0.024

*Blacktown station closed pending relocation to Prospect

Bold font indicates AAQ NEPM standard and goal exceedances.

AAQ NEPM standard: 0.08 ppm (1-hour average)

Table 71 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Bringelly

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	93.6	0	0.078	0.071	0.061	0.050	0.046	0.036	0.029	0.025
2009	92.5	5	0.108	0.085	0.078	0.063	0.054	0.039	0.029	0.025
2010	85.2	3	0.089	0.072	0.066	0.055	0.047	0.037	0.030	0.025
2011	88.5	2	0.118	0.076	0.070	0.056	0.048	0.035	0.029	0.025
2012	97.0	0	0.072	0.066	0.062	0.054	0.046	0.037	0.029	0.025
2013	98.9	1	0.102	0.074	0.068	0.054	0.047	0.037	0.030	0.025
2014	97.2	3	0.113	0.078	0.070	0.056	0.049	0.038	0.031	0.026
2015	97.0	0	0.078	0.065	0.062	0.057	0.050	0.037	0.029	0.025
2016	94.5	0	0.080	0.066	0.064	0.055	0.049	0.038	0.029	0.026
2017	95.6	1	0.089	0.077	0.070	0.063	0.050	0.038	0.031	0.026

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 72 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Camden

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
201	21.1	1	0.084	0.083	0.074	0.069	0.059	0.048	0.038	0.029
201	97.0	4	0.090	0.085	0.072	0.062	0.050	0.038	0.030	0.026
201	98.3	3	0.110	0.080	0.071	0.058	0.050	0.040	0.032	0.027
201	98.4	0	0.072	0.067	0.064	0.058	0.048	0.037	0.029	0.025
201	94.8	0	0.075	0.070	0.066	0.056	0.051	0.039	0.030	0.026
201	97.6	3	0.108	0.076	0.072	0.058	0.048	0.038	0.031	0.027

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 73 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Chullora

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	98.3	0	0.074	0.058	0.050	0.045	0.039	0.030	0.025	0.020
2009	96.8	2	0.112	0.075	0.070	0.056	0.045	0.033	0.026	0.021
2010	96.4	0	0.072	0.062	0.058	0.045	0.039	0.029	0.024	0.021
2011	97.1	1	0.096	0.067	0.056	0.047	0.038	0.030	0.023	0.020
2012	98.1	0	0.068	0.058	0.049	0.041	0.037	0.028	0.024	0.020
2013	98.7	1	0.094	0.061	0.055	0.048	0.042	0.032	0.026	0.022
2014	98.8	0	0.073	0.060	0.055	0.049	0.041	0.031	0.025	0.022
2015	97.9	0	0.078	0.069	0.063	0.052	0.042	0.033	0.026	0.022
2016	98.7	0	0.077	0.073	0.069	0.053	0.045	0.033	0.027	0.022
2017	97.7	3	0.110	0.079	0.064	0.050	0.044	0.033	0.028	0.024

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 74 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Liverpool

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	90.5	1	0.089	0.064	0.057	0.050	0.042	0.032	0.026	0.021
2009	92.5	4	0.103	0.085	0.077	0.057	0.046	0.035	0.028	0.022
2010	98.3	1	0.081	0.069	0.061	0.052	0.042	0.033	0.026	0.021
2011	97.3	1	0.095	0.068	0.060	0.051	0.042	0.030	0.024	0.020
2012	96.1	0	0.071	0.062	0.055	0.048	0.043	0.033	0.026	0.021
2013	98.2	1	0.110	0.070	0.065	0.055	0.044	0.036	0.028	0.023
2014	97.6	1	0.087	0.075	0.063	0.056	0.046	0.035	0.028	0.025
2015	95.2	0	0.077	0.065	0.061	0.054	0.047	0.034	0.026	0.022
2016	97.0	2	0.086	0.070	0.065	0.055	0.050	0.035	0.027	0.023
2017	98.5	2	0.117	0.075	0.066	0.056	0.047	0.035	0.029	0.023

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 75 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Macarthur/Campbelltown West*

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	97.9	0	0.070	0.065	0.063	0.054	0.047	0.035	0.030	0.025
2009	96.6	9	0.097	0.090	0.083	0.068	0.056	0.040	0.031	0.027
2010	98.0	1	0.103	0.075	0.073	0.057	0.049	0.038	0.031	0.027
2011	96.4	2	0.122	0.079	0.072	0.062	0.048	0.035	0.029	0.025
2012	33.8	0	0.071	0.069	0.065	0.061	0.051	0.038	0.033	0.028
2013	97.8	1	0.082	0.074	0.067	0.054	0.044	0.034	0.028	0.023
2014	95.4	2	0.111	0.078	0.066	0.054	0.046	0.035	0.029	0.025
2015	95.8	0	0.079	0.067	0.064	0.056	0.046	0.035	0.027	0.023
2016	97.7	0	0.077	0.075	0.064	0.056	0.049	0.036	0.028	0.025
2017	97.1	1	0.091	0.078	0.069	0.058	0.049	0.036	0.030	0.024

* Replaced the Macarthur trend station from September 2012

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 76 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Oakdale

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	96.8	0	0.075	0.061	0.056	0.052	0.045	0.037	0.031	0.026
2009	89.9	6	0.108	0.090	0.080	0.064	0.053	0.040	0.032	0.029
2010	98.4	2	0.088	0.075	0.070	0.058	0.049	0.038	0.032	0.028
2011	99.2	3	0.098	0.074	0.066	0.057	0.047	0.036	0.030	0.026
2012	96.7	1	0.081	0.071	0.060	0.050	0.045	0.036	0.029	0.026
2013	97.9	1	0.081	0.069	0.068	0.057	0.050	0.039	0.031	0.026
2014	98.5	1	0.088	0.077	0.067	0.058	0.049	0.039	0.030	0.027
2015	97.7	0	0.070	0.069	0.062	0.054	0.047	0.038	0.029	0.025
2016	97.2	0	0.067	0.064	0.061	0.053	0.050	0.038	0.030	0.027
2017	99.3	0	0.080	0.076	0.070	0.057	0.051	0.040	0.032	0.027

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 77 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Richmond

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	94.5	0	0.067	0.060	0.055	0.048	0.041	0.034	0.029	0.024
2009	94.2	3	0.090	0.079	0.069	0.058	0.051	0.040	0.032	0.027
2010	97.3	1	0.082	0.067	0.061	0.054	0.047	0.037	0.031	0.026
2011	98.5	1	0.088	0.065	0.059	0.050	0.045	0.034	0.029	0.025
2012	96.6	0	0.070	0.061	0.056	0.050	0.044	0.036	0.030	0.025
2013	98.3	0	0.076	0.065	0.061	0.054	0.049	0.039	0.032	0.026
2014	98.3	0	0.073	0.068	0.065	0.057	0.049	0.039	0.032	0.028
2015	97.1	0	0.074	0.067	0.059	0.051	0.045	0.037	0.029	0.025
2016	98.4	0	0.070	0.061	0.059	0.053	0.047	0.038	0.031	0.027
2017	96.7	2	0.085	0.077	0.067	0.055	0.048	0.039	0.032	0.027

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 78 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Rozelle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	97.0	0	0.048	0.046	0.043	0.038	0.034	0.028	0.025	0.020	
2009	94.8	0	0.073	0.059	0.054	0.044	0.037	0.031	0.026	0.022	
2010	86.8	0	0.067	0.056	0.051	0.043	0.036	0.031	0.027	0.023	
2011	97.1	0	0.080	0.058	0.049	0.041	0.035	0.029	0.024	0.021	
2012	98.6	0	0.054	0.049	0.047	0.042	0.037	0.032	0.028	0.023	
2013	96.0	0	0.063	0.051	0.045	0.041	0.037	0.031	0.027	0.023	
2014	98.8	0	0.060	0.053	0.049	0.042	0.036	0.030	0.027	0.022	
2015	96.7	0	0.079	0.060	0.050	0.046	0.036	0.029	0.026	0.022	
2016	98.6	0	0.075	0.067	0.059	0.043	0.036	0.030	0.026	0.022	
2017	96.8	1	0.109	0.069	0.054	0.040	0.036	0.030	0.025	0.019	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 79 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: St Marys

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	97.0	1	0.082	0.069	0.056	0.048	0.044	0.036	0.029	0.025	
2009	97.2	5	0.106	0.087	0.073	0.063	0.055	0.039	0.031	0.026	
2010	97.8	1	0.083	0.072	0.066	0.057	0.049	0.038	0.031	0.026	
2011	98.8	3	0.121	0.080	0.063	0.054	0.047	0.034	0.028	0.024	
2012	97.2	0	0.072	0.065	0.061	0.053	0.045	0.035	0.029	0.024	
2013	97.6	2	0.101	0.068	0.063	0.057	0.048	0.040	0.030	0.025	
2014	97.7	2	0.085	0.076	0.068	0.059	0.051	0.040	0.032	0.027	
2015	94.9	0	0.071	0.065	0.064	0.055	0.049	0.038	0.029	0.025	
2016	97.7	1	0.081	0.068	0.065	0.057	0.051	0.040	0.031	0.027	
2017	98.2	4	0.096	0.082	0.073	0.059	0.050	0.040	0.032	0.027	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 80 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Wyong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2012	20.1	0	0.066	0.066	0.065	0.057	0.050	0.039	0.031	0.027	
2013	96.1	0	0.072	0.063	0.057	0.046	0.040	0.034	0.028	0.024	
2014	98.1	0	0.069	0.058	0.055	0.046	0.039	0.033	0.029	0.025	
2015	95.6	1	0.091	0.059	0.054	0.045	0.040	0.032	0.027	0.024	
2016	97.9	0	0.079	0.070	0.057	0.048	0.041	0.033	0.028	0.024	
2017	98.0	2	0.105	0.064	0.059	0.049	0.042	0.035	0.030	0.026	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 81 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Albion Park South

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	94.1	0	0.055	0.053	0.048	0.044	0.038	0.032	0.029	0.024	
2009	95.4	1	0.083	0.066	0.060	0.048	0.041	0.036	0.033	0.028	
2010	86.2	0	0.073	0.056	0.048	0.044	0.037	0.029	0.027	0.024	
2011	85.7	3	0.099	0.061	0.052	0.042	0.034	0.031	0.027	0.023	
2012	97.8	0	0.064	0.051	0.047	0.041	0.037	0.031	0.028	0.024	
2013	97.1	3	0.100	0.074	0.056	0.047	0.041	0.034	0.029	0.026	
2014	97.2	0	0.079	0.057	0.054	0.044	0.039	0.033	0.030	0.027	
2015	95.7	0	0.075	0.061	0.054	0.044	0.037	0.032	0.028	0.025	
2016	98.5	2	0.098	0.068	0.061	0.047	0.038	0.032	0.029	0.026	
2017	98.0	2	0.102	0.076	0.063	0.042	0.037	0.033	0.029	0.026	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 82 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Kembla Grange

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	97.5	0	0.066	0.054	0.050	0.043	0.039	0.031	0.028	0.023	
2009	90.1	2	0.090	0.075	0.065	0.046	0.040	0.033	0.029	0.026	
2010	86.7	0	0.078	0.055	0.052	0.044	0.038	0.031	0.028	0.024	
2011	98.4	2	0.105	0.066	0.057	0.048	0.038	0.033	0.029	0.025	
2012	98.4	0	0.061	0.051	0.047	0.041	0.037	0.031	0.027	0.024	
2013	97.8	2	0.103	0.070	0.057	0.044	0.039	0.032	0.029	0.024	
2014	98.4	0	0.080	0.058	0.055	0.047	0.039	0.032	0.029	0.026	
2015	98.8	0	0.079	0.071	0.057	0.046	0.037	0.031	0.027	0.024	
2016	96.8	1	0.102	0.064	0.059	0.047	0.039	0.031	0.028	0.025	
2017	98.6	4	0.098	0.081	0.063	0.047	0.040	0.033	0.030	0.026	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 83 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Wollongong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	97.9	0	0.063	0.056	0.051	0.043	0.040	0.031	0.027	0.023	
2009	92.9	0	0.074	0.064	0.050	0.043	0.037	0.033	0.029	0.025	
2010	94.9	0	0.073	0.061	0.055	0.046	0.039	0.032	0.027	0.024	
2011	96.9	0	0.078	0.066	0.052	0.043	0.036	0.032	0.027	0.023	
2012	98.9	0	0.061	0.055	0.050	0.042	0.038	0.030	0.026	0.023	
2013	96.5	2	0.091	0.076	0.058	0.048	0.041	0.032	0.027	0.023	
2014	98.2	0	0.068	0.059	0.051	0.044	0.039	0.031	0.028	0.025	
2015	98.4	1	0.083	0.066	0.064	0.048	0.039	0.031	0.027	0.023	
2016	98.6	1	0.085	0.075	0.062	0.049	0.040	0.033	0.028	0.025	
2017	96.0	2	0.094	0.080	0.063	0.047	0.041	0.034	0.030	0.026	

Bold font indicates AAQ NEPM standard and goal exceedances.
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 84 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Newcastle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	93.8	0	0.058	0.049	0.046	0.040	0.037	0.032	0.027	0.022	
2009	88.2	0	0.067	0.062	0.056	0.047	0.042	0.035	0.031	0.025	
2010	85.1	0	0.076	0.062	0.054	0.045	0.040	0.034	0.029	0.025	
2011	86.8	0	0.063	0.051	0.048	0.044	0.038	0.033	0.027	0.023	
2012	97.8	0	0.057	0.049	0.048	0.043	0.039	0.032	0.027	0.022	
2013	98.0	0	0.075	0.054	0.050	0.044	0.039	0.033	0.027	0.023	
2014	97.0	0	0.056	0.054	0.048	0.042	0.037	0.032	0.028	0.024	
2015	97.4	0	0.066	0.054	0.050	0.045	0.038	0.032	0.026	0.023	
2016	97.4	0	0.069	0.058	0.055	0.045	0.039	0.032	0.027	0.023	
2017	97.8	0	0.073	0.058	0.051	0.044	0.039	0.033	0.028	0.024	

Bold font indicates AAQ NEPM standard and goal exceedances
AAQ NEPM standard: 0.08 ppm (4-hour average)

Table 85 Statistical summary for O₃: Daily maximum rolling 4-hour average concentrations. Station: Wallsend

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	95.7	0	0.054	0.048	0.045	0.040	0.036	0.031	0.027	0.022	
2009	89.2	0	0.076	0.063	0.058	0.046	0.040	0.034	0.028	0.023	
2010	88.2	0	0.063	0.056	0.052	0.042	0.037	0.032	0.027	0.023	
2011	95.8	0	0.059	0.053	0.050	0.045	0.037	0.031	0.025	0.021	
2012	98.7	0	0.070	0.056	0.051	0.046	0.041	0.033	0.027	0.022	
2013	96.1	0	0.078	0.063	0.057	0.049	0.042	0.036	0.029	0.024	
2014	98.8	0	0.065	0.059	0.052	0.045	0.040	0.034	0.029	0.024	
2015	98.2	0	0.062	0.058	0.052	0.045	0.041	0.031	0.026	0.022	
2016	98.1	0	0.078	0.061	0.057	0.050	0.042	0.033	0.027	0.023	
2017	99.0	2	0.097	0.066	0.060	0.051	0.043	0.034	0.029	0.024	

Bold font indicates AAQ NEPM standard and goal exceedances

AAQ NEPM standard: 0.08 ppm (4-hour average)

Sulfur dioxide

Statistical summary for 2017

Table 86 Statistical summary for SO₂: Daily maximum 1-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Maximum (ppm)	Percentile (ppm)						
			99 th	98 th	95 th	90 th	75 th	50 th	25 th
Sydney									
Bringelly	93.1	0.009	0.007	0.006	0.005	0.003	0.001	0.001	0.001
Campbelltown West	92.6	0.011	0.009	0.008	0.005	0.004	0.002	0.001	0.001
Chullora	93.6	0.014	0.010	0.009	0.007	0.005	0.003	0.001	0.001
Prospect	94.5	0.023	0.012	0.011	0.007	0.005	0.003	0.002	0.000
Richmond	91.9	0.034	0.011	0.008	0.006	0.004	0.002	0.001	0.000
Central Coast									
Wyong	92.9	0.047	0.029	0.023	0.017	0.010	0.004	0.001	0.000
Illawarra									
Albion Park South	94.6	0.030	0.024	0.020	0.016	0.011	0.004	0.000	0.000
Wollongong	94.3	0.047	0.021	0.017	0.013	0.011	0.006	0.003	0.001
Lower Hunter									
Newcastle	94.4	0.050	0.029	0.025	0.020	0.016	0.010	0.005	0.002
Wallsend	94.5	0.056	0.032	0.026	0.019	0.017	0.010	0.005	0.002

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 87 Statistical summary for SO₂: Daily 24-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Maximum (ppm)	Percentile (ppm)						
			99 th	98 th	95 th	90 th	75 th	50 th	25 th
Sydney									
Bringelly	96.7	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000
Chullora	97.5	0.003	0.003	0.002	0.002	0.002	0.001	0.000	0.000
Campbelltown West	96.2	0.003	0.002	0.002	0.001	0.001	0.001	0.000	0.000
Prospect	98.1	0.004	0.003	0.003	0.002	0.002	0.001	0.001	0.000
Richmond	94.8	0.004	0.003	0.002	0.002	0.001	0.000	0.000	0.000
Central Coast									
Wyong	96.2	0.007	0.004	0.004	0.003	0.002	0.001	0.000	0.000
Illawarra									
Albion Park South	97.8	0.008	0.007	0.006	0.004	0.003	0.001	0.000	0.000
Wollongong	98.4	0.005	0.005	0.004	0.003	0.002	0.001	0.001	0.000
Lower Hunter									
Newcastle	98.1	0.006	0.006	0.006	0.004	0.004	0.002	0.001	0.001
Wallsend	98.6	0.010	0.006	0.005	0.004	0.003	0.002	0.001	0.001

AAQ NEPM standard: 0.08 ppm (24-hour average)

Trend analysis

Table 88 Annual maximum 1-hour average concentrations for SO₂ (ppm)

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Bringelly	0.019	0.012	0.008	0.011	0.015	0.011	0.009	0.007	0.006	0.009
Macarthur/ Campbelltown West*	0.015	0.010	0.01	0.014	0.006	0.009	0.012	0.011	0.016	0.011
Chullora	0.021	0.029	0.021	0.026	0.025	0.012	0.019	0.014	0.014	0.014
Prospect	0.014	0.017	0.018	0.014	0.012	0.020	0.019	0.027	0.021	0.023
Richmond	0.015	0.013	0.009	0.010	0.013	0.010	0.009	0.032	0.025	0.034
Central Coast										
Wyong	--	--	--	--	0.030	0.029	0.040	0.069	0.032	0.047
Illawarra										
Albion Park South	0.028	0.031	0.032	0.035	0.027	0.039	0.016	0.036	0.022	0.030
Wollongong	0.021	0.020	0.027	0.018	0.017	0.040	0.019	0.019	0.020	0.047
Lower Hunter										
Newcastle	0.033	0.039	0.027	0.033	0.034	0.052	0.064	0.036	0.055	0.050
Wallsend	0.044	0.044	0.031	0.044	0.035	0.050	0.046	0.034	0.038	0.056

* Replaced the Macarthur trend station from September 2012
AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 89 Annual 24-hour average concentrations for SO₂ (ppm)

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Bringelly	0.003	0.003	0.002	0.002	0.002	0.002	0.003	0.001	0.002	0.002
Macarthur/ Campbelltown West*	0.004	0.004	0.003	0.002	0.002	0.002	0.004	0.002	0.002	0.003
Chullora	0.005	0.005	0.004	0.005	0.004	0.003	0.004	0.003	0.003	0.003
Prospect	0.004	0.003	0.004	0.003	0.003	0.004	0.005	0.003	0.004	0.004
Richmond	0.003	0.004	0.002	0.003	0.002	0.002	0.002	0.003	0.002	0.004
Central Coast										
Wyong	--	--	--	--	0.004	0.005	0.004	0.009	0.004	0.007
Illawarra										
Albion Park South	0.008	0.012	0.011	0.010	0.010	0.009	0.005	0.007	0.006	0.008
Wollongong	0.007	0.004	0.008	0.009	0.005	0.008	0.005	0.004	0.004	0.005
Lower Hunter										
Newcastle	0.008	0.01	0.005	0.009	0.007	0.007	0.006	0.007	0.007	0.006
Wallsend	0.007	0.007	0.007	0.007	0.005	0.005	0.008	0.007	0.006	0.010

* Replaced the Macarthur trend station from September 2012
AAQ NEPM standard: 0.08 ppm (24-hour average)

Table 90 Annual average concentrations for SO₂ (ppm)

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Bringelly	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Macarthur/ Campbelltown West*	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.001
Chullora	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Prospect	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Richmond	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Central Coast										
Wyong	--	--	--	--	0.001	0.001	0.001	0.001	0.001	0.001
Illawarra										
Albion Park South	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001
Wollongong	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Lower Hunter										
Newcastle	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.002	0.002
Wallsend	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

* Replaced the Macarthur trend station from September 2012

AAQ NEPM standard: 0.02 ppm (annual average)

Statistical summaries for multiple years, by station

Table 91 Statistical summary for SO₂: Annual daily maximum 1-hour average concentrations. Station: Bringelly

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	89.2	0	0.019	0.008	0.006	0.005	0.003	0.002	0.001	0.000
2009	84.6	0	0.012	0.008	0.005	0.004	0.003	0.001	0.000	0.000
2010	79.9	0	0.008	0.005	0.005	0.004	0.003	0.002	0.001	0.000
2011	88.9	0	0.011	0.005	0.005	0.003	0.003	0.002	0.001	0.000
2012	94.6	0	0.015	0.005	0.005	0.003	0.003	0.002	0.001	0.000
2013	94.5	0	0.011	0.008	0.006	0.004	0.003	0.002	0.001	0.001
2014	92.4	0	0.009	0.007	0.006	0.004	0.002	0.002	0.001	0.000
2015	92.9	0	0.007	0.005	0.004	0.003	0.002	0.001	0.001	0.000
2016	94.5	0	0.006	0.006	0.005	0.004	0.003	0.001	0.001	0.000
2017	93.1	0	0.009	0.007	0.006	0.005	0.003	0.001	0.001	0.001

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 92 Statistical summary for SO₂: Annual daily maximum 1-hour average concentrations. Station: Macarthur/Campbelltown West*

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	92.1	0	0.015	0.013	0.009	0.006	0.004	0.003	0.001	0.001
2009	91.6	0	0.010	0.009	0.007	0.006	0.004	0.003	0.002	0.001
2010	92.9	0	0.010	0.006	0.006	0.005	0.004	0.002	0.001	0.001
2011	91.9	0	0.014	0.009	0.006	0.005	0.003	0.002	0.001	0.000
2012	33.9	0	0.008	0.006	0.005	0.005	0.004	0.002	0.001	0.001
2013	95.0	0	0.009	0.007	0.006	0.004	0.003	0.002	0.001	0.001
2014	93.2	0	0.012	0.007	0.006	0.005	0.003	0.002	0.001	0.001
2015	91.7	0	0.011	0.006	0.005	0.004	0.003	0.002	0.001	0.001
2016	94.2	0	0.016	0.009	0.007	0.005	0.004	0.002	0.001	0.001
2017	92.6	0	0.011	0.009	0.008	0.005	0.004	0.002	0.001	0.001

* Replaced the Macarthur trend station from September 2012

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 93 Statistical summary for SO₂: Annual daily maximum 1-hour average concentrations. Station: Chullora

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	77.5	0	0.021	0.018	0.012	0.007	0.006	0.004	0.002	0.001	
2009	89.8	0	0.029	0.015	0.012	0.010	0.008	0.004	0.002	0.001	
2010	92.1	0	0.021	0.015	0.014	0.010	0.007	0.004	0.002	0.001	
2011	92.7	0	0.026	0.016	0.011	0.009	0.006	0.004	0.002	0.001	
2012	93.6	0	0.025	0.011	0.008	0.007	0.005	0.003	0.002	0.001	
2013	92.9	0	0.012	0.010	0.008	0.006	0.005	0.003	0.002	0.001	
2014	94.7	0	0.019	0.010	0.009	0.007	0.005	0.003	0.001	0.001	
2015	93.5	0	0.014	0.010	0.008	0.005	0.004	0.003	0.001	0.001	
2016	93.9	0	0.014	0.011	0.008	0.006	0.004	0.003	0.002	0.001	
2017	93.6	0	0.014	0.010	0.009	0.007	0.005	0.003	0.001	0.001	

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 94 Statistical summary for SO₂: Annual daily maximum 1-hour average concentrations. Station: Prospect

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	85.1	0	0.014	0.011	0.010	0.008	0.005	0.003	0.002	0.001	
2009	91.3	0	0.017	0.010	0.010	0.008	0.006	0.004	0.002	0.001	
2010	88.9	0	0.018	0.013	0.011	0.008	0.006	0.004	0.002	0.001	
2011	93.8	0	0.014	0.011	0.008	0.006	0.005	0.003	0.002	0.001	
2012	91.3	0	0.012	0.008	0.007	0.006	0.004	0.003	0.002	0.001	
2013	90.9	0	0.020	0.014	0.010	0.006	0.005	0.003	0.002	0.001	
2014	91.4	0	0.019	0.013	0.012	0.008	0.005	0.003	0.002	0.001	
2015	94.6	0	0.027	0.010	0.008	0.006	0.004	0.003	0.002	0.001	
2016	93.4	0	0.021	0.015	0.012	0.008	0.005	0.003	0.002	0.001	
2017	94.5	0	0.023	0.012	0.011	0.007	0.005	0.003	0.002	0.001	

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 95 Statistical summary for SO₂: Annual daily maximum 1-hour average concentrations. Station: Richmond

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	72.0	0	0.015	0.010	0.007	0.005	0.003	0.002	0.001	0.000
2009	89.5	0	0.013	0.010	0.009	0.006	0.004	0.002	0.001	0.000
2010	93.3	0	0.009	0.007	0.006	0.005	0.003	0.002	0.001	0.000
2011	94.5	0	0.010	0.008	0.005	0.004	0.003	0.002	0.001	0.000
2012	83.4	0	0.013	0.008	0.007	0.005	0.004	0.002	0.001	0.000
2013	94.2	0	0.010	0.008	0.007	0.005	0.004	0.002	0.001	0.000
2014	94.0	0	0.009	0.007	0.006	0.005	0.003	0.001	0.001	0.000
2015	92.6	0	0.032	0.011	0.006	0.005	0.003	0.002	0.001	0.000
2016	93.8	0	0.025	0.008	0.007	0.005	0.003	0.002	0.001	0.000
2017	91.9	0	0.034	0.011	0.008	0.006	0.004	0.002	0.001	0.000

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 96 Statistical summary for SO₂: Annual daily maximum 1-hour average concentrations. Station: Wyong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2012	19.3	0	0.030	0.030	0.027	0.018	0.013	0.005	0.002	0.001
2013	94.7	0	0.029	0.024	0.020	0.015	0.009	0.004	0.002	0.001
2014	93.7	0	0.040	0.023	0.019	0.014	0.010	0.005	0.001	0.000
2015	92.9	0	0.069	0.029	0.022	0.015	0.009	0.004	0.001	0.000
2016	94.4	0	0.032	0.025	0.024	0.013	0.010	0.004	0.001	0.000
2017	92.9	0	0.047	0.029	0.023	0.017	0.010	0.004	0.001	0.000

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 97 Statistical summary for SO₂: Annual daily maximum 1-hour average concentrations. Station: Albion Park South

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	93.0	0	0.028	0.026	0.022	0.015	0.011	0.005	0.001	0.000
2009	85.4	0	0.031	0.027	0.023	0.018	0.013	0.005	0.001	0.000
2010	89.6	0	0.032	0.027	0.023	0.019	0.013	0.005	0.001	0.000
2011	87.4	0	0.035	0.024	0.022	0.017	0.009	0.004	0.000	0.000
2012	92.5	0	0.027	0.017	0.015	0.010	0.008	0.003	0.001	0.000
2013	89.6	0	0.039	0.022	0.017	0.012	0.009	0.004	0.001	0.000
2014	94.5	0	0.016	0.015	0.013	0.010	0.008	0.004	0.001	0.000
2015	90.8	0	0.036	0.018	0.017	0.013	0.010	0.004	0.001	0.000
2016	94.1	0	0.022	0.019	0.017	0.013	0.009	0.004	0.001	0.000
2017	94.6	0	0.030	0.024	0.020	0.016	0.011	0.004	0.000	0.000

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 98 Statistical summary for SO₂: Annual daily maximum 1-hour average concentrations. Station: Wollongong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	78.2	0	0.021	0.019	0.015	0.012	0.009	0.006	0.002	0.000
2009	75.3	0	0.020	0.016	0.014	0.010	0.007	0.004	0.002	0.000
2010	88.4	0	0.027	0.018	0.015	0.013	0.011	0.006	0.003	0.001
2011	92.9	0	0.018	0.018	0.017	0.012	0.009	0.005	0.003	0.001
2012	94.9	0	0.017	0.016	0.014	0.010	0.008	0.004	0.002	0.001
2013	92.4	0	0.040	0.018	0.016	0.010	0.008	0.005	0.002	0.001
2014	92.7	0	0.019	0.017	0.016	0.012	0.009	0.005	0.003	0.001
2015	89.7	0	0.019	0.017	0.013	0.011	0.009	0.005	0.002	0.001
2016	91.7	0	0.020	0.016	0.014	0.011	0.009	0.005	0.002	0.001
2017	94.3	0	0.047	0.021	0.017	0.013	0.011	0.006	0.003	0.001

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 99 Statistical summary for SO₂: Annual daily maximum 1-hour average concentrations. Station: Newcastle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	86.9	0	0.033	0.027	0.024	0.019	0.015	0.010	0.004	0.002
2009	69.7	0	0.039	0.033	0.027	0.021	0.015	0.008	0.005	0.002
2010	84.6	0	0.027	0.022	0.020	0.015	0.012	0.008	0.004	0.002
2011	90.7	0	0.033	0.027	0.023	0.017	0.014	0.008	0.005	0.001
2012	93.1	0	0.034	0.025	0.022	0.019	0.014	0.008	0.004	0.002
2013	95.1	0	0.052	0.030	0.024	0.017	0.015	0.009	0.004	0.002
2014	93.7	0	0.064	0.030	0.024	0.019	0.015	0.009	0.004	0.001
2015	93.6	0	0.036	0.032	0.027	0.018	0.014	0.008	0.004	0.002
2016	93.1	0	0.055	0.033	0.025	0.020	0.015	0.010	0.006	0.002
2017	94.4	0	0.050	0.029	0.025	0.020	0.016	0.01	0.005	0.002

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 100 Statistical summary for SO₂: Annual daily maximum 1-hour average concentrations. Station: Wallsend

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	91.3	0	0.044	0.032	0.026	0.021	0.018	0.011	0.006	0.002
2009	67.2	0	0.044	0.028	0.025	0.019	0.014	0.009	0.005	0.001
2010	70.3	0	0.031	0.022	0.020	0.017	0.014	0.009	0.004	0.001
2011	93.7	0	0.044	0.031	0.024	0.018	0.014	0.008	0.004	0.001
2012	95.1	0	0.035	0.021	0.020	0.016	0.013	0.008	0.004	0.002
2013	92.2	0	0.050	0.028	0.021	0.016	0.012	0.007	0.004	0.002
2014	93.7	0	0.046	0.030	0.022	0.018	0.015	0.009	0.004	0.002
2015	90.3	0	0.034	0.024	0.021	0.017	0.013	0.008	0.003	0.002
2016	93.5	0	0.038	0.024	0.022	0.018	0.013	0.008	0.004	0.002
2017	94.5	0	0.056	0.032	0.026	0.019	0.017	0.010	0.005	0.002

AAQ NEPM standard: 0.20 ppm (1-hour average)

Table 101 Statistical summary for SO₂: 24-hour average concentrations. Station: Bringelly

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	92.3	0	0.003	0.002	0.002	0.002	0.001	0.001	0.000	0.001	
2009	87.1	0	0.003	0.002	0.001	0.001	0.001	0.000	0.000	0.001	
2010	85.8	0	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000	
2011	94.8	0	0.002	0.001	0.001	0.001	0.001	0.000	0.000	0.000	
2012	98.4	0	0.002	0.002	0.001	0.001	0.001	0.001	0.000	0.000	
2013	98.6	0	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	
2014	96.2	0	0.003	0.002	0.002	0.001	0.001	0.000	0.000	0.000	
2015	96.7	0	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	
2016	98.4	0	0.002	0.001	0.001	0.001	0.001	0.000	0.000	0.000	
2017	96.7	0	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000	

AAQ NEPM standard: 0.08 ppm (24-hour average)

Table 102 Statistical summary for SO₂: 24-hour average concentrations. Station: Macarthur/Campbelltown West*

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	97.0	0	0.004	0.003	0.003	0.002	0.002	0.001	0.000	0.000	
2009	95.9	0	0.004	0.003	0.003	0.002	0.002	0.001	0.001	0.000	
2010	97.0	0	0.003	0.002	0.002	0.001	0.001	0.001	0.000	0.000	
2011	96.2	0	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	
2012	35.0	0	0.002	0.002	0.002	0.002	0.001	0.001	0.000	0.000	
2013	99.2	0	0.002	0.002	0.002	0.002	0.001	0.001	0.000	0.000	
2014	96.4	0	0.004	0.002	0.002	0.001	0.001	0.001	0.000	0.000	
2015	93.7	0	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	
2016	97.8	0	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	
2017	96.2	0	0.003	0.002	0.002	0.001	0.001	0.001	0.000	0.000	

* Replaced the Macarthur trend station from September 2012

AAQ NEPM standard: 0.08 ppm (24-hour average)

Table 103 Statistical summary for SO₂: 24-hour average concentrations. Station: Chullora

Year	Data availability rate (%)	Number of Exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	80.9	0	0.005	0.004	0.003	0.002	0.002	0.001	0.001	0.000	
2009	94.5	0	0.005	0.004	0.003	0.003	0.002	0.001	0.001	0.000	
2010	96.2	0	0.004	0.004	0.003	0.003	0.002	0.001	0.001	0.000	
2011	96.7	0	0.005	0.003	0.003	0.002	0.002	0.001	0.001	0.000	
2012	97.0	0	0.004	0.003	0.002	0.002	0.001	0.001	0.000	0.000	
2013	97.3	0	0.003	0.003	0.002	0.002	0.001	0.001	0.001	0.000	
2014	98.6	0	0.004	0.003	0.002	0.002	0.001	0.001	0.000	0.000	
2015	96.7	0	0.003	0.003	0.002	0.002	0.001	0.001	0.000	0.000	
2016	97.0	0	0.003	0.002	0.002	0.002	0.001	0.001	0.000	0.000	
2017	97.5	0	0.003	0.003	0.002	0.002	0.002	0.001	0.000	0.000	

AAQ NEPM standard: 0.08 ppm (24-hour average)

Table 104 Statistical summary for SO₂: 24-hour average concentrations. Station: Prospect

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	89.9	0	0.004	0.003	0.003	0.002	0.001	0.001	0.000	0.000
2009	96.4	0	0.003	0.003	0.002	0.002	0.002	0.001	0.000	0.000
2010	96.4	0	0.004	0.003	0.003	0.002	0.002	0.001	0.001	0.000
2011	97.8	0	0.003	0.003	0.002	0.002	0.001	0.001	0.001	0.000
2012	94.5	0	0.003	0.002	0.002	0.002	0.002	0.001	0.001	0.000
2013	93.4	0	0.004	0.003	0.002	0.002	0.002	0.001	0.001	0.000
2014	94.5	0	0.005	0.003	0.002	0.002	0.002	0.001	0.001	0.000
2015	98.4	0	0.003	0.003	0.002	0.002	0.001	0.001	0.000	0.000
2016	97.5	0	0.004	0.003	0.002	0.002	0.001	0.001	0.000	0.000
2017	98.1	0	0.004	0.003	0.003	0.002	0.002	0.001	0.001	0.000

* Blacktown station closed pending relocation

AAQ NEPM standard: 0.08 ppm (24-hour average)

Table 105 Statistical summary for SO₂: 24-hour average concentrations. Station: Richmond

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	74.9	0	0.003	0.002	0.001	0.001	0.001	0.000	0.000	0.000
2009	93.7	0	0.004	0.003	0.002	0.001	0.001	0.000	0.000	0.000
2010	97.5	0	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000
2011	98.4	0	0.003	0.001	0.001	0.001	0.001	0.000	0.000	0.000
2012	86.3	0	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000
2013	98.1	0	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000
2014	97.5	0	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000
2015	95.1	0	0.003	0.002	0.002	0.001	0.001	0.001	0.000	0.000
2016	97.3	0	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000
2017	94.8	0	0.004	0.003	0.002	0.002	0.001	0.000	0.000	0.000

AAQ NEPM standard: 0.08 ppm (24-hour average)

Table 106 Statistical summary for SO₂: 24-hour average concentrations. Station: Wyong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2012	19.9	0	0.004	0.004	0.004	0.003	0.003	0.002	0.001	0.000
2013	98.1	0	0.005	0.004	0.003	0.002	0.002	0.001	0.000	0.000
2014	97.0	0	0.004	0.004	0.003	0.002	0.002	0.001	0.000	0.000
2015	96.4	0	0.009	0.003	0.003	0.002	0.002	0.001	0.000	0.000
2016	97.5	0	0.004	0.004	0.003	0.002	0.002	0.001	0.000	0.000
2017	96.2	0	0.007	0.004	0.004	0.003	0.002	0.001	0.000	0.000

AAQ NEPM standard: 0.08 ppm (24-hour average)

Table 107 Statistical summary for SO₂: 24-hour average concentrations. Station: Albion Park South

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	97.0	0	0.008	0.006	0.005	0.004	0.003	0.002	0.000	0.000	
2009	88.5	0	0.012	0.009	0.008	0.006	0.004	0.002	0.000	0.000	
2010	97.8	0	0.011	0.010	0.008	0.006	0.003	0.001	0.000	0.000	
2011	94.8	0	0.010	0.007	0.006	0.004	0.002	0.001	0.000	0.000	
2012	96.4	0	0.010	0.004	0.004	0.003	0.002	0.001	0.000	0.000	
2013	93.4	0	0.009	0.007	0.005	0.003	0.002	0.001	0.000	0.000	
2014	98.4	0	0.005	0.005	0.003	0.003	0.002	0.001	0.000	0.000	
2015	93.4	0	0.007	0.006	0.004	0.003	0.002	0.001	0.000	0.000	
2016	97.8	0	0.006	0.005	0.004	0.003	0.002	0.001	0.000	0.000	
2017	97.8	0	0.008	0.007	0.006	0.004	0.003	0.001	0.000	0.000	

AAQ NEPM standard: 0.08 ppm (24-hour average)

Table 108 Statistical summary for SO₂: 24-hour average concentrations. Station: Wollongong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	79.8	0	0.007	0.004	0.003	0.003	0.002	0.001	0.000	0.000	
2009	73.4	0	0.004	0.003	0.003	0.002	0.002	0.001	0.000	0.000	
2010	92.9	0	0.008	0.005	0.004	0.002	0.002	0.001	0.000	0.000	
2011	96.7	0	0.009	0.004	0.003	0.003	0.002	0.001	0.000	0.000	
2012	99.2	0	0.005	0.004	0.003	0.002	0.001	0.001	0.000	0.000	
2013	96.4	0	0.008	0.004	0.003	0.002	0.002	0.001	0.000	0.000	
2014	96.4	0	0.005	0.004	0.003	0.002	0.002	0.001	0.001	0.000	
2015	93.4	0	0.004	0.004	0.003	0.002	0.002	0.001	0.000	0.000	
2016	95.1	0	0.004	0.003	0.003	0.002	0.002	0.001	0.000	0.000	
2017	98.4	0	0.005	0.005	0.004	0.003	0.002	0.001	0.001	0.000	

AAQ NEPM standard: 0.080 ppm (24-hour average)

Table 109 Statistical summary for SO₂: 24-hour average concentrations. Station: Newcastle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	90.2	0	0.008	0.006	0.006	0.004	0.003	0.002	0.001	0.000	
2009	73.4	0	0.010	0.008	0.006	0.004	0.004	0.002	0.001	0.000	
2010	91.8	0	0.005	0.005	0.004	0.004	0.003	0.002	0.001	0.000	
2011	98.9	0	0.009	0.006	0.005	0.005	0.004	0.002	0.001	0.000	
2012	97.5	0	0.007	0.006	0.005	0.004	0.003	0.002	0.001	0.001	
2013	98.6	0	0.007	0.006	0.005	0.004	0.003	0.002	0.001	0.000	
2014	97.8	0	0.006	0.005	0.004	0.004	0.003	0.002	0.001	0.000	
2015	97.3	0	0.007	0.006	0.005	0.004	0.003	0.002	0.001	0.000	
2016	96.4	0	0.007	0.007	0.005	0.004	0.003	0.002	0.001	0.001	
2017	98.1	0	0.006	0.006	0.006	0.004	0.004	0.002	0.001	0.001	

AAQ NEPM standard: 0.08 ppm (24-hour average)

Table 110 Statistical summary for SO₂: 24-hour average concentrations. Station: Wallsend

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (ppm)	Percentile (ppm)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	95.4	0	0.007	0.006	0.006	0.005	0.004	0.002	0.001	0.001
2009	68.2	0	0.007	0.006	0.006	0.004	0.003	0.002	0.001	0.000
2010	74.2	0	0.007	0.005	0.004	0.003	0.003	0.002	0.001	0.000
2011	99.5	0	0.007	0.005	0.005	0.003	0.002	0.001	0.001	0.000
2012	99.7	0	0.005	0.004	0.004	0.003	0.002	0.002	0.001	0.000
2013	96.2	0	0.005	0.004	0.004	0.003	0.002	0.002	0.001	0.000
2014	97.5	0	0.008	0.006	0.004	0.004	0.003	0.002	0.001	0.000
2015	92.9	0	0.007	0.005	0.004	0.003	0.003	0.001	0.001	0.000
2016	97.8	0	0.006	0.005	0.004	0.003	0.003	0.002	0.001	0.000
2017	98.6	0	0.010	0.006	0.005	0.004	0.003	0.002	0.001	0.001

AAQ NEPM standard: 0.08 ppm (24-hour average)

Particles as PM₁₀

Statistical summary for 2017

Table 111 Statistical summary for PM₁₀: 24-hour average concentrations (2017)

Region/ monitoring station	Data availability rate (%)	Maximum (µg/m ³)	Percentile (µg/m ³)						
			99 th	98 th	95 th	90 th	75 th	50 th	25 th
Sydney									
Bringelly	97.0	83.7	55.0	49.4	37.0	30.6	24.0	17.4	13.8
Camden	98.4	48.4	33.9	31.4	27.1	23.9	18.1	13.3	10.4
Campbelltown West	98.1	53.1	32.5	31.5	27.8	24.5	18.8	14.3	11.4
Chullora	99.5	63.0	51.3	42.7	33.9	30.0	24.1	18.2	14.3
Liverpool	98.9	74.0	42.4	38.4	35.0	31.3	25.0	19.7	15.3
Oakdale	98.6	46.8	29.3	26.1	22.3	19.6	15.0	10.9	7.9
Prospect	98.4	61.1	37.9	36.2	32.0	28.1	22.5	17.7	14.5
Richmond	95.9	51.5	37.9	33.4	29.3	25.5	19.4	14.5	11.2
Rozelle	98.6	54.1	43.0	35.4	31.2	27.8	21.5	16.3	13.2
Central Coast									
Wyong	98.4	63.4	36.0	32.7	29.5	25.5	19.9	14.3	10.7
Illawarra									
Albion Park South	98.9	44.6	40.6	34.9	30.6	26.1	19.2	13.0	10.2
Kembla Grange	98.4	67.7	55.5	45.4	38.9	33.1	24.8	18.1	14.4
Wollongong	98.4	55.2	46.3	42.8	35.4	30.5	23.6	15.2	11.8
Lower Hunter									
Beresfield	98.9	49.4	40.8	37.1	33.4	29.2	23.7	18.6	14.2
Newcastle	98.6	55.0	46.3	44.3	36.3	32.5	26.7	20.8	17.2
Regional NSW									
Albury	97.5	48.8	37.8	33.4	28.6	24.2	19.3	14.7	11.5
Bathurst	97.3	49.9	37.3	30.3	24.9	21.2	16.9	12.8	9.9
Tamworth	99.2	54.1	37.1	33.7	27.1	22.5	18.5	14.0	10.7
Wagga Wagga North	98.4	171.6	61.5	53.2	42.5	33.3	25.7	17.9	12.2

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

Trend analysis

Table 112 Maximum 24-hour average concentrations for PM₁₀ (µg/m³)

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Bringelly	62.7	1683.9	41.1	86.0	40.1	97.2	42.6	57.0	61.6	83.7
Camden	--	--	--	--	35.6	97.5	41.4	62.4	43.6	48.4
Macarthur/ Campbelltown West*	65.5	1146.3	58.7	38.1	33.9	56.9	49.4	69.7	50.1	53.1
Chullora	44.3	1474.7	42.1	65.2	52.4	69.4	40.0	64.6	63.5	63.0
Liverpool	53.8	1579.8	41.1	68.8	42.5	98.5	40.8	68.6	68.7	74.0
Oakdale	68.2	1528.3	33.3	54.7	38.9	99.0	56.3	61.7	75.9	46.8
Prospect	41.8	1680.3	40.1	41.5	38.7	81.8	44.3	68.7	110.1	61.1
Richmond	39.0	1637.3	37.0	46.2	99.2	104.6	40.0	49.3	102.8	51.5
Rozelle	43.1	1562.8	37.6	39.4	40.7	58.5	43.8	60.3	58.8	54.1
Central Coast										
Wyong	--	--	--	--	37.4	70.2	41.9	58.6	46.0	63.4
Illawarra										
Albion Park South	96.1	1359.6	41.8	51.0	43.9	69.0	48.3	41.2	43.1	44.6
Kembla Grange	100.8	1174.0	47.5	55.5	57.2	102.2	99.2	62.8	56.3	67.7
Wollongong	78.3	1145.4	49.6	48.5	47.5	93.8	45.3	45.8	52.9	55.2
Lower Hunter										
Beresfield	59.9	1999.0	50.0	42.8	50.8	55.3	45.4	64.9	48.0	49.4
Newcastle	54.4	2426.8	57.1	49.2	48.7	69.0	53.7	70.4	89.1	55.0
Regional NSW										
Albury	124.8	249.7	60.8	28.0	54.4	59.2	159.6	92.5	51.0	48.8
Bathurst	63.0	2114.4	43.3	24.3	55.5	145.0	42.8	94.6	34.1	49.9
Tamworth	100.4	1791.4	29.1	50.9	55.1	47.5	66.6	52.7	51.7	54.1
Wagga Wagga/ Wagga Wagga North**	294.9	297.4	64.9	56.3	67.2	110.7	88.2	145.1	114.7	171.6

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)

* Replaced the Macarthur trend station from September 2012

** Replaced the Wagga Wagga station in October 2011

Bold font indicates values that exceed the AAQ NEPM standard.

Table 113 Annual average concentrations for PM₁₀ (µg/m³)

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Bringelly	15.7	24.7	15.5	15.9	15.7	17	16.6	15.8	16.9	19.8
Camden	--	--	--	--	20.1	15.4	15.6	13.8	14.4	14.7
Macarthur/ Campbelltown West*	14.5	21.3	14.0	13.2	18.9	15.5	17	15.6	16.1	15.7
Chullora	19.5	26.1	17.7	19.8	18.1	18.3	18.1	17.5	18.1	20.1
Liverpool	17.6	25.8	17.0	18.1	19.8	21.0	19.1	18.5	19.6	20.8
Oakdale	12.3	20.1	10.7	10.7	11.7	13.6	13.1	11.4	12.2	12.1
Prospect	17.8	25.9	15.4	15.8	17.2	19.2	17.6	17.6	18.9	16.0
Richmond	13.0	21.5	13.1	13.2	15.1	17.3	15.4	12.8	16.0	18.9
Rozelle	17.3	24.8	16.1	16.6	16.9	18.3	17.9	16.7	16.8	18.1
Central Coast										
Wyong	--	--	--	--	21.9	16.6	15.1	14.9	15.2	16.1
Illawarra										
Albion Park South	14.8	22.0	14.0	13.6	13.6	14.7	16.2	14.0	14.9	15.3
Kembla Grange	18.4	24.1	17.7	16.8	18.3	18.5	17.3	17.8	20.0	20.5
Wollongong	17.8	24.0	17.8	17.0	18.0	17.6	17.7	16.9	17.3	18.1
Lower Hunter										
Beresfield	18.4	28.9	16.6	17.2	21.3	21.4	19.4	18.8	19.1	19.6
Newcastle	20.5	31.9	18.6	19.1	20.6	22.7	21.4	21.4	21.6	22.4
Regional NSW										
Albury	17.4	19.2	12.6	12.3	14.3	15.8	15.9	14.6	15.1	15.8
Bathurst	14.0	23.1	9.4	11.0	13.4	15.1	14.6	13.4	13.3	14.1
Tamworth	15.8	27.2	12.0	13.1	15.9	16.6	15.8	14.1	15.3	15.3
Wagga Wagga/ Wagga Wagga North**	24.9	27.0	17.2	16.5	18.8	22.1	20.7	19.9	20.6	20.6

AAQ NEPM standard: 25.0 µg/m³ (annual average)

* Replaced the Macarthur trend station from September 2012

** Replaced the Wagga Wagga station in October 2011

Bold font indicates values that exceed the AAQ NEPM standard.

Statistical summaries for multiple years, by station

Table 114 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Bringelly

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	97.0	1	62.7	35.2	33.0	28.6	24.6	19.3	14.4	10.6
2009	94.8	6	1683.9	114.8	47.4	37.1	31.9	22.8	17.0	12.4
2010	97.3	0	41.1	37.5	33.9	29.1	23.7	18.5	14.4	10.7
2011	98.9	2	86.0	41.5	36.5	30.7	25.0	18.9	14.3	10.6
2012	100	0	40.1	34.6	30.2	27.1	24.7	19.0	14.9	11.2
2013	99.5	3	97.2	46.1	35.9	30.4	26.9	20.9	15.1	11.5
2014	98.4	0	42.6	36.2	33.4	29.2	25.9	20.6	15.5	11.5
2015	99.2	1	57.0	36.9	32.6	27.8	24.3	19.6	15.1	10.9
2016	98.6	3	61.6	41.4	34.1	30.1	26.7	21.5	15.9	11.0
2017	97.0	6	83.7	55.0	49.4	37.0	30.6	24.0	17.4	13.8

AAQ NEPM standard: 50.0 $\mu\text{g}/\text{m}^3$ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

Table 115 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Camden

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2012	19.1	0	35.6	35.5	34.5	31.1	28.6	23.6	20.0	14.8
2013	98.9	2	97.5	40.9	34.3	30.6	25.9	18.8	13.5	9.7
2014	99.2	0	41.4	35.5	31.5	28.0	24.9	19.4	14.6	10.7
2015	98.9	1	62.4	32.4	30.6	24.7	22.2	16.9	12.6	9.5
2016	95.1	0	43.6	33.9	31.6	26.2	23.4	18.3	13.5	9.4
2017	98.4	0	48.4	33.9	31.4	27.1	23.9	18.1	13.3	10.4

AAQ NEPM standard: 50.0 $\mu\text{g}/\text{m}^3$ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

Table 116 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Macarthur/Campbelltown West*

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	99.5	1	65.5	33.2	30.7	27.6	23.3	17.5	13.7	9.9
2009	96.7	7	1146.3	111.4	56.2	35.5	29.6	21.2	15.5	10.5
2010	99.5	1	58.7	35.7	30.9	26.8	21.5	16.7	12.5	9.5
2011	98.4	0	38.1	31.9	28.5	23.0	20.6	16.0	12.1	8.9
2012	35.2	0	39.3	37.1	34.4	30.2	27.9	24.0	18.1	13.9
2013	99.2	1	56.9	36.9	32.0	29.4	25.7	18.9	14.1	10.5
2014	91.8	0	49.4	36.6	33.8	30.1	26.2	20.7	16.0	12.2
2015	95.9	1	69.7	38.9	34.5	27.9	24.4	19.2	13.8	10.7
2016	98.1	1	50.1	35.3	31.7	29.2	25.3	20.4	15.0	10.6
2017	98.1	1	53.1	32.5	31.5	27.8	24.5	18.8	14.3	11.4

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)

* Replaced the Macarthur trend station from September 2012

Bold font indicates values that exceed the AAQ NEPM standard.

Table 117 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Chullora

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	97.0	0	44.3	38.8	36.5	33.0	30.2	23.7	18.6	13.9	
2009	98.4	9	1474.7	121.0	58.7	38.1	32.7	25.0	19.9	14.8	
2010	98.9	0	42.1	39.1	35.6	30.6	26.6	21.4	16.9	12.9	
2011	99.2	7	65.2	55.8	49.0	38.1	30.7	23.1	18.1	13.6	
2012	98.6	1	52.4	36.6	35.1	31.7	27.6	21.8	16.9	13.4	
2013	99.5	4	69.4	50.8	39.0	32.3	28.0	21.6	17.1	13.0	
2014	98.9	0	40.0	36.8	34.0	30.3	26.6	21.3	17.1	13.5	
2015	98.1	1	64.6	46.0	32.2	29.4	26.3	21.7	16.3	12.7	
2016	99.2	1	63.5	43.5	35.1	30.7	27.9	22.2	17.1	12.7	
2017	99.5	4	63.0	51.3	42.7	33.9	30.0	24.1	18.2	14.3	

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 118 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Liverpool**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	92.9	1	53.8	36.2	33.6	30.1	26.6	21.7	16.9	12.2	
2009	93.7	8	1579.8	114.8	59.5	38.8	31.7	25.1	18.4	14.3	
2010	97.3	0	41.1	35.3	33.0	29.9	26.2	20.4	16.2	12.0	
2011	69.0	1	68.8	46.1	37.5	33.1	27.7	21.7	16.9	13.0	
2012	97.0	0	42.5	39.3	37.7	35.1	30.8	24.4	18.8	13.7	
2013	97.5	3	98.5	45.3	40.3	36.8	31.9	26.3	19.5	14.2	
2014	97.5	0	40.8	39.2	36.6	32.9	30.1	23.7	17.9	13.6	
2015	95.1	1	68.6	35.6	34.1	31.0	28.3	22.9	17.2	12.8	
2016	99.5	3	68.7	39.8	36.4	33.0	30.3	25.1	18.7	13.0	
2017	98.9	2	74.0	42.4	38.4	35.0	31.3	25.0	19.7	15.3	

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 119 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Oakdale**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	96.7	1	68.2	33.9	31.0	27.0	21.3	15.5	10.7	7.2	
2009	91.2	6	1528.3	130.2	48.4	30.6	25.5	19.5	12.7	7.5	
2010	99.5	0	33.3	29.3	27.9	23.3	18.1	13.4	9.2	6.6	
2011	99.5	1	54.7	28.1	24.9	21.3	17.3	13.1	9.6	6.9	
2012	98.9	0	38.9	33.4	28.2	24.0	19.8	14.9	10.2	6.9	
2013	100	4	99.0	70.3	31.6	27.7	22.5	16.8	11.3	7.9	
2014	98.4	1	56.3	32.7	31.3	24.9	21.9	16.5	11.3	8.4	
2015	98.9	1	61.7	29.7	27.3	22.4	20.0	14.5	10.0	7.2	
2016	96.4	5	75.9	56.9	27.4	23.5	21.0	15.0	10.5	7.1	
2017	98.6	0	46.8	29.3	26.1	22.3	19.6	15.0	10.9	7.9	

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Table 120 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Prospect

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	88.5	0	41.8	39.6	35.0	32.6	27.5	21.0	16.4	12.8
2009	96.4	11	1680.3	135.3	60.7	38.9	32.3	24.1	18.2	13.5
2010	97.5	0	40.1	31.7	30.1	26.7	22.8	18.7	14.9	11.2
2011	93.2	0	41.5	36.2	31.7	27.4	24.3	19.3	15.1	10.9
2012	94.3	0	38.7	34.8	33.8	29.3	26.5	20.5	16.3	13.0
2013	94.5	4	81.8	51.2	43.4	33.8	30.0	23.3	17.6	13.3
2014	93.4	0	44.3	35.4	34.3	30.2	25.6	21.1	16.8	12.7
2015	95.1	1	68.7	39.8	34.1	29.9	26.2	21.1	16.8	12.8
2016	98.9	4	110.1	51.2	38.0	33.8	29.7	23.1	17.6	12.5
2017	98.4	1	61.1	37.9	36.2	32.0	28.1	22.5	17.7	14.5

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 121 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Richmond**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	98.4	0	39.0	30.9	28.3	24.9	20.2	16.0	11.9	9.1
2009	95.9	6	1637.3	121.7	46.1	32.9	28.0	19.4	13.4	9.6
2010	96.2	0	37.0	30.2	26.9	24.6	20.6	15.9	12.0	9.2
2011	98.9	0	46.2	32.3	29.7	25.3	21.3	15.9	11.8	8.9
2012	95.9	3	99.2	43.7	33.8	28.6	24.8	17.6	12.9	10.2
2013	97.8	5	104.6	69.9	45.9	35.7	27.8	20.4	14.6	11.1
2014	96.7	0	40.0	34.5	32.7	26.4	23.7	19.2	14.2	10.7
2015	96.7	0	49.3	32.2	27.3	25.6	21.8	16.1	12.0	8.2
2016	96.2	2	102.8	44.5	35.5	31.1	26.2	19.3	14.6	10.2
2017	95.9	1	51.5	37.9	33.4	29.3	25.5	19.4	14.5	11.2

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 122 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Rozelle**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	96.4	0	43.1	34.0	32.6	28.7	26.0	20.6	16.7	12.9
2009	95.3	8	1562.8	128.5	55.8	36.1	31.0	24.3	17.8	13.1
2010	98.9	0	37.6	31.1	29.3	26.8	24.3	19.6	15.6	12.1
2011	98.4	0	39.4	34.7	32.3	27.2	24.5	20.5	15.7	12.0
2012	99.5	0	40.7	35.4	32.1	29.4	25.6	20.3	15.7	12.3
2013	96.7	3	58.5	42.9	39.5	33.6	29.3	21.9	16.6	12.5
2014	96.7	0	43.8	39.4	37.7	30.4	26.6	21.4	16.9	12.8
2015	96.4	1	60.3	37.1	32.6	29.5	25.5	20.4	15.4	11.9
2016	98.4	1	58.8	35.0	32.3	29.6	26.9	20.9	15.8	11.0
2017	98.6	1	54.1	43.0	35.4	31.2	27.8	21.5	16.3	13.2

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Table 123 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Wyong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2012	19.9	0	37.4	37.2	35.4	31.3	30.4	26.9	21.7	17.1
2013	98.6	1	70.2	40.8	36.9	32.4	28.6	20.3	14.3	10.4
2014	98.6	0	41.9	37.4	35.2	28.0	24.2	18.4	13.7	10.1
2015	98.9	1	58.6	34.5	33.0	27.0	24.4	18.3	13.0	10.2
2016	98.4	0	46.0	33.6	32.1	27.5	25.2	19.1	13.6	9.6
2017	98.4	1	63.4	36.0	32.7	29.5	25.5	19.9	14.3	10.7

AAQ NEPM standard: 50.0 $\mu\text{g}/\text{m}^3$ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 124 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Albion Park South**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	97.0	1	96.1	40.0	35.3	29.7	25.2	18.2	13.0	9.4
2009	99.5	9	1359.6	73.0	50.7	38.0	31.6	22.8	15.4	10.1
2010	96.7	0	41.8	37.2	35.6	29.0	24.7	18.4	11.6	8.6
2011	98.9	1	51.0	34.9	31.6	27.2	23.5	17.0	11.9	8.6
2012	98.4	0	43.9	36.0	32.7	26.9	22.9	16.7	11.9	8.6
2013	96.7	2	69.0	45.4	40.8	32.7	25.1	17.6	12.6	8.7
2014	99.7	0	48.3	39.7	35.9	30.0	25.9	20.0	15.1	10.8
2015	95.1	0	41.2	38.1	33.4	27.8	22.2	17.6	12.5	8.9
2016	98.4	0	43.1	36.7	33.8	30.4	25.7	19.5	12.9	9.0
2017	98.9	0	44.6	40.6	34.9	30.6	26.1	19.2	13.0	10.2

AAQ NEPM standard: 50.0 $\mu\text{g}/\text{m}^3$ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 125 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Kembla Grange**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	98.6	4	100.8	52.8	42.0	33.3	30.3	23.4	16.7	11.1
2009	99.2	14	1174.0	134.4	67.0	42.5	34.0	25.5	18.0	11.5
2010	98.6	0	47.5	42.7	39.5	33.4	28.4	22.7	16.2	11.7
2011	98.9	1	55.5	45.9	39.7	33.6	29.1	21.1	15.0	9.9
2012	98.4	3	57.2	45.5	42.6	37.1	29.7	23.7	16.5	11.9
2013	99.7	4	102.2	56.0	46.7	37.4	31.2	23.0	15.9	11.9
2014	98.1	1	99.2	41.5	36.9	32.6	27.5	21.3	16.4	11.6
2015	99.2	1	62.8	45.0	42.1	34.5	28.7	22.1	16.5	11.2
2016	99.2	4	56.3	50.7	45.7	39.0	33.2	26.0	18.2	12.6
2017	98.4	4	67.7	55.5	45.4	38.9	33.1	24.8	18.1	14.4

AAQ NEPM standard: 50.0 $\mu\text{g}/\text{m}^3$ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Table 126 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Wollongong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	94.5	1	78.3	41.0	36.8	31.2	28.7	21.5	16.3	12.1	
2009	95.9	6	1145.4	107.0	49.5	40.3	34.7	24.5	18.8	12.6	
2010	95.1	0	49.6	44.2	40.2	31.9	28.3	22.4	15.8	12.1	
2011	96.7	0	48.5	42.4	37.7	32.6	26.3	21.0	15.8	11.4	
2012	98.6	0	47.5	38.2	36.1	33.4	28.8	22.8	16.5	12.2	
2013	98.9	6	93.8	54.1	49.3	37.2	29.7	20.9	15.3	10.5	
2014	99.7	0	45.3	40.9	37.9	34.8	29.7	21.6	16.0	12.0	
2015	99.2	0	45.8	38.1	37.1	32.3	27.4	21.6	15.3	10.8	
2016	98.6	2	52.9	46.5	42.1	36.1	29.9	22.5	15.4	10.4	
2017	98.4	1	55.2	46.3	42.8	35.4	30.5	23.6	15.2	11.8	

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 127 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Beresfield**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	99 th	98 th	95 th	90 th	75 th	50 th	
2008	95.4	5	59.9	52.5	38.3	32.3	27.3	21.5	16.9	13.4	
2009	98.6	15	1999.0	174.3	70.6	47.7	35.3	26.2	18.4	14.2	
2010	97.0	0	50.0	37.7	32.1	28.3	24.7	20.0	15.4	12.3	
2011	95.1	0	42.8	39.9	35.8	29.3	25.5	21.3	16.1	12.5	
2012	99.2	1	50.8	47.4	44.1	39.2	32.4	25.8	19.6	15.2	
2013	95.9	5	55.3	52.4	44.3	38.0	34.5	26.5	19.1	14.8	
2014	95.3	0	45.4	42.0	39.4	33.9	30.0	23.3	18.3	13.9	
2015	97.8	2	64.9	42.2	36.4	32.4	28.4	22.8	17.8	13.1	
2016	99.2	0	48.0	39.3	36.4	32.5	29.9	23.4	17.7	13.8	
2017	98.9	0	49.4	40.8	37.1	33.4	29.2	23.7	18.6	14.2	

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 128 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Newcastle**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	93.2	2	54.4	44.2	39.6	34.4	31.4	24.8	19.1	15.1	
2009	93.2	13	2426.8	119.5	71.2	44.9	37.0	28.1	22.3	16.5	
2010	96.2	1	57.1	38.7	34.7	30.3	27.3	23.1	17.9	13.7	
2011	99.5	0	49.2	42.6	38.7	32.4	29.6	24.0	18.2	13.6	
2012	98.9	0	48.7	43.3	41.8	36.2	32.5	26.0	18.8	14.4	
2013	98.9	4	69.0	50.5	48.3	41.9	37.4	27.8	20.5	15.2	
2014	98.6	2	53.7	48.1	40.5	35.7	31.8	25.6	20.5	15.8	
2015	98.6	3	70.4	47.0	42.3	37.2	32.9	26.5	20.2	15.1	
2016	97.5	1	89.1	43.1	41.1	36.9	34.3	27.1	20.8	15.2	
2017	98.6	1	55.0	46.3	44.3	36.3	32.5	26.7	20.8	17.2	

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard

Table 129 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Albury

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	96.4	8	124.8	67.8	53.5	40.2	29.7	20.7	14.3	9.9
2009	96.7	15	249.7	144.0	102.0	39.0	28.5	19.3	14.0	10.1
2010	99.5	2	60.8	45.1	31.6	24.1	19.4	14.6	11.2	8.6
2011	90.7	0	28.0	25.2	23.7	19.9	17.9	14.5	11.9	9.2
2012	92.1	1	54.4	38.7	32.3	25.8	21.3	16.7	12.8	10.2
2013	98.6	2	59.2	47.8	42.5	30.7	26.4	18.8	13.6	10.4
2014	98.9	5	159.6	88.2	37.8	29.4	22.8	17.4	13.4	10.5
2015	95.6	2	92.5	35.4	30.2	26.0	23.3	17.5	13.0	10.1
2016	98.6	1	51.0	47.2	43.5	32.4	25.6	18.7	13.1	9.3
2017	97.5	0	48.8	37.8	33.4	28.6	24.2	19.3	14.7	11.5

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 130 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Bathurst**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	94.8	1	63.0	40.8	35.9	28.8	24.1	16.9	12.3	8.8
2009	97.8	12	2114.4	122.4	69.8	36.9	26.8	20.3	13.8	9.0
2010	98.6	0	43.3	32.6	26.7	21.2	18.5	12.5	7.9	5.0
2011	97.3	0	24.3	23.2	21.1	18.6	17.5	13.8	10.3	7.8
2012	99.5	2	55.5	31.0	28.1	24.2	21.3	16.4	12.2	9.2
2013	99.7	3	145.0	46.9	43.7	32.4	25.3	17.3	12.7	9.4
2014	98.6	0	42.8	37.8	36.0	29.4	25.1	18.2	12.8	9.2
2015	99.5	2	94.6	39.5	32.9	28.7	22.3	16.1	11.7	8.5
2016	93.2	0	34.1	31.8	29.7	25.9	23.6	17.5	11.6	8.0
2017	97.3	0	49.9	37.3	30.3	24.9	21.2	16.9	12.8	9.9

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 131 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Tamworth**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	85.8	3	100.4	52.0	40.7	30.5	23.8	18.7	14.0	10.5
2009	96.7	17	1791.4	235.9	120.7	47.0	33.8	22.8	15.7	11.4
2010	98.4	0	29.1	26.5	24.6	21.8	18.4	14.7	11.2	8.3
2011	96.7	1	50.9	34.0	27.4	22.4	19.2	15.8	12.3	9.1
2012	98.9	1	55.1	47.0	38.0	27.8	24.3	19.5	14.3	10.7
2013	98.4	0	47.5	43.8	35.9	30.7	27.0	20.4	15.2	11.3
2014	99.5	1	66.6	36.5	34.5	27.6	24.7	19.3	14.9	10.9
2015	98.9	1	52.7	30.9	29.1	24.7	22.2	17.1	12.9	10.2
2016	99.2	1	51.7	32.2	30.1	27.0	23.1	18.6	14.6	11.0
2017	99.2	2	54.1	37.1	33.7	27.1	22.5	18.5	14.0	10.7

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Table 132 Statistical summary for PM₁₀: 24-hour average concentrations. Station: Wagga Wagga/Wagga Wagga North*

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	93.7	23	294.9	70.6	62.6	53.2	45.1	28.4	21.0	14.5
2009	82.5	21	297.4	214.4	112.3	55.9	46.2	30.6	19.8	12.4
2010	97.0	6	64.9	52.1	48.5	38.7	29.0	21.5	15.4	10.0
2011	42.7	1	56.3	40.9	33.0	28.4	24.9	20.6	15.4	11.2
2012	98.4	1	67.2	46.5	43.1	37.4	32.6	23.1	16.6	12.4
2013	98.9	15	110.7	67.9	57.8	47.2	40.5	27.9	18.9	12.8
2014	96.4	13	88.2	59.3	55.1	44.9	36.8	25.5	18.3	12.5
2015	98.4	7	145.1	72.4	51.3	42.3	34.2	24.8	17.2	11.3
2016	98.9	16	114.7	66.8	57.7	48.2	39.9	27.2	17.5	10.0
2017	98.4	10	171.6	61.5	53.2	42.5	33.3	25.7	17.9	12.2

AAQ NEPM standard: 50.0 µg/m³ (24-hour average)

* Replaced the Wagga Wagga station in October 2011.

Bold font indicates values that exceed the AAQ NEPM standard.

Particles as PM_{2.5}

The current USEPA-approved (United States Environmental Protection Agency) method for PM_{2.5} compliance monitoring (also known as the Federal Reference Method, FRM) is a non-continuous (batch), one-day-in-three technique that requires pre- and post-laboratory weighing. As this involves a substantial delay in acquiring and reporting data, jurisdictions use continuous monitoring techniques for near-real-time reporting of air quality (e.g. by using TEOM or BAM monitors).

The Federal government's PM_{2.5} AAQ NEPM variation requires the reporting of all PM_{2.5} data, including the compliance method (FRM) and the continuous monitoring technique used.

Pre-2010 PM_{2.5} data reporting

In all PM_{2.5} reporting by NSW before 2010, continuous TEOM PM_{2.5} data were recorded with the internal USEPA PM₁₀ equivalency factors applied (of $A = 3$ and $B = 1.03$ where $y = A + Bx$). During 2010, all PM_{2.5} data was recalculated by removing the PM₁₀ equivalency factor (i.e., now $A = 0$ and $B = 1$). This approach harmonised NSW reporting of PM_{2.5} with that of other Australian jurisdictions. All data included in this report, for all years, do not have any equivalency factors applied.

Post-2012 PM_{2.5} monitoring technique

During 2012, there was staggered replacement of continuous TEOM PM_{2.5} monitors with a USEPA-equivalent method, namely Beta Attenuation Monitors (BAMs). The BAM method differs from TEOM in terms of sample treatment, using lower temperatures intermittently to reduce moisture levels in the sample stream. This is intended to promote greater retention of volatile components adsorbed to the fine particulate matter.

Statistical summary for 2017 (BAM method)

Table 133 Statistical summary for PM_{2.5}: 24-hour average concentrations (2017) – continuous BAM method.

Region/ monitoring station	Data availability rate (%)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)						
			99 th	98 th	95 th	90 th	75 th	50 th	25 th
Sydney									
Bringelly	94.5	52.5	21.9	17.8	15.3	12.4	9.1	6.4	4.7
Camden	96.7	27.7	19.5	17.5	13.1	10.8	8.2	6.0	4.3
Campbelltown West	95.3	25.0	16.9	15.9	12.8	11.0	9.0	7.0	5.1
Chullora	97.3	44.6	33.6	26.4	20.1	14.7	10.9	8.3	6.3
Earlwood	99.5	50.9	20.7	18.7	15.2	12.0	9.0	6.4	4.3
Liverpool	95.3	56.4	25.2	20.9	16.6	14.1	10.9	8.0	5.9
Oakdale	94.8	25.5	16.3	13.9	11.0	9.2	7.7	5.4	4.0
Prospect	97.0	30.1	24.6	20.6	15.7	11.7	9.3	6.9	4.9
Richmond	93.2	34.3	24.9	20.7	14.3	11.6	8.5	6.2	4.3
Rozelle	97.5	36.3	19.6	16.8	13.5	11.3	9.0	6.4	4.6
St Marys	98.6	38.2	24.4	21.5	13.1	10.8	8.3	6.2	4.6
Central Coast									
Wyong	97.8	27.2	17.9	14.2	10.5	9.1	7.1	5.2	4.1
Illawarra									
Albion Park South	85.8	19.3	15.5	14.0	11.3	10.5	8.1	6.0	4.5
Kembla Grange	93.2	21.3	17.3	15.2	12.8	11.0	8.6	6.2	4.5
Wollongong	94.8	24.7	16.4	15.6	13.4	11.5	8.8	6.5	4.6
Lower Hunter									
Beresfield	98.6	18.7	16.7	15.5	13.8	11.8	9.4	7.0	5.2
Newcastle	97.3	18.0	16.9	15.4	12.8	11.8	9.2	6.8	5.2
Wallsend	98.6	20.4	17.1	15.6	13.7	11.7	9.4	6.7	4.8
Regional									
Albury	85.5	18.7	17.7	16.9	14.8	13.1	9.5	6.3	4.4
Bathurst	97.3	17.5	13.1	12	10.1	9.2	7.7	6	4.2
Tamworth	94.8	21.6	17.2	15.7	14.3	12.9	9.9	7.2	5.1
Wagga Wagga North	98.1	32.5	27	22.8	18.3	14.4	10.1	6.7	4.7

AAQ NEPM standard: 25.0 $\mu\text{g}/\text{m}^3$ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

Trend analysis (TEOM and BAM methods)

PM_{2.5} TEOM 24-hour daily and annual averages provided in NEPM reports from 2009 onwards will differ from those reported previously, as the USEPA PM₁₀ equivalence factors have been removed from all TEOM PM_{2.5} data values; in reports published before 2009 these factors were included. Annual maximum 24-hour averages and annual averages for all stations are given below.

Table 134 Annual maximum 24-hour average concentrations for PM_{2.5} (µg/m³): continuous TEOM and BAM* methods.

Region/ monitoring station	2008	2009	2010	2011	2012	2013*	2014*	2015*	2016*	2017*
Sydney										
Bringelly	--	--	--	--	--	--	--	--	21.6	52.5
Camden	--	--	--	--	19.5	61.9	18.5	25.0	36.0	27.7
Campbelltown West	--	--	--	--	--	--	--	15.7	35.8	25.0
Chullora	19.5	183.2	24.2	23.9	23.4	49.1	23.1	37.2	49.4	44.6
Earlwood	18.2	186.7	22.5	23.6	20.7	37.3	22.7	28.0	33.3	50.9
Liverpool	32.2	268.1	21.8	38.0	24.9	73.8	24.3	32.2	50.8	56.4
Oakdale	--	--	--	--	--	--	--	--	12.6	25.5
Prospect	--	--	--	--	--	--	14.0	29.6	84.9	30.1
Richmond	17.7	148.9	20.8	42.9	116.7	68.0	24.7	24.5	83.4	34.3
Rozelle	--	--	--	--	--	--	--	33.4	49.4	36.3
St Marys	--	--	--	--	--	--	--	--	93.2	38.2
Central Coast										
Wyong	--	--	--	--	14.7	55.8	19.7	13.2	19.8	27.2
Illawarra										
Albion Park South	--	--	--	--	--	--	--	21.1	30.7	19.3
Kembla Grange	--	--	--	--	--	--	--	23.8	32.0	21.3
Wollongong	14.6	241	23.5	17.7	15.6	88.4	17.3	31.6	33.7	24.7
Lower Hunter										
Beresfield	16.9	230.8	25.9	18.8	22.4	40.8	19.0	25.9	27.9	18.7
Newcastle	--	--	--	--	--	15.4	21.2	28.4	66.1	18.0
Wallsend	22.8	415.6	18.8	16.2	16.2	37.0	18.0	24.0	50.7	20.4
Regional										
Albury	--	--	--	--	--	--	--	--	--	18.7
Bathurst	--	--	--	--	--	--	--	--	15.0	17.5
Tamworth	--	--	--	--	--	--	--	--	17.6	21.6
Wagga Wagga North	--	--	--	15.4	23.2	29.9	27.6	24.2	28.1	32.5

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

* BAM data

Table 135 Annual average concentrations for PM_{2.5} (µg/m³) – continuous TEOM and BAM* methods.

Region/ monitoring station	2008	2009	2010	2011	2012	2013*	2014*	2015*	2016*	2017*
Sydney										
Bringelly	--	--	--	--	--	--	--	--	7.6	7.5
Camden	--	--	--	--	7.8	6.5	6.3	6.2	6.4	6.7
Campbelltown West	--	--	--	--	--	--	--	7.9	7.9	7.4
Chullora	5.9	7.1	5.7	5.9	6.0	8.4	9.0	8.0	8.0	9.5
Earlwood	5.5	6.8	5.7	5.4	5.6	7.9	7.8	8.5	8.1	7.3
Liverpool	6.5	8.3	6.3	5.9	8.5	9.4	8.6	8.5	8.7	8.9
Oakdale	--	--	--	--	0.0	--	--	--	7.9	6.0
Prospect	--	--	--	--	--	--	7.5	8.2	8.7	7.7
Richmond	7.3	5.7	4.2	4.7	5.3	8.3	6.7	7.7	7.9	7.0
Rozelle	--	--	--	--	--	--	--	7.2	7.4	7.2
St Marys	--	--	--	--	--	--	--	--	7.8	7.0
Central Coast										
Wyong	--	--	--	--	7.3	6.7	5.5	5.2	5.7	5.8
Illawarra										
Albion Park South	--	--	--	--	--	--	--	6.4	7.2	6.6
Wollongong	--	--	--	--	--	--	--	6.7	6.6	6.9
Kembla Grange	5.3	7.1	5.1	4.6	4.6	7.7	7.0	7.6	7.4	7.1
Lower Hunter										
Beresfield	6.0	8.5	6.0	5.5	7.9	8.2	7.5	7.3	7.4	7.6
Newcastle	--	--	--	--	--	8.7	8.1	7.8	7.8	7.4
Wallsend	5.9	8.1	4.6	4.8	5.1	7.7	6.7	7.3	8.0	7.3
Regional										
Albury	--	--	--	--	--	--	--	--	--	7.3
Bathurst	--	--	--	--	--	--	--	--	5.9	6.1
Tamworth	--	--	--	--	--	--	--	-	7.6	7.8
Wagga Wagga North	--	--	--	7.0	8.7	7.9	7.5	7.6	7.4	8.1

AAQ NEPM standard: 8.0 µg/m³ (annual average)**Bold** font indicates values that exceed the AAQ NEPM standard.

* BAM data

Statistical summaries for multiple years, by station: TEOM and BAM methods

Table 136 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Bringelly

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2016	47.5	0	21.6	17.4	14.8	13.2	12.0	9.6	7.1	5.4	
2017	94.5	2	52.5	21.9	17.8	15.3	12.4	9.1	6.4	4.7	

AAQ NEPM standard: 25.0 $\mu\text{g}/\text{m}^3$ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

Table 137 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Camden

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2012	20.8	0	19.5	19.4	18.1	13.2	11.6	9.5	7.8	5.3	
2013	99.7	3	61.9	24.8	16.7	13.2	10.9	8.0	5.5	3.8	
2014	98.6	0	18.5	15.4	14.0	12.4	10.6	8.1	5.8	3.9	
2015	98.4	0	25.0	17.3	13.4	11.2	10.2	7.9	5.8	3.8	
2016	94.3	3	36.0	17.2	13.4	11.2	10.1	8.0	5.9	4.1	
2017	96.7	2	27.7	19.5	17.5	13.1	10.8	8.2	6.0	4.3	

AAQ NEPM standard: 25.0 $\mu\text{g}/\text{m}^3$ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

Table 138 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Campbelltown West

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2015	20.3	0	15.7	15.6	15.2	13.4	11.9	10.2	7.3	5.5	
2016	95.1	3	35.8	26.0	17.0	14.0	12.3	9.6	7.2	5.3	
2017	95.3	0	25.0	16.9	15.9	12.8	11.0	9.0	7.0	5.1	

AAQ NEPM standard: 25.0 $\mu\text{g}/\text{m}^3$ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

Table 139 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Chullora

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	96.7	0	19.5	16.8	14.5	12.1	9.9	7.6	5.4	3.7
2009	98.6	3	183.2	19.4	17.3	14.1	11.3	8.5	5.9	3.9
2010	93.7	0	24.2	19.2	15.4	11.9	10.0	7.3	5.0	3.4
2011	98.9	0	23.9	18.6	16.2	12.3	10.8	7.6	5.2	3.4
2012	97.0	0	23.4	17.6	14.5	12.1	9.9	7.5	5.3	3.7
2013	98.6	3	49.1	22.4	19.9	15.9	13.6	10.6	7.2	5.3
2014	89.0	0	23.1	20.5	18.3	16.3	14.1	10.9	8.2	6.2
2015	96.4	1	37.2	16.8	15.3	14.4	12.5	9.7	7.4	5.6
2016	96.2	5	49.4	28.5	19.2	14.3	12.7	9.6	7.1	5.3
2017	97.3	8	44.6	33.6	26.4	20.1	14.7	10.9	8.3	6.3

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard)

*TEOM was replaced by BAM on 14/12/2012.

Table 140 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous TEOM and BAM* methods. Station: Earlwood

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	98.4	0	18.2	15.9	14.7	11.3	9.7	7.2	4.9	3.3
2009	75.6	1	186.7	22.5	18.9	13.9	11.3	8.2	5.3	3.4
2010	95.6	0	22.5	16.7	14.2	11.4	9.9	7.3	5.0	3.4
2011	96.2	0	23.6	18.4	15.8	12.7	10.5	6.9	4.5	2.8
2012	98.9	0	20.7	17.4	14.5	11.8	10.3	7.3	4.6	3.2
2013	91.2	4	37.3	27.4	20.8	16.6	13.5	9.8	6.6	4.7
2014	97.3	0	22.7	18.1	17.4	14.5	12.9	9.7	7.1	5.2
2015	93.4	2	28.0	22.9	20.4	16.4	14	10.8	7.7	5.6
2016	95.6	5	33.3	28.5	21.9	15.9	13.4	10.0	6.8	5.0
2017	99.5	2	50.9	20.7	18.7	15.2	12.0	9.0	6.4	4.3

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

*TEOM was replaced by BAM on 19/12/2012.

Table 141 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Liverpool

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	92.3	1	32.2	16.	14.8	12.2	10.6	8.4	5.8	4.0	
2009	94.5	3	268.1	25.	19.9	14.9	12.9	9.7	6.7	4.5	
2010	95.9	0	21.8	17.	15.6	13.2	11.0	8.1	5.6	3.9	
2011	99.2	2	38.0	20.	16.2	14.0	10.9	7.4	4.9	3.1	
2012	85.8	0	24.9	21.	19.5	15.2	13.9	10.8	7.6	5.7	
2013	93.2	2	73.8	24.	22.1	18.7	16.0	11.7	8.1	5.8	
2014	97.0	0	24.3	20.	19.1	16.1	14.4	10.8	7.6	5.7	
2015	94.2	2	32.2	22.	20.8	17.1	14.0	10.8	7.3	5.5	
2016	95.6	4	50.8	31.	20.9	15.6	13.4	10.9	7.6	5.7	
2017	95.3	3	56.4	25.	20.9	16.6	14.1	10.9	8.0	5.9	

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

*TEOM was replaced by BAM on 2/3/2012.

Table 142 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Oakdale

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2016	7.7	0	12.6	12.6	12.6	11.7	10.4	9.1	7.5	6.7	
2017	94.8	1	25.5	16.3	13.9	11.0	9.2	7.7	5.4	4.0	

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

Table 143 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Prospect

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2014	6.6	0	14.0	14.0	14.0	12.4	10.8	8.8	6.9	5.7	
2015	92.6	1	29.6	21.3	19.2	15.6	13.5	10.0	7.3	5.6	
2016	98.6	5	84.9	38.7	23.5	17.9	14.0	10.1	7.2	5.2	
2017	97.0	3	30.1	24.6	20.6	15.7	11.7	9.3	6.9	4.9	

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard.

Table 144 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous TEOM and BAM* methods. Station: Richmond

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2008	98.9	0	17.7	15.6	13.8	12.3	10.5	8.6	6.8	5.6	
2009	89.3	2	148.9	22.1	15.6	11.5	9.9	6.7	4.4	2.8	
2010	97.3	0	20.8	14.3	12.3	9.4	7.9	5.7	3.5	2.1	
2011	97.8	2	42.9	22.7	15.7	10.6	8.6	6.2	3.7	2.2	
2012	94.3	2	116.7	18.0	14.8	11.0	9.4	6.7	4.1	2.6	
2013	95.1	14	68.0	40.8	31.4	24.3	14.8	9.9	6.0	4.2	
2014	95.9	0	24.7	18.1	16.4	13.3	11.5	8.4	6.0	4.4	
2015	92.6	0	24.5	23.4	18.2	15.0	13.1	9.6	6.9	5.0	
2016	94.5	6	83.4	35.4	21.9	15.6	12.5	9.4	6.7	4.7	
2017	93.2	3	34.3	24.9	20.7	14.3	11.6	8.5	6.2	4.3	

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

*TEOM was replaced by BAM on 7/9/2012.

Table 145 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Rozelle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2015	77.5	1	33.4	18.8	17.0	13.7	11.9	8.9	6.3	4.7	
2016	97.8	5	49.4	29.0	22.8	14.4	12.0	8.8	6.4	4.5	
2017	97.5	2	36.3	19.6	16.8	13.5	11.3	9.0	6.4	4.6	

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 146 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: St Marys**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2016	77.0	5	93.2	49.5	23.6	13.7	11.5	9.1	6.5	4.6	
2017	98.6	3	38.2	24.4	21.5	13.1	10.8	8.3	6.2	4.6	

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Table 147 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Wyong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2012	19.7	0	14.7	14.7	14.6	12.5	11.4	9.0	6.9	4.8	
2013	94.2	1	55.8	20.7	16.7	12.6	11.0	8.1	5.8	4.1	
2014	96.2	0	19.7	14.6	13.1	10.8	8.9	6.5	4.9	3.7	
2015	97.3	0	13.2	11.7	10.6	9.1	8.0	6.4	4.8	3.6	
2016	97.3	0	19.8	13.9	13.0	10.9	9.4	7.1	5.3	3.9	
2017	97.8	1	27.2	17.9	14.2	10.5	9.1	7.1	5.2	4.1	

AAQ NEPM standard: 25.0 $\mu\text{g}/\text{m}^3$ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 148 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Albion Park South**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2015	78.4	0	21.1	16.9	15.3	13.0	11.1	7.8	5.4	4.1	
2016	89.3	2	30.7	18.2	15.8	13.1	11.2	8.7	6.5	4.9	
2017	85.8	0	19.3	15.5	14.0	11.3	10.5	8.1	6.0	4.5	

AAQ NEPM standard: 25.0 $\mu\text{g}/\text{m}^3$ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 149 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Kembla Grange**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum ($\mu\text{g}/\text{m}^3$)	Percentile ($\mu\text{g}/\text{m}^3$)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2015	72.9	0	23.8	15.5	14.7	12.7	10.9	8.4	6.3	4.4	
2016	96.4	2	32.0	17.8	15.1	12.6	10.7	8.1	5.9	4.2	
2017	93.2	0	21.3	17.3	15.2	12.8	11.0	8.6	6.2	4.5	

AAQ NEPM standard: 25.0 $\mu\text{g}/\text{m}^3$ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Table 150 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous TEOM and BAM* methods. Station: Wollongong

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	94.0	0	14.6	14.2	13.0	10.7	9.3	7.1	4.8	3.0
2009	96.2	3	241.0	23.0	19.3	14.9	12.1	8.2	5.6	3.4
2010	92.1	0	23.5	15.0	13.8	11.2	9.3	6.4	4.2	3.0
2011	96.4	0	17.7	16.0	14.1	11.2	8.8	6.4	3.8	2.4
2012	98.1	0	15.6	13.7	13.1	10.6	8.3	5.9	4.0	2.4
2013	94.8	4	88.4	28.8	21.5	15.5	12.8	9.2	6.4	4.6
2014	92.1	0	17.3	15.9	14.9	13.1	11.8	9.1	6.4	4.6
2015	81.6	1	31.6	18.9	16.3	14.2	12.6	9.5	6.9	4.9
2016	91.0	3	33.7	22.7	18.4	15.3	11.8	9.2	6.6	4.9
2017	94.8	0	24.7	16.4	15.6	13.4	11.5	8.8	6.5	4.6

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

*TEOM was replaced by BAM on 5/12/2012.

Table 151 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous TEOM and BAM* methods. Station: Beresfield

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	91.5	0	16.9	15.	14.1	11.8	9.9	7.7	5.7	3.7
2009	93.7	5	230.8	34.	21.5	16.3	13.6	9.7	6.7	4.8
2010	97.3	1	25.9	15.	13.6	11.6	9.9	7.4	5.4	3.9
2011	99.2	0	18.8	15.	13.5	11.0	9.7	7.0	4.9	3.2
2012	93.4	0	22.4	21.	18.1	14.4	12.7	9.9	7.1	5.3
2013	94.2	2	40.8	23.	20.4	15.9	13.3	10.3	7.2	5.1
2014	96.2	0	19.0	17.	16.3	13.9	12.1	9.4	6.9	5.0
2015	93.7	1	25.9	19.	16.5	13.4	12.4	9.3	6.6	4.7
2016	97.5	1	27.9	17.	15.9	13.6	11.7	9.4	7.0	4.8
2017	98.6	0	18.7	16.	15.5	13.8	11.8	9.4	7.0	5.2

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

*TEOM was replaced by BAM on 29/11/2012.

Table 152 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Newcastle

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2013	3.3	0	15.4	15.4	15.4	15.4	15.3	13.2	8.8	3.9
2014	95.1	0	21.2	20.0	17.3	15.6	13.3	10.3	7.4	5.6
2015	93.2	1	28.4	19.5	17.3	15.4	13.0	9.5	7.2	5.1
2016	95.6	1	66.1	17.6	15.9	14.3	11.9	9.5	7.1	5.0
2017	97.3	0	18.0	16.9	15.4	12.8	11.8	9.2	6.8	5.2

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Table 153 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous TEOM and BAM¹ methods. Station: Wallsend

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	87.2	0	22.8	18.3	14.8	12.1	10.2	7.5	5.3	3.4
2009	88.8	5	415.6	39.7	21.0	14.5	12.5	8.4	5.6	3.9
2010	92.6	0	18.8	11.9	10.7	9.2	7.4	5.7	4.2	3.1
2011	100	0	16.2	13.9	12.3	10.9	8.8	6.2	4.2	2.7
2012	99.5	0	16.2	14.2	13.1	11.3	9.1	6.4	4.3	3.1
2013	96.2	6	37.0	29.1	22.5	16.6	13.1	9.6	6.2	4.5
2014	96.2	0	18.0	15.2	13.6	12.3	10.1	8.5	6.3	4.6
2015	95.9	0	24.0	21.9	17.2	14.2	12.3	9.3	6.3	4.6
2016	91.0	1	50.7	19.6	16.7	14.4	12.6	9.9	7.5	5.4
2017	98.6	0	20.4	17.1	15.6	13.7	11.7	9.4	6.7	4.8

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.¹TEOM was replaced by BAM on 21/2/2012.**Table 154 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Albury**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2017	85.5	0	18.7	17.7	16.9	14.8	13.1	9.5	6.3	4.4

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 155 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Bathurst**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2016	64.8	0	15.0	14.5	12.2	10.0	8.8	7.7	5.8	4.1
2017	97.3	0	17.5	13.1	12.0	10.1	9.2	7.7	6.0	4.2

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.**Table 156 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Tamworth**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2016	74.9	0	17.6	16.7	15.8	14.5	12.2	9.7	7.1	5.2
2017	94.8	0	21.6	17.2	15.7	14.3	12.9	9.9	7.2	5.1

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Table 157 Statistical summary for PM_{2.5}: 24-hour average concentrations – continuous BAM method. Station: Wagga Wagga North

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)							
				99 th	98 th	95 th	90 th	75 th	50 th	25 th	
2011	42.5	0	15.4	15.1	14.2	12.4	10.9	8.8	6.4	4.8	
2012	85.8	0	23.2	22.4	21.8	17.9	14.9	11.4	7.5	5.1	
2013	98.9	3	29.9	24.3	20.7	16.2	14.3	9.6	6.6	4.9	
2014	96.2	2	27.6	20.8	17.0	14.0	12.7	9.7	6.6	4.7	
2015	99.2	0	24.2	21.4	20.0	16.6	13.8	9.4	6.4	4.6	
2016	98.1	2	28.1	22.1	19.6	16.3	13.5	8.8	6.4	4.5	
2017	98.1	5	32.5	27	22.8	18.3	14.4	10.1	6.7	4.7	

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Statistical summary (FRM method)

Table 158 Statistical summary for PM_{2.5}: 24-hour average concentrations (2017) – FRM method.

Region/monitoring station	Data availability rate (%)	Maximum (µg/m ³)	Percentile (µg/m ³)							
			99 th	98 th	95 th	90 th	75 th	50 th	25 th	
Sydney										
Chullora	77.9	27.9	24.2	21.3	17.5	12.5	8.8	6.1	4.2	

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Data availability rates are based on a one-day-in-three sampling regime.

Trend analysis (FRM method)

Annual maximum 24-hour averages and annual averages for all stations are given below. Please note that monitoring using FRM technique ceased at Richmond in September 2007 because of technical issues. Please note that the data availability rates are based on a one-day-in-three sampling regime. Data are based on a one-day-in-three sampling regime.

Table 159 Maximum 24-hour average concentrations for PM_{2.5} (µg/m³) – FRM method.

Region/monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Chullora	22.1	27.5	28.2	16.7	14.6	53.9	18.9	38.6	21.0	27.9

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)**Bold** font indicates values that exceed the AAQ NEPM standard.

Table 160 Annual average concentrations for PM_{2.5} (µg/m³) – FRM method.

Region/ monitoring station	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sydney										
Chullora	6.1	6.7	6.5	6.2	NA	7.2	7.2	6.9	6.9	7.4

AAQ NEPM standard: 8.0 µg/m³ (annual average)

Bold font indicates values that exceed the AAQ NEPM standard.

NA: Due to technical problems and problems with parts availability, an annual average was not able to be calculated.

Data are based on a one-day-in-three sampling regime.

Statistical summaries for multiple years, by station (FRM method)

**Table 161 Statistical summary for PM_{2.5}: 24-hour average concentrations – FRM method.
Station: Chullora**

Year	Data availability rate (%)	Number of exceedances (days)	Maximum (µg/m ³)	Percentile (µg/m ³)						
				99 th	98 th	95 th	90 th	75 th	50 th	25 th
2008	88.5	0	22.1	19.2	14.3	11.5	10.5	7.2	5.4	4.0
2009	87.6	2	27.5	26.7	19.1	13.1	11.3	9.1	5.4	3.8
2010	83.8	1	28.2	21.9	16.6	12.8	11.0	7.5	5.8	4.2
2011	77.9	0	16.7	16.3	15.5	13.9	12.5	7.5	5.4	3.8
2012	38.0	0	14.6	12.7	10.8	9.9	9.4	8.3	6.3	4.6
2013	65.8	2	53.9	27.4	24.4	13.3	12.3	8.5	5.4	4.1
2014	77.3	0	18.9	18.1	16.2	14.1	11.7	8.7	6.3	4.6
2015	80.6	1	38.6	14.3	13.8	13.0	12.3	8.4	5.9	4.1
2016	75.5	0	21.0	16.8	16.0	12.0	11.7	8.8	5.9	4.2
2017	77.9	1	27.9	24.2	21.3	17.5	12.5	8.8	6.1	4.2

AAQ NEPM standard: 25.0 µg/m³ (24-hour average)

Bold font indicates values that exceed the AAQ NEPM standard

Data availability rates are based on a one-day-in-three sampling regime.

Section E – Episode analyses and population exposure to PM_{2.5} pollution

Episode analyses

In New South Wales, concentrations of ozone (O₃) in urban areas and particles (PM₁₀ and PM_{2.5}) in both rural and urban areas can sometimes be above national standards. The purpose of this section of the report is to investigate selected typical exceedance events for these criterion pollutants observed during 2017.

Exceedance events for PM₁₀ and PM_{2.5} in 2017 have been classified as either exceptional or non-exceptional (see Table 20, Table 22 respectively and Table A. 3 to Table A. 7), as required by clause 18 (3A) of the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM). Clause 18 (3A) also requires jurisdictions to describe exceptional events when reporting against PM₁₀ and PM_{2.5} 1-day average standards.

Here we undertake detailed investigations of typical air quality events (episode analysis) to demonstrate how weather and emission sources affected air quality in New South Wales during 2017.

The following events were significant for New South Wales when PM₁₀, PM_{2.5} and ozone in New South Wales exceeded national standards for these parameters:

- 2-3 September 2017 (exceptional event due to hazard reduction burning): five Sydney stations recorded their annual maximum 24-hour PM_{2.5} concentrations, exceeding the AAQ NEPM 1-day standard.
- 22-24 September 2017 (exceptional event due to long-range transport of windblown dust): nine NSW GMR stations recorded their annual maximum 24-hour PM₁₀ concentrations, exceeding the AAQ NEPM 1-day standard.
- 11-12 February 2017: annual maximum 1-hour and 4-hour ozone concentrations were recorded in the NSW GMR, during an extensive intense heatwave. Thirteen of 15 NSW GMR stations recorded exceedances of AAQ NEPM ozone standards.

For easy interpretation, these analyses may also refer to measurements from non-NEPM stations in the NSW Air Quality Monitoring Network.

Episode 1. Analysis of typical exceedance event in Sydney due to PM_{2.5} pollution from hazard reduction burning, 2-3 September 2017

This analysis provides insight into the occurrence of typical high PM_{2.5} pollution in Sydney, due to the impact of hazard reduction burns (HRB). The results are useful for understanding HRB-related fine particle pollution in Sydney.

Event description

Over the weekend of 2-3 September 2017, 24-hour (daily) average PM_{2.5} levels exceeded the NEPM standard at six monitoring stations in Sydney, on the east coast of New South Wales. This was due to smoke from large hazard reduction burns (HRB), west of Sydney.

Figure 3 shows two large HRBs to the north-west of Sydney in the Hawkesbury area; one large HRB to the south-west of the Sydney near Warragamba dam; and numerous smaller HRBs near Sydney's western suburbs. The three major HRBs covered a total area of approximately 2600 hectares.

Elevated PM_{2.5} pollution in the region exceeded the NEPM PM_{2.5} 24-hour standard at five air quality monitoring stations in the Greater Sydney Region on 2 September and at two stations on 3 September 2017, as shown in Figure 4. This event was associated with calm conditions and light north-westerly winds on 2 September, ahead of stronger south-westerly winds and the passage of a cold front on 3 September 2017.

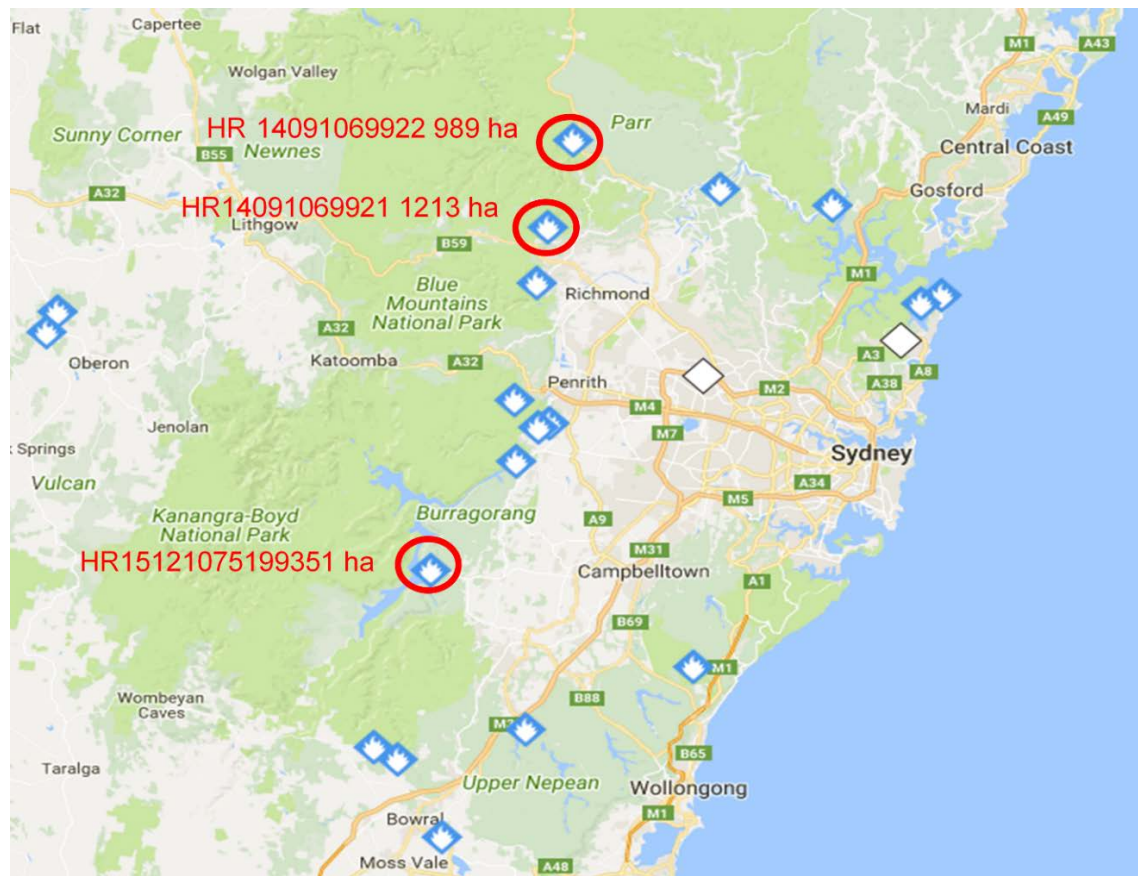


Figure 3 Hazard Reduction Burns and other fire incidents in the Sydney region on Friday, 1 September 2017. Locations of larger hazard reduction burns shown in circles.

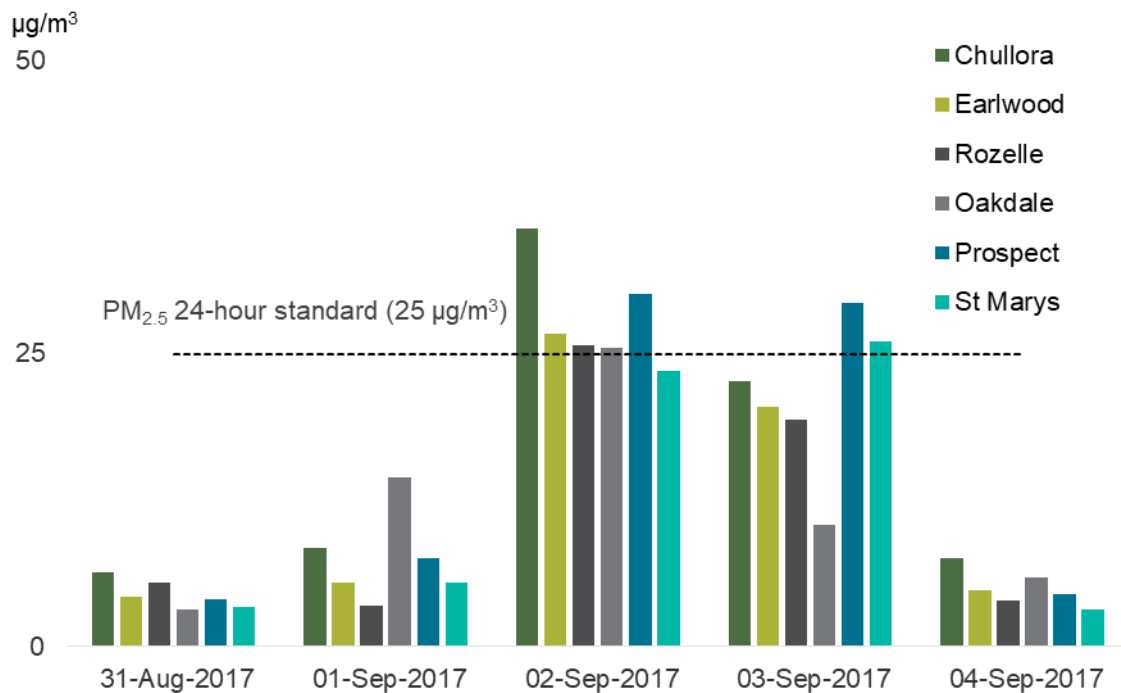


Figure 4 PM_{2.5} daily average concentrations at Sydney sites, showing that five sites exceeded the daily PM_{2.5} NEPM standard on Saturday, 2 September, and two sites exceeded the standard on Sunday, 3 September 2017

Event analysis

Day 1, Saturday, 2 September 2017

A high-pressure system over the east coast of Australia brought relatively calm conditions and light north-westerly winds to the Greater Sydney Region (Figure 5, top left and right). These conditions, combined with a strong temperature inversion, caused smoke from HRBs to be transported across the city.

Exceedances of the NEPM PM_{2.5} 24-hour standard were recorded at air quality monitoring sites in Sydney East (Chullora, Earlwood and Rozelle), Sydney North West (Prospect) and Sydney South West (Oakdale). Chullora and Prospect recorded the highest levels (Figure 4, Figure 6). Sydney’s more eastern suburbs recorded relatively lower impacts of HRB emissions (Randwick, Figure 6).

Sydney East experienced a north-easterly sea breeze on Saturday, 2 September 2017 (Figure 12). This suggested that the afternoon north-easterly sea breezes may have suppressed the offshore transport and dispersion of particles. This would account for Chullora and Prospect having the highest daily PM_{2.5} levels, while Randwick (Sydney East) recorded no PM_{2.5} exceedance (Figure 6). The spatial distribution of PM_{2.5} daily averages recorded across Sydney suggested a build-up of smoke between Prospect and Chullora.

This interpretation was supported by information presented in Figure 7 to Figure 10:

- Smoke dispersion modelling, by the NSW Rural Fire Service, and PM_{2.5} dispersion modelling, by OEH (CCAM-CTM)¹, predicted higher smoke levels in Sydney's western and central areas, than in the eastern suburbs (Figure 7 to Figure 8).
- The Bureau of Meteorology, MetEye forecast for wind speed and direction, for 1pm, Saturday, 2 September 2017, showed prevailing offshore air flows and the onshore progression of the afternoon sea breeze, across Sydney (Figure 9).
- HYSPLIT in NSW back trajectory analysis by OEH showed smoke flowing into the Greater Sydney Region from the north-west, where two major HRBs were burning (Figure 10).

Day 2, Sunday, 3 September 2017:

A strong temperature inversion overnight and calm conditions with very light north-westerly air flows meant minimal dispersion of smoke from the HRBs on the previous day. Typically, HRBs occur on Saturdays and then smolder over the remainder of the weekend. These conditions may account for the exceedances of the NEPM PM_{2.5} daily standard at St Marys and Prospect (Sydney North West) on Sunday (Figure 4). These monitoring sites were closest to the HRBs near Sydney's western suburbs.

Dispersion conditions improved, with northerly winds after midday and moderate south-westerly winds in the evening, associated with the passage of a cold front (Figure 5).

Day 3, Monday, 4 September 2017

Particle levels in Sydney returned to low levels on Monday, 4 September 2017, due to consistent westerly to south-westerly winds and the absence of active HRBs (Figure 5).

¹ The CCAM-CTM air quality model is a meteorological model, the Conformal Cubic Atmospheric Model (CCAM) and a dispersion model called the Chemical Transport Model (CTM). CCAM and CTM were developed by CSIRO (McGregor et al., 2008, Cope et al., 2009)

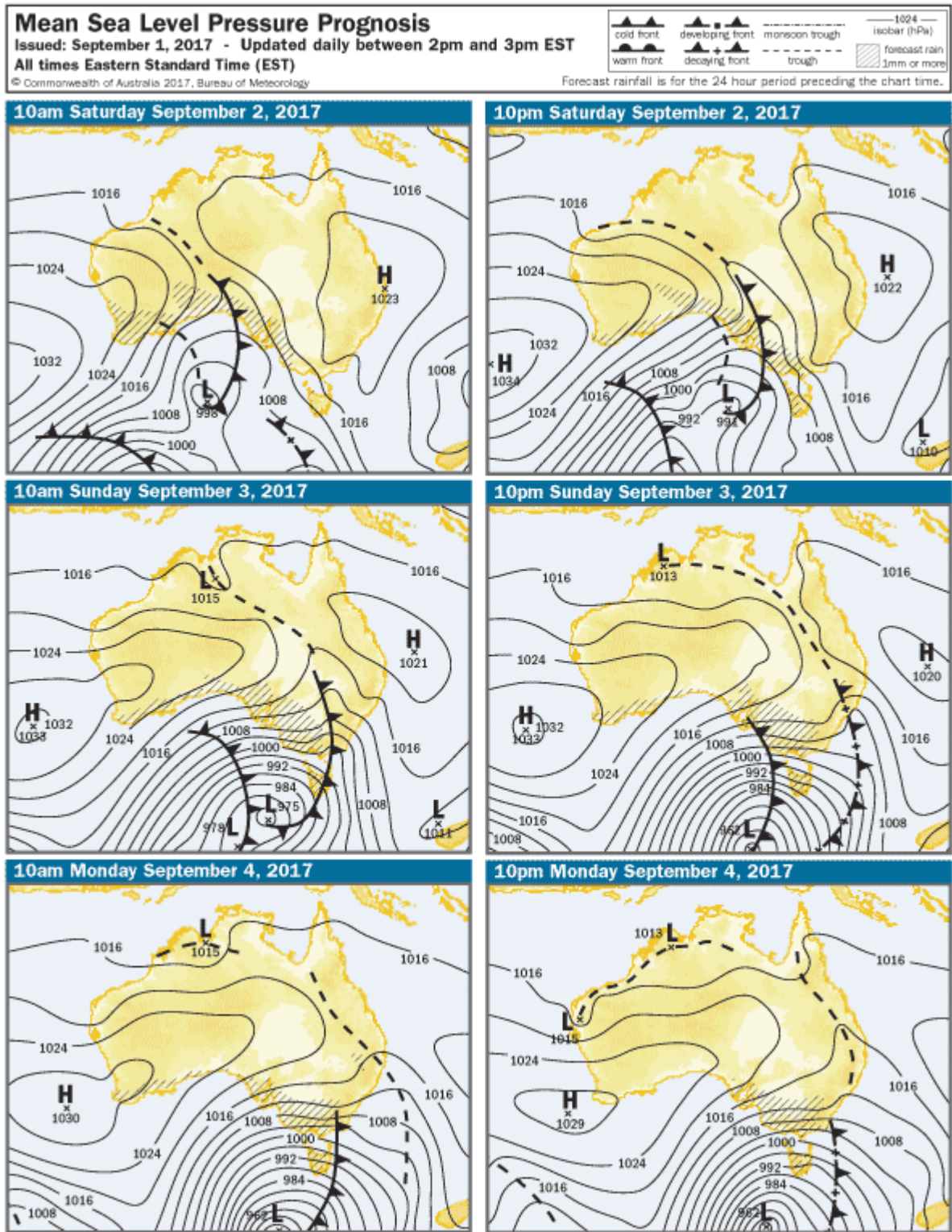


Figure 5 Synoptic charts for Saturday-Monday, 2-4 September 2017. Source: BOM (2017)

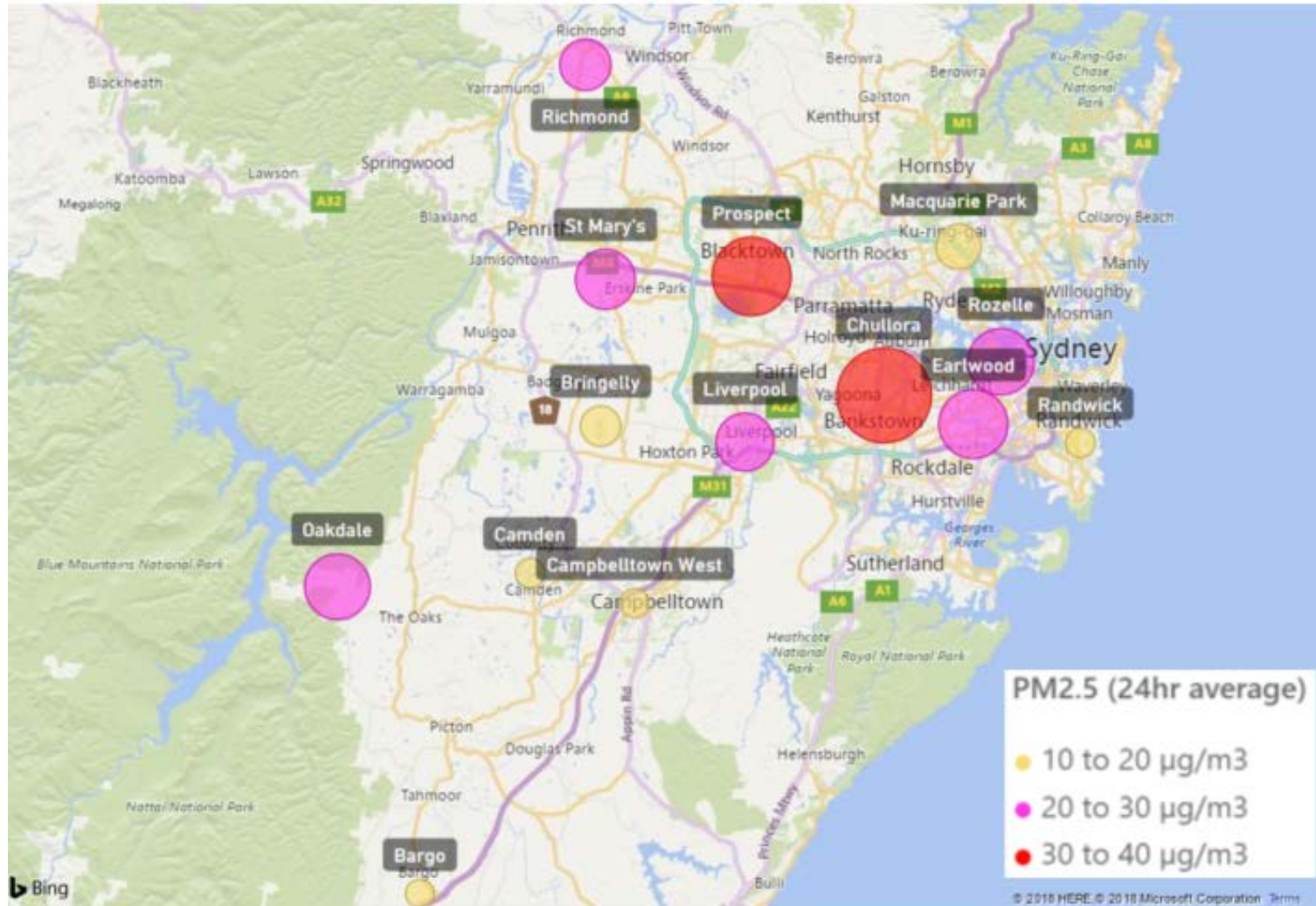


Figure 6 Spatial distribution of PM_{2.5} 24-hour average concentrations in the Greater Sydney Region on Saturday, 2 September 2017

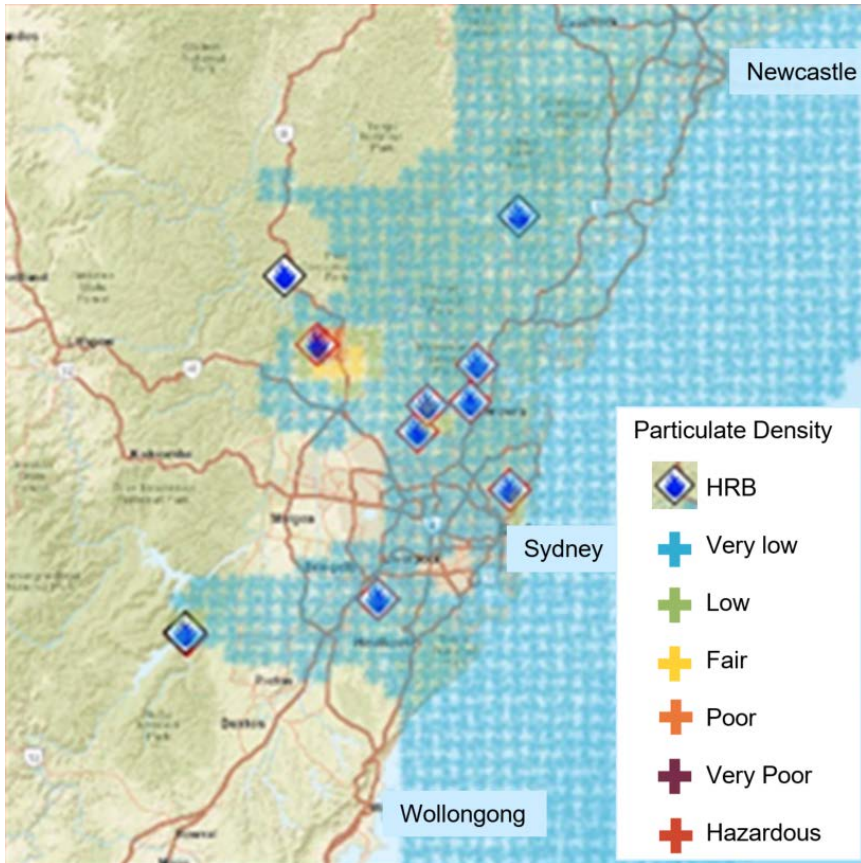


Figure 7 NSW Rural Fire Services Smoke Dispersion Model incremental particle prediction for 1pm, Saturday, 2 September 2017

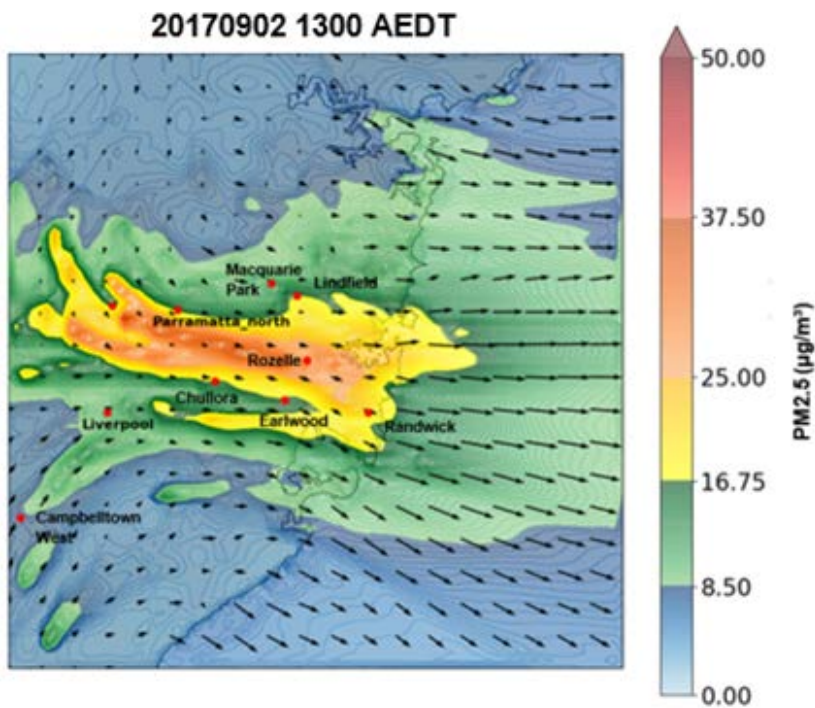


Figure 8 OEH Chemical Transport Modelling of PM_{2.5} concentrations for 1pm, Saturday, 2 September 2017

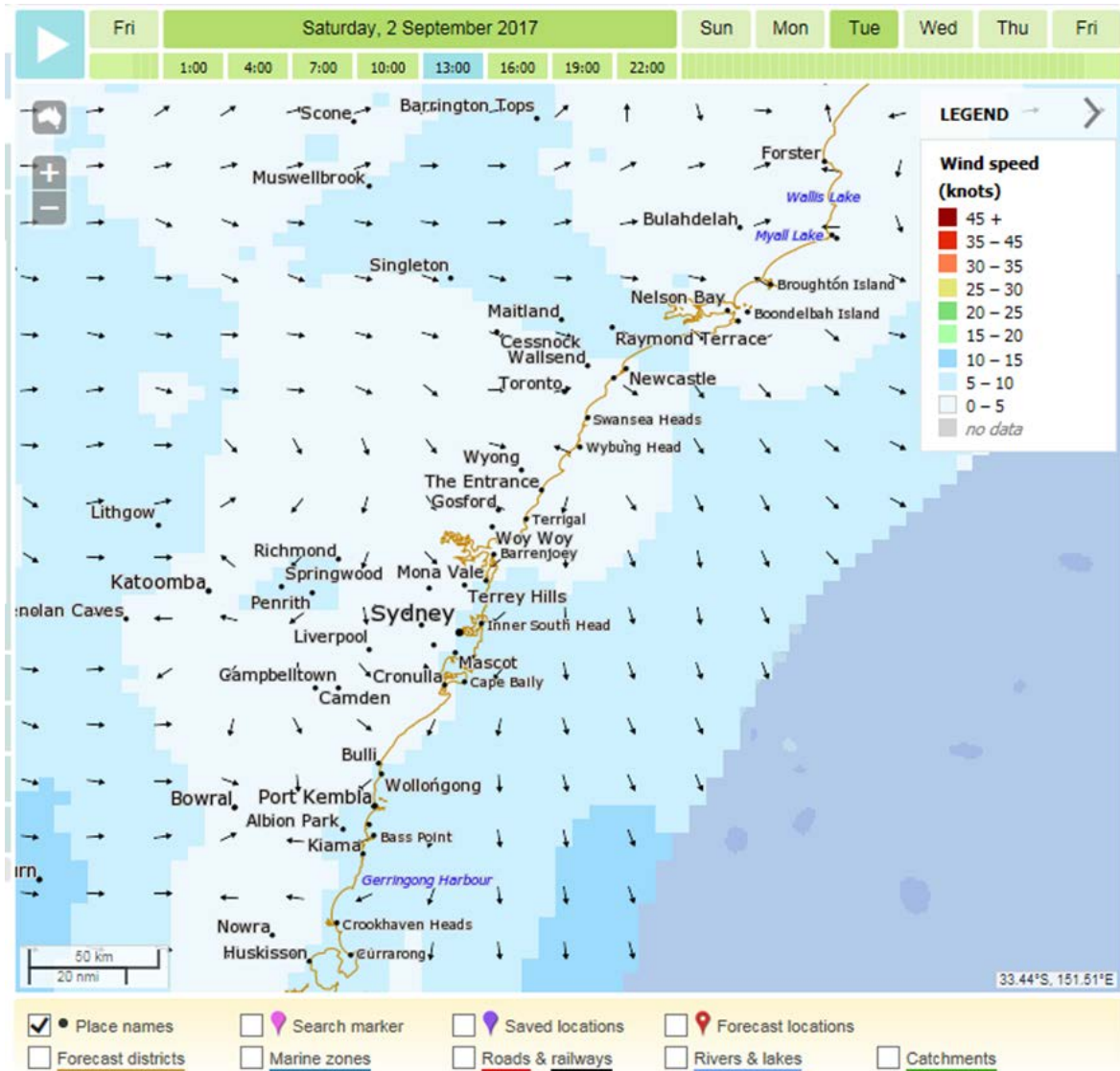


Figure 9 MetEye forecast for wind speed and direction, for 1pm, Saturday, 2 September 2017, showing offshore air flows and onshore progression of the afternoon sea breeze, across Sydney. Source: Bureau of Meteorology

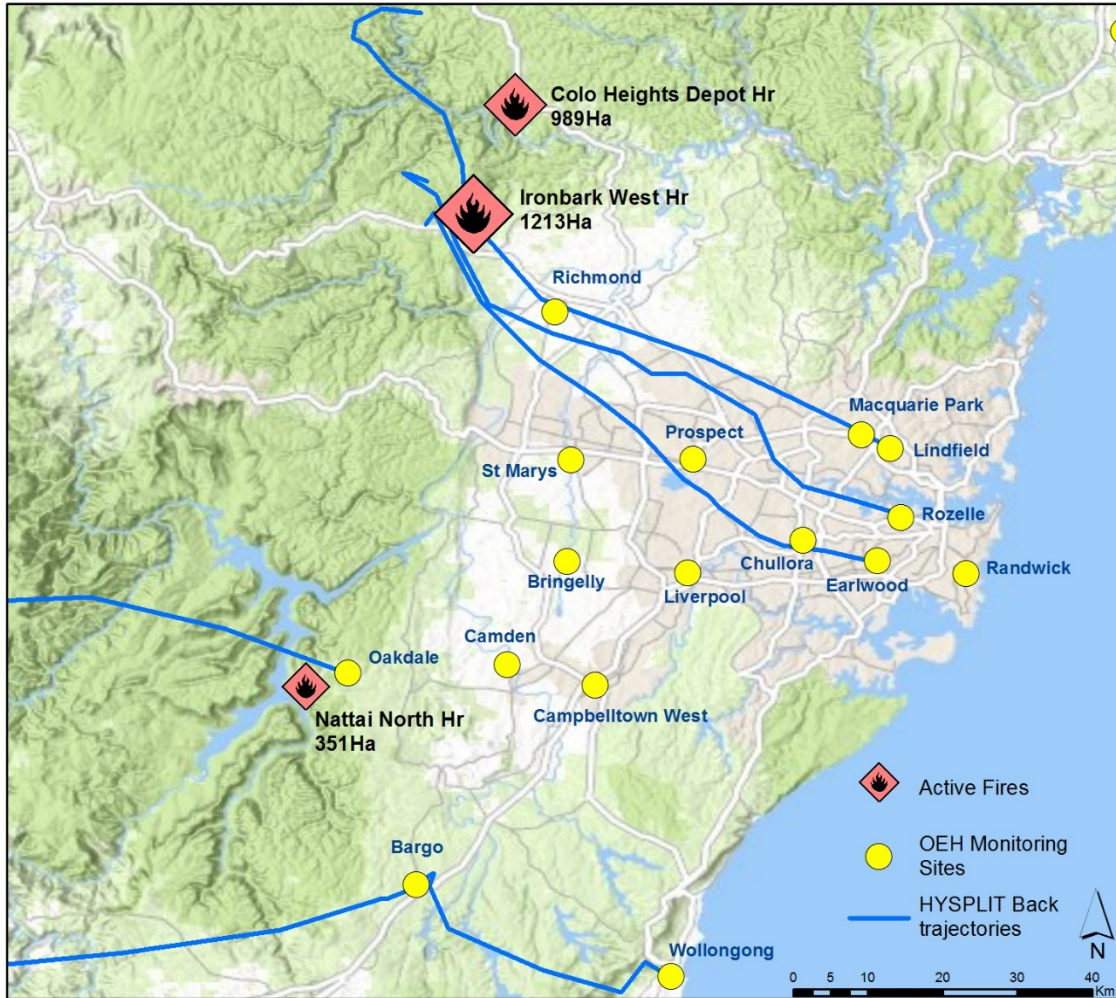


Figure 10 OEH HYSPLIT in NSW back trajectories for Saturday, 2 September 2017

Smoke-indicator timeseries plots of visibility, as nephelometer readings

Nephelometer readings of reduced visibility are a good indicator of fine smoke particles.

Figure 11 shows a timeseries plot of the visibility readings, for Thursday-Monday (31 August-September 2017), for sites in Sydney, the Illawarra and the Central Coast that exceeded the OEH visibility standard, on Saturday-Sunday (2-3 September 2017).

The highest readings for hazardous visibility were at Oakdale (Sydney South West) and Chullora (Sydney East). The higher reading at Oakdale was due to the proximity of the HRBs to the monitoring site. The second highest reading at Chullora was consistent with the spatial distribution of PM_{2.5} (Figure 6) and the HYSPLIT in NSW back trajectory (Figure 10).

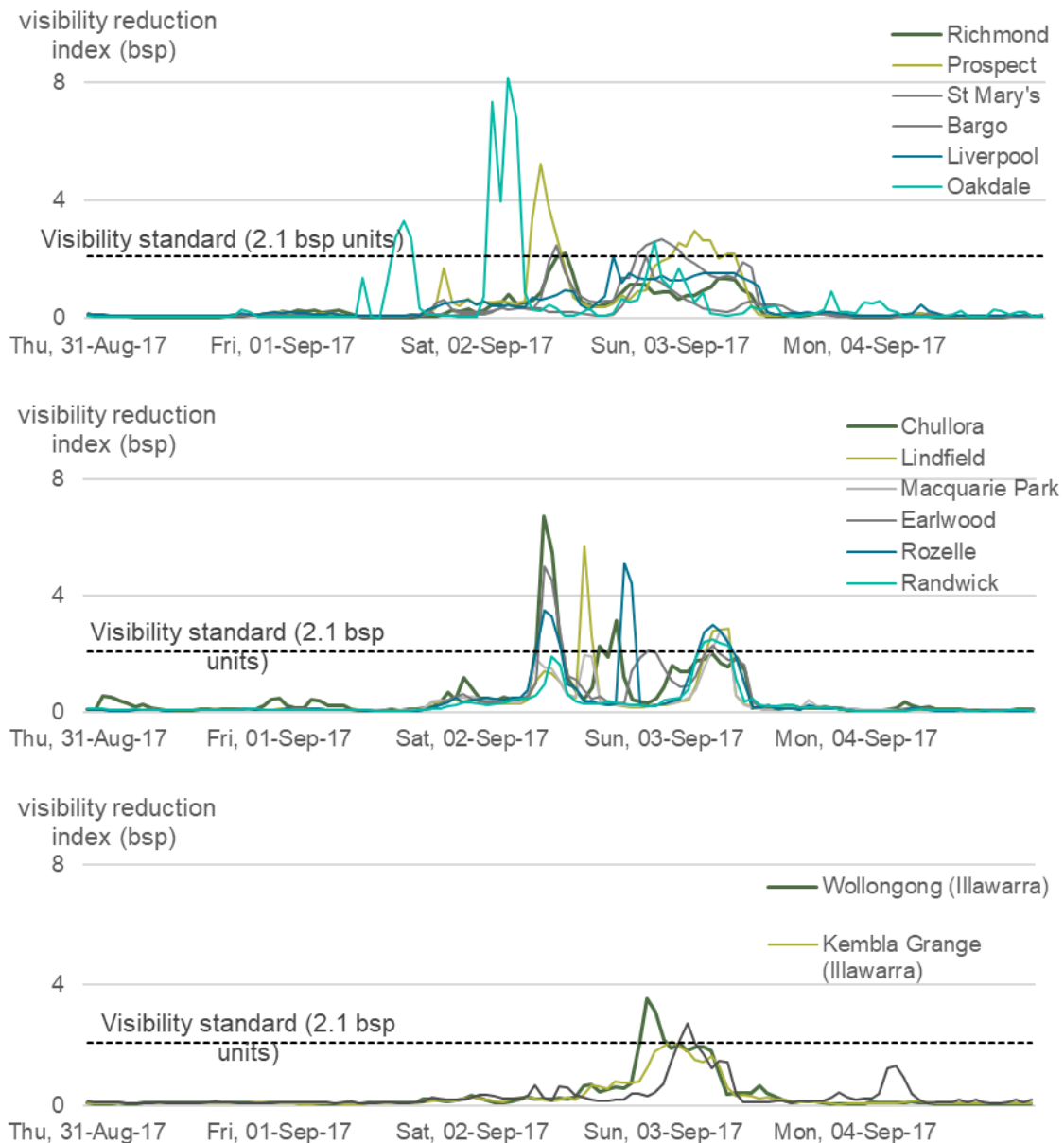


Figure 11 Time series plot of Nephelometer (visibility) exceedances for Sydney North West and Sydney South West (top), Sydney East (middle), and Illawarra and Central Coast (bottom), during 2-3 September 2017

The role of wind speed and direction in determining particle levels

Chullora was chosen for a panel plot to show the role of wind speed and direction in determining particle levels.

Figure 12 presents a panel plot for the nephelometer readings, wind speed and wind direction at Chullora, from 31 August-4 September 2017. This plot identifies the following key associations between meteorological conditions and particle levels.

- Before and during the period of high nephelometer readings (low visibility), there were very calm conditions (wind speed less than 2 metres per second) with air flows from the north-west. These conditions, combined with a strong temperature inversion and smoke from HRBs north-west of the Greater Sydney Region, resulted in high particle levels in across the city.
- On Saturday afternoon, the north-easterly sea breezes most likely blocked the dispersion of smoke within the Sydney region, causing a build-up of smoke and the highest PM_{2.5} readings at Chullora and Prospect.
- After midday on Sunday, the stronger north-westerly to south-westerly winds, associated with passing of a cold front late in the evening, helped to disperse smoke (particles) over the ocean waters.
- On Monday, 4 September 2017, low levels of particles were recorded.

The evidence provided by the panel plot (Figure 10) was consistent with the analysis based on Figure 5 to Figure 11, above.

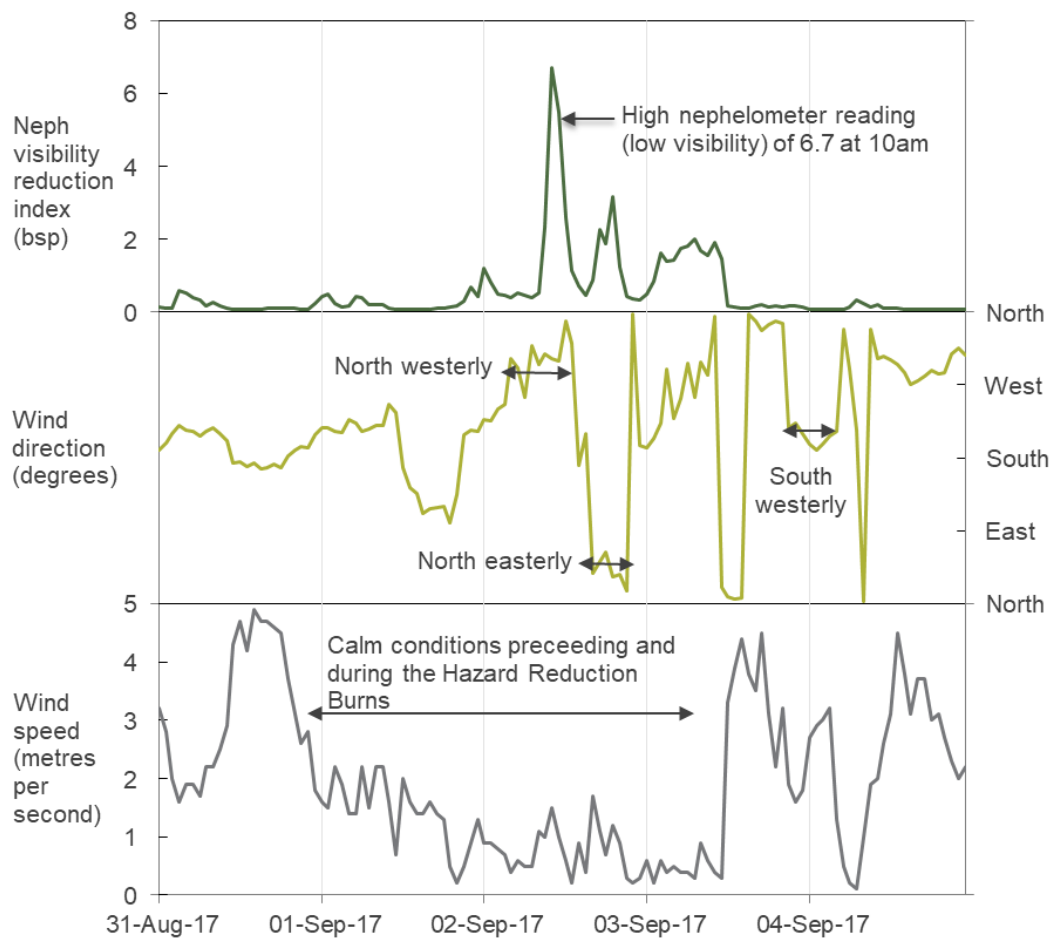


Figure 12 Panel plot of Nephelometer (visibility) (top), wind direction (middle) and wind speed (bottom) at Chullora, from 31 August-4 September 2017

Summary

The Greater Sydney Region, experienced reduced visibility and exceedances of the PM_{2.5} 24-hour NEPM standard at six monitoring stations, on 2-3 September 2017. This was due to smoke from hazard reduction burning to the north and west of the region. A high-pressure system over the east coast of Australia brought calm conditions, a strong temperature inversion and light north-westerly air flows to the Sydney region. Smoke from HRBs in the west was transported across the city, reducing visibility and elevating PM_{2.5} levels. The afternoon north-easterly sea breeze blocked the dispersion of smoke, causing the build-up of smoke and exceedances of the PM_{2.5} 24-hour standard across the city. Smoke continued to elevate PM_{2.5} levels in calm conditions, especially closer to the HRBs near western Sydney, until the passage of a cold front with stronger south-westerly assisted dispersion of smoke.

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Cope M, Lee S, Noonan J, Lilley B, Hess D, Azzi M 2009, *Chemical Transport Model—Technical Description*; CSIRO: Canberra, Australia; p. 114

Episode 2. Analysis of a typical PM₁₀ exceedance event in Sydney associated with long-range transport of windblown dust, 22-24 September 2017

This analysis is to provide some insight into the occurrence of typical high PM₁₀ pollution in Sydney, due to long-range transport of dust. The results are useful for understanding most non-bushfire-related PM₁₀ pollution days in Sydney.

Event description

During Friday, 22 September to Sunday, 24 September 2017, the 24-hour (daily) average PM₁₀ levels exceeded the NEPM standard at seven air quality monitoring stations across the Greater Sydney Region. This was most evident on 24 September 2017 (Figure 13).

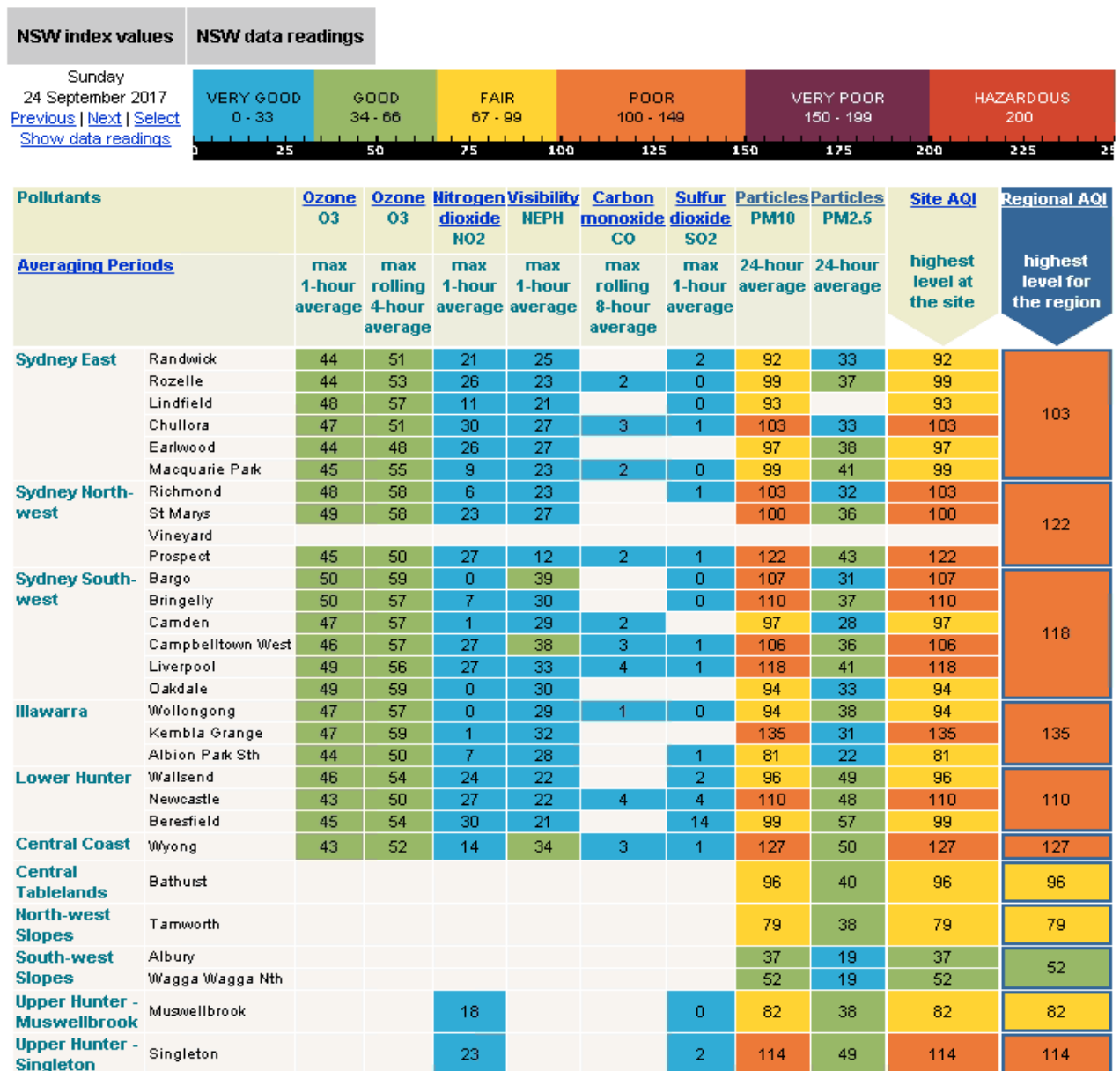


Figure 13 Screenshot of the OEH daily Air Quality Index (AQI) webpage for 24 September 2017. Source: NSW Air Quality Index

Day 1, Friday, 22 September 2017

Light north-westerly winds combined with a strong temperature inversion over coastal New South Wales. These meteorological conditions favoured the transport of dust from north-west NSW into the Greater Sydney Region, elevating PM₁₀ levels. Bringelly in Sydney South West exceeded the NEPM daily PM₁₀ standard, as shown in Figure 14.

Day 2, Saturday, 23 September 2017

Light north-westerly winds continued to transport dust from north-west NSW into the Sydney region, with temperatures rising above 30°C. These conditions, combined with a strong temperature inversion, limited the dispersion of dust from the Sydney region. PM₁₀ pollution built-up across Sydney, as shown at Bargo, Richmond and St Marys in Figure 14.

Day 3, Sunday, 24 September 2017

Another day of light west north-westerly winds and a strong temperature inversion continued conditions of poor dispersal and the accumulation of dust from previous days. Exceedances of the daily PM₁₀ standard were recorded at seven monitoring sites across Sydney, Bargo, Bringelly, Chullora, Liverpool, Prospect, Richmond and St Marys (Figure 14 and Figure 15).

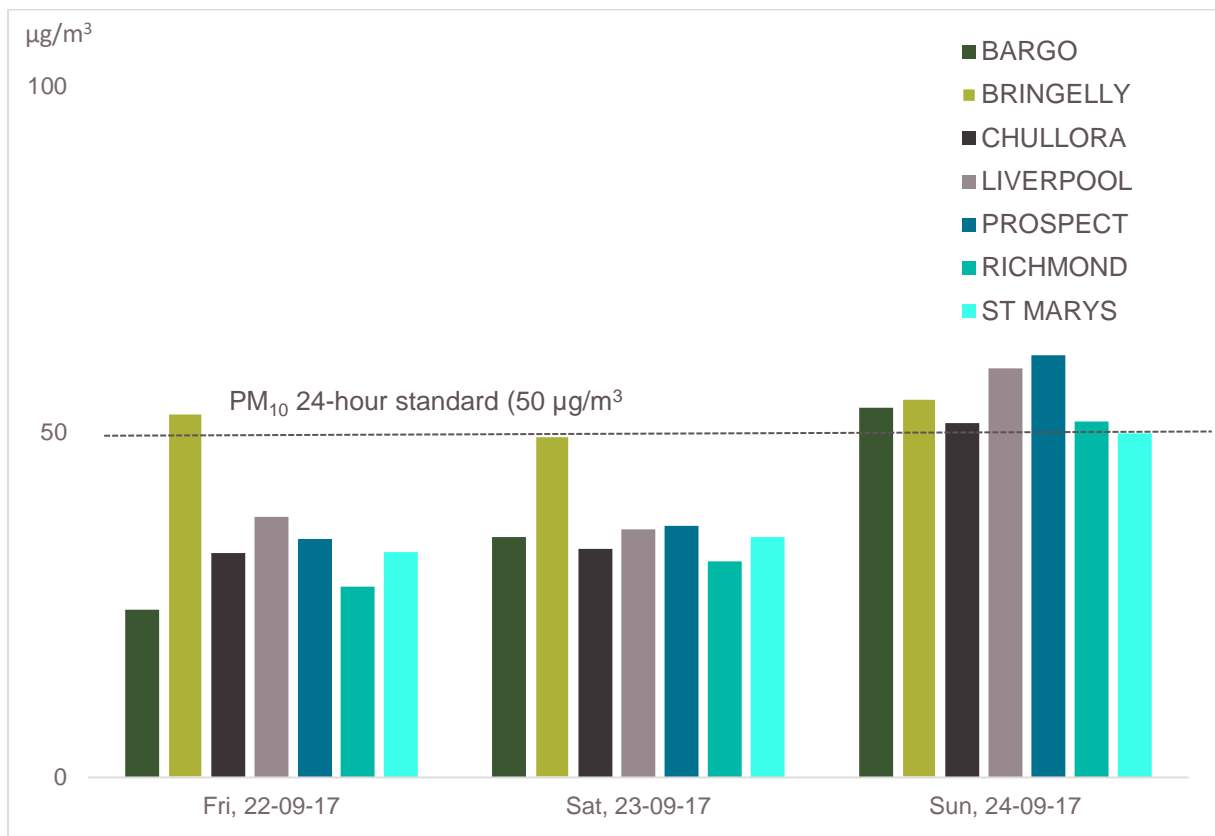


Figure 14 24-hour average PM₁₀ concentrations at selected sites in the Greater Sydney Region, for 22-24 September 2017, showing seven sites exceeded the PM₁₀ NEPM standard on Sunday 24 September 2017

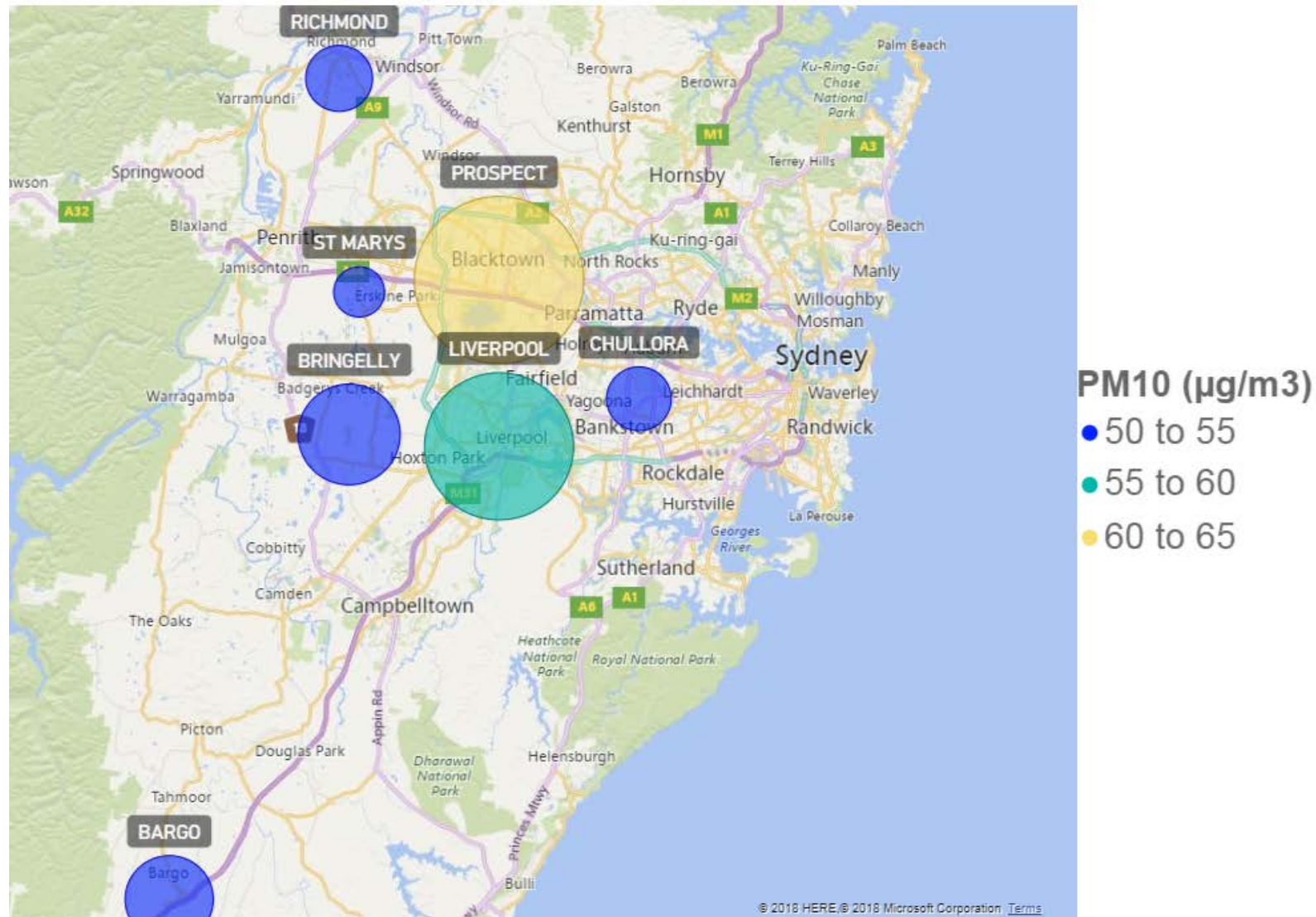


Figure 15 Locations of high 24-hour average PM₁₀ levels ($\geq 50 \mu\text{g}/\text{m}^3$) in Sydney on 24 September 2017

Event Analysis

Synoptic conditions

Figure 16 shows the synoptic surface analyses during 22-24 September 2017. A high-pressure system over the northern Tasman Sea, a broad low-pressure system south of the continent and the passage of a strong cold front, brought north-westerly winds and extreme temperatures across New South Wales. The Greater Sydney Region recorded a maximum temperature of 35 °C. The prevailing westerly to north-westerly winds drew hot air from central Australia into the region. On 22 September 2017, Australia had its warmest September day since national area-averaged temperature records began in 1911. These synoptic situations often are associated with elevated PM₁₀ pollution in Sydney (Jiang et al., 2016).

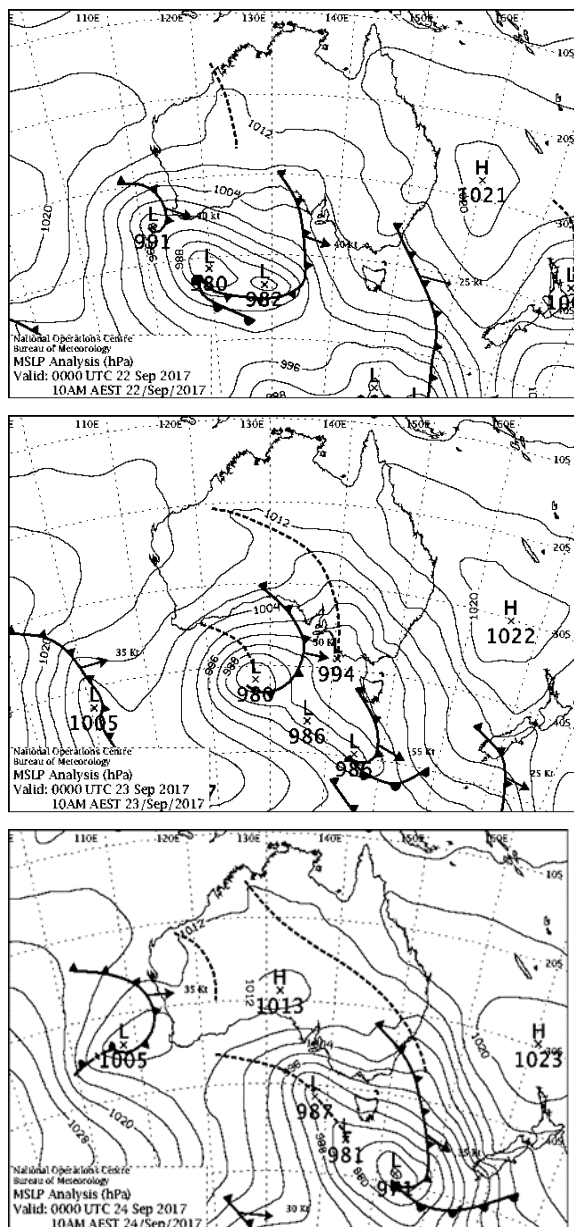


Figure 16 Synoptic charts for 10am on 22 September (top) 10am on 23 September (middle) and 10am on 24 September 2017 (bottom). Source: Bureau of Meteorology

Dust activity across New South Wales

The DustWatch report (OEH 2017) indicated extremely dry and hot conditions in September 2017, with further reduced groundcover, especially in the north-west of New South Wales. Dust activities increased significantly in September 2017 (Figure 17). On 23 September 2017, Wilcannia set a new September temperature record of 40.5°C, while strong winds caused a substantial dust event across the north-west of the State (Figure 18). Winds also transported smoke across the continent from massive bushfires in the north of the Northern Territory and Western Australia (Figure 19).

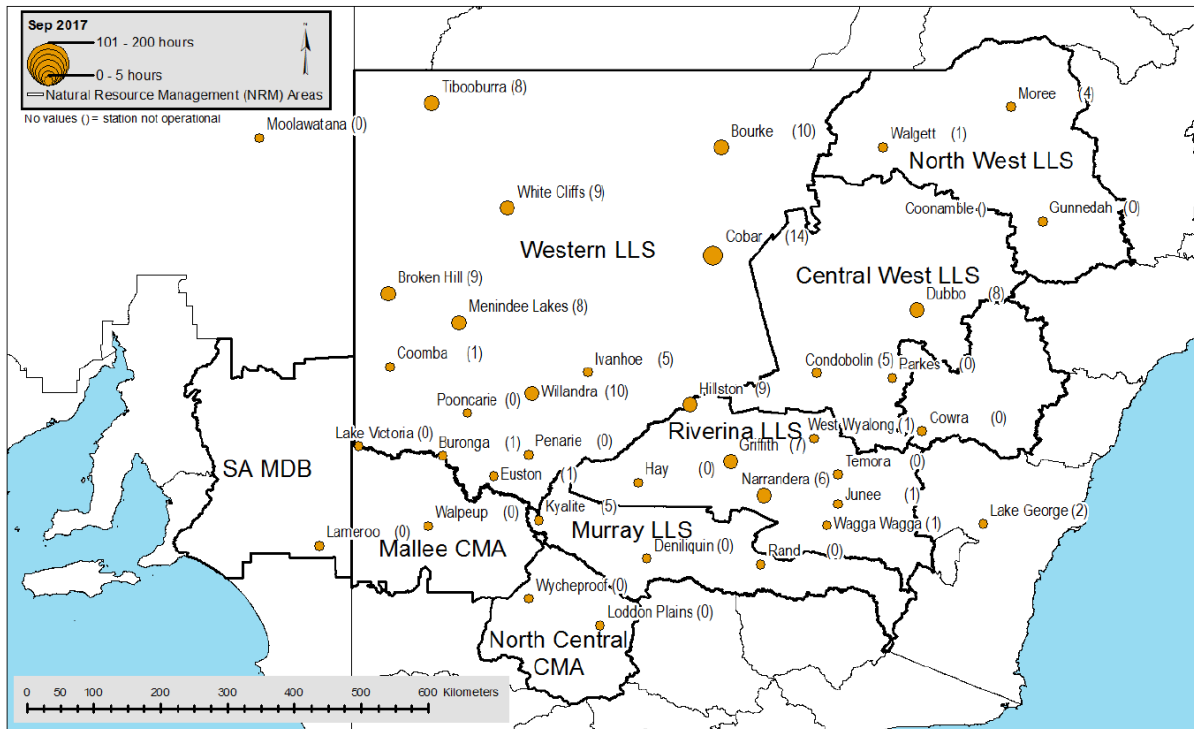


Figure 17 Hours of dust activity (number in brackets) at each DustWatch site in September 2017



Figure 18 Dust storm near Wilcannia, north-west NSW, on 23 September 2017 Photo: Ayala McFarland/OEH

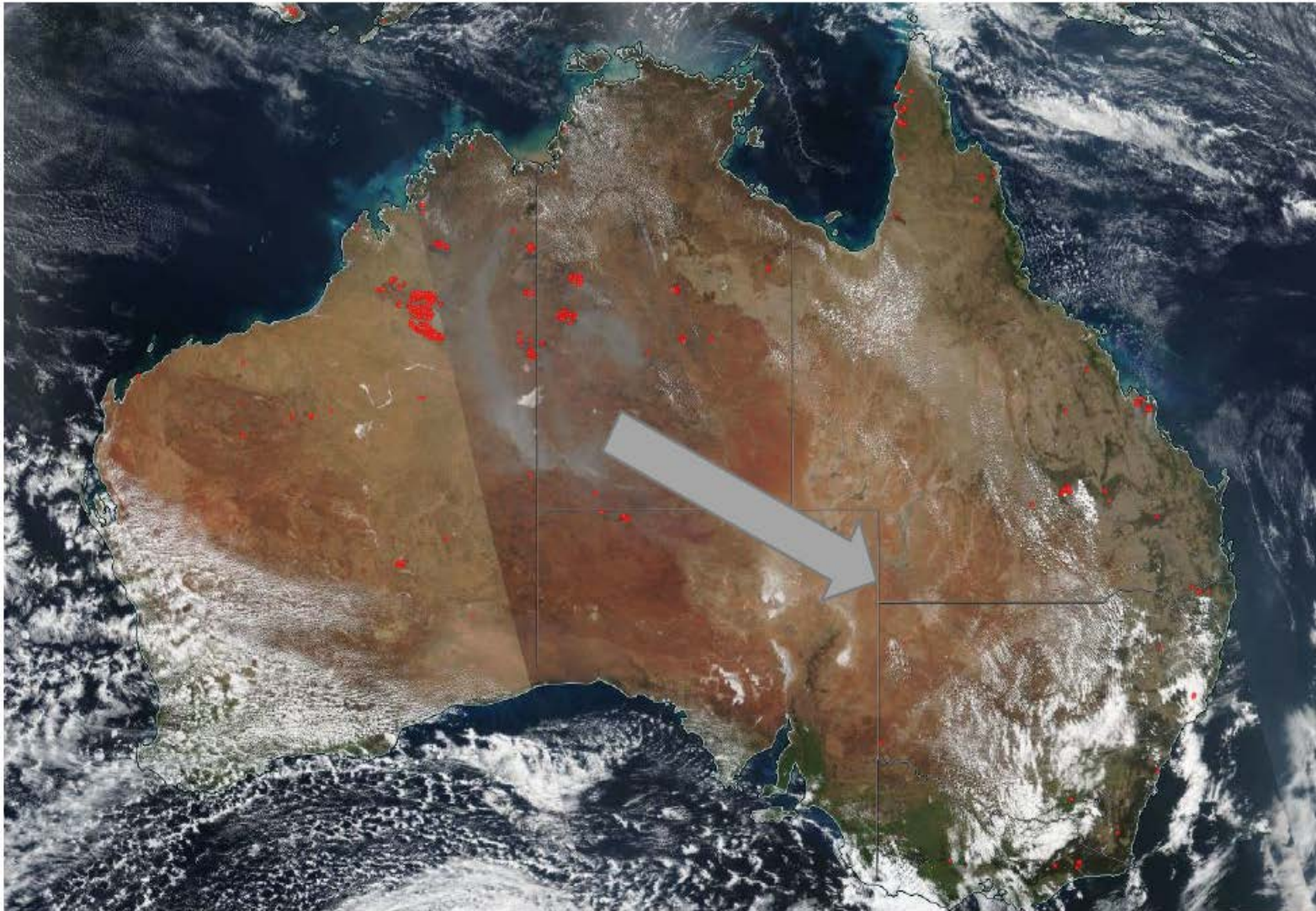


Figure 19 MODIS Terra image showing fires and smoke plumes from Western Australia and Northern Territory on 23 September 2017. Source: Image reproduced from DustWatch Report, September 2017

Back trajectory modelling to track dust particles across New South Wales

The OEH used modelled 24-hour pathways of air parcels, to determine the source of high PM10 levels in the Greater Sydney Region on 24 September 2017.

The HYSPLIT (Stein et al. 2015) backward trajectory analyses were conducted with two different horizontal resolution datasets, HYSPLIT in NSW² (Watt et al, 2017) (Figure 20) and NOAA-HYSPLIT³ (Figure 21).

Figure 20 shows the HYSPLIT in NSW (with higher resolution meteorological data) 24-hour back trajectories at 300 metres (m) above ground level, from various Sydney air quality monitoring stations (AQMS). The analyses started at 4am on 24 September 2017, when most of the Sydney air quality monitoring stations experienced elevated hourly PM₁₀, over 100 µg/m³. The trajectories clearly show air travelling from north-west NSW (where dust activities were recorded by DustWatch) to Sydney (where the elevated PM₁₀ concentrations were recorded).



Figure 20 OEH HYSPLIT in NSW 24-hour back trajectories starting at 4am on 24 September 2017 (18 UTC 23 September) from various air quality monitoring sites at 300m above ground level. Source: OEH modelling using HYSPLIT in NSW (Watt et al 2017)

² Utilising Bureau of Meteorology’s (BOM) Australian Community Climate and Earth-System Simulator (ACCESS) regional 12-km horizontal resolution data as input

³ Global Data Assimilation System 0.5° resolution HYSPLIT-ready data (~50km horizontal resolution)

Figure 21 shows 24-hour back trajectories using the NOAA-HYSPLIT (with coarser resolution meteorological data). The model showed the potential for dust from north-west NSW and smoke from the Northern Territory and Western Australia, to contribute to PM₁₀ exceedances in the Sydney region on 24 September 2017.

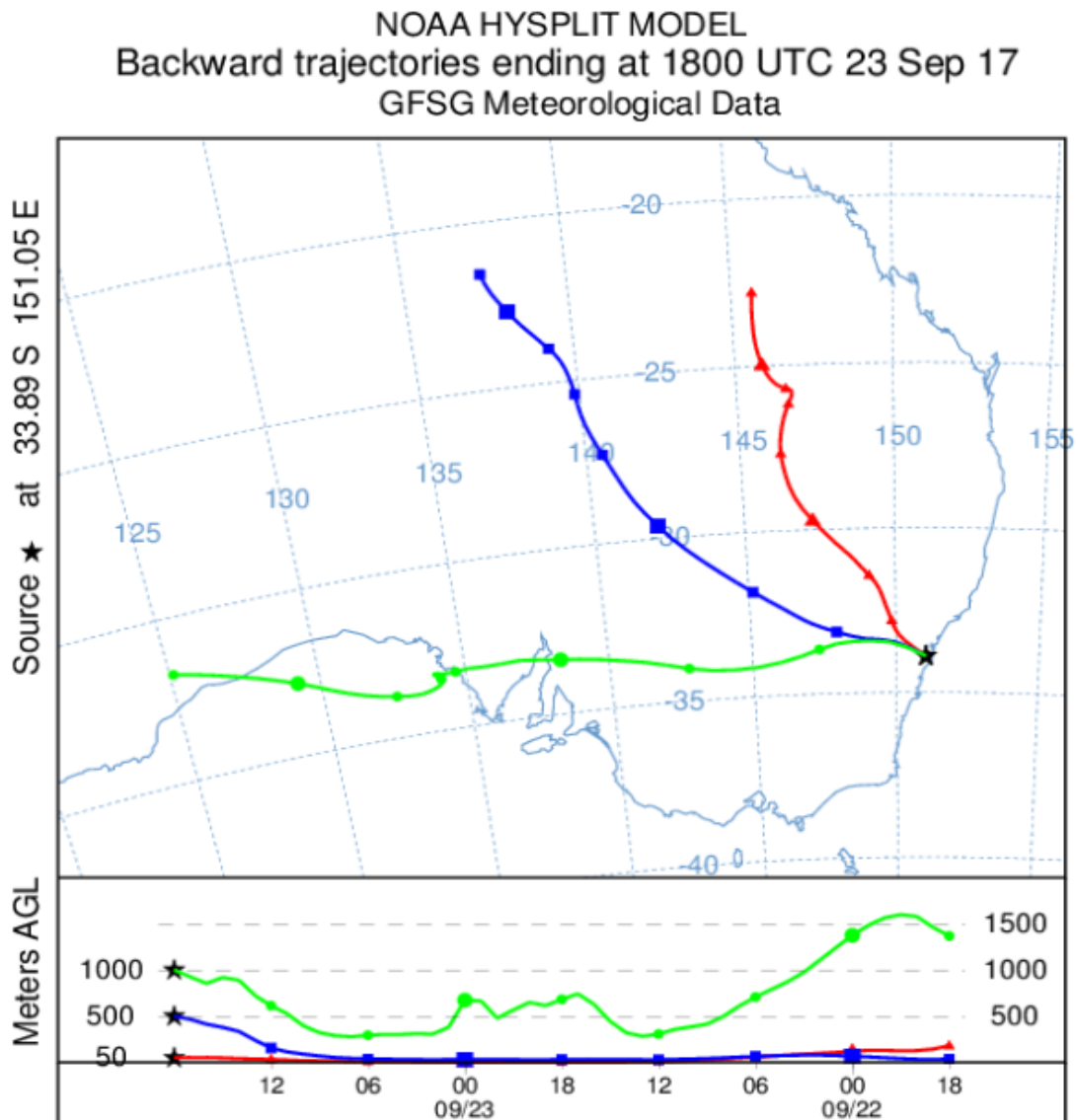


Figure 21 NOAA-HYSPLIT 48-hour back trajectories starting at 4am on 24 September 2017 (18 UTC 23 September) from Chullora air quality monitoring station at 50 m (red), 500 m (blue) and 1,000 m (green) above ground level. Source: OEH modelling using US National Oceanic and Atmospheric Administration (NOAA), HYSPLIT model

Summary

This event analysis has shown that Sydney air quality on 24 September 2017 was affected by long-range transport of particles, from areas of dust activity in north-west NSW and potentially from smoke and dust activity in the Northern Territory and Western Australia. These continental sources, combined with local particle sources, resulted in exceedances of the national standard for 24-hour concentrations of PM₁₀, at seven air quality monitoring stations across Sydney. The results can be used to interpret most non-bushfire-related PM₁₀ pollution days in Sydney.

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Watt S, Chang LTC, Jiang N, Fuchs D, Barthelemy X, Scorgie Y and Riley M 2017: Using HYSPLIT to forecast smoke plumes during hazard reduction burns in New South Wales. The Clean Air Society of Australia and New Zealand (CASANZ) 2017 Conference, 15-18 October, Brisbane.

Episode 3. Analysis of a typical ozone exceedance event in coastal New South Wales, during an extreme heatwave on 10-11 February 2017

This analysis provides some insight into the occurrence of typical high ozone pollution events in the NSW Greater Metropolitan Region (GMR). The results are useful for understanding most high ozone pollution events in coastal cities in New South Wales, including Sydney.

Event description

During 9–12 February 2017, New South Wales experienced an extreme summer heatwave (BOM 2017). At least 93% of the State was 10°C warmer than average, on 11 February 2017. Liverpool, in Sydney South West, recorded maximum temperatures of 44°C at 5pm on 10 February and 45°C at 5pm and 6pm on 11 February 2017. An extensive ozone pollution event occurred in coastal cities of the NSW GMR, on 10-11 February 2017. Ozone exceeded national standards at 13 of 16 ozone-monitoring stations in the NSW GMR, including eight of 10 sites in the Greater Sydney Region (Table 162, Figure 23).

Table 162 Ozone exceedances in the NSW Greater Metropolitan Region, 10–11 February 2017

Region	10 February 2017		11 February 2017	
	1-hour Ozone	4-hour Ozone	1-hour Ozone	4-hour Ozone
AQMN Station	<i>start time; duration (hours); maximum concentration (pphm)</i>			
Lower Hunter				
Wallsend		15:00; 1 h; 8.1	13:00; 1 h; 10.6	13:00; 4 h; 9.7
Central Coast				
Wyong	14:00; 2 h; 12.1	15:00; 4 h; 10.5		16:00; 2 h; 8.4
Sydney East				
Rozelle	12:00; 3 h; 11.4	13:00; 5 h; 10.9		
Earlwood	17:00; 1 h; 10.9	14:00; 2 h; 12.1		15:00; 5 h; 8.7
Lindfield	18:00; 1 h; 10.6	19:00; 2 h; 8.3		19:00; 2 h; 8.3
Randwick	15:00; 2 h; 11.6	15:00; 4 h; 10.2	18:00; 1 h; 11.4	17:00; 5 h; 9.7
Chullora		14:00; 1 h; 8.3	13:00; 5 h; 11.4	14:00; 7 h; 11.0
Sydney North West				
Prospect		14:00; 2 h; 8.3	15:00; 2 h; 12.3	15:00; 4 h; 10.6
St Marys	12:00; 2 h; 11.0	13:00; 3 h; 9.6	14:00; 2 h; 10.0	15:00; 1 h; 8.5
Sydney South West				
Liverpool			14:00; 3 h; 13.5	14:00; 5 h; 11.7

Region	10 February 2017		11 February 2017	
	1-hour Ozone	4-hour Ozone	1-hour Ozone	4-hour Ozone
AQMN Station	<i>start time; duration (hours); maximum concentration (pphm)</i>			
Illawarra				
Albion Park South	15:00; 2 h; 10.9	15:00; 3 h; 10.2		
Kembla Grange	16:00; 1 h; 11.3	15:00; 3 h; 9.4		
Wollongong	16:00; 1 h; 10.2	15:00; 3 h; 9.3		

Notes:

1. In this case study, O₃ is measured in parts per hundred million (pphm) by volume, that is, parts of pollutant per hundred million parts of air.
2. The equivalent AAQ NEPM 1-hour ozone standard is 10.0 pphm. The 4-hour ozone standard is 8.0 pphm.

On 10 February 2017, exceedances occurred at stations in four coastal metropolitan regions: Lower Hunter, Central Coast, Sydney and Illawarra (Table 162, Figure 23, left). On 11 February 2017, exceedances occurred in three regions: Lower Hunter, Central Coast and Sydney (Figure 23, right). Higher 1-hour and 4-hour ozone concentrations were recorded, than on the previous day, with the highest level (13.5 pphm) at Liverpool, in Sydney South West. Longer exceedance periods were recorded, with the episode at Chullora in Sydney East persisting for seven hours (Table 162, Figure 23, Figure 23).

Event analysis

During 9-12 February 2017, a slow-moving high-pressure ridge extended north-west over New South Wales from the Tasman Sea (Figure 24). On 9 February 2017, the high-pressure ridge was located over eastern NSW, providing a consistent northerly to north-westerly synoptic flow over coastal regions. On 10-11 February 2017, these light and persistent westerly air flows transported hot and dry inland air over coastal NSW, leading to consecutive high-temperature days over the region. By 12 February 2017, a southerly change, accompanying the passage of a slow-moving trough/cold front, brought cooler weather conditions across coastal regions.

Ground level ozone forms from interactions between sunlight and emissions of oxides of nitrogen (NO_x) and volatile organic compounds (VOCs), from sources such as motor vehicles and industry.

The synoptic configuration on 10 and 11 February 2017 reflected typical stable atmospheric conditions conducive to elevated photochemical pollution episodes in Sydney (Figure 24, Jiang et al. 2016a). In contrast, the synoptic conditions on 9 February 2017 were not favourable for the generation or build-up of ozone pollution, due to higher wind speeds which dispersed the precursor pollutants, NO_x and VOCs, offshore (Figure 24) (DECCW 2010, Jiang et al. 2016a, 2016b).

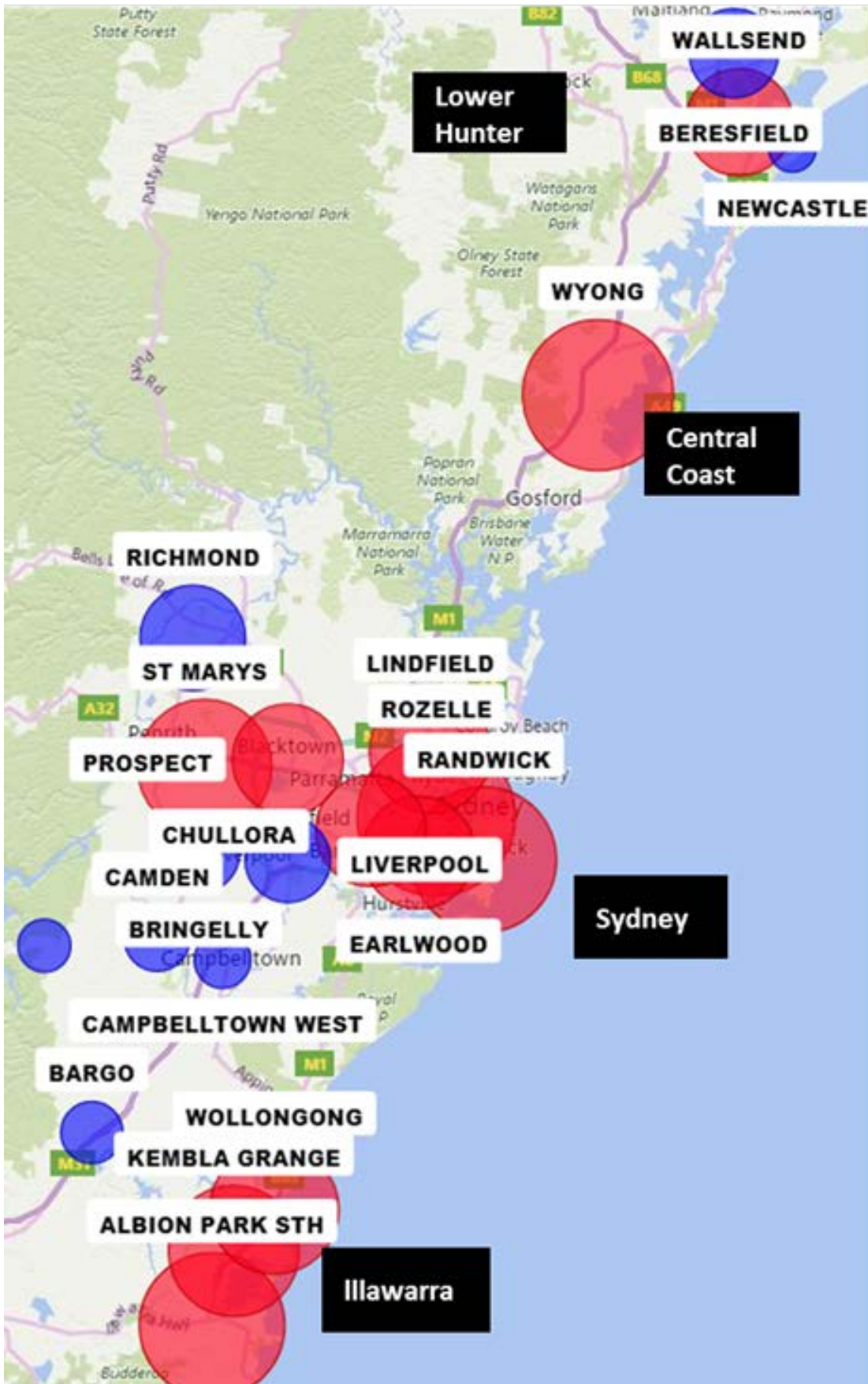


Figure 22 Spatial distribution of daily maximum 4-hour rolling average ozone during 10 February 2017, showing exceedances were more intense nearer to the coast and extending to the Illawarra region (red circles, > 8 pphm, blue ≤ 8 pphm)

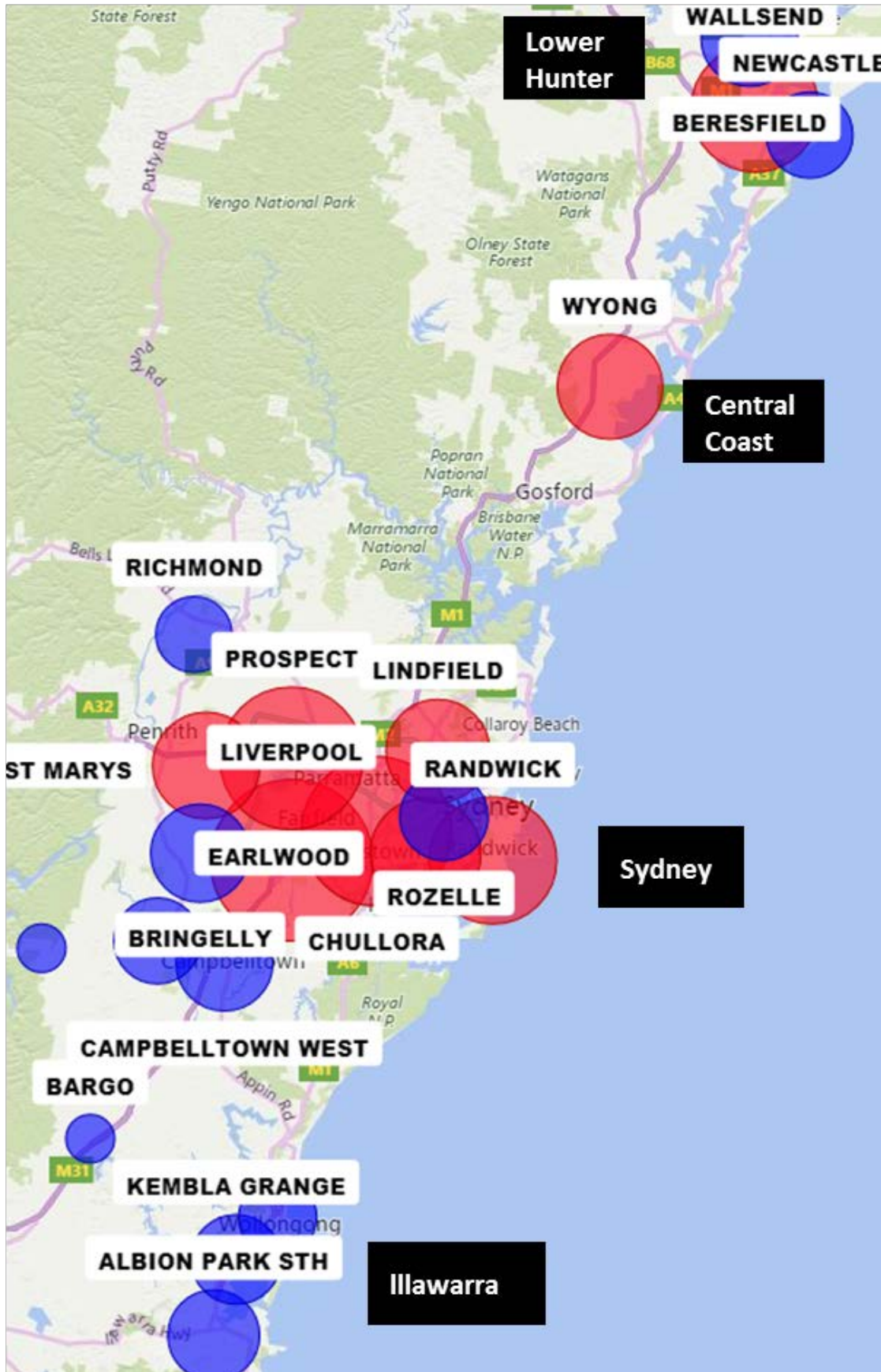


Figure 23 Spatial distribution of daily maximum 4-hour rolling average ozone during 11 February 2017, showing exceedances were more intense in the central Greater Sydney Region (red circles, > 8 pphm, blue ≤ 8 pphm)

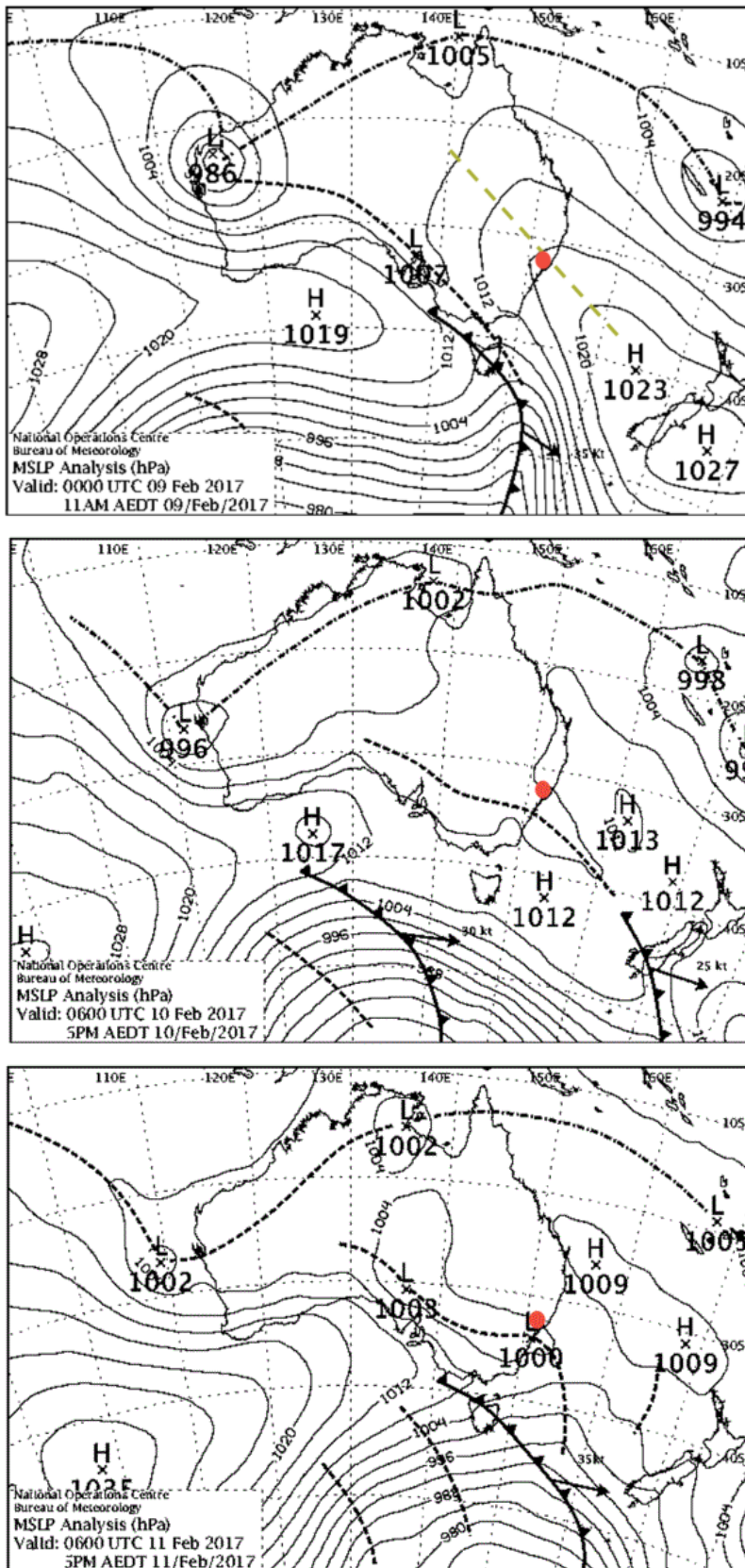


Figure 24 Synoptic charts for 11am on 9 February (top), 5pm on 10 February (middle) and 5pm on 11 February 2017 (bottom), showing a persistent high-pressure system over the Tasman Sea, extending over northeast NSW (top, green line), and drawing hot air from central Australia into coastal areas (red dot). Source: Bureau of Meteorology

Day 1, Thursday, 9 February 2017

On 9 February 2017, no ozone build-up occurred across the NSW GMR. Although conditions were hot and sunny, with temperatures above 30°C, prevailing northerly to westerly winds dispersed ozone and ozone precursor pollutants offshore (Figure 25).

Days 2 and 3, Friday and Saturday, 10-11 February 2017

During 10-11 February 2017, synoptic conditions created hot, sunny, calm conditions across NSW coastal regions. Daytime temperatures in Sydney exceeded 40°C. High ozone concentrations, above the 1-hour and 4-hour standards, occurred in the afternoons on both days, coinciding with the onset of sea breezes and their progression inland (Figure 25 a, d).

Within the Greater Sydney Region, north-easterly sea breezes converged with weaker synoptic westerly air flows, creating calm conditions and blocking air pollutants from drifting offshore (Figure 26 and Figure 27). These blocking conditions accumulated ozone and precursor pollutants along the coast. High concentrations of precursor pollutants, hot sunny conditions and maximum temperatures above 40°C accelerated the formation of ozone. This resulted in ozone exceedances at numerous coastal stations in the NSW GMR, from the Lower Hunter in the north to the Illawarra in the south (Figure 23).

Night-time ozone was generally low, due to limited availability of sunlight and ozone precursors NO_x and VOCs.

On Friday, 10 February 2017, early morning calm conditions helped the build-up of NO_x levels (Figure 25 c, e). High concentrations of precursor pollutants and high temperatures (above 40°C) accelerated the formation of ozone. Light north-westerly winds transported ozone and ozone precursors towards Sydney East. Although Liverpool in Sydney South West recorded a maximum temperature of 44°C at 5pm (Figure 25 a), Sydney South West experienced higher wind speeds than in the east and did not record ozone exceedances. In contrast, calmer conditions in Sydney East allowed the build-up of ozone and precursors NO_x and VOCs, leading to exceedances of the 1-hour and 4-hour ozone standards (Table 162, Figure 23, Figure 25).

Five monitoring stations exceeded the 1-hour and 4-hour ozone standards (Sydney East: Rozelle, Earlwood, Lindfield and Randwick; Sydney North West: St Marys). Two sites exceeded the 4-hour ozone standard (Sydney East: Chullora; Sydney North West (Prospect) (Table 162)).

On Saturday, 11 February 2017, local conditions were similar to the previous day, with higher temperatures across the Greater Sydney Region. Liverpool in Sydney South West recorded temperatures of 45°C at 5pm and 6pm (Figure 25 a). The afternoon sea breezes penetrated further inland than on the previous day, transporting ozone and ozone precursor pollutants to the west. This led to the highest ozone exceedances in western regions of Sydney, with the maximum recorded at Liverpool. Elevated ozone levels persisted across the city for five to seven hours (Table 162, Figure 23, Figure 25, Figure 27).

Five monitoring stations exceeded the 1-hour and 4-hour ozone standard (Sydney East: Randwick and Chullora; Sydney North West: Prospect and St Marys; Sydney South West, Liverpool). Two sites exceeded the 4-hour standard (Sydney East: Earlwood and Lindfield) (Table 162).

Day 4, Sunday, 12 February 2017

On Sunday, 12 February 2017, a southerly change, associated with the passage of a slow-moving cold front, brought relatively lower temperatures and higher wind speeds. Ozone levels were relatively lower across the Greater Sydney Region.

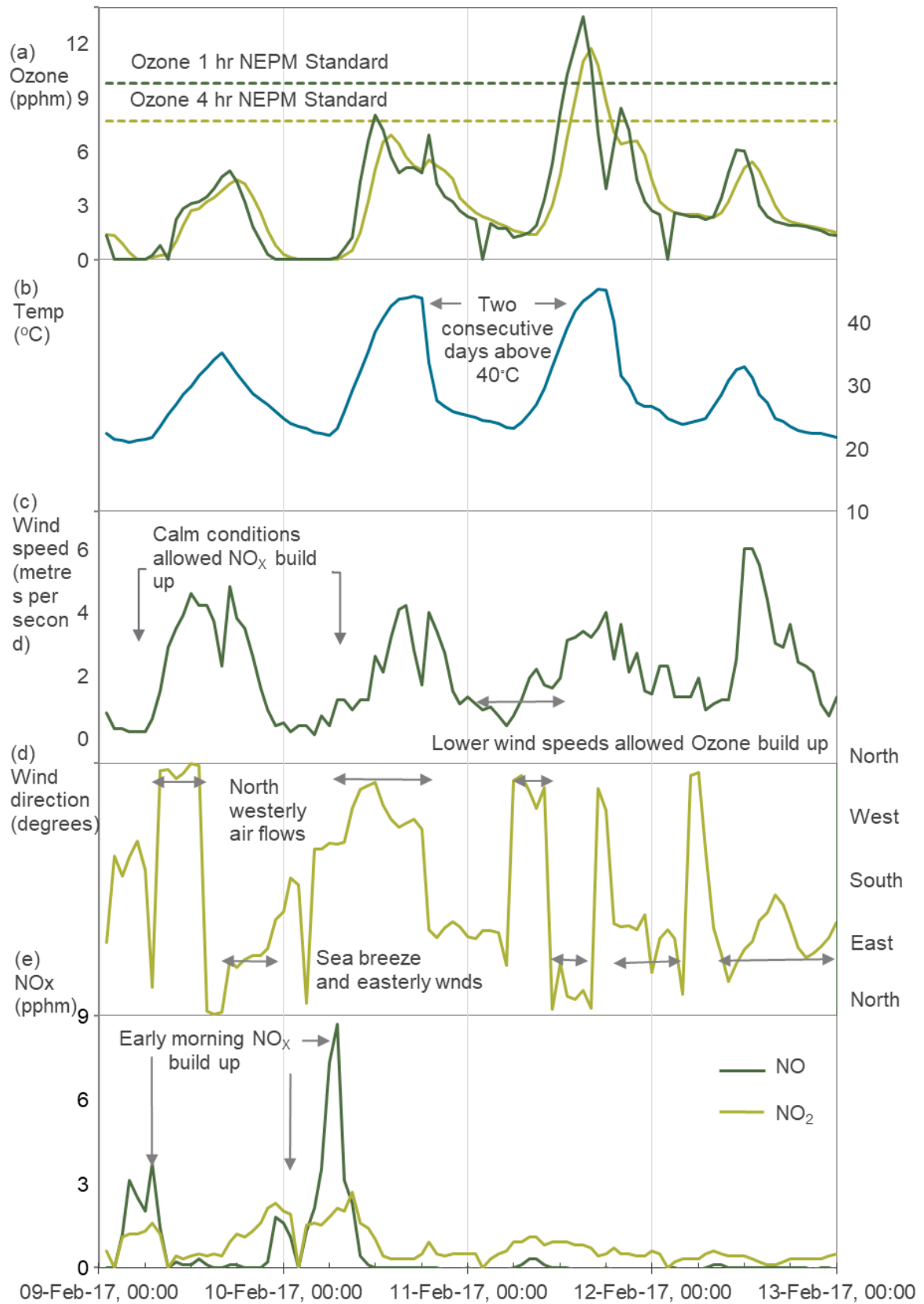


Figure 25 Influence on ozone of low wind speeds, wind direction (calm and stable conditions), above 40°C maximum temperatures and high NO_x (ozone precursor pollutant) at Liverpool, during 9-12 February 2017

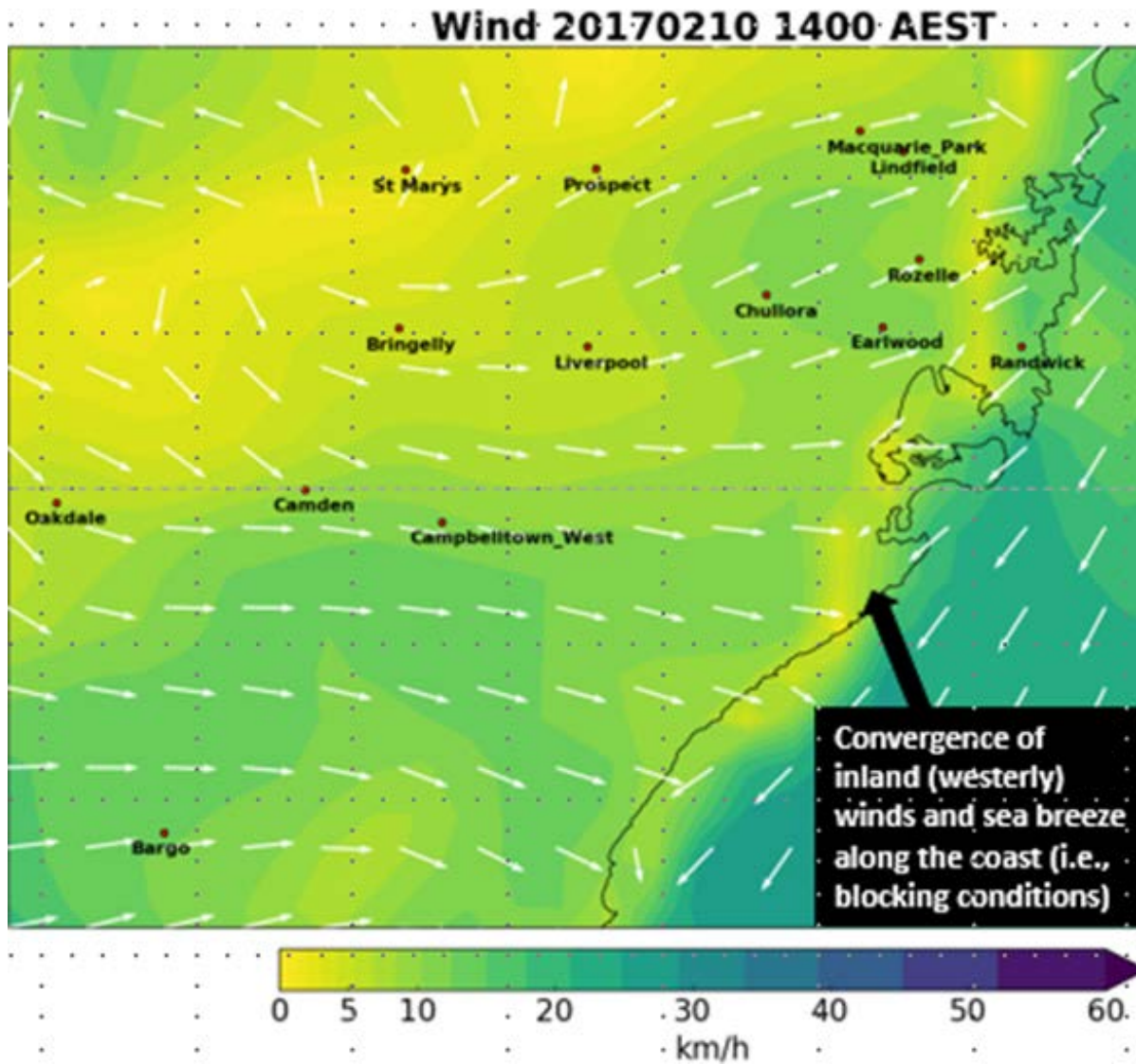


Figure 26 Wind field plot for the Greater Sydney Region at 2pm on 10 February 2017, showing the easterly sea breeze and the inland westerly breeze converging near the coast. This blocking pattern persisted and combined with the calm conditions (yellow) to confine air pollution along the coast. Source: Bureau of Meteorology

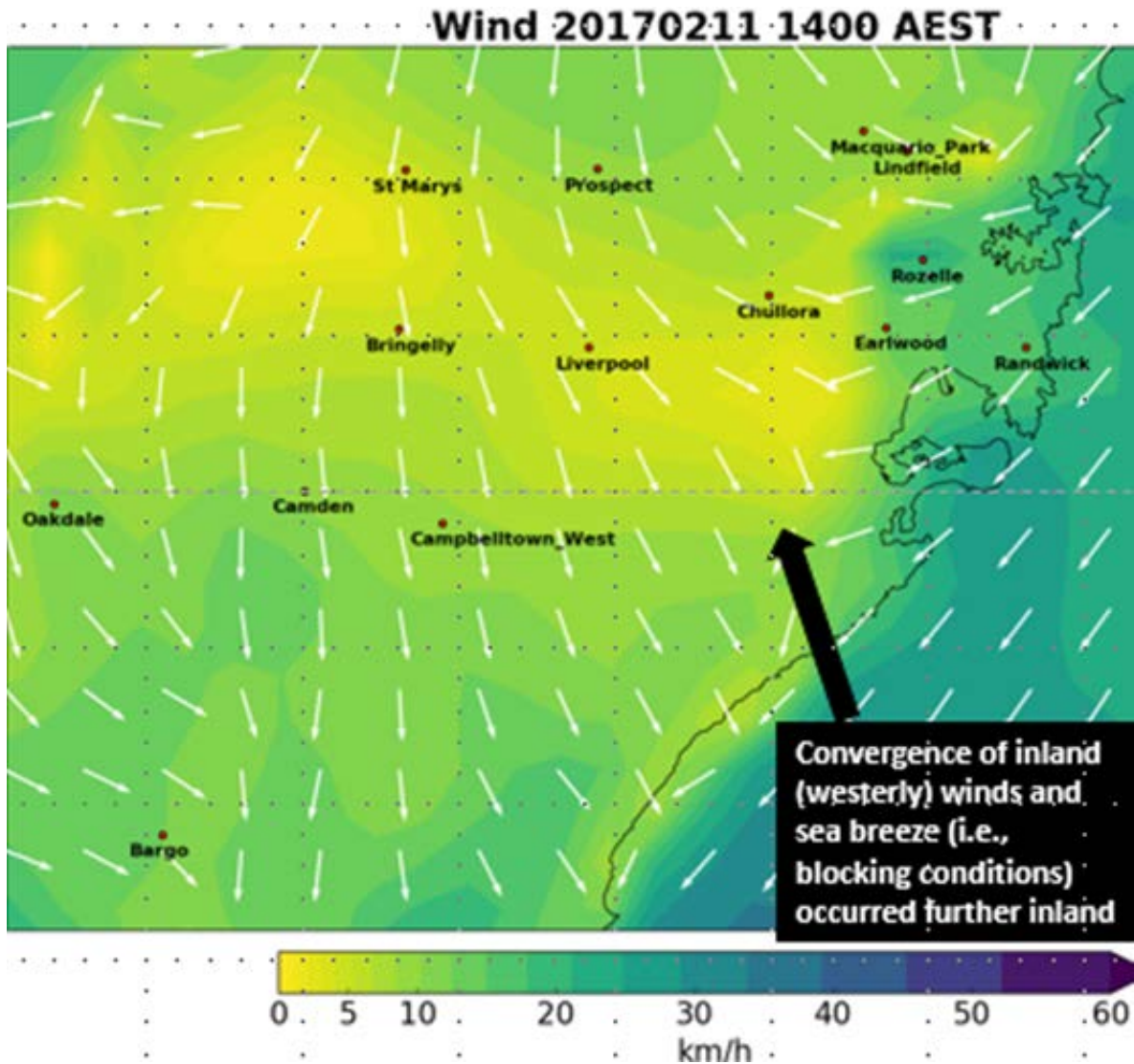


Figure 27 Wind field plot for the Greater Sydney Region at 2pm on 11 February 2017, showing the easterly sea breeze and the inland westerly breeze converging near Chullora. The westward progression of the sea breeze led to higher levels of ozone pollution further inland, compared with the previous day. Source: Bureau of Meteorology

Summary

An extensive ozone pollution episode was experienced across coastal NSW on 10-11 February 2017, during a severe four-day heat wave. The episode reflected the impact of local and synoptic meteorological configurations that typically lead to elevated ozone pollution in Sydney, or broadly across the NSW GMR. A slow-moving high-pressure ridge, extending north-west over New South Wales from the Tasman Sea brought hot, sunny calm conditions, conducive to the formation and build-up of photochemical ozone across Sydney. Light north-westerly synoptic flows, converging with the north-easterly (afternoon) sea breezes, often determine the extent, location and duration of elevated ozone pollution in the region.

Further information on meteorology-ozone pollution relationships can be found in Jiang et al. (2016a, 2016b).

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Jiang N, Betts A and Riley M 2016a, Summarising Climate and Air Quality (Ozone) Data on Self-Organising Maps: A Sydney Case Study. *Environmental Monitoring Assessment*, 188(2):103. doi: 10.1007/s10661-016-5113-x.

Jiang N, Scorgie Y, Hart M, Riley ML, Crawford J, Beggs PJ, Edwards GC, Chang L, Salter D, and Virgilio GD 2016b, Visualising the relationships between synoptic circulation type and air quality in Sydney, a subtropical coastal-basin environment. *International Journal of Climatology*, doi:10.1002/joc.4770

Bureau of Meteorology (BOM) (2017) Special Climate Statement 61—exceptional heat in southeast Australia in early 2017

Population exposures to particles as PM_{2.5}

Clause 17 of the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) required every jurisdiction to report annual performance against air quality standards and goals, from June 2018, by evaluating population exposures to particles as PM_{2.5}.

We describe below the approach adopted by New South Wales for assessing PM_{2.5} population exposure and present PM_{2.5} population exposure for 2017. We note that at the time of drafting this report, there is no agreed approach between participating jurisdictions on the procedures or methods to ensure nationally consistent evaluation and reporting. The inter-jurisdictional Expert Working Group, advising the AAQ NEPM review, has endorsed the NSW approach to reporting population exposure, pending the finalisation of a more detailed assessment methodology.

New South Wales' approach to PM_{2.5} exposure assessment

The Air Quality Index (AQI) is used by the Office of Environment and Heritage (OEH) for hourly air quality updates as a simple but effective way to communicate how air quality compares across regions and pollutants. While the AQI has wide public acceptance and will continue to be used, it is noted that the AQI does not consider the population exposed to different levels of pollution in a town or region.

OEH developed a method to account for population exposure when tracking changes in average annual PM_{2.5} concentrations. The method considers the population exposed to different levels of pollution in a town or region. The approach was described in the background paper, Clean Air Metric, published for the NSW Clean Air Summit in June 2017.

The method combines population data from the Australian Bureau of Statistics (ABS) and air quality data from all OEH-operated monitoring stations in the NSW Greater Metropolitan Region (GMR), including Greater Sydney, the Lower Hunter, Central Coast and Illawarra regions.

It involves two main steps:

1. Generating maps of population exposure to PM_{2.5} pollution. Exposure maps help to summarise spatial distributions of areas with higher population exposure to PM_{2.5} pollution.
2. Calculating the Clean Air Metric (CAM) for the selected region or area from PM_{2.5} data. The CAM values provide annual population-weighted air pollution levels, as population-weighted PM_{2.5} concentrations (micrograms per cubic metre, $\mu\text{g}/\text{m}^3$) or as Air Quality Index (AQI) values.

The benefit of the method is a means to help track whether air quality management is delivering the greatest positive health outcomes for the people of New South Wales.

How annual PM_{2.5} exposure is calculated and mapped

Annual PM_{2.5} exposure is calculated through a series of steps involving spatial mapping techniques. The steps are summarised below and illustrated with reference to the NSW GMR and Greater Sydney Region in Figure 28 to Figure 30:

Gather the air quality data, measured as the annual average PM_{2.5} concentrations ($\mu\text{g}/\text{m}^3$), for all OEH-operated air quality monitoring stations in the defined region or study area

Allocate an annual average PM_{2.5} concentration to each 1 km² square area (i.e. 1km² grid cell) across the region, using a spatial interpolation technique known as kriging. This creates

a grid of PM_{2.5} concentrations in µg/m³, one value per 1 km² area across the region (Figure 28).

Gather ABS Usual Resident Population Data, as density per 1 km² grid cell for the defined region (people per square kilometre) (Figure 29).

Generate a map of annual PM_{2.5} exposure, as follows:

For each 1km² grid cell, multiply the cell's PM_{2.5} value (µg/m³) by the cell's population density value

The product (resulting value) for the cell is the population exposure to PM_{2.5} concentration (Figure 30).

Annual population exposure to PM_{2.5} pollution is assessed by analysing the spatial distribution of the exposure map, generated at the 1 km by 1 km resolution, or to the scale of a chosen study area.

How CAM is calculated

The CAM is calculated by applying the following steps to a chosen region:

Sum the annual population exposure to PM_{2.5} pollution (based on the method described above) for all grid cells across the region of interest

Divide the result by the total population of the region. The resulting CAM value is referred to as the region's annual average population-weighted PM_{2.5} concentration (µg/m³)

The CAM value can also be presented as the region's annual average population-weighted Air Quality Index (AQI) if the result from 2) is divided by the annual NEPM standard for PM_{2.5}.

Air quality can vary significantly from year to year due to "exceptional events" such as bushfires, dust storms and climatological events like El Niño. The CAM uses three-year rolling averages to smooth out this natural variability. This aligns with reporting approaches in the European Union and the US Environmental Protection Agency exposure. It allows us to focus on assessing progress in addressing human sources contributing to poor air quality.

Further information on the CAM method can be found in the following references:

- Riley M, Scorgie Y, Jiang N, Capnerhurst J and Salter D 2017, 'A metric for assessing population-weighted average air quality exposure in New South Wales', 23rd International Clean Air and Environment Conference, Brisbane, 15-18 October 2017.
- NSW Government 2017, Clean Air Metric, background paper prepared for the NSW Clean Air Summit, Sydney, June 2017.

The calculation of NSW population exposure to PM_{2.5} pollution and the CAM values for 2017, for NSW Greater Metropolitan Region (GMR) and Greater Sydney Region (Sydney) are discussed in further detail below.

PM_{2.5} exposure for New South Wales in 2017

Spatial distribution of PM_{2.5} annual average concentration, for NSW Greater Metropolitan Region and Greater Sydney Region during 2017

Figure 28 presents the estimated distribution of PM_{2.5} annual average concentrations, across the GMR and the Greater Sydney Region for 2017. The highest PM_{2.5} annual average

concentrations, exceeding the AAQ NEPM standard of $8 \mu\text{g}/\text{m}^3$, were estimated to be experienced in areas including:

- Central Sydney, west of the central business district (CBD)
- Newcastle and the Lower Hunter Valley
- The Upper Hunter Valley.

The [NSW air emissions inventory](#) reported that the main sources of $\text{PM}_{2.5}$ emissions in 2008 were solid fuel burning and motor vehicles in Sydney, industries and vehicles in Newcastle and coal-fired power stations and domestic solid fuel burning in the Upper Hunter Valley.

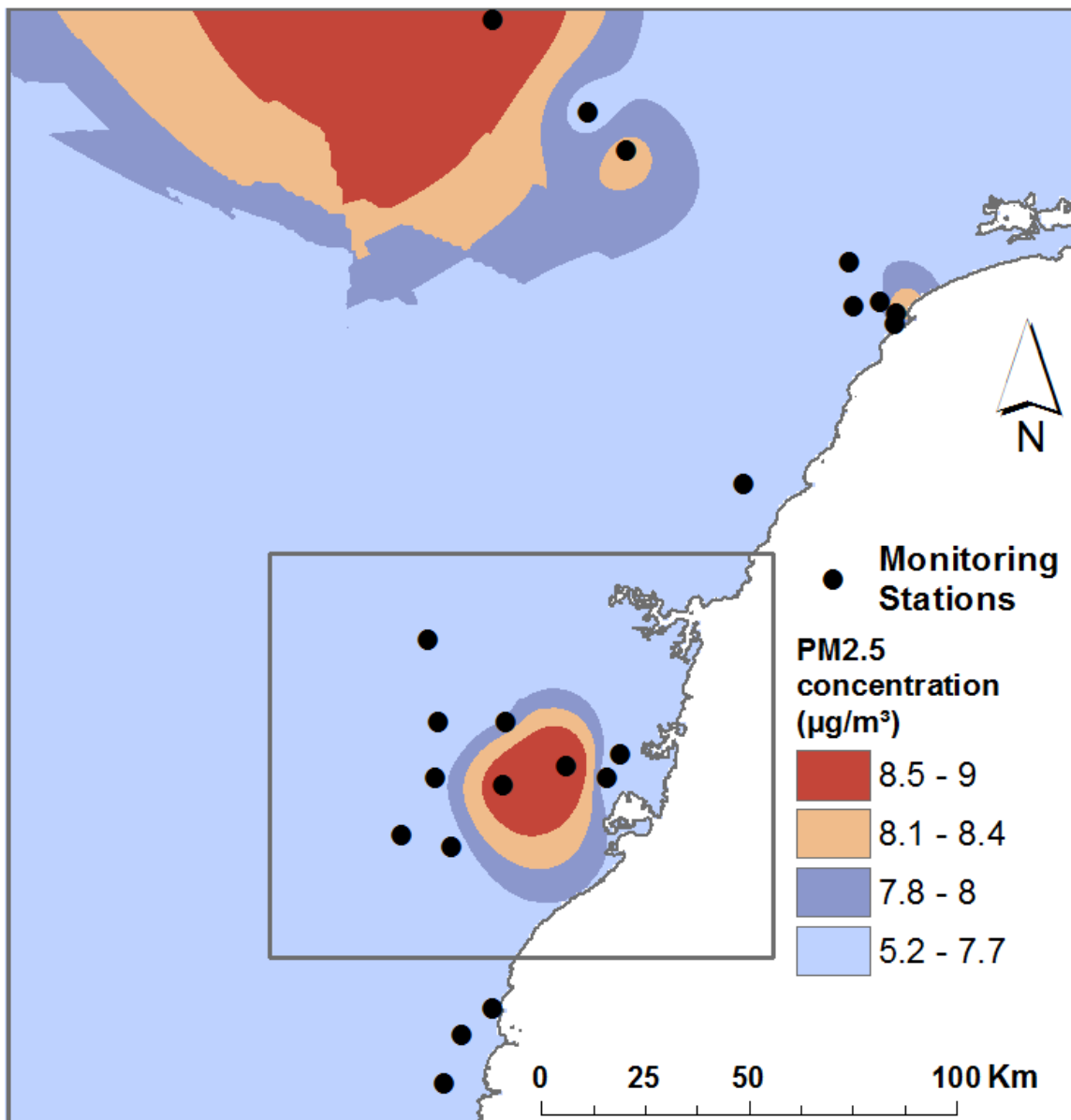


Figure 28. Spatial distribution of $\text{PM}_{2.5}$ annual average concentration for 2017, for NSW Greater Metropolitan Region and the Greater Sydney Region (inset). The air quality monitoring stations measuring $\text{PM}_{2.5}$ concentrations are shown as black dots.

Figure 28 was generated using the method outlined above, with further details below:

- The annual average PM_{2.5} concentration ($\mu\text{g}/\text{m}^3$) for 2017 at each OEH-operated air quality monitoring station in the GMR was plotted on a map of the region.
- The GIS mapping technique known as kriging was applied to shade areas in proportion to the estimated annual average PM_{2.5} concentrations across the region at the 1km² resolution.
- This technique created a grid of PM_{2.5} concentrations in $\mu\text{g}/\text{m}^3$, one value per 1km² across the region for 2017.

Population density for the NSW Greater Metropolitan and Sydney Regions in 2017

Figure 29 presents the population density for the GMR and Sydney region for 2017, at a resolution of 1km², projected from the ABS Census, 2016.

The highest population densities are located in central and east Sydney and along major transport corridors in the region.

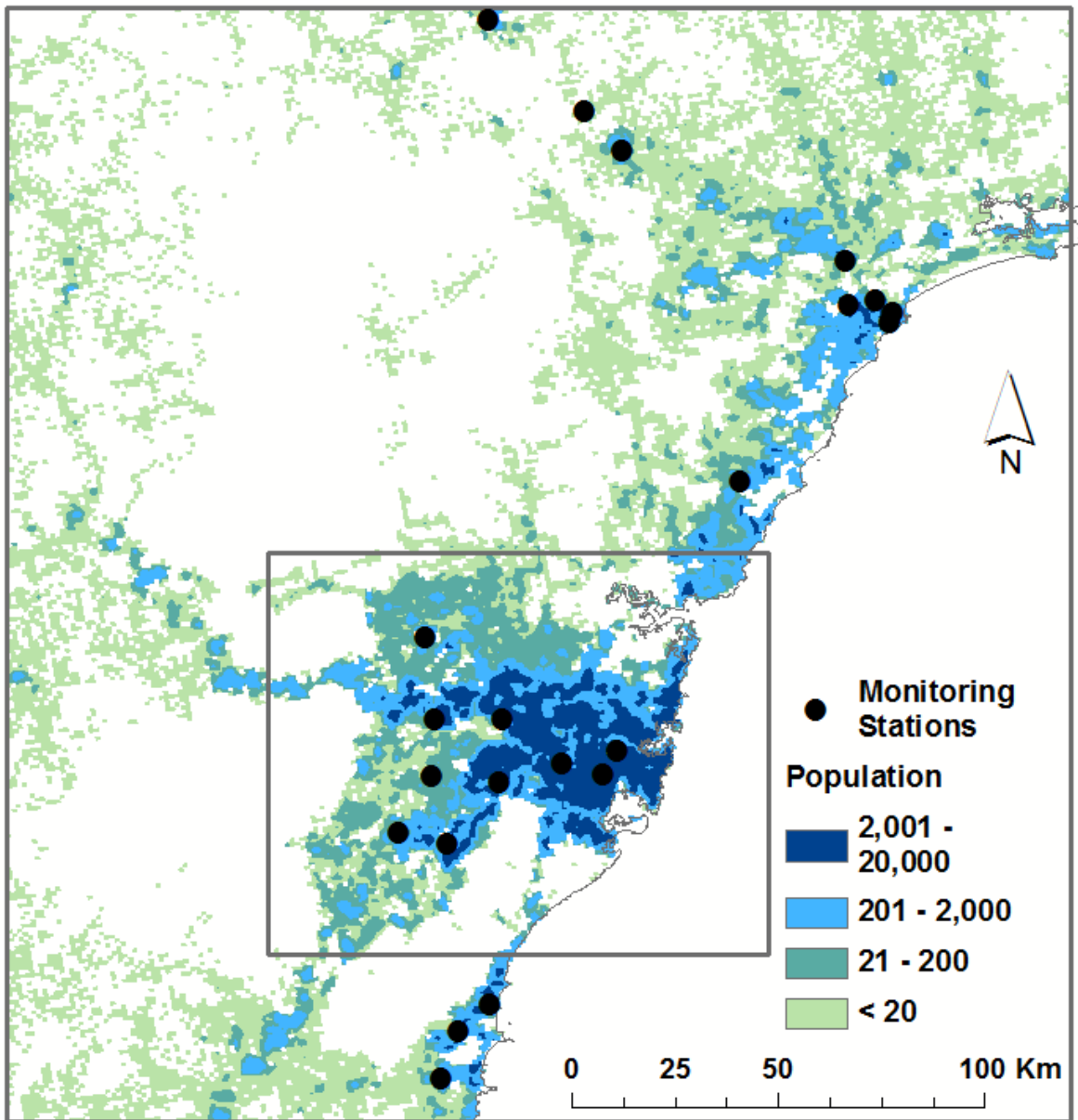


Figure 29 Population density (population/km²) for NSW Greater Metropolitan Region and Greater Sydney Region for 2017, projected from the Australian Bureau of Statistics, Census, 2016

These values were used to calculate the population exposure to PM_{2.5} concentrations for the region and the CAM, below.

PM_{2.5} population exposure for the NSW Greater Metropolitan and Greater Sydney Regions for 2017

Figure 30 presents an estimate of the population's exposure to PM_{2.5} concentrations in 2017, represented as the product of annual average PM_{2.5} concentration and population density at 1km² resolution.

The main points are summarised below:

- The greatest population exposure to PM_{2.5} pollution in the GMR during 2017 was in Sydney's CBD and along inner Sydney transport corridors (red shading).
- Annual average population exposure to PM_{2.5} was generally two times lower in central Sydney, outside the Sydney CBD and transport corridors (yellow shading).
- Population exposure to PM_{2.5} in western Sydney, the Central Coast and Lower Hunter (green and blue shading) was more than seven times lower than in the Sydney CBD and inner Sydney transport corridors.

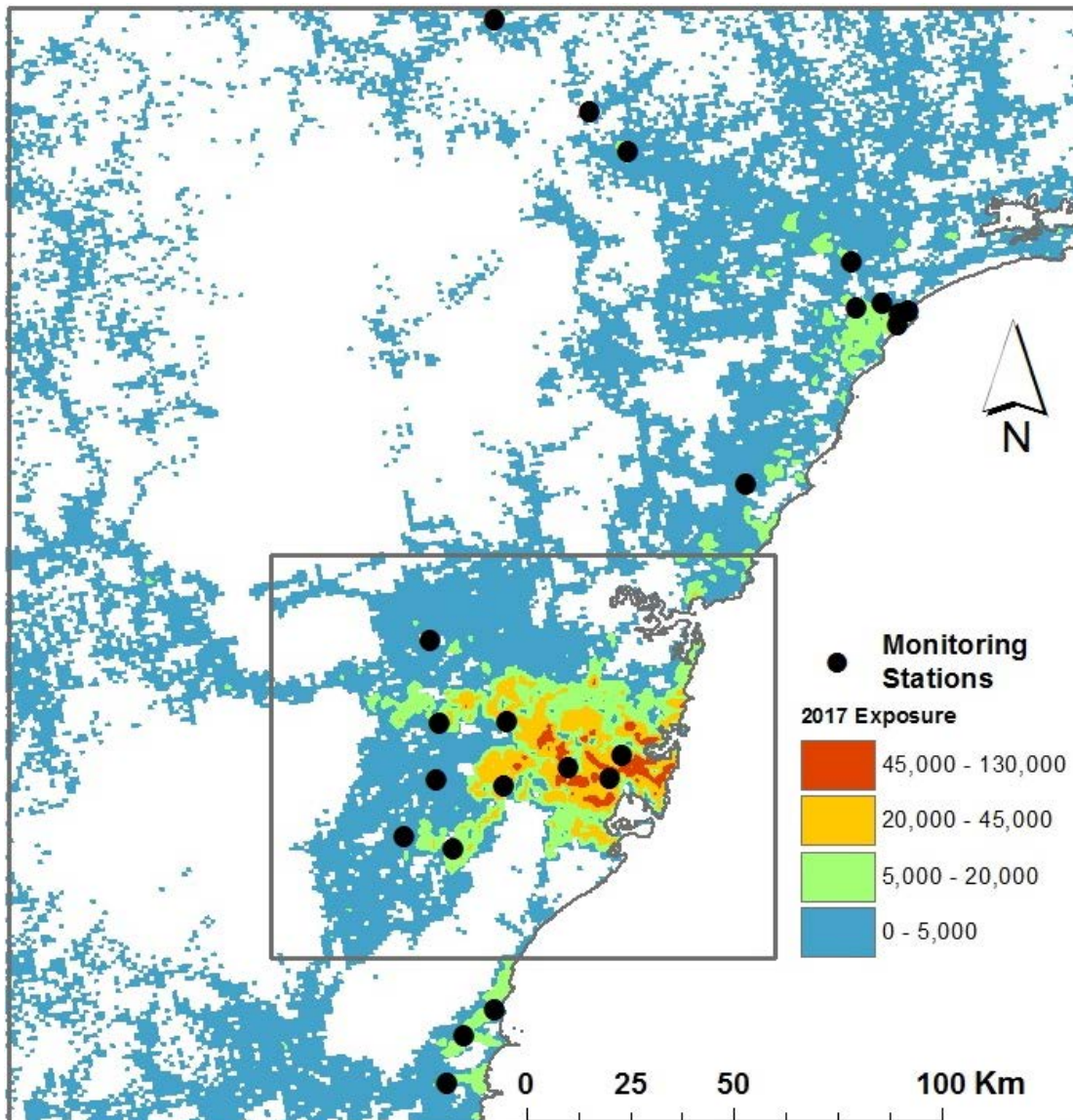


Figure 30. PM_{2.5} exposure expressed as the product of population and annual average PM_{2.5} concentration, for NSW Greater Metropolitan Region and Greater Sydney Region 2017 (PM_{2.5} * population, per square kilometre).

The values of population exposure to PM_{2.5}, referred to above, were used to calculate the CAM (below).

Clean Air Metric (CAM) calculated from PM_{2.5} data for 2017

Table 163 shows the PM_{2.5} exposure for 2017, for the NSW Greater Metropolitan Region and the Greater Sydney Region, presented as CAM in PM_{2.5} population-weighted concentration (Column 3), CAM in population-weighted Air Quality Index (AQI) (Column 4).

The Clean Air Metrics (CAMs) for the NSW GMR and the Sydney region were calculated by the method outlined above, with further details below:

- Gather data and calculate the three-year rolling average PM_{2.5} concentrations for 2017 and for each OEH-operated air quality monitoring station in the NSW GMR, based on data for 2015 to 2017.
- Calculate and map the three-year rolling average population exposure to PM_{2.5} concentrations for each 1km² grid cell across the region based on mapping methods described above.
- Sum the three-year average population exposure to PM_{2.5} concentration for all grid cells across the region.
- Divide the result by the total population of the region. The resulting value is referred to as the region's three-year rolling average population-weighted PM_{2.5} concentration (µg/m³).
- Convert the region's three-year rolling average population-weighted PM_{2.5} concentration (µg/m³) to a three-year rolling average population-weighted Air Quality Index (AQI). (That is, multiply the region's three-year average population-weighted PM_{2.5} concentration by 100/8. The value eight is used because AAQ NEPM standard for the annual average PM_{2.5} concentration is 8 µg/m³).

Table 163 Population, Clear Air Metric (CAM) expressed as population-weighted PM_{2.5} concentration, and CAM expressed as population-weighted PM_{2.5} Air Quality Index for the NSW Greater Metropolitan Region and the Greater Sydney Region, 2017

Region	Population, 3-year average	CAM as three-year average, population-weighted PM _{2.5} µg/m ³	CAM as three-year average, population-weighted PM _{2.5} AQI
Greater Sydney	4,606,160	7.6	95
NSW GMR	5,760,220	7.4	93

Analysis of Table 163 shows:

- The CAM for the Sydney Region in 2017 was 95. This means that the population-weighted average exposure of residents to PM_{2.5}, in the Greater Sydney Region, was 95% of the NEPM annual standard for PM_{2.5}.
- The CAM for the NSW GMR in 2017 was 93. This means that the population-weighted average exposure of residents to PM_{2.5}, in the NSW GMR, was 93% of the NEPM annual standard for PM_{2.5}.

OEH commissioned the ABS to provide 1km² resolution population data for all years from 1996 to 2017, based on Estimated Resident Population. This allowed OEH to calculate the metric for historic years to track changes in population exposure to air pollution.

Figure 31 and **Figure 32** show the CAM time series for Greater Sydney and the NSW GMR, respectively, for 1998 to 2017.

Figure 31 shows the following recent trends:

- The population-weighted average exposure of residents to PM_{2.5}, in the Sydney region, fell from 98% in 2016 to 95% of the NEPM standard in 2017.
- The level of exposure to PM_{2.5} in 2017 was similar to levels in 2012 to 2015.

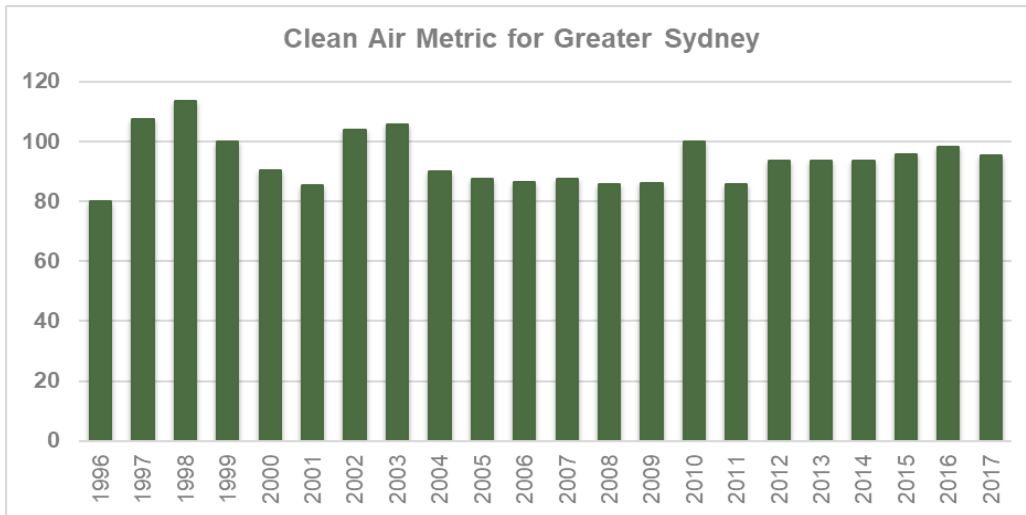


Figure 31 Clean Air Metric (CAM) time series expressed as AQI for Greater Sydney from 1996 to 2017

Figure 32 shows the following recent trends:

- The population-weighted average exposure of residents to PM_{2.5}, in the NSW GMR, fell from 96% in 2016 to 93% of the NEPM standard in 2017.
- The level of exposure to PM_{2.5} in 2017 was similar to levels in 2014, 2015 and 2010, and marginally higher than those in 2011 to 2013.

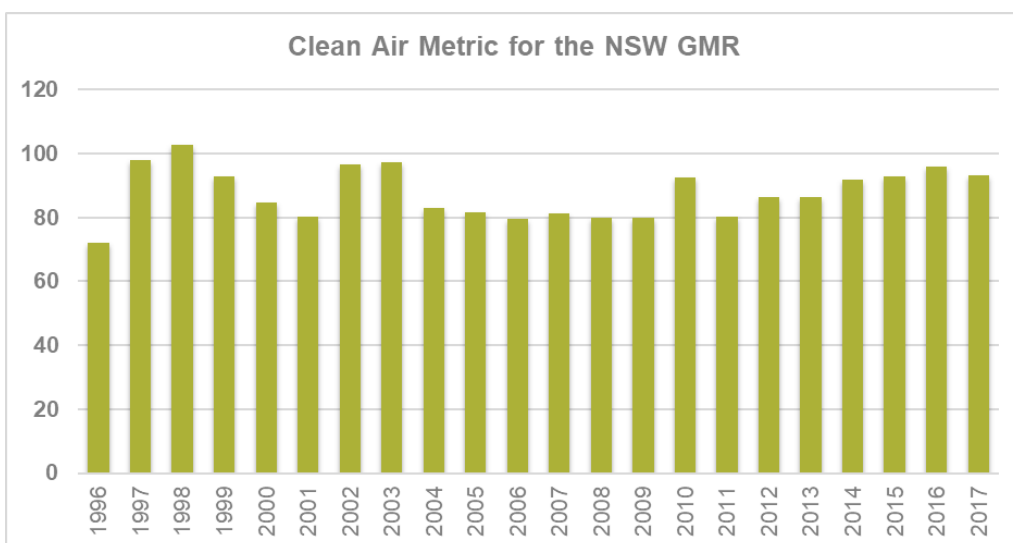


Figure 32 Clean Air Metric (CAM) time series expressed as AQI for the NSW Greater Metropolitan Region from 1996 to 2017

Appendix

A1. Summary of compliance with AAQ NEPM standards and goals

Table A. 1 Classification of NEPM particle exceedances.

NEPM particles	Exceedance days	Exceptional events	Non-exceptional events
PM ₁₀	22	7	15
PM _{2.5}	18	11	7

Source: Table A.6 below

Table A. 2 Compliance with AAQ NEPM goals, by NSW regions.

Region	1-hour O ₃	4-hour O ₃	1-day PM ₁₀	Annual PM ₁₀	1-day PM _{2.5}	Annual PM _{2.5}
Sydney	N-C	N-C	N-C	C	N-C	N-N
Illawarra	N-C	N-C	C	C	C	C
Central Coast	C	N-C	C	C	C	N-C
Lower Hunter	C	N-C	N-C	C	C	C
NSW Regional	C	N-C	N-C	C	N-C	N-C

C indicates compliance

N-C indicates non-compliance

Source: Table A.6 below

Table A. 3 Summary classification of days exceeding AAQ NEPM standards, exceptional and non-exceptional events, by air pollutant.

Air pollutant	Description of exceedance day	Number of exceedance days	Calendar dates 2017
PM ₁₀	Days when PM ₁₀ exceeded only	15 (5 exceptional) (10 non-exceptional)	13, 30-31 January (non-exceptional) 12 February (exceptional - fire) 29-31 March (non-exceptional) 10 April (exceptional – dust) 18 April (non-exceptional) 7 July (non-exceptional) 22-24 September (exceptional – dust) 12 October (non-exceptional) 14, 20 December (non-exceptional)
PM _{2.5}	Days when PM _{2.5} exceeded only	14 (9 exceptional) (5 non-exceptional)	7, 9 March (non-exceptional) 1-12, 16 May (exceptional - HRB) 3, 12 June (non-exceptional) 14, 23, 27 August (exceptional - HRB) 2-3, 10 September (exceptional HRB)
PM ₁₀ and PM _{2.5}	Days when PM ₁₀ and PM _{2.5} exceeded	4 (2 exceptional) (2 non-exceptional)	8 March (exceptional – HRB) 12 March (non-exceptional) 14 August (exceptional – HRB) 12 September (non-exceptional)
Ozone	Days when ozone exceeded only	7	1, 11 January; 10-11, 23 February; 13, 16 December
Ozone and PM ₁₀	Days when both ozone and PM ₁₀ exceeded	3	17 January; 6 February; 19 December (non-exceptional PM ₁₀)
Ozone and PM _{2.5}	Days when both ozone and PM _{2.5} exceeded	0	
Total number of AAQ NEPM exceedance days		43	

HRB – hazard reduction burning

Source: Table A. 6 below

Table A. 4 Summary of days exceeding AAQ NEPM standards classified as exceptional events, by particle type, by natural event.

Air pollutant	Natural event	Number of events	Calendar dates 2017
PM ₁₀	HRB and/or bushfires only	1	2 February (Tamworth);
	Windblown dust only	3	10 April (Tamworth); 22-23 September (statewide)
	HRB and/or bushfire and windblown dust	1	24 September 2018 (statewide dust, fire in Lower Hunter)
	Total of PM ₁₀ exceptional events	5	
PM _{2.5}	HRB and/or bushfires only	9	11-12 May (Wagga Wagga North); 15 August (Sydney South-west, Sydney North West), 23 August (Sydney North West); 2-3,10 September (Sydney North-west)
	Total of PM _{2.5} exceptional events	9	

HRB – hazard reduction burning

Source: Table A. 6 below

Table A. 5 Summary of days exceeding AAQ NEPM standards classified as exceptional events, by natural event.

Natural event	Number of exceptional events	Calendar
Hazard reduction burning or bushfires	10	2 February (Tamworth) 11-12 May (Wagga Wagga North); 15 August (Sydney South-west, Sydney North West), 23 August (Sydney North West); 2-3,10 September (Sydney North West)
Windblown dust	3	10 April (Tamworth); 22-23 September (statewide)
Hazard reduction burning or bushfires and windblown dust	1	24 September 2018 (statewide dust, fire in Lower Hunter)
Total	14	

Source: Table A. 6 below

Table A.6 Inventory of AAQ NEPM exceedance days. Source: OEH exceedance events register 2017

Count	Date	PM ₁₀ exceedance	PM ₁₀ comment	PM _{2.5} exceedance	PM _{2.5} comment	Ozone 1-hour	Ozone 4-hour	Ozone comment
1.	9/01/2017						Richmond, St Marys	High temperatures (St Marys 34°C, Richmond 36°C)
2.	11/01/2017					Albion Park South, Kembla Grange, Wollongong	Albion Park South, Kembla Grange, Wollongong	High temperatures (Albion Park South 36°C, Kembla Grange 36°C, Wollongong 31°C)
3.	13/01/2017	Wagga Wagga North	Non-exceptional event					
4.	17/01/2017	Wagga Wagga North	Non-exceptional event				Kembla Grange	High temperatures (34°C)
5.	30/01/2017	Wagga Wagga North	Non-exceptional event					
6.	31/01/2017	Wagga Wagga North	Non-exceptional event					
7.	6/02/2017	Rozelle	Non-exceptional event				Richmond	High temperatures (38°C)
8.	10/02/2017					Wyong, Rozelle, St Marys, Albion Park South, Kembla	Wallsend, Wyong, Chullora, Prospect, Rozelle, St Marys,	Two consecutive days during the most severe heatwave period recorded

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Count	Date	PM ₁₀ exceedance	PM ₁₀ comment	PM _{2.5} exceedance	PM _{2.5} comment	Ozone 1-hour	Ozone 4-hour	Ozone comment
						Grange, Wollongong	Kembla Grange, Albion Park South, Wollongong	in south-east Australia in summer 2017 (Liverpool 44°C)
9.	11/02/2017					Wallsend, Chullora, Liverpool, Prospect	Wallsend, Wyong, Chullora, Liverpool, Prospect, St Marys	Two consecutive days during the most severe heatwave period recorded in south-east Australia in summer 2017 (Liverpool 45°C)
10.	12/02/2017	Tamworth	Exceptional event – fire: Numerous small fires or smoke reported within 6 km west and south					
11.	23/02/2017						St Marys	High temperatures (35°C)
12.	7/03/2017			Chullora	Non-exceptional event			
13.	8/03/2017	Chullora	Non-exceptional event	Chullora	Non-exceptional event			
14.	9/03/2017			Chullora	Non-exceptional event			
15.	12/03/2017	Wagga Wagga North	Non-exceptional event	Chullora	Non-exceptional event			

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Count	Date	PM ₁₀ exceedance	PM ₁₀ comment	PM _{2.5} exceedance	PM _{2.5} comment	Ozone 1-hour	Ozone 4-hour	Ozone comment
16.	29/03/2017	Wagga Wagga North	Non-exceptional event					
17.	31/03/2017	Wagga Wagga North	Non-exceptional event					
18.	10/04/2017	Tamworth	Exceptional event - dust					
19.	18/04/2017	Wagga Wagga North	Non-exceptional event					
20.	11/05/2017			St Marys, Wagga Wagga North	Exceptional event – fire: HRB at Wentworth Falls, 40 km north-west of St Marys. HRB according to HR advisory for Wagga			
21.	12/05/2017			Wagga Wagga North	Exceptional event – fire: HRB according to HR advisory			
22.	16/05/2017			Wagga Wagga North	Exceptional event – fire: HRB according to HR advisory			
23.	3/06/2017			Wagga Wagga North	Non-exceptional event			
24.	12/06/2017			Wagga Wagga North	Non-exceptional event			

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Count	Date	PM ₁₀ exceedance	PM ₁₀ comment	PM _{2.5} exceedance	PM _{2.5} comment	Ozone 1-hour	Ozone 4-hour	Ozone comment
25.	3/07/2017			Liverpool	Non-exceptional event			
26.	11/07/2017	Bringelly	Non-exceptional event					
27.	14/08/2017	Bringelly, Chullora, Liverpool	Exceptional event – fire: HRBs affected most Sydney sites with significant smoke	Bringelly, Camden, Chullora, Rozelle, Earlwood, Liverpool, Prospect	Exceptional event – fire: HRBs affected most Sydney sites with significant smoke			
28.	15/08/2017			Bringelly, Camden, Liverpool, St Marys	Exceptional event – fire: Effects of HRB from 14/08/17			
29.	23/08/2017			Richmond	Exceptional event – fire: HRBs (226 ha and 198 ha) in Hawkesbury area near Richmond			
30.	27/08/2017			Chullora, Richmond	Exceptional event – fire: HRB Blue Mountains (464 ha) on 26/08/17			
31.	2/09/2017			Chullora, Earlwood, Oakdale, Prospect, Rozelle	Exceptional event – fire: Numerous HRBs around Sydney			

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Count	Date	PM ₁₀ exceedance	PM ₁₀ comment	PM _{2.5} exceedance	PM _{2.5} comment	Ozone 1-hour	Ozone 4-hour	Ozone comment
32.	3/09/2017			Prospect, St Marys	Exceptional event – fire: Smoke from HRBs on 02/09/17			
33.	10/09/2017			Richmond	Exceptional event – fire: HRB smoke			
34.	12/09/2017	Bringelly	Smoke from small burn (<20 ha)	Chullora, Wyong	Exceptional event – fire: Smoke from fire (< 20 ha) at Chullora. Numerous fires near Wyong, 52 ha, 8 km north-east			
35.	22/09/2017	Bringelly	Exceptional event – dust: First day of regional dust storm, blown by north-west winds. Elevated PM ₁₀ at most Sydney sites					
36.	23/09/2017	Kembla Grange	Exceptional event – dust: Second day					
37.	24/09/2017	Bringelly, Campbelltown West, Chullora, Kembla	Exceptional event – dust, fire: Third day of dust storm					

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Count	Date	PM ₁₀ exceedance	PM ₁₀ comment	PM _{2.5} exceedance	PM _{2.5} comment	Ozone 1-hour	Ozone 4-hour	Ozone comment
		Grange, Liverpool, Prospect, Richmond, Newcastle, Wyong	combined with 1,115 ha fire north of Newcastle (Old Inn Rd, Bulahdelah)					
38.	12/10/2017	Chullora	Non-exceptional event					
39.	13/12/2017						Bringelly, Camden	High temperatures (Camden 38°C, Bringelly 35°C)
40.	14/12/2017	Kembla Grange, Wagga Wagga North, Wollongong	Non-exceptional event					
41.	16/12/2017						Camden, Campbelltown West	High temperatures (Camden 38°C, Campbelltown West 36°C)
43.	19/12/2017	Kembla Grange, Wagga Wagga North	Non-exceptional event			Camden, Liverpool	Camden, Chullora, Kembla Grange, Liverpool	Severe heatwave (Penrith 43°C)
44.	20/12/2017	Bringelly	Non-exceptional event					

HRB – hazard reduction burning

Table A. 7 Number of exceedance days, by region, for AAQ NEPM standard 2016 and 2017.
 Source: Table 15, Table 16 (ozone), Table 20 (PM₁₀), Table 22 (PM_{2.5})

Monitoring region /station	Ozone, O ₃				Particles			
	1-hour		4-hour		24-hour PM ₁₀		24-hour PM _{2.5}	
	2016	2017	2016	2017	2016	2017	2016	2017
Sydney	2	3	2	8	6 (4)	9 (4)	6 (6)	14 (9)
Central Coast	0	1	0	2	0	1 (1)	0	1 (1)
Illawarra	1	2	3	4	5 (2)	4 (1)	3 (3)	0
Lower Hunter	0	1	0	2	1 (1)	1 (1)	1 (1)	0
Regional NSW					17 (0)	12 (2)		5 (3)
Albury					1 (0)	0		
Bathurst					0	0		
Tamworth					1 (0)	2 (2)		
Wagga Wagga Nth					16 (0)	10 (0)		5 (3)

Notes.

1. A blank cell means no monitoring was undertaken at the station.
2. Parentheses () show the number of days classified as exceptional events.
3. Compliance light green indicates a region recorded no exceedances of AAQ NEPM standards and complied with AAQ NEPM goals.
4. Compliance dark green indicates a region exceeded the AAQ NEPM standard and complied with the AAQ NEPM goal. This means, the region experienced, either more than one exceedance day for ozone, and/or one or more exceptional events for particles.
5. Non-compliance grey indicates a region failed to comply with the AAQ NEPM goal. This means the region experienced, either more than one exceedance day for ozone, and/or one or more exceedance days for particles that were non-exceptional events.

Notes for determining non-compliance

6. Each count is a distinct calendar day, when one or more monitoring stations in a region recorded an exceedance of an AAQ NEPM standard. That is, an exceedance day may be observed at more than one station in a region or at more than one region in the State.
7. Non-compliance with an AAQ NEPM ozone goal occurs when one or more monitoring stations in a region records more than one exceedance day.
8. Parentheses () show the number of days when a region recorded exceedances of AAQ NEPM 1-day particle standards, which were classified as exceptional events (exceedances directly related to natural events such as hazard reduction burning, bushfires or windblown dust).
9. Non-compliance with AAQ NEPM particle goals occurs when one or more exceedance day was a non-exceptional event.
10. Individual stations for NSW regions are shown to distinguish Wagga Wagga North, where agricultural burning is practiced.
11. In 2016, PM_{2.5} exceedances in NSW regions were classification as exceptional events or non-exceptional events.
12. Data availability criteria defined by AAQ NEPM (> 75% data available) has not been applied to the regions.