



Government of **Western Australia**  
Department of **Environment Regulation**

REPORT

# 2014 Western Australia Air Monitoring Report

*Written to comply with the National Environment Protection  
(Ambient Air Quality) Measure*

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## Section A – Monitoring summary

### Current monitoring stations

The Department of Environment Regulation (DER) monitoring network shown in Figure A1 was the subject of careful design for the purposes of the Perth Photochemical Smog Study, the Perth Haze Study and the management of sulfur dioxide in the Kwinana area.

The network's design was based on the knowledge of emissions sources, pollutant chemistry and important features of the meteorology.

CSIRO (Commonwealth Scientific and Industrial Research Organisation) Atmospheric Research provided advice on monitoring site locations for the Perth Photochemical Smog Study and Perth Haze Study.

The Bunbury station shown in Figure A2 was established in the south-west of the state to monitor fuel reduction burns, and stations in Busselton and Collie are also in operation for that purpose.

The Geraldton station shown in Figure A3 was established in the mid-west of the state to monitor windblown crustal material and smoke from bushfires, hazard reduction or stubble burning and possibly wood-fired home heaters. A particle monitoring station was also established in Albany (Figure A4). Table A1 indicates the pollutants monitored at each site.

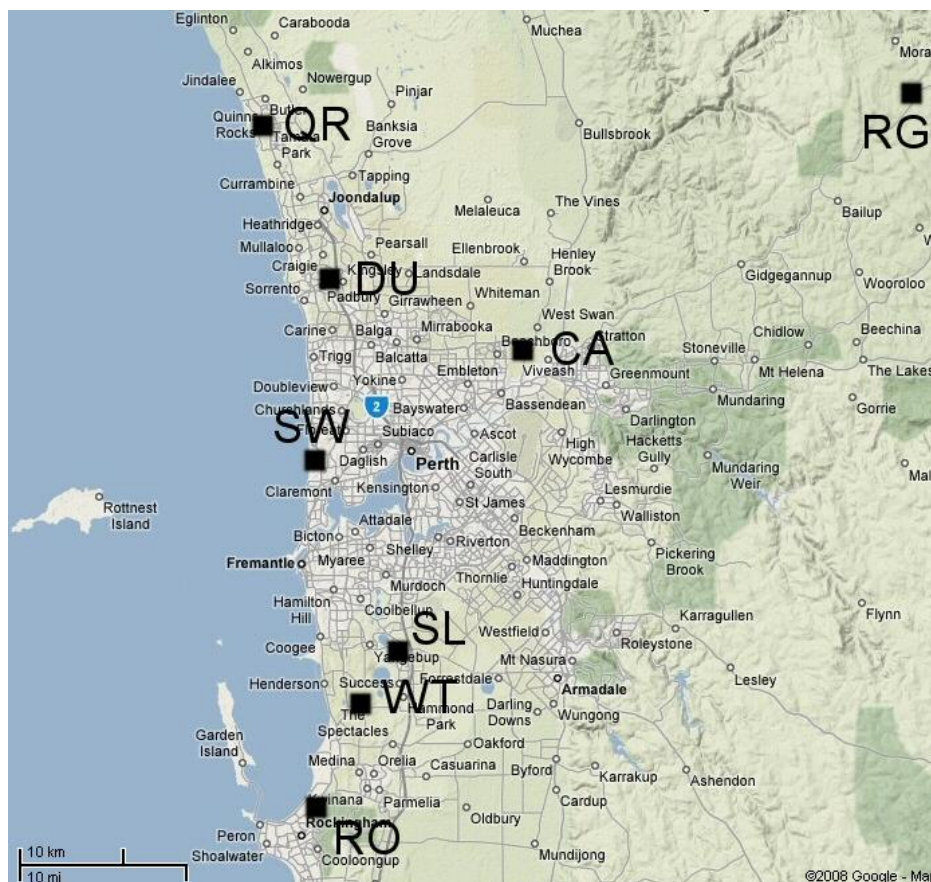


Figure A1 - DER air quality monitoring stations operating in the Perth metropolitan region.





Figure A2 - DER air quality monitoring stations operating in Bunbury, Busselton and Collie



Figure A3 - DER air quality monitoring station operating in Geraldton

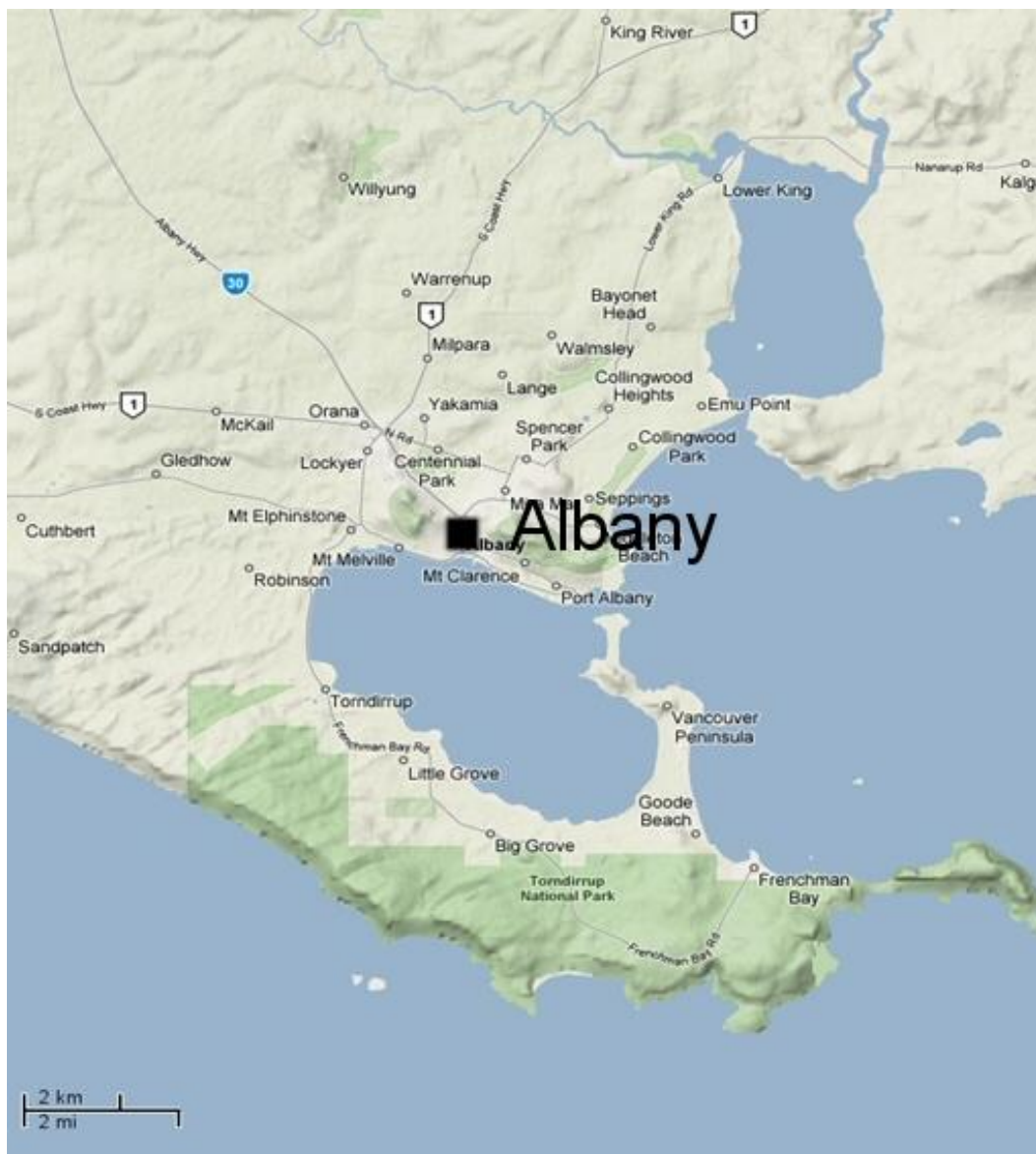


Figure A4 - DER air quality monitoring station operating in Albany

**Table A1. Air quality parameters measured at DER monitoring stations.**

Monitoring site	CO	O <sub>3</sub>	NO <sub>2</sub>	SO <sub>2</sub>	PM <sub>10</sub> TEOM	PM <sub>2.5</sub> TEOM
<b>AL</b> Albany					07/06 to present	
<b>BN</b> Bunbury					06/99 to present	04/97 to present
<b>BS</b> Busselton						11/06 to present
<b>CA</b> Caversham	08/93 to present	11/89 to present	09/90 to present		01/04 to present	03/94 to present
<b>CO</b> Collie					02/08 to present	
<b>DU</b> Duncraig	08/95 to present		08/95 to present		06/96 to present	01/95 to present
<b>GE</b> Geraldton					09/05 to present	
<b>QR</b> Quinns Rock		11/92 to present	11/92 to present			07/06 to present
<b>RO</b> Rockingham		12/95 to present	12/95 to present	07/88 to present		
<b>RG</b> Rolling Green		01/93 to present	01/93 to present			
<b>SL</b> South Lake	03/00 to present	03/00 to present	03/00 to present	03/00 to present	03/00 to present	04/06 to present
<b>SW</b> Swanbourne		01/93 to present	03/93 to present			
<b>WT</b> Wattleup				01/88 to present		

DER has from time to time performed campaign monitoring for various projects. While these short-term projects are not reported within this document, detailed reports and/or data can be obtained from [www.der.wa.gov.au](http://www.der.wa.gov.au), by emailing [airquality@der.wa.gov.au](mailto:airquality@der.wa.gov.au) or telephoning (08) 6467 5000.



**Table A2. Methods used to monitor air quality at DER monitoring stations.**

Pollutant	Standard	Method
Carbon monoxide	AS 3580.7.1 1992 – Methods for sampling and analysis of ambient air – Determination of carbon monoxide – Direct-reading instrumental method	Gas filter correlation spectrophotometry
Ozone	AS 3580.6.1 1990 – Methods for sampling and analysis of ambient air – Determination of ozone – Direct-reading instrumental method	Ultraviolet absorption
Nitrogen dioxide	AS 3580.5.1 1993 – Methods for sampling and analysis of ambient air – Determination of oxides of nitrogen – Chemiluminescence method	Chemiluminescence
Sulfur dioxide	AS 3580.4.1 2008 – Methods for sampling and analysis of ambient air – Determination of sulfur dioxide – Direct-reading instrumental method	Ultraviolet fluorescence
Particles as PM <sub>10</sub>	AS 3580.9.8 2008 – Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM <sub>10</sub> continuous direct mass method using a tapered element oscillating microbalance analyser	Tapered element oscillating microbalance
Particles as PM <sub>2.5</sub> <sup>1</sup>	AS 3580.9.13 2013 – Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM <sub>2.5</sub> continuous direct mass method using a tapered element oscillating microbalance analyser	Tapered element oscillating microbalance

1 – PM<sub>2.5</sub> TEOMs within the DER network are not fitted with filter dynamic measurement systems (FDMS).

**Table A3. Monitoring in Western Australia.**

Site	CO	O <sub>3</sub>	NO <sub>2</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
AL - Albany					M	
BN - Bunbury					M	DER
BS - Busselton						DER
CA - Caversham	DER	T	T		P	DER
CO - Collie					DER	
DU - Duncraig	T		DER		T	DER
GE - Geraldton					M	
QR - Quinns Rock		DER	DER			DER
RG - Rolling Green		DER	DER			
RO - Rockingham		DER	DER	DER		
SL - South Lake	P	T	P	T	P	DER
SW - Swanbourne		T	P		DER	
WT - Wattleup				DER		

**Key to symbols:****P** Performance monitoring station**M** Campaign monitoring**T** Trend performance monitoring station**DER** Station will be maintained by DER for the foreseeable future

**Table A4. Monitoring site description**

Site	Description
AL - Albany	Large rural town located 380 kilometres south south-west of Perth with moderate density housing and typical local traffic flows.
BN - Bunbury	Large rural town located 145 kilometres south of Perth with moderate density housing and typical local traffic flows.
BS - Busselton	Small rural town located 185 kilometres south of Perth with moderate density housing and typical local traffic flows.
CA - Caversham	Semi-rural north east metropolitan suburb located in the Swan Valley, a grape growing region next to the Perth foothills, 14 kilometres north-east of the Perth CBD. The region mainly comprises low density housing and paddocks. Some brick manufacturing occurs in the region.
CO - Collie	Small rural town located within a forested region 152 kilometres south of Perth with moderate density housing and typical traffic flows. Coal mining and power generation industries are located within the region.
DU - Duncraig	North metropolitan suburb located 16 kilometres NNW from the Perth CBD with moderate/high density housing and moderate to high traffic flow. The site is located 200 metres west of the Mitchell Freeway, a main north-south arterial road carrying approximately 98,000 vehicles daily.
GE - Geraldton	Large rural town located 377 kilometres north of Perth in the mid-west with moderate density housing and typical traffic flows.
QR - Quinns Rock	Outer north coastal suburb located 35 kilometres north of Perth with moderate density housing and typical local traffic flows
RG - Rolling Green	Outer east rural suburb located 56 kilometres north-east of Perth with low density rural housing and low traffic flows. The closest road is 80 metres east of the site supporting a traffic flow of 3200 vehicles per day.
RO - Rockingham	A south coastal site located 35 kilometres south of Perth with moderate density housing and typical traffic flows and adjacent to the southern border of the Kwinana Industrial Area. There exists a 34,700 vehicle per day major arterial road 1 kilometre east of the site.
SL - South Lake	South-east metropolitan site located 17 kilometres south of Perth with moderate/high density housing and moderate to high traffic flow. The site is located 1.6 kilometres west of the Kwinana freeway, a main north-south arterial road carrying approximately 87,000 vehicles daily and is 4 kilometres north east of the northern border of the Kwinana industrial area
SW - Swanbourne	An inner coastal site located on coastal sand dunes 9 kilometres west of the Perth CBD, is 150 metres west of a major north-south arterial road carrying approximately 27,200 vehicles per day.
WT - Wattleup	A south metro site located 25 kilometres south of Perth within a defined buffer area for the Kwinana Industrial Area. Surrounding land uses are retail outlets and market gardens.

**Table A5. Screening procedures used to demonstrate whether pollutants are consistently below standards.**

Screening procedures
A. Campaign monitoring at a Generally Representative Upper Bound (GRUB) monitoring location (with no significant deterioration expected over 5-10 years).
B. Use of historical data within a region which will contain one or more GRUB monitoring stations to demonstrate that the full number of stations (according to 14(1)) is not required, either to detect exceedences or gain a more representative depiction of pollutant distribution.
C. Use of modelling within a region which will contain one or more GRUB monitoring stations to demonstrate that the full number of stations (according to 14(1)) is not required, either to detect exceedences or gain a more representative depiction of pollutant distribution.
D. In a region with no performance monitoring, use of validated (1) modelling with detailed and reliable estimates of emissions and meteorological data.
E. In a region with no performance monitoring, and in the absence of emissions and detailed meteorological data, use of generic model results based on gross emissions estimates, 'worst case' meteorology estimates and other conservative assumptions.
F. In a region with no performance monitoring, comparison with a NEPM compliant region with greater population, emissions and pollution potential.
P. Performance monitoring.
T. Trend monitoring.
M. Campaign monitoring.

**Table A6. Screening procedures satisfied at each station.**

Site	Pop'n <sup>a</sup>	CO	O <sub>3</sub>	NO <sub>2</sub>	SO <sub>2</sub>	Pb	PM <sub>10</sub>
Perth and Rockingham	1,740,000				B&C	A	
Mandurah <sup>b</sup>	74,127	P	P	P	F	F	P
Albany	36,551						
Bunbury	35,242	A&F	E&F	E&F	D&F	F	
Kalgoorlie-Boulder <sup>c</sup>	33,092	M	E&F	E&F	T	F	P
Geraldton	39,404	F	E&F	E&F	D&F	F	M

Grey shaded cells represent Performance, Trend or Campaign sites where monitoring is currently underway.

a – 2011 data (www.abs.gov.au)

b – Mandurah station has yet to be established

c – Kalgoorlie station has yet to be established

Details of screening procedures are given in the monitoring plan available at <http://www.scew.gov.au/files/resources/9947318f-af8c-0b24-d928-04e4d3a4b25c/files/aaqprctp04screeningprocedures200705final.pdf>

**Table A7. Stations site compliance with AS/NZ 3580.1.1 - 2007**

	Height above ground	Min. distance to support structures	Clear sky angle of 120°	Unrestricted airflow of 270°/360°	20m from trees	No extraneous sources nearby	Minimum distance from road or traffic	Sample line material	Sample line length	Comments
<b>Perth region</b>										
Caversham	☑	☑	☑	☑	☑	☑	☑	☑	☑	
Duncraig	☑	☑	☒	☑	☒	☑	☑	☑	☑	6 metres to medium sized trees and presence of power pole.
Quinns Rocks	☑	☑	☑	☑	☒	☑	☑	☑	☑	15 metres to small to medium size trees. Surrounding area dominated by low scrub.
Rockingham	☑	☑	☑	☑	☒	☑	☑	☑	☑	12 metres to trees. Northern vector dominated by grain storage facility.
Rolling Green	☑	☑	☑	☑	☑	☑	☑	☑	☑	
South Lake	☑	☑	☑	☑	☑	☑	☑	☑	☑	
Swanbourne	☑	☑	☑	☑	☑	☑	☑	☑	☑	
Wattleup	☑	☑	☑	☑	☒	☑	☑	☑	☑	10 metres to medium to large eucalyptus trees.
<b>Southwest region</b>										
Albany	☑	☑	☑	☑	☑	☑	☑	☑	☑	
Bunbury	☑	☑	☑	☑	☒	☑	☑	☑	☑	15 metres to small to medium eucalyptus trees.
Busselton	☑	☑	☑	☑	☒	☑	☑	☑	☑	5 metres to small to medium eucalyptus trees.
Collie	☑	☑	☒	☑	☒	☑	☑	☑	☑	Some trees and containers nearby.
<b>Midwest region</b>										
Geraldton	☑	☑	☑	☑	☑	☑	☑	☑	☑	

## Carbon monoxide

Duncraig monitoring station is an upper bound site for monitoring the combined effects of emissions from vehicles on the nearby Mitchell Freeway, and from domestic wood fires.

The site is located approximately 200 metres west of the Mitchell Freeway, so it is well beyond the distance of roadside measurement.



By Perth's standards, the site is representative of dense population, and lies in a dunal depression through which the freeway passes, hence the effect of stable air pooling in the depression is likely to lead to elevated concentrations. This feature would be found in many other places across the coastal plain.

South Lake monitoring station lies in a growing urban area and is likely to see moderate levels of CO from wood fires in particular. It is not as close to major roads as the Duncraig site, and is therefore more typical of a population-average site.

Caversham monitoring station is located in a region of low population density and is therefore not considered a performance monitoring station.

In summary, WA maintained performance monitoring of CO at nominated trend stations of Duncraig and South Lake.

Trend analysis for each of these sites shows that overall the maximum of the eight-hourly averages at each site have declined between 0.1 and 0.04 ppm per year as shown in Figure A5.

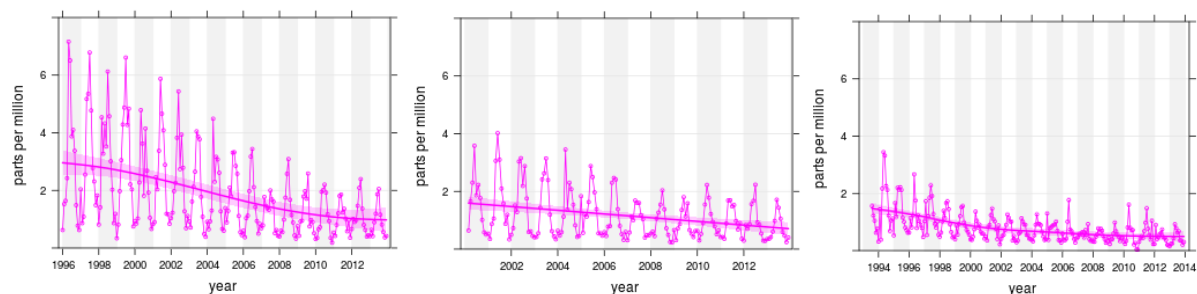


Figure A5 -Smoothed trend (dark lines) for CO at Duncraig(left), South Lake (centre) and Caversham (right)

## Photochemical oxidants as ozone

Statistics for the coastal sites of Quinns Rocks, Swanbourne and Rockingham indicate there is little difference between each station over the long term. Swanbourne was selected as a performance monitoring station, while monitoring stations at Quinns Rocks and at or near Rockingham were maintained.

Given its location, there is reason to be confident that Caversham monitoring station represents an upper bound, middle distance, inland site. Accordingly, Caversham was selected as a performance monitoring station site.

A third performance monitoring station was located at South Lake. It has the following desirable attributes:

- it provides spatial spread of stations (it will measure ozone returning on shore in the southern part of the metropolitan area);
- it is a moderate distance inland in a growing urban area, hence it is well classed as a population average station;
- it may occasionally detect the interactions of O<sub>3</sub>-rich air with the NO<sub>x</sub>-rich plumes from Kwinana industry (potentially giving elevated NO<sub>2</sub> concentrations).

Caversham, Swanbourne and South Lake sites are all nominated as trend stations.

DER will continue to maintain the stations at Rockingham, Quinns Rocks and Rolling Green as part of its wider ozone network.

Long-term analysis is presented in Figure A6. The number of periods when the one hour ozone concentration exceeded the long term average at Swanbourne has increased for every five year period with the ratio climbing from 0.82 in 1995-99 to 1.2 in 2010-14.

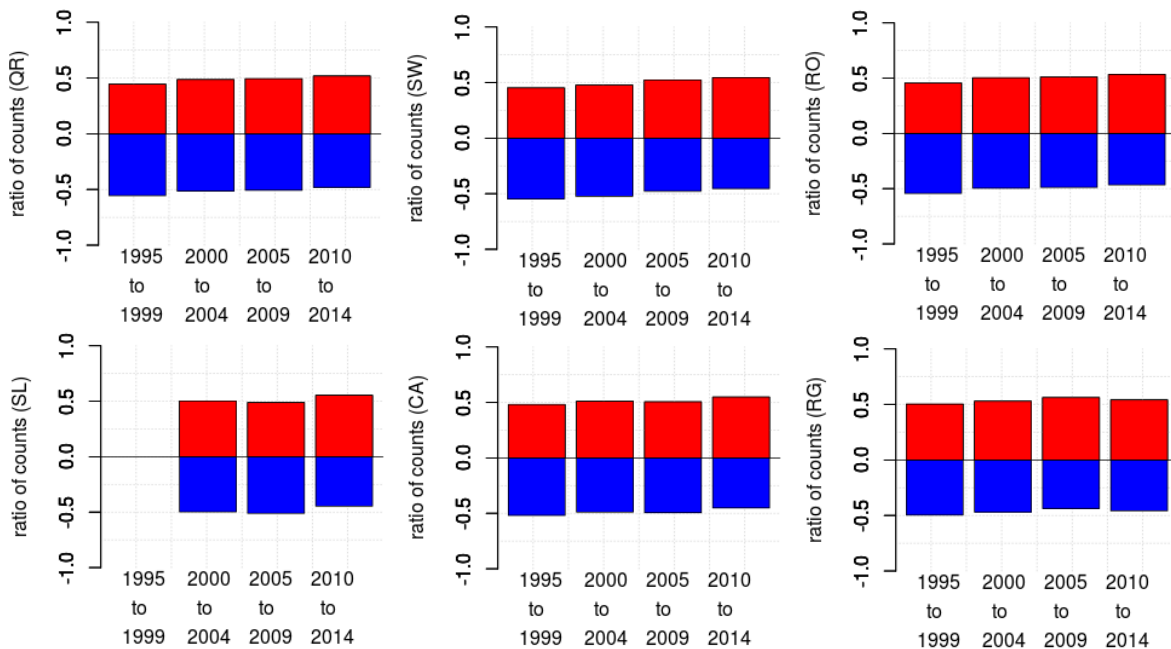


Figure A6 - Ratio of the number of hourly averaged ozone concentrations at Quinns Rocks, Swanbourne and Rockingham (top panel) and South Lake, Caversham and Rolling Green (lower panel) that was higher (red) or equal to or lower (blue) than the 20 year average concentration for that site

A similar pattern is evident at the two other coastal sites of Quinns Rocks and Rockingham. The inland sites of Caversham, Rolling Green have a less distinct pattern. South Lake commenced in Feb 2000 and therefore cannot be directly compared with the others, but is shown in the figure for completeness.

### Nitrogen dioxide

Owing to the close chemical reactivity relationship, NO<sub>2</sub> is currently being monitored at all stations where O<sub>3</sub> is monitored. Caversham, Swanbourne and South Lake sites were chosen as performance monitoring stations for NO<sub>2</sub> as these provide a good spatial distribution.

Caversham, Swanbourne and South Lake sites are also trend stations.

DER will continue to measure NO<sub>2</sub> at Quinns Rocks, Rolling Green and Duncraig as part of its wider network.

Figure A7 demonstrates how NO<sub>x</sub> (NO + NO<sub>2</sub>) monthly means have decreased at all sites. The median of the daily one hour NO maximum have also seen a general decrease over time with Duncraig experiencing an average of 1.9 ppb per annum decrease since 1996.

A possible unintended result of these decreasing concentrations of oxides of nitrogen is their inability to fully suppress ozone formation by (typically) producing NO<sub>2</sub> (NO + O<sub>3</sub> → NO<sub>2</sub> + O<sub>2</sub>). The general build-up in O<sub>3</sub> therefore commences earlier (and therefore closer to populated areas) than it otherwise would.

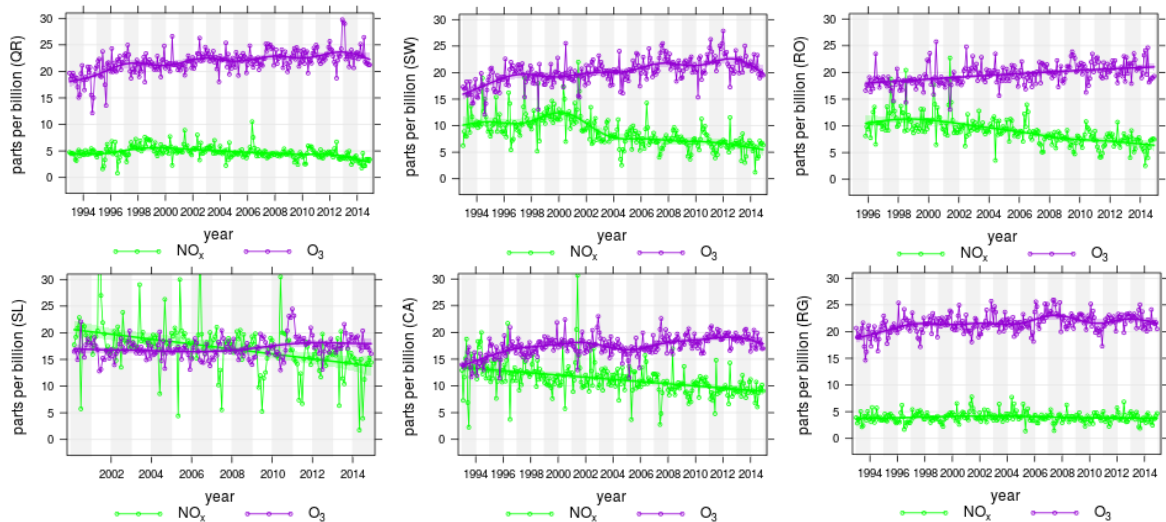


Figure A7 - Smoothed deseasonalised trend (dark lines) at Quinns Rocks, Swanbourne and Rockingham (top panel) and South Lake, Caversham and Rolling Green (lower panel) using the monthly mean concentration of NO<sub>x</sub> (green) and O<sub>3</sub> (violet)

## Sulfur dioxide

DER operates one performance monitoring station at South Lake for sulfur dioxide, while maintaining a source management network which includes Wattleup and Rockingham monitoring stations.

South Lake site is an upper bound performance monitoring station for sulfur dioxide, and a trend station. South Lake is near the southern extent of the main urban population and downwind of Kwinana in sea breeze conditions.

Heavy industries in Kwinana are the only significant sources of sulfur dioxide in the Perth / Kwinana / Rockingham region. Concentrations of sulfur dioxide have reduced markedly since the late 1970s due to the conversion from high to low sulfur fuels and the installation of sulfur dioxide control technologies. Emissions are controlled under the provisions of an Environmental Protection Policy (EPP) to ensure ambient concentrations do not exceed ambient standards set in the EPP.

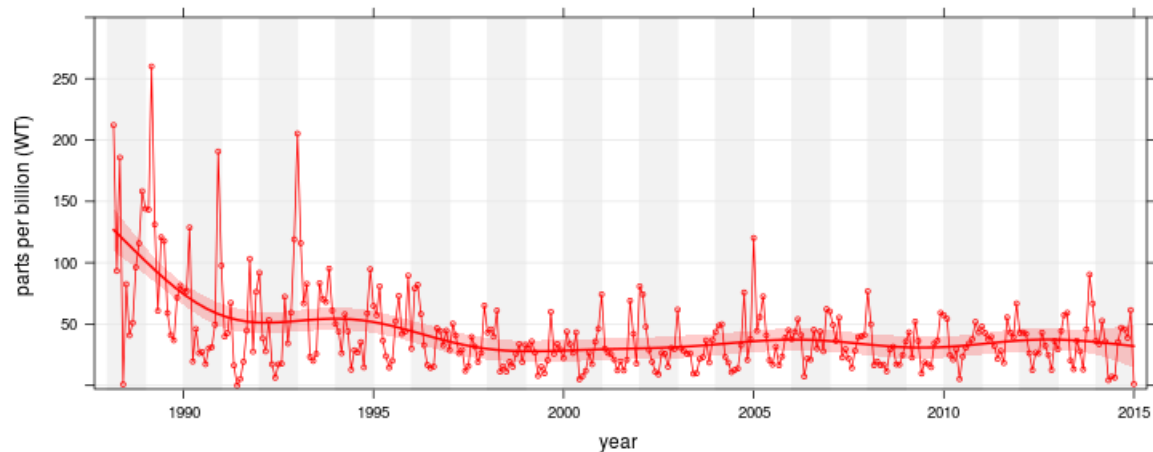


Figure A8 – Trend line for maximum hourly averaged sulfur dioxide concentration at Wattleup, located within the Kwinana Industrial Buffer.

## Lead

Since 1995, lead levels within the Perth CBD have been below 60% of the  $0.5 \mu\text{g}/\text{m}^3$  annual NEPM standard. In 2001, the average lead level in Perth was  $0.022 \mu\text{g}/\text{m}^3$ , less than 5% of the NEPM standard.

In accordance with National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 4, Screening Procedures, and the WA Monitoring Plan, a performance monitoring station for lead has not been maintained since 2001.

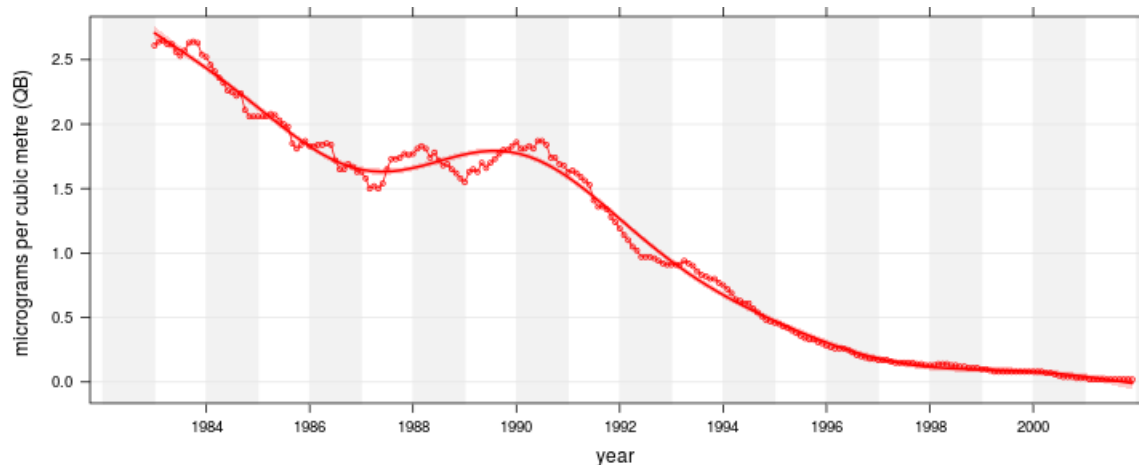


Figure A9 – Trend line for annual moving averaged lead concentration within the Perth CBD.

## Particles as $\text{PM}_{10}$

Dun Craig site is an upper-bound performance monitoring station site for  $\text{PM}_{10}$ . High levels of  $\text{PM}_{10}$  here are caused by a combination of vehicle and domestic wood heater emissions during strongly stable meteorological conditions.

Likewise, the site at South Lake measures significant  $\text{PM}_{10}$  concentrations arising from wood fires.

Dun Craig and South Lake sites are both nominated as trend stations.

Campaign monitoring stations were established at Geraldton in September 2005, Albany in July 2006 and Collie in February 2008.

All Tapered Element Oscillating Microbalances (TEOMs) used by DER are operated continuously and unadjusted for temperature. All TEOM data presented in this report has the manufacturers recommended equivalency factor of  $1.03x + 3.00$  applied.

## Particles as $\text{PM}_{2.5}$

To make assessments against the advisory standard, four  $\text{PM}_{2.5}$  TEOMs were installed in the greater Perth metropolitan area at Quinns Rocks, Caversham, Dun Craig and South Lake and one each in Bunbury and Busselton. All will remain in use at these locations indefinitely with the intention of developing trend data.

All Tapered Element Oscillating Microbalances (TEOMs) used by DER are operated continuously (unadjusted for temperature).

All TEOM data presented in this report has the manufacturers recommended equivalency factor of  $1.03x + 3.00$  applied.

## Exceedence Summary

While there were a number of exceedences of both PM<sub>2.5</sub> and PM<sub>10</sub> in 2014, the NEPM goal for particles was met at all sites. Detailed summaries of all exceedences are provided in Attachment 2.

**Table A8. Air NEPM exceedences recorded during 2014**

Site	Pollutant	Concentration <sup>1</sup>	Date / Time
Bunbury	PM <sub>2.5</sub> – 24 hour	34.6 µg/m <sup>3</sup>	02/11/2014
Busselton	PM <sub>2.5</sub> – 24 hour	25.1 µg/m <sup>3</sup>	03/05/2014
Caversham	PM <sub>10</sub> – 24 hour	52.6 µg/m <sup>3</sup>	05/01/2014
Caversham	PM <sub>2.5</sub> – 24 hour	39.3 µg/m <sup>3</sup>	05/01/2014
Duncraig	PM <sub>10</sub> – 24 hour	53.0 µg/m <sup>3</sup>	05/01/2014
Duncraig	PM <sub>2.5</sub> – 24 hour	47.6 µg/m <sup>3</sup>	05/01/2014
Collie	PM <sub>10</sub> – 24 hour	50.8 µg/m <sup>3</sup>	12/10/2014
Collie	PM <sub>10</sub> – 24 hour	73.3 µg/m <sup>3</sup>	28/10/2014
Geraldton	PM <sub>10</sub> – 24 hour	53.6 µg/m <sup>3</sup>	05/01/2014
Geraldton	PM <sub>10</sub> – 24 hour	51.1 µg /m <sup>3</sup>	11/01/2014
Geraldton	PM <sub>10</sub> – 24 hour	52.1 µg/m <sup>3</sup>	20/01/2014
Geraldton	PM <sub>10</sub> – 24 hour	55.7 µg /m <sup>3</sup>	24/12/2014
Quinns Rocks	PM <sub>2.5</sub> – 24 hour	39.5 µg/m <sup>3</sup>	05/01/2014
Quinns Rocks	PM <sub>2.5</sub> – 24 hour	31.3 µg/m <sup>3</sup>	15/10/2014
South Lake	PM <sub>2.5</sub> – 24 hour	29.8 µg/m <sup>3</sup>	05/01/2014
South Lake	PM <sub>2.5</sub> – 24 hour	25.7 µg/m <sup>3</sup>	15/10/2014

1. All Tapered Element Oscillating Microbalances (TEOMs) used by DER are operated continuously (unadjusted for temperature) and has the manufacturers recommended equivalency factor of 1.03x + 3.00 applied.



## Section B – Assessment of compliance with standards and goals

**Table B1. 2014 compliance summary for carbon monoxide**

AAQ NEPM Standard  
9.0 ppm (8-hour average)

Regional Performance Monitoring Station	Data availability rates (% of hours)					Number of exceedences (days)	Performance against the standards and goal
	Q1	Q2	Q3	Q4	Annual		
<b>Perth region</b>							
Caversham (North East Metro)	87.5	98.3	98.5	99.8	96.1	0	met
Duncraig (North Metro)	99.3	99.9	99.9	99.8	99.7	0	met
South Lake (South East Metro)	98.9	99.8	100	99.3	99.5	0	met

Performance against the standards and goal: “met”, “not met”, “not demonstrated”

**Table B2. 2014 compliance summary for nitrogen dioxide**

AAQ NEPM Standard  
0.12 ppm (1-hour average)  
0.03 ppm (1-year average)

Regional Performance Monitoring Station	Data availability rates (% of hours)					Annual mean (ppm)	Number of exceedences (days)	Performance against the standards and goal	
	Q1	Q2	Q3	Q4	Annual			1-hour	1-year
<b>Perth region</b>									
Caversham (North East Metro)	84.8	97.8	97.9	96.2	94.2	0.006	0	met	met
Duncraig (North Metro)	99.4	99.7	98.3	99.8	99.3	0.006	0	met	met
Quinns Rocks (Outer North Coast)	99.4	99.7	99.6	99.9	99.6	0.002	0	met	met
Rockingham (South Coast)	99.6	97.1	99.6	98.6	98.7	0.004	0	met	met
Rolling Green (Outer East Rural)	97.4	97.8	94.6	99	97.2	0.002	0	met	met
South Lake (South East Metro)	98.9	99.9	99.9	99.3	99.5	0.007	0	met	met
Swanbourne (Inner West Coast)	99.7	99.9	99.9	99.8	99.8	0.004	0	met	met

Performance against the standards and goal: “met”, “not met”, “not demonstrated”

**Table B3. 2014 compliance summary for ozone**

AAQ NEPM Standard  
0.10 ppm (1-hour average)  
0.08 ppm (4-hour average)

Regional Performance Monitoring Station	Data availability rates (% of hours)					Number of exceedences (days)		Performance against the standards and goal	
	Q1	Q2	Q3	Q4	Annual	1-hour	4-hour	1-hour	4-hour
<b>Perth region</b>									
Caversham (North East Metro)	87.7	98.0	99.6	99.7	96.3	0	0	met	met
Quinns Rocks (Outer North Coast)	99.4	98.4	99.7	99.8	99.3	0	0	met	met
Rockingham (South Coast)	97.8	99.9	99.9	98.6	99.0	0	0	met	met
Rolling Green (Outer East Rural)	95.8	98.0	99.5	99.0	98.1	0	0	met	met
South Lake (South East Metro)	99.0	99.6	100	99.0	99.4	0	0	met	met
Swanbourne (Inner West Coast)	99.6	91.8	100	99.9	97.8	0	0	met	met

Performance against the standards and goal: "met", "not met", "not demonstrated"

**Table B4. 2014 compliance summary for sulfur dioxide**

AAQ NEPM Standard  
0.20 ppm (1-hour average)  
0.08 ppm (24-hour average)  
0.02 ppm (1-year average)

Regional Performance Monitoring Station	Data availability rates (% of hours)					Annual mean (ppm)	Number of exceedences (days)		Performance against the standards and goal		
	Q1	Q2	Q3	Q4	Annual		1-hour	24-hour	1-hour	24-hour	1-year
<b>Perth region</b>											
Rockingham (South Coast)	92.8	95.6	94.6	92.7	93.9	0.001	0	0	met	met	met
South Lake (South East Metro)	94.5	94.4	95.3	93.9	94.5	0.001	0	0	met	met	met
Wattleup (South Metro)	95.0	95.2	95.2	95.1	95.1	0.002	0	0	met	met	met

Performance against the standards and goal: "met", "not met", "not demonstrated"

**Table B5. 2014 compliance summary for particles as PM<sub>10</sub>**

 AAQ NEPM Standard  
 50 µg/m<sup>3</sup> (24-hour average)

Regional Performance Monitoring Station	Data availability rates (% of days)					Number of exceedences (days)	Performance against the standards and goal
	Q1	Q2	Q3	Q4	Annual		
<b>Perth region</b>							
Caversham (North East Metro)	91.2	98.0	99.8	99.7	97.2	1	met
Duncraig (North Metro)	98.9	99.5	99.9	99.4	99.4	1	met
South Lake (South East Metro)	98.9	99.7	99.9	99.2	99.4	0	met
<b>Southwest region</b>							
Albany	99.9	98.3	97.5	98.8	98.6	0	met
Bunbury	97.0	96.7	98.8	99.9	98.1	0	met
Collie	99.5	98.8	99.5	99.3	99.3	2	met
<b>Midwest region</b>							
Geraldton	99.2	99.3	98.1	98.7	98.8	4	met

Performance against the standards and goal: "met", "not met", "not demonstrated"

**Table B6. 2014 compliance summary for particles as PM<sub>2.5</sub>**

 AAQ NEPM Advisory  
 Standard  
 25 µg/m<sup>3</sup> (24-hour average)

Regional Performance Monitoring Station	Data availability rates (% of days)					Number of exceedences (Days)	Performance against the standards and goal
	Q1	Q2	Q3	Q4	Annual		
<b>Perth region</b>							
Caversham (North East Metro)	90.1	98.3	99.8	99.6	97.0	1	n/a
Duncraig (North Metro)	99.3	99.7	99.9	99.8	99.7	1	n/a
Quinns Rocks (Outer North Coast)	98.8	96.7	99.6	99.8	98.8	2	n/a
South Lake (South East Metro)	95.7	99.7	99.9	99.3	98.7	2	n/a
<b>Southwest region</b>							
Bunbury	96.8	98.9	98	99.9	98.4	1	n/a
Busselton	99.8	99.7	99.5	99.6	99.6	1	n/a

## Section C – Analysis of air quality monitoring

### Carbon monoxide

The NEPM standard for carbon monoxide of 9.0 ppm averaged over eight hours was not exceeded at any site during 2014. The NEPM goal of no more than one exceedence at each site was met. Table C1 contains the summary statistics for daily peak eight-hour CO in Western Australia.

**Table C1. 2014 summary statistics for daily peak eight-hour carbon monoxide**

*AAQ NEPM Standard  
9.0 ppm (8-hour average)*

Regional Performance Monitoring Station	Data recovery rates (%)	Highest (ppm)	Highest		2nd highest (ppm)	2nd highest	
			(date)	(time)		(date)	(time)
<b>Perth region</b>							
Caversham (North East Metro)	96.1	0.7	15/06/2014	0400	0.7	17/08/2014	0700
Duncraig (North Metro)	99.7	1.9	26/06/2014	0300	1.7	25/06/2014	0500
South Lake (South East Metro)	99.5	1.8	26/06/2014	0200	1.5	15/06/2014	0400

## Nitrogen dioxide

The NEPM standard for nitrogen dioxide of 0.12 ppm averaged over one hour and the 0.03 ppm annual average were not exceeded at any site during 2014. The NEPM goal of no more than one exceedence at each site was met. Table C2 contains the summary statistics for daily peak one-hour NO<sub>2</sub> in Western Australia.

**Table C2. 2014 summary statistics for daily peak one-hour nitrogen dioxide**

*AAQ NEPM Standard  
0.12 ppm (1-hour average)*

Regional Performance Monitoring Station	Data recovery rates (%)	Highest (ppm)	Highest (date) (time)	2nd highest (ppm)	2nd highest (date) (time)
<b>Perth region</b>					
Caversham (North East Metro)	94.2	0.033	24/04/2014 1800	0.033	13/04/2014 2100
Duncraig (North Metro)	99.3	0.048	11/04/2014 2000	0.030	28/02/2014 2400
Quinns Rocks (Outer North Coast)	99.6	0.031	04/06/2014 2000	0.030	11/04/2014 2200
Rockingham (South Coast)	98.7	0.034	30/06/2014 2300	0.028	25/06/2014 1900
Rolling Green (Outer East Rural)	97.2	0.021	02/05/2014 2000	0.019	01/04/2014 2000
South Lake (South East Metro)	99.5	0.034	05/06/2014 1800	0.033	04/04/2014 1900
Swanbourne (Inner West Coast)	99.8	0.036	25/06/2014 2100	0.031	05/06/2014 1900



## Photochemical smog as ozone

The NEPM standard for ozone of 0.10 ppm averaged over one hour was not exceeded during 2014. The NEPM goal of no more than one exceedence at each site was met. Table C3 contains the summary statistics for daily peak one-hour O<sub>3</sub> in Western Australia.

**Table C3. 2014 summary statistics for daily peak 1-hour ozone**

*AAQ NEPM Standard  
0.10 ppm (1-hour average)*

Regional Performance Monitoring Station	Data recovery rates (%)	Highest (ppm)	Highest		2nd highest (ppm)	2nd highest	
			(date)	(time)		(date)	(time)
<b>Perth region</b>							
Caversham (North East Metro)	96.3	0.091	30/01/2014	1300	0.071	05/02/2014	1300
Quinns Rocks (Outer North Coast)	99.3	0.073	12/03/2014	1600	0.072	15/10/2014	1300
Rockingham (South Coast)	99.0	0.076	11/04/2014	1700	0.066	28/02/2014	1700
Rolling Green (Outer East Rural)	98.1	0.080	30/01/2014	1600	0.076	06/01/2014	1800
South Lake (South East Metro)	99.4	0.065	12/03/2014	1500	0.063	06/01/2014	1300
Swanbourne (Inner West Coast)	97.8	0.066	12/03/2014	1500	0.061	04/02/2014	1600

The NEPM standard for ozone of 0.08 ppm averaged over four hours was not exceeded during 2014. The NEPM goal of no more than one exceedence at each site was met. Table C4 contains the summary statistics for daily peak four-hour O<sub>3</sub> in Western Australia.

**Table C4. 2014 summary statistics for daily peak 4-hour ozone**

*AAQ NEPM Standard  
0.08 ppm (4-hour average)*

Regional Performance Monitoring Station	Data recovery rates (%)	Highest (ppm)	Highest (date) (time)		2nd highest (ppm)	2nd highest (date) (time)	
<b>Perth region</b>							
Caversham (North East Metro)	96.3	0.073	30/01/2014	1400	0.061	13/04/2014	1700
Quinns Rocks (Outer North Coast)	99.3	0.062	15/10/2014	1500	0.060	28/02/2014	1900
Rockingham (South Coast)	99.0	0.067	11/04/2014	1800	0.064	28/02/2014	1800
Rolling Green (Outer East Rural)	98.1	0.070	05/02/2014	1700	0.067	30/01/2014	1900
South Lake (South East Metro)	99.4	0.058	12/03/2014	1600	0.057	06/01/2014	1500
Swanbourne (Inner West Coast)	97.8	0.057	04/02/2014	1700	0.053	11/04/2014	1900

## Sulfur dioxide

The NEPM standard for sulfur dioxide of 0.20 ppm averaged over one hour was not exceeded at any site during 2014. The NEPM goal of no more than one exceedance at each site was met. Table C5 contains the summary statistics for daily peak one-hour SO<sub>2</sub> in Western Australia.

**Table C5. 2014 summary statistics for daily peak 1-hour sulfur dioxide**

*AAQ NEPM Standard  
0.20 ppm (1-hour average)*

Regional Performance Monitoring Station	Data recovery rates (%)	Highest (ppm)	Highest		2nd highest (ppm)	2nd highest	
			(date)	(time)		(date)	(time)
<b>Perth region</b>							
Rockingham (South Coast)	93.9	0.036	21/06/2014	0400	0.035	21/08/2014	0100
South Lake (South East Metro)	94.5	0.051	05/02/2014	1400	0.038	18/01/2014	1700
Wattleup (South Metro)	95.1	0.061	11/12/2014	1600	0.053	28/03/2014	1600

The NEPM standard for sulfur dioxide of 0.08 ppm averaged over 24 hours was not exceeded at any site during 2014. The NEPM goal of no more than one exceedance at each site was met. Table C6 contains the summary statistics for daily peak 24-hour SO<sub>2</sub> in Western Australia.

**Table C6. 2014 summary statistics for 24-hour sulfur dioxide**

*AAQ NEPM Standard  
0.08 ppm (24-hour average)*

Regional Performance Monitoring Station	Data recovery rates (%)	Highest (ppm)	Highest		2nd highest (ppm)	2nd highest	
			(date)	(time)		(date)	(time)
<b>Perth region</b>							
Rockingham (South Coast)	93.9	0.007	01/07/2014	2400	0.007	21/06/2014	2400
South Lake (South East Metro)	94.5	0.010	05/02/2014	2400	0.007	26/01/2014	2400
Wattleup (South Metro)	95.1	0.008	18/09/2014	2400	0.008	26/01/2014	2400

The NEPM advisory standard for sulfur dioxide of 0.02 ppm averaged over one year was not exceeded at any site during 2014. Table C7 contains the summary statistics for annual SO<sub>2</sub> in Western Australia.

**Table C7. 2014 summary statistics for annual sulfur dioxide**

*AAQ NEPM Advisory Standard  
0.02 ppm (annual average)*

Regional Performance Monitoring Station	Data recovery rates (%)	Annual average (ppm)
<b>Perth region</b>		
Rockingham (South Coast)	93.9	0.001
South Lake (South East Metro)	94.5	0.001
Wattleup (South Metro)	95.1	0.002

## Particles as PM<sub>10</sub>

The NEPM standard for particles as PM<sub>10</sub> of 50 µg/m<sup>3</sup> averaged over 24 hours was exceeded a number of times as detailed in Table A8 during 2014. The NEPM goal of no more than five exceedences was met. Table C8 contains the summary statistics for daily peak 24-hour PM<sub>10</sub> in Western Australia.

**Table C8. 2014 summary statistics for 24-hour particles as PM<sub>10</sub>**

AAQ NEPM Standard  
50 µg/m<sup>3</sup> (24-hour average)

Regional Performance Monitoring Station	Data recovery rates (%)	Highest (µg/m <sup>3</sup> )	Highest (date) (time)	6 <sup>th</sup> Highest (µg/m <sup>3</sup> )	6 <sup>th</sup> Highest (date) (time)
<b>Perth region</b>					
Caversham <sup>1</sup> (North East Metro)	97.2	52.6	05/01/2014 2400	35.7	24/02/2014 2400
Duncraig <sup>1</sup> (North Metro)	99.4	53.0	05/01/2014 2400	29.6	09/09/2014 2400
South Lake <sup>1</sup> (South East Metro)	99.4	44.5	15/10/2014 2400	36.5	30/12/2014 2400
<b>Southwest region</b>					
Albany <sup>1</sup>	98.6	43.5	16/10/2014 2400	33.1	24/07/2014 2400
Bunbury <sup>1</sup>	98.1	44.5	02/11/2014 2400	28.0	27/06/2014 2400
Collie <sup>1</sup>	99.3	73.3	28/10/2014 2400	40.1	04/06/2014 2400
<b>Midwest region</b>					
Geraldton <sup>1</sup>	98.8	55.7	24/12/2014 2400	48.2	11/02/2014 2400

1 – Tapered Element Oscillating Microbalance (TEOM) operating continuously (unadjusted for temperature) and includes the manufacturers recommended equivalency factor of 1.03x + 3.00.

## Particles as PM<sub>2.5</sub>

The NEPM advisory standard for particles as PM<sub>2.5</sub> of 25 micrograms per cubic metre averaged over 24 hours was exceeded a number of times as detailed in Table A8 during 2014. Table C9 contains the summary statistics for daily peak 24-hour PM<sub>2.5</sub> in Western Australia.

**Table C9. 2014 summary statistics for 24-hour particles as PM<sub>2.5</sub>**

*AAQ NEPM Advisory Standard  
25 µg/m<sup>3</sup> (24-hour average)*

Regional Performance Monitoring Station	Data recovery rates (%)	Highest (µg/m <sup>3</sup> )	Highest		6 <sup>th</sup> highest (µg/m <sup>3</sup> )	6th highest	
			(date)	(time)		(date)	(time)
<b>Perth region</b>							
Caversham <sup>1</sup> (North East Metro)	97	39.3	05/01/2014	2400	16.1	05/02/2014	2400
Duncraig <sup>1</sup> (North Metro)	99.7	47.6	05/01/2014	2400	15.9	25/06/2014	2400
Quinns Rocks <sup>1</sup> (Outer North Coast)	98.8	39.5	05/01/2014	2400	14.8	09/09/2014	2400
South Lake <sup>1</sup> (South East Metro)	98.7	29.8	05/01/2014	2400	15.8	14/06/2014	2400
<b>Southwest region</b>							
Bunbury <sup>1</sup>	98.4	34.6	02/11/2014	2400	15.4	12/04/2014	2400
Busselton <sup>1</sup>	99.6	25.1	03/05/2014	2400	12.6	28/05/2014	2400

1 - Tapered Element Oscillating Microbalance (TEOM) operating continuously (unadjusted for temperature) and includes the manufacturers recommended equivalency factor of 1.03x + 3.00.

The NEPM advisory standard for particles as PM<sub>2.5</sub> of eight micrograms per cubic metre averaged over one year was not met at Caversham, Quinns Rocks and South Lake during 2014. Table C10 contains the summary statistics for annual PM<sub>2.5</sub> in Western Australia.

**Table C10. 2014 summary statistics for annual particles as PM<sub>2.5</sub>**

*AAQ NEPM Advisory Standard  
8 µg/m<sup>3</sup> (annual average)*

Regional Performance Monitoring Station	Data recovery rates (%)	Annual average (µg/m <sup>3</sup> )
<b>Perth region</b>		
Caversham <sup>1</sup> (North East Metro)	97.0	8.1
Duncraig <sup>1</sup> (North Metro)	99.7	7.6
Quinns Rocks <sup>1</sup> (Outer North Coast)	98.8	8.0
South Lake <sup>1</sup> (South East Metro)	98.7	8.1
<b>Southwest region</b>		
Bunbury <sup>1</sup>	98.4	7.8
Busselton <sup>1</sup>	99.6	7.2

1 - Tapered Element Oscillating Microbalance (TEOM) operating continuously (unadjusted for temperature) and includes the manufacturers recommended equivalency factor of 1.03x + 3.00.



## Section D – Data analysis

### Maxima and percentiles by pollutant in 2014

**Table D1. 2014 percentiles of daily peak 8-hour carbon monoxide concentrations**

AAQ NEPM Standard  
9.0 ppm (8-hour average)

Regional Performance Monitoring Station	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
<b>Perth region</b>								
Caversham (North East Metro)	96.1	0.7	0.7	0.6	0.5	0.4	0.2	0.1
Duncraig (North Metro)	99.7	1.9	1.4	1.0	0.8	0.7	0.4	0.3
South Lake (South East Metro)	99.5	1.8	1.4	1.0	0.8	0.7	0.4	0.2

**Table D2. 2014 percentiles of daily peak 1-hour nitrogen dioxide concentrations**

AAQ NEPM Standard  
0.12 ppm (1-hour average)

Regional Performance Monitoring Station	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
<b>Perth region</b>								
Caversham (North East Metro)	94.2	0.033	0.031	0.030	0.026	0.024	0.020	0.015
Duncraig (North Metro)	99.3	0.048	0.029	0.028	0.026	0.024	0.020	0.014
Quinns Rocks (Outer North Coast)	99.6	0.031	0.026	0.024	0.020	0.017	0.012	0.008
Rockingham (South Coast)	98.7	0.034	0.027	0.026	0.024	0.021	0.017	0.011
Rolling Green (Outer East Rural)	97.2	0.021	0.017	0.015	0.013	0.013	0.010	0.006
South Lake (South East Metro)	99.5	0.034	0.032	0.029	0.028	0.026	0.022	0.016
Swanbourne (Inner West Coast)	99.8	0.036	0.029	0.028	0.024	0.022	0.017	0.012

**Table D3. 2014 percentiles of daily peak 1-hour ozone concentrations**

*AAQ NEPM Standard  
0.10 ppm (1-hour average)*

Regional Performance Monitoring Station	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
<b>Perth region</b>								
Caversham (North East Metro)	96.3	0.091	0.065	0.058	0.052	0.047	0.037	0.030
Quinns Rocks (Outer North Coast)	99.3	0.073	0.065	0.062	0.052	0.045	0.038	0.033
Rockingham (South Coast)	99.0	0.076	0.060	0.053	0.047	0.039	0.035	0.031
Rolling Green (Outer East Rural)	98.1	0.080	0.069	0.063	0.056	0.047	0.038	0.032
South Lake (South East Metro)	99.4	0.065	0.059	0.056	0.046	0.041	0.034	0.030
Swanbourne (Inner West Coast)	97.8	0.066	0.056	0.053	0.048	0.042	0.035	0.031

**Table D4. 2014 percentiles of daily peak 4-hour ozone concentrations**

*AAQ NEPM Standard  
0.08 ppm (4-hour average)*

Regional Performance Monitoring Station	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
<b>Perth region</b>								
Caversham (North East Metro)	96.3	0.073	0.055	0.050	0.046	0.041	0.034	0.029
Quinns Rocks (Outer North Coast)	99.3	0.062	0.057	0.051	0.046	0.042	0.036	0.032
Rockingham (South Coast)	99.0	0.067	0.051	0.048	0.043	0.037	0.033	0.030
Rolling Green (Outer East Rural)	98.1	0.070	0.058	0.054	0.048	0.042	0.035	0.031
South Lake (South East Metro)	99.4	0.058	0.053	0.049	0.042	0.037	0.032	0.029
Swanbourne (Inner West Coast)	97.8	0.057	0.050	0.049	0.043	0.038	0.033	0.030

**Table D5. 2014 percentiles of daily peak 1-hour sulfur dioxide concentrations**

*AAQ NEPM Standard  
0.20 ppm (1-hour average)*

Regional Performance Monitoring Station	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
<b>Perth region</b>								
Rockingham (South Coast)	93.9	0.036	0.024	0.021	0.013	0.008	0.004	0.002
South Lake (South East Metro)	94.5	0.051	0.028	0.024	0.016	0.012	0.007	0.003
Wattleup (South Metro)	95.1	0.061	0.046	0.037	0.031	0.024	0.015	0.005

**Table D6. 2014 percentiles of daily peak 24-hour sulfur dioxide concentrations**

*AAQ NEPM Standard  
0.08 ppm (24-hour average)*

Regional Performance Monitoring Station	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
<b>Perth region</b>								
Rockingham (South Coast)	93.9	0.007	0.005	0.004	0.003	0.002	0.001	0.001
South Lake (South East Metro)	94.5	0.010	0.005	0.004	0.003	0.003	0.002	0.001
Wattleup (South Metro)	95.1	0.008	0.007	0.006	0.005	0.004	0.003	0.001

**Table D7. 2014 percentiles of daily peak 24-hour particles as PM<sub>10</sub> concentrations**

*AAQ NEPM Standard  
50 µg/m<sup>3</sup> (24-hour average)*

Regional Performance Monitoring Station	Data availability rates (%)	Max conc. (µg/m <sup>3</sup> )	99 <sup>th</sup> percentile (µg/m <sup>3</sup> )	98 <sup>th</sup> percentile (µg/m <sup>3</sup> )	95 <sup>th</sup> percentile (µg/m <sup>3</sup> )	90 <sup>th</sup> percentile (µg/m <sup>3</sup> )	75 <sup>th</sup> percentile (µg/m <sup>3</sup> )	50 <sup>th</sup> percentile (µg/m <sup>3</sup> )
<b>Perth region</b>								
Caversham (North East Metro)	97.2	52.6	37.3	34.5	27.2	24.8	21.1	16.6
Duncraig (North Metro)	99.4	53.0	31.2	28.1	25.1	22.4	18.9	14.5
South Lake (South East Metro)	99.4	44.5	38.2	34.0	29.4	26.3	20.7	16.2
<b>Southwest region</b>								
Albany	98.6	43.5	35.5	31.4	28.1	24.4	19.3	15.5
Bunbury	98.1	44.5	31.7	26.2	24.6	22.8	20.0	15.5
Collie	99.3	73.3	42.2	38.8	34.0	29.8	24.1	17.7
<b>Midwest region</b>								
Geraldton	98.8	55.7	49.7	47.1	41.4	37.5	28.2	20.4

**Table D8. 2014 percentiles of daily peak 24-hour particles as PM<sub>2.5</sub> concentrations**

*AAQ NEPM Advisory Standard  
25 µg/m<sup>3</sup> (24-hour average)*

Regional Performance Monitoring Station	Data availability rates (%)	Max conc. (µg/m <sup>3</sup> )	99 <sup>th</sup> percentile (µg/m <sup>3</sup> )	98 <sup>th</sup> percentile (µg/m <sup>3</sup> )	95 <sup>th</sup> percentile (µg/m <sup>3</sup> )	90 <sup>th</sup> percentile (µg/m <sup>3</sup> )	75 <sup>th</sup> percentile (µg/m <sup>3</sup> )	50 <sup>th</sup> percentile (µg/m <sup>3</sup> )
<b>Perth region</b>								
Caversham (North East Metro)	97.0	39.3	16.2	15.2	14.1	11.9	9.2	7.6
Duncraig (North Metro)	99.7	47.6	16.8	15.3	13.0	11.0	8.9	7.1
Quinns Rocks (Outer North Coast)	98.8	39.5	15.8	14.5	13.4	11.7	9.2	7.4
South Lake (South East Metro)	98.7	29.8	17.7	15.0	13.4	11.5	9.3	7.5
<b>Southwest region</b>								
Bunbury	98.4	34.6	16.1	15.0	13.3	11.7	9.6	7.4
Busselton	99.6	25.1	13.2	12.4	11.1	10.2	8.3	6.9

## Maxima and percentiles by site 2005 to 2014

**Table D9. Daily peak 8-hour carbon monoxide at Caversham (2005-2014)**

**Trend station/region: Caversham**

AAQ NEPM Standard  
9.0 ppm (8-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	98.3	0	1.3	0.9	0.8	0.7	0.6
2006	99.7	0	1.8	0.9	0.9	0.6	0.5
2007	98.2	0	0.9	0.6	0.6	0.5	0.4
2008	99.5	0	0.8	0.7	0.7	0.6	0.5
2009	99.2	0	1.0	0.6	0.5	0.4	0.4
2010	85.0	0	1.6	0.8	0.7	0.6	0.5
2011	98.2	0	1.5	1.2	1.0	0.6	0.5
2012	98.0	0	0.9	0.7	0.6	0.5	0.4
2013	97.5	0	0.9	0.7	0.6	0.5	0.4
2014	96.1	0	0.7	0.7	0.6	0.5	0.4

**Table D10. Daily peak 8-hour carbon monoxide at Duncraig (2005-2014)**

**Trend station/region: Duncraig**

AAQ NEPM Standard  
9.0 ppm (8-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	98.5	0	3.3	2.7	2.2	1.7	1.2
2006	99.3	0	3.4	2.8	2.3	1.8	1.3
2007	99.5	0	2.0	1.6	1.4	1.2	0.8
2008	99.0	0	3.1	1.9	1.7	1.4	1.0
2009	98.2	0	2.6	1.7	1.4	1.0	0.7
2010	87.5	0	2.3	2.0	1.8	1.5	1.1
2011	99.3	0	1.9	1.3	1.2	1.0	0.7
2012	99.5	0	2.4	1.9	1.5	1.1	0.9
2013	99.5	0	2.1	1.8	1.6	1.2	0.8
2014	99.7	0	1.9	1.4	1.0	0.8	0.7

**Table D11. Daily peak 8-hour carbon monoxide at South Lake (2005-2014)**

**Trend station/region: South Lake**

AAQ NEPM Standard  
9.0 ppm (8-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	96.9	0	2.9	2.5	2.0	1.6	1.1
2006	98.6	0	2.5	2.4	2.2	1.6	1.0
2007	99.3	0	1.7	1.4	1.2	1.0	0.8
2008	99.6	0	2.0	1.6	1.4	1.2	0.9
2009	99.3	0	1.8	1.4	1.1	0.9	0.7
2010	87.8	0	2.2	1.6	1.5	1.2	0.9
2011	98.3	0	1.7	1.5	1.3	1.0	0.8
2012	98.9	0	2.2	1.6	1.4	1.0	0.8
2013	98.5	0	1.7	1.3	1.2	1.0	0.6
2014	99.5	0	1.8	1.4	1.0	0.8	0.7

**Table D12. Daily peak 1-hour nitrogen dioxide at Caversham (2005-2014)**
**Trend station/region: Caversham**

 AAQ NEPM Standard  
 0.12 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	98.3	0	0.048	0.040	0.034	0.031	0.027
2006	98.3	0	0.084	0.037	0.034	0.031	0.028
2007	98.5	0	0.044	0.037	0.033	0.028	0.026
2008	99.5	0	0.036	0.033	0.032	0.028	0.026
2009	99.3	0	0.044	0.034	0.033	0.028	0.026
2010	84.9	0	0.054	0.040	0.037	0.032	0.029
2011	99.5	0	0.035	0.031	0.029	0.027	0.025
2012	97.0	0	0.037	0.033	0.032	0.029	0.025
2013	97.5	0	0.043	0.034	0.032	0.029	0.025
2014	94.2	0	0.033	0.031	0.030	0.026	0.024

**Table D13. Daily peak 1-hour nitrogen dioxide at Duncraig (2005-2014)**
**Trend station/region: Duncraig**

 AAQ NEPM Standard  
 0.12 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	96.7	0	0.051	0.039	0.036	0.032	0.030
2006	99.5	0	0.056	0.037	0.036	0.032	0.030
2007	99.6	0	0.053	0.034	0.032	0.030	0.028
2008	97.7	0	0.038	0.034	0.030	0.029	0.027
2009	98.5	0	0.042	0.037	0.034	0.030	0.027
2010	87.5	0	0.038	0.035	0.033	0.030	0.028
2011	99.3	0	0.035	0.032	0.030	0.028	0.027
2012	96.8	0	0.047	0.037	0.033	0.030	0.027
2013	97.9	0	0.040	0.031	0.030	0.028	0.026
2014	99.3	0	0.048	0.029	0.028	0.026	0.024

**Table D14. Daily peak 1-hour nitrogen dioxide at Quinns Rocks (2005-2014)**
**Trend station/region: Quinns Rocks**

 AAQ NEPM Standard  
 0.12 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	96.9	0	0.041	0.031	0.030	0.027	0.024
2006	96.9	0	0.065	0.051	0.042	0.035	0.029
2007	99.5	0	0.035	0.031	0.029	0.028	0.025
2008	96.1	0	0.037	0.033	0.032	0.028	0.025
2009	99.0	0	0.034	0.032	0.031	0.027	0.024
2010	88.8	0	0.040	0.032	0.032	0.030	0.027
2011	99.0	0	0.031	0.028	0.027	0.025	0.022
2012	97.3	0	0.041	0.032	0.031	0.027	0.024
2013	97.9	0	0.032	0.026	0.026	0.023	0.020
2014	99.6	0	0.031	0.026	0.024	0.020	0.017

**Table D15. Daily peak 1-hour nitrogen dioxide at Rockingham (2005-2014)**
**Trend station/region: Rockingham**

 AAQ NEPM Standard  
 0.12 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	99.1	0	0.045	0.038	0.036	0.032	0.030
2006	98.9	0	0.054	0.040	0.036	0.034	0.031
2007	99.4	0	0.040	0.034	0.030	0.028	0.025
2008	99.3	0	0.031	0.028	0.027	0.025	0.024
2009	98.6	0	0.031	0.029	0.028	0.026	0.024
2010	88.7	0	0.036	0.032	0.030	0.028	0.026
2011	96.6	0	0.034	0.028	0.027	0.025	0.022
2012	96.4	0	0.053	0.030	0.030	0.027	0.024
2013	97.8	0	0.035	0.031	0.029	0.027	0.025
2014	98.7	0	0.034	0.027	0.026	0.024	0.021

**Table D16. Daily peak 1-hour nitrogen dioxide at Rolling Green (2005-2014)**
**Trend station/region: Rolling Green**

 AAQ NEPM Standard  
 0.12 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	97.9	0	0.029	0.025	0.023	0.020	0.017
2006	98.0	0	0.026	0.020	0.019	0.017	0.015
2007	98.8	0	0.020	0.019	0.018	0.016	0.014
2008	99.3	0	0.023	0.020	0.019	0.016	0.015
2009	99.5	0	0.035	0.023	0.019	0.017	0.015
2010	87.5	0	0.030	0.022	0.019	0.017	0.016
2011	97.1	0	0.023	0.019	0.018	0.015	0.013
2012	91.9	0	0.029	0.019	0.017	0.016	0.014
2013	96.5	0	0.030	0.018	0.017	0.015	0.013
2014	97.2	0	0.021	0.017	0.015	0.013	0.013

**Table D17. Daily peak 1-hour nitrogen dioxide at South Lake (2005-2014)**
**Trend station/region: South Lake**

 AAQ NEPM Standard  
 0.12 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	87.1	0	0.052	0.043	0.039	0.033	0.028
2006	98.0	0	0.045	0.039	0.037	0.032	0.029
2007	99.1	0	0.057	0.041	0.038	0.032	0.029
2008	99.6	0	0.044	0.040	0.038	0.033	0.030
2009	99.3	0	0.048	0.039	0.036	0.033	0.029
2010	87.8	0	0.058	0.045	0.040	0.036	0.030
2011	96.1	0	0.041	0.033	0.032	0.030	0.028
2012	98.7	0	0.046	0.038	0.035	0.031	0.028
2013	97.1	0	0.043	0.037	0.033	0.031	0.027
2014	99.5	0	0.034	0.032	0.029	0.028	0.026



**Table D18. Daily peak 1-hour nitrogen dioxide at Swanbourne (2005-2014)****Trend station/region: Swanbourne**AAQ NEPM Standard  
0.12 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	96.2	0	0.039	0.037	0.033	0.029	0.026
2006	99.5	0	0.043	0.034	0.033	0.031	0.028
2007	98.7	0	0.038	0.033	0.032	0.030	0.027
2008	98.2	0	0.035	0.034	0.033	0.031	0.029
2009	99.2	0	0.037	0.034	0.032	0.028	0.026
2010	86.6	0	0.038	0.033	0.032	0.031	0.029
2011	99.4	0	0.032	0.029	0.028	0.026	0.024
2012	98.4	0	0.045	0.033	0.032	0.030	0.027
2013	99.6	0	0.037	0.033	0.031	0.027	0.025
2014	99.8	0	0.036	0.029	0.028	0.024	0.022

**Table D19. Daily peak 1-hour ozone at Caversham (2005-2014)****Trend station/region: Caversham**AAQ NEPM Standard  
0.10 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	99.3	0	0.094	0.078	0.063	0.054	0.043
2006	99.6	0	0.080	0.072	0.067	0.058	0.049
2007	98.6	0	0.085	0.073	0.066	0.059	0.047
2008	99.5	0	0.083	0.067	0.066	0.053	0.046
2009	99.3	1	0.104	0.072	0.067	0.056	0.050
2010	84.5	0	0.082	0.069	0.059	0.055	0.046
2011	99.2	0	0.077	0.070	0.067	0.054	0.045
2012	97.5	0	0.098	0.078	0.064	0.052	0.047
2013	95.7	1	0.101	0.074	0.070	0.056	0.051
2014	96.3	0	0.091	0.065	0.058	0.052	0.047

**Table D20. Daily peak 1-hour ozone at Quinns Rocks (2005-2014)****Trend station/region: Quinns Rocks**AAQ NEPM Standard  
0.10 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	98.0	0	0.095	0.068	0.063	0.055	0.045
2006	99.0	0	0.085	0.065	0.063	0.052	0.045
2007	98.8	0	0.081	0.061	0.057	0.050	0.045
2008	99.4	0	0.083	0.073	0.060	0.052	0.043
2009	94.3	0	0.070	0.063	0.061	0.053	0.045
2010	88.7	0	0.091	0.061	0.058	0.054	0.048
2011	99.1	0	0.083	0.068	0.057	0.051	0.045
2012	95.7	1	0.130	0.073	0.069	0.058	0.048
2013	99.2	0	0.087	0.077	0.066	0.058	0.050
2014	99.3	0	0.073	0.065	0.062	0.052	0.045

**Table D21. Daily peak 1-hour ozone at Rockingham (2005-2014)****Trend station/region: Rockingham**AAQ NEPM Standard  
0.10 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	99.1	0	0.081	0.064	0.056	0.044	0.040
2006	98.9	0	0.072	0.061	0.056	0.050	0.041
2007	99.5	0	0.084	0.065	0.056	0.049	0.042
2008	99.4	0	0.077	0.063	0.053	0.045	0.038
2009	99.0	0	0.078	0.064	0.054	0.048	0.041
2010	88.2	0	0.067	0.060	0.057	0.052	0.044
2011	94.9	0	0.065	0.062	0.057	0.048	0.043
2012	99.0	0	0.095	0.073	0.064	0.053	0.044
2013	98.8	0	0.084	0.068	0.065	0.052	0.044
2014	99.0	0	0.076	0.060	0.053	0.047	0.039

**Table D22. Daily peak 1-hour ozone at Rolling Green (2005-2014)****Trend station/region: Rolling Green**AAQ NEPM Standard  
0.10 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	97.9	0	0.079	0.071	0.064	0.058	0.050
2006	98.6	0	0.093	0.075	0.072	0.060	0.053
2007	98.9	0	0.095	0.081	0.078	0.062	0.053
2008	99.5	0	0.087	0.080	0.071	0.056	0.047
2009	99.5	1	0.103	0.081	0.069	0.059	0.052
2010	85.6	0	0.088	0.077	0.070	0.056	0.046
2011	95.9	0	0.073	0.068	0.060	0.052	0.043
2012	91.8	1	0.103	0.074	0.066	0.055	0.045
2013	96.8	0	0.099	0.078	0.071	0.061	0.049
2014	98.1	0	0.080	0.069	0.063	0.056	0.047

**Table D23. Daily peak 1-hour ozone at South Lake (2005-2014)****Trend station/region: South Lake**AAQ NEPM Standard  
0.10 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	97.0	0	0.080	0.062	0.056	0.049	0.041
2006	99.6	0	0.066	0.057	0.054	0.045	0.040
2007	99.4	0	0.067	0.056	0.053	0.047	0.040
2008	99.6	0	0.082	0.061	0.056	0.044	0.037
2009	99.4	0	0.065	0.057	0.053	0.045	0.039
2010	88.0	0	0.070	0.067	0.062	0.052	0.045
2011	99.4	0	0.076	0.064	0.057	0.050	0.044
2012	98.2	0	0.085	0.065	0.062	0.051	0.041
2013	98.6	0	0.087	0.074	0.062	0.054	0.043
2014	99.4	0	0.065	0.059	0.056	0.046	0.041

**Table D24. Daily peak 1-hour ozone at Swanbourne (2005-2014)****Trend station/region: Swanbourne**AAQ NEPM Standard  
0.10 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	96.4	0	0.076	0.066	0.061	0.051	0.043
2006	99.7	0	0.075	0.066	0.060	0.050	0.044
2007	99.3	0	0.077	0.064	0.057	0.051	0.044
2008	98.2	0	0.076	0.067	0.060	0.048	0.042
2009	99.6	0	0.068	0.063	0.059	0.053	0.044
2010	86.6	0	0.066	0.059	0.056	0.050	0.044
2011	99.6	0	0.085	0.069	0.061	0.051	0.046
2012	98.2	1	0.128	0.074	0.067	0.056	0.047
2013	99.8	0	0.083	0.069	0.064	0.052	0.045
2014	97.8	0	0.066	0.056	0.053	0.048	0.042

**Table D25. Daily peak 4-hour ozone at Caversham (2005-2014)****Trend station/region: Caversham**AAQ NEPM Standard  
0.08 ppm (4-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	99.3	0	0.069	0.055	0.052	0.046	0.039
2006	99.6	0	0.072	0.063	0.058	0.049	0.043
2007	98.6	0	0.073	0.062	0.058	0.049	0.042
2008	99.5	0	0.076	0.061	0.056	0.047	0.041
2009	99.3	1	0.092	0.067	0.057	0.051	0.043
2010	84.5	0	0.072	0.056	0.052	0.047	0.041
2011	99.2	0	0.063	0.061	0.056	0.049	0.041
2012	97.5	2	0.086	0.070	0.056	0.047	0.041
2013	95.7	0	0.075	0.065	0.060	0.049	0.044
2014	96.3	0	0.073	0.055	0.050	0.046	0.041

**Table D26. Daily peak 4-hour ozone at Quinns Rocks (2005-2014)****Trend station/region: Quinns Rocks**AAQ NEPM Standard  
0.08 ppm (4-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	98.0	0	0.070	0.058	0.057	0.047	0.041
2006	99.0	0	0.074	0.059	0.055	0.046	0.041
2007	98.8	0	0.075	0.056	0.053	0.046	0.041
2008	99.4	0	0.073	0.061	0.055	0.046	0.041
2009	94.3	0	0.062	0.056	0.054	0.048	0.040
2010	88.7	0	0.065	0.056	0.052	0.048	0.042
2011	99.1	0	0.075	0.060	0.052	0.047	0.041
2012	95.7	2	0.108	0.065	0.061	0.051	0.043
2013	99.2	0	0.079	0.068	0.061	0.051	0.045
2014	99.3	0	0.062	0.057	0.051	0.046	0.042

**Table D27. Daily peak 4-hour ozone at Rockingham (2005-2014)**
**Trend station/region: Rockingham**
*AAQ NEPM Standard  
0.08 ppm (4-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	99.1	0	0.075	0.061	0.052	0.042	0.038
2006	98.9	0	0.067	0.056	0.051	0.046	0.038
2007	99.5	0	0.079	0.057	0.052	0.046	0.038
2008	99.4	0	0.072	0.058	0.049	0.042	0.036
2009	99.0	0	0.066	0.058	0.051	0.045	0.039
2010	88.2	0	0.064	0.054	0.053	0.046	0.041
2011	94.9	0	0.061	0.058	0.053	0.045	0.040
2012	99.0	0	0.079	0.065	0.060	0.048	0.040
2013	98.8	0	0.075	0.064	0.057	0.047	0.042
2014	99.0	0	0.067	0.051	0.048	0.043	0.037

**Table D28. Daily peak 4-hour ozone at Rolling Green (2005-2014)**
**Trend station/region: Rolling Green**
*AAQ NEPM Standard  
0.08 ppm (4-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	97.9	0	0.068	0.060	0.058	0.049	0.044
2006	98.6	0	0.079	0.065	0.059	0.053	0.046
2007	98.9	0	0.080	0.070	0.066	0.053	0.046
2008	99.5	0	0.075	0.065	0.062	0.051	0.043
2009	99.5	2	0.083	0.064	0.057	0.051	0.043
2010	85.6	0	0.080	0.065	0.056	0.049	0.042
2011	95.9	0	0.061	0.055	0.051	0.045	0.040
2012	91.8	1	0.081	0.064	0.058	0.049	0.042
2013	96.8	1	0.083	0.065	0.059	0.051	0.045
2014	98.1	0	0.070	0.058	0.054	0.048	0.042

**Table D29. Daily peak 4-hour ozone at South Lake (2005-2014)**
**Trend station/region: South Lake**
*AAQ NEPM Standard  
0.08 ppm (4-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	97.0	0	0.070	0.053	0.052	0.042	0.037
2006	99.6	0	0.063	0.051	0.049	0.041	0.036
2007	99.4	0	0.059	0.051	0.048	0.042	0.037
2008	99.6	0	0.067	0.051	0.046	0.040	0.034
2009	99.4	0	0.057	0.053	0.048	0.040	0.036
2010	88.0	0	0.061	0.055	0.053	0.046	0.042
2011	99.4	0	0.064	0.056	0.051	0.046	0.039
2012	98.2	0	0.080	0.060	0.054	0.046	0.037
2013	98.6	0	0.074	0.063	0.057	0.048	0.039
2014	99.4	0	0.058	0.053	0.049	0.042	0.037

**Table D30. Daily peak 4-hour ozone at Swanbourne (2005-2014)**
**Trend station/region: Swanbourne**

 AAQ NEPM Standard  
 0.10 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	96.4	0	0.066	0.058	0.052	0.044	0.039
2006	99.7	0	0.069	0.060	0.052	0.045	0.040
2007	99.3	0	0.067	0.054	0.051	0.048	0.042
2008	98.2	0	0.070	0.060	0.053	0.045	0.039
2009	99.6	0	0.063	0.058	0.054	0.046	0.039
2010	86.6	0	0.055	0.053	0.050	0.044	0.040
2011	99.6	0	0.073	0.059	0.056	0.047	0.043
2012	98.2	1	0.108	0.064	0.061	0.051	0.042
2013	99.8	0	0.068	0.063	0.056	0.048	0.042
2014	97.8	0	0.057	0.050	0.049	0.043	0.038

**Table D31. Daily peak 1-hour sulfur dioxide at Rockingham (2005-2014)**
**Trend station/region: Rockingham**

 AAQ NEPM Standard  
 0.20 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	99.2	0	0.041	0.024	0.022	0.017	0.010
2006	98.9	0	0.040	0.031	0.022	0.013	0.008
2007	98.6	0	0.041	0.025	0.020	0.013	0.008
2008	98.3	0	0.079	0.026	0.019	0.015	0.008
2009	98.7	0	0.032	0.022	0.017	0.010	0.007
2010	89.9	0	0.037	0.022	0.019	0.013	0.009
2011	93.7	0	0.040	0.029	0.024	0.017	0.010
2012	94.4	0	0.040	0.020	0.018	0.011	0.008
2013	94.5	0	0.037	0.028	0.022	0.016	0.011
2014	93.9	0	0.036	0.024	0.021	0.013	0.008

**Table D32. Daily peak 1-hour sulfur dioxide at South Lake (2005-2014)**
**Trend station/region: South Lake**

 AAQ NEPM Standard  
 0.20 ppm (1-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	96.9	0	0.046	0.033	0.030	0.022	0.017
2006	99.5	0	0.060	0.044	0.032	0.028	0.022
2007	99.4	0	0.040	0.032	0.028	0.019	0.012
2008	99.6	0	0.046	0.025	0.020	0.014	0.010
2009	98.4	0	0.036	0.033	0.029	0.018	0.015
2010	87.8	0	0.073	0.036	0.033	0.025	0.017
2011	95.7	0	0.044	0.029	0.026	0.017	0.012
2012	94.0	0	0.039	0.027	0.019	0.014	0.010
2013	93.3	0	0.044	0.034	0.031	0.020	0.015
2014	94.5	0	0.051	0.028	0.024	0.016	0.012

**Table D33. Daily peak 1-hour sulfur dioxide at Wattleup (2005-2014)**
**Trend station/region: Wattleup**
*AAQ NEPM Standard  
0.20 ppm (1-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	99.7	0	0.120	0.058	0.045	0.037	0.026
2006	99.0	0	0.062	0.046	0.043	0.035	0.028
2007	93.3	0	0.060	0.045	0.040	0.034	0.025
2008	89.6	0	0.077	0.034	0.028	0.022	0.016
2009	95.6	0	0.059	0.039	0.036	0.029	0.022
2010	86.8	0	0.057	0.049	0.043	0.036	0.023
2011	94.3	0	0.067	0.049	0.042	0.032	0.026
2012	94.7	0	0.043	0.039	0.034	0.025	0.017
2013	92.5	0	0.090	0.059	0.047	0.037	0.027
2014	95.1	0	0.061	0.046	0.037	0.031	0.024

**Table D34. Daily peak 24-hour sulfur dioxide at Rockingham (2005-2014)**
**Trend station/region: Rockingham**
*AAQ NEPM Standard  
0.08 ppm (24-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	99.2	0	0.009	0.006	0.004	0.003	0.002
2006	98.9	0	0.007	0.004	0.004	0.002	0.002
2007	98.6	0	0.012	0.005	0.004	0.003	0.002
2008	98.3	0	0.007	0.005	0.004	0.002	0.001
2009	98.7	0	0.008	0.003	0.002	0.001	0.001
2010	89.9	0	0.007	0.004	0.003	0.002	0.002
2011	93.7	0	0.008	0.006	0.006	0.003	0.002
2012	94.4	0	0.006	0.005	0.003	0.002	0.002
2013	94.5	0	0.007	0.005	0.004	0.003	0.002
2014	93.9	0	0.007	0.005	0.004	0.003	0.002

**Table D35. Daily peak 24-hour sulfur dioxide at South Lake (2005-2014)**
**Trend station/region: South Lake**
*AAQ NEPM Standard  
0.08 ppm (24-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	96.9	0	0.007	0.006	0.004	0.004	0.002
2006	99.5	0	0.009	0.006	0.005	0.004	0.003
2007	99.4	0	0.006	0.004	0.003	0.002	0.002
2008	99.6	0	0.005	0.003	0.003	0.002	0.001
2009	98.4	0	0.006	0.005	0.003	0.003	0.002
2010	87.8	0	0.009	0.005	0.004	0.003	0.002
2011	95.7	0	0.006	0.004	0.003	0.002	0.002
2012	94.0	0	0.006	0.004	0.003	0.003	0.002
2013	93.3	0	0.014	0.005	0.004	0.003	0.002
2014	94.5	0	0.010	0.005	0.004	0.003	0.003

**Table D36. Daily peak 24-hour sulfur dioxide at Wattleup (2005-2014)**
**Trend station/region: Wattleup**

 AAQ NEPM Standard  
 0.08 ppm (24-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
2005	99.7	0	0.014	0.008	0.006	0.005	0.004
2006	99.0	0	0.009	0.007	0.006	0.004	0.004
2007	93.3	0	0.010	0.008	0.007	0.005	0.004
2008	89.6	0	0.011	0.005	0.004	0.003	0.002
2009	95.6	0	0.008	0.005	0.005	0.004	0.003
2010	86.8	0	0.010	0.008	0.006	0.005	0.003
2011	94.3	0	0.008	0.006	0.005	0.004	0.003
2012	94.7	0	0.008	0.005	0.004	0.003	0.002
2013	92.5	0	0.010	0.008	0.006	0.005	0.004
2014	95.1	0	0.008	0.007	0.006	0.005	0.004

**Table D37. Daily peak 24-hour particles as PM<sub>10</sub> at Caversham (2005-2014)**
**Trend station/region: Caversham**

 AAQ NEPM Standard  
 50 µg/m<sup>3</sup> (24-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	98.2	1	76.8	41.4	37.1	32.2	28.1
2006	97.3	0	42.6	38.4	35.3	29.3	26.4
2007	98.4	1	58.8	39.7	35.9	30.3	26.1
2008	99.3	0	39.1	37.0	32.5	26.1	22.5
2009	99.4	0	45.7	37.2	32.4	29.0	25.8
2010	99.5	1	63.4	40.7	36.1	30.5	26.3
2011	99.1	1	76.1	33.2	30.2	27.3	23.8
2012	97.8	4	68.7	49.2	36.7	27.2	24.4
2013	97.4	1	62.4	34.4	30.7	26.2	23.6
2014	97.2	1	52.6	37.3	34.5	27.2	24.8

**Table D38. Daily peak 24-hour particles as PM<sub>10</sub> at Duncraig (2005-2014)**
**Trend station/region: Duncraig**

 AAQ NEPM Standard  
 50 µg/m<sup>3</sup> (24-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	98.5	1	59.2	34.8	30.7	26.7	23.9
2006	99.1	0	40.6	32.9	30.5	27.3	24.0
2007	99.7	0	40.3	31.8	29.4	25.8	22.0
2008	99.2	0	46.9	34.4	31.1	25.8	21.9
2009	99.2	0	45.5	36.2	30.4	24.5	22.6
2010	99.4	0	47.9	33.1	30.8	25.1	22.7
2011	99.3	1	65.9	30.1	29.5	25.7	23.2
2012	99.4	2	89.5	35.5	28.3	26.1	23.0
2013	99.3	0	37.6	32.1	28.1	25.6	22.8
2014	99.4	1	53.0	31.2	28.1	25.1	22.4



**Table D39. Daily peak 24-hour particles as PM<sub>10</sub> at South Lake (2005-2014)**

Trend station/region: South Lake

AAQ NEPM Standard  
50 µg/m<sup>3</sup> (24-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	98.8	3	98.8	46.1	39.6	33.6	28.7
2006	97.0	0	45.3	39.8	37.0	34.4	29.0
2007	97.9	1	56.7	37.7	36.0	32.9	26.7
2008	99.6	1	55.0	39.9	36.1	30.3	25.8
2009	99.5	0	49.0	38.7	34.3	30.8	27.5
2010	99.7	4	61.0	46.7	39.8	33.9	28.5
2011	99.2	1	66.2	35.8	31.5	28.1	24.8
2012	99.1	2	81.5	36.6	30.3	28.5	24.1
2013	98.6	0	38.8	34.4	32.3	28.9	25.9
2014	99.4	0	44.5	38.2	34.0	29.4	26.3

**Table D40. Daily peak 24-hour particles as PM<sub>10</sub> at Bunbury (2005-2014)**

Trend station/region: Bunbury

AAQ NEPM Standard  
50 µg/m<sup>3</sup> (24-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	99.1	3	63.3	37.9	33.3	27.5	24.9
2006	99.2	3	123.5	45.6	38.8	28.3	25.8
2007	99.6	0	46.5	32.8	29.6	27.1	24.5
2008	99.4	0	39.1	31.4	30.3	27.3	23.7
2009	99.5	1	53.8	40.3	36.0	29.5	25.4
2010	99.1	2	134.0	37.6	36.0	29.3	25.3
2011	99.6	2	68.4	39.3	33.8	28.0	23.8
2012	99.5	2	53.5	40.0	32.9	26.5	24.1
2013	98.9	0	46.8	38.1	33.5	26.8	22.6
2014	98.1	0	44.5	31.7	26.2	24.6	22.8

**Table D41. Daily peak 24-hour particles as PM<sub>10</sub> at Albany (2005-2014)**

Trend station/region: Albany

AAQ NEPM Standard  
50 µg/m<sup>3</sup> (24-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	0.0	0					
2006	52.4	0	39.4	35.4	33.0	26.6	24.6
2007	99.8	1	55.7	31.3	28.0	24.7	22.1
2008	99.2	2	56.3	34.1	32.8	26.1	22.7
2009	97.7	0	36.7	32.3	28.7	24.5	21.4
2010	99.8	1	52.5	36.1	33.2	27.3	25.3
2011	99.3	0	37.3	33.6	30.6	26.3	22.0
2012	99.5	0	37.0	34.6	31.1	27.4	23.6
2013	98.1	3	110.8	43.3	36.0	29.1	23.8
2014	98.6	0	43.5	35.5	31.4	28.1	24.4

**Table D42. Daily peak 24-hour particles as PM<sub>10</sub> at Geraldton (2005-2014)**
**Trend station/region: Geraldton**

 AAQ NEPM Standard  
 50 µg/m<sup>3</sup> (24-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	27.7	2	61.3	52.9	47.0	34.8	31.6
2006	99.4	4	78.0	48.6	45.8	40.0	35.4
2007	99.7	10	116.3	87.2	67.9	44.7	36.4
2008	98.9	10	150.7	105.2	58.1	45.9	38.6
2009	99.6	14	128.9	69.2	58.6	48.5	40.3
2010	97.7	4	55.6	49.3	47.8	41.6	37.9
2011	98.6	3	63.0	45.4	40.2	35.8	32.2
2012	99.6	3	61.5	47.0	45.3	40.2	33.8
2013	99.3	2	63.1	45.9	42.1	38.9	34.6
2014	98.8	4	55.7	49.7	47.1	41.4	37.5

**Table D43. Daily peak 24-hour particles as PM<sub>10</sub> at Collie (2005-2014)**
**Trend station/region: Collie**

 AAQ NEPM Standard  
 50 µg/m<sup>3</sup> (24-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	0.0	0					
2006	0.0	0					
2007	0.0	0					
2008	87.6	7	85.9	56.7	50.1	37.4	30.5
2009	99.5	3	80.4	47.3	46.2	38.0	31.3
2010	99.7	16	163.0	86.7	67.3	46.1	34.9
2011	97.6	4	61.5	52.1	40.4	32.0	29.2
2012	99.4	6	91.7	54.9	46.9	35.1	30.1
2013	99.0	3	61.6	46.0	41.3	36.0	32.0
2014	99.3	2	73.3	42.2	38.8	34.0	29.8

**Table D44. Daily peak 24-hour particles as PM<sub>2.5</sub> at Caversham (2005-2014)**
**Trend station/region: Caversham**

 AAQ NEPM Advisory Standard  
 25 µg/m<sup>3</sup> (24-hour average)

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	0.0	0					
2006	63.8	1	34.0	18.6	15.6	13.4	12.0
2007	98.4	0	24.5	15.1	14.0	12.1	10.7
2008	99.4	1	26.3	15.2	14.0	11.7	10.6
2009	99.5	2	25.5	19.4	17.3	12.9	11.0
2010	99.1	3	45.2	21.9	16.2	13.7	12.1
2011	99.4	1	41.5	12.4	11.7	10.8	9.8
2012	96.9	3	45.9	19.2	15.9	12.3	10.6
2013	97.4	0	22.6	17.2	16.4	13.6	11.6
2014	97.0	1	39.3	16.2	15.2	14.1	11.9

**Table D45. Daily peak 24-hour particles as PM<sub>2.5</sub> at Duncraig (2005-2014)****Trend station/region: Duncraig***AAQ NEPM Advisory Standard  
25 µg/m<sup>3</sup> (24-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	98.6	3	40.6	17.3	15.0	13.1	11.4
2006	99.0	2	33.4	18.7	16.2	13.4	11.9
2007	99.6	0	19.6	14.2	13.5	11.6	10.1
2008	99.3	1	38.3	18.0	15.9	12.6	11.1
2009	99.4	3	32.7	22.1	17.5	13.2	11.5
2010	99.3	3	36.4	20.1	15.9	13.7	12.0
2011	99.4	1	52.1	14.7	13.4	11.5	10.4
2012	97.5	3	77.3	22.0	14.4	12.7	11.0
2013	98.5	0	18.7	15.6	14.4	12.7	11.4
2014	99.7	1	47.6	16.8	15.3	13.0	11.0

**Table D46. Daily peak 24-hour particles as PM<sub>2.5</sub> at Quinns Rocks (2005-2014)****Trend station/region: Quinns Rocks***AAQ NEPM Advisory Standard  
25 µg/m<sup>3</sup> (24-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	0.0	0					
2006	55.3	1	63.9	17.0	14.3	13.2	11.0
2007	99.7	0	19.9	15.4	13.7	12.1	10.1
2008	99.3	1	53.3	17.3	15.4	12.8	11.3
2009	99.8	2	31.3	20.7	15.2	12.7	11.3
2010	99.6	3	33.7	17.6	14.5	12.0	10.9
2011	99.0	2	43.2	17.3	14.6	11.6	10.1
2012	96.5	4	74.5	22.7	14.3	11.9	10.6
2013	98.5	0	19.3	16.6	15.0	13.1	10.9
2014	98.8	2	39.5	15.8	14.5	13.4	11.7

**Table D47. Daily peak 24-hour particles as PM<sub>2.5</sub> at South Lake (2005-2014)****Trend station/region: South Lake***AAQ NEPM Advisory Standard  
25 µg/m<sup>3</sup> (24-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	0.0	0					
2006	76.7	1	30.5	21.5	17.2	14.6	12.8
2007	98.9	0	21.2	15.6	12.9	11.8	10.5
2008	99.4	1	45.2	18.2	14.1	12.7	11.2
2009	99.3	3	32.0	22.8	19.1	14.1	11.7
2010	99.5	2	40.0	22.0	19.2	15.9	13.2
2011	99.2	1	48.2	16.2	15.3	13.1	11.5
2012	99.0	4	71.6	25.0	19.3	14.6	13.2
2013	98.6	0	17.1	15.2	14.9	14.0	11.7
2014	98.7	2	29.8	17.7	15.0	13.4	11.5

**Table D48. Daily peak 24-hour particles as PM<sub>2.5</sub> at Bunbury (2005-2014)****Trend station/region: Bunbury***AAQ NEPM Advisory Standard  
25 µg/m<sup>3</sup> (24-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	99.0	5	64.2	26.9	19.1	15.4	12.1
2006	99.3	8	113.5	32.4	26.0	14.8	13.0
2007	99.4	3	34.5	21.2	17.8	13.2	10.7
2008	99.7	2	27.8	21.0	18.6	13.2	11.4
2009	99.5	7	40.0	26.6	22.3	16.9	12.6
2010	98.6	7	115.3	28.4	24.2	14.8	12.2
2011	98.9	5	45.5	26.6	18.7	13.2	11.2
2012	99.6	7	43.0	26.3	21.0	14.9	12.8
2013	99.3	1	38.3	16.6	15.7	14.0	11.5
2014	98.4	1	34.6	16.1	15.0	13.3	11.7

**Table D49. Daily peak 24-hour particles as PM<sub>2.5</sub> at Busselton (2005-2014)****Trend station/region: Busselton***AAQ NEPM Advisory Standard  
25 µg/m<sup>3</sup> (24-hour average)*

Year	Data recovery (%)	No. of exceedences (days)	Max conc. (µg/m <sup>3</sup> )	99th percentile (µg/m <sup>3</sup> )	98th percentile (µg/m <sup>3</sup> )	95th percentile (µg/m <sup>3</sup> )	90th percentile (µg/m <sup>3</sup> )
2005	0.0	0					
2006	16.7	0	12.7	11.9	11.3	10.8	10.1
2007	99.4	2	51.1	15.6	14.3	11.7	9.9
2008	99.3	3	35.6	20.5	15.5	11.9	10.5
2009	99.8	12	69.0	45.0	31.6	17.7	14.0
2010	99.4	7	62.5	31.6	22.9	15.7	11.6
2011	99.8	6	85.2	36.7	20.5	13.9	11.4
2012	99.6	5	78.0	27.1	21.4	13.4	11.8
2013	98.6	0	17.9	16.6	15.5	12.9	10.9
2014	99.6	1	25.1	13.2	12.4	11.1	10.2

## Maxima by pollutant 2005-2014

**Table D50. Annual daily peak 8-hour carbon monoxide concentrations (ppm) for 2005-2014**

Regional Performance Monitoring Station										
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<i>AAQ NEPM Standard 9.0 ppm (8-hour average)</i>										
<b>Perth region</b>										
Caversham (North East Metro)	1.3	1.8	0.9	0.8	1.0	1.6	1.5	0.9	0.9	0.7
Duncraig (North Metro)	3.3	3.4	2.0	3.1	2.6	2.3	1.9	2.4	2.1	1.9
South Lake (South East Metro)	2.9	2.5	1.7	2.0	1.8	2.2	1.7	2.2	1.7	1.8

**Table D51. Annual daily peak 1-hour nitrogen dioxide concentrations (ppm) for 2005-2014**

Regional Performance Monitoring Station										
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<i>AAQ NEPM Standard 0.12 ppm (1-hour average)</i>										
<b>Perth region</b>										
Caversham (North East Metro)	0.048	0.084	0.044	0.036	0.044	0.054	0.035	0.037	0.043	0.033
Duncraig (North Metro)	0.051	0.056	0.053	0.038	0.042	0.038	0.035	0.047	0.040	0.048
Quinns Rocks (Outer North Coast)	0.041	0.065	0.035	0.037	0.034	0.040	0.031	0.041	0.032	0.031
Rockingham (South Coast)	0.045	0.054	0.040	0.031	0.031	0.036	0.034	0.053	0.035	0.034
Rolling Green (Outer East Rural)	0.029	0.026	0.020	0.023	0.035	0.030	0.023	0.029	0.030	0.021
South Lake (South East Metro)	0.052	0.045	0.057	0.044	0.048	0.058	0.041	0.046	0.043	0.034
Swanbourne (Inner West Coast)	0.039	0.043	0.038	0.035	0.037	0.038	0.032	0.045	0.037	0.036

**Table D52. Annual daily peak 1-hour ozone concentrations (ppm) for 2005-2014**

*AAQ NEPM Standard  
0.10 ppm (1-hour average)*

Regional Performance Monitoring Station	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>Perth region</b>										
Caversham (North East Metro)	0.094	0.080	0.085	0.083	0.104	0.082	0.077	0.098	0.101	0.091
Quinns Rocks (Outer North Coast)	0.095	0.085	0.081	0.083	0.070	0.091	0.083	0.130	0.087	0.073
Rockingham (South Coast)	0.081	0.072	0.084	0.077	0.078	0.067	0.065	0.095	0.084	0.076
Rolling Green (Outer East Rural)	0.079	0.093	0.095	0.087	0.103	0.088	0.073	0.103	0.099	0.080
South Lake (South East Metro)	0.080	0.066	0.067	0.082	0.065	0.070	0.076	0.085	0.087	0.065
Swanbourne (Inner West Coast)	0.076	0.075	0.077	0.076	0.068	0.066	0.085	0.128	0.083	0.066

Highlighted cells indicate NEPM exceedences.

For explanation of exceedences in previous years, please refer to the relevant year report.

**Table D53. Annual daily peak 4-hour ozone concentrations (ppm) for 2005-2014**

*AAQ NEPM Standard  
0.08 ppm (4-hour average)*

Regional Performance Monitoring Station	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>Perth region</b>										
Caversham (North East Metro)	0.069	0.072	0.073	0.076	0.092	0.072	0.063	0.086	0.075	0.073
Quinns Rocks (Outer North Coast)	0.070	0.074	0.075	0.073	0.062	0.065	0.075	0.108	0.079	0.062
Rockingham (South Coast)	0.075	0.067	0.079	0.072	0.066	0.064	0.061	0.079	0.075	0.067
Rolling Green (Outer East Rural)	0.068	0.079	0.080	0.075	0.083	0.080	0.061	0.081	0.083	0.070
South Lake (South East Metro)	0.070	0.063	0.059	0.067	0.057	0.061	0.064	0.080	0.074	0.058
Swanbourne (Inner West Coast)	0.066	0.069	0.067	0.070	0.063	0.055	0.073	0.108	0.068	0.057

Highlighted cells indicate NEPM exceedences.

For explanation of exceedences in previous years, please refer to the relevant year report.

**Table D54. Annual daily peak 1-hour sulfur dioxide concentrations (ppm)  
for 2005-2014**

*AAQ NEPM Standard  
0.20 ppm (1-hour average)*

Regional Performance Monitoring Station	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>Perth region</b>										
Rockingham (South Coast)	0.041	0.040	0.041	0.079	0.032	0.037	0.040	0.040	0.037	0.036
South Lake (South East Metro)	0.046	0.060	0.040	0.046	0.036	0.073	0.044	0.039	0.044	0.051
Wattleup (South Metro)	0.120	0.062	0.060	0.077	0.059	0.057	0.067	0.043	0.090	0.061

**Table D55. Annual daily peak 24-hour sulfur dioxide concentrations (ppm)  
for 2005-2014**

*AAQ NEPM Standard  
0.08 ppm (24-hour average)*

Regional Performance Monitoring Station	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>Perth region</b>										
Rockingham (South Coast)	0.009	0.007	0.012	0.007	0.008	0.007	0.008	0.006	0.007	0.007
South Lake (South East Metro)	0.007	0.009	0.006	0.005	0.006	0.009	0.006	0.006	0.014	0.010
Wattleup (South Metro)	0.014	0.009	0.010	0.011	0.008	0.010	0.008	0.008	0.010	0.008



**Table D56. Annual daily peak 24-hour particles as PM<sub>10</sub> concentrations (µg/m<sup>3</sup>) for 2005-2014**

*AAQ NEPM Standard  
50 µg/m<sup>3</sup> (24-hour average)*

Regional Performance Monitoring Station	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>Perth region</b>										
Caversham (North East Metro)	76.8	42.6	58.8	39.1	45.7	63.4	76.1	68.7	62.4	52.6
Duncraig (North Metro)	59.2	40.6	40.3	46.9	45.5	47.9	65.9	89.5	37.6	53.0
South Lake (South East Metro)	98.8	45.3	56.7	55.0	49.0	61.0	66.2	81.5	38.8	44.5
<b>Southwest region</b>										
Bunbury	63.3	123.5	46.5	39.1	53.8	134.0	68.4	53.5	46.8	44.5
Collie	-	-	-	85.9	80.4	163.0	61.5	91.7	61.6	73.3
Albany	-	39.4	55.7	56.3	36.7	52.5	37.3	37.0	110.8	43.5
<b>Mid West region</b>										
Geraldton	61.3	78.0	116.3	150.7	128.9	55.6	63.0	61.5	63.1	55.7

Highlighted cells indicate NEPM exceedences.

For explanation of exceedences in 2014, please see [Table A8](#) on page 14 of this report. For explanation of exceedences in previous years, please refer to the relevant year report.

**Table D57. Annual daily peak 24-hour particles as PM<sub>2.5</sub> concentrations (µg/m<sup>3</sup>) for 2005-2014**

*AAQ NEPM Advisory Standard  
25 µg/m<sup>3</sup> (24-hour average)*

Regional Performance Monitoring Station	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>Perth region</b>										
Caversham (North East Metro)	-	34.0	24.5	26.3	25.5	45.2	41.5	45.9	22.6	39.3
Duncraig (North Metro)	40.6	33.4	19.6	38.3	32.7	36.4	52.1	77.3	18.7	47.6
Quinns Rocks (Outer North Coast)	-	63.9	19.9	53.3	31.3	33.7	43.2	74.5	19.3	39.5
South Lake (South East Metro)	-	30.5	21.2	45.2	32.0	40.0	48.2	71.6	17.1	29.8
<b>Southwest region</b>										
Bunbury	64.2	113.5	34.5	27.8	40.0	115.3	45.5	43.0	38.3	34.6
Busselton	-	12.7	51.1	35.6	69.0	62.5	85.2	78.0	17.9	25.1

Highlighted cells indicate NEPM exceedences.

For explanation of exceedences in 2013, please see [Table A8](#) on page 14 of this report. For explanation of exceedences in previous years, please refer to the relevant year report.

**Table D58. Annual averaged particles as PM<sub>2.5</sub> concentrations (µg/m<sup>3</sup>) for 2005-2014**

 AAQ NEPM Advisory Standard  
 8 µg/m<sup>3</sup> (annual average)

Regional Performance Monitoring Station	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>Perth region</b>										
Caversham (North East Metro)	-	8.1	7.5	7.1	7.8	8.2	7.0	7.8	7.9	8.1
Duncraig (North Metro)	7.8	8.2	7.3	7.7	8.2	8.2	7.8	8.2	7.6	7.6
Quinns Rocks (Outer North Coast)	-	7.8	6.9	7.2	7.8	7.8	7.2	7.9	7.8	8.0
South Lake (South East Metro)	-	8.7	7.6	7.7	8.2	8.7	7.8	8.9	8.0	8.1
<b>Southwest region</b>										
Bunbury	8.6	8.7	7.8	7.6	8.3	9.2	8.0	8.6	7.8	7.8
Busselton	-	6.9	7.4	7.3	9.0	8.5	8.5	8.6	7.7	7.2

Highlighted cells indicate NEPM exceedences.

## Attachment 1 – Graphical trends

This attachment provides graphical representations of tables D9 to D49 of Section D.

Each graph show the maximum, 99<sup>th</sup> percentile, 98<sup>th</sup> percentile, 95<sup>th</sup> percentile and 90<sup>th</sup> percentile of daily maximum concentration for all pollutants monitored by the Department of Environment Regulation in Western Australia. The nominated percentiles can also be expressed as an Nth highest concentration.

Based on 100 per cent data recovery and a normal year (i.e. 365 days), the following table gives each percentile an equivalent Nth highest ordinal value. The bracketed numbers represent the exact (as calculated) value of the ordinal number.

Percentile	Nth highest
100	1 (maximum)
99	5 (4.65)
98	8 (8.3)
95	19 (19.25)
90	38 (37.5)

## Carbon monoxide

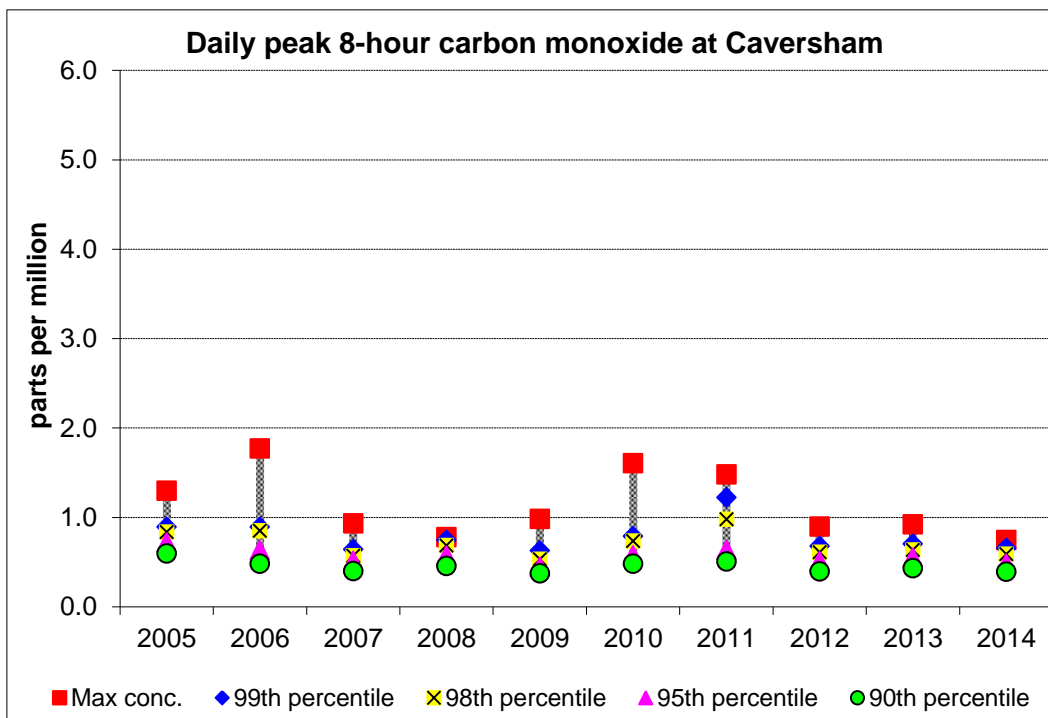


Figure A1-1 - 8-hour carbon monoxide at Caversham

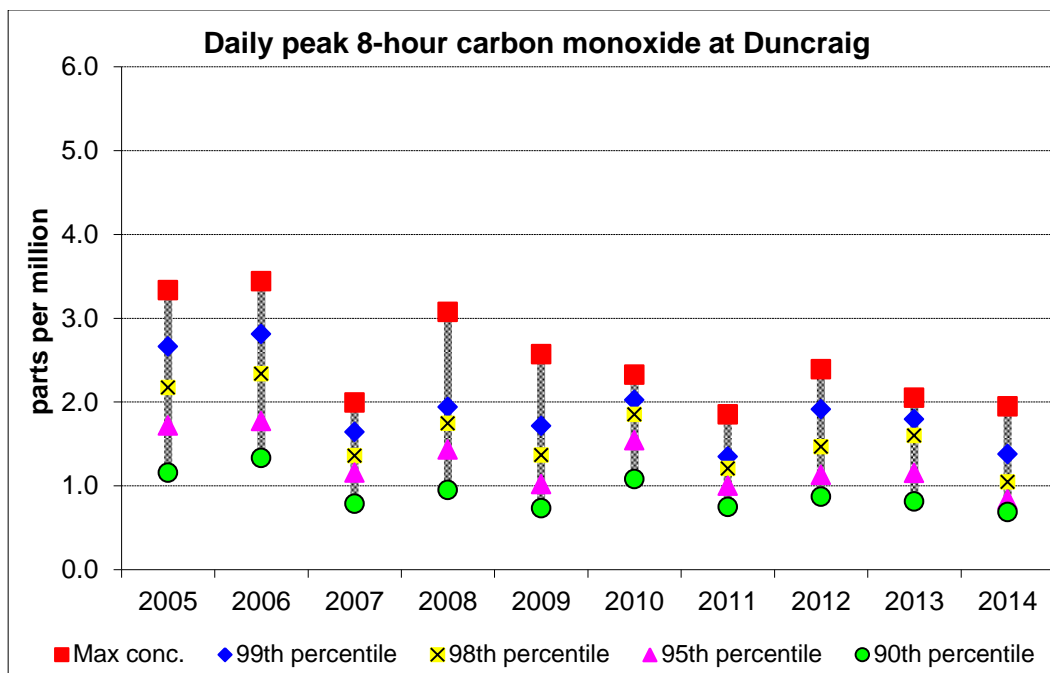


Figure A1-2 - 8-hour carbon monoxide at Duncraig

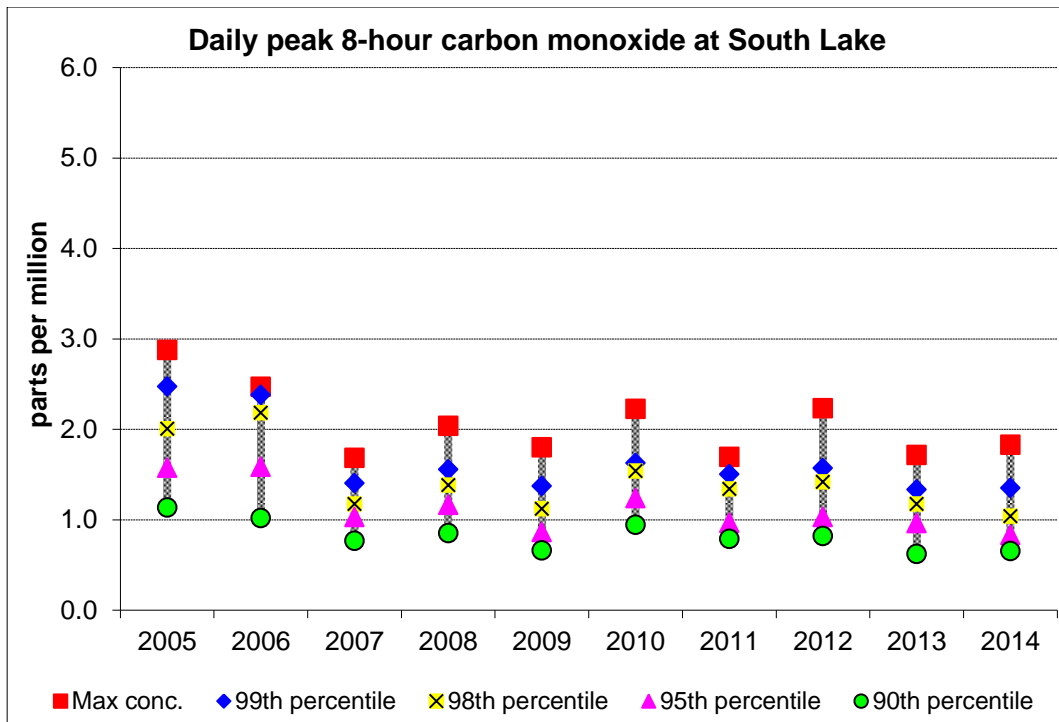


Figure A1-3 - 8-hour carbon monoxide at South Lake

Nitrogen dioxide

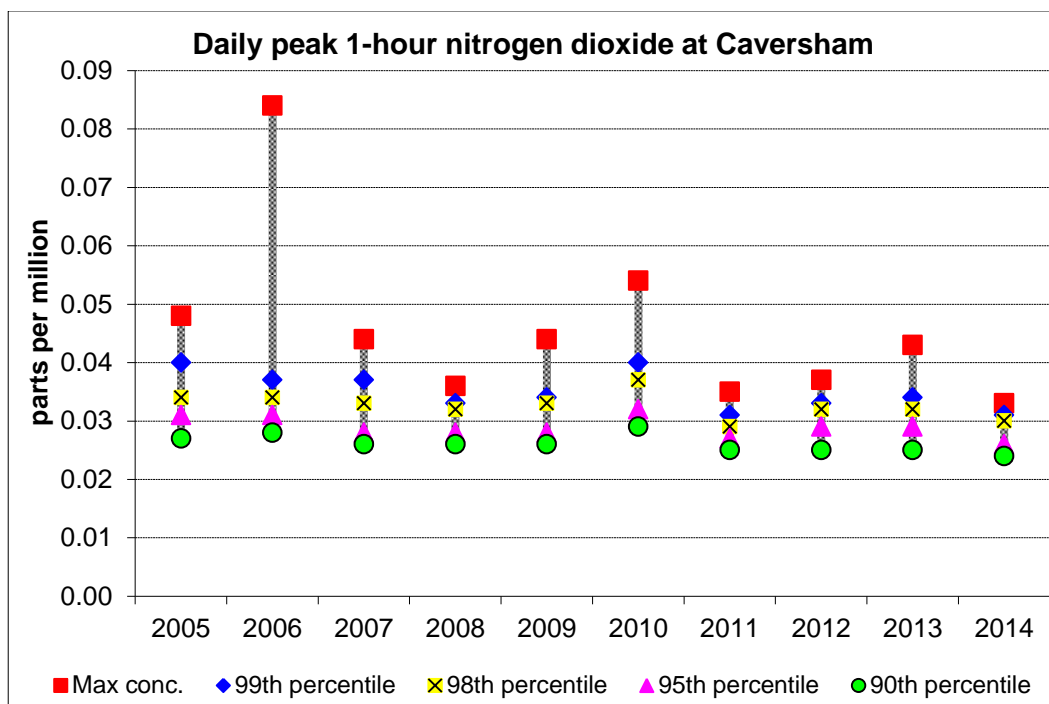


Figure A1-4 - 1-hour nitrogen dioxide at Caversham

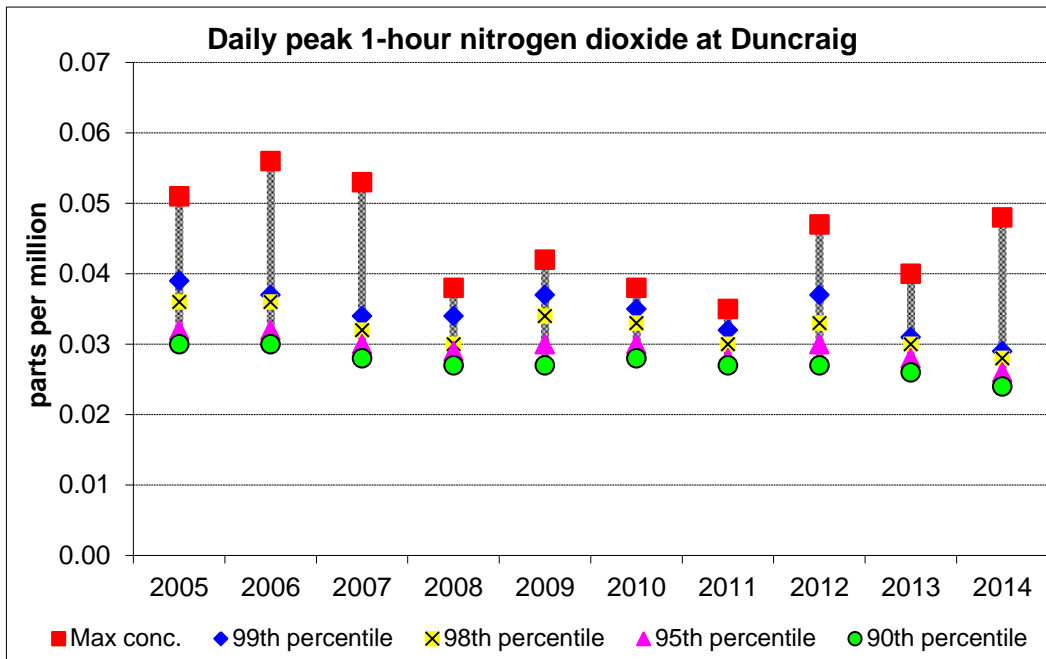


Figure A1-5 - 1-hour nitrogen dioxide at Duncraig

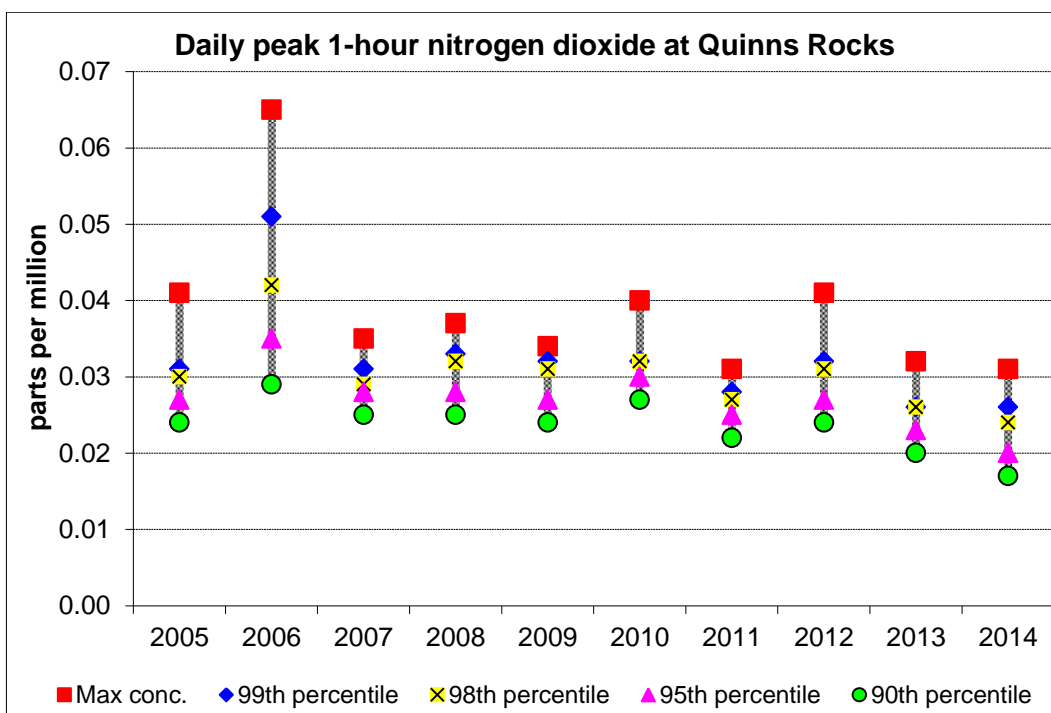


Figure A1-6 - 1-hour nitrogen dioxide at Quinns Rocks

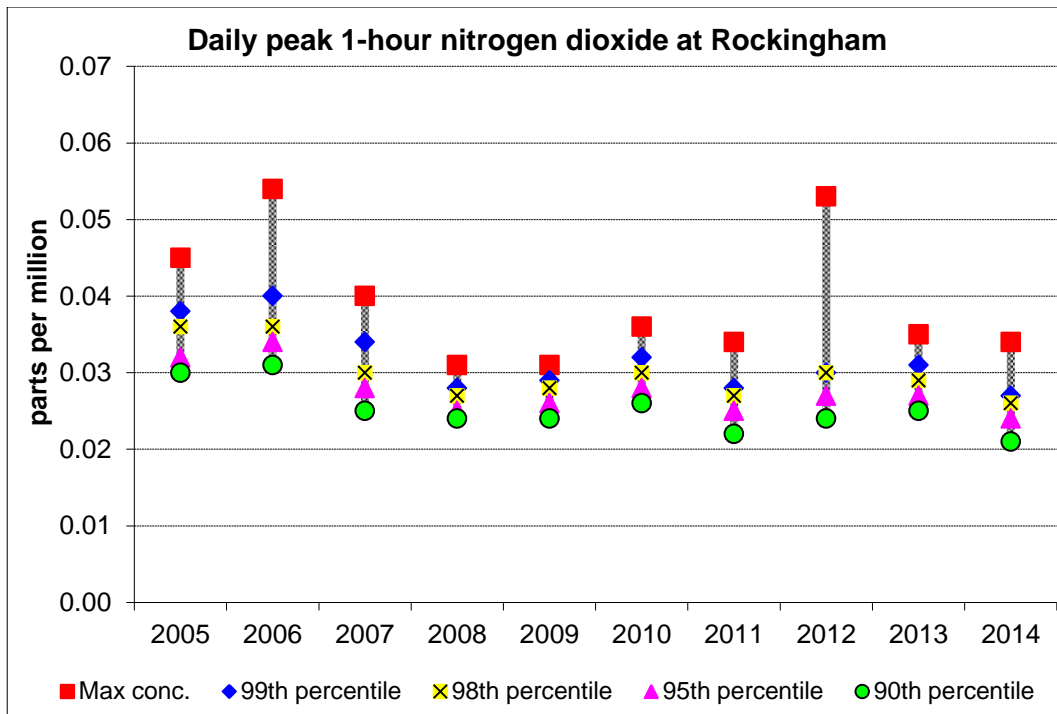


Figure A1-7 - 1-hour nitrogen dioxide at Rockingham

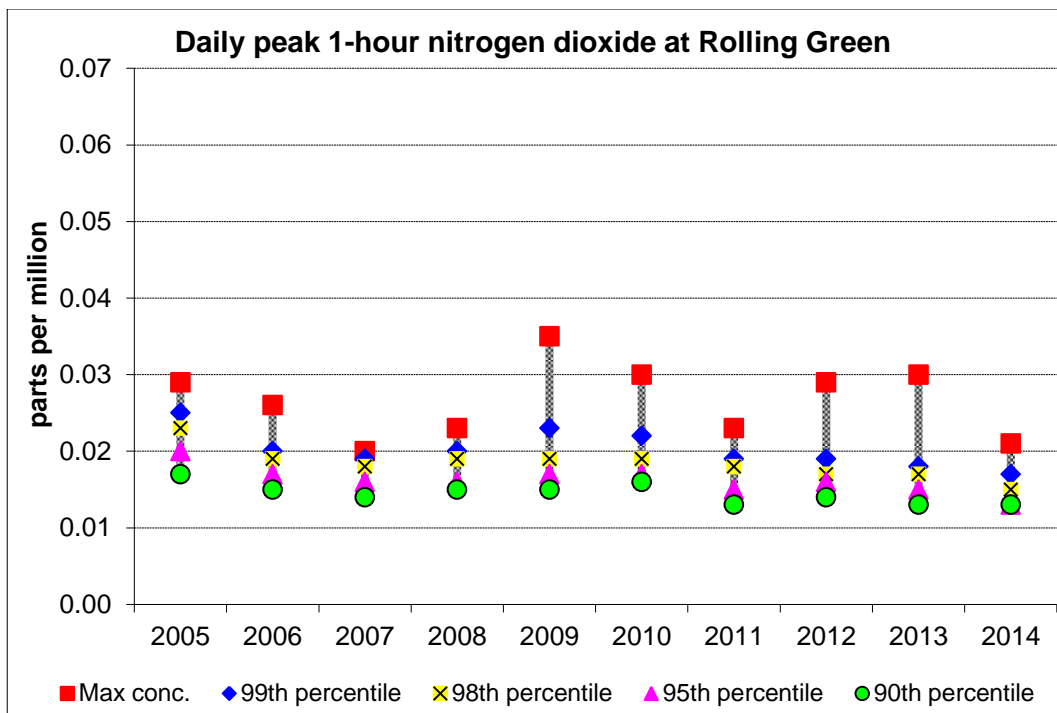


Figure A1-8 - 1-hour nitrogen dioxide at Rolling Green

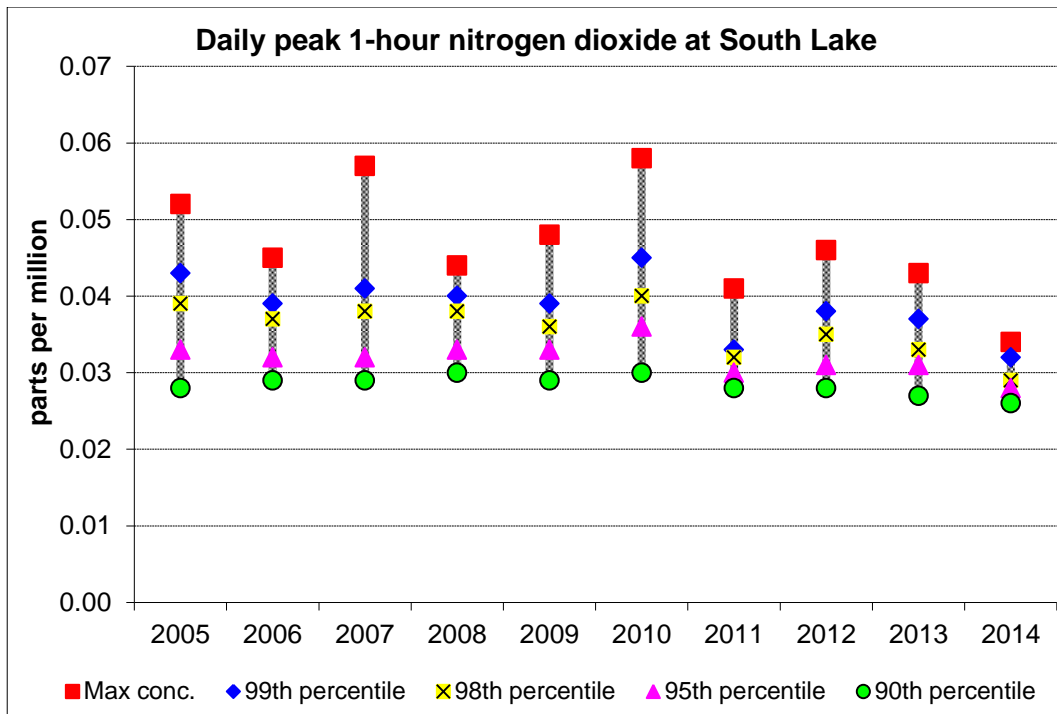


Figure A1-9 - 1-hour nitrogen dioxide at South Lake

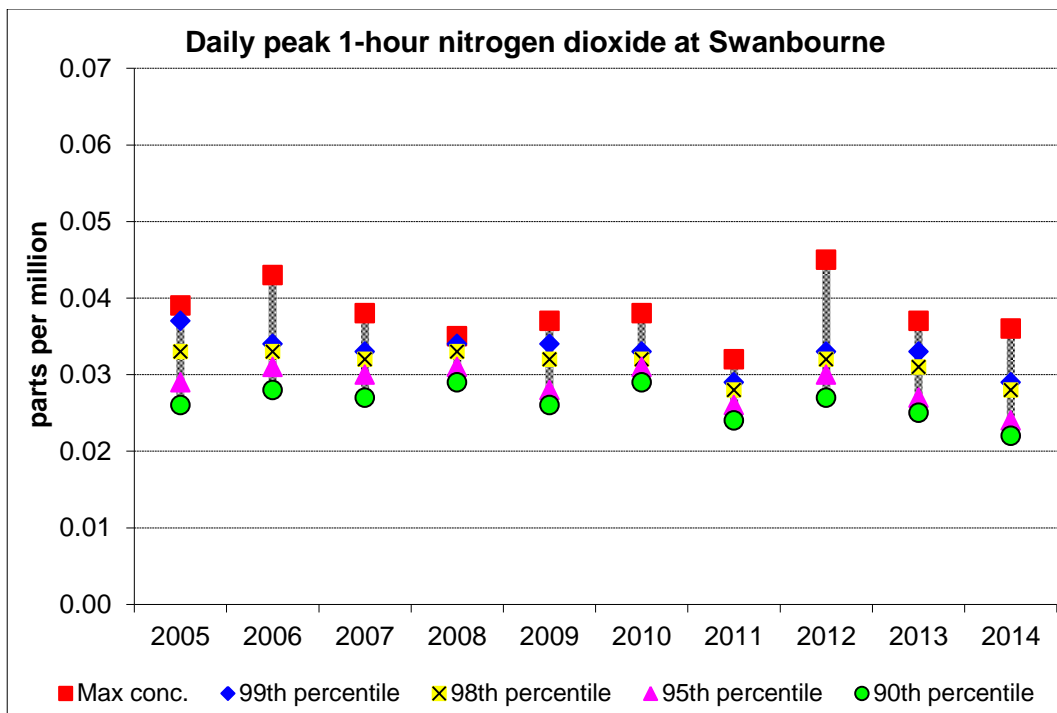


Figure A1-10 - 1-hour nitrogen dioxide at Swanbourne



Ozone

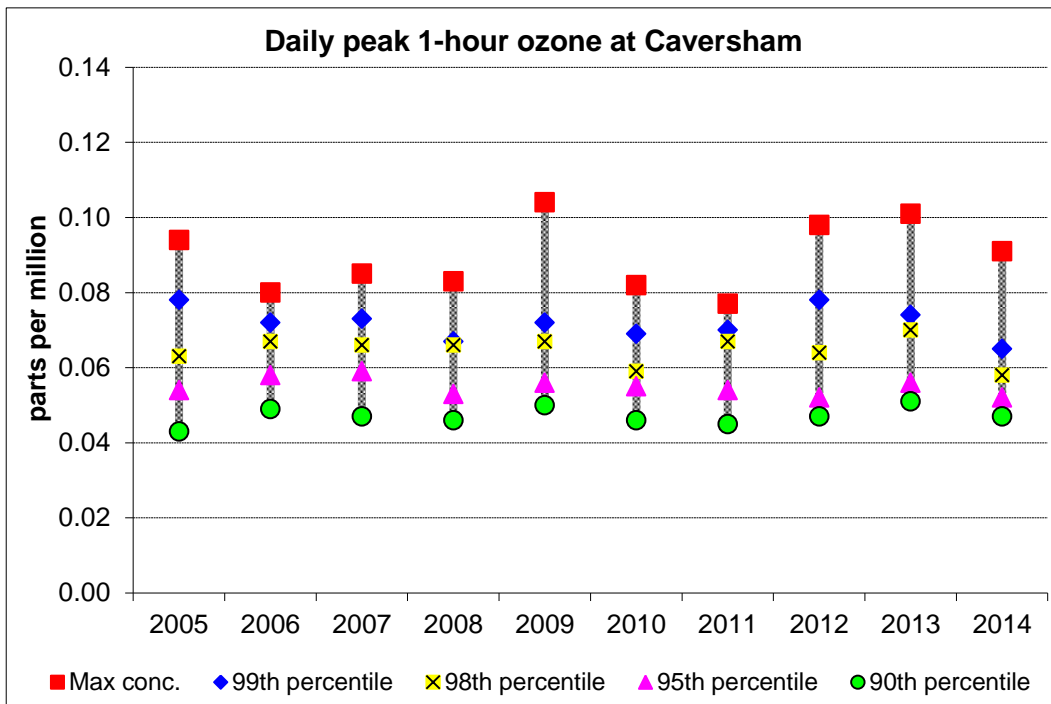


Figure A1-11 1-hour ozone at Caversham

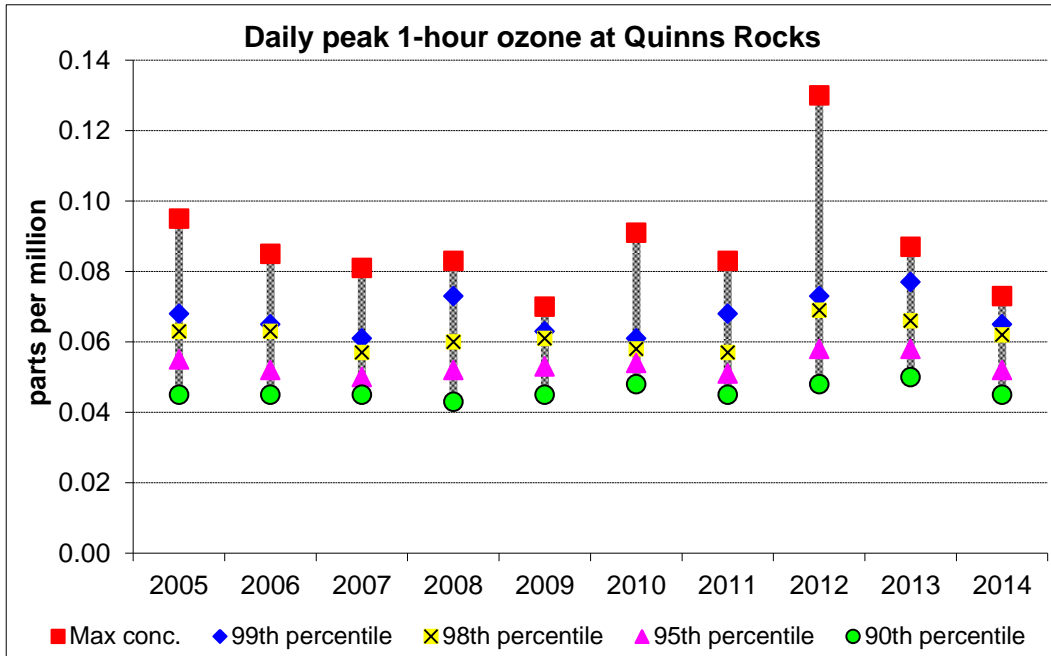


Figure A1-12 –1-hour ozone at Quinns Rocks

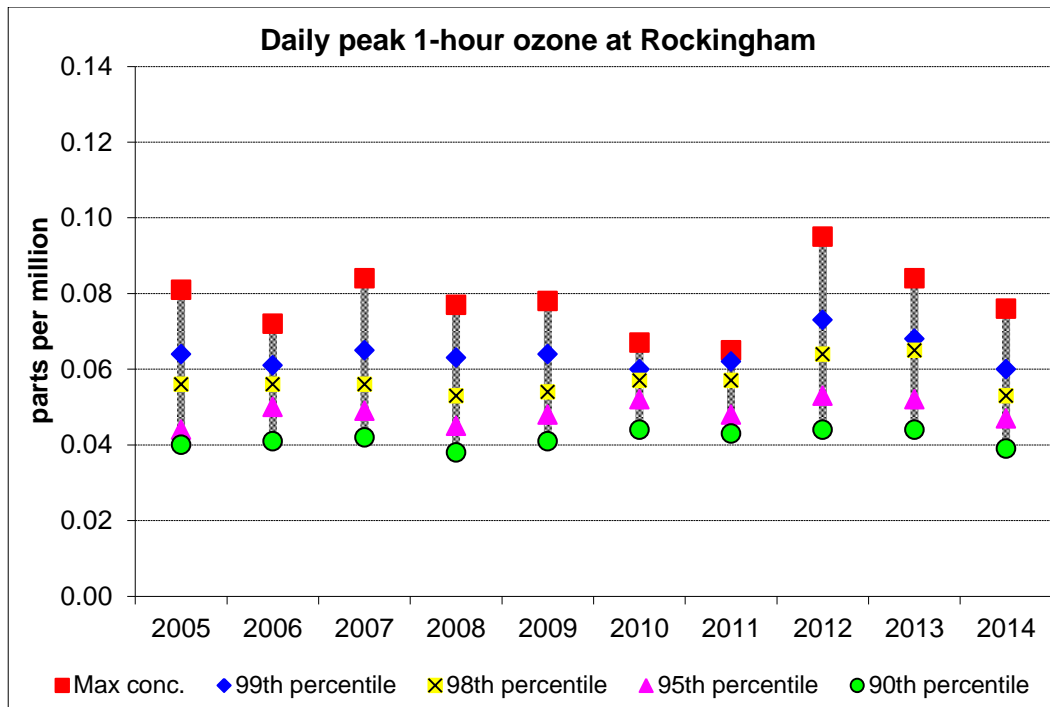


Figure A1-13 - 1-hour ozone at Rockingham

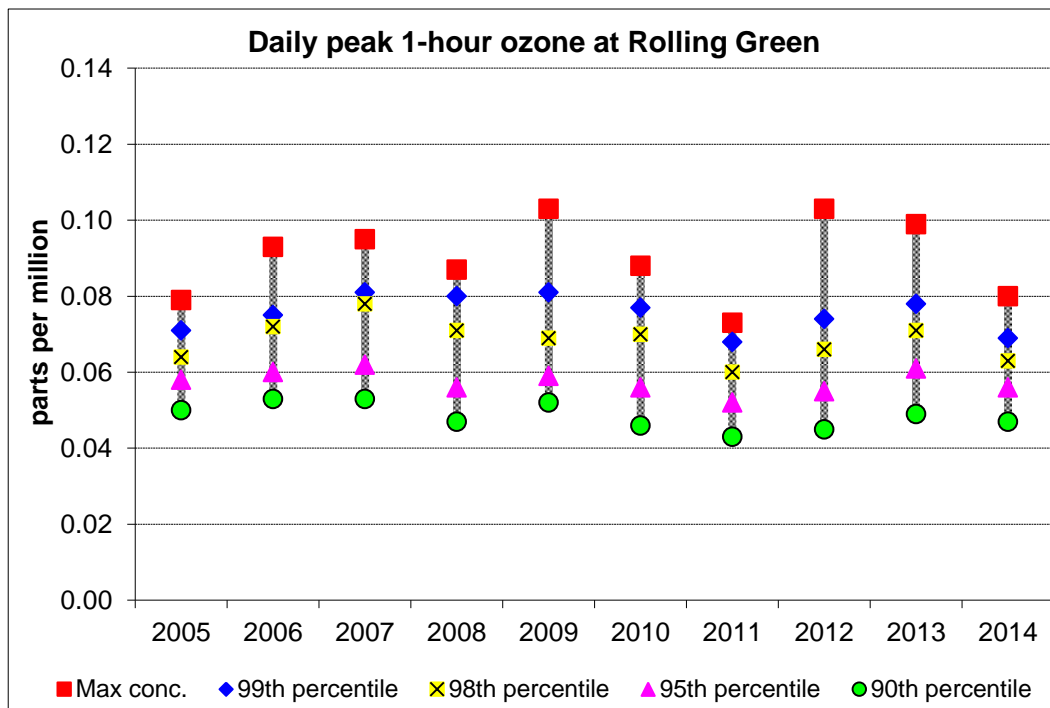


Figure A1-14 - 1-hour ozone at Rolling Green

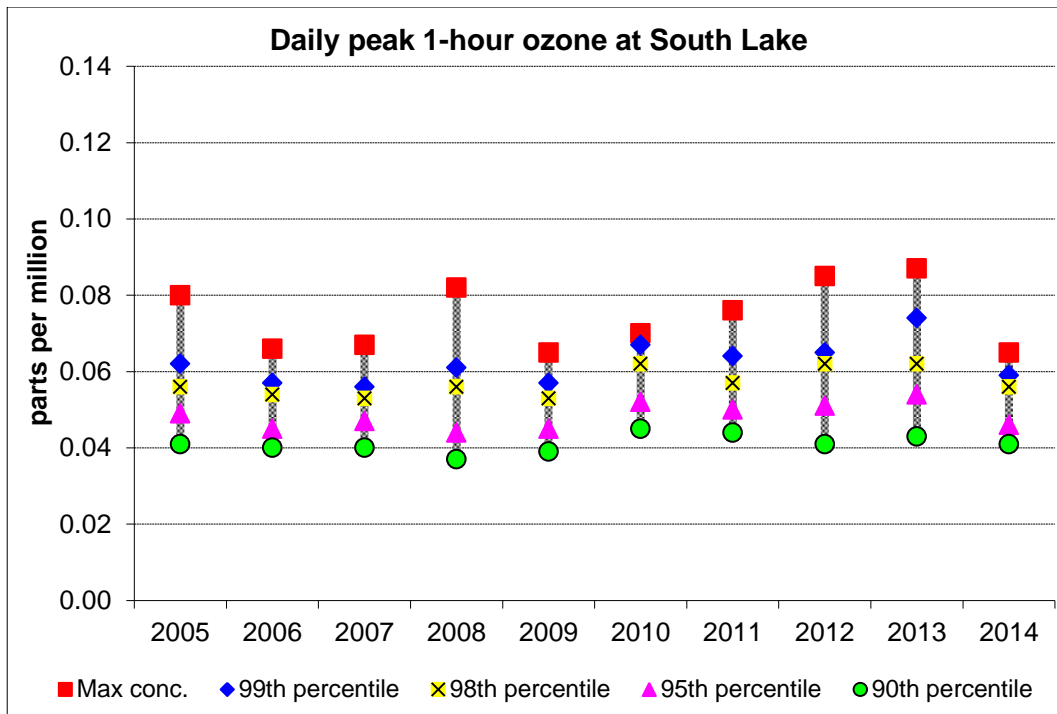


Figure A1-15 - 1-hour ozone at South Lake

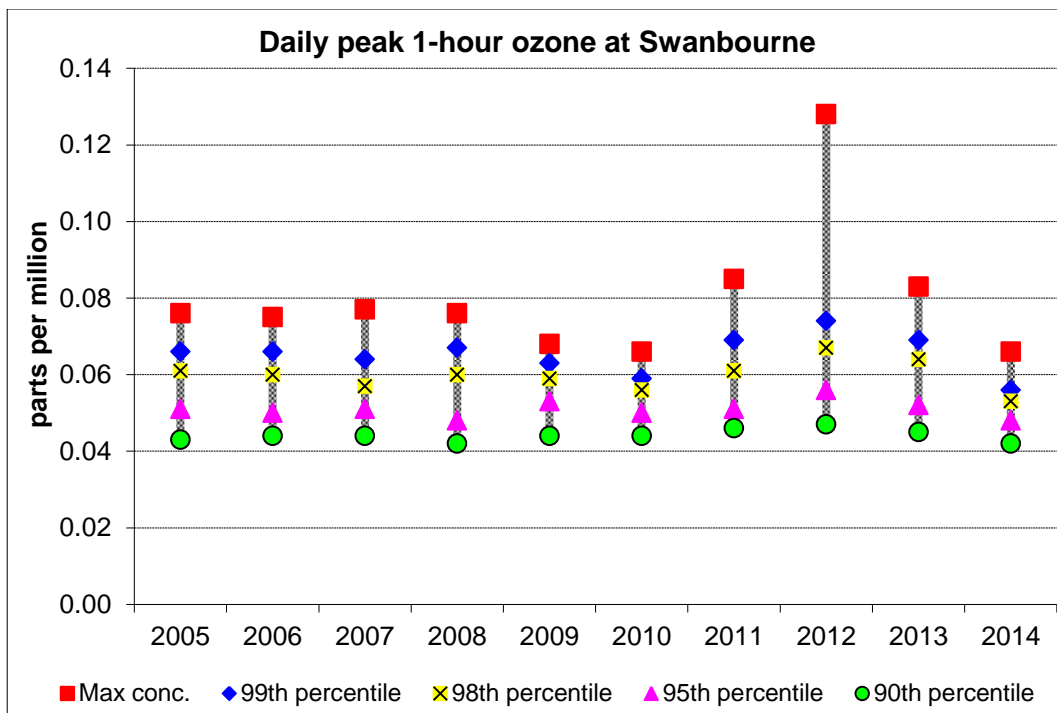


Figure A1-16 - 1-hour ozone at Swanbourne

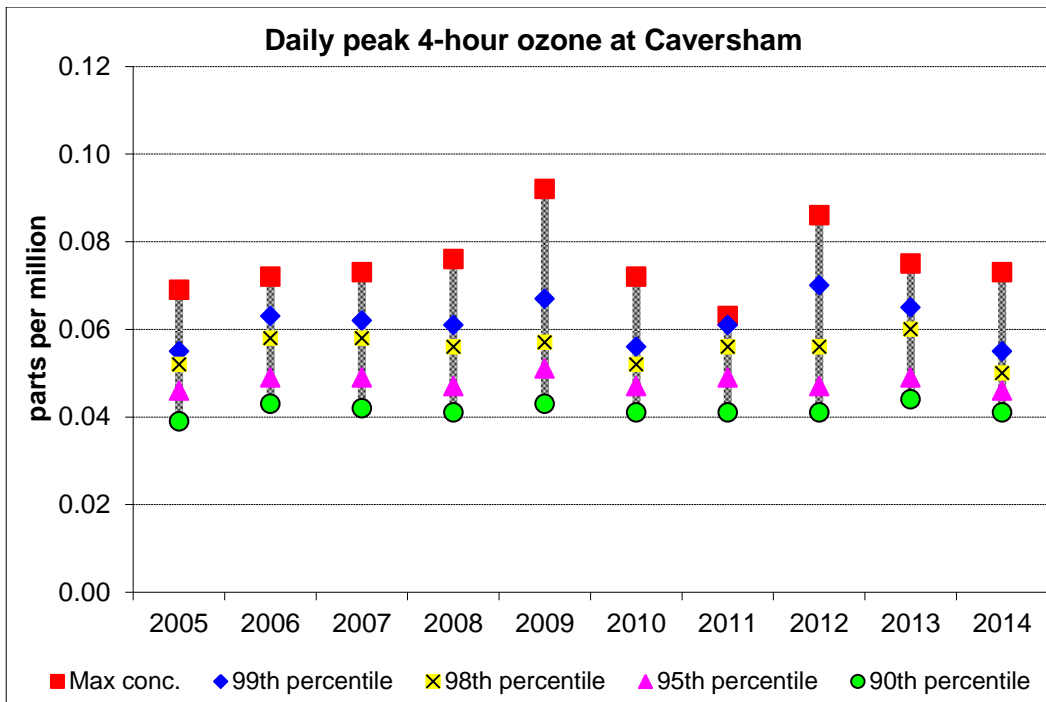


Figure A1-17 - 4-hour ozone at Caversham

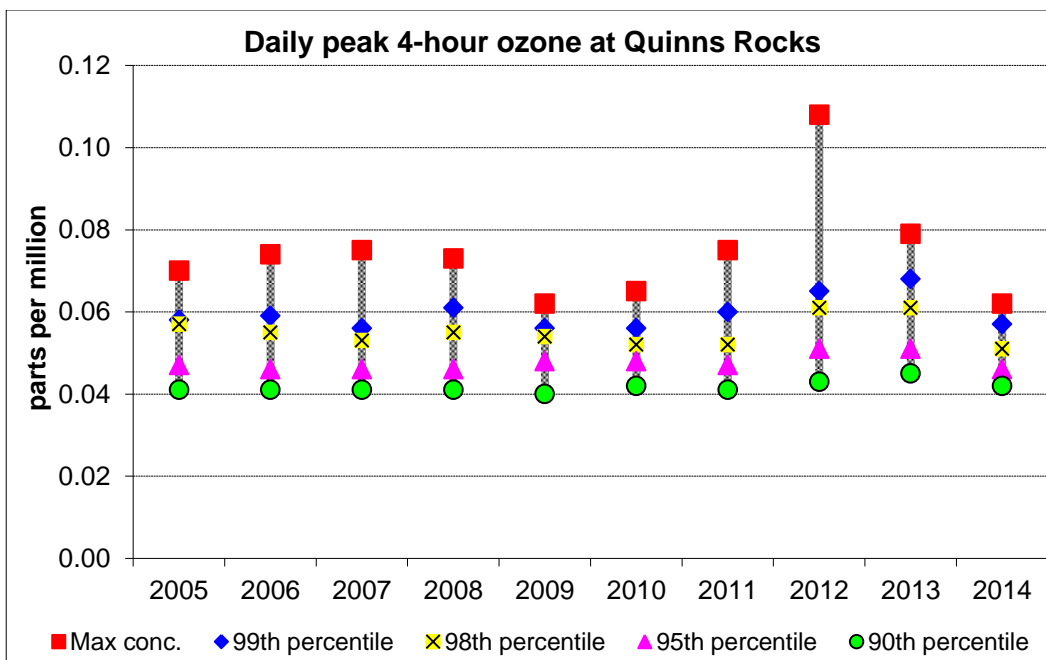


Figure A1-18 - 4-hour ozone at Quinns Rocks

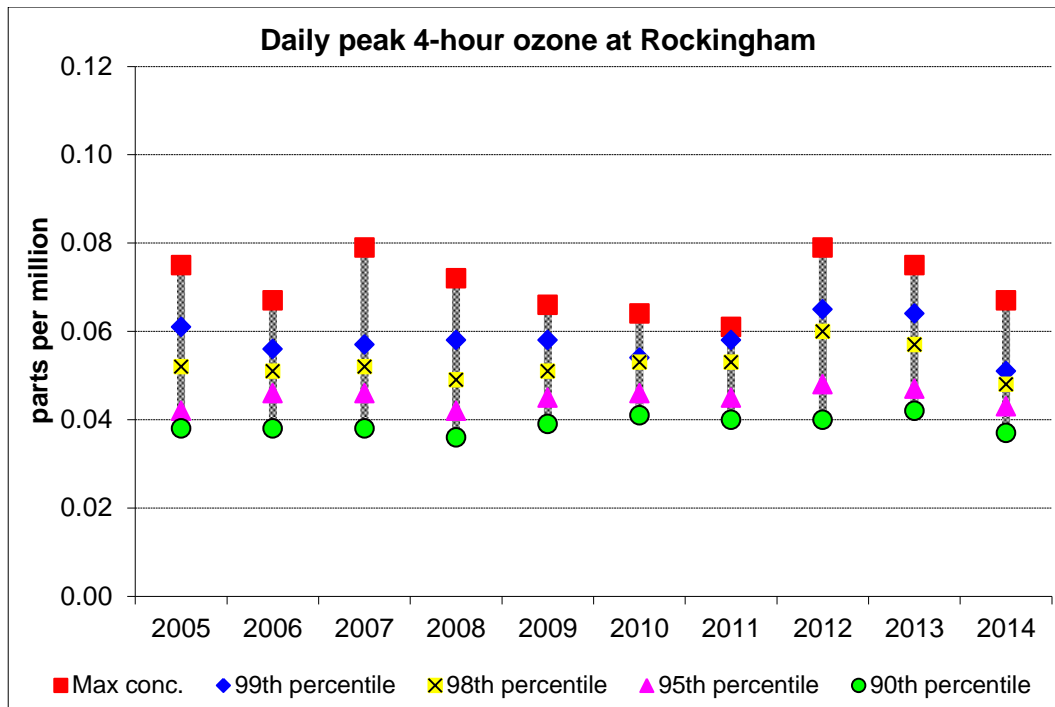


Figure A1-19 - 4-hour ozone at Rockingham

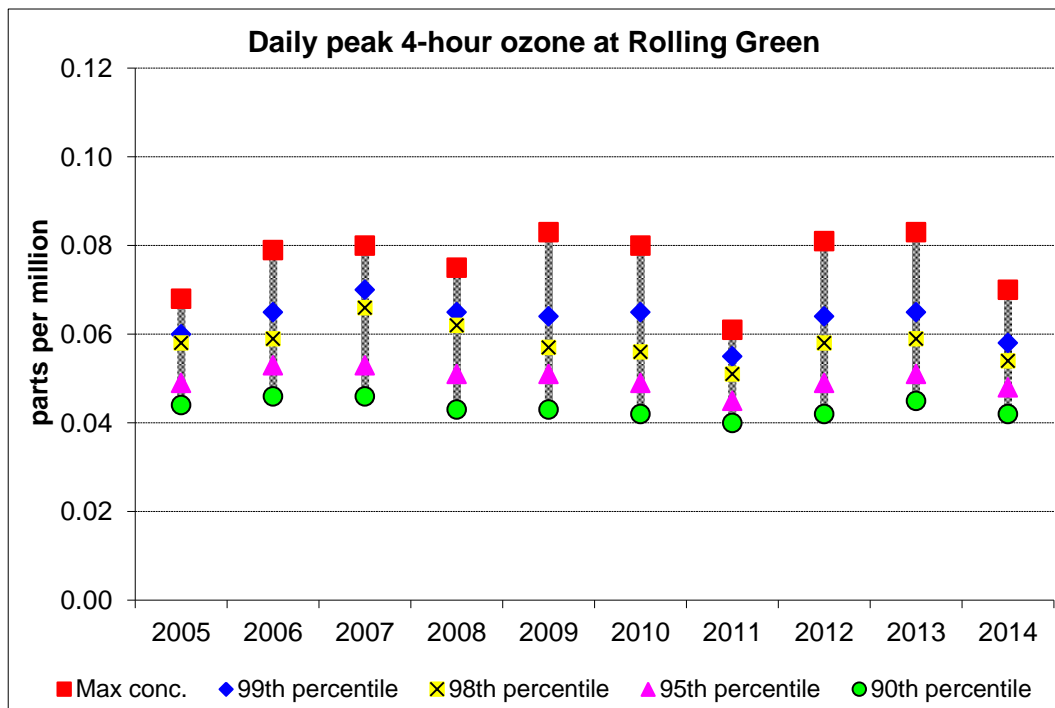


Figure A1-20 - 4-hour ozone at Rolling Green

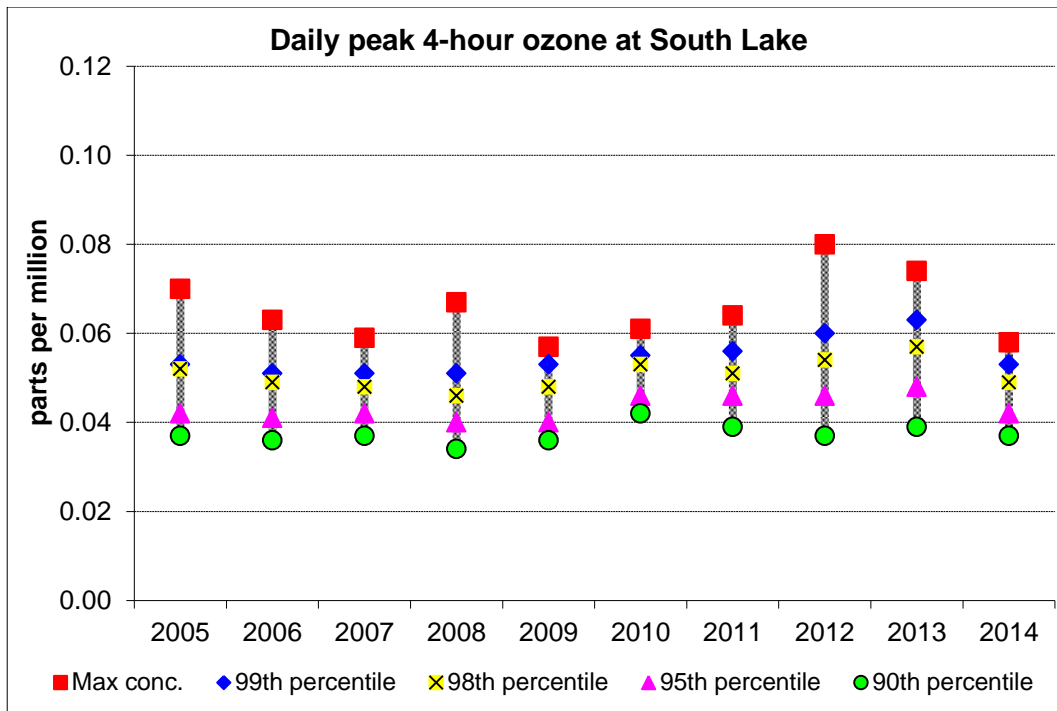


Figure A1-21 - 4-hour ozone at South Lake

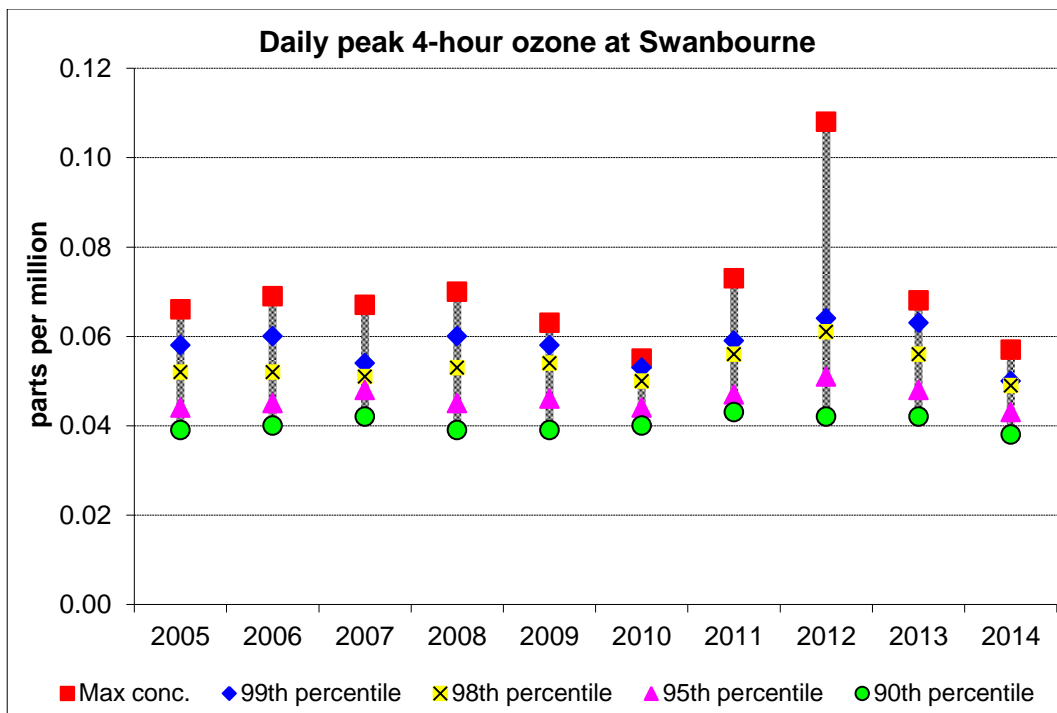


Figure A1-22 - 4-hour ozone at Swanbourne

## Sulfur dioxide

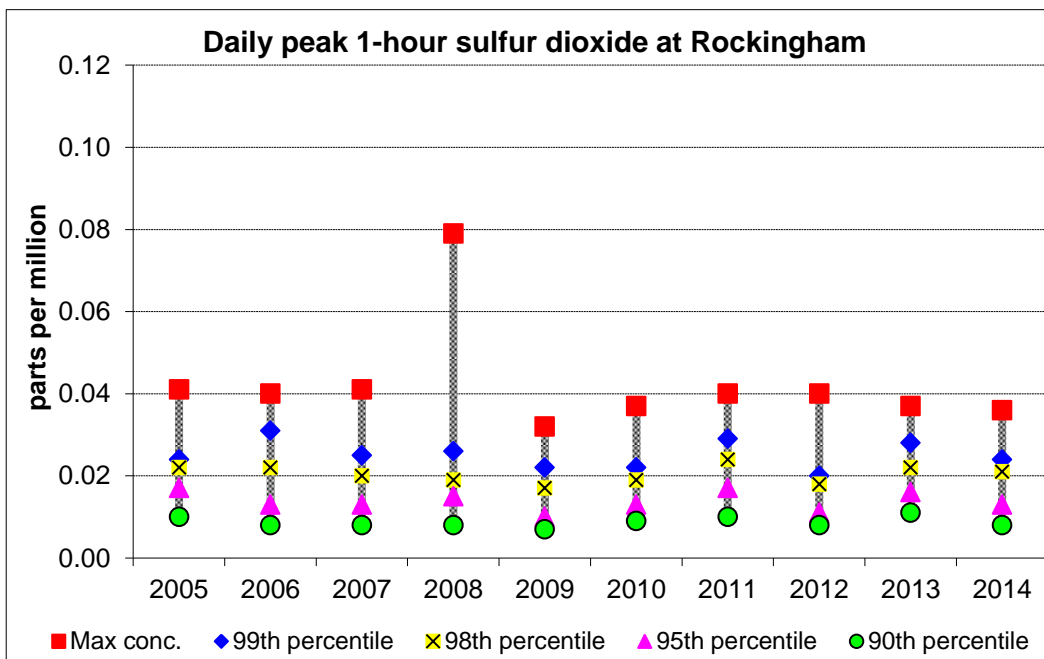


Figure A1-23 - 1-hour sulfur dioxide at Rockingham

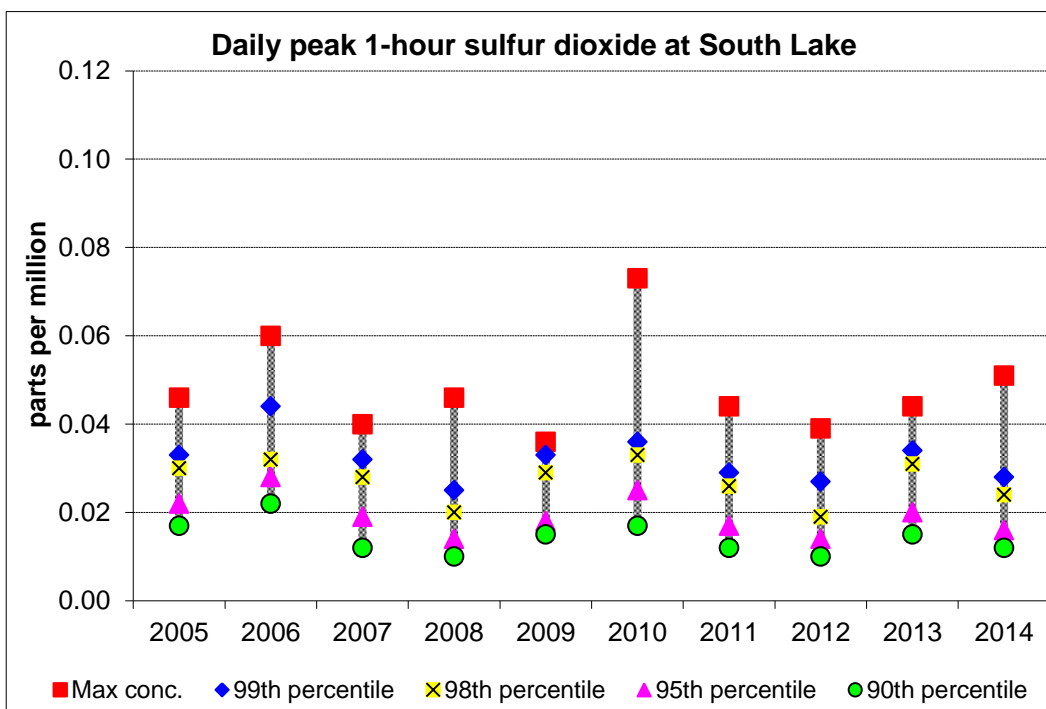


Figure A1-24 - 1-hour sulfur dioxide at South Lake

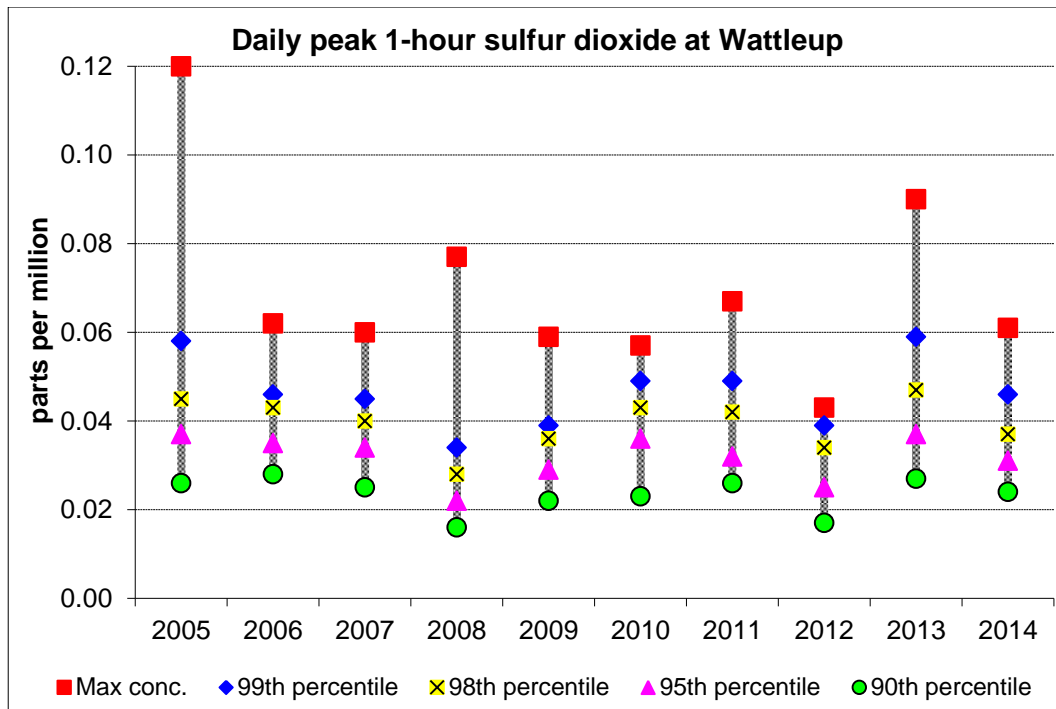


Figure A1-25 - 1-hour sulfur dioxide at Wattleup

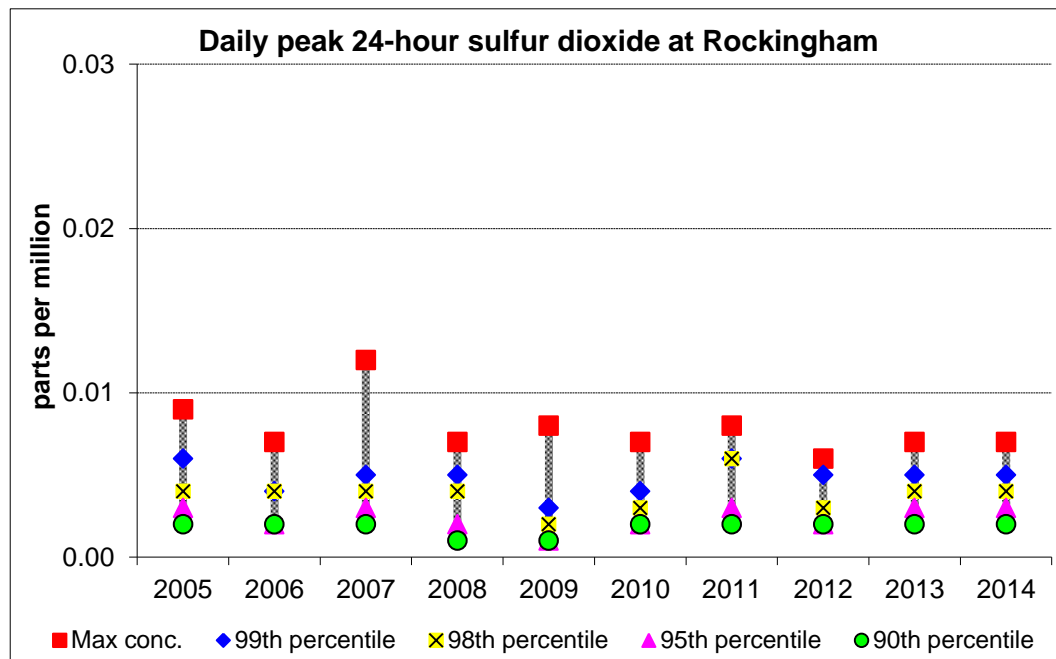


Figure A1-26 - 24-hour sulfur dioxide at Rockingham



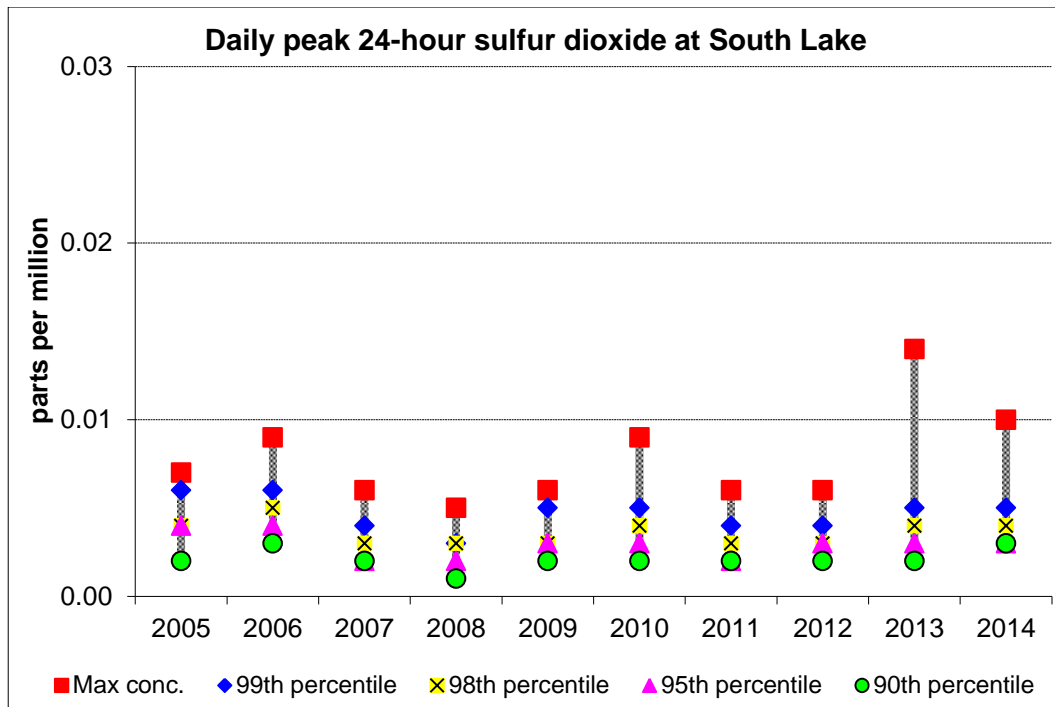


Figure A1-27 - 24-hour sulfur dioxide at South Lake

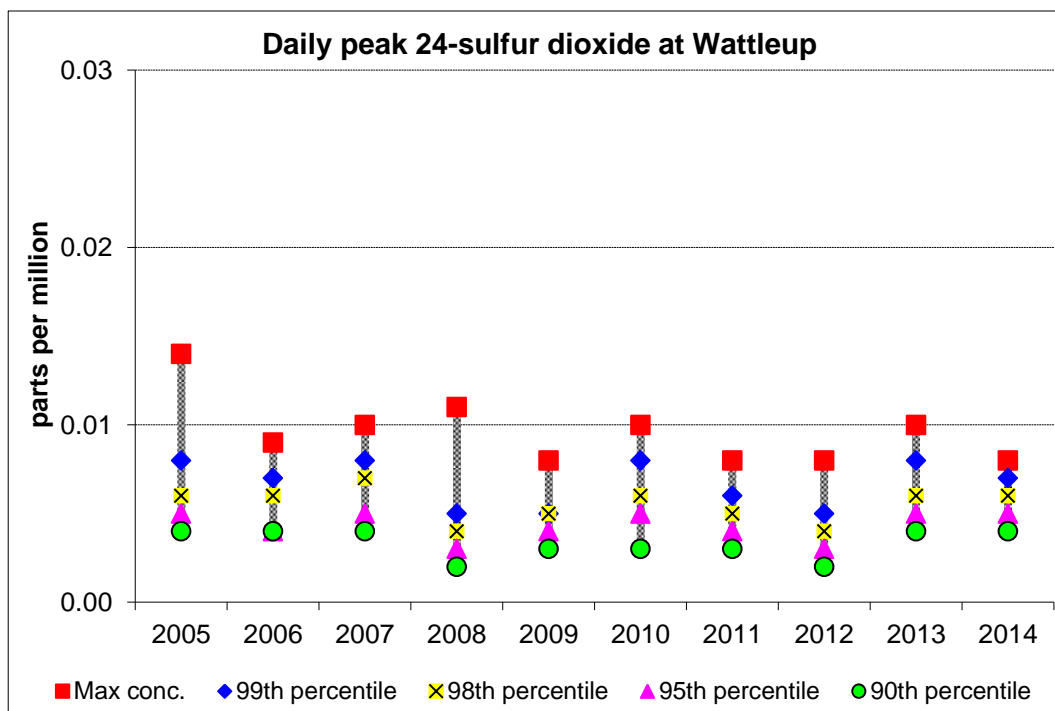


Figure A1-28 - 24-hour sulfur dioxide at Wattleup

Particles as PM<sub>10</sub>

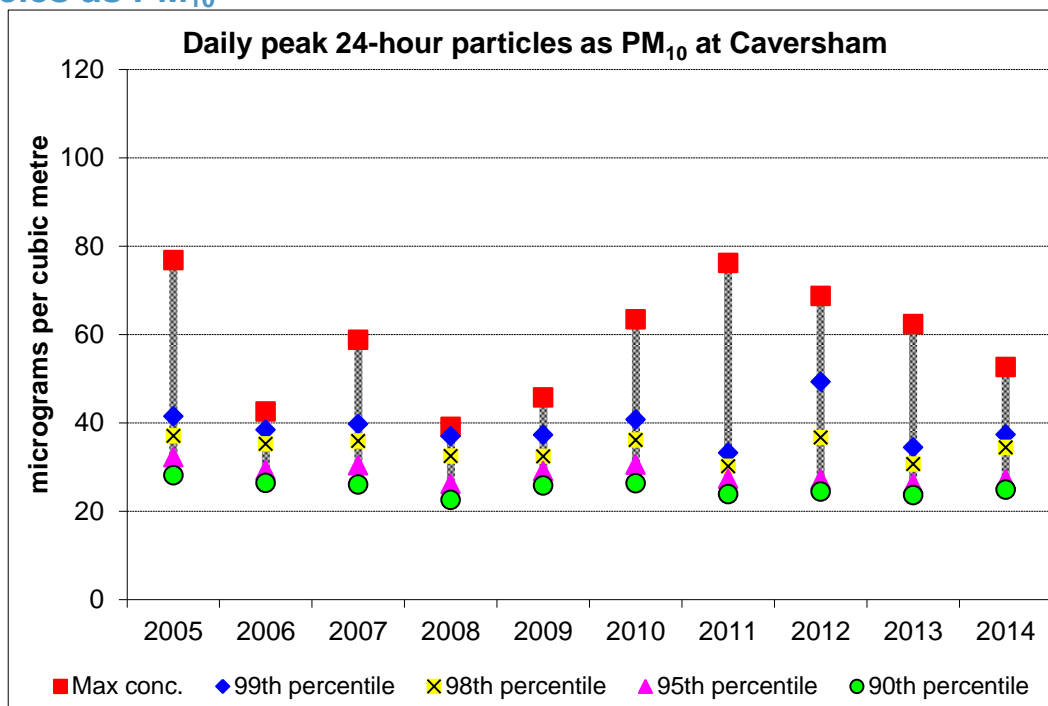


Figure A1-29 - 24-hour PM<sub>10</sub> at Caversham

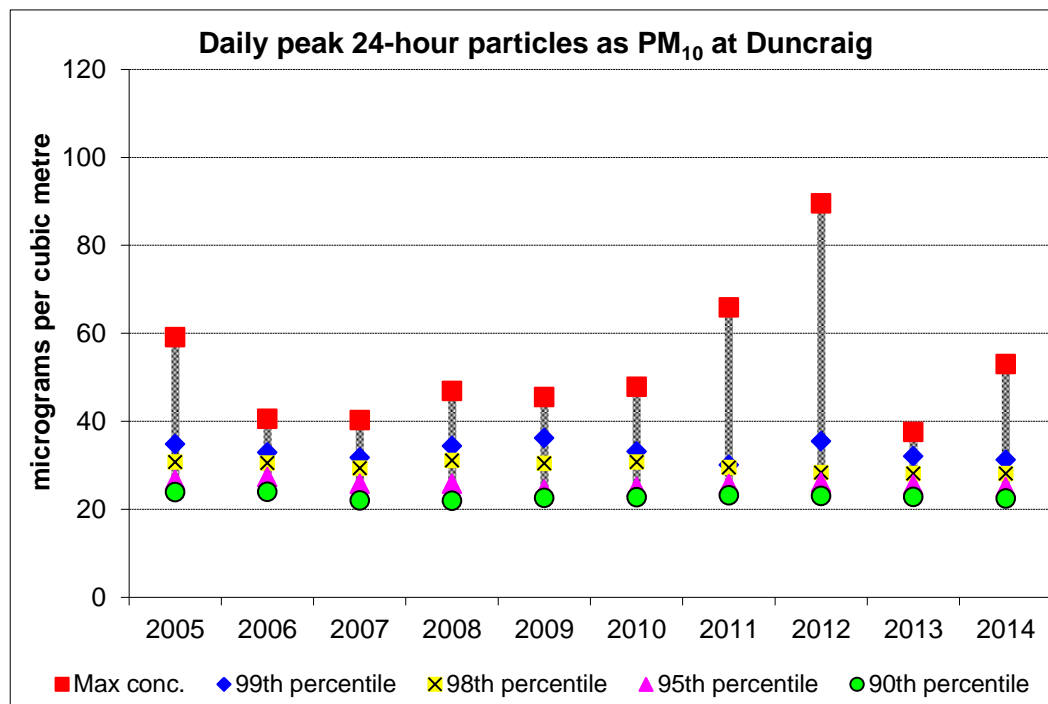


Figure A1-30 - 24-hour PM<sub>10</sub> at Duncraig

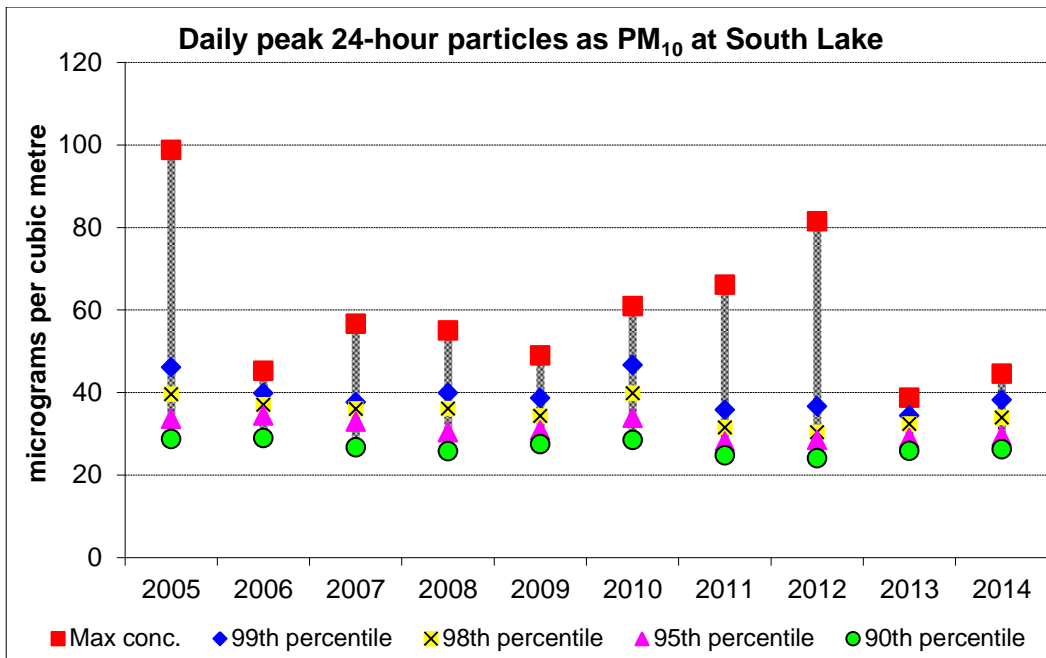


Figure A1-31 - 24-hour PM<sub>10</sub> at South Lake

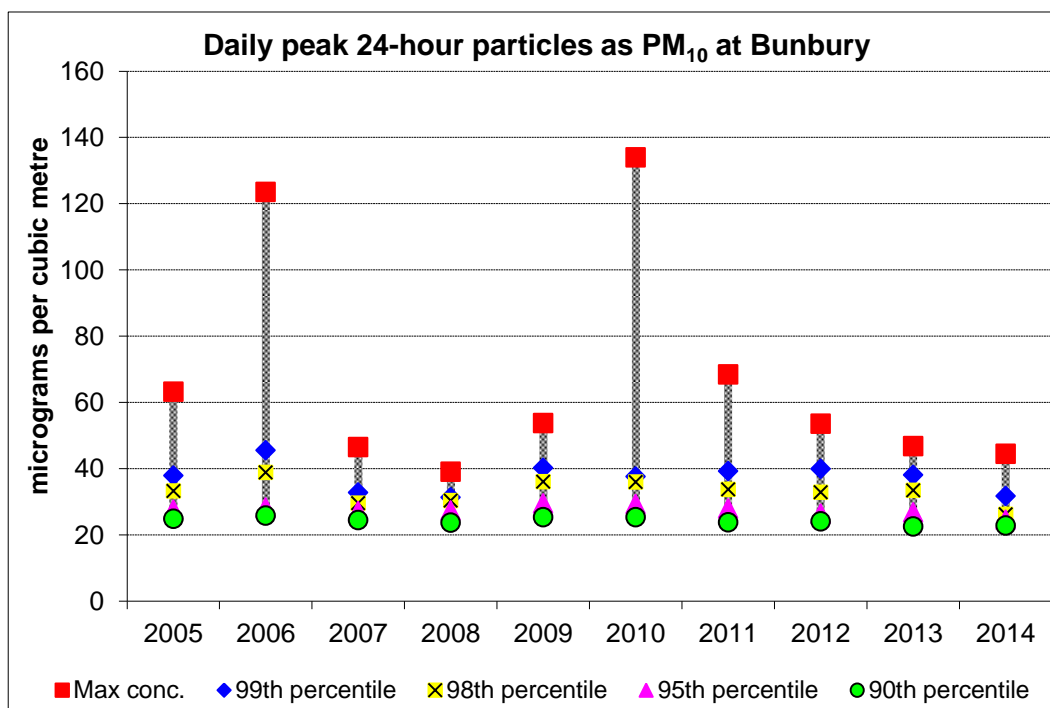


Figure A1-32 - 24-hour PM<sub>10</sub> at Bunbury

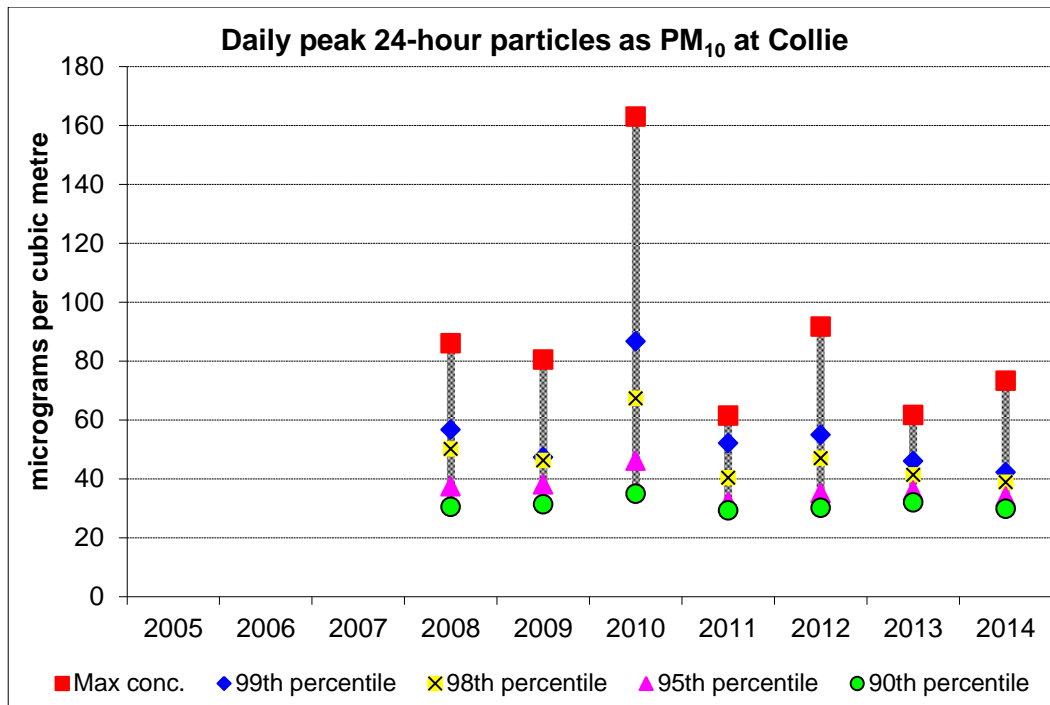


Figure A1-33 - 24-hour PM<sub>10</sub> at Collie

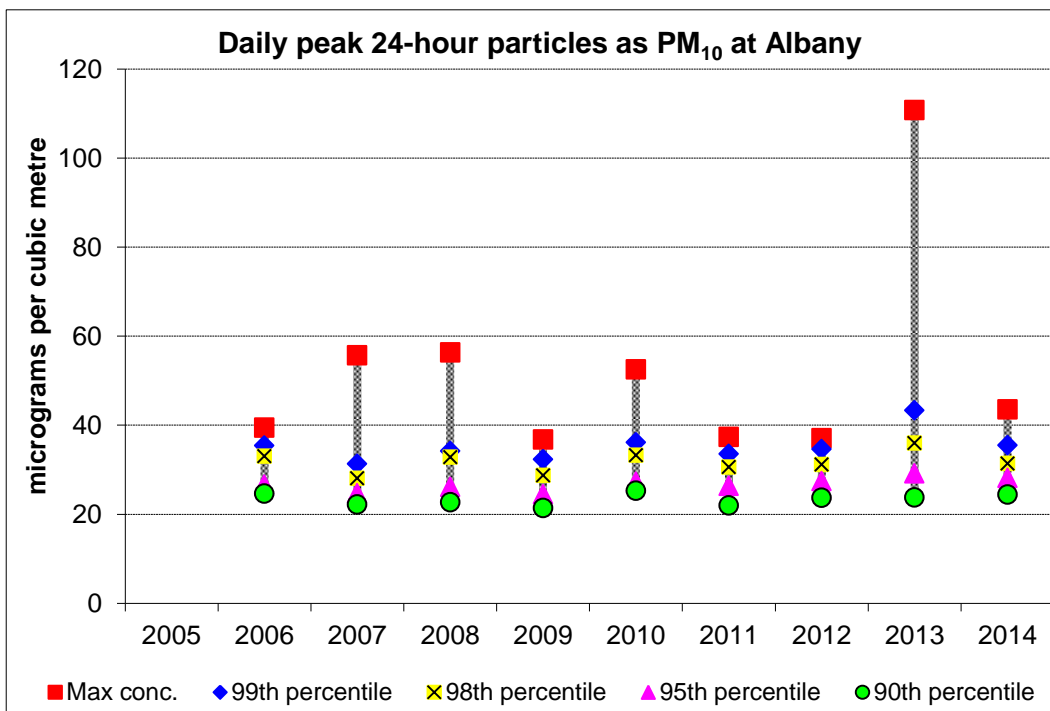
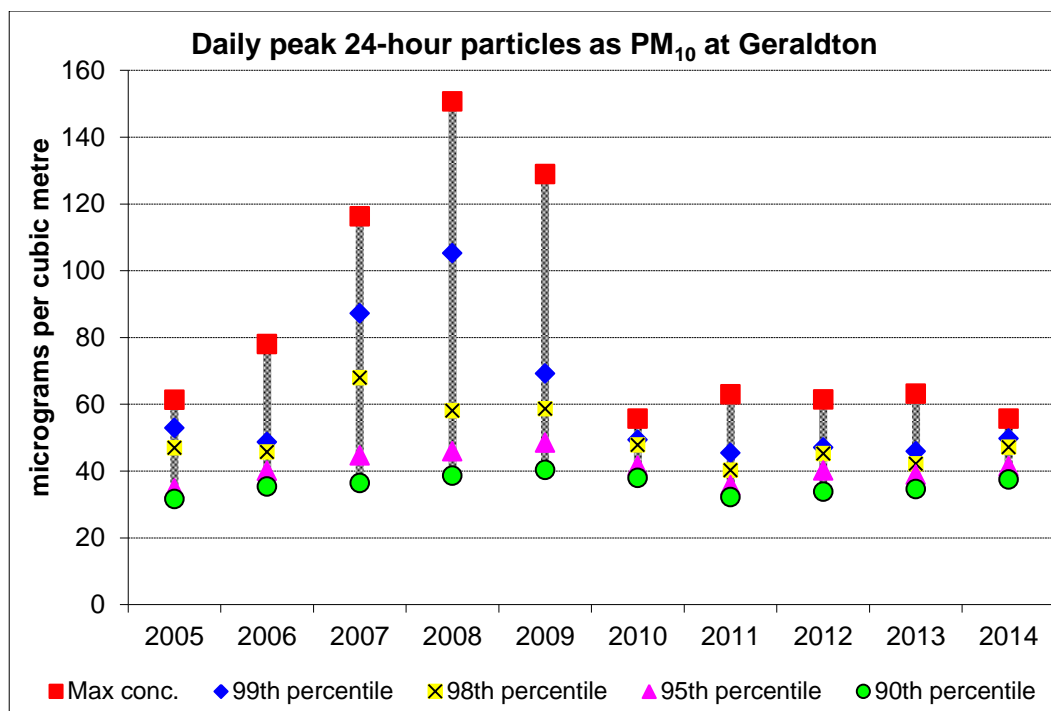


Figure A1-34 - 24-hour PM<sub>10</sub> at Albany



**Figure A1-35 - 24-hour PM<sub>10</sub> at Geraldton**

Particles as PM<sub>2.5</sub>

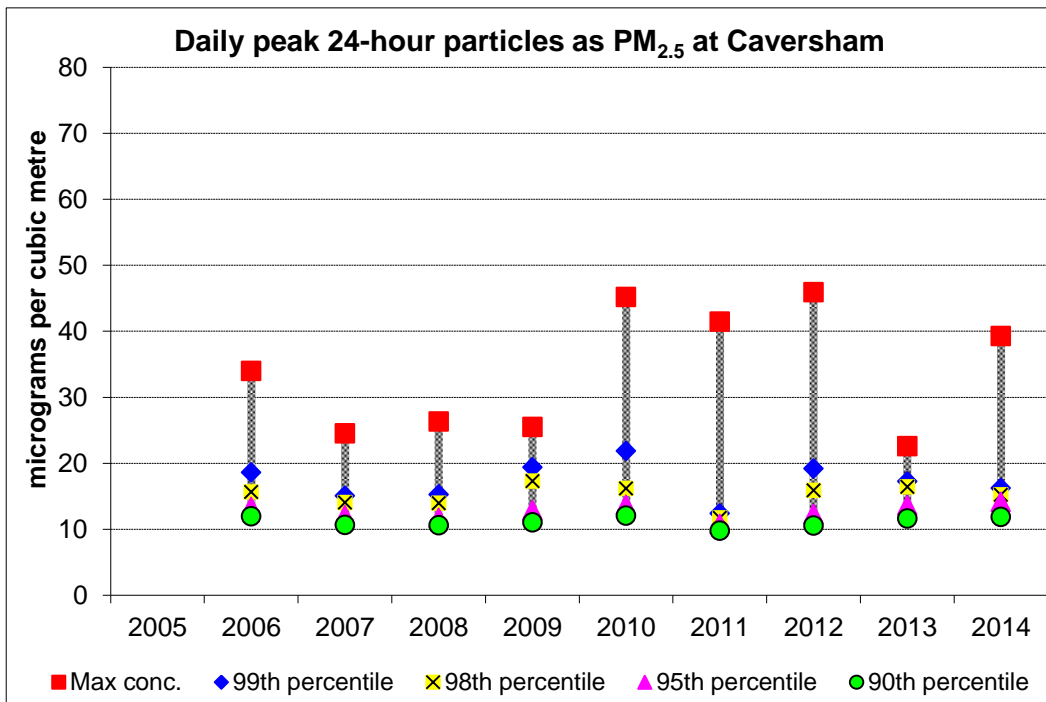


Figure A1-36 - 24-hour PM<sub>2.5</sub> at Caversham

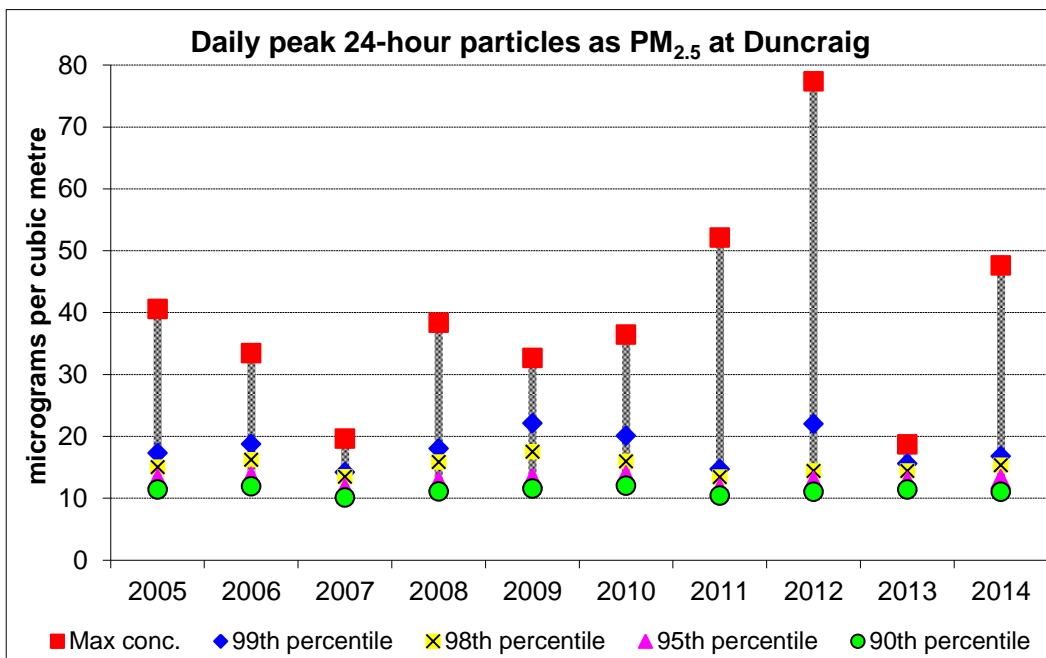


Figure A1-37 - 24-hour PM<sub>2.5</sub> at Duncraig

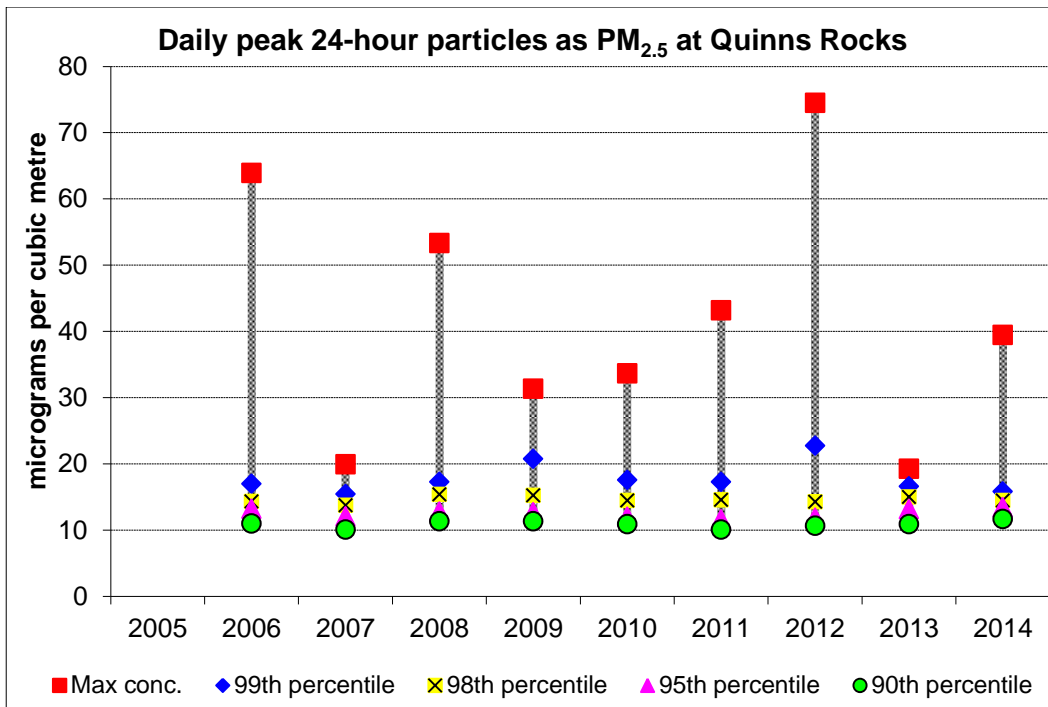


Figure A1-38 - 24-hour PM<sub>2.5</sub> at Quinns Rocks

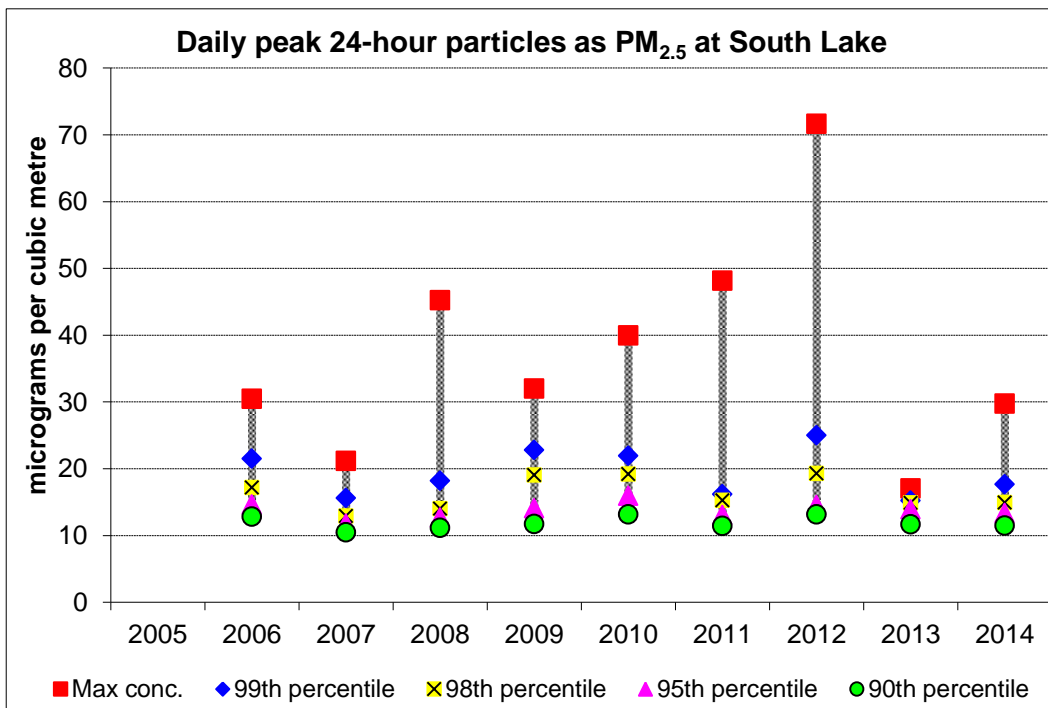


Figure A1-39 - 24-hour PM<sub>2.5</sub> at South Lake

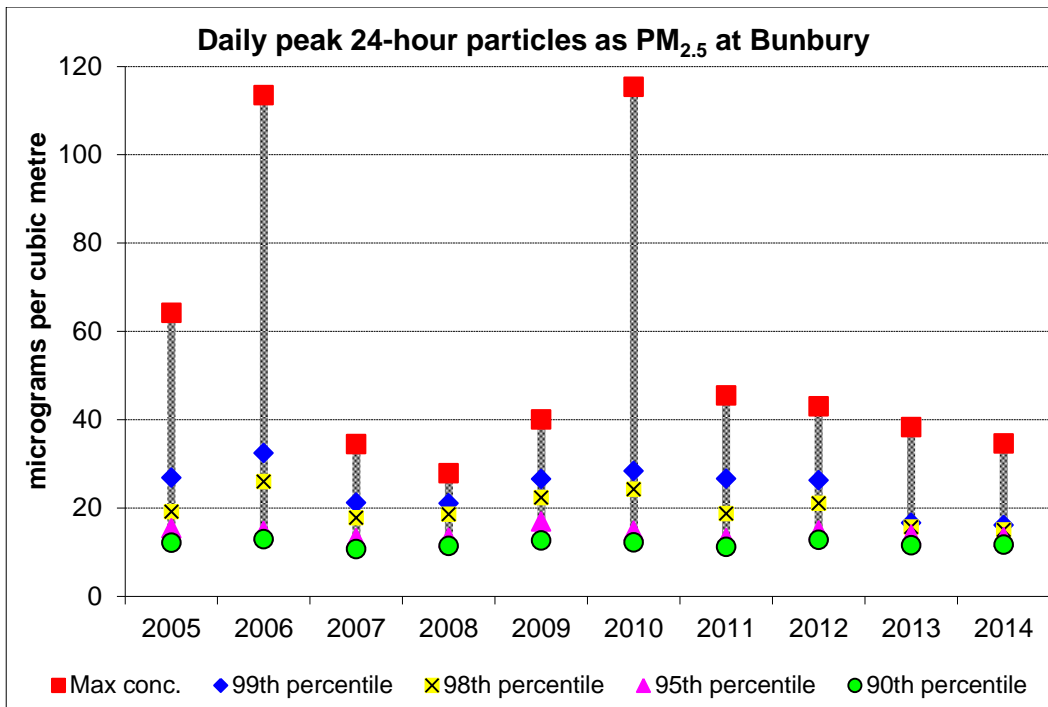


Figure A1-40 - 24-hour PM<sub>2.5</sub> at Bunbury

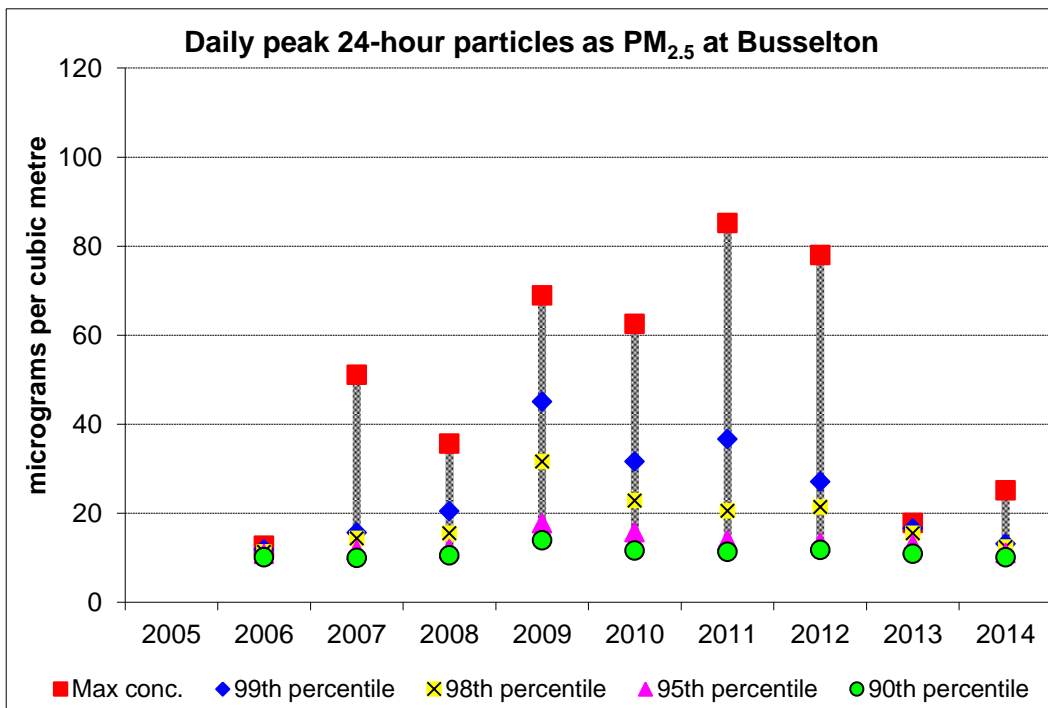


Figure A1-41 - 24-hour PM<sub>2.5</sub> at Busselton



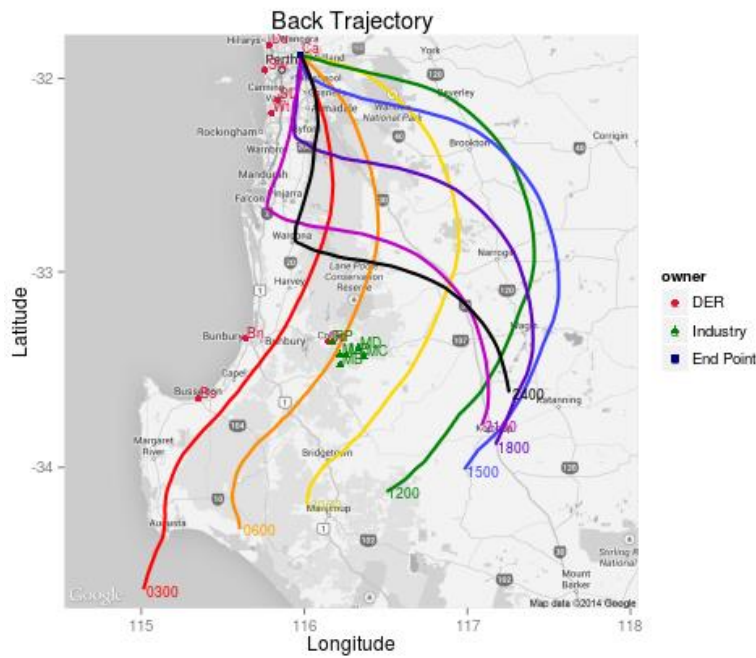
## Attachment 2 – Exceedence summary

The following pages contain information specific to each parameter exceeding the relevant NEPM standard during 2014. Each analysis is provided in date order and may include one or more of a satellite image of the region, a back trajectory, concentration and wind plots together with information on the specific concentrations reached and possible sources.

Each back trajectory is specific to one event and shows a possible path that a parcel of air may have taken through space to have arrived at a particular location at a certain time. Where multiple trajectories are included on one map, the times and back trajectories displayed are those ending at the indicated location at 3am (red), 6am (orange), 9am (yellow), noon (green), 3pm (blue), 6pm (mauve), 9pm (purple) and midnight (black). A back trajectory does no more than use the wind speed and direction information recorded at various monitoring sites to track a simple path backwards to a possible origin site. Some major assumptions made in the calculation of these back trajectories, such as the meteorological conditions can be interpolated between sites and no air dispersion throughout the path, create large uncertainties in the predicted path and must be acknowledged. Notwithstanding, the back trajectories as calculated provide a reasonable first approximation for the possible path taken by an air parcel in arriving at its destination.

Satellite images are obtained from <https://earthdata.nasa.gov/labs/worldview> where available and cloud cover does not obscure the plume.

### 5 January 2014



Back trajectory over 24 hours ending at Caversham at the indicated times.



Fire map showing hot spot locations from Terra / MODIS (<https://earthdata.nasa.gov/labs/worldview>)

### Pollutant

PM<sub>10</sub> and PM<sub>2.5</sub>

### Monitoring Site

Caversham, Duncraig, Geraldton, South Lake and Quinns Rocks

### NEPM Standard

PM<sub>10</sub> – 50 µg/m<sup>3</sup>

PM<sub>2.5</sub> – 25 µg/m<sup>3</sup>

### Averaging Period

24 hours

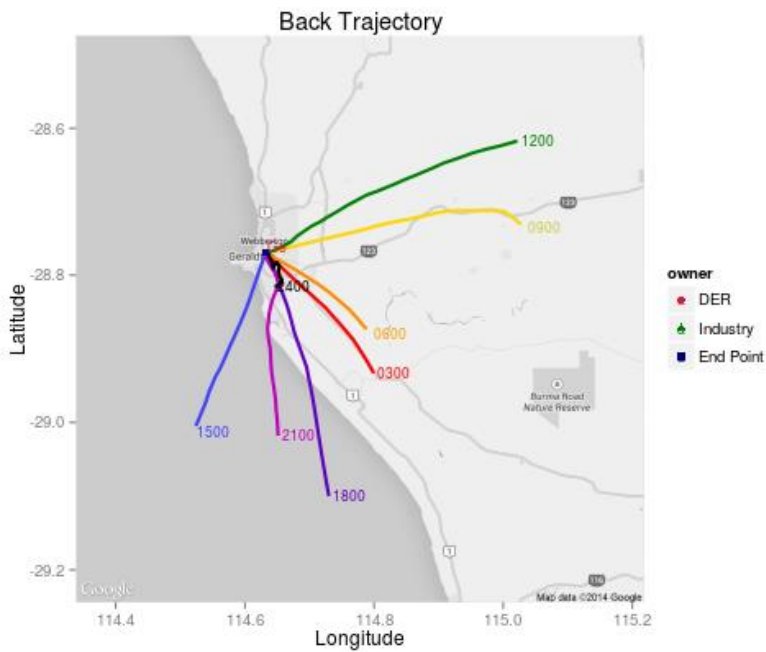
### Concentration (µg/m<sup>3</sup>)

Site	PM <sub>10</sub>	PM <sub>2.5</sub>
Caversham	52.5	39.3
Duncraig	53.0	47.6
Geraldton	53.6	N/A
South Lake	40.6	29.8
Quinns Rocks	N/A	39.5

### Description of Event

Smoke from bushfires in the Perth hills and Albany impacted Perth and some major regional centres.

### 11 January 2014



**Pollutant**

PM<sub>10</sub>

**Monitoring Site**

Geraldton

**NEPM Standard**

PM<sub>10</sub> – 50 µg/m<sup>3</sup>

**Averaging Period**

24 hours

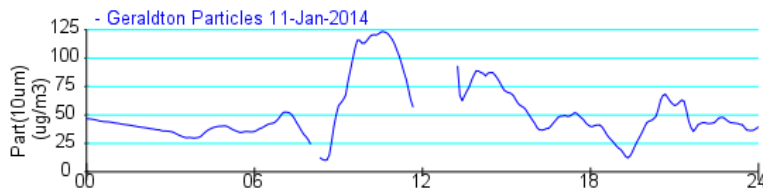
**Concentration**

51.1 µg/m<sup>3</sup>

**Description of Event**

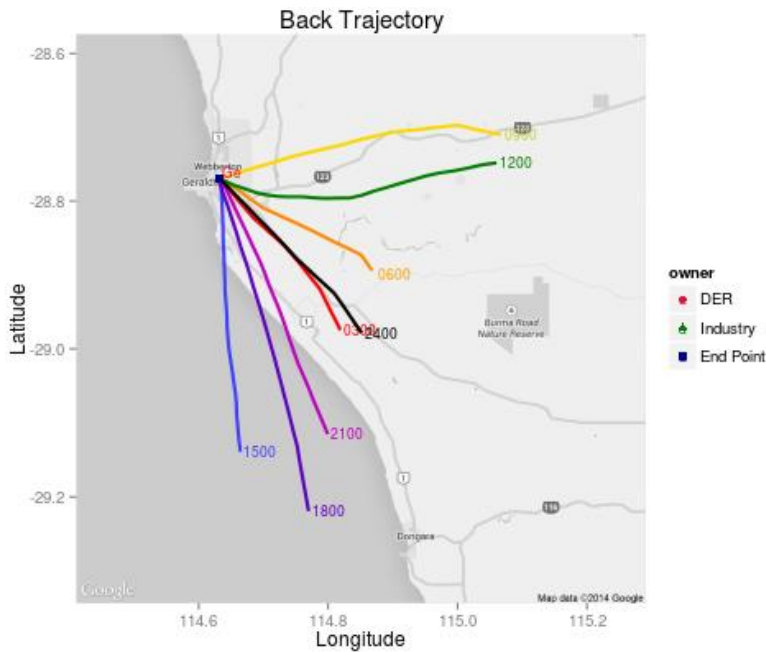
Smoke or dust from a local source. There were no fires indicated within the region.

Back trajectory over 120 minutes ending at Geraldton at the indicated times.



60 minute averaged time series plot of PM<sub>10</sub> at Geraldton on 11/01/2014

## 20 January 2014



### Pollutant

PM<sub>10</sub>

### Monitoring Site

Geraldton

### NEPM Standard

PM<sub>10</sub> – 50 µg/m<sup>3</sup>

### Averaging Period

24 hours

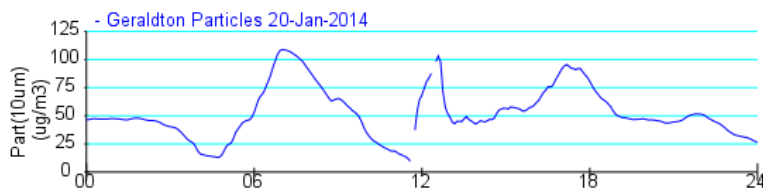
### Concentration

52.1 µg/m<sup>3</sup>

### Description of Event

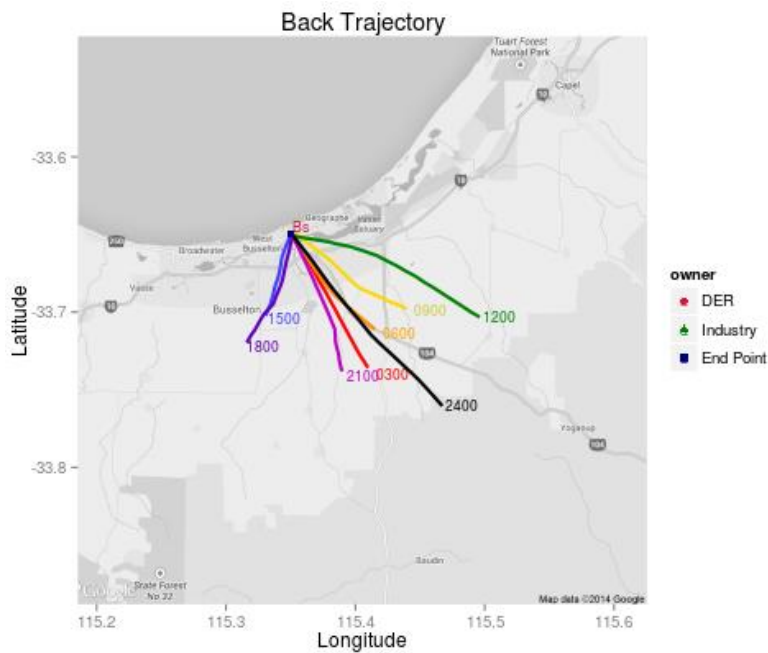
Smoke or dust from a local source. There were no fires indicated within the region.

Back trajectory over 120 minutes ending at Geraldton at the indicated times.



60 minute averaged time series plot of PM<sub>10</sub> at Geraldton on 20/01/2014

### 3 May 2014



#### Pollutant

PM<sub>2.5</sub>

#### Monitoring Site

Busselton

#### NEPM Standard

PM<sub>2.5</sub> – 25 µg/m<sup>3</sup>

#### Averaging Period

24 hours

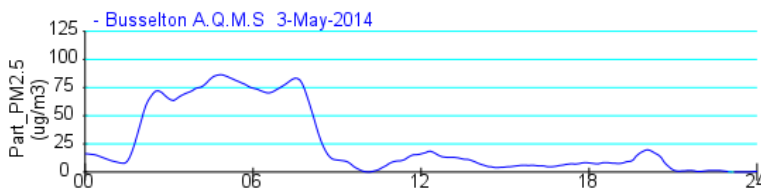
#### Concentration

25.1 µg/m<sup>3</sup>

#### Description of Event

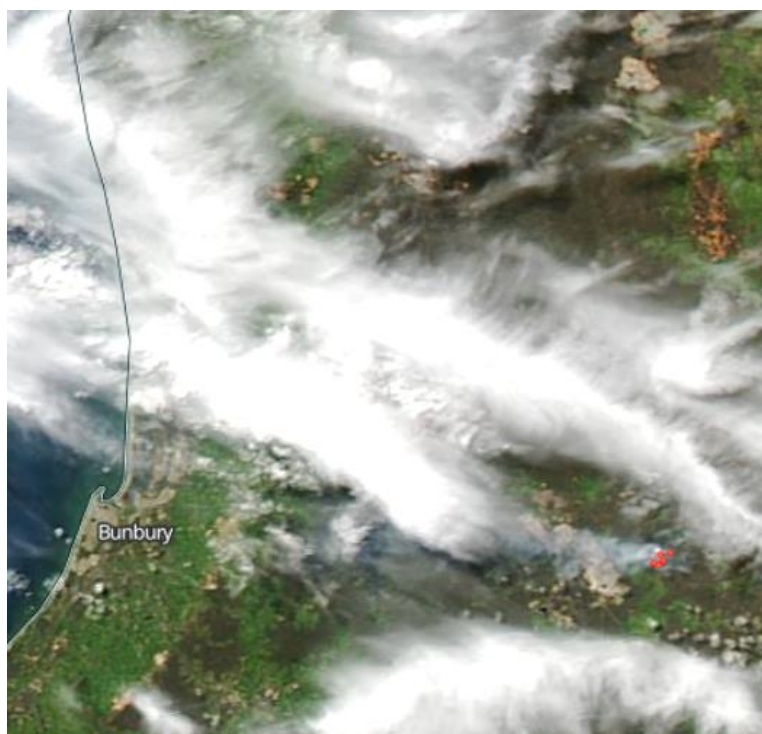
No other sites affected.  
Likely early morning smoke from domestic wood heating.

Back trajectory over 24 hours ending at Busselton at the indicated times.



60 minute averaged time series plot of PM<sub>2.5</sub> at Busselton on 03/05/2014

12 October 2014



Fire map showing hot spot locations (lower right quadrant) from Aqua / MODIS

(<https://earthdata.nasa.gov/labs/worldview>)

**Pollutant**

PM<sub>10</sub>

**Monitoring Site**

Collie

**NEPM Standard**

PM<sub>10</sub> – 50 µg/m<sup>3</sup>

**Averaging Period**

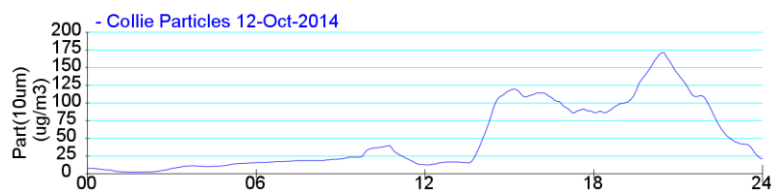
24 hours

**Concentration**

50.8 µg/m<sup>3</sup>

**Description of Event**

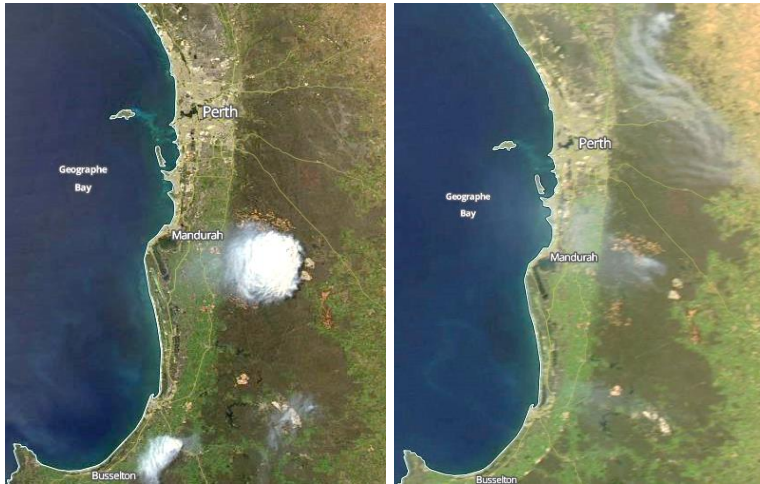
Smoke from bushfires and/or prescribed burn in vicinity of Collie.



60 minute averaged time series plot of PM<sub>10</sub> at Collie on 12/10/2014



### 15 October 2014



Fire map showing hot spot locations from Aqua / MODIS for 14/10/2014 (left) and 15/10/2014 (right) (<https://earthdata.nasa.gov/labs/worldview>)

### Pollutant

PM<sub>2.5</sub>

### Monitoring Site

South Lake

Quinns Rocks

### NEPM Standard

PM<sub>2.5</sub> – 25 µg/m<sup>3</sup>

### Averaging Period

24 hours

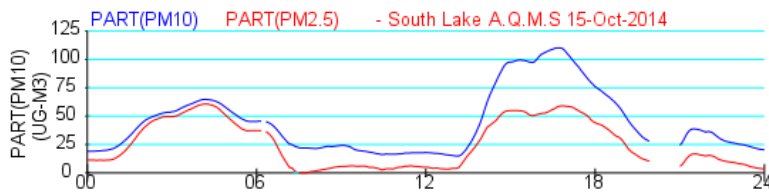
### Concentration

25.7 µg/m<sup>3</sup> – South Lake

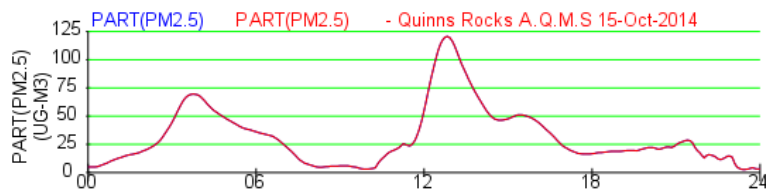
31.3 µg/m<sup>3</sup> – Quinns Rocks

### Description of Event

Residual smoke from PHS\_018 Duncan (Inglehope) prescribed burn 10km E of Dwellingup.

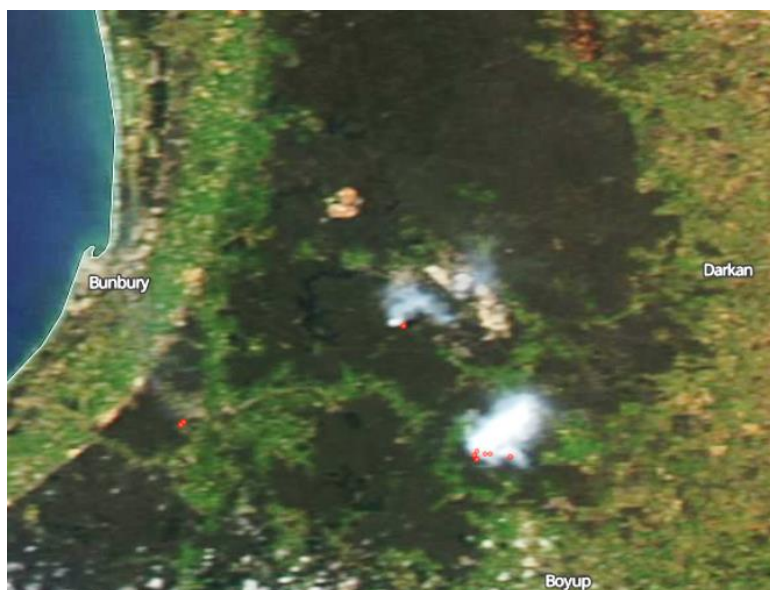


60 minute averaged time series plot of PM<sub>10</sub> and PM<sub>2.5</sub> at South Lake on 15/10/2014

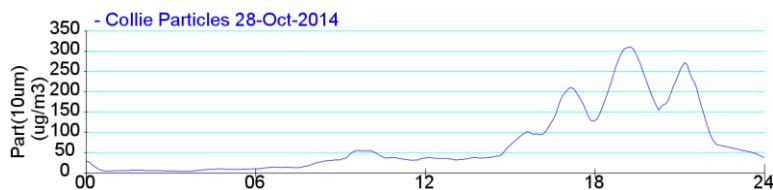


60 minute averaged time series plot of PM<sub>2.5</sub> at Quinns Rocks on 15/10/2014

28 October 2014



Fire map showing hot spot locations from Aqua / MODIS (<https://earthdata.nasa.gov/labs/worldview>)



60 minute averaged time series plot of PM<sub>10</sub> at Collie on 28/10/2014

**Pollutant**

PM<sub>10</sub>

**Monitoring Site**

Collie

**NEPM Standard**

PM<sub>10</sub> – 50 µg/m<sup>3</sup>

**Averaging Period**

24 hours

**Concentration**

73.2 µg/m<sup>3</sup>

**Description of Event**

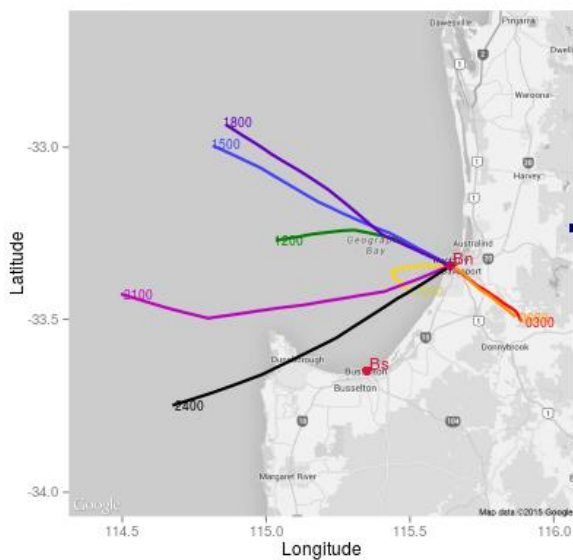
Smoke from 335 hectare prescribed burn (WTN\_005-Bristol-067) conducted 5 km south of Collie.



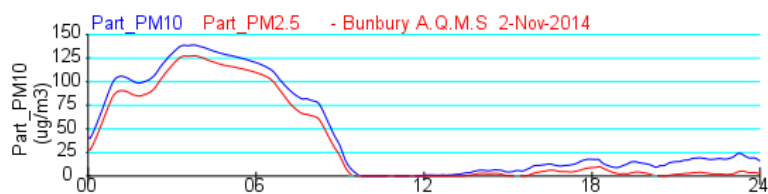
2 November 2014



Fire map showing hot spot locations from Aqua / MODIS (<https://earthdata.nasa.gov/labs/worldview>)



Back trajectory over 4 hours ending at Bunbury at the indicated times



60 minute averaged time series plot of PM<sub>10</sub> and PM<sub>2.5</sub> at Bunbury on 02/11/2014

**Pollutant**

PM<sub>2.5</sub>

**Monitoring Site**

Bunbury

**NEPM Standard**

PM<sub>2.5</sub> – 25 µg/m<sup>3</sup>

**Averaging Period**

24 hours

**Concentration**

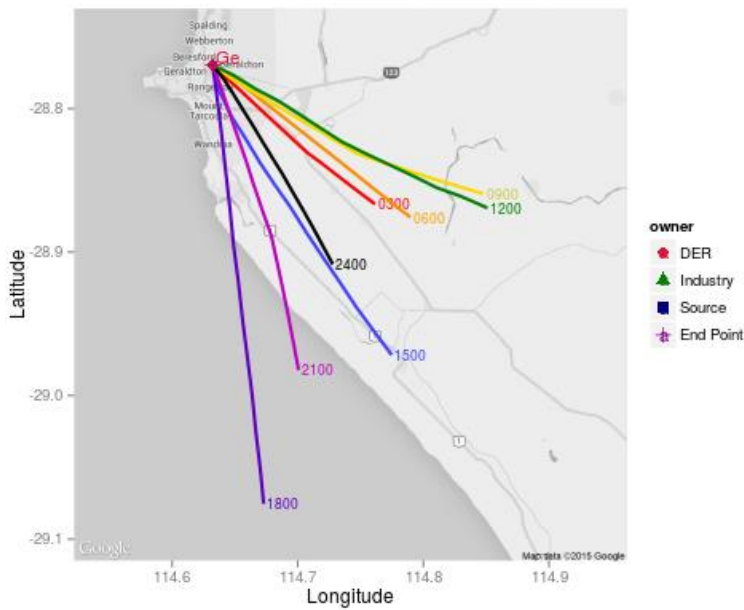
34.6 µg/m<sup>3</sup>

**Description of Event**

Smoke from prescribed burn WTN\_005 Bristol 5km S of Collie and/or WTN\_009 Davis 12km ESE of Dardanup.

## 24 December 2014

### Back Trajectory



### Pollutant

PM<sub>10</sub>

### Monitoring Site

Geraldton

### NEPM Standard

PM<sub>10</sub> – 50 µg/m<sup>3</sup>

### Averaging Period

24 hours

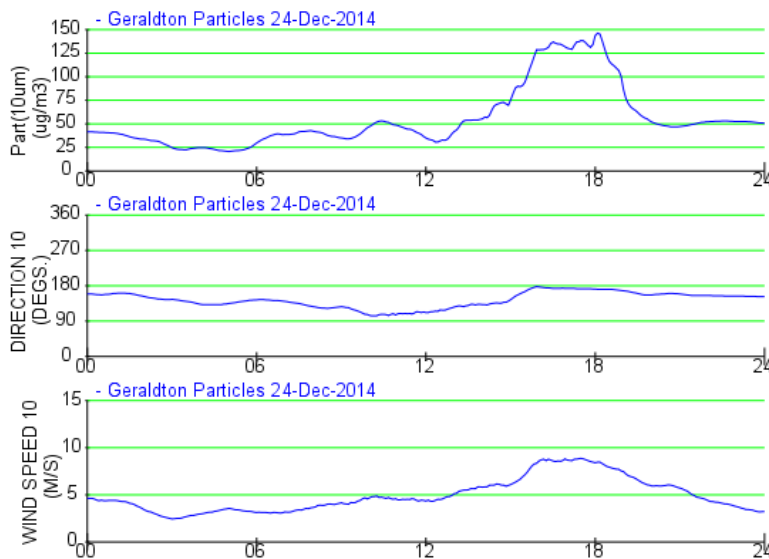
### Concentration

55.7 µg/m<sup>3</sup>

### Description of Event

Possible local dust event caused by moderate winds which were from the south

There were no fires noted in the region



60 minute averaged time series plot of PM<sub>10</sub> and winds at Geraldton on 24/12/2014

