Department of Environment

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Western Australia

Air Monitoring Report

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National Environment Protection Measure

(Ambient Air Quality)

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Table of Contents

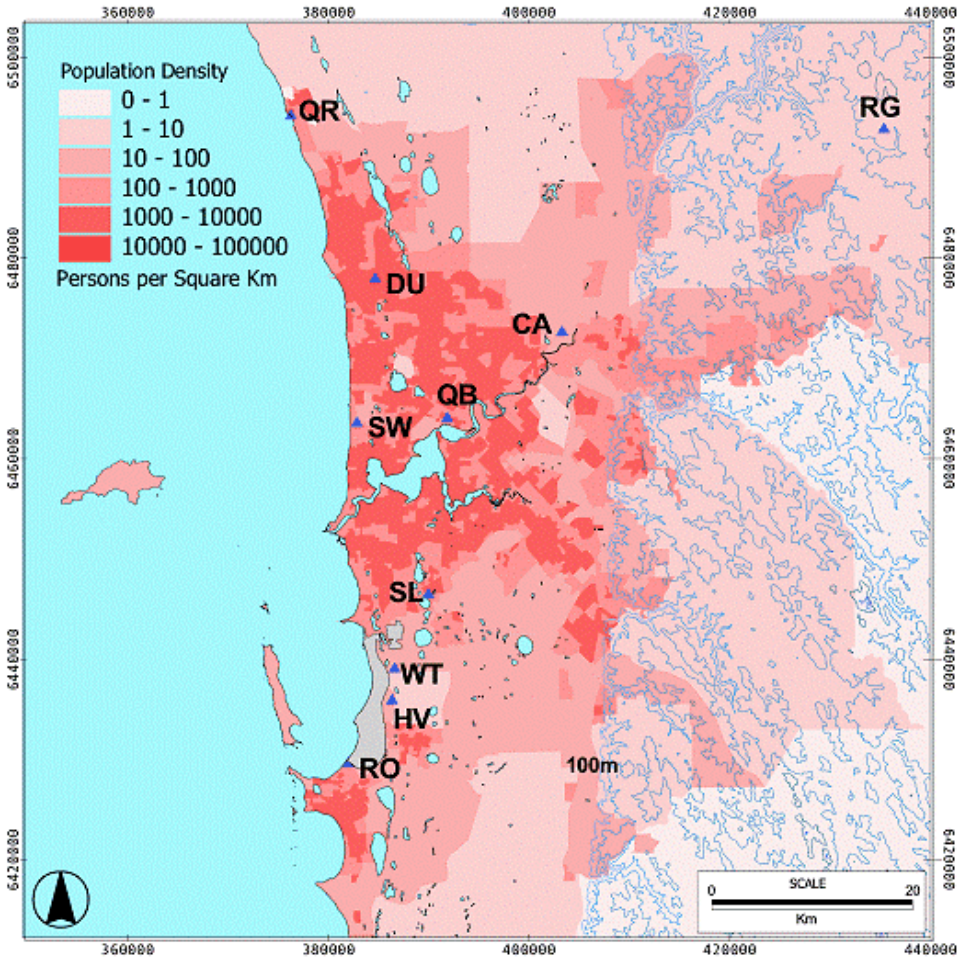
List of Figures

List of Tables

SECTION A – MONITORING SUMMARY

Current Monitoring Stations

The Department of Environment (DoE) monitoring network shown in Figures A1 and A2 is a combination of networks which were each 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. Network design was based on the knowledge of emissions sources, pollutant chemistry and important features of the meteorology. CSIRO Atmospheric Research provided advice on monitoring site locations for the Perth Photochemical Smog Study and Perth Haze Study. Table A1 indicates the pollutants monitored at each site in the Perth metropolitan and Bunbury region.



CA Caversham	**RO Rockingham**
DU Duncraig	**RG Rolling Green**
HV Hope Valley	**SL South Lake**
QB Queens Building	**SW Swanbourne**
QR Quinns Rock	**WT Wattleup**

Figure A1 - DoE air quality monitoring stations which are currently operating in the Perth metropolitan region.

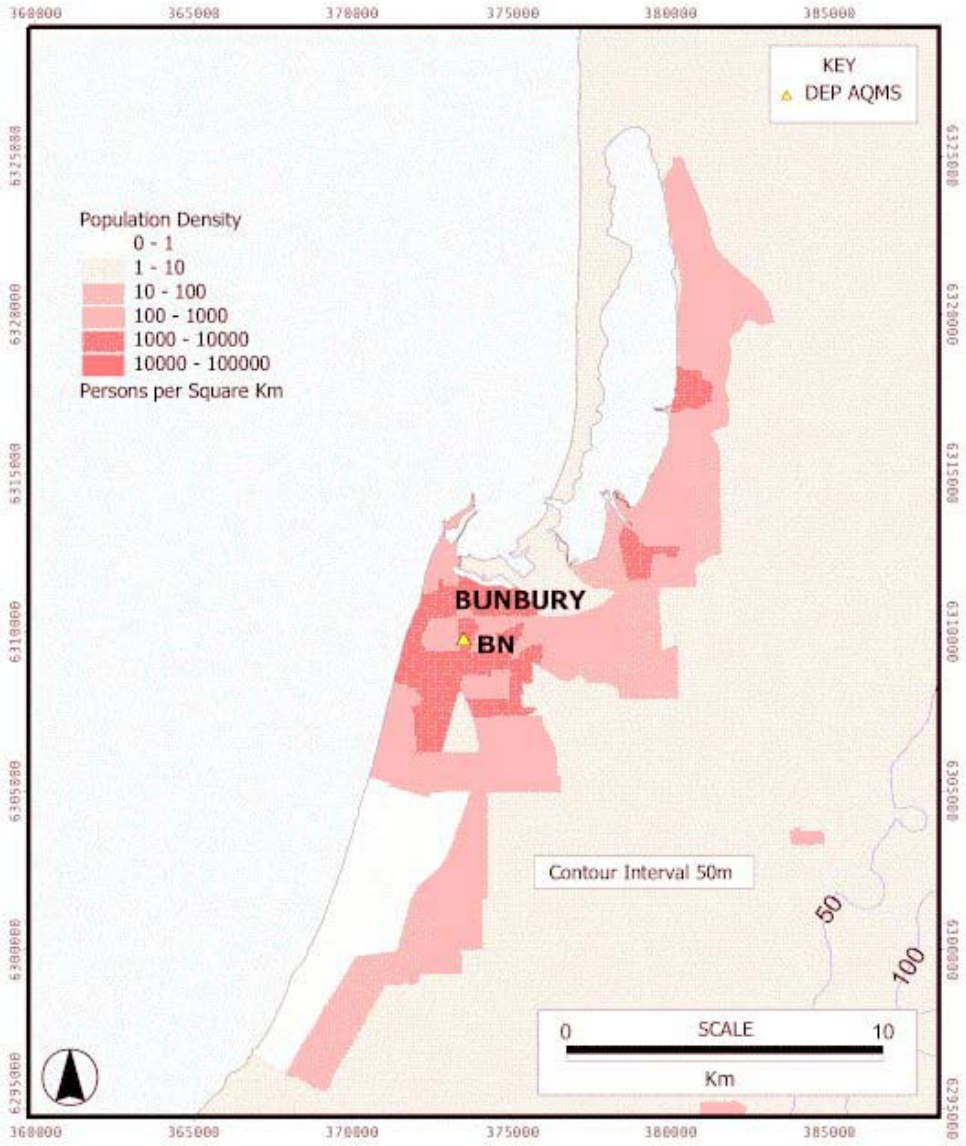


Figure A2 - DoE air quality monitoring stations which are currently operating in Bunbury

Table A1 Air quality parameters measured at DoE monitoring stations.

Monitoring Site	CO	O_3	NO_2	SO_2	lead	PM_{10} Hi-Vol	PM_{10} TEOM	$PM_{2.5}$ TEOM	Visibil-ity
BN Bunbury	03/99 to 04/02						06/99 to present	04/97 to present	02/97 to present
CA Caversham	08/93 to present	11/89 to present	09/90 to present			05/93 to present	01/04 to present	03/94 to 01/04	12/89 to present
DU Duncraig	08/95 to present		08/95 to present			09/94 to present	06/96 to present	01/95 to present	03/94 to present
HV Hope Valley	01/90 to 03/91		12/89 to present	12/89 to present					01/89 to present
QB Queens Building	08/89 to present		01/90 to present		01/90 to 12/01	01/90 to present			01/90 to present
QR Quinns Rock		11/92 to present	11/92 to present						12/95 to present
RO Rockingham		12/95 to present	12/95 to present	07/88 to present					
RG Rolling Green		01/93 to present	01/93 to present						
SL South Lake	03/00 to present	03/00 to present	03/00 to present	03/00 to present			03/00 to present		03/00 to present
SW Swanbourne	01/93 to 05/95	01/93 to present	03/93 to present			03/94 to present		06/94 to 07/95	06/94 to 07/03
WT Wattleup				01/88 to present					

The grey font indicates those pollutants that are no longer monitored at that site.

Table A2 Monitoring in Western Australia.

Site:	CO	O_3	NO_2	SO_2	Pb	PM_{10}
BN – Bunbury						C
CA - Caversham	DoE	T	T			P
DU - Duncraig	P/T		DoE			T
HV – Hope Valley			DoE	DoE		
QB - Queens Building	P		DoE		$P^{(1)}$	DoE
QR - Quinns Rock		DoE	DoE			
RG - Rolling Green		DoE	DoE			
RO - Rockingham		DoE	DoE	DoE		
SL - South Lake	P	P	P	T		P
SW - Swanbourne		P	P			DoE
WT - Wattleup				DoE		

Key to symbols:
P – performance monitoring station
$P^{(1)}$ – performance monitoring for lead was removed on 31 December 2001 after the annual average concentration reduced to less than 10% of the NEPM standard in accordance with the WA Monitoring Plan.
C – Campaign Monitoring
T – trend performance monitoring station
DoE – station will be maintained by DoE for the foreseeable future

Table A3 Stations site compliance with AS 2922 - 1987

	Height above ground	Min. distance to support structures	Clear sky angle of 120°	Unrestricted airflow of 270°/360°	20m from trees	No boilers or incinerators nearby	Minimum distance from road or traffic	Sample line material	Sample line length	Comments
Perth Region										
Caversham	☑	☑	☑	☑	☑	☑	☑	☑	☑	
Duncraig	☑	☑	☒	☑	☒	☑	☑	☑	☑	6 metres to medium sized trees and presence of power pole.
Hope Valley	☑	☑	☑	☑	☑	☑	☑	☑	☑	
Queens Building	☑	☒	☒	☒	☑	☑	☒	☑	☑	City canyon with high traffic volume.
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.
Bunbury Region										
Bunbury	☑	☑	☑	☑	☒	☑	☑	☑	☑	15 metres to small to medium eucalyptus trees.

Carbon Monoxide

Duncraig is an upper bound site for monitoring the combined effects of emissions from vehicles on the nearby Mitchell Freeway and domestic wood fires. The site is about 200 metres from the freeway; hence it is well beyond the distance of “roadside” measurement. By Perth’s standards the site is representative of dense population. The site lies in a dunal depression through which the freeway passes, hence the effect of stable air “ponding” 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 lies in a growing urban area and is likely to see increasing levels of CO from wood fires in particular. It is not as close as Duncraig to major roads and is therefore more typical of a population-average site.

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

The DoE maintains the Queens Buildings station as a performance monitoring station to provide an upper bound measurement of motor vehicle emitted CO, and to track the improving compliance with the NEPM. It is not nominated as a trend site since it does not fit the normal pattern of a GRUB or population-average monitoring site.

In summary, WA maintains performance monitoring of CO at Duncraig, South Lake and Queens Buildings. Duncraig and South Lake are also nominated as trend stations.

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 maintaining monitoring stations at Quinns Rocks and at or near Rockingham for the foreseeable future, as resources allow.

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

South Lake is the third performance monitoring station. 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_3-rich air with the NO_x -rich plumes from Kwinana industry (potentially giving elevated NO_2 concentrations);

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

The DoE also maintains the stations at Quinns Rocks and Rolling Green for the foreseeable future as part of its wider ozone network.

Nitrogen dioxide

The Queens Buildings site located within the CBD provides an upper limit for NO_2.

For purposes of scientific understanding, NO_x is currently being monitored at all stations where O_3 is monitored. Caversham, Swanbourne and South Lake were therefore chosen as performance monitoring stations for NO_2 as these provide a good spatial distribution.

Caversham, Swanbourne and South Lake are also trend stations.

The DoE will continue to measure NO_2 at Quinns Rocks, Rolling Green and Duncraig for the foreseeable future as part of its wider network. The DoE will also continue to measure NO_2 at Queens Buildings in order to determine the long-term trend.

Sulfur dioxide

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

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

Lead

Since 1995, lead levels at Queens Buildings in the Perth CBD have been below 60 % of the NEPM standard of 0.5 ug/m^3. In 2001, the average lead level in Perth was 0.022 ug/m^3 representing less than 5% of the NEPM standard. In accordance with NEPM (Ambient Air Quality) Technical Paper No. 4, Screening Procedures, and the WA Monitoring Plan, a performance monitoring station for lead has not been maintained.

Particles as PM_{10}

Duncraig is an upper bound performance monitoring station site for PM_{10} caused by the combination of vehicle and home fire emissions during strongly stable meteorological conditions. Likewise, the site at South Lake is measures significant PM_{10} concentrations from wood fires.

Duncraig and South Lake are all nominated as trend stations.

Status of NATA Accreditation

WA is still working towards achieving NATA accreditation as discussed in the WA Monitoring Plan, and hence the data within this report only meets Department of Environment quality standards.

SECTION B – ASSESSMENT OF COMPLIANCE WITH STANDARDS AND GOALS

Table B1. 2003 compliance summary for carbon monoxide

AAQ NEPM Standard
9.0 ppm (8-hour average)

Regional Performance Monitoring Station	Data availability rates					Number of exceedances	Performance against the standards and goal
	%	%	%	%	%	(days)	
	Q1	Q2	Q3	Q4	Annual		
Perth Region							
Caversham (North East Metro)	86.3	99.1	99.5	97.6	95.7	0	met
Duncraig (North Metro)	96.7	97.3	99.5	97.7	97.8	0	met
Queens Building (CBD)	99.6	90	96.9	97.1	95.9	0	met
South Lake (South East Metro)	99.3	97.2	99.6	99.3	98.9	0	met

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

Table B2. 2003 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					Annual mean	Number of exceedances	Performance against the standards and goal	
	%	%	%	%	%				
	Q1	Q2	Q3	Q4	Annual	(ppm)	(days)	1-hour	1-year
Perth Region									
Caversham (North East Metro)	86.3	99.1	99.5	97.6	95.7	0.007	0	met	met
Duncraig (North Metro)	95.1	97	99.5	97.7	97.4	0.009	0	met	met
Hope Valley (South Metro)	99.6	84	99.3	95.4	94.6	0.005	0	met	met
Queens Building (CBD)	99.6	90	96.9	97.1	95.9	0.020	1	met	met
Quinns Rocks (Outer North Coast)	99.5	92.3	99.6	98	97.4	0.004	0	met	met
Rockingham (South Coast)	96	98.5	99.5	99.3	98.4	0.006	0	met	met
Rolling Green (Outer East Rural)	92.5	86.7	99.8	96.9	94	0.002	0	met	met
South Lake (South East Metro)	99.3	97.2	99.6	99.3	98.9	0.008	0	met	met
Swanbourne (Inner West Coast)	97.6	99.7	99.6	99.7	99.2	0.006	0	met	met

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

Table B3. 2003 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					Number of Exceedances (days)		Performance against the standards and goal	
	%	%	%	%	%				
	Q1	Q2	Q3	Q4	Annual	1-hour	4-hour	1-hour	4-hour
Perth Region									
Caversham (North East Metro)	78.9	99.1	99.5	97.4	93.8	0	0	met	met
Quinns Rocks (Outer North Coast)	99.5	99.6	99.6	46.2	86.1	0	0	not demonstrated	not demonstrated
Rockingham (South Coast)	96	98.5	99.6	99.3	98.4	0	0	met	met
Rolling Green (Outer East Rural)	92.5	88.1	99.8	96.9	94.4	0	0	met	met
South Lake (South East Metro)	99.4	98.3	99.4	99.3	99.1	0	0	met	met
Swanbourne (Inner West Coast)	99.6	99.6	99.6	99.7	99.7	0	0	met	met

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

Table B4. 2003 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					Annual mean	Number of Exceedances (days)		Performance against the standards and goal		
	%	%	%	%	%						
	Q1	Q2	Q3	Q4	Annual	(ppm)	1-hour	24-hour	1-hour	24-hour	1-y
Perth Region											
Hope Valley (South Metro)	97.5	84	99.1	95.5	94.1	0.001	0	0	met	met	met
Rockingham (South Coast)	95.8	98.5	99.6	99.3	98.3	0.001	0	0	met	met	met
South Lake (South East Metro)	99.5	97.2	99.6	99.3	98.9	0.001	0	0	met	met	met
Wattleup (South Metro)	93.8	96.9	99.6	99.4	97.5	0.001	0	0	met	met	met

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

Table B5. 2003 compliance summary for particles as PM_{10}

AAQ NEPM Standard
50 ug/m^3 (24-hour average)

Regional Performance Monitoring Station	Data availability rates (% of days)					Number of exceedances (Days)	Performance against the standards and goal
	Q1	Q2	Q3	Q4	Annual		
Perth Region							
Duncraig (North Metro)	99.6	99.5	99.4	97.8	99.1	1	met
South Lake (South East Metro)	98.2	86.7	98.8	99.4	95.8	0	met
Bunbury Region							
Bunbury (South West Region)	98.6	99.1	99.6	99.5	99.2	1	met

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

Table B6. 2003 compliance summary for particles as $PM_{2.5}$

AAQ NEPM Advisory Standard
25 ug/m^3 (24-hour average)

Regional Performance Monitoring Station	Data availability rates (% of days)					Number of exceedances (Days)	Performance against the standards and goal
	Q1	Q2	Q3	Q4	Annual		
Perth Region							
Caversham (North East Metro)	98.9	96.5	99.3	99.5	98.6	1	N/A
Duncraig (North Metro)	97.1	99.4	99.3	97.9	98.4	1	N/A
Bunbury Region	98.8	97.6	99.7	99.5	98.9	3	N/A

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

Table B7. 2003 compliance summary for lead

AAQ NEPM Standard
0.50 ug/m^3 (1-year average)

Regional Performance Monitoring Station	Data availability rates (% of days)					Annual mean Concentration (ug/m^3)	Performance against the standards and goal
	Q1	Q2	Q3	Q4	Annual		
Perth Region							
Queens Building (CBD)	-	-	-	-	-	N/A	N/A

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

SECTION C – ANALYSIS OF AIR QUALITY MONITORING

Carbon Monoxide

The NEPM standard for carbon monoxide of 9.0 ppm averaged over 8 hours was not exceeded at any site during 2003. The NEPM goal of no more than 1 exceedance at each site was met. Table C1 contains the summary statistics for daily peak 8-hour CO in Western Australia.

Table C1. 2003 summary statistics for daily peak 8-hour carbon monoxide

AAQ NEPM Standard
9.0 ppm (8-hour average)

Regional Performance Monitoring Station	Data Recovery Rates (%)	Highest (ppm)	Highest (date)	Highest (time)	2nd Highest (ppm)	2nd Highest (date)	2nd Highest (time)
Perth Region							
Caversham (North East Metro)	95.7	1.1	24/05/2003	0100	1.0	13/06/2003	0400
Duncraig (North Metro)	97.8	4.1	09/06/2003	0500	3.9	20/07/2003	0200
Queens Building (CBD)	95.9	2.8	23/05/2003	2300	2.3	25/07/2003	0100
South Lake (South East Metro)	98.9	3.1	20/07/2003	0100	2.6	09/06/2003	0100

Nitrogen Dioxide

The NEPM standard for nitrogen dioxide of 0.12 ppm averaged over 1 hour was exceeded at one site during 2003 while the 0.03 ppm annual average was not exceeded at any site during 2003. The NEPM goal of no more than 1 exceedance at each site was met. Table C2 contains the summary statistics for daily peak 1-hour NO_2 in Western Australia.

Table C2. 2003 summary statistics for daily peak 1-hour nitrogen dioxide

AAQ NEPM Standard
0.12 ppm (1-hour average)

Regional Performance Monitoring Station	Data Recovery Rates (%)	Highest (ppm)	Highest (date)	Highest (time)	2nd Highest (ppm)	2nd Highest (date)	2nd Highest (time)
Perth Region							
Caversham (North East Metro)	95.7	0.043	11/11/2003	1900	0.041	30/04/2003	1900
Duncraig (North Metro)	97.4	0.057	11/11/2003	2000	0.048	01/02/2003	2200
Hope Valley (South Metro)	94.6	0.039	28/05/2003	1800	0.037	09/02/2003	1600
Queens Building (CBD)	95.9	0.121	17/01/2003	2200	0.101	11/11/2003	1700
Quinns Rocks (Outer North Coast)	97.4	0.035	02/05/2003	2000	0.033	30/04/2003	2100
Rockingham (South Coast)	98.4	0.051	03/05/2003	2000	0.051	01/02/2003	2200
Rolling Green (Outer East Rural)	94	0.032	17/12/2003	2200	0.021	20/04/2003	2000
South Lake (South East Metro)	98.9	0.048	11/11/2003	1700	0.045	02/05/2003	1900
Swanbourne (Inner West Coast)	99.2	0.048	02/05/2003	1900	0.042	22/04/2003	1900

Photochemical Smog as Ozone

The NEPM standard for ozone of 0.10 ppm averaged over 1 hour was not exceeded at any site during 2003. The NEPM goal of no more than 1 exceedance at each site was met. Table C3 contains the summary statistics for daily peak 1-hour O_3 in Western Australia.

Table C3. 2003 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 (date)	Highest (time)	2nd Highest (ppm)	2nd Highest (date)	2nd Highest (time)
Perth Region							
Caversham (North East Metro)	93.8	0.083	16/01/2003	1300	0.081	08/11/2003	1300
Quinns Rocks (Outer North Coast)	86.1	0.086	08/02/2003	1500	0.068	15/01/2003	1500
Rockingham (South Coast)	98.4	0.064	08/02/2003	1500	0.061	21/02/2003	1600
Rolling Green (Outer East Rural)	94.3	0.087	08/11/2003	1500	0.079	16/01/2003	1500
South Lake (South East Metro)	99.1	0.071	11/11/2003	1400	0.068	21/02/2003	1500
Swanbourne (Inner West Coast)	99.7	0.082	11/11/2003	1600	0.069	08/02/2003	1500

The NEPM standard for ozone of 0.08 ppm averaged over 4 hours was not exceeded at any site during 2003. The NEPM goal of no more than 1 exceedance at each site was met. Table C4 contains the summary statistics for daily peak 4-hour O_3 in Western Australia.

Table C4. 2003 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)	Highest (time)	2nd Highest (ppm)	2nd Highest (date)	2nd Highest (time)
Perth Region							
Caversham (North East Metro)	93.8	0.069	08/11/2003	1400	0.059	21/01/2003	1800
Quinns Rocks (Outer North Coast)	86.1	0.071	08/02/2003	1700	0.057	15/01/2003	1700
Rockingham (South Coast)	98.4	0.059	08/02/2003	1600	0.056	21/02/2003	1800
Rolling Green (Outer East Rural)	94.4	0.075	08/11/2003	1700	0.071	10/02/2003	1700
South Lake (South East Metro)	99.1	0.063	11/11/2003	1600	0.063	21/02/2003	1600
Swanbourne (Inner West Coast)	99.7	0.066	11/11/2003	1600	0.064	08/02/2003	1700

Sulfur Dioxide

The NEPM standard for sulfur dioxide of 0.20 ppm averaged over 1 hour was not exceeded at any site during 2003. The NEPM goal of no more than 1 exceedance at each site was met. Table C5 contains the summary statistics for daily peak 1-hour SO_2 in Western Australia.

Table C5. 2003 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 (date)	Highest (time)	2nd Highest (ppm)	2nd Highest (date)	2nd Highest (time)
Perth Region							
Hope Valley (South Metro)	94.1	0.060	28/03/2003	1400	0.051	13/02/2003	1400
Rockingham (South Coast)	98.3	0.026	22/06/2003	0200	0.026	04/05/2003	1200
South Lake (South East Metro)	98.9	0.038	14/02/2003	1800	0.029	04/10/2003	1600
Wattleup (South Metro)	97.5	0.062	28/01/2003	1400	0.037	07/12/2003	1600

The NEPM standard for ozone of 0.08 ppm averaged over 24 hours was not exceeded at any site during 2003. The NEPM goal of no more than 1 exceedance at each site was met. Table C6 contains the summary statistics for daily peak 24-hour SO_2 in Western Australia.

Table C6. 2003 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 (date)	Highest (time)	2nd Highest (ppm)	2nd Highest (date)	2nd Highest (time)
Perth Region							
Hope Valley (South Metro)	94.1	0.006	12/04/2003	2400	0.005	25/03/2003	2400
Rockingham (South Coast)	98.3	0.005	22/06/2003	2400	0.004	29/07/2003	2400
South Lake (South East Metro)	98.9	0.006	22/01/2003	2400	0.005	14/03/2003	2400
Wattleup (South Metro)	97.5	0.006	28/01/2003	2400	0.005	26/02/2003	2400

Particles as PM_{10}

The NEPM standard for particles as PM_{10} of 50 micrograms per cubic metre averaged over 24 hours was exceeded once at Duncraig (66.7 ug/m^3 on 29/10/2003) and once at Bunbury (54.5 ug/m^3 on 14/03/2003) during 2003. Attachments 1 and 2 contain descriptions of the circumstances which lead to the exceedances. The NEPM goal of no more than 5 exceedance at each site was met. Table C7 contains the summary statistics for daily peak 24-hour PM_{10} in Western Australia.

Table C7. 2003 summary statistics for 24-hour particles as PM_{10}

AAQ NEPM Standard
50 ug/m^3 (24-hour average)

Regional Performance Monitoring Station	Data Recovery Rates (%)	Highest (ug/m^3)	Highest (date)	Highest (time)	6th Highest (ug/m^3)	6th Highest (date)	6th Highest (time)
Perth Region							
Caversham [1] (North East Metro)	100	42	29/11/2003	2400	27	26/02/2003	2400
Duncraig [2] (North Metro)	99.1	66.7	29/10/2003	2400	31.6	14/03/2003	2400
Queens Buildings [1] (CBD)	100	45	29/11/2003	2400	29	10/03/2003	2400
South Lake [2] (South East Metro)	95.8	44.5	08/11/2003	2400	38.3	07/03/2003	2400
Swanbourne [1] (Inner West Coast)	100	35	26/06/2003	2400	29	28/03/2003	2400
Bunbury Region							
Bunbury [2](South West Region)	99.2	54.5	14/03/2003	2400	34.0	30/12/2003	2400

1 – High volume samplers operating 1 day in every six.
2 – Tapered Element Oscillating Microbalance (TEOM) operating continuously

Particles as $PM_{2.5}$

The NEPM advisory standard for particles as $PM_{2.5}$ of 25 micrograms per cubic metre averaged over 24 hours was exceeded once at Caversham (27.3 ug/m^3 on 29/11/2003), once at Duncraig (25.2 ug/m^3 on 08/11/2003) and three times at Bunbury (37.6 ug/m^3 on 14/03/2003, 25.9 ug/m^3 on 05/05/2003 and 27.4 ug/m^3 on 08/11/2003) during 2003. Table C8 contains the summary statistics for daily peak 24-hour $PM_{2.5}$ in Western Australia.

Table C8. 2003 summary statistics for 24-hour particles as $PM_{2.5}$

AAQ NEPM Advisory Standard 25 ug/m^3 (24-hour average)

Regional Performance Monitoring Station	Data Recovery Rates (%)	Highest (ug/m^3)	Highest (date)	Highest (time)	6th Highest (ug/m^3)	6th Highest (date)	6th Highest (time)
Perth Region							
Caversham (North East Metro)	98.6	27.3	29/11/2003	2400	15.3	11/03/2003	2400
Duncraig (North Metro)	98.4	25.2	08/11/2003	2400	17.2	29/11/2003	2400
Bunbury Region							
Bunbury (South West Region)	98.9	37.6	14/03/2003	2400	19.4	18/06/2003	2400

SECTION D – DATA ANALYSIS

Maxima and percentiles by pollutant in 2003

Table D1. 2003 percentiles of daily peak 1-hour carbon monoxide concentrations

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)
Perth Region								
Caversham (North East Metro)	95.7	1.1	0.9	0.8	0.7	0.6	0.4	0.2
Duncraig (North Metro)	97.8	4.1	3.1	2.8	2.0	1.5	0.7	0.4
Queens Building (CBD)	95.9	2.8	2.2	2.2	2.0	1.8	1.5	1.3
South Lake (South East Metro)	98.9	3.1	2.5	2.3	1.7	1.3	0.6	0.2

Table D2. 2003 percentiles of daily peak 1-hour nitrogen dioxide concentrations

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)
Perth Region								
Caversham (North East Metro)	95.7	0.043	0.037	0.034	0.031	0.028	0.024	0.018
Duncraig (North Metro)	97.4	0.057	0.042	0.037	0.033	0.031	0.027	0.022
Hope Valley (South Metro)	94.6	0.039	0.034	0.028	0.024	0.021	0.017	0.012
Queens Building (CBD)	95.9	0.121	0.075	0.067	0.058	0.055	0.047	0.040
Quinns Rocks (Outer North Coast)	97.4	0.035	0.032	0.030	0.027	0.025	0.020	0.012
Rockingham (South Coast)	98.4	0.051	0.040	0.036	0.034	0.032	0.026	0.018
Rolling Green (Outer East Rural)	94	0.032	0.020	0.017	0.016	0.015	0.012	0.007
South Lake (South East Metro)	98.9	0.048	0.039	0.038	0.030	0.028	0.024	0.020
Swanbourne (Inner West Coast)	99.2	0.048	0.036	0.034	0.031	0.029	0.023	0.016

Table D3. 2003 percentiles of daily peak 1-hour ozone concentrations

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)
Perth Region								
Caversham (North East Metro)	93.8	0.083	0.070	0.062	0.052	0.044	0.034	0.030
Quinns Rocks (Outer North Coast)	86.1	0.086	0.060	0.057	0.049	0.045	0.036	0.033
Rockingham (South Coast)	98.4	0.064	0.053	0.050	0.045	0.039	0.034	0.031
Rolling Green (Outer East Rural)	94.3	0.087	0.076	0.071	0.059	0.049	0.036	0.032
South Lake (South East Metro)	99.1	0.071	0.061	0.055	0.048	0.041	0.033	0.030
Swanbourne (Inner West Coast)	99.7	0.082	0.060	0.052	0.045	0.041	0.034	0.031

Table D4. 2003 percentiles Percentiles of daily peak 4-hour ozone concentrations

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)
Perth Region								
Caversham (North East Metro)	93.8	0.069	0.058	0.054	0.046	0.039	0.032	0.029
Quinns Rocks (Outer North Coast)	86.1	0.071	0.055	0.051	0.043	0.040	0.035	0.032
Rockingham (South Coast)	98.4	0.059	0.049	0.048	0.041	0.037	0.033	0.030
Rolling Green (Outer East Rural)	94.4	0.075	0.063	0.060	0.053	0.043	0.034	0.031
South Lake (South East Metro)	99.1	0.063	0.052	0.048	0.043	0.037	0.032	0.028
Swanbourne (Inner West Coast)	99.7	0.066	0.054	0.047	0.041	0.037	0.033	0.030

Table D5. 2003 percentiles of daily peak 1-hour sulfur dioxide concentrations

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)
Perth Region								
Hope Valley (South Metro)	94.1	0.060	0.041	0.031	0.024	0.017	0.008	0.003
Rockingham (South Coast)	98.3	0.026	0.020	0.016	0.010	0.006	0.003	0.001
South Lake (South East Metro)	98.9	0.038	0.028	0.026	0.020	0.015	0.008	0.002
Wattleup (South Metro)	97.5	0.062	0.032	0.028	0.023	0.018	0.010	0.004

Table D6. 2003 percentiles of daily peak 1-hour sulfur dioxide concentrations

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)
Perth Region								
Hope Valley (South Metro)	94.1	0.006	0.005	0.004	0.003	0.002	0.001	0.001
Rockingham (South Coast)	98.3	0.005	0.003	0.003	0.002	0.001	0.001	0.001
South Lake (South East Metro)	98.9	0.006	0.005	0.004	0.003	0.002	0.001	0.001
Wattleup (South Metro)	97.5	0.006	0.005	0.005	0.004	0.003	0.002	0.001

Table D7. 2003 percentiles of daily peak 24-hour particles as PM_{10} concentrations

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)
Perth Region								
Duncraig (North Metro)	99.1	66.7	33.7	31.0	28.3	25.5	20.4	16.0
South Lake (South East Metro)	95.8	44.5	40.1	36.3	32.4	28.2	21.8	16.3
Bunbury (South West Region)	99.2	54.5	34.2	33.3	30.2	26.3	21.8	17.5

Table D8. 2003 percentiles of daily peak 24-hour particles as PM_{10} concentrations

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)
Perth Region								
Caversham (North East Metro)	98.6	27.3	16.3	14.4	13.4	11.6	9.2	7.6
Duncraig (North Metro)	98.4	25.2	19.2	16.1	14.9	13.1	10.8	8.3
Bunbury (South West Region)	98.9	37.6	20.7	18.3	15.7	13.1	10.0	7.8

Maxima and percentiles by site 1994 to 2003

Table D9. Daily peak 8-hour carbon monoxide at Caversham (1994-2003)
Trend station/region: Caversham AAQ NEPM Standard 9.0 ppm (8-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	83.0	0	3.4	2.3	2.2	1.7	1.3
1995	94.9	0	2.2	2.1	1.8	1.2	0.9
1996	98.5	0	2.7	2.0	1.7	1.2	0.8
1997	97.6	0	2.3	1.6	1.3	1.0	0.9
1998	98.0	0	1.7	1.3	1.2	1.0	0.8
1999	99.6	0	1.6	1.2	1.1	0.8	0.6
2000	99.3	0	1.4	1.0	1.0	0.8	0.6
2001	99.6	0	1.5	1.3	1.2	1.0	0.9
2002	98.1	0	1.3	1.0	0.9	0.8	0.7
2003	95.7	0	1.1	0.9	0.8	0.7	0.6

Table D10. Daily peak 8-hour carbon monoxide at Duncraig (1994-2003)
Trend station/region: Duncraig AAQ NEPM Standard 9.0 ppm (8-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	47.9	0	5.2	4.8	3.8	2.8	1.9
1996	96.4	0	7.2	6.1	4.7	3.3	2.1
1997	98.0	0	6.8	5.2	4.8	3.9	2.4
1998	98.4	0	6.1	4.9	4.3	3.0	2.0
1999	96.9	0	6.6	4.5	4.2	2.8	2.0
2000	98.7	0	4.8	3.5	3.0	2.3	1.6
2001	99.5	0	5.9	4.7	4.2	3.1	2.6
2002	96.6	0	5.4	3.7	3.6	2.6	1.8
2003	97.8	0	4.1	3.1	2.8	2.0	1.5

Table D11. Daily peak 8-hour carbon monoxide at Queens Building (1994-2003)
Trend station/region: Queens Building AAQ NEPM Standard 9.0 ppm (8-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	97.6	0	8.8	7.2	6.7	5.6	5.2
1995	96.2	0	8.5	5.9	5.5	5.0	4.6
1996	99.0	0	7.2	6.4	5.6	4.9	4.3
1997	99.2	0	5.6	5.0	4.8	4.2	3.8
1998	98.5	0	6.1	5.3	4.7	3.9	3.6
1999	99.4	0	5.0	4.3	4.0	3.6	3.1
2000	98.7	0	4.3	3.5	3.3	3.0	2.7
2001	99.6	0	4.8	3.9	3.1	2.5	2.4
2002	96.8	0	4.7	2.7	2.5	2.2	2.0
2003	95.9	0	2.8	2.2	2.2	2.0	1.8

Table D12. Daily peak 8-hour carbon monoxide at South Lake (1994-2003)
Trend station/region: South Lake AAQ NEPM Standard 9.0 ppm (8-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	0.0	0	-	-	-	-	-
1996	0.0	0	-	-	-	-	-
1997	0.0	0	-	-	-	-	-
1998	0.0	0	-	-	-	-	-
1999	0.0	0	-	-	-	-	-
2000	82.3	0	3.6	2.2	2.1	1.8	1.6
2001	99.6	0	4.0	3.5	3.1	2.3	1.7
2002	97.6	0	3.2	2.8	2.4	1.9	1.3
2003	98.9	0	3.1	2.5	2.3	1.7	1.3

Table D13. Daily peak 1-hour nitrogen dioxide at Caversham (1994-2003)
Trend station/region: Caversham AAQ NEPM Standard 0.12 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	95.0	0	0.058	0.042	0.039	0.034	0.030
1995	97.3	0	0.047	0.037	0.034	0.029	0.026
1996	98.1	0	0.045	0.036	0.034	0.030	0.026
1997	99.3	0	0.051	0.041	0.034	0.028	0.026
1998	99.0	0	0.051	0.038	0.034	0.031	0.028
1999	99.6	0	0.038	0.031	0.030	0.028	0.025
2000	99.3	0	0.044	0.035	0.033	0.030	0.028
2001	99.4	0	0.045	0.037	0.033	0.029	0.027
2002	99.5	0	0.055	0.035	0.033	0.031	0.028
2003	95.7	0	0.043	0.037	0.034	0.031	0.028

Table D14. Daily peak 1-hour nitrogen dioxide at Duncraig (1994-2003)

Trend station/region: Duncraig

AAQ NEPM Standard
0.12 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	48.8	0	0.038	0.035	0.032	0.028	0.026
1996	97.6	0	0.043	0.035	0.035	0.028	0.025
1997	98.3	0	0.046	0.039	0.035	0.029	0.027
1998	98.5	0	0.065	0.040	0.037	0.031	0.028
1999	93.5	0	0.049	0.035	0.032	0.030	0.027
2000	98.7	0	0.050	0.035	0.033	0.031	0.029
2001	99.5	0	0.041	0.038	0.035	0.032	0.030
2002	97.1	0	0.049	0.040	0.037	0.034	0.031
2003	97.4	0	0.057	0.042	0.037	0.033	0.031

Table D15. Daily peak 1-hour nitrogen dioxide at Hope Valley (1994-2003)
Trend station/region: Hope valley AAQ NEPM Standard 0.12 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	71.1	0	0.047	0.037	0.034	0.030	0.025
1995	72.5	0	0.033	0.029	0.025	0.022	0.020
1996	99.6	0	0.045	0.034	0.028	0.023	0.019
1997	99.0	0	0.033	0.028	0.027	0.024	0.021
1998	97.0	0	0.044	0.029	0.027	0.024	0.020
1999	98.8	0	0.032	0.028	0.026	0.024	0.022
2000	99.6	0	0.033	0.030	0.028	0.025	0.023
2001	99.6	0	0.033	0.031	0.030	0.027	0.025
2002	99.6	0	0.039	0.033	0.030	0.028	0.024
2003	94.6	0	0.039	0.034	0.028	0.024	0.021

Table D16. Daily peak 1-hour nitrogen dioxide at Queens Building (1994-2003)
Trend station/region: Queens Building AAQ NEPM Standard 0.12 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	65.8	0	0.097	0.089	0.083	0.075	0.062
1995	98.3	0	0.084	0.070	0.066	0.057	0.050
1996	46.6	0	0.093	0.079	0.077	0.060	0.050
1997	99.4	0	0.098	0.077	0.074	0.063	0.056
1998	99.5	0	0.093	0.085	0.077	0.068	0.058
1999	99.4	0	0.073	0.063	0.061	0.054	0.047
2000	98.6	0	0.073	0.068	0.065	0.056	0.049
2001	99.5	0	0.082	0.065	0.064	0.058	0.055
2002	99.0	0	0.091	0.077	0.072	0.060	0.055
2003	95.9	1	0.121	0.075	0.067	0.058	0.055

Table D17. Daily peak 1-hour nitrogen dioxide at Quinns Rocks (1994-2003)
Trend station/region: Quinns Rocks AAQ NEPM Standard 0.12 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	95.5	0	0.051	0.031	0.030	0.028	0.025
1995	60.9	0	0.036	0.028	0.027	0.024	0.021
1996	94.8	0	0.036	0.029	0.028	0.023	0.020
1997	99.5	0	0.039	0.028	0.026	0.024	0.022
1998	96.7	0	0.041	0.033	0.029	0.026	0.024
1999	98.5	0	0.034	0.030	0.029	0.025	0.023
2000	98.7	0	0.045	0.032	0.031	0.028	0.025
2001	96.4	0	0.036	0.033	0.031	0.027	0.026
2002	99.5	0	0.037	0.031	0.030	0.028	0.026
2003	97.4	0	0.035	0.032	0.030	0.027	0.025

Table D18. Daily peak 1-hour nitrogen dioxide at Rockingham (1994-2003)
Trend station/region: Rockingham AAQ NEPM Standard
0.12 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	11.0	0	0.020	0.020	0.020	0.019	0.015
1996	97.3	0	0.041	0.031	0.030	0.027	0.024
1997	85.1	0	0.033	0.030	0.029	0.026	0.024
1998	99.2	0	0.043	0.031	0.028	0.026	0.024
1999	93.5	0	0.030	0.029	0.028	0.025	0.024
2000	99.4	0	0.048	0.041	0.039	0.036	0.032
2001	98.9	0	0.046	0.040	0.038	0.035	0.033
2002	99.6	0	0.042	0.039	0.038	0.035	0.032
2003	98.4	0	0.051	0.040	0.036	0.034	0.032

Table D19. Daily peak 1-hour nitrogen dioxide at Rolling Green (1994-2003)
Trend station/region: Rolling Green AAQ NEPM Standard
0.12 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	82.1	0	0.028	0.023	0.021	0.017	0.013
1995	50.5	0	0.035	0.020	0.017	0.013	0.011
1996	65.1	0	0.022	0.018	0.017	0.015	0.013
1997	64.1	0	0.035	0.019	0.018	0.017	0.014
1998	95.7	0	0.029	0.021	0.019	0.017	0.014
1999	98.7	0	0.024	0.017	0.016	0.015	0.012
2000	97.1	0	0.027	0.021	0.019	0.015	0.014
2001	99.1	0	0.026	0.021	0.020	0.017	0.015
2002	97.6	0	0.025	0.022	0.020	0.017	0.015
2003	94.0	0	0.032	0.020	0.017	0.016	0.015

Table D20. Daily peak 1-hour nitrogen dioxide at South Lake (1994-2003)
Trend station/region: South Lake AAQ NEPM Standard
0.12 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	0.0	0	-	-	-	-	-
1996	0.0	0	-	-	-	-	-
1997	0.0	0	-	-	-	-	-
1998	0.0	0	-	-	-	-	-
1999	0.0	0	-	-	-	-	-
2000	81.3	0	0.041	0.035	0.032	0.031	0.029
2001	99.2	0	0.039	0.032	0.030	0.029	0.027
2002	95.5	0	0.048	0.035	0.032	0.030	0.028
2003	98.9	0	0.048	0.039	0.038	0.030	0.028

Table D21. Daily peak 1-hour nitrogen dioxide at Swanbourne (1994-2003)
Trend station/region: Swanbourne AAQ NEPM Standard
0.12 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	98.3	0	0.049	0.037	0.034	0.031	0.028
1995	99.6	0	0.038	0.032	0.028	0.027	0.026
1996	98.6	0	0.046	0.037	0.033	0.028	0.025
1997	98.4	0	0.040	0.034	0.031	0.029	0.027
1998	93.5	0	0.051	0.036	0.033	0.030	0.028
1999	95.3	0	0.037	0.034	0.033	0.031	0.028
2000	98.0	0	0.045	0.038	0.036	0.034	0.030
2001	87.4	0	0.037	0.034	0.032	0.031	0.030
2002	92.1	0	0.051	0.040	0.036	0.031	0.029
2003	99.2	0	0.048	0.036	0.034	0.031	0.029

Table D22. Daily peak 1-hour ozone at Caversham (1994-2003)
Trend station/region: Caversham AAQ NEPM Standard
0.10 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	98.8	1	0.103	0.077	0.070	0.057	0.045
1995	96.8	0	0.093	0.072	0.069	0.058	0.047
1996	99.4	2	0.114	0.085	0.075	0.061	0.049
1997	99.1	0	0.100	0.095	0.083	0.058	0.047
1998	99.2	1	0.112	0.085	0.076	0.058	0.049
1999	99.5	1	0.101	0.083	0.075	0.061	0.048
2000	99.3	0	0.084	0.069	0.064	0.054	0.046
2001	99.6	0	0.099	0.072	0.067	0.051	0.044
2002	99.6	0	0.091	0.074	0.065	0.057	0.048
2003	93.8	0	0.083	0.070	0.062	0.052	0.044

Table D23. Daily peak 1-hour ozone at Quinns Rocks (1994-2003)
Trend station/region: Quinns Rocks AAQ NEPM Standard
0.10 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	95.3	0	0.074	0.072	0.066	0.053	0.044
1995	67.5	0	0.089	0.078	0.070	0.062	0.052
1996	98.0	0	0.084	0.072	0.070	0.055	0.046
1997	99.4	1	0.106	0.076	0.067	0.060	0.052
1998	98.5	0	0.080	0.072	0.070	0.058	0.049
1999	98.6	1	0.105	0.070	0.068	0.058	0.046
2000	98.7	0	0.078	0.069	0.067	0.055	0.045
2001	99.5	0	0.073	0.065	0.058	0.049	0.042
2002	99.5	0	0.079	0.069	0.060	0.055	0.046
2003	86.1	0	0.086	0.060	0.057	0.049	0.045

Table D24. Daily peak 1-hour ozone at Rockingham (1994-2003)

Trend station/region: Rockingham — AAQ NEPM Standard 0.10 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	12.3	0	0.043	0.041	0.039	0.038	0.037
1996	97.2	0	0.091	0.067	0.060	0.048	0.041
1997	83.8	0	0.078	0.063	0.056	0.045	0.039
1998	99.0	0	0.082	0.065	0.060	0.051	0.043
1999	99.0	0	0.076	0.067	0.060	0.050	0.040
2000	99.4	0	0.083	0.077	0.063	0.050	0.040
2001	99.1	0	0.076	0.057	0.050	0.042	0.037
2002	99.6	0	0.079	0.067	0.057	0.050	0.043
2003	98.4	0	0.064	0.053	0.050	0.045	0.039

Table D25. Daily peak 1-hour ozone at Rolling Green (1994-2003)

Trend station/region: Rolling Green — AAQ NEPM Standard 0.10 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	98.9	0	0.092	0.076	0.070	0.059	0.051
1995	70.4	0	0.088	0.082	0.078	0.063	0.051
1996	99.2	2	0.104	0.096	0.084	0.065	0.051
1997	63.9	1	0.134	0.091	0.077	0.069	0.059
1998	99.5	1	0.109	0.085	0.077	0.063	0.056
1999	98.8	0	0.096	0.080	0.073	0.064	0.052
2000	97.1	0	0.092	0.072	0.065	0.058	0.049
2001	99.0	0	0.097	0.080	0.068	0.051	0.044
2002	99.6	0	0.091	0.080	0.068	0.059	0.049
2003	94.3	0	0.087	0.076	0.071	0.059	0.049

Table D26. Daily peak 1-hour ozone at South Lake (1994-2003)

Trend station/region: South Lake — AAQ NEPM Standard 0.10 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	0.0	0	-	-	-	-	-
1996	0.0	0	-	-	-	-	-
1997	0.0	0	-	-	-	-	-
1998	0.0	0	-	-	-	-	-
1999	0.0	0	-	-	-	-	-
2000	83.3	0	0.077	0.061	0.053	0.043	0.038
2001	99.6	0	0.079	0.062	0.054	0.044	0.038
2002	99.5	0	0.067	0.062	0.054	0.049	0.043
2003	99.1	0	0.071	0.061	0.055	0.048	0.041

Table D27. Daily peak 1-hour ozone at Swanbourne (1994-2003)

Trend station/region: Swanbourne — AAQ NEPM Standard 0.10 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	98.9	0	0.079	0.070	0.060	0.049	0.043
1995	99.2	0	0.098	0.075	0.065	0.057	0.046
1996	98.2	0	0.089	0.072	0.066	0.056	0.044
1997	98.1	1	0.109	0.069	0.064	0.056	0.046
1998	98.4	0	0.081	0.070	0.064	0.052	0.046
1999	96.6	0	0.088	0.069	0.064	0.054	0.042
2000	98.0	0	0.079	0.069	0.064	0.053	0.043
2001	98.7	0	0.074	0.064	0.059	0.048	0.040
2002	95.9	0	0.081	0.063	0.057	0.051	0.046
2003	99.7	0	0.082	0.060	0.052	0.045	0.041

Table D28. Daily peak 4-hour ozone at Caversham (1994-2003)

Trend station/region: Caversham — AAQ NEPM Standard 0.08 ppm (4-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	98.8	2	0.084	0.063	0.057	0.045	0.038
1995	96.8	1	0.083	0.062	0.055	0.047	0.040
1996	99.4	1	0.090	0.072	0.062	0.052	0.045
1997	99.1	3	0.084	0.071	0.063	0.050	0.042
1998	99.2	2	0.087	0.068	0.061	0.050	0.043
1999	99.5	0	0.080	0.071	0.064	0.052	0.043
2000	99.3	0	0.058	0.056	0.054	0.047	0.041
2001	99.6	0	0.079	0.062	0.055	0.045	0.039
2002	99.6	0	0.068	0.065	0.058	0.049	0.042
2003	93.8	0	0.069	0.058	0.054	0.046	0.039

Table D29. Daily peak 4-hour ozone at Quinns Rocks (1994-2003)

Trend station/region: Quinns Rocks — AAQ NEPM Standard 0.08 ppm (4-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	95.3	0	0.064	0.058	0.055	0.044	0.038
1995	67.5	0	0.078	0.066	0.063	0.051	0.046
1996	98.0	0	0.075	0.062	0.054	0.049	0.041
1997	99.4	1	0.100	0.065	0.060	0.053	0.044
1998	98.5	0	0.077	0.061	0.060	0.050	0.042
1999	98.6	1	0.083	0.061	0.057	0.051	0.042
2000	98.7	0	0.072	0.064	0.059	0.048	0.041
2001	99.5	0	0.066	0.057	0.051	0.044	0.039
2002	99.5	0	0.069	0.057	0.053	0.048	0.041
2003	86.1	0	0.071	0.055	0.051	0.043	0.040

Table D30. Daily peak 4-hour ozone at Rockingham (1994-2003)

Trend station/region: Rockingham — AAQ NEPM Standard 0.08 ppm (4-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	12.3	0	0.039	0.038	0.037	0.035	0.034
1996	97.2	1	0.085	0.061	0.056	0.042	0.039
1997	83.8	0	0.069	0.055	0.050	0.042	0.035
1998	99.0	0	0.074	0.062	0.051	0.046	0.039
1999	99.0	0	0.067	0.060	0.055	0.045	0.038
2000	99.4	0	0.078	0.069	0.059	0.046	0.037
2001	99.1	0	0.071	0.053	0.045	0.039	0.036
2002	99.6	0	0.071	0.058	0.050	0.047	0.039
2003	98.4	0	0.059	0.049	0.048	0.041	0.037

Table D31. Daily peak 4-hour ozone at Rolling Green (1994-2003)

Trend station/region: Rolling Green — AAQ NEPM Standard 0.08 ppm (4-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	98.9	1	0.084	0.061	0.055	0.048	0.044
1995	70.4	0	0.080	0.069	0.064	0.054	0.046
1996	99.2	5	0.085	0.082	0.070	0.053	0.043
1997	63.9	2	0.124	0.077	0.070	0.058	0.051
1998	99.5	2	0.095	0.069	0.066	0.052	0.048
1999	98.8	0	0.077	0.070	0.059	0.055	0.046
2000	97.1	0	0.075	0.059	0.055	0.047	0.041
2001	99.0	2	0.094	0.067	0.058	0.046	0.038
2002	99.6	0	0.071	0.065	0.061	0.052	0.043
2003	94.4	0	0.075	0.063	0.060	0.053	0.043

Table D32. Daily peak 4-hour ozone at South Lake (1994-2003)

Trend station/region: South Lake — AAQ NEPM Standard 0.08 ppm (4-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	0.0	0	-	-	-	-	-
1996	0.0	0	-	-	-	-	-
1997	0.0	0	-	-	-	-	-
1998	0.0	0	-	-	-	-	-
1999	0.0	0	-	-	-	-	-
2000	83.3	0	0.067	0.051	0.045	0.037	0.035
2001	99.6	0	0.076	0.053	0.048	0.039	0.035
2002	99.5	0	0.058	0.053	0.050	0.044	0.039
2003	99.1	0	0.063	0.052	0.048	0.043	0.037

Table D33. Daily peak 1-hour ozone at Swanbourne (1994-2003)
Trend station/region: Swanbourne AAQ NEPM Standard 0.10 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	98.9	0	0.067	0.057	0.051	0.042	0.037
1995	99.2	1	0.082	0.065	0.056	0.048	0.041
1996	98.2	1	0.081	0.066	0.056	0.048	0.039
1997	98.1	1	0.104	0.060	0.055	0.049	0.041
1998	98.4	0	0.078	0.060	0.054	0.047	0.040
1999	96.6	0	0.074	0.060	0.056	0.048	0.039
2000	98.0	0	0.073	0.065	0.057	0.047	0.039
2001	98.7	0	0.069	0.055	0.049	0.041	0.037
2002	95.9	0	0.066	0.056	0.054	0.047	0.041
2003	99.7	0	0.066	0.054	0.047	0.041	0.037

Table D34. Daily peak 1-hour sulfur dioxide at Hope Valley (1994-2003)
Trend station/region: Hope Valley AAQ NEPM Standard 0.20 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	97.2	0	0.191	0.073	0.055	0.035	0.023
1995	99.3	0	0.076	0.056	0.045	0.037	0.029
1996	99.5	0	0.076	0.053	0.043	0.033	0.024
1997	97.4	0	0.047	0.040	0.031	0.023	0.016
1998	97.5	0	0.061	0.035	0.031	0.024	0.017
1999	98.7	0	0.064	0.036	0.029	0.019	0.014
2000	99.4	0	0.079	0.051	0.036	0.020	0.014
2001	99.6	0	0.044	0.029	0.025	0.019	0.013
2002	99.6	0	0.058	0.048	0.032	0.024	0.017
2003	94.1	0	0.060	0.041	0.031	0.024	0.017

Table D35. Daily peak 1-hour sulfur dioxide at Rockingham (1994-2003)
Trend station/region: Rockingham AAQ NEPM Standard 0.20 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	15.3	0	0.017	0.014	0.012	0.008	0.004
1996	97.0	0	0.057	0.050	0.038	0.025	0.016
1997	88.1	0	0.039	0.028	0.018	0.013	0.008
1998	96.9	0	0.047	0.029	0.022	0.017	0.010
1999	99.0	0	0.047	0.027	0.024	0.016	0.011
2000	98.8	0	0.034	0.021	0.017	0.010	0.006
2001	99.2	0	0.028	0.023	0.019	0.010	0.006
2002	99.6	0	0.035	0.021	0.017	0.009	0.006
2003	98.3	0	0.026	0.020	0.016	0.010	0.006

Table D36. Daily peak 1-hour sulfur dioxide at South Lake (1994-2003)
Trend station/region: South Lake AAQ NEPM Standard
0.20 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	0.0	0	-	-	-	-	-
1996	0.0	0	-	-	-	-	-
1997	0.0	0	-	-	-	-	-
1998	0.0	0	-	-	-	-	-
1999	0.0	0	-	-	-	-	-
2000	82.5	0	0.042	0.027	0.024	0.019	0.013
2001	99.6	0	0.046	0.027	0.023	0.018	0.013
2002	97.4	0	0.043	0.036	0.026	0.020	0.015
2003	98.9	0	0.038	0.028	0.026	0.020	0.015

Table D37. Daily peak 1-hour sulfur dioxide at Wattleup (1994-2003)
Trend station/region: Wattleup AAQ NEPM Standard
0.20 ppm (1-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	97.3	0	0.095	0.058	0.048	0.037	0.026
1995	98.7	0	0.090	0.063	0.055	0.042	0.033
1996	96.7	0	0.082	0.049	0.044	0.033	0.026
1997	91.9	0	0.065	0.047	0.039	0.026	0.018
1998	94.4	0	0.061	0.043	0.040	0.027	0.020
1999	99.3	0	0.060	0.033	0.030	0.022	0.017
2000	99.7	0	0.046	0.034	0.027	0.022	0.016
2001	99.7	0	0.074	0.032	0.027	0.021	0.017
2002	99.0	0	0.081	0.039	0.030	0.023	0.019
2003	97.5	0	0.062	0.032	0.028	0.023	0.018

Table D38. Daily peak 24-hour sulfur dioxide at Hope Valley (1994-2003)
Trend station/region: Hope Valley AAQ NEPM Standard
0.08 ppm (24-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	97.2	0	0.017	0.008	0.007	0.005	0.004
1995	99.3	0	0.011	0.008	0.007	0.005	0.004
1996	99.5	0	0.008	0.006	0.005	0.004	0.003
1997	97.4	0	0.005	0.005	0.004	0.003	0.002
1998	97.5	0	0.008	0.006	0.004	0.003	0.002
1999	98.7	0	0.007	0.004	0.003	0.003	0.002
2000	99.4	0	0.007	0.005	0.003	0.003	0.002
2001	99.6	0	0.004	0.004	0.003	0.002	0.002
2002	99.6	0	0.007	0.006	0.004	0.003	0.002
2003	94.1	0	0.006	0.005	0.004	0.003	0.002

Table D39. Daily peak 24-hour sulfur dioxide at Rockingham (1994-2003)
Trend station/region: Rockingham AAQ NEPM Standard 0.08 ppm (24-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	15.3	0	0.002	0.002	0.001	0.001	0.001
1996	97.0	0	0.022	0.010	0.008	0.005	0.003
1997	88.1	0	0.014	0.005	0.004	0.003	0.003
1998	96.9	0	0.009	0.006	0.005	0.003	0.002
1999	99.0	0	0.016	0.008	0.006	0.004	0.002
2000	98.8	0	0.012	0.003	0.003	0.002	0.001
2001	99.2	0	0.009	0.004	0.003	0.002	0.001
2002	99.6	0	0.006	0.002	0.002	0.002	0.001
2003	98.3	0	0.005	0.003	0.003	0.002	0.001

Table D40. Daily peak 24-hour sulfur dioxide at South Lake (1994-2003)
Trend station/region: South Lake AAQ NEPM Standard 0.08 ppm (24-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	0.0	0	-	-	-	-	-
1996	0.0	0	-	-	-	-	-
1997	0.0	0	-	-	-	-	-
1998	0.0	0	-	-	-	-	-
1999	0.0	0	-	-	-	-	-
2000	82.5	0	0.004	0.003	0.003	0.003	0.002
2001	99.6	0	0.006	0.004	0.003	0.002	0.002
2002	97.4	0	0.006	0.005	0.004	0.003	0.002
2003	98.9	0	0.006	0.005	0.004	0.003	0.002

Table D41. Daily peak 24-hour sulfur dioxide at Wattleup (1994-2003)
Trend station/region: Wattleup AAQ NEPM Standard 0.08 ppm (24-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	97.3	0	0.008	0.006	0.006	0.005	0.004
1995	98.7	0	0.012	0.010	0.008	0.006	0.005
1996	96.7	0	0.011	0.009	0.009	0.007	0.006
1997	91.9	0	0.010	0.006	0.005	0.004	0.003
1998	94.4	0	0.008	0.006	0.005	0.004	0.003
1999	99.3	0	0.007	0.005	0.005	0.004	0.003
2000	99.7	0	0.006	0.004	0.004	0.003	0.002
2001	99.7	0	0.009	0.005	0.004	0.003	0.003
2002	99.0	0	0.008	0.005	0.005	0.004	0.003
2003	97.5	0	0.006	0.005	0.005	0.004	0.003

Table D42. Daily peak 24-hour particles as PM_{10} at Duncraig (1994-2003)
Trend station/region: Duncraig AAQ NEPM Standard
50 ug/m3 (24-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	0.0	0	-	-	-	-	-
1996	44.9	0	37.7	36.4	33.4	27.5	25.2
1997	60.8	4	56.2	50.2	46.5	37.3	30.7
1998	98.4	1	68.9	39.2	35.8	29.7	26.5
1999	97.2	0	35.2	32.0	29.3	25.3	22.4
2000	76.5	0	29.8	28.0	25.2	24.0	22.2
2001	99.5	1	53.6	34.3	31.9	27.5	23.4
2002	97.6	1	54.0	37.5	30.8	26.4	24.2
2003	99.1	1	66.7	33.7	31.0	28.3	25.5

Table D43. Daily peak 24-hour particles as PM_{10} at South Lake (1994-2003)
Trend station/region: South Lake AAQ NEPM Standard
50 ug/m3 (24-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	0.0	0	-	-	-	-	-
1996	0.0	0	-	-	-	-	-
1997	0.0	0	-	-	-	-	-
1998	0.0	0	-	-	-	-	-
1999	0.0	0	-	-	-	-	-
2000	82.7	0	39.6	33.2	30.6	29.3	26.0
2001	99.1	1	56.7	37.3	33.2	27.7	25.3
2002	99.3	2	82.6	45.8	38.8	32.8	27.9
2003	95.8	0	44.5	40.1	36.3	32.4	28.2

Table D44. Daily peak 24-hour particles as PM_{10} at Bunbury (1994-2003)
Trend station/region: Bunbury AAQ NEPM Standard
50 ug/m3 (24-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	0.0	0	-	-	-	-	-
1996	0.0	0	-	-	-	-	-
1997	0.0	0	-	-	-	-	-
1998	0.0	0	-	-	-	-	-
1999	52.3	0	40.0	33.8	30.8	27.7	24.6
2000	99.5	0	42.4	33.8	31.0	28.4	24.8
2001	99.6	1	57.6	41.0	37.5	29.3	26.8
2002	99.5	0	42.5	38.9	32.9	29.5	27.1
2003	99.2	1	54.5	34.2	33.3	30.2	26.3

Table D45. Daily peak 24-hour particles as $PM_{2.5}$ at Caversham (1994-2003)
Trend station/region: Caversham AAQ NEPM Advisory Standard 25 ug/m3 (24-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	84.7	7	32.7	27.4	25.0	21.3	16.8
1995	95.3	0	21.4	16.3	15.6	13.4	12.2
1996	98.1	1	37.6	19.7	17.2	13.9	12.0
1997	92.1	1	28.1	22.1	18.0	14.2	12.5
1998	97.6	0	21.2	16.5	14.9	12.8	10.9
1999	98.2	0	20.3	14.3	13.6	12.4	10.9
2000	93.7	0	20.1	16.5	14.8	11.9	10.5
2001	97.2	1	31.8	15.9	15.1	12.9	11.3
2002	99.6	1	25.7	16.2	15.0	13.4	12.0
2003	98.6	1	27.3	16.3	14.4	13.4	11.6

Table D46. Daily peak 24-hour particles as $PM_{2.5}$ at Duncraig (1994-2003)
Trend station/region: Duncraig AAQ NEPM Advisory Standard 25 ug/m3 (24-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	15.9	0	20.0	17.5	15.5	13.7	11.5
1995	97.7	8	39.7	28.7	25.3	20.4	13.1
1996	98.3	4	30.1	24.8	22.2	17.6	14.2
1997	86.1	15	44.2	39.2	35.6	24.0	18.2
1998	98.2	3	31.8	23.9	21.2	17.1	15.2
1999	96.9	2	26.3	21.3	17.3	14.5	12.4
2000	79.2	0	22.2	17.1	15.0	13.4	11.5
2001	93.8	4	27.0	25.5	22.6	16.1	13.4
2002	98.9	1	28.3	20.3	17.4	15.7	13.3
2003	98.4	1	25.2	19.2	16.1	14.9	13.1

Table D47. Daily peak 24-hour particles as $PM_{2.5}$ at Bunbury (1994-2003)
Trend station/region: Bunbury AAQ NEPM Advisory Standard 25 ug/m3 (24-hour average)

Year	Data Recovery (%)	No. of exceedances (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	0.0	0	-	-	-	-	-
1995	0.0	0	-	-	-	-	-
1996	0.0	0	-	-	-	-	-
1997	78.9	5	35.4	26.4	24.3	20.7	17.1
1998	99.5	3	33.2	22.8	20.0	16.1	13.6
1999	88.9	1	30.0	21.7	18.4	15.0	12.9
2000	99.6	3	29.2	23.3	20.4	16.0	13.7
2001	92.7	2	47.3	19.6	17.4	15.4	13.1
2002	99.5	4	36.1	24.5	20.2	15.7	14.0
2003	98.9	3	37.6	20.7	18.3	15.7	13.1

Maxima by pollutant 1994 to 2004

Table D48. Annual daily peak 8-hour carbon monoxide concentrations (ppm) for 1994-2003

AAQ NEPM Standard
9.0 ppm (8-hour average)

Regional Performance Monitoring Station	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Perth Region										
Caversham (North East Metro)	3.4	2.2	2.7	2.3	1.7	1.6	1.4	1.5	1.3	1.1
Duncraig (North Metro)	-	5.2	7.2	6.8	6.1	6.6	4.8	5.9	5.4	4.1
Queens Building (CBD)	8.8	8.5	7.2	5.6	6.1	5.0	4.3	4.8	4.7	2.8
South Lake (South East Metro)	-	-	-	-	-	-	3.6	4.0	3.2	3.1

Highlighted cells indicate NEPM exceedances.

Table D49. Annual daily peak 1-hour nitrogen dioxide concentrations (ppm) for 1994-2003

AAQ NEPM Standard
0.12 ppm (1-hour average)

Regional Performance Monitoring Station	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Perth Region										
Caversham (North East Metro)	0.058	0.047	0.045	0.051	0.051	0.038	0.044	0.045	0.055	0.043
Duncraig (North Metro)	-	0.038	0.043	0.046	0.065	0.049	0.050	0.041	0.049	0.057
Hope Valley (South Metro)	0.047	0.033	0.045	0.033	0.044	0.032	0.033	0.033	0.039	0.039
Queens Building (CBD)	0.097	0.084	0.093	0.098	0.093	0.073	0.073	0.082	0.091	0.121
Quinns Rocks (Outer North Coast)	0.051	0.036	0.036	0.039	0.041	0.034	0.045	0.036	0.037	0.035
Rockingham (South Coast)	-	0.020	0.041	0.033	0.043	0.030	0.048	0.046	0.042	0.051
Rolling Green (Outer East Rural)	0.028	0.035	0.022	0.035	0.029	0.024	0.027	0.026	0.025	0.032
South Lake (South East Metro)	-	-	-	-	-	-	0.041	0.039	0.048	0.048
Swanbourne (Inner West Coast)	0.049	0.038	0.046	0.040	0.051	0.037	0.045	0.037	0.051	0.048

Highlighted cells indicate NEPM exceedances.

Table D50. Annual daily peak 1-hour ozone concentrations (ppm) for 1994-2003

AAQ NEPM Standard
0.10 ppm (1-hour average)

Regional Performance Monitoring Station	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Perth Region										
Caversham (North East Metro)	0.103	0.093	0.114	0.100	0.112	0.101	0.084	0.099	0.091	0.083
Quinns Rocks (Outer North Coast)	0.074	0.089	0.084	0.106	0.080	0.105	0.078	0.073	0.079	0.086
Rockingham (South Coast)	-	0.043	0.091	0.078	0.082	0.076	0.083	0.076	0.079	0.064
Rolling Green (Outer East Rural)	0.092	0.088	0.104	0.134	0.109	0.096	0.092	0.097	0.091	0.108
South Lake (South East Metro)	-	-	-	-	-	-	0.077	0.079	0.067	0.071
Swanbourne (Inner West Coast)	0.079	0.098	0.089	0.109	0.081	0.088	0.079	0.074	0.081	0.082

Highlighted cells indicate NEPM exceedances.

Table D51. Annual daily peak 4-hour ozone concentrations (ppm) for 1994-2003

AAQ NEPM Standard
0.08 ppm (4-hour average)

Regional Performance Monitoring Station	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Perth Region										
Caversham (North East Metro)	0.084	0.083	0.090	0.084	0.087	0.080	0.058	0.079	0.068	0.069
Quinns Rocks (Outer North Coast)	0.064	0.078	0.075	0.100	0.077	0.083	0.072	0.066	0.069	0.071
Rockingham (South Coast)	-	0.039	0.085	0.069	0.074	0.067	0.078	0.071	0.071	0.059
Rolling Green (Outer East Rural)	0.084	0.080	0.085	0.124	0.095	0.077	0.075	0.094	0.071	0.075
South Lake (South East Metro)	-	-	-	-	-	-	0.067	0.076	0.058	0.063
Swanbourne (Inner West Coast)	0.067	0.082	0.081	0.104	0.078	0.074	0.073	0.069	0.066	0.066

Highlighted cells indicate NEPM exceedances.

Table D52. Annual daily peak 1-hour sulfur dioxide concentrations (ppm) for 1994-2003

AAQ NEPM Standard
0.20 ppm (1-hour average)

Regional Performance Monitoring Station	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Perth Region										
Hope Valley (South Metro)	0.191	0.076	0.076	0.047	0.061	0.064	0.079	0.044	0.058	0.060
Rockingham (South Coast)	-	0.017	0.057	0.039	0.047	0.047	0.034	0.028	0.035	0.026
South Lake (South East Metro)	-	-	-	-	-	-	0.042	0.046	0.043	0.038
Wattleup (South Metro)	0.095	0.090	0.082	0.065	0.061	0.060	0.046	0.074	0.081	0.062

Highlighted cells indicate NEPM exceedances.

Table D53. Annual daily peak 24-hour sulfur dioxide concentrations (ppm) for 1994-2003

AAQ NEPM Standard
0.08 ppm (24-hour average)

Regional Performance Monitoring Station	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Perth Region										
Hope Valley (South Metro)	0.017	0.011	0.008	0.005	0.008	0.007	0.007	0.004	0.007	0.006
Rockingham (South Coast)	-	0.002	0.022	0.014	0.009	0.016	0.012	0.009	0.006	0.005
South Lake (South East Metro)	-	-	-	-	-	-	0.004	0.006	0.006	0.006
Wattleup (South Metro)	0.008	0.012	0.011	0.010	0.008	0.007	0.006	0.009	0.008	0.006

Highlighted cells indicate NEPM exceedances.

Table D54. Annual daily peak 24-hour particles as PM_{10} concentrations (ug/m3) for 1994-2003

AAQ NEPM Standard
50 ppm (24-hour average)

Regional Performance Monitoring Station	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Perth Region										
Duncraig (North Metro)	-	-	37.7	56.2	68.9	35.2	29.8	53.6	54.0	66.7
South Lake (South East Metro)	-	-	-	-	-	-	39.6	56.7	82.6	44.5
Bunbury Region										
Bunbury (South West Region)	-	-	-	-	-	40.0	42.4	57.6	42.5	54.5

Highlighted cells indicate NEPM exceedances.

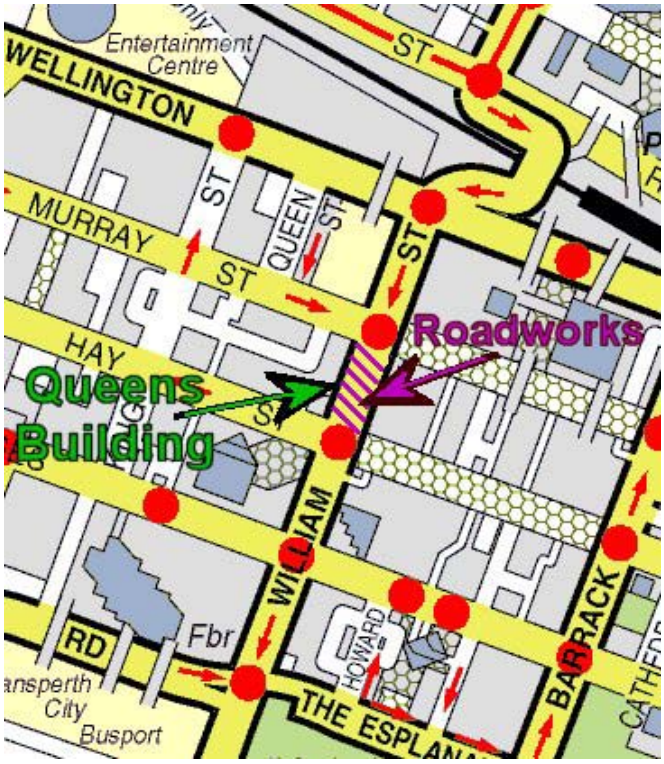
Table D55. Annual daily peak 24-hour particles as $PM_{2.5}$ concentrations (ug/m3) for 1994-2003

AAQ NEPM Advisory Standard
25 ppm (24-hour average)

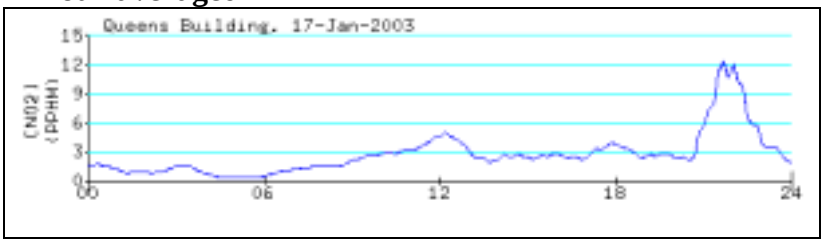
Regional Performance Monitoring Station	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Perth Region										
Caversham (North East Metro)	32.7	21.4	37.6	28.1	21.2	20.3	20.1	31.8	25.7	27.3
Duncraig (North Metro)	20.0	39.7	30.1	44.2	31.8	26.3	22.2	27.0	28.3	25.2
Bunbury Region										
Bunbury (South West Region)	-	-	-	35.4	33.2	30.0	29.2	47.3	36.1	37.6

Highlighted cells indicate NEPM exceedances.

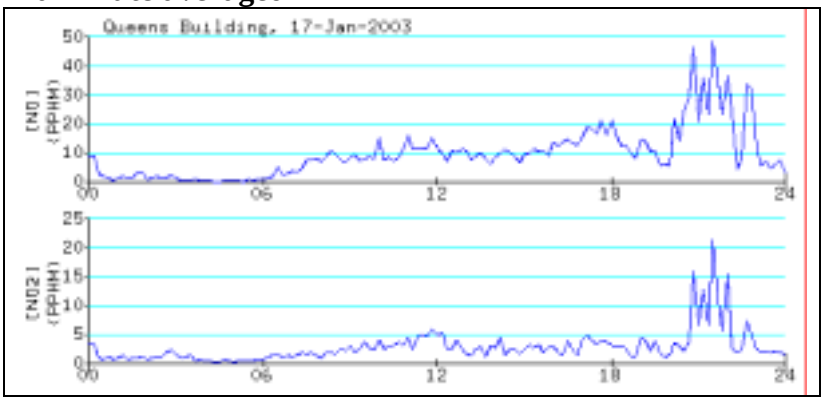
ATTACHMENT 1 - NO_2 Exceedance on 17 January 2003



1 hour averaged



10 minute averaged



Pollutant

NO_2

Monitoring Site

Queens Buildings (CBD)

Highest Concentration

0.121 ppm

Averaging Period

1 hour

NEPM Standard

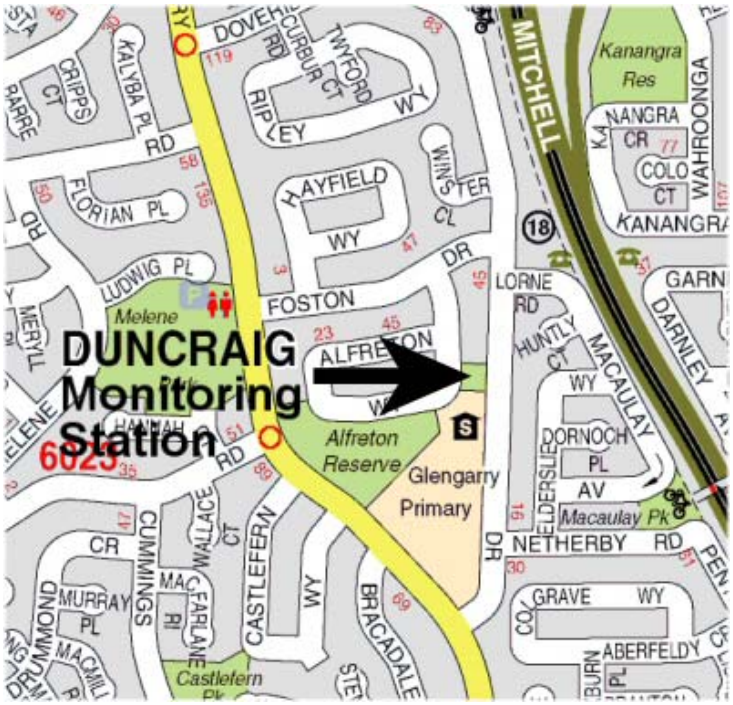
0.12 ppm

Description of Event

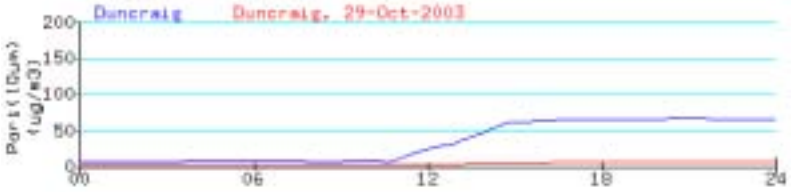
Perth City Council advised that road reconstruction took place in William Street between Murray and Hay Streets from 6pm on January 17th 2003 to 6am on January 20th 2003.

NOx emissions from road machinery was the most likely cause of the NO_2 exceedence.

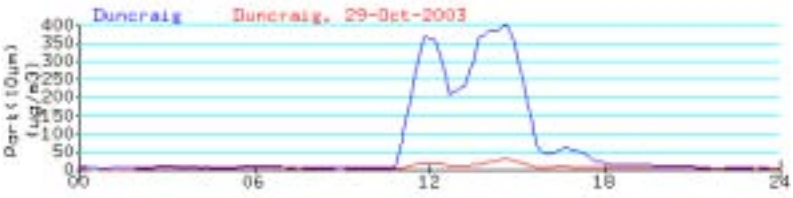
ATTACHMENT 2 – PM_{10} Exceedance on 29 October 2003



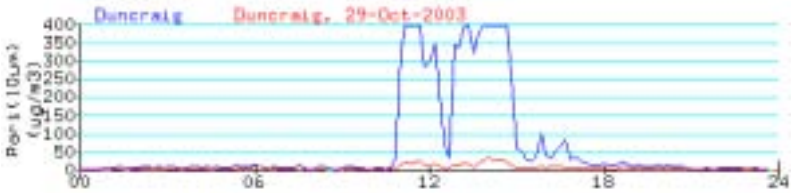
24 hour averaged



1 hour averaged



10 minute averaged



Pollutant

PM_{10}

Monitoring Site

Duncraig

Highest Concentration

PM_{10} – 66.7 µg/m^3
$PM_{2.5}$ – 7.2 µg/m^3

Averaging Period

24 hours

NEPM Standard

PM_{10} – 50 µg/m^3
$PM_{2.5}$ – 25 µg/m^3

Description of Event

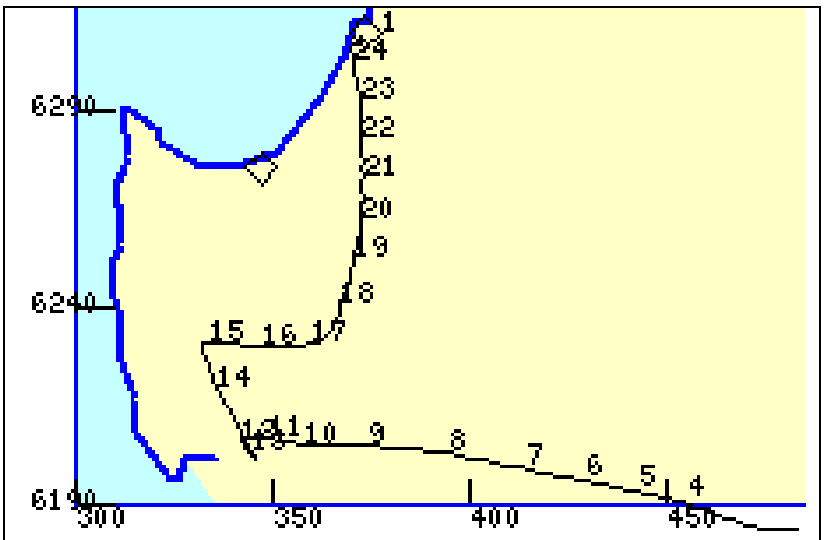
The area within the fence line which protects the monitoring station and a compensating basin was graded on 29/10/2003. A comparison of PM_{10} to $PM_{2.5}$ indicates a high proportion of larger crustal particles consistent with earth works.

The TEOM recorded its maximum concentration of approximately 400 µg/m^3 several times during the day which suggests the actual concentrations exceeded the capability of the monitor to record the event.

TIME	PM10	TIME	PM10
1050	35.65	1310	397.56
1100	319.17	1320	399.39
1110	399.27	1330	321.25
1120	396.58	1340	376.92
1130	396.34	1350	399.27
1140	399.27	1400	399.27
1150	285.23	1410	399.27
1200	300.73	1420	399.27
1210	348.84	1430	399.39
1220	210.13	1440	399.27
1230	66.91	1450	217.70
1240	32.23	1500	59.34
1250	345.67		
1300	337.48		

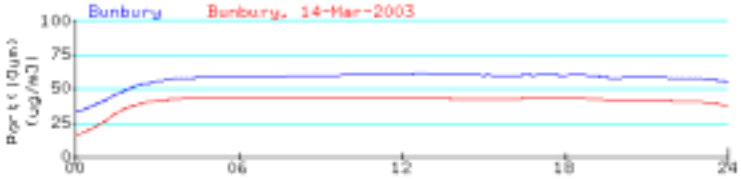
Removing these values results in the daily average concentration of PM_{10} for 29/10/2003 reducing to 25.8 µg/m^3.

ATTACHMENT 3 - PM_{10} and $PM_{2.5}$ Exceedance on 14 March 2003

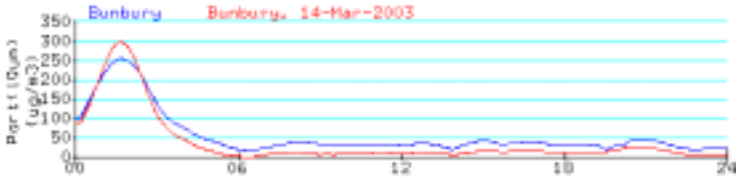


Back trajectory from Bunbury, ending at 0100 hours on 14/03/2003.

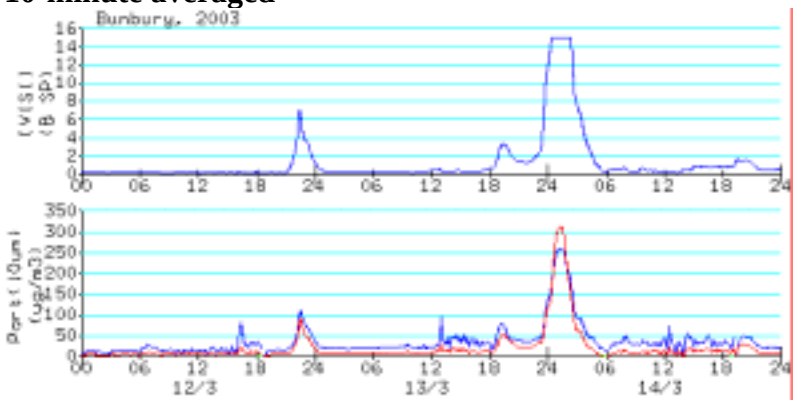
24 hour averaged



1 hour averaged



10-minute averaged



Pollutant

PM_{10}, $PM_{2.5}$

Monitoring Site

Bunbury

Highest Concentration

PM_{10} – 54.5 ug/m^3
$PM_{2.5}$ – 37.6 ug/m^3

Averaging Period

24 hours

NEPM Standard

PM_{10} – 50.0 ug/m^3
$PM_{2.5}$ – 25.0 ug/m^3

Description of Event

See article from "*The West Australian*" on March 13th 2003 reproduced below.

Month-old bushfire takes toll on wilderness

By Eloise Dortch
A FIRE started by lightning strikes a month ago has become the biggest single WA bushfire in 36 years.

The fire, started in heavy fuel-loaded forests north-east of Walpole, is the biggest that the Department of Conservation and Land Management has fought since 1967. It has jumped containment lines into five forest blocks.

At least 39,000 ha of the proposed Walpole Wilderness Area national park, described in a 1998 study as one of the South-West's most biodiverse, will have been severely burnt by the time it reaches containment lines in the next few days.

The area includes jarrah, karri, wandoo forests, sedge and heather woodlands and peat wetlands, the habitat of the rare sunset frog.

CALM regional services manager Alan Walker said it could take decades for the fauna and flora to re-colonise. Forecasts of possible thunderstorms and northerly winds in the next few days also cast doubt on whether the fire could be contained to edging lines.

Two water bombers, a helicopter, 36 fire trucks, five earthmoving machines and 100 CALM and volunteer bush fire brigade personnel had worked to contain the fire.

On Sunday, wind gusts up to 70kmh, combined with high temperatures, had fanned a fire that had been smoldering in Northumberland block south of Rocky Gully since a lightning strike on February 10.

Mr Walker rejected criticism by a Denmark volunteer firefighter for the past 30 years, Tony Pedro, that CALM should have put out the original fire during earlier cooler, calmer weather using bulldozers.

"This fire has been extremely difficult to contain because of a lack of access and environmental considerations associated with using bulldozers," Mr Walker said. "It can take decades for bulldozer lines to be fully rehabilitated."

http://www.thewest.com.au/20030313/news/state/tw-news-state-home-sto91189.html

Notes:

Nephelometer went full scale for 2-hours (blue).

$PM_{2.5}$ is greater than PM_{10} for about 1.5 hours (red).

	B SP	T2.5	PD25	T10	PD10
0010	13.97	131.5	50.6	149.4	43.5
0020	15.01	162.3	51.6	176.1	43.7
0030	15.01	210.4	56.2	209.8	44.0
0040	15.01	257.3	62.4	228.7	44.2
0050	15.01	287.4	65.5	247.5	44.4
0100	15.01	301.9	67.3	257.0	44.7
0110	15.01	310.3	68.9	259.3	44.9
0120	15.01	311.8	69.4	257.1	45.2
0130	15.01	305.4	69.2	255.9	45.5
0140	15.01	283.3	66.6	251.6	45.8
0150	15.01	244.6	62.5	228.8	45.9
0200	15.01	210.6	58.9	215.8	46.1
0210	15.01	169.0	53.9	195.8	46.3
0220	14.92	147.2	53.7	175.9	46.5
0230	12.44	120.9	53.7	147.6	46.5

ATTACHMENT 4 - $PM_{2.5}$ Exceedance on 05 May 2003

Pollutant

$PM_{2.5}$

Monitoring Site

Bunbury

Highest Concentration

$PM_{2.5}$ – 25.9 µg/m^3 (BN)

Averaging Period

24 hours

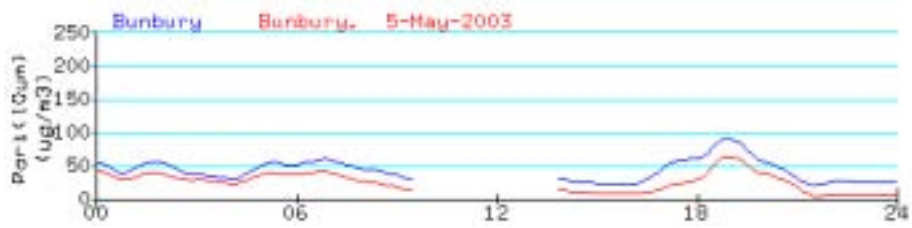
NEPM Advisory Standard

$PM_{2.5}$ – 25 µg/m^3

Description of Event

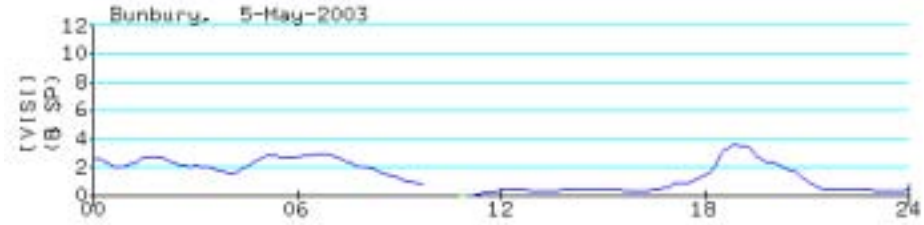
Various controlled fuel reduction burns were conducted in the south west during 05/05/2003. The total area was approximately 2,000 hectares.

1 hour averaged



Note: The **blue** trace represents the PM_{10} concentration and the **red** trace represents the $PM_{2.5}$ concentration**.**

1 hour averaged



ATTACHMENT 5 - $PM_{2.5}$ Exceedance on 08 November 2003

Pollutant

$PM_{2.5}$

Monitoring Site

Bunbury and
Duncraig

Highest Concentration

$PM_{2.5}$ – 27.5 µg/m^3 (BN)
$PM_{2.5}$ – 25.2 µg/m^3 (DU)

PM_{10} – 34.3 µg/m^3 (BN)
PM_{10} – 39.5 µg/m^3 (DU)

Averaging Period

24 hours

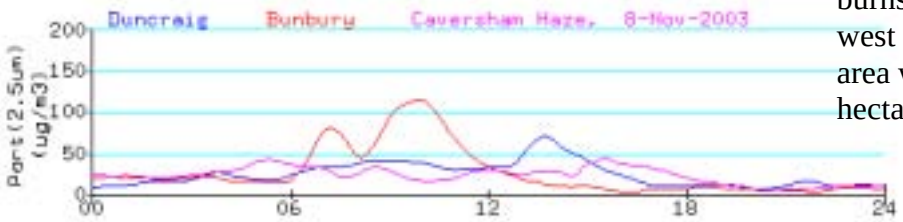
NEPM Advisory Standard

$PM_{2.5}$ – 25 µg/m^3

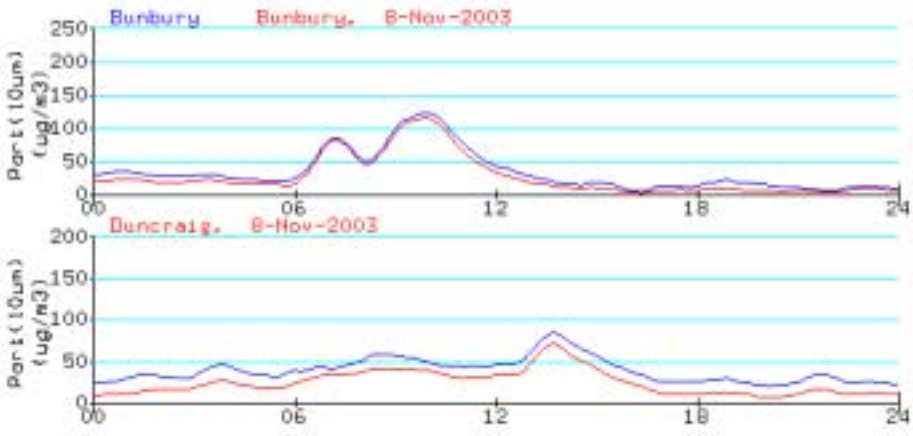
Description of Event

Various controlled fuel reduction burns were conducted in the south west during 7/11/2003. The total area was approximately 12,000 hectares.

1 hour averaged

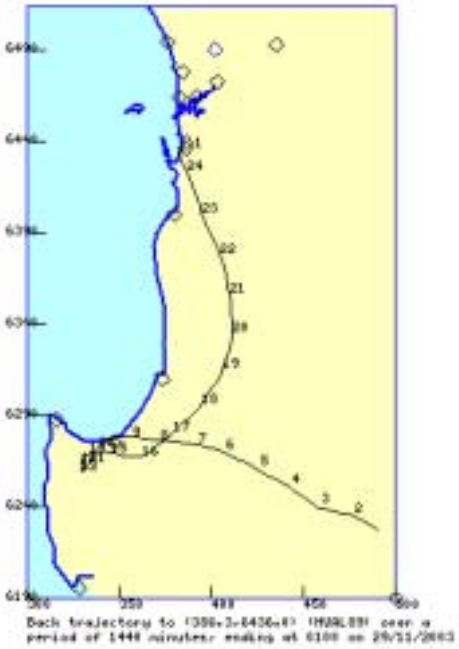


1 hour averaged

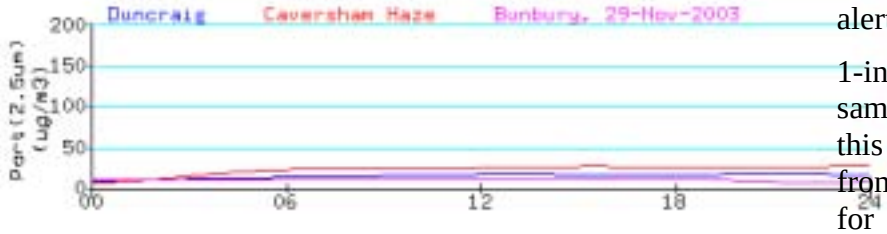


Note: The **blue** trace represents the PM_{10} concentration and the **red** trace represents the $PM_{2.5}$ concentration.

ATTACHMENT 6 - $PM_{2.5}$ Exceedance on 29 November 2003



24 hour averaged



1 hour averaged

10 minute averaged

Pollutant

$PM_{2.5}$

Monitoring Site

Caversham

Highest Concentration

$PM_{2.5}$ – 27.3 µg/m^3 (CA)
$PM_{2.5}$ – 17.2 µg/m^3 (DU)
$PM_{2.5}$ – 8.8 µg/m^3 (BN)

PM_{10} – 28.5 µg/m^3 (DU)
PM_{10} – 33.9 µg/m^3 (SL)
PM_{10} – 15.4 µg/m^3 (BN)

Averaging Period

24 hours

NEPM Advisory Standard

$PM_{2.5}$ – 25 µg/m^3

Description of Event

See attached for CALM smoke alert..

1-in-6 day PM_{10} high-volume air samplers were in operation during this event. PM_{10} concentrations from these filters will be available for Caversham, Swanbourne, Duncraig and Queens Building following the conditioning and weighing of the filters.

Concentrations for the previous day **28-11-2003** are as follows:

$PM_{2.5}$ – 8.4 µg/m^3 (CA)
$PM_{2.5}$ – 8.6 µg/m^3 (DU)
$PM_{2.5}$ – 12.2 µg/m^3 (BN)

PM_{10} – 15.0 µg/m^3 (DU)
PM_{10} – 14.2 µg/m^3 (SL)
PM_{10} – 20.1 µg/m^3 (BN)

Smoke

A l e r t

28 November 2003

Metropolitan area – 2000 hours

The Department of Conservation and Land Management has warned there may be smoke over parts of the metropolitan area and Mandurah early tomorrow morning as a result of prescribed burning in the south-west and other burning on private lands and by volunteer bush fire brigades.

The Department today carried out several prescribed burns in areas around Chittering, Dwellingup, Bridgetown, Margaret River, Manjimup, Nannup and Harvey.

South-west winds are driving the smoke north along the Darling Scarp. Overnight south to south-easterlies will tend to push the smoke back over the Swan Coastal Plain. This smoke will mix with other smoke currently offshore and may be trapped under a weak temperature inversion in the morning leading to hazy conditions.

The Department's State Fire Duty Officer Roger Armstrong said the prescribed burns had been conducted for a range of purposes.

"For example, a burn in the Hester forest block near Bridgetown has been carried out at the request of the community and surrounding land owners while another burn near Jewel Cave, south of Margaret River, aims to reduce the build up of leaves and twigs to improve water penetration into the cave system," he said.

Mr Armstrong says the Department apologises for any inconvenience the smoke may cause. However, is expected to dissipate during the morning. People with conditions that are exacerbated by smoke should follow their medical advice.

ATTACHMENT 7 – Graphical Trends

This attachment provides graphical representations of tables D8 to D44 of Section D. Each graph show the maximum, 99th percentile, 98th percentile, 95th percentile and 90th percentile of daily maximum concentration for all pollutants monitored by the Department of Environment in Western Australia. The nominated percentiles can also be expressed as an Nth highest concentration. Based on 100% 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

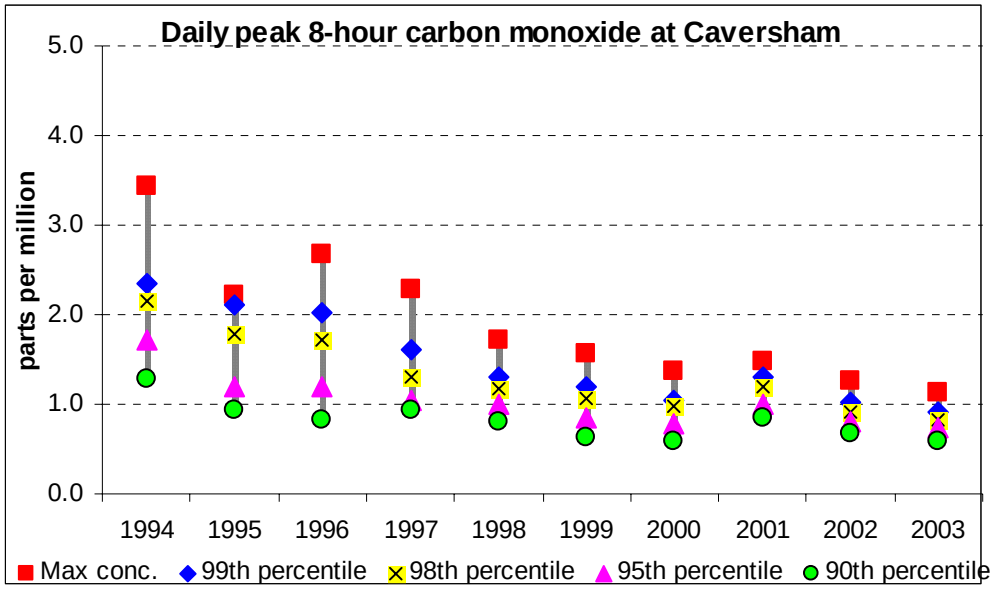


Figure A7-1 - 8-hour carbon monoxide at Caversham

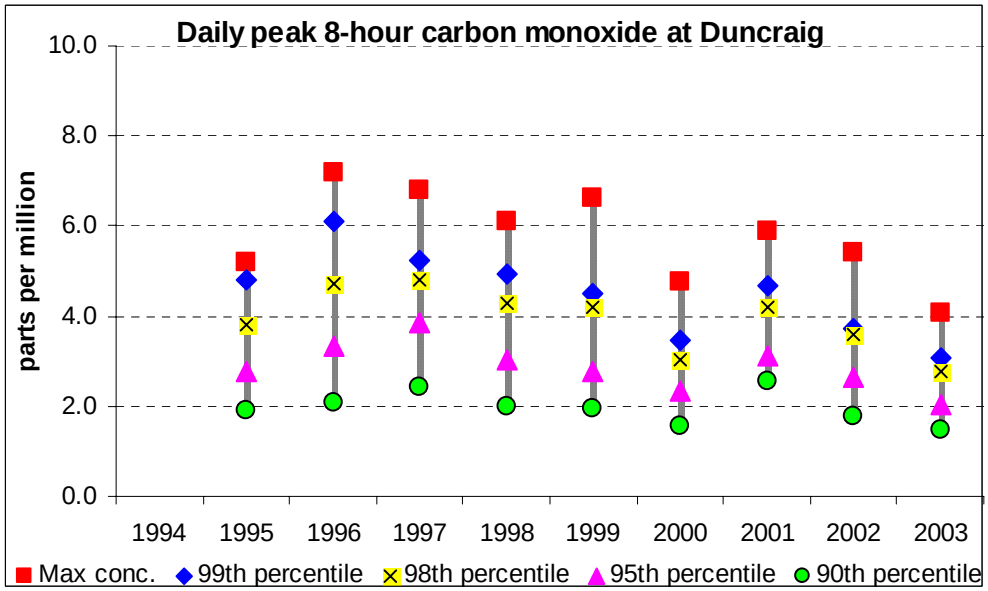


Figure A7-2 - 8-hour carbon monoxide at Duncraig

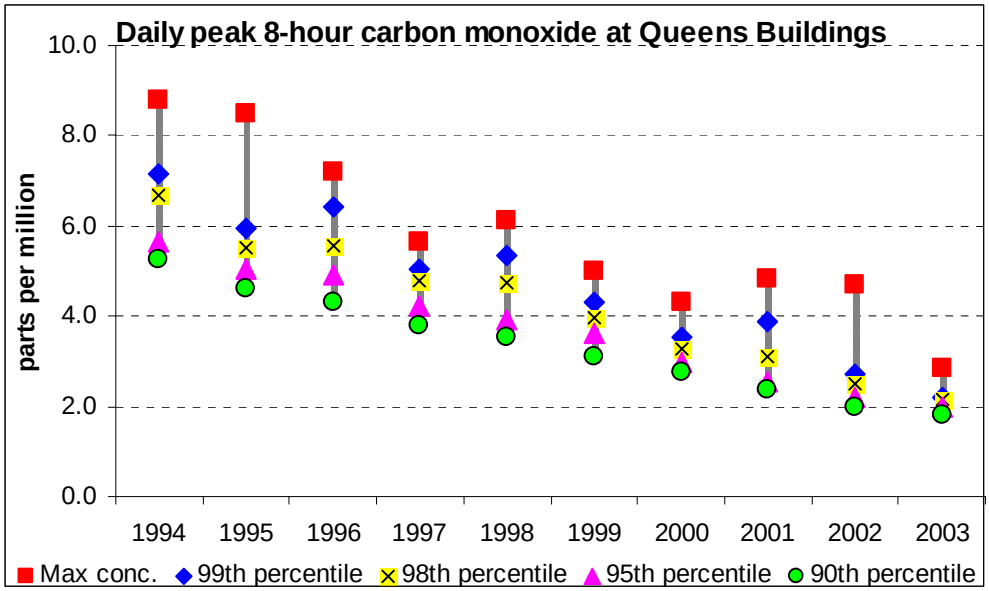


Figure A7-3 - 8-hour carbon monoxide at Queens Buildings

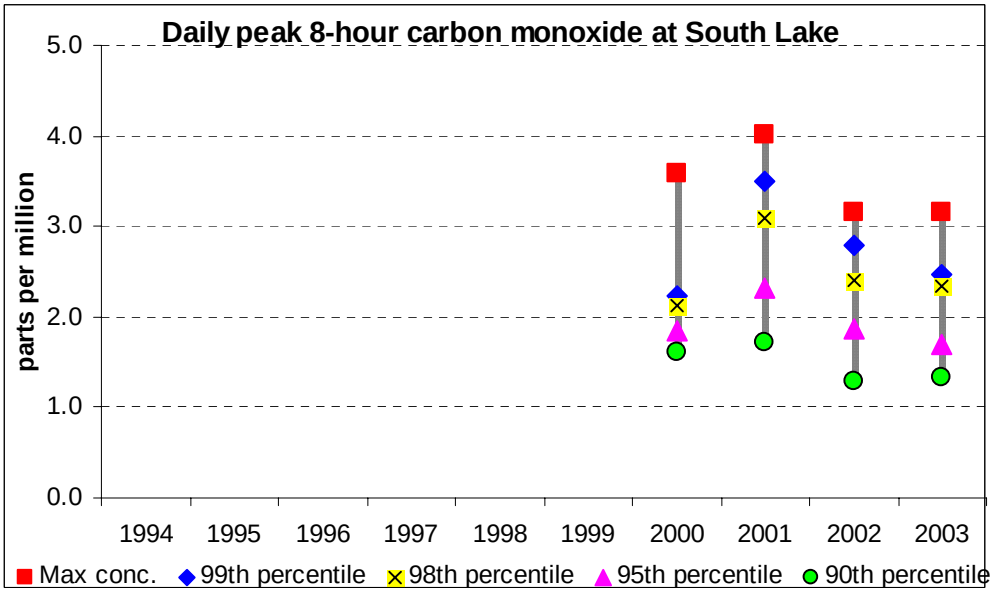


Figure A7-4 - 8-hour carbon monoxide at South Lake

Nitrogen dioxide

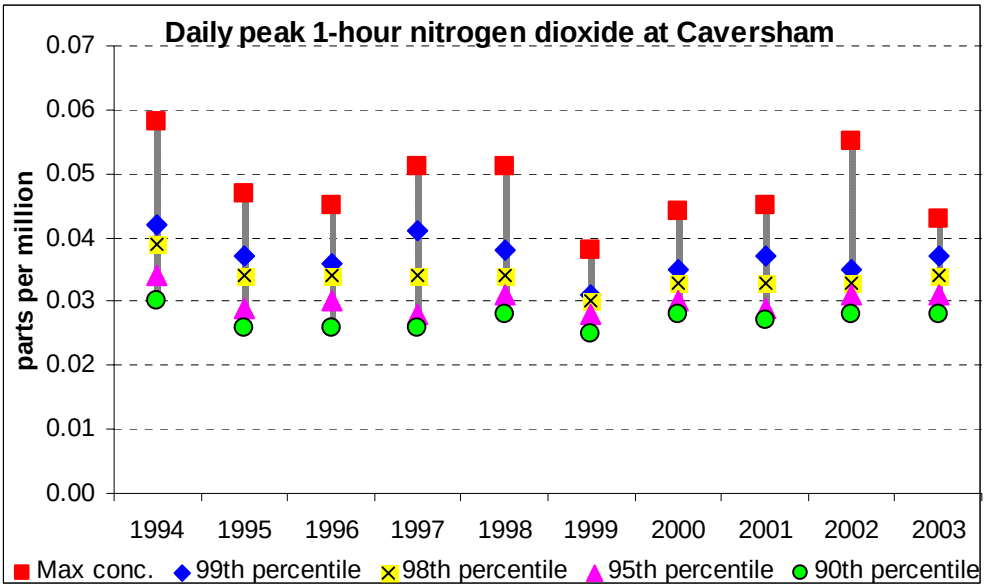


Figure A7-5 - 1-hour nitrogen dioxide at Caversham

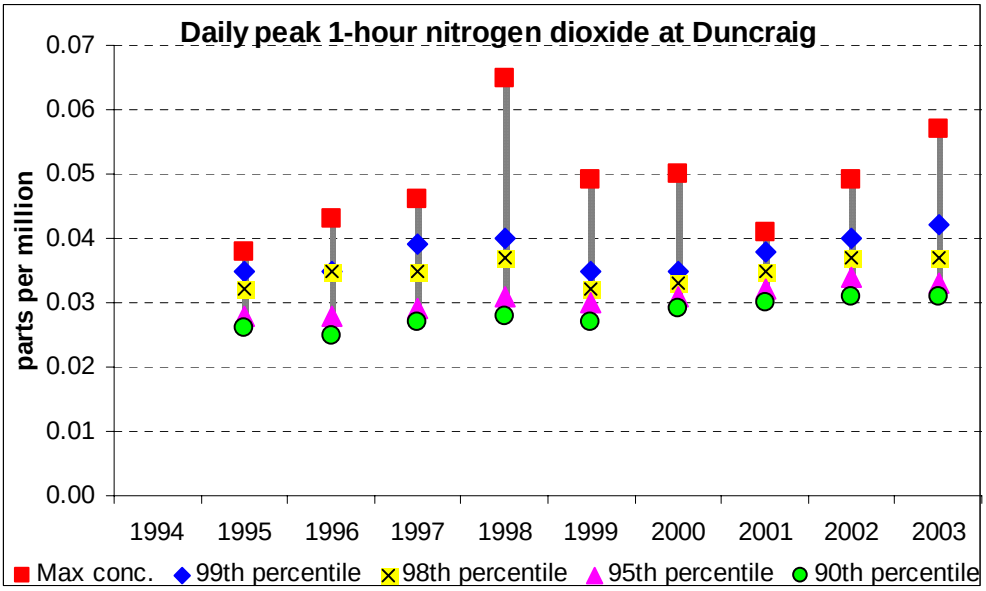


Figure A7-6 - 1-hour nitrogen dioxide at Duncraig

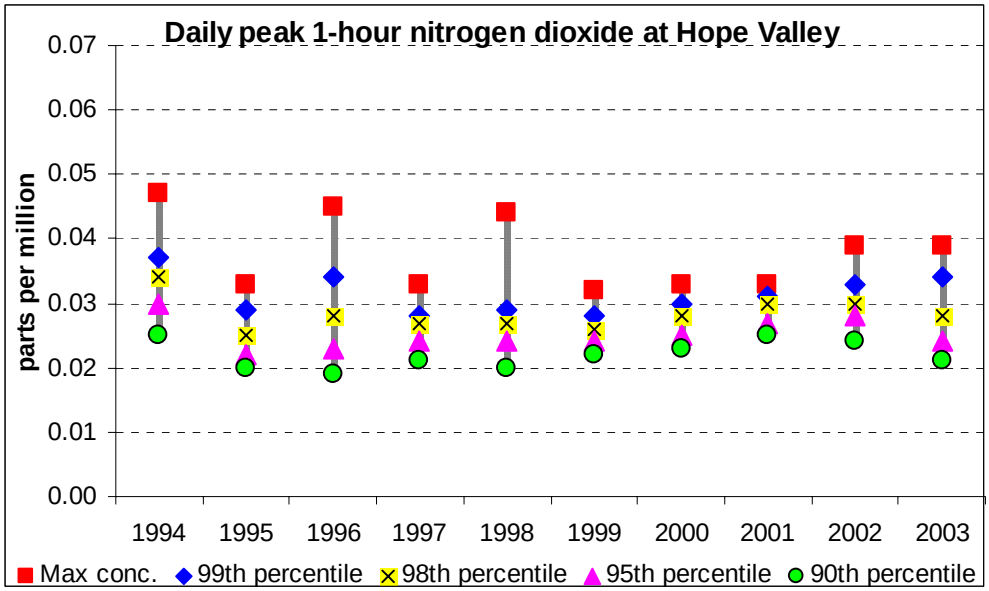


Figure A7-7 - 1-hour nitrogen dioxide at Hope Valley

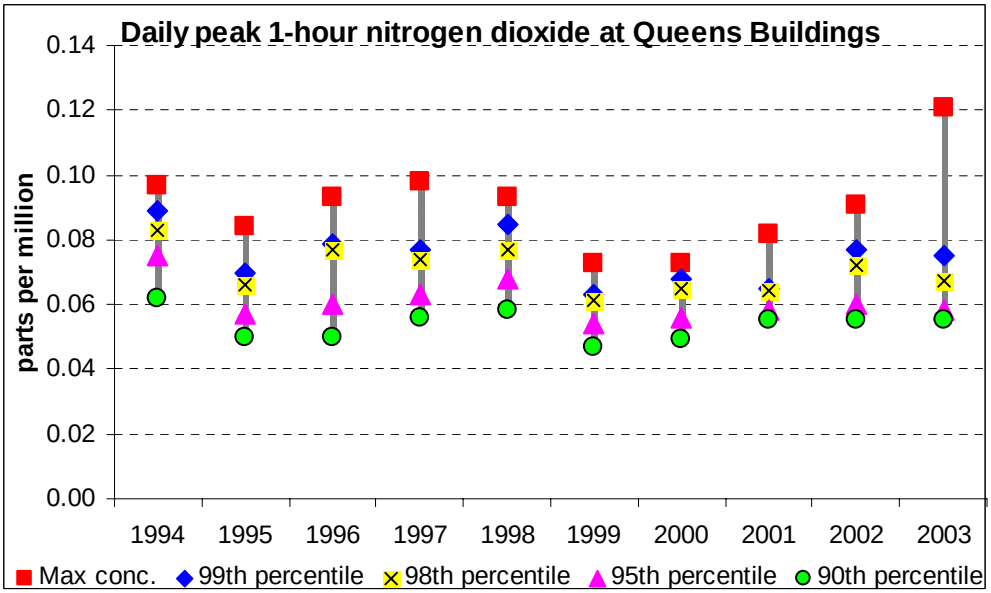


Figure A7-8 - 1-hour nitrogen dioxide at Queens Buildings

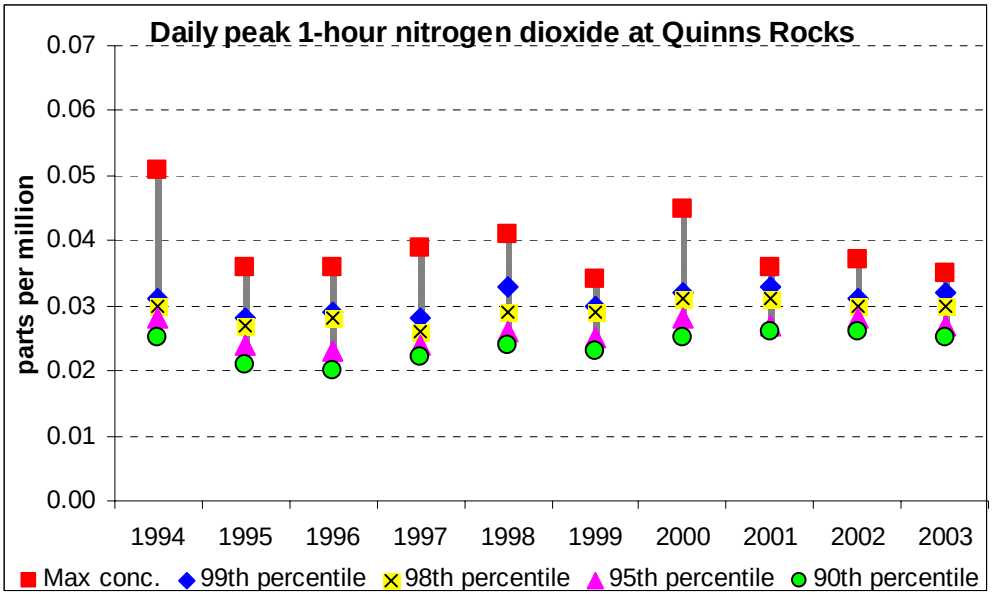


Figure A7-9 - 1-hour nitrogen dioxide at Quinns Rocks

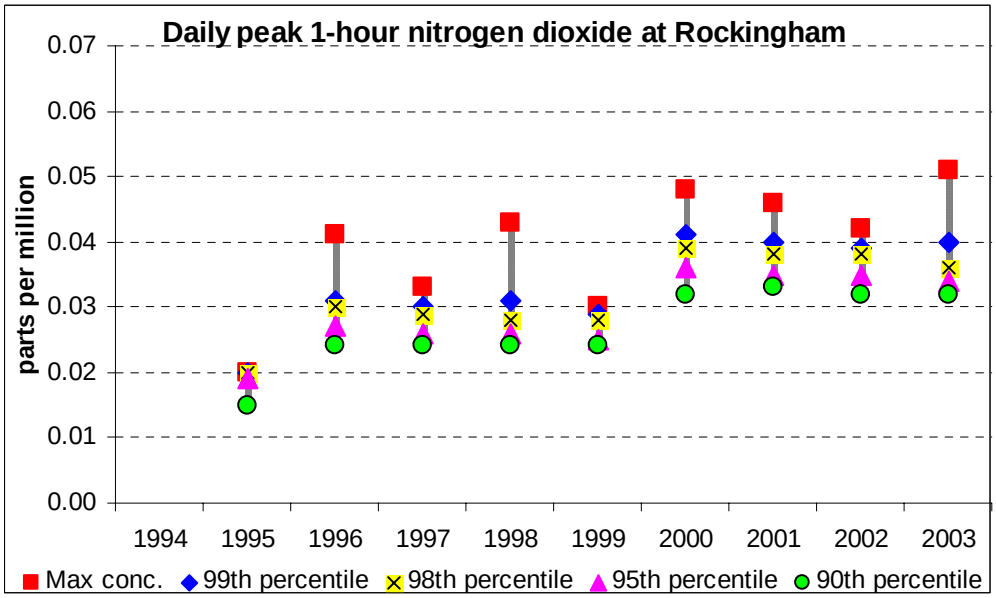


Figure A7-10 - 1-hour nitrogen dioxide at Rockingham

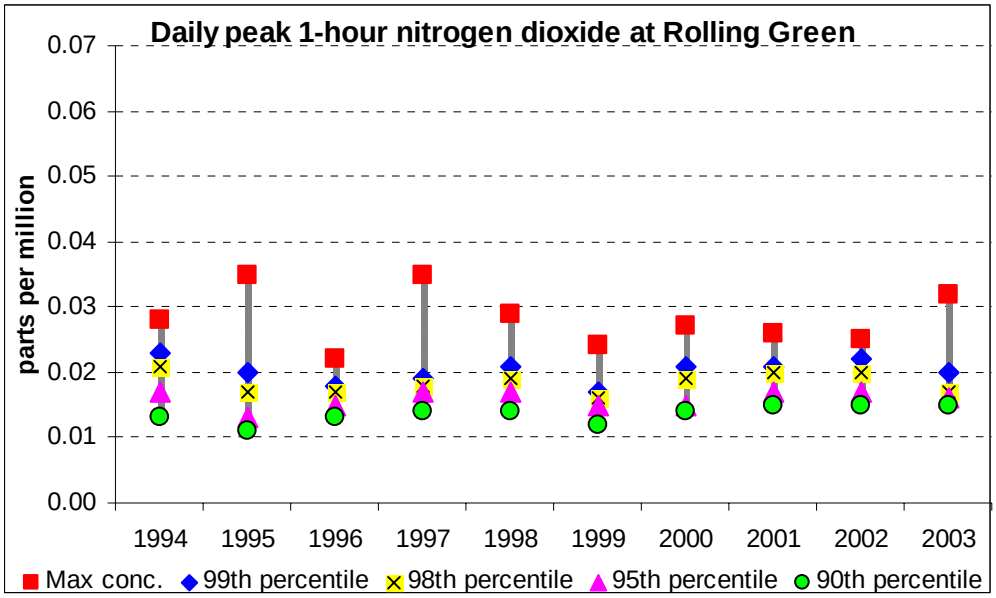


Figure A7-11 - 1-hour nitrogen dioxide at Rolling Green

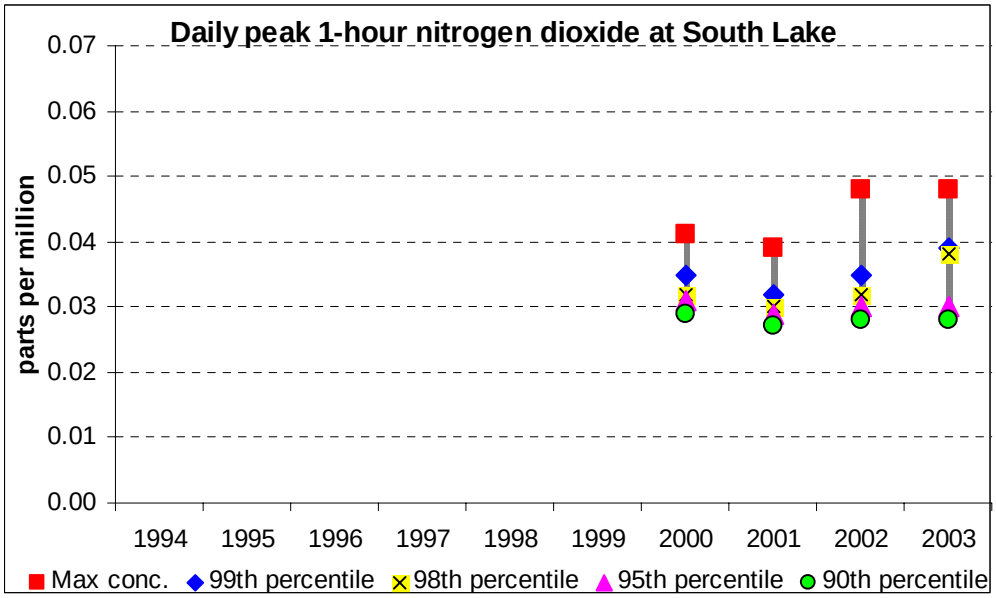


Figure A7-12 - 1-hour nitrogen dioxide at South Lake

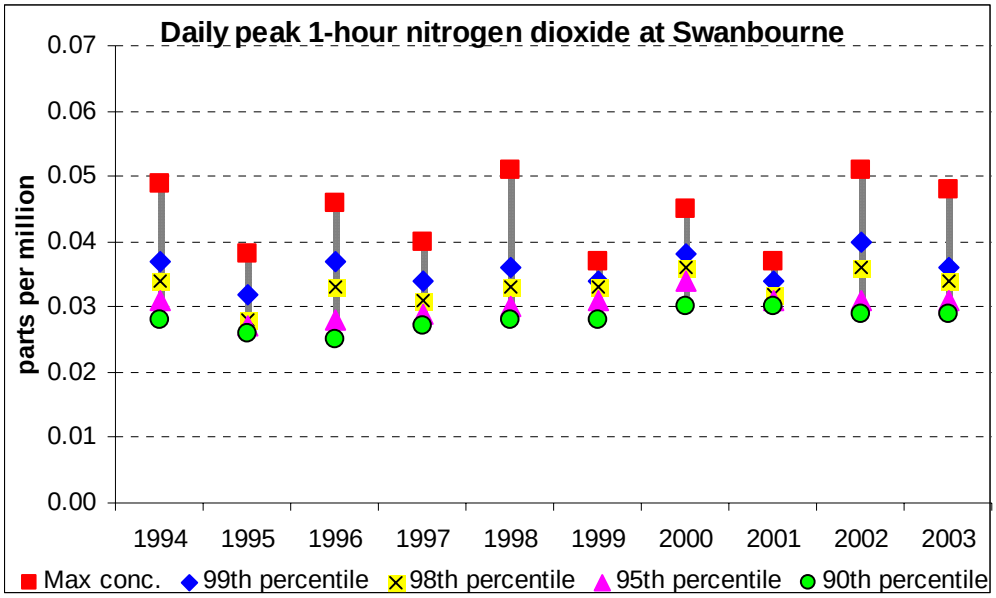


Figure A7-13 - 1-hour nitrogen dioxide at Swanbourne

Ozone

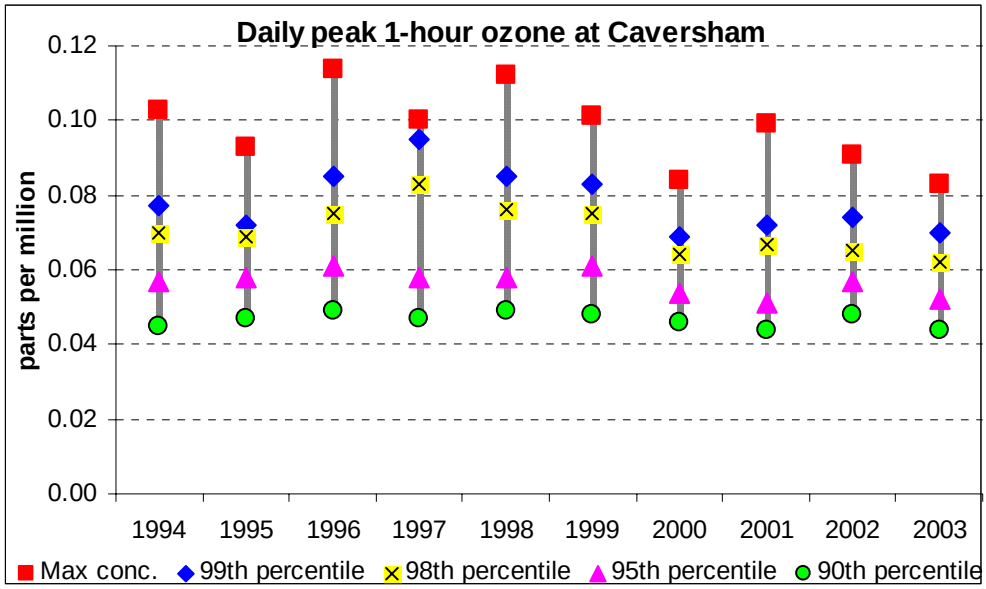


Figure A7-14 - 1-hour ozone at Caversham

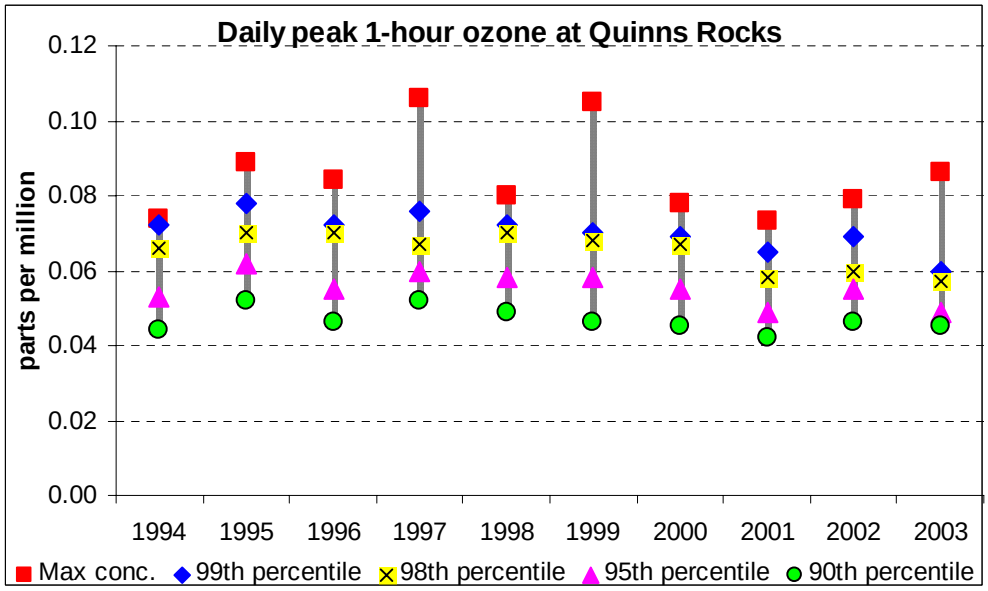


Figure A7-15 - 1-hour ozone at Quinns Rocks

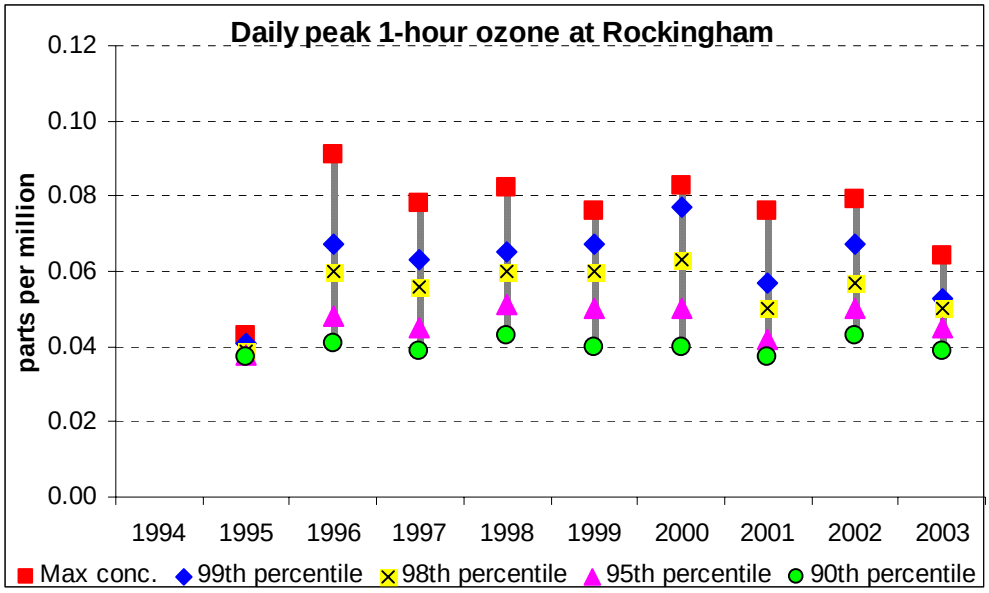


Figure A7-16 - 1-hour ozone at Rockingham

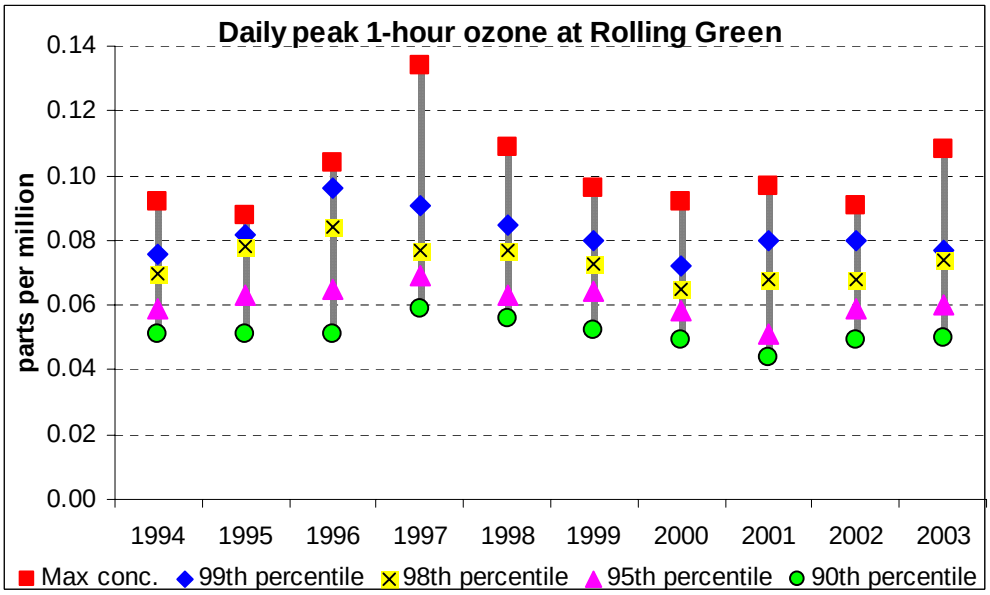


Figure A7-17 - 1-hour ozone at Rolling Green

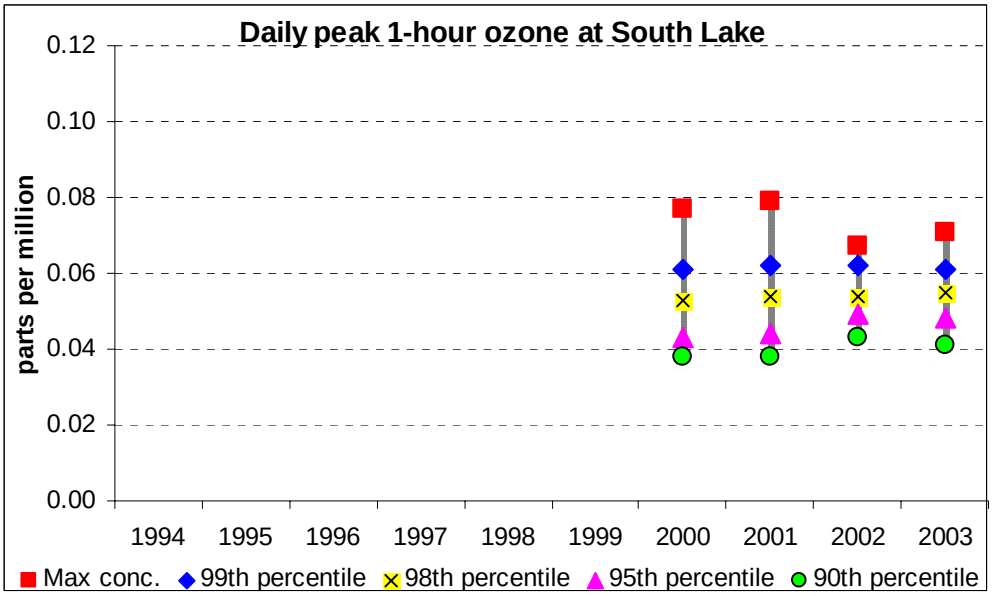


Figure A7-18 - 1-hour ozone at South Lake

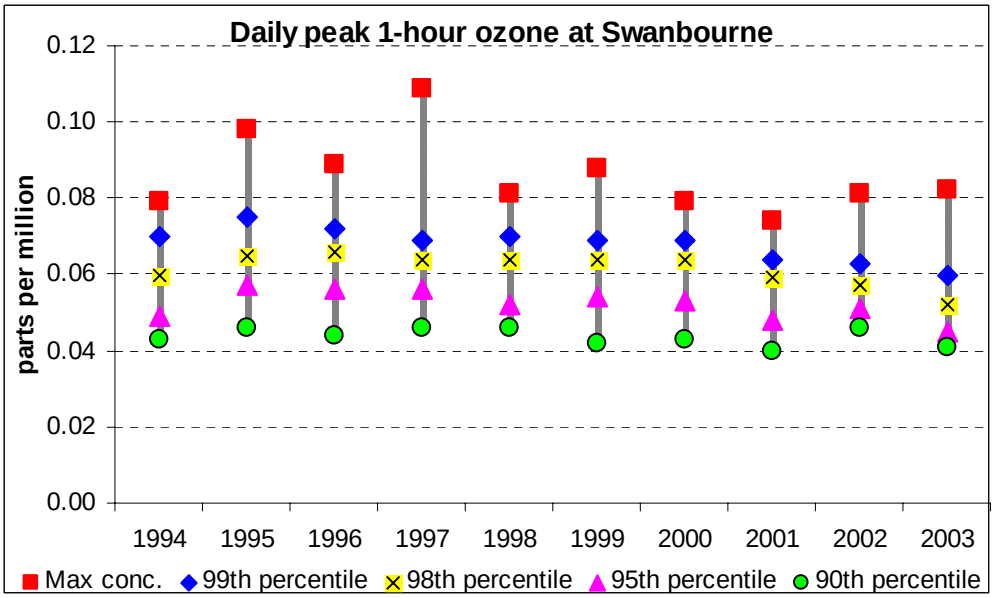


Figure A7-19 - 1-hour ozone at Swanbourne

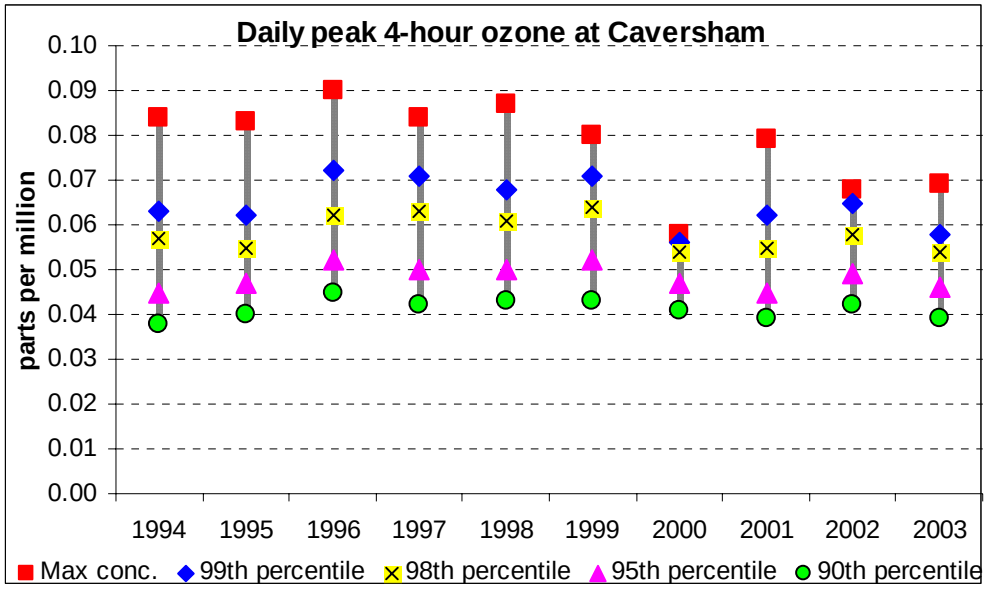


Figure A7-20 - 4-hour ozone at Caversham

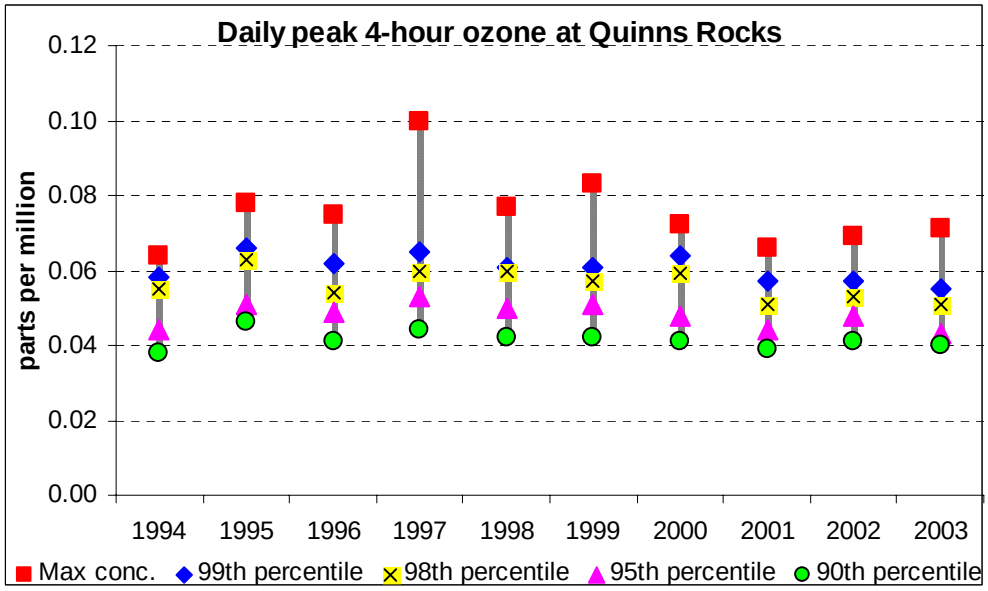


Figure A7-21 - 4-hour ozone at Quinns Rocks

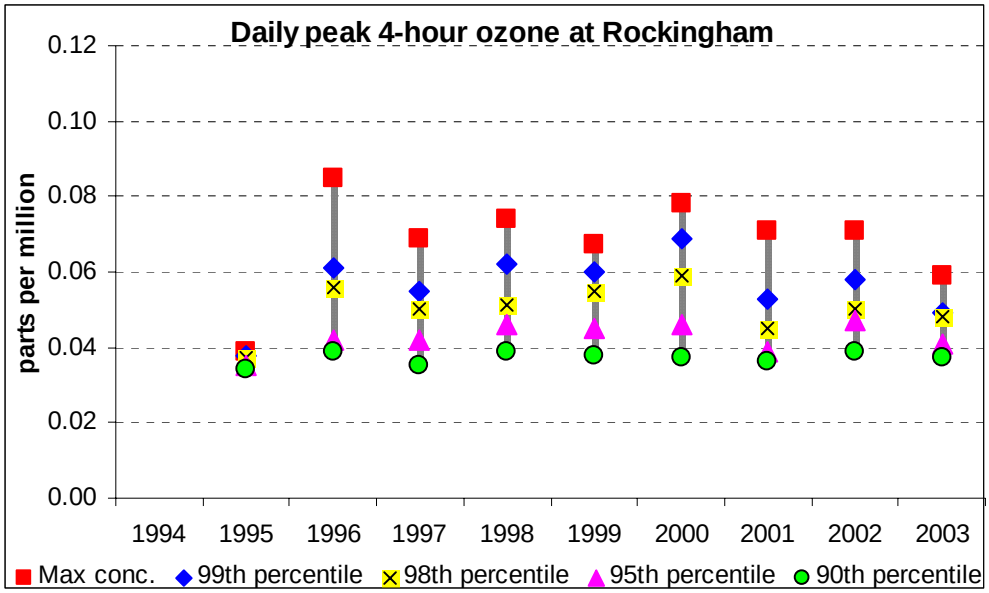


Figure A7-22 - 4-hour ozone at Rockingham

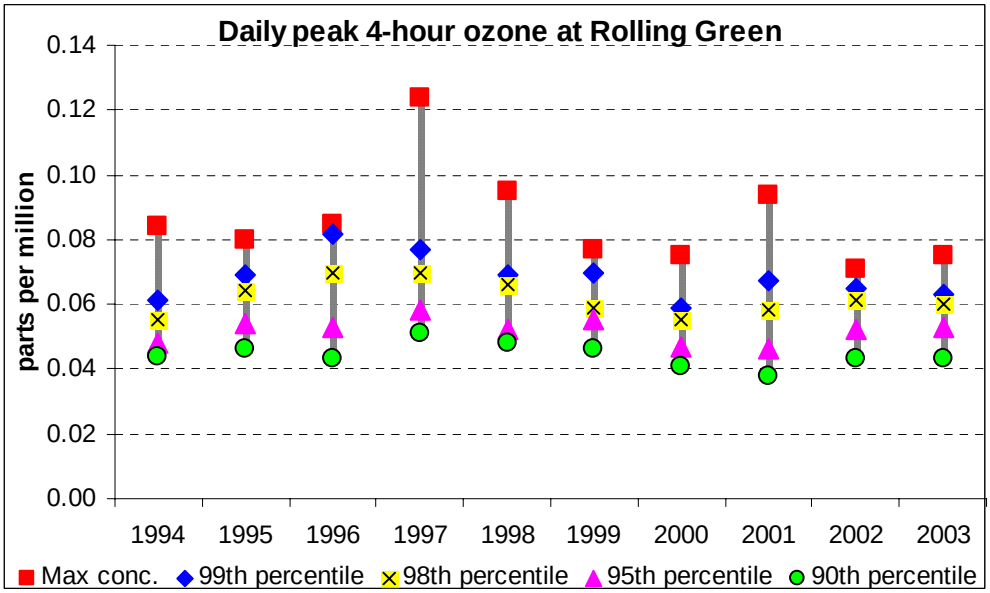


Figure A7-23 - 4-hour ozone at Rolling Green

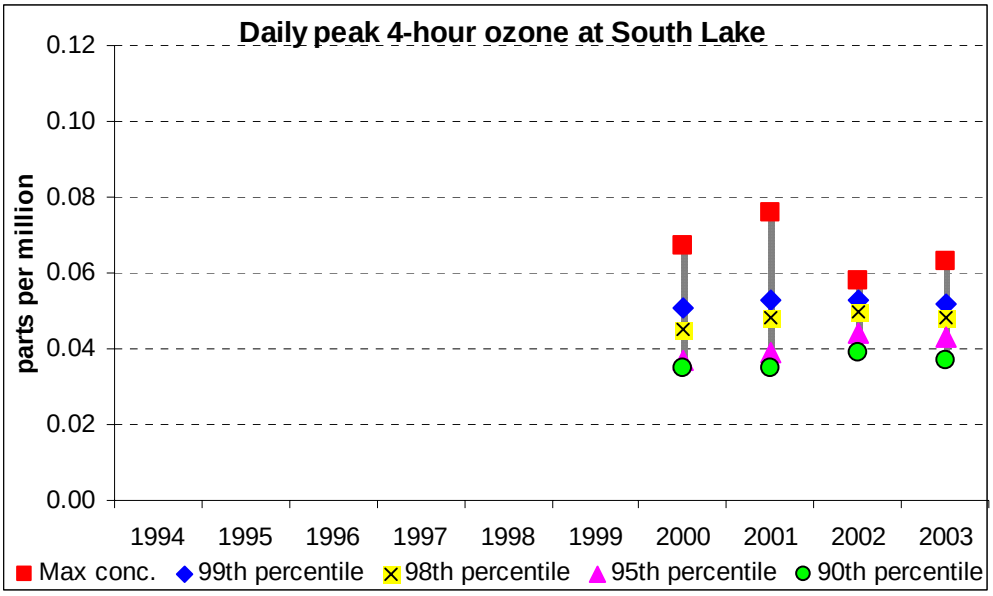


Figure A7-24 - 4-hour ozone at South Lake

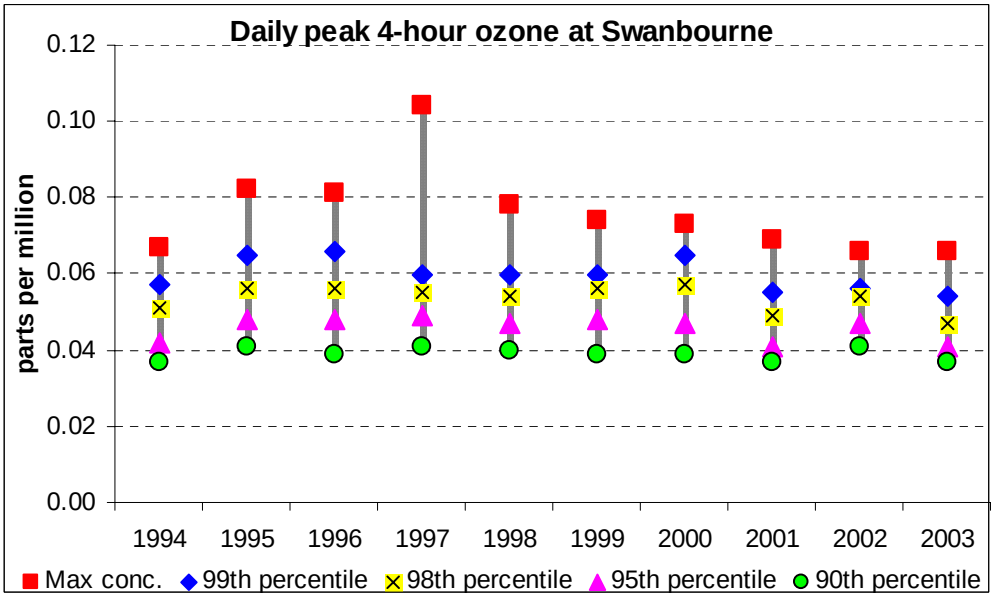


Figure A7-25 - 4-hour ozone at Swanbourne

Sulfur dioxide

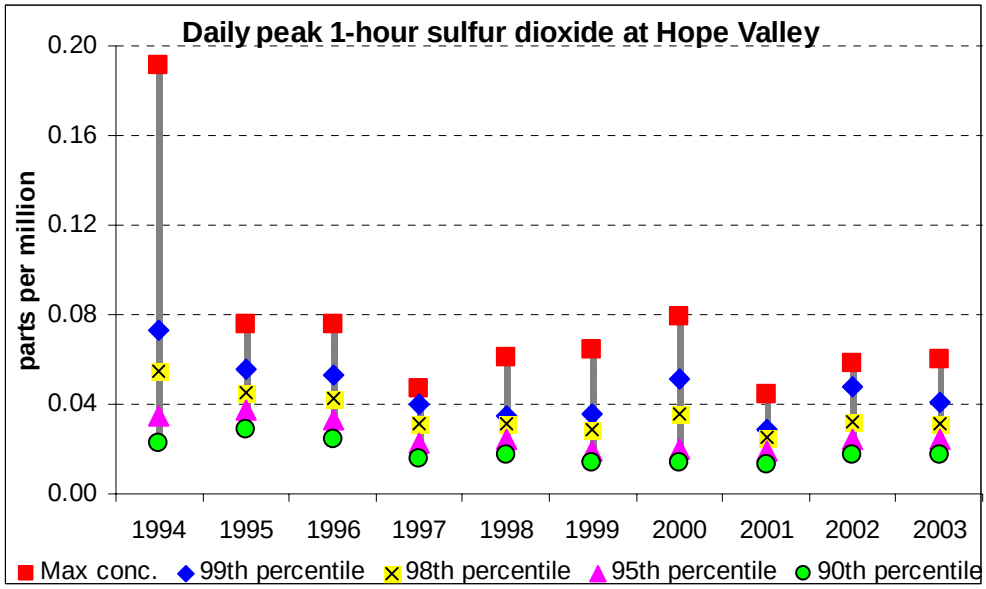


Figure A7-26 - 1-hour sulfur dioxide at Hope valley

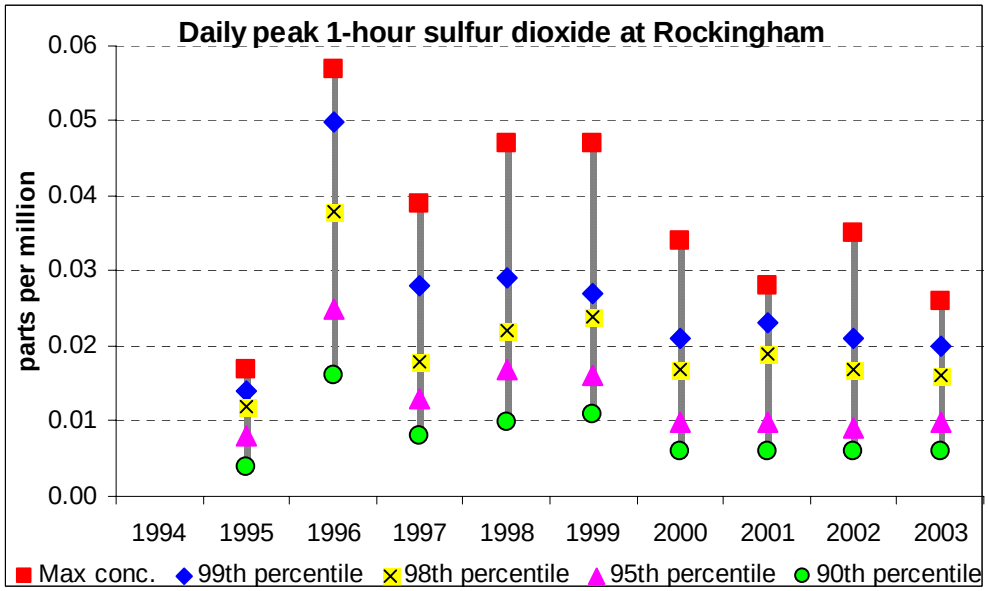


Figure A7-27 - 1-hour sulfur dioxide at Rockingham

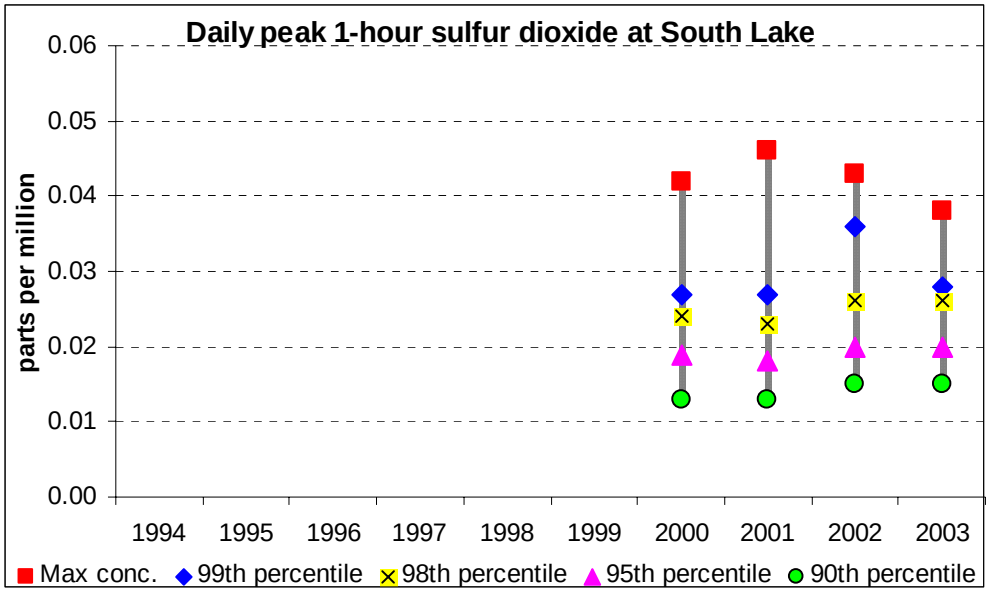


Figure A7-28 - 1-hour sulfur dioxide at South Lake

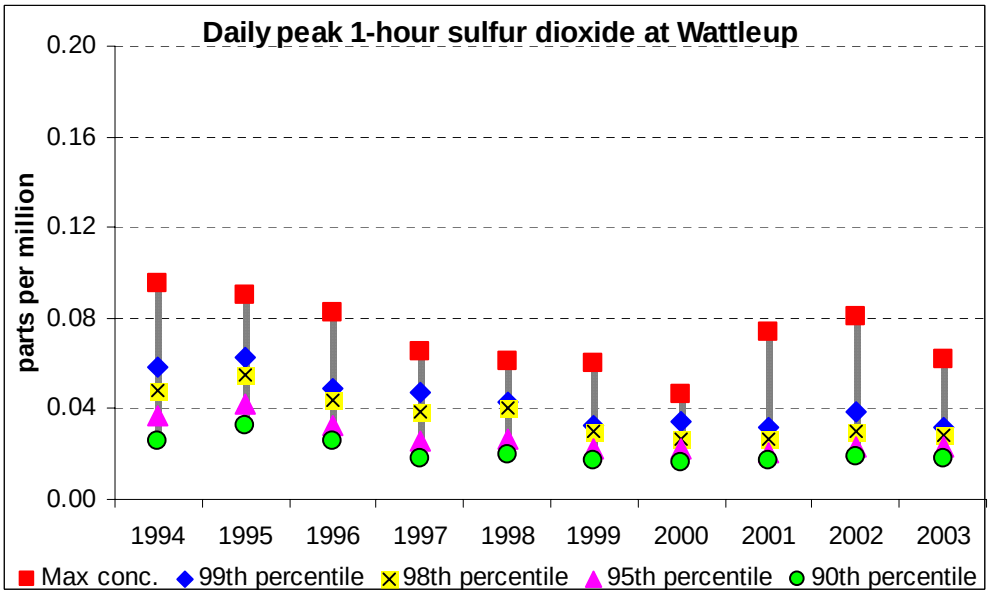


Figure A7-29 - 1-hour sulfur dioxide at Wattleup

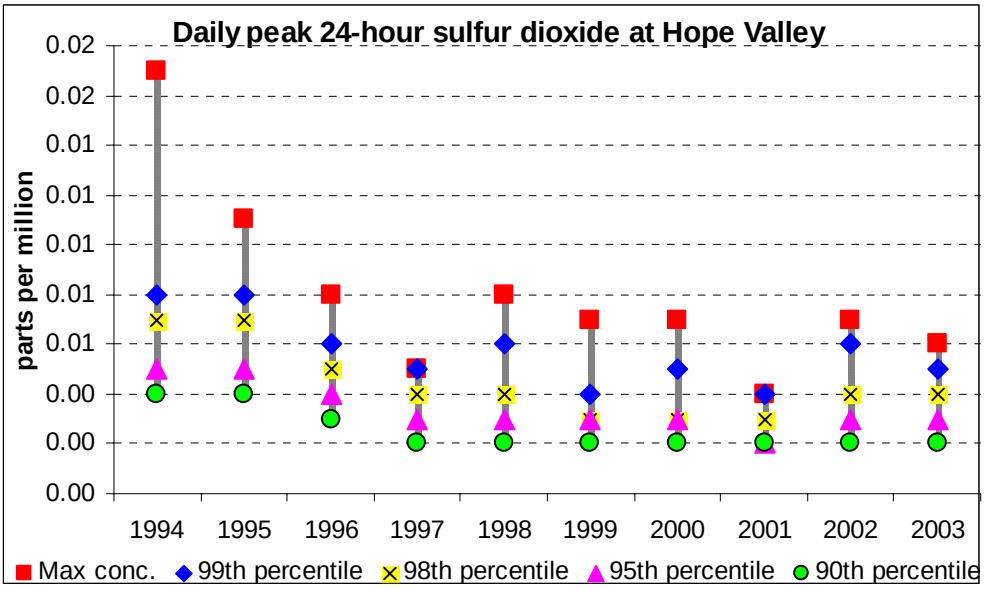


Figure A7-30 - 24-hour sulfur dioxide at Hope Valley

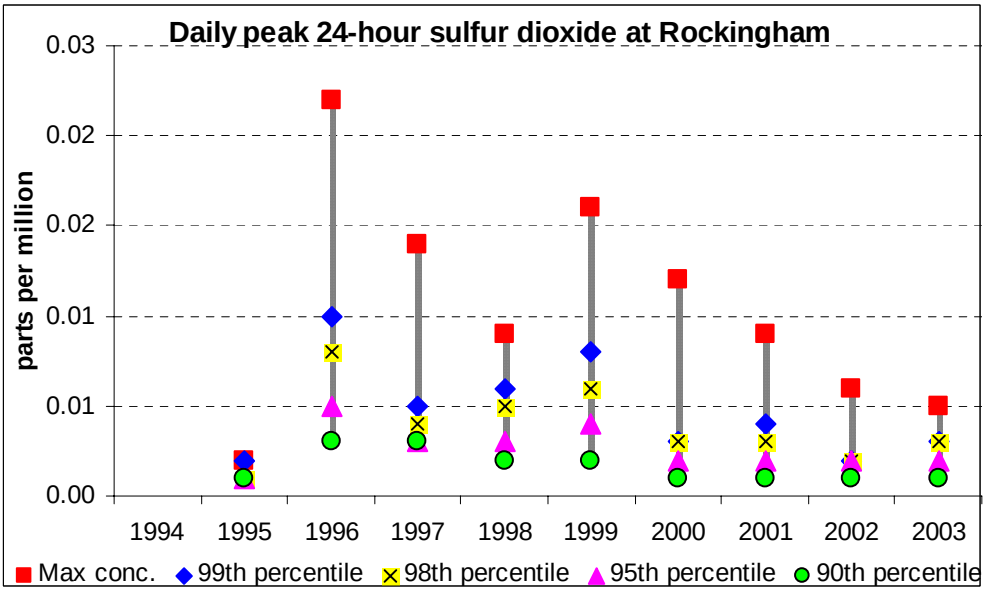


Figure A7-31 - 24-hour sulfur dioxide at Rockingham

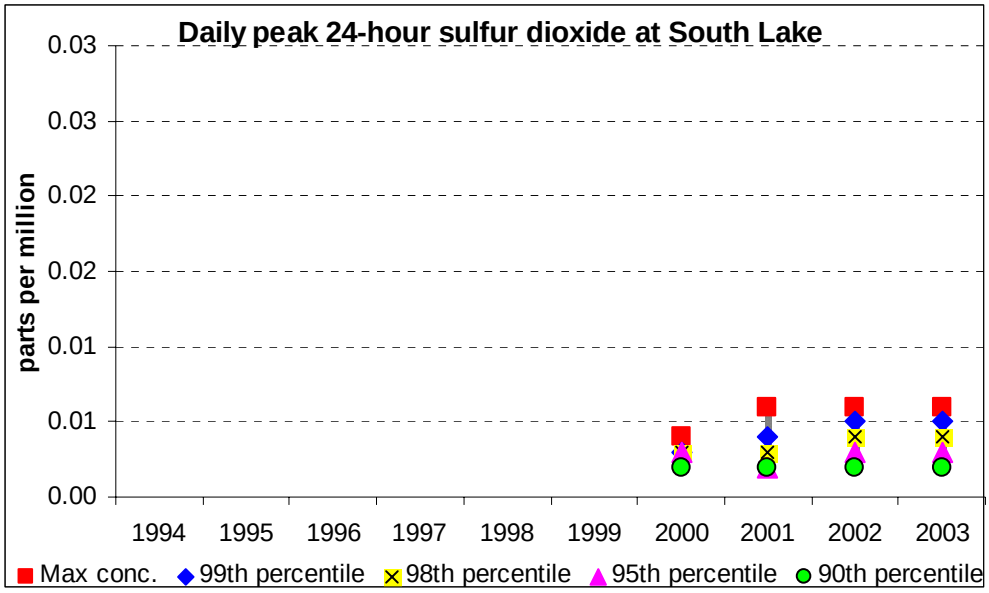


Figure A7-32 - 24-hour sulfur dioxide at South Lake

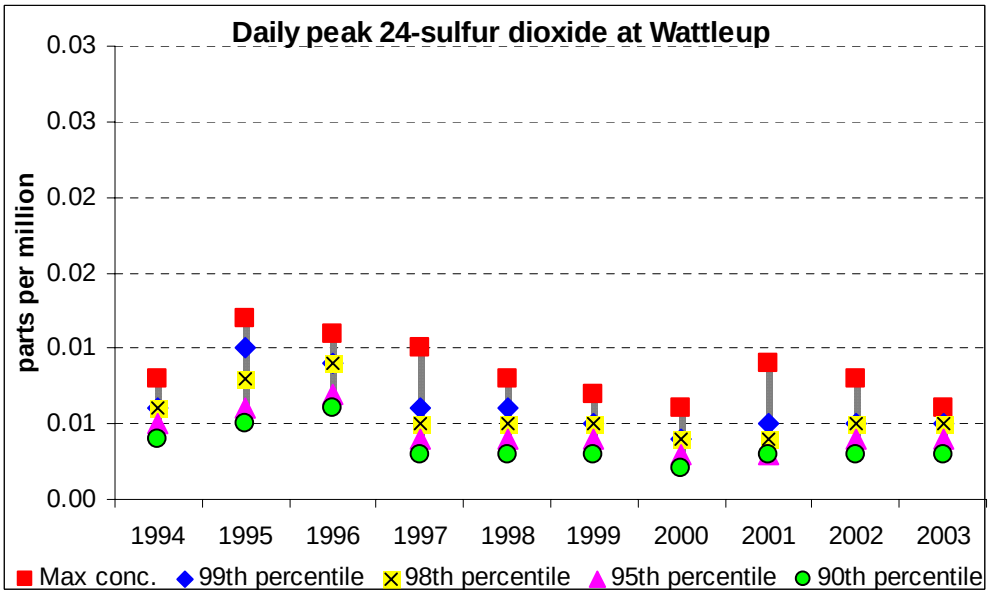


Figure A7-33 - 24-hour sulfur dioxide at Wattleup

Particles as PM_{10}

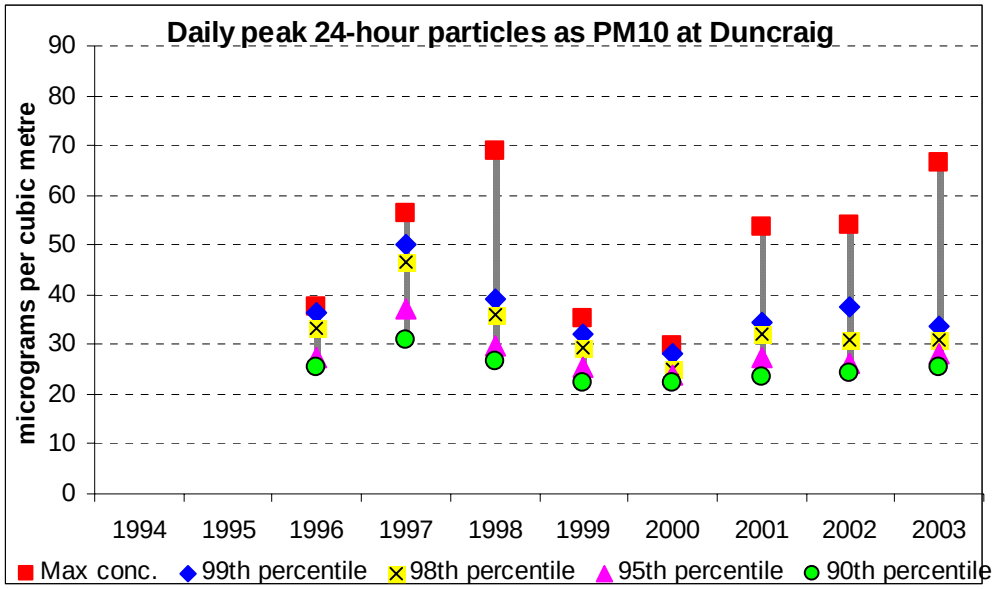


Figure A7-34 - 24-hour PM_{10} at Duncraig

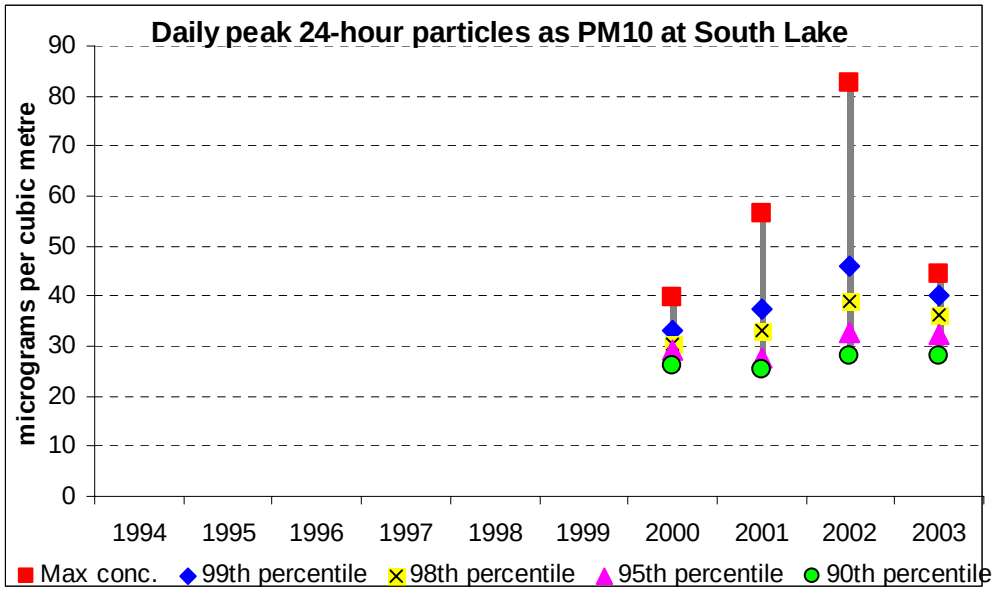


Figure A7-35 - 24-hour PM_{10} at South Lake

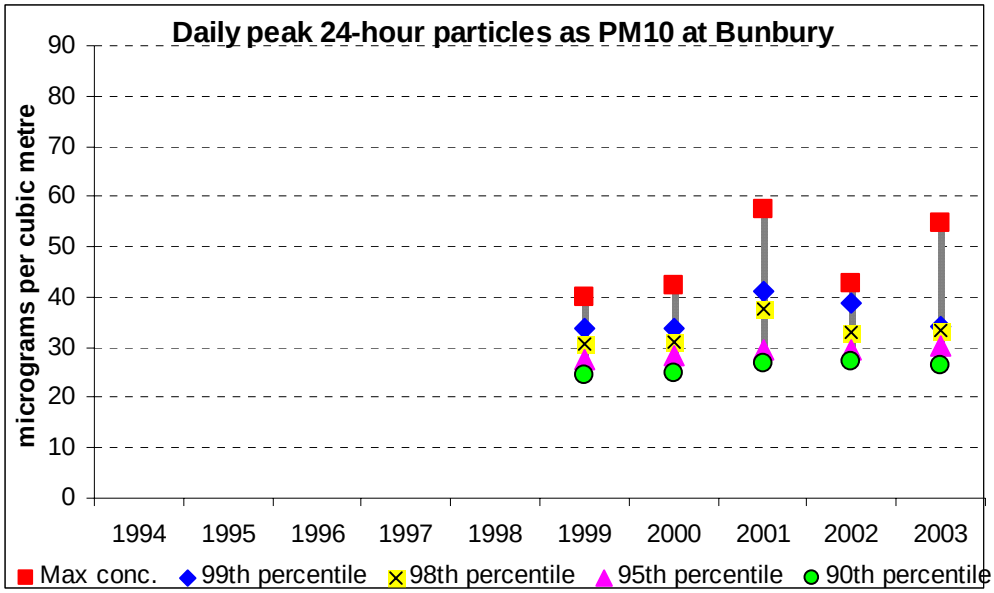


Figure A7-36 - 24-hour PM_{10} at Bunbury

Particles as $PM_{2.5}$

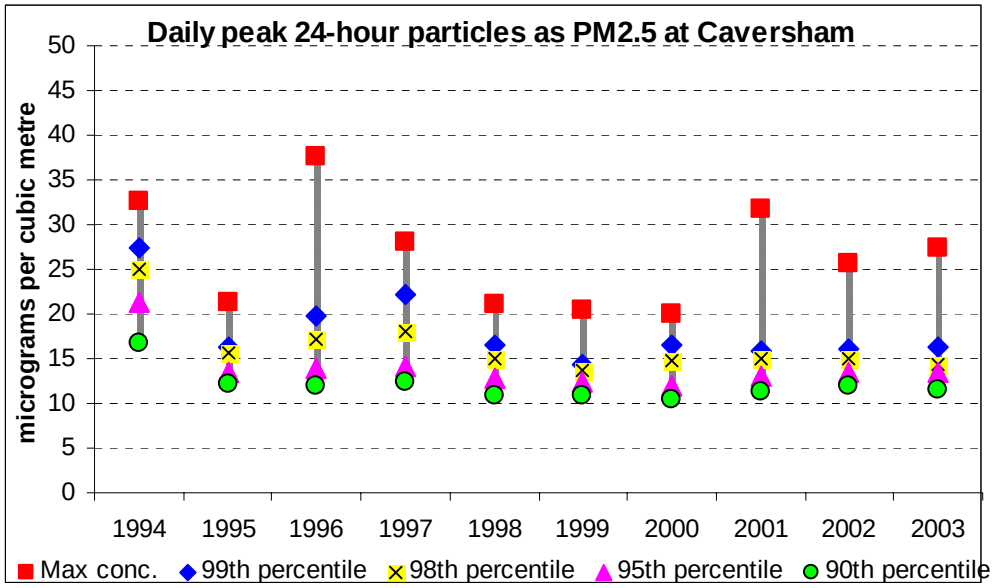


Figure A7-37 - 24-hour $PM_{2.5}$ at Caversham

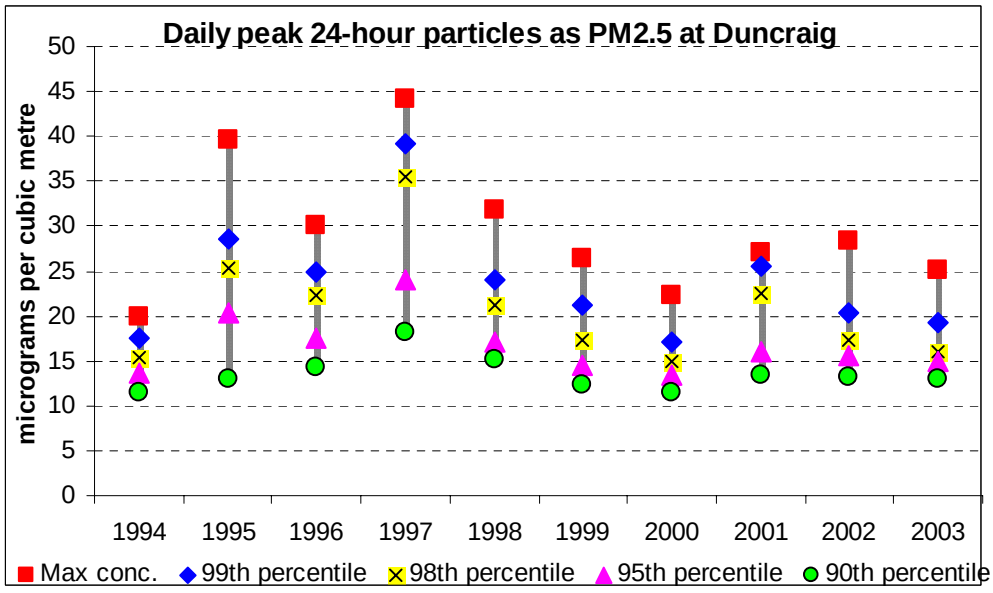


Figure A7-38 - 24-hour $PM_{2.5}$ at Duncraig

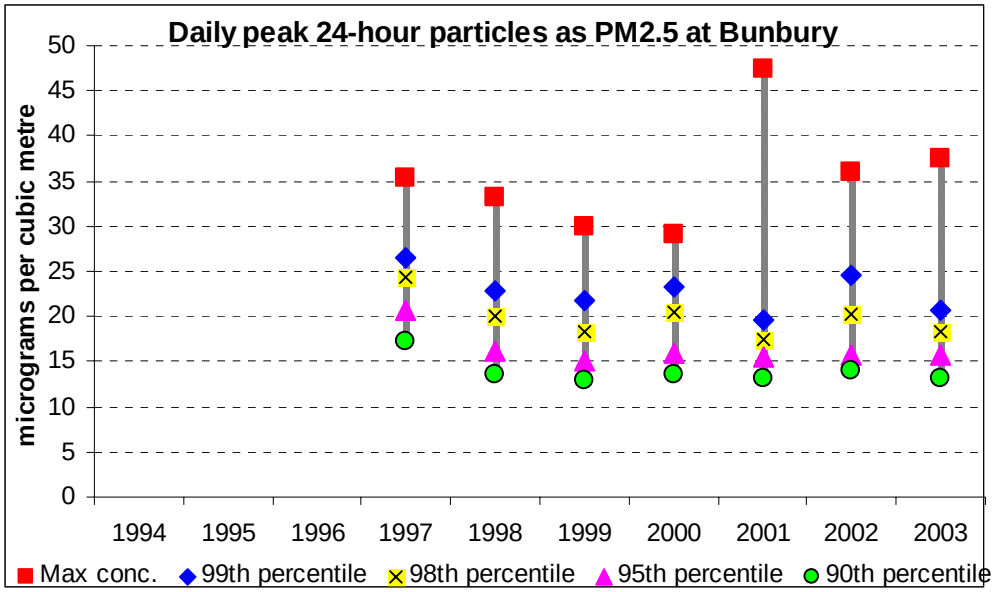


Figure A7-39 - 24-hour $PM_{2.5}$ at Bunbury