

AIR MONITORING REPORT 2005:

COMPLIANCE WITH THE NATIONAL ENVIRONMENT PROTECTION (AMBIENT AIR QUALITY) MEASURE

Publication 1045

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SUMMARY

This report assesses compliance of air quality in Victoria with the *Ambient Air Quality National Environment Protection Measure*¹ (AAQ NEPM). In addition, EPA also produces an annual air quality report for a more general audience.²

Victoria's monitoring results for 2005 indicated that:

- the goal of the AAQ NEPM, to achieve by 2008 the standards to the extent specified, was met for all pollutants at all monitoring stations where there was sufficient data capture to assess compliance, except particles (as PM₁₀) at three of the 10 stations.
- PM₁₀ exceeded the standard at about half the monitoring stations, on up to nine days in Port Phillip Region and 24 days in Mildura. On the majority of these days the cause was windblown dust. Poor dispersion in highly stable air accounted for most of the remaining exceedences.
- The 24-hour advisory reporting standard for particles (as PM_{2.5}) was exceeded at the two stations in the Port Phillip region. The annual

reporting standard for PM_{2.5} was exceeded at Alphington.

- The four-hour ozone standard was exceeded on one day at one station. The one-hour ozone standard was met at all stations.
- The high data capture rates required to demonstrate compliance with the AAQ NEPM goals were achieved in all stations that operated continuously throughout the year.
- EPA Victoria commenced a three-year program to replace and upgrade instrumentation and infrastructure at all of its monitoring stations. When stations are taken off-line for these upgrades, the AAQ NEPM data capture targets may not be met. This affected monitoring at Traralgon in quarter four.

Performance monitoring stations operated continuously throughout the year and campaign monitoring was conducted to fulfil commitments in Victoria's monitoring plan.³ Monitoring proceeded in accordance with the monitoring plan, AAQ NEPM Technical Papers and EPA's NATA accreditation.

¹ *National Environment Protection Measure for Ambient Air Quality*, National Environment Protection Council publication, available from www.ephc.gov.au.

² *Victoria's Air Quality – 2005* (EPA publication 1044), available from www.epa.vic.gov.au/publications.

³ *Ambient Air Quality NEPM Monitoring Plan Victoria*, (EPA Publication 763), available from www.epa.vic.gov.au.

A. MONITORING SUMMARY

Current performance monitoring stations

Victoria's AAQ NEPM air monitoring plan was approved by the National Environment Protection Council (NEPC) Ministers in February 2001. Data presented in this report have been produced in accordance with the monitoring plan, except where amendments or other issues are noted.

The AAQ NEPM requires the monitoring of the pollutants carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), sulfur dioxide (SO₂), lead (Pb), particles less than 10 micrometres in diameter (PM₁₀) and particles less than 2.5 micrometres in diameter (PM_{2.5}).

Eight regions are defined in the monitoring plan. They are shown in Figure 1. Port Phillip and Latrobe Valley regions have permanent performance monitoring stations (shown in Figure 1 and Figure 2, respectively). The six rural regions, Ballarat, Bendigo, Shepparton, Wodonga, Warrnambool, and Mildura are being monitored sequentially for a year each by a mobile monitoring station.

The performance monitoring stations, pollutants monitored and site types are summarised in Table 1. Site types are defined⁴ as: generally representative upper bound for community exposure sites; population-average sites; and peak sites.

⁴ National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 3, *Monitoring Strategy*, available from www.ephc.gov.au.

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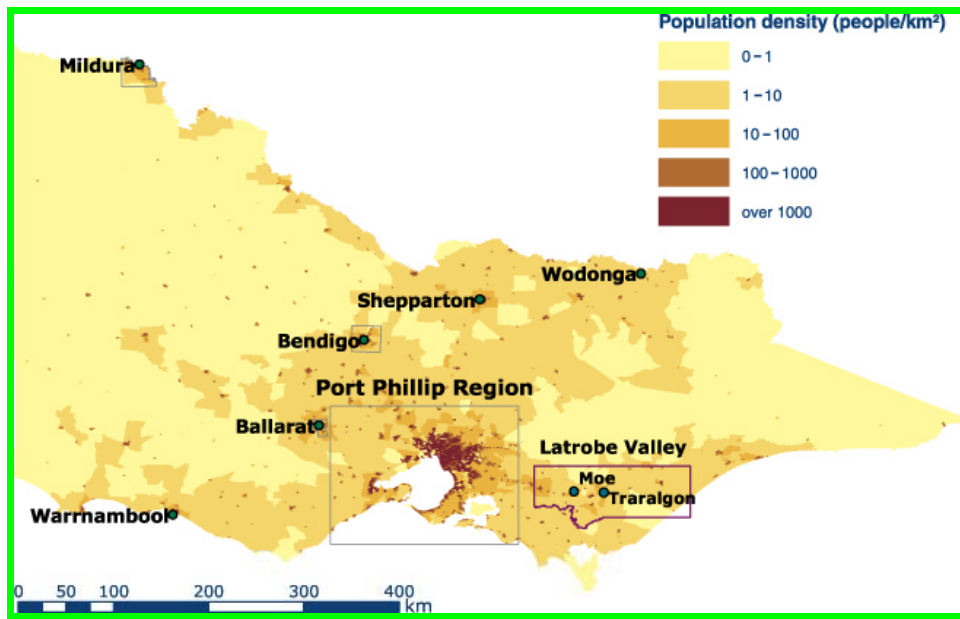


Figure 1: AAQ NEPM regions and population density in Victoria



Figure 2: Monitoring stations in Port Phillip region

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Table 1: Victorian performance monitoring stations

Region	Location category	Site type				
		CO	NO ₂	O ₃	SO ₂	PM ₁₀
Performance monitoring station						
Port Phillip						
Alphington	Res/LI	G*	G*	Pop	Pop*	G*
Brighton	Res		G	Pop*		Pop
Dandenong	LI			Pop		Pop
Footscray	I/Res		G*	G*		G*
Geelong South	LI/Res	G*	G*	Pop*	G*	G*
Melton	Res			G		
Mooroolbark	Res			Pop		Pop
Paisley	I/Res				G	
Point Cook	Rur/Res		Pop*	G*		
Point Henry	I/Rur			Pop		
Richmond	Res	G				G
RMIT (CBD)	CBD	G*	G*		G	G*
Latrobe Valley						
Moe	Res		Pop	G	G	G
Traralgon	Res		G*	G*	G*	G*

RMIT (CBD) RMIT University
 I Industrial
 Res Residential
 G Generally representative upper bound
 * Trend station

CBD Central business district
 LI Light industrial
 Rur Rural
 Pop Population-average

Description of exposed population

The exposed population represented by each monitoring station is described qualitatively by the location category column in Table 1 and Table 2. Further information is given in Appendix C of the monitoring plan.

Implementation of the monitoring plan

In addition to the performance monitoring stations specified in the monitoring plan, mobile monitoring stations commenced in 2005 at Ballarat, in July for a period of 12 months.

The peak station for lead, at Collingwood, was closed in December 2004. This change to Victoria's

monitoring plan was approved in accordance with NEPM procedures, because levels were so low.⁵

Campaign monitoring continued at:

- Bendigo until July 2005, when the mobile laboratory moved to Ballarat
- Moorooduc, where ozone has been monitored since December 2004.
- Mildura, where PM₁₀ has been monitored since December 2004.

⁵ National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 9, *Lead Monitoring*, available from www.ephc.gov.au.

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Table 2: Summary of campaign stations' siting compliance with AS 2922-1987

Region Station	Location category	Height above ground	Minimum distance to support structure	Clear sky angle of 120°	Unrestricted airflow of 270°/360°	20m from trees	No boiler or incinerators nearby	Minimum distance from road or traffic
Port Phillip								
Moorooduc	Rur	☑	☑	☑	☑	☑	☑	☑
Mooroolbark	Res	☑	☑	☑	☑	☑	☑	☑
Bendigo	Res	☑	☑	☑	☑	☒	☑	☑
Ballarat	Res	☑	☑	☑	☑	☑	☑	☑
Mildura	Res	☑	☑	☑	☑	☑	☑	☑
Res	Residential		Rur	Rural				

Each of these campaign stations meets the requirements of the Australian standard for siting of sampling units, except for proximity to trees at Bendigo as shown in Table 2, and the data is included in this report. Alphington, Richmond and Moe also continue to have minor non-compliances due to the proximity of trees.

Victorian monitoring is conducted in accordance with the standards shown in Table 3. Data not meeting the requirements of these standards and EPA's quality assurance procedures are invalidated and not reported. At Mildura a substantial quantity of PM₁₀ data were invalidated because of an incorrect flow calibration, resulting in an underestimation of actual levels. During the period of incorrect calibration, two days that exceeded the standard are reported as exceedences although they are not included in the data availability rates.

TEOM PM₁₀ data quoted in this report have been adjusted according to the default procedure⁶, using the temperature-dependent formula with a constant

value of K equal to 0.04. The resulting adjustments vary from no change at daily average temperatures at or above 15°C to an increase of 40 per cent at a temperature of 5°C.

NATA status

All performance monitoring stations and AAQ NEPM campaign monitoring operated by EPA are covered by its NATA accreditation (Number 1576).

Monitoring in the Latrobe Valley region was performed for EPA by Connell Wagner PPI under its NATA accreditation (Number 4669).

⁶ National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 10, *Collection and Reporting of TEOM PM₁₀ Data*, available from www.ephc.gov.au.

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Monitoring methods

Table 3: Methods for monitoring the NEPM pollutants

Pollutant	Standard	Title	Method Used
Carbon monoxide	CO AS3580.7.1-1992	Ambient Air – Determination of Carbon Monoxide – Direct Reading Instrument Method	Gas filter correlation/ Infrared.
Nitrogen dioxide	NO ₂ AS3580.5.1-1993	Ambient Air – Determination of Oxides of Nitrogen – Chemiluminescence Method	Gas phase chemiluminescence.
Photochemical oxidant (ozone)	O ₃ AS3580.6.1-1990	Ambient Air – Determination of Ozone – Direct Reading Instrument Method	Non-dispersive ultraviolet.
Sulfur dioxide	SO ₂ AS3580.4.1-1990	Ambient Air – Determination of Sulfur Dioxide – Direct Reading Instrument Method	Pulsed fluorescence
Particles	PM ₁₀ AS3580.9.8-2001	Determination of Suspended Particulate Matter - PM ₁₀ Continuous Direct Mass Method using a Tapered Element Oscillating Microbalance Analyser	Tapered element oscillating microbalance (TEOM).
	PM _{2.5} US CFR 40 Part 50 Appendix L ^a	Reference Method for the Determination of Fine Particulate matter as PM _{2.5} in the Atmosphere	Gravimetric reference method
	PM _{2.5} AS3580.9.8-2001 ^a	Technical Paper on Monitoring for Particles as PM _{2.5}	TEOM

^a Modified for use in the PM_{2.5} Equivalence Program according to the NEPM Technical Paper

Screening

For regions other than Port Phillip and Latrobe Valley, the monitoring plan presents a process to demonstrate whether levels of CO, NO₂, O₃ and PM₁₀ are consistently below the standards. Monitoring is not required if specified screening procedures are satisfied.⁷

CO monitored at Bendigo satisfies Procedure A of the Technical Paper for Bendigo and Procedure F for Shepparton, Mildura, Wodonga and Warrnambool.

As proposed in Victoria's monitoring plan, CO data from Toowoomba have been used to satisfy Screening Procedure F for Ballarat.

NO₂ monitoring at Bendigo in 2004-05 yielded a maximum one-hour reading of 0.046 ppm and an annual average of 0.006 ppm. These are sufficiently low to satisfy Procedure A for Bendigo and Procedure F for Shepparton, Wodonga, Warrnambool and Mildura. Screening for NO₂ at Ballarat is not completed and compliance is reported as 'not demonstrated'.

⁷ National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 4, *Screening Procedures*, available from www.ephc.gov.au.

Screening for O₃ in rural regions is not completed and compliance is reported as 'not demonstrated'.

Campaign monitoring for PM₁₀, which has been performed at Bendigo⁸, Ballarat⁹ and Shepparton¹⁰ (and is currently under way at Mildura)¹¹ has indicated that ongoing monitoring will be required. Monitoring at Albury by NSW Department of Environment and Conservation indicates that this is so for Wodonga also. The mobile monitoring station was moved to Ballarat during 2005 and will be relocated to other rural regions sequentially in future years.

PM_{2.5} monitoring

The 2003 modifications to the NEPM commit Victoria to monitoring PM_{2.5} at at least one PM₁₀ performance monitoring station. PM_{2.5} was monitored by the reference method (on a one-day-in-three basis) at two stations (Alphington and Footscray) throughout 2005. Control of humidity in the filter weighing room was upgraded in 2005, allowing substantial compliance with the recommended operating procedures.¹²

Victoria also participates in the PM_{2.5} Equivalence Program, with TEOM monitors located at Alphington and Footscray – not Alphington and Mooroolbark, as proposed in the NEPM. TEOM PM_{2.5} readings are taken with the inbuilt adjustment for PM₁₀ removed

(A and B constants set to 0 and 1) and no adjustment for loss of volatiles.

B. ASSESSMENT OF COMPLIANCE WITH STANDARDS AND GOAL

The following tables summarise the compliance of monitoring with the standards and goal of the AAQ NEPM. Performance is assessed as meeting the 2008 goal if the number of exceedences of the standard is no more than the number specified in Schedule 2 of the AAQ NEPM and data availability was at least 75 per cent in each quarter of the year. Regions also meet the standards and goal if they do not require monitoring on the basis that screening shows pollutant levels are reasonably expected to be consistently below the relevant standards.

Performance is assessed as 'not demonstrated' if there has been insufficient data collected to demonstrate that the standards and 2008 goal have been met or not met. Regions may also be assessed as 'not demonstrated' if screening has not been completed.

⁸ *Air quality assessment of fine particles in Bendigo – a pilot study* (EPA Publication 869), available from www.epa.gov.au.

⁹ *Airborne particle monitoring at Ballarat, February 2002 to September 2003* (EPA Publication 936), available from www.epa.gov.au.

¹⁰ *Airborne particle monitoring at Shepparton, December 2003 to December 2004* (EPA Publication 992), available from www.epa.gov.au.

¹¹ *Airborne particle monitoring at Mildura, December 2004 to May 2005 – interim report* (EPA Publication 1004), available from www.epa.vic.gov.au.

¹² *National Environment Protection (Ambient Air Quality) Measure Technical Paper on Monitoring for PM_{2.5}*, available from www.ephc.gov.au.

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Carbon monoxide

Table 4: 2005 Compliance summary for carbon monoxide in Victoria

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

Region Performance monitoring station	Data availability rates (% of hours)					Number of exceedences (days)	Performance against the standard and goal
	Q1	Q2	Q3	Q4	Annual		
Port Phillip							
Alphington	93.0	94.1	86.5	91.3	91.2	0	Met
Geelong South	92.3	92.9	91.6	94.4	92.8	0	Met
Richmond	93.1	93.1	92.1	93.5	92.9	0	Met
RMIT (CBD)	94.9	94.5	86.3	94.1	92.4	0	Met
Ballarat^a	0.0	0.0	51.1	86.0	34.5	0	ND
Bendigo^b	92.8	94.2	4.4	0.0	47.5	0	ND

ND Not demonstrated by monitoring. See comments below.

a Campaign monitoring commenced at Ballarat in July.

b Campaign monitoring ceased at Bendigo in July.

Regions which do not require monitoring on the basis that screening shows pollutant levels are reasonably expected to be consistently below the relevant AAQ NEPM standard: Latrobe Valley, Ballarat, Bendigo, Shepparton, Warrnambool, Wodonga, Mildura.

During 2005, the carbon monoxide standard was not exceeded at any station and compliance was demonstrated at all stations where there was adequate data capture. Bendigo and Ballarat regions have been assessed as complying with the standard and goal on the basis of screening procedures; there was insufficient monitoring data to confirm this in 2005. Monitoring at Bendigo from May 2004 to July 2005 demonstrated compliance during that period.

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Nitrogen dioxide

Table 5: 2005 Compliance summary for nitrogen dioxide in Victoria

AAQ NEPM standards: 0.12ppm (1-hour average); 0.03ppm (1-year average)

Region Performance monitoring station	Data availability rates (% of hours)					Number of exceedences (days)	Annual mean (ppm)	Performance against the standards and goal	
	Q1	Q2	Q3	Q4	Annual			1-hour	1-year
Port Phillip									
Alphington	94.0	93.2	86.5	91.3	91.3	0	0.011	Met	Met
Brighton	94.1	94.7	94.5	93.2	94.1	0	0.009	Met	Met
Footscray	94.3	94.8	94.4	94.3	94.5	0	0.011	Met	Met
Geelong South	94.4	94.1	92.0	94.4	93.7	0	0.007	Met	Met
Pt Cook	92.3	94.8	90.9	93.5	92.9	0	0.005	Met	Met
RMIT (CBD)	94.8	94.6	94.6	90.1	93.5	0	0.017	Met	Met
Latrobe Valley									
Moe	95.7	90.1	92.2	95.6	93.4	0	0.007	Met	Met
Traralgon ^a	95.4	95.6	95.6	64.3	87.6	0	0.008	ND	ND
Ballarat^b	0.0	0.0	53.4	63.9	29.6	0	0.004	ND	ND
Bendigo^c	93.6	94.9	4.4	0.0	47.9	0	0.007	ND	ND

ND Not demonstrated by monitoring. See comments below.

a Traralgon was out of service for one month for a major station refurbishment.

b Campaign monitoring commenced at Ballarat in July.

c Campaign monitoring ceased at Bendigo in July.

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant AAQ NEPM standard: Bendigo, Shepparton, Warrnambool, Wodonga, Mildura. Region for which screening has not been completed: Ballarat.

During 2005, the nitrogen dioxide standards were not exceeded at any station and compliance was demonstrated at all stations where there was adequate data capture. Monitoring of nitrogen dioxide at Bendigo in 2004-05 yielded a maximum one-hour average of 0.046ppm and a 14-month average of 0.006ppm. This satisfies Screening Procedure A for Bendigo and procedure F for Shepparton, Mildura, Warrnambool and Wodonga. At Traralgon data capture was reduced because the station was taken out of service for a major upgrade.

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Ozone

Table 6: 2005 compliance summary for ozone in Victoria

AAQ NEPM standards: 0.10ppm (1-hour average); 0.08ppm (4-hour average)

Region 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
Port Phillip									
Alphington	90.8	93.4	86.5	88.1	89.7	0	0	Met	Met
Brighton	94.1	94.7	94.5	89.6	93.2	0	0	Met	Met
Dandenong	88.0	79.0	94.7	94.0	88.9	0	0	Met	Met
Footscray	94.4	94.8	94.2	94.3	94.4	0	0	Met	Met
Geelong South	94.3	94.2	92.0	94.4	93.7	0	0	Met	Met
Melton	92.5	84.4	91.4	95.2	90.9	0	0	Met	Met
Moorooduc	95.0	94.9	92.0	95.1	94.2	0	0	Met	Met
Mooroolbark	94.0	93.4	95.0	90.9	93.3	0	0	Met	Met
Point Cook	92.8	94.8	93.5	91.2	93.1	0	1	Met	Met
Point Henry	93.5	95.6	95.4	95.4	95.0	0	0	Met	Met
Lalrobo Valley									
Moe	95.6	95.0	94.8	95.6	95.3	0	0	Met	Met
Traralgon ^a	82.9	94.6	95.4	64.2	84.2	0	0	ND	ND
Ballarat^b	0.0	0.0	61.0	90.4	38.2	0	0	ND	ND
Bendigo^c	94.0	94.9	4.4	0.0	47.9	0	0	ND	ND

ND Not demonstrated by monitoring. See comments below.

a Traralgon was out of service for one month for a major station refurbishment.

b Campaign monitoring commenced at Ballarat in July.

c Campaign monitoring ceased at Bendigo in July.

Screening by generic modelling was approved by the Peer Review Committee (PRC) and used last year to screen all rural regions. Further work on revising the generic screening procedures has been undertaken by the PRC – this work is yet to be completed.

During 2005, compliance was demonstrated for ozone at all stations where there was adequate data capture. At Traralgon data capture was reduced because the station was taken out of service for a major upgrade. Monitoring at Bendigo from May

2004 to July 2005 demonstrated compliance during that period.

The single exceedence occurred in typical conditions conducive to the accumulation of photochemical oxidant, as described in Section C.

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Sulfur dioxide

Table 7: 2005 compliance summary for sulfur dioxide in Victoria

AAQ NEPM standards: 0.20ppm (1-hour average); 0.08ppm (24-hour average); 0.02ppm (1-year average)

Region Performance monitoring station	Data availability rates (% of hours)					Exceedences (days)		Annual mean (ppm)	Performance against the standards and goal		
	Q1	Q2	Q3	Q4	Annual	1-hour	24-hour		1-hour	24-hour	1-year
Port Phillip											
Alphington	92.3	93.9	86.5	91.3	91.0	0	0	0.000	Met	Met	Met
Geelong South	89.2	86.3	88.7	90.3	88.6	0	0	0.001	Met	Met	Met
Paisley	93.5	90.2	90.7	94.5	92.2	0	0	0.002	Met	Met	Met
RMIT (CBD)	94.8	94.4	94.1	94.1	94.3	0	0	0.001	Met	Met	Met
Latrobe Valley											
Moe	96.7	95.8	95.6	94.6	95.7	0	0	0.001	Met	Met	Met
Traralgon ^a	96.4	95.7	95.6	63.1	87.6	0	0	0.002	ND	ND	ND

ND Not demonstrated by monitoring. See comments below.

a Traralgon was out of service for one month for a major station refurbishment.

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant AAQ NEPM standard: Ballarat, Bendigo, Shepparton, Warrnambool, Wodonga, Mildura.

During 2005, the sulphur dioxide standards were not exceeded at any station and compliance was demonstrated at all stations where there was adequate data capture. At Traralgon data capture was reduced because the station was taken out of service for a major upgrade. Annual mean values are close to the limits of detection.

monitoring plan. All regions are assessed as complying with the standard and goal.

Lead

Following the phasing out of leaded petrol, levels are below the level of precision threshold¹³ at the peak station, Collingwood. EPA ceased monitoring lead in Melbourne at the end of 2004. Past results easily meet Screening Procedure A and all other regions also satisfy screening arguments, as in the

¹³ National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 9, *Lead Monitoring*, available from www.ephc.gov.au.

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Particles as PM₁₀

Table 8: 2005 compliance summary for PM₁₀ in Victoria

AAQ NEPM Standard: 50µg/m³ (24-hour average)

Region Performance monitoring station	Data availability rates (% of days)					Number of exceedences (days)	Performance against the standard and goal
	Q1	Q2	Q3	Q4	Annual		
Port Phillip							
Alphington	100.0	92.3	90.2	88.0	92.6	0	Met
Brighton	83.3	89.0	83.7	80.4	84.1	0	Met
Dandenong	84.4	81.3	100.0	94.6	90.1	0	Met
Footscray	91.1	94.5	100.0	100.0	96.4	0	Met
Geelong South	100.0	97.8	96.7	90.2	96.2	7	Not met
Mooroolbark	100.0	100.0	97.8	100.0	99.5	9	Not met
Richmond	98.9	97.8	91.3	96.7	96.2	1	Met
RMIT (CBD)	100.0	100.0	95.7	97.8	98.4	0	Met
Latrobe Valley							
Moe	98.9	100.0	100.0	100.0	99.7	0	Met
Traralgon ^a	100.0	100.0	100.0	60.9	90.1	0	ND
Ballarat^b	0.0	0.0	63.0	91.3	38.9	0	ND
Bendigo^c	100.0	98.9	4.3	0.0	50.4	2	ND
Mildura	100.0	97.8	31.5	28.3	64.1	24 ^d	Not met

Monitoring was by TEOM.

ND Not demonstrated by monitoring. See comments below.

a Traralgon was out of service for one month for a major station refurbishment.

b Campaign monitoring commenced at Ballarat in July.

c Campaign monitoring ceased at Bendigo in July.

d Some readings in Q3 and Q4 at Mildura were flagged as invalid because of an incorrect flow calibration. The readings are known to be too low and two exceedences are counted although the invalid data are excluded from other statistics in this report.

Screening has not been completed for any region and regions not shown are assessed as 'not demonstrated'.

For PM₁₀, the goal was met at all Port Phillip stations, except Geelong South and Mooroolbark. In the Latrobe Valley region, no exceedences were recorded but at Traralgon data capture was reduced because the station was taken out of service for a major upgrade. The campaign stations at Bendigo and Ballarat had insufficient data capture to demonstrate compliance in the calendar year 2005.

On the basis of May 2004 to July 2005 data, Bendigo achieved the 2008 goal. Mildura was confirmed as a location severely affected by windblown dust. In addition to TEOM monitoring, PM₁₀ was also monitored by high-volume sampler one day in six at Alphington, Geelong South and RMIT (CBD) throughout the year – no additional exceedence days were recorded.

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The most common causes of PM₁₀ exceedences were windblown dust in the warmer months and accumulation of combustion particles in poor dispersion conditions during the colder months; the former was predominant at Geelong South and Mildura, the latter at Mooroolbark. Details are given in Section C.

Particles as PM_{2.5}

The NEPM was revised in 2003 to include advisory reporting standards for particles as PM_{2.5}. There is no time frame for compliance, but monitoring by the reference method and other acceptable methods is required to be reported. Table 9 summarises

Victoria's monitoring of PM_{2.5} by the reference method. Only reference method monitoring is to be used for comparisons with the advisory reporting standards. The goal is to gather sufficient data nationally to facilitate a review of the advisory reporting standards as part of the review of the NEPM which commenced in 2005. Data losses occurred at Footscray in the first and fourth quarters, due to equipment failures. Exceedences of the 24-hour standard occurred when particles were trapped in stable conditions during the colder months.

Table 10 summarises Victoria's monitoring of PM_{2.5} by TEOM. Details are given in Section C.

Table 9: 2005 monitoring summary for PM_{2.5} in Victoria

AAQ NEPM advisory reporting standards: 25µg/m³ (24-hour average); 8µg/m³ (1-year average)

Region Performance monitoring station	Data availability rates (% of days)					Number of exceedences (days)	Annual mean (µg/m ³)
	Q1	Q2	Q3	Q4	Annual		
Port Phillip							
Alphington	96.7	96.7	87.1	96.8	94.3	3	8.1
Footscray	66.7	100.0	93.5	64.5	81.1	2	7.1

Monitoring by reference method (one-day-in-three).

Table 10: PM_{2.5} Equivalence Program 2005 TEOM monitoring – summary

Region Performance monitoring station	Data availability rates (% of days)					Annual mean (µg/m ³)
	Q1	Q2	Q3	Q4	Annual	
Port Phillip						
Alphington	98.9	90.1	90.2	94.6	93.4	5.5
Footscray	98.9	100.0	100.0	100.0	99.7	4.7

Monitoring by TEOM (daily).

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Table 11: 2005 summary statistics for daily peak eight-hour carbon monoxide in Victoria

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

Region Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:hour)
Port Phillip					
Alphington	342	3.1	Jun 28:03	2.9	May 20:02
Geelong South	352	3.5	Jun 08:02	2.9	Jun 07:24
Richmond	351	3.8	Jun 28:03	3.5	May 10:02
RMIT (CBD)	348	2.3	May 14:02 Jun 29:04		
Ballarat^a	126	1.5	Sep 06:02	1.1	Sep 05:24
Bendigo^b	179	2.0	May 21:02	1.9	Jun 25:02

a Campaign monitoring commenced at Ballarat in July.

b Campaign monitoring ceased at Bendigo in July.

C. ANALYSIS OF AIR QUALITY MONITORING

Annual summary statistics that allow assessment of how close air quality was to the standards are presented in this section. The AAQ NEPM states that the short-term standards should not be exceeded on more than one day for carbon monoxide, nitrogen dioxide, ozone and sulfur dioxide, or on more than five days per year for PM₁₀. The second highest non-overlapping daily value for the year (or the sixth for PM₁₀) can indicate the extent to which the standards are, or are not, met. Concentrations exceeding the standard are highlighted in bold.

All occasions when a standard was exceeded are also listed and the circumstances leading to the exceedence are noted, if they can be inferred.

Tables of monitoring statistics presented in this Section have been prepared according to AAQ NEPM guidelines.¹⁴

Carbon monoxide

Refer to Table 11.

Carbon monoxide levels were well within the standard at all stations. The highest readings were at the inner-suburban site Richmond, where carbon monoxide reached 42 per cent of the standard.

¹⁴ National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 8, Annual Reports, available from www.ephc.gov.au.

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Nitrogen dioxide

Table 12: 2005 summary statistics for daily peak one-hour nitrogen dioxide in Victoria

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

Region Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:hour)
Port Phillip					
Alphington	346	0.050	Apr 27:18	0.049	Apr 23:19
Brighton	362	0.054	Apr 27:20	0.044	Apr 22:19
Footscray	363	0.053	Feb 23:17	0.052	Apr 27:20
Geelong South	358	0.048	Apr 28:08	0.044	Apr 27:21
Point Cook	353	0.043	Jun 24:14		
			Apr 27:21		
RMIT (CBD)	358	0.058	Apr 22:19	0.054	Jun 27:15
					Apr 27:19
Latrobe Valley					
Moe	357	0.039	May 04:18	0.036	Apr 01:19
Traralgon	334	0.040	Apr 13:18	0.033	May 04:18
					Apr 02:20
Ballarat^a	112	0.030	Sep 02:20	0.026	Sep 05:19
Bendigo^b	180	0.037	Jun 06:19	0.036	Mar 11:22
					Apr 22:20

a Campaign monitoring commenced at Ballarat in July.

b Campaign monitoring ceased at Bendigo in July.

Nitrogen dioxide levels were well within the standard at all stations. The highest reading occurred at the CBD site, RMIT (CBD), and was 48 per cent of the standard. The highest annual average was 57 per cent of the standard (Table 5).

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Ozone

Table 13: 2005 summary statistics for daily peak one-hour ozone in Victoria

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

Region Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:hour)
Port Phillip					
Alphington	339	0.077	Feb 23:18	0.076	Dec 31:14
Brighton	357	0.088	Dec 31:15	0.074	Mar 12:17
Dandenong	338	0.072	Jan 13:16	0.070	Mar 12:15
Footscray	362	0.082	Dec 31:15	0.076	Mar 12:14
Geelong South	357	0.080	Feb 23:17	0.075	Mar 12:18
Melton	343	0.079	Mar 12:17	0.078	Jan 10:16
Moorooduc	361	0.080	Mar 12:15	0.069	Jan 25:17
Mooroolbark	357	0.089	Dec 31:13	0.081	Jan 27:16
Point Cook	354	0.092	Mar 12:15	0.075	Feb 23:16
Point Henry	363	0.088	Feb 23:16	0.075	Mar 12:15
Latrobe Valley					
Moe	363	0.062	Mar 01:17	0.059	Mar 13:15 Mar 14:16
Traralgon	315	0.067	Mar 01:17	0.058	Mar 13:14
Ballarat^a	143	0.056	Dec 11:18	0.045	Dec 30:18 Nov 02:19
Bendigo^b	181	0.055	Jan 24:19	0.051	Mar 01:13

a Campaign monitoring commenced at Ballarat in July.

b Campaign monitoring ceased at Bendigo in July.

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Table 14: 2005 summary statistics for daily peak four-hour ozone in Victoria

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

Region Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:hour)
Port Phillip					
Alphington	339	0.070	Feb 23:19	0.056	Dec 31:17
Brighton	357	0.069	Mar 12:17	0.065	Nov 01:18
Dandenong	339	0.067	Jan 13:18	0.066	Feb 23:17
Footscray	362	0.066	Mar 12:16	0.063	Jan 10:18
Geelong South	356	0.068	Feb 23:17	0.067	Mar 12:19
Melton	344	0.075	Mar 12:19	0.073	Jan 10:18
Moorooduc	361	0.072	Mar 12:17	0.061	Mar 13:14 Jan 25:18
Mooroolbark	357	0.072	Dec 31:15	0.071	Jan 27:18
Point Cook	354	0.082	Mar 12:17	0.067	Feb 23:18
Point Henry	363	0.076	Feb 23:18	0.069	Mar 12:17
Latrobe Valley					
Moe	363	0.051	Mar 13:16	0.050	Mar 14:18 Jan 31:18 Dec 30:18
Traralgon	315	0.055	Mar 13:16	0.052	Mar 01:19
Ballarat^a	143	0.049	Dec 11:20	0.044	Nov 02:20
Bendigo^b	182	0.050	Jan 24:20	0.049	Mar 01:15

a Campaign monitoring commenced at Ballarat in July.

b Campaign monitoring ceased at Bendigo in July.

Ozone is generated by chemical reactions in strong sunlight as precursor chemicals are transported from the point of emission. Ozone events are highly variable in terms of both frequency and severity. Four-hour averages are usually higher relative to the standard than one-hour averages, leading to more

exceedences. In 2005 there was only one exceedence, of the four-hour standard, at Point Cook. On this day there was a typical build-up of ozone as precursors from Melbourne entered Port Phillip Bay and then were blown back towards land.

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Table 15: 2005 ozone exceedences

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

Date	Port Phillip Point Cook	Inferred cause
12-Mar-2005	0.082 ppm	Recirculation

Sulfur dioxide

Table 16: 2005 summary statistics for daily peak one-hour sulfur dioxide in Victoria

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

Region Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:hour)
Port Phillip					
Alphington	345	0.011	Dec 02:09	0.010	Jan 02:05
Geelong South	352	0.054	Jun 25:14	0.050	Jun 26:13
Paisley	351	0.044	Dec 17:20	0.036	Nov 20:04
RMIT (CBD)	361	0.017	Dec 20:08	0.016	Jan 02:05 Jun 29:09
Latrobe Valley					
Moe	365	0.047	Feb 27:14	0.039	Feb 13:19
Traralgon	334	0.061	Nov 05:11	0.060	Feb 27:12

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Table 17: 2005 summary statistics for daily peak 24-hour sulfur dioxide in Victoria

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

Region Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:hour)
Port Phillip					
Alphington	345	0.002	Nov 27 Oct 17 Jan 02 Aug 26 Aug 24 Jun 27 Jun 02 May 29 Mar 15 Mar 04 Jan 17		
Geelong South	352	0.008	Jun 06	0.005	Aug 25 Jun 26 Jun 25 Feb 28
Paisley	351	0.010	Dec 18	0.009	Jan 06
RMIT (CBD)	361	0.005	Mar 15	0.004	Oct 17 Aug 22 Jun 29 May 29 May 12
Latrobe Valley					
Moe	365	0.009	Nov 05	0.007	Oct 17
Traralgon	334	0.012	May 29	0.008	Nov 05

Sulfur dioxide levels were well within the standards at all stations. One-hour averages are higher relative to the standard than 24-hour or annual averages. The highest readings occurred in the Latrobe Valley

and were 31 per cent of the one-hour standard and 15 per cent of the 24-hour standard. The highest annual average was approximately 10 per cent of the standard (Table 7).

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Particles as PM₁₀

Table 18: 2005 summary statistics for 24-hour PM₁₀ in Victoria

AAQ NEPM standard: 50µg/m³ (24-hour average)

Region Performance monitoring station	Number of valid days	Highest (µg/m ³)	Highest (date)	6th highest (µg/m ³)	6th highest (date)
Port Phillip					
Alphington	338	46.6	Jun 27	38.6	Mar 13
Brighton	307	41.5	Jun 27	33.4	Jun 28
Dandenong	329	43.7	Jun 27	38.0	Jun 08
Footscray	352	48.9	May 19	43.9	Apr 28
Geelong South	351	83.0	Apr 03	52.0	Apr 01
Mooroolbark	363	57.6	Apr 28	53.5	Jun 27
					May 21
Richmond	351	54.9	Dec 28	37.7	Dec 31
RMIT (CBD)	359	41.7	Apr 23	36.0	May 29
Latrobe Valley					
Moe	364	36.9	Apr 28	32.8	Apr 03
					Jan 11
Traralgon	329	44.9	Apr 01	36.0	May 03
Ballarat^a	142	26.0	Dec 15	24.0	Nov 23
Bendigo^b	184	55.7	Apr 28	45.2	Jun 06
Mildura	234	476.0	Apr 03	110.2	Jan 20

a Campaign monitoring commenced at Ballarat in July

b Campaign monitoring ceased at Bendigo in July.

In addition to TEOM monitoring shown in Table 18, PM₁₀ was monitored by high-volume sampler one day in six at Alphington, Geelong South and RMIT (CBD) throughout the year. The highest high-volume sampler readings were 33.6, 67.5 and 38.5 µg/m³, respectively. The single exceedence at Geelong South was on a day (June 7) when the TEOM also registered an exceedence.

In 2005 PM₁₀ exceedences occurred on the days listed in Table 19. Most exceedences have been attributed to windblown dust from the ground, typically in high winds and with high coarse-to-fine particle ratios. The standard is also exceeded in stable atmospheric conditions with low winds, which allow combustion particle emissions to accumulate, especially in colder weather.

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Table 19: 2005 PM₁₀ exceedences

AAQ NEPM standard: 50µg/m³ (24-hour average)

Date	Port Phillip			Bendigo	Mildura	Inferred cause
	Geelong S	Mooroolbark	Richmond	Bendigo	Mildura	
04-Jan-2005					100.8	Dust
20-Jan-2005					110.2	Dust
01-Feb-2005					177.5	Dust
02-Feb-2005					117.5	Dust
03-Feb-2005					71.3	Dust
18-Feb-2005					82.2	Dust
28-Feb-2005		56.9				Stable conditions.
01-Mar-2005					258.2	Dust.
02-Mar-2005					58.4	Dust
15-Mar-2005					56.6	Dust
25-Mar-2005					53.5	Dust
01-Apr-2005	52.0					Dust.
03-Apr-2005	83.0				476.0	Dust
09-Apr-2005		52.7				Local source
10-Apr-2005					68.9	Dust
23-Apr-2005		56.0				Prescribed burns
28-Apr-2005	80.0	57.6		55.7		Dust (Geelong South, Bendigo). Prescribed burns and dust (Mooroolbark)
03-May-2005		54.0				Stable conditions
04-May-2005		50.1				Stable conditions
20-May-2005				50.7		Stable conditions
21-May-2005		53.5				Stable conditions
30-May-2005					52.1	Stable conditions
03-Jun-2005					85.7	Stable conditions
06-Jun-2005	51.4				55.4	Stable conditions
07-Jun-2005	73.8					Stable conditions
08-Jun-2005		53.0				Stable conditions
27-Jun-2005		53.5				Stable conditions
18-Jul-2005					50.1	Stable conditions
30-Aug-2005					208.1 ^a	Dust
15-Oct-2005	56.2					Stable conditions
19-Oct-2005	54.1					Local dust
02-Dec-2005					218.1 ^a	Dust
12-Dec-2005					104.3	Dust
15-Dec-2005					102.1	Dust
17-Dec-2005					62.3	Dust
21-Dec-2005					75.5	Dust
23-Dec-2005					203.0	Dust
28-Dec-2005			54.9			Unknown
31-Dec-2005					63.2	Dust
Total 2005	7	9	1	2	24	

All readings in µg/m³.

a Some readings at Mildura were flagged as invalid because of an incorrect flow calibration. The readings indicated are known to be too low and would have been true exceedences.

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The two main causes of PM₁₀ exceedences were *dust* and *stable conditions*. *Dust* is defined as crustal material carried by (usually high) winds. The dust may be picked up from the ground by the wind or generated by other mechanical disturbances. It may originate either close to the monitoring station or be transported over large distances. *Stable conditions* refer to the build-up of pollutants in conditions of poor dispersion such as typically occur on calm, cold nights, when pollutants may be transported in the airshed with little dilution.

Mildura station had the most PM₁₀ exceedence days, and most of them were attributed to windblown dust, which is exacerbated by the hot, dry climate and the flat sandy soils of the Mallee region. Most often these events at Mildura were associated with the passage of a cold front or trough. Dust was also the most frequent cause of exceedences at Geelong South.

At Mooroolbark, exceedences were caused by the accumulation of local emissions in stable air overnight, sometimes added to by traffic emissions during the day. The location of this station in a valley makes it prone to this type of occurrence.

Particles as PM_{2.5}

**Table 20: 2005 summary statistics
for 24-hour PM_{2.5} in Victoria**

AAQ NEPM advisory reporting standard:
25µg/m³ (24-hour average)

Region Performance monitoring station	Number of valid days	Highest (µg/m ³)	Highest (date)
Port Phillip			
Alphington	115	37.4	Jun 25
Footscray	99	31.8	Jun 28

Monitoring by reference method (one-day-in-three).

The 24-hour reporting standard was exceeded at both stations and the annual reporting standard was exceeded at Alphington (Table 9). The 24-hour exceedences occurred on three days when poor dispersion conditions caused the accumulation of pollution. Results of PM_{2.5} monitoring by TEOM are not adjusted for loss of volatiles and are often lower than the reference method results.

**Table 21: PM_{2.5} Equivalence Program 2004
TEOM monitoring – daily statistics**

Region Performance monitoring station	Number of valid days	Highest (µg/m ³)	Highest (date)
Port Phillip			
Alphington	341	24.8	Apr 23
Footscray	364	20.3	Apr 23

Table 22: 2005 PM_{2.5} exceedences

AAQ NEPM standard: 25 µg/m³ (24-hour average)

Date	Port Phillip		Inferred Cause
	Alphington	Footscray	
23-Apr-2005	26.8	29.4	Stable conditions
25-Jun-2005	37.4		Stable conditions
28-Jun-2005	30.7	31.8	Stable conditions

All readings in µg/m³. Measured by reference method.

Summary of Progress towards achieving the AAQ NEPM 2008 goal

Compliance

The AAQ NEPM goal for carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead and PM₁₀ is to achieve the standards, to the extent specified by the number of allowed exceedences, by 2008. As assessed in accordance with the monitoring protocol, in 2005 the 2008 goal was met for all pollutants except for PM₁₀.

Compliance with the 2008 goal for PM₁₀ was demonstrated at all stations with sufficient data, except for Geelong South, Mooroolbark and Mildura (see Table 8 and Table 19).

For ozone, the goal of no more than one exceedence of the standards was achieved at all stations. The one-hour standard was not exceeded at any stations. There was a single exceedence of the four-hour standard (see Table 6 and Table 15).

The AAQ NEPM goal for PM_{2.5} is to gather sufficient data to facilitate a review of the advisory reporting standards as part of the review of the NEPM. PM_{2.5} has been monitored at two stations in the Port Phillip region.

Data Capture

There were no 'not demonstrated' assessments due to insufficient data at stations operating continuously throughout the year. This is attributed to Victoria's ongoing program to increase data capture through improvements to systems and instrument upgrades.

In 2005, EPA commenced a three-year program to replace and upgrade instrumentation and infrastructure at all of its monitoring stations. When stations are taken off-line for these upgrades, the AAQ NEPM data capture targets may not be met. This affected monitoring at Traralgon in quarter four, where the station was out of service for one month. As there were no exceedences, it is likely the standards and goal would have been met at Traralgon for all pollutants.

In 2005, compliance could not be demonstrated at the campaign stations Ballarat and Bendigo, as they did not operate for the full year. Bendigo results for May 2004 to July 2005 demonstrated compliance for nitrogen dioxide, ozone and PM₁₀ during this period and compliance is likely for Ballarat also.

Screening

Regions which do not require monitoring on the basis of screening procedures are listed below the compliance summary tables (Table 4 to Table 8).

Screening by campaign monitoring is being progressively implemented. Monitoring of nitrogen dioxide at Bendigo in 2004-05 satisfied screening criteria for Bendigo and the other rural regions, except Ballarat. Campaign monitoring for PM₁₀ at Bendigo, Ballarat, Shepparton and Mildura has not met the screening criteria. Compliance in regions

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where screening criteria have not been met are reported as 'not demonstrated'.

D. DATA ANALYSIS

Results of further analysis of the monitoring data are presented in this section. In these tables daily peak values are formed only when at least 75 per cent of the data for the day are valid. Data for stations with less than 15 per cent data availability are omitted and stations with less than 75 per cent data availability are shown in italics. Exceedences are shown in bold. The percentiles for 8-hour carbon monoxide and 4-hour ozone are based on running averages, including those that overlap from one day to the next.

Percentiles of 2005 daily peak concentrations are presented for each station and standard. Annual statistics for the past ten years are also presented for trend stations with at least five years of data. Trends at different stations and for different statistics have different statistical significance and in most cases there is no obvious overall trend over the ten-year period shown, in spite of increasing population pressures. lead is an exception, where annual averages have decreased markedly, so that monitoring is no longer necessary. Carbon monoxide has also decreased over the period.

Carbon monoxide

Table 23: 2005 percentiles of daily peak eight-hour carbon monoxide concentrations in Victoria

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

Region Performance monitoring station	Data availability (% of days)	Max (ppm)	Percentiles (ppm)					
			99th	98th	95th	90th	75th	50th
Port Phillip								
Alphington	93.7	3.1	2.5	2.4	2.0	1.6	0.9	0.6
Geelong South	96.4	3.5	1.8	1.5	0.9	0.7	0.2	0.1
Richmond	96.2	3.8	3.1	2.8	2.2	1.5	0.6	0.2
RMIT (CBD)	95.3	2.3	2.1	1.9	1.7	1.3	0.9	0.6
Ballarat	<i>34.5</i>	<i>1.5</i>	<i>1.1</i>	<i>0.9</i>	<i>0.4</i>	<i>0.2</i>	<i>0.1</i>	<i>0.0</i>
Bendigo	<i>49.0</i>	<i>2.0</i>	<i>1.9</i>	<i>1.7</i>	<i>1.5</i>	<i>1.0</i>	<i>0.5</i>	<i>0.2</i>

Years with data availability below 75 per cent shown in italics.

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Table 24: Percentiles of daily maximum eight-hour carbon monoxide at Alphington (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	98.6	0	6.5	5.8	5.0	3.3	2.5	1.6	0.8
1997	98.9	0	6.5	5.5	4.4	3.4	2.6	1.5	0.8
1998	95.3	0	6.8	6.0	5.1	3.9	2.7	1.7	0.7
1999	<i>55.1</i>	<i>0</i>	6.2	4.7	4.1	3.0	2.1	1.1	0.6
2000	96.7	0	5.0	4.5	4.3	3.1	2.4	1.2	0.6
2001	92.9	0	5.2	3.8	3.4	2.9	2.0	1.1	0.6
2002	93.7	0	3.8	3.5	3.1	2.7	2.0	0.9	0.4
2003	96.7	0	5.4	3.9	3.5	2.7	1.8	0.9	0.5
2004	97.0	0	3.7	2.4	2.3	1.7	1.3	0.8	0.5
2005	93.7	0	3.1	2.5	2.4	2.0	1.6	0.9	0.6

Years with data availability below 75 per cent shown in italics.

Table 25: Percentiles of daily maximum eight-hour carbon monoxide at Geelong South (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	86.3	0	4.3	3.3	2.9	1.9	1.2	0.5	0.3
1997	0.0								
1998	<i>66.0</i>	<i>0</i>	3.3	2.8	2.6	2.3	1.6	0.7	0.4
1999	92.6	0	3.0	2.7	2.3	1.6	1.1	0.7	0.3
2000	85.8	0	2.7	2.1	1.9	1.4	1.0	0.5	0.3
2001	87.7	0	2.2	1.9	1.6	1.2	0.9	0.5	0.2
2002	87.1	0	2.3	1.8	1.4	1.0	0.6	0.3	0.1
2003	87.1	0	3.2	1.8	1.6	1.1	0.7	0.4	0.2
2004	85.8	0	2.6	1.7	1.6	0.9	0.6	0.4	0.1
2005	96.4	0	3.5	1.8	1.5	0.9	0.7	0.2	0.1

Years with data availability below 75 per cent shown in italics. Years with data availability below 15 per cent not shown.

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Table 26: Percentiles of daily maximum eight-hour carbon monoxide at RMIT (CBD) (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	90.4	0	5.5	4.5	3.8	2.8	2.2	1.6	0.9
1997	98.4	0	5.5	4.3	3.8	2.9	2.4	1.4	0.9
1998	86.3	0	5.9	4.7	4.4	3.0	2.1	1.4	0.8
1999	<i>35.6</i>	<i>0</i>	<i>5.9</i>	<i>5.0</i>	<i>3.3</i>	<i>2.7</i>	<i>2.0</i>	<i>1.5</i>	<i>1.2</i>
2000	96.4	0	5.0	3.4	3.2	2.5	1.8	1.1	0.8
2001	88.8	0	3.6	2.7	2.4	2.1	1.7	1.1	0.7
2002	85.2	0	3.2	2.9	2.7	1.8	1.5	0.9	0.5
2003	96.7	0	3.9	3.0	2.6	1.8	1.5	0.9	0.6
2004	91.5	0	2.1	1.9	1.8	1.5	1.2	0.8	0.6
2005	95.3	0	2.3	2.1	1.9	1.7	1.3	0.9	0.6

Years with data availability below 75 per cent shown in italics.

Nitrogen dioxide

Table 27: 2005 percentiles of daily peak one-hour nitrogen dioxide concentrations in Victoria

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

Region Performance monitoring station	Data availability (% of days)	Max (ppm)	Percentiles (ppm)						
			99th	98th	95th	90th	75th	50th	
Port Phillip									
Alphington	94.8	0.050	0.043	0.039	0.035	0.033	0.027	0.022	
Brighton	99.2	0.054	0.040	0.038	0.034	0.032	0.027	0.020	
Footscray	99.5	0.053	0.046	0.043	0.038	0.034	0.027	0.021	
Geelong South	98.1	0.048	0.038	0.034	0.029	0.026	0.021	0.015	
Pt Cook	96.7	0.043	0.039	0.037	0.032	0.027	0.021	0.014	
RMIT (CBD)	97.8	0.058	0.050	0.047	0.040	0.037	0.032	0.027	
Latrobe Valley									
Moe	97.8	0.039	0.034	0.032	0.027	0.024	0.019	0.014	
Traralgon	91.5	0.040	0.032	0.030	0.028	0.026	0.023	0.016	
Ballarat	<i>30.7</i>	<i>0.030</i>	<i>0.026</i>	<i>0.024</i>	<i>0.022</i>	<i>0.019</i>	<i>0.015</i>	<i>0.010</i>	
Bendigo	<i>49.3</i>	<i>0.037</i>	<i>0.036</i>	<i>0.035</i>	<i>0.032</i>	<i>0.030</i>	<i>0.026</i>	<i>0.017</i>	

Stations with data availability below 75 per cent shown in italics.

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Table 28: Percentiles of daily maximum one-hour nitrogen dioxide at Alphington (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	93.7	0	0.061	0.046	0.043	0.038	0.034	0.029	0.024
1997	84.4	0	0.075	0.059	0.051	0.044	0.038	0.030	0.025
1998	95.9	0	0.073	0.058	0.055	0.045	0.039	0.031	0.026
1999	97.5	0	0.065	0.046	0.045	0.038	0.035	0.029	0.025
2000	89.0	0	0.069	0.053	0.048	0.040	0.035	0.029	0.024
2001	90.4	0	0.060	0.052	0.047	0.039	0.034	0.029	0.024
2002	93.7	0	0.060	0.048	0.046	0.038	0.034	0.030	0.023
2003	90.1	0	0.065	0.050	0.046	0.037	0.032	0.027	0.023
2004	95.6	0	0.056	0.044	0.039	0.034	0.032	0.028	0.023
2005	94.8	0	0.050	0.043	0.039	0.035	0.033	0.027	0.022

Table 29: Percentiles of daily maximum one-hour nitrogen dioxide at Footscray (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	91.5	0	0.071	0.054	0.049	0.043	0.037	0.028	0.023
1997	98.1	0	0.088	0.066	0.058	0.048	0.040	0.032	0.026
1998	89.9	0	0.070	0.057	0.053	0.048	0.042	0.032	0.024
1999	97.8	0	0.081	0.057	0.051	0.045	0.040	0.033	0.026
2000	82.7	0	0.070	0.060	0.054	0.046	0.039	0.030	0.025
2001	<i>32.6</i>	<i>0</i>	<i>0.041</i>	<i>0.040</i>	<i>0.039</i>	<i>0.036</i>	<i>0.033</i>	<i>0.028</i>	<i>0.021</i>
2002	91.8	0	0.059	0.055	0.049	0.040	0.035	0.029	0.022
2003	97.8	0	0.065	0.058	0.054	0.044	0.037	0.029	0.022
2004	95.6	0	0.056	0.047	0.044	0.040	0.035	0.029	0.023
2005	99.5	0	0.053	0.046	0.043	0.038	0.034	0.027	0.021

Years with data availability below 75 per cent shown in italics.

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Table 30: Percentiles of daily maximum one-hour nitrogen dioxide at Geelong South (1996-2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	86.6	0	0.044	0.041	0.038	0.033	0.028	0.024	0.018
1997	0.0								
1998	68.5	0	0.067	0.039	0.037	0.034	0.032	0.026	0.020
1999	93.7	0	0.046	0.038	0.035	0.031	0.028	0.022	0.016
2000	85.2	0	0.048	0.038	0.037	0.028	0.024	0.019	0.015
2001	91.2	0	0.047	0.035	0.032	0.029	0.027	0.022	0.015
2002	94.2	0	0.056	0.036	0.031	0.027	0.025	0.019	0.012
2003	87.7	0	0.050	0.034	0.033	0.028	0.025	0.021	0.014
2004	93.2	0	0.050	0.037	0.030	0.027	0.024	0.020	0.015
2005	98.1	0	0.048	0.038	0.034	0.029	0.026	0.021	0.015

Years with data availability below 75 per cent shown in italics. Years with data availability below 15 per cent not shown.

Table 31: Percentiles of daily maximum one-hour nitrogen dioxide at Point Cook (1996-2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	91.5	0	0.054	0.046	0.045	0.038	0.029	0.023	0.015
1997	0.0								
1998	92.1	0	0.064	0.049	0.046	0.036	0.028	0.022	0.015
1999	84.4	0	0.044	0.037	0.036	0.032	0.028	0.018	0.011
2000	68.8	0	0.048	0.043	0.039	0.032	0.028	0.020	0.014
2001	87.7	0	0.054	0.044	0.040	0.033	0.029	0.022	0.015
2002	96.2	0	0.056	0.045	0.041	0.031	0.027	0.021	0.013
2003	93.2	0	0.064	0.048	0.044	0.031	0.028	0.020	0.013
2004	94.8	0	0.066	0.041	0.035	0.030	0.026	0.020	0.013
2005	96.7	0	0.043	0.039	0.037	0.032	0.027	0.021	0.014

Years with data availability below 75 per cent shown in italics. Years with data availability below 15 per cent not shown.

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Table 32: Percentiles of daily maximum one-hour nitrogen dioxide at RMIT (CBD) (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	92.1	0	0.085	0.059	0.052	0.045	0.040	0.032	0.027
1997	90.4	0	0.100	0.074	0.065	0.055	0.046	0.039	0.032
1998	83.8	0	0.089	0.067	0.057	0.049	0.046	0.036	0.028
1999	97.3	0	0.078	0.062	0.050	0.045	0.041	0.033	0.028
2000	91.5	0	0.090	0.064	0.058	0.049	0.041	0.032	0.026
2001	93.4	0	0.071	0.055	0.050	0.043	0.036	0.029	0.024
2002	94.2	0	0.079	0.053	0.046	0.039	0.035	0.028	0.023
2003	98.9	0	0.069	0.059	0.053	0.045	0.039	0.032	0.026
2004	93.7	0	0.075	0.049	0.046	0.040	0.037	0.031	0.026
2005	97.8	0	0.058	0.050	0.047	0.040	0.037	0.032	0.027

Table 33: Percentiles of daily maximum one-hour nitrogen dioxide at Traralgon (1996-2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	85.8	0	0.035	0.032	0.029	0.027	0.025	0.022	0.016
1997	64.7	0	0.038	0.037	0.034	0.031	0.028	0.024	0.018
1998	89.0	0	0.036	0.030	0.029	0.027	0.025	0.022	0.016
1999	80.8	0	0.042	0.034	0.031	0.028	0.027	0.023	0.018
2000	98.4	0	0.041	0.037	0.033	0.027	0.025	0.021	0.017
2001	98.9	0	0.033	0.031	0.026	0.024	0.022	0.019	0.015
2002	98.1	0	0.033	0.031	0.030	0.027	0.025	0.020	0.015
2003	99.2	0	0.053	0.032	0.030	0.028	0.026	0.022	0.016
2004	98.6	0	0.036	0.034	0.030	0.028	0.024	0.019	0.015
2005	91.5	0	0.040	0.032	0.030	0.028	0.026	0.023	0.016

Years with data availability below 75 per cent shown in italics.

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Ozone

Table 34: 2005 percentiles of daily peak one-hour ozone concentrations in Victoria

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

Region Performance monitoring station	Data availability (% of days)	Max (ppm)	Percentiles (ppm)					
			99th	98th	95th	90th	75th	50th
Port Phillip								
Alphington	92.9	0.077	0.058	0.051	0.045	0.039	0.031	0.026
Brighton	97.8	0.088	0.067	0.053	0.047	0.040	0.032	0.028
Dandenong	92.6	0.072	0.062	0.054	0.045	0.041	0.033	0.028
Footscray	99.2	0.082	0.063	0.052	0.044	0.039	0.031	0.027
Geelong South	97.8	0.080	0.059	0.056	0.046	0.039	0.031	0.028
Melton	94.0	0.079	0.063	0.056	0.048	0.043	0.036	0.031
Moorooduc	98.9	0.080	0.065	0.061	0.048	0.042	0.034	0.030
Mooroolbark	97.8	0.089	0.064	0.053	0.045	0.042	0.035	0.029
Point Cook	97.0	0.092	0.068	0.059	0.047	0.038	0.031	0.027
Point Henry	99.5	0.088	0.059	0.057	0.048	0.038	0.033	0.029
Latrobe Valley								
Moe	99.5	0.062	0.055	0.047	0.041	0.036	0.031	0.027
Traralgon	86.3	0.067	0.050	0.046	0.040	0.035	0.031	0.026
Ballarat								
	<i>39.2</i>	<i>0.056</i>	<i>0.045</i>	<i>0.044</i>	<i>0.041</i>	<i>0.037</i>	<i>0.032</i>	<i>0.029</i>
Bendigo								
	<i>49.6</i>	<i>0.055</i>	<i>0.049</i>	<i>0.048</i>	<i>0.045</i>	<i>0.041</i>	<i>0.034</i>	<i>0.028</i>

Stations with data availability below 75 per cent shown in italics.

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Table 35: 2005 percentiles of daily peak four-hour ozone concentrations in Victoria

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

Region Performance monitoring station	Data availability (% of days)	Max (ppm)	Percentiles (ppm)					
			99th	98th	95th	90th	75th	50th
Port Phillip								
Alphington	92.9	0.070	0.050	0.047	0.042	0.037	0.030	0.025
Brighton	97.8	0.069	0.062	0.051	0.043	0.038	0.030	0.026
Dandenong	92.9	0.067	0.054	0.052	0.043	0.039	0.031	0.026
Footscray	99.2	0.066	0.053	0.047	0.042	0.035	0.030	0.025
Geelong South	97.5	0.068	0.055	0.049	0.042	0.037	0.030	0.026
Melton	94.2	0.075	0.054	0.051	0.045	0.041	0.034	0.030
Moorooduc	98.9	0.072	0.059	0.054	0.046	0.040	0.032	0.029
Mooroolbark	97.8	0.072	0.055	0.049	0.043	0.039	0.033	0.028
Point Cook	97.0	0.082	0.062	0.050	0.043	0.037	0.030	0.026
Point Henry	99.5	0.076	0.056	0.051	0.045	0.036	0.031	0.028
Latrobe Valley								
Moe	99.5	0.051	0.049	0.042	0.038	0.034	0.030	0.025
Traralgon	86.3	0.055	0.046	0.039	0.035	0.033	0.029	0.024
Ballarat	<i>39.2</i>	<i>0.049</i>	<i>0.043</i>	<i>0.041</i>	<i>0.039</i>	<i>0.035</i>	<i>0.031</i>	<i>0.028</i>
Bendigo	<i>49.9</i>	<i>0.050</i>	<i>0.048</i>	<i>0.046</i>	<i>0.042</i>	<i>0.040</i>	<i>0.034</i>	<i>0.027</i>

Stations with data availability below 75 per cent shown in italics. Exceedences shown in bold.

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Table 36: Percentiles of daily maximum one-hour ozone at Brighton (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	95.6	0	0.089	0.077	0.062	0.049	0.039	0.029	0.024
1997	95.6	3	0.112	0.082	0.072	0.056	0.039	0.028	0.024
1998	95.6	0	0.085	0.070	0.060	0.050	0.037	0.027	0.022
1999	99.5	0	0.070	0.067	0.063	0.052	0.041	0.030	0.024
2000	96.4	0	0.073	0.068	0.060	0.048	0.041	0.028	0.023
2001	80.3	0	0.078	0.071	0.058	0.049	0.039	0.029	0.024
2002	93.7	0	0.085	0.063	0.053	0.043	0.036	0.029	0.025
2003	99.2	2	0.109	0.070	0.065	0.056	0.046	0.029	0.025
2004	94.5	1	0.106	0.062	0.058	0.043	0.039	0.030	0.025
2005	97.8	0	0.088	0.067	0.053	0.047	0.040	0.032	0.028

Exceedences shown in bold.

Table 37: Percentiles of daily maximum one-hour ozone at Footscray (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	96.4	0	0.082	0.069	0.063	0.049	0.040	0.028	0.025
1997	98.1	1	0.105	0.090	0.073	0.055	0.042	0.030	0.025
1998	94.2	1	0.113	0.064	0.059	0.048	0.038	0.028	0.023
1999	95.9	0	0.079	0.070	0.066	0.054	0.041	0.032	0.025
2000	88.2	0	0.064	0.054	0.052	0.046	0.038	0.027	0.022
<i>2001</i>	<i>34.5</i>	<i>0</i>	<i>0.044</i>	<i>0.043</i>	<i>0.041</i>	<i>0.038</i>	<i>0.036</i>	<i>0.030</i>	<i>0.026</i>
2002	96.7	0	0.095	0.066	0.047	0.042	0.038	0.028	0.024
2003	98.1	1	0.105	0.072	0.061	0.051	0.041	0.027	0.023
2004	94.8	1	0.106	0.058	0.049	0.042	0.036	0.028	0.024
2005	99.2	0	0.082	0.063	0.052	0.044	0.039	0.031	0.027

Years with data availability below 75 per cent shown in italics. Exceedences shown in bold.

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Table 38: Percentiles of daily maximum one-hour ozone at Geelong South (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	86.8	0	0.091	0.063	0.056	0.044	0.033	0.027	0.022
1997	0.0								
1998	95.3	0	0.083	0.056	0.046	0.035	0.031	0.027	0.024
1999	95.3	0	0.073	0.053	0.048	0.040	0.033	0.027	0.022
2000	88.8	0	0.065	0.057	0.049	0.040	0.033	0.021	0.017
2001	92.3	0	0.082	0.064	0.057	0.040	0.032	0.024	0.020
2002	90.7	0	0.058	0.056	0.053	0.043	0.032	0.025	0.021
2003	97.3	0	0.081	0.069	0.063	0.043	0.033	0.023	0.020
2004	92.1	0	0.094	0.061	0.058	0.044	0.035	0.030	0.025
2005	97.8	0	0.080	0.059	0.056	0.046	0.039	0.031	0.028

Table 39: Percentiles of daily maximum one-hour ozone at Point Cook (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	99.5	0	0.090	0.079	0.069	0.051	0.038	0.030	0.026
1997	86.8	2	0.126	0.080	0.064	0.049	0.037	0.030	0.025
1998	94.5	1	0.107	0.083	0.063	0.044	0.034	0.025	0.021
1999	91.2	0	0.083	0.071	0.067	0.055	0.040	0.028	0.023
2000	85.2	0	0.079	0.067	0.063	0.049	0.040	0.032	0.028
2001	91.0	0	0.099	0.072	0.064	0.050	0.044	0.031	0.025
2002	97.0	0	0.093	0.068	0.063	0.048	0.039	0.030	0.027
2003	97.0	0	0.094	0.080	0.069	0.053	0.041	0.031	0.025
2004	98.6	0	0.093	0.065	0.056	0.047	0.039	0.028	0.025
2005	97.0	0	0.092	0.068	0.059	0.047	0.038	0.031	0.027

Exceedences shown in bold.

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Table 40: Percentiles of daily maximum one-hour ozone at Traralgon (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	80.8	0	0.049	0.043	0.041	0.036	0.033	0.028	0.022
1997	<i>60.3</i>	0	<i>0.072</i>	<i>0.058</i>	<i>0.057</i>	<i>0.052</i>	<i>0.041</i>	<i>0.030</i>	<i>0.025</i>
1998	92.3	0	0.075	0.062	0.054	0.044	0.037	0.030	0.026
1999	<i>31.8</i>	0	<i>0.060</i>	<i>0.055</i>	<i>0.050</i>	<i>0.043</i>	<i>0.036</i>	<i>0.028</i>	<i>0.023</i>
2000	96.2	0	0.056	0.050	0.047	0.039	0.033	0.027	0.023
2001	97.0	0	0.064	0.053	0.048	0.040	0.034	0.028	0.024
2002	100.0	0	0.057	0.048	0.043	0.036	0.033	0.029	0.024
2003	97.3	0	0.077	0.062	0.060	0.049	0.037	0.030	0.024
2004	97.5	0	0.058	0.049	0.048	0.042	0.037	0.031	0.025
2005	86.3	0	0.067	0.050	0.046	0.040	0.035	0.031	0.026

Years with data availability below 75 per cent shown in italics.

Table 41: Percentiles of daily maximum four-hour ozone at Brighton (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	95.6	0	0.078	0.065	0.056	0.044	0.035	0.027	0.022
1997	95.6	3	0.097	0.068	0.062	0.049	0.037	0.026	0.023
1998	95.6	1	0.082	0.062	0.055	0.042	0.034	0.026	0.021
1999	99.5	0	0.069	0.059	0.056	0.047	0.037	0.028	0.022
2000	96.4	0	0.064	0.061	0.052	0.044	0.038	0.026	0.022
2001	80.0	0	0.068	0.059	0.055	0.046	0.038	0.027	0.022
2002	93.2	0	0.072	0.056	0.048	0.039	0.034	0.028	0.023
2003	98.4	2	0.102	0.065	0.061	0.048	0.042	0.028	0.024
2004	94.5	1	0.092	0.057	0.051	0.042	0.036	0.029	0.024
2005	97.5	0	0.069	0.062	0.051	0.043	0.038	0.030	0.026

Exceedences shown in bold.

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Table 42: Percentiles of daily maximum four-hour ozone at Footscray (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	96.2	0	0.070	0.062	0.057	0.043	0.036	0.027	0.023
1997	98.1	3	0.095	0.072	0.063	0.049	0.038	0.028	0.024
1998	94.2	1	0.089	0.055	0.051	0.041	0.035	0.027	0.022
1999	95.9	0	0.069	0.063	0.057	0.048	0.037	0.030	0.024
2000	87.7	0	0.055	0.052	0.047	0.043	0.035	0.026	0.021
2001	<i>34.5</i>	<i>0</i>	<i>0.042</i>	<i>0.042</i>	<i>0.040</i>	<i>0.035</i>	<i>0.034</i>	<i>0.028</i>	<i>0.025</i>
2002	96.7	1	0.080	0.051	0.046	0.038	0.034	0.027	0.023
2003	97.8	2	0.094	0.063	0.056	0.045	0.038	0.026	0.021
2004	94.8	1	0.083	0.051	0.045	0.039	0.034	0.027	0.022
2005	98.9	0	0.066	0.053	0.047	0.042	0.035	0.030	0.025

Years with data availability below 75per cent shown in italics. Exceedences shown in bold.

Table 43: Percentiles of daily maximum four-hour ozone at Geelong South (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	86.8	0	0.076	0.058	0.051	0.039	0.031	0.026	0.021
1997	0.0								
1998	95.1	0	0.076	0.048	0.042	0.033	0.029	0.026	0.022
1999	95.6	0	0.063	0.048	0.044	0.038	0.031	0.026	0.021
2000	89.0	0	0.057	0.052	0.045	0.035	0.030	0.020	0.016
2001	92.3	0	0.075	0.057	0.054	0.038	0.030	0.023	0.019
2002	89.3	0	0.053	0.048	0.046	0.038	0.031	0.024	0.020
2003	97.0	0	0.072	0.059	0.054	0.040	0.029	0.022	0.019
2004	91.3	1	0.085	0.054	0.052	0.041	0.034	0.028	0.023
2005	97.3	0	0.068	0.055	0.049	0.042	0.037	0.030	0.026

Exceedences shown in bold.

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Table 44: Percentiles of daily maximum four-hour ozone at Point Cook (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	99.5	0	0.079	0.066	0.057	0.045	0.034	0.029	0.025
1997	86.8	2	0.113	0.073	0.057	0.044	0.034	0.028	0.024
1998	94.8	3	0.090	0.075	0.061	0.039	0.032	0.024	0.020
1999	91.2	0	0.069	0.065	0.060	0.047	0.035	0.026	0.022
2000	85.5	0	0.067	0.060	0.058	0.046	0.037	0.030	0.027
2001	91.0	1	0.095	0.063	0.057	0.048	0.040	0.029	0.024
2002	96.4	0	0.070	0.062	0.056	0.044	0.036	0.029	0.025
2003	96.2	1	0.093	0.072	0.063	0.048	0.038	0.029	0.024
2004	98.6	1	0.082	0.058	0.051	0.044	0.036	0.027	0.024
2005	96.7	1	0.082	0.062	0.050	0.043	0.037	0.030	0.026

Exceedences shown in bold.

Table 45: Percentiles of daily maximum four-hour ozone at Traralgon (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	80.8	0	0.043	0.039	0.037	0.033	0.031	0.026	0.021
1997	<i>60.5</i>	0	<i>0.064</i>	<i>0.055</i>	<i>0.051</i>	<i>0.045</i>	<i>0.039</i>	<i>0.029</i>	<i>0.024</i>
1998	92.1	0	0.058	0.053	0.048	0.041	0.035	0.029	0.024
1999	<i>31.8</i>	0	<i>0.053</i>	<i>0.051</i>	<i>0.044</i>	<i>0.040</i>	<i>0.033</i>	<i>0.026</i>	<i>0.021</i>
2000	96.7	0	0.050	0.046	0.043	0.034	0.031	0.026	0.021
2001	97.3	0	0.052	0.047	0.045	0.037	0.031	0.026	0.022
2002	100.0	0	0.049	0.046	0.038	0.034	0.031	0.027	0.022
2003	97.3	0	0.067	0.056	0.052	0.046	0.035	0.027	0.023
2004	97.3	0	0.050	0.044	0.043	0.039	0.034	0.029	0.023
2005	86.1	0	0.055	0.046	0.039	0.035	0.033	0.029	0.024

Years with data availability below 75 per cent shown in italics.

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Sulfur Dioxide

Table 46: 2005 percentiles of daily peak one-hour sulfur dioxide concentrations in Victoria

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

Region Performance monitoring station	Data availability (% of days)	Max (ppm)	Percentiles (ppm)					
			99th	98th	95th	90th	75th	50th
Port Phillip								
Alphington	94.5	0.011	0.008	0.007	0.005	0.004	0.002	0.001
Geelong South	96.4	0.054	0.029	0.022	0.017	0.012	0.008	0.003
Paisley	96.2	0.044	0.032	0.028	0.021	0.018	0.009	0.005
RMIT (CBD)	98.9	0.017	0.015	0.012	0.010	0.008	0.005	0.003
Latrobe Valley								
Moe	100.0	0.047	0.029	0.026	0.017	0.012	0.006	0.002
Traralgon	91.5	0.061	0.044	0.034	0.022	0.015	0.009	0.005

Table 47: 2005 percentiles of daily sulfur dioxide concentrations in Victoria

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

Region Performance monitoring station	Data availability (% of days)	Max (ppm)	Percentiles (ppm)					
			99th	98th	95th	90th	75th	50th
Port Phillip								
Alphington	94.5	0.002	0.002	0.002	0.001	0.001	0.001	0.000
Geelong South	96.4	0.008	0.005	0.004	0.003	0.002	0.001	0.001
Paisley	96.2	0.010	0.007	0.006	0.004	0.003	0.002	0.001
RMIT (CBD)	98.9	0.005	0.004	0.003	0.003	0.002	0.001	0.001
Latrobe Valley								
Moe	100.0	0.009	0.006	0.004	0.004	0.003	0.002	0.001
Traralgon	91.5	0.012	0.007	0.005	0.004	0.003	0.002	0.001

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Table 48: Percentiles of daily maximum one-hour sulfur dioxide at Alphington (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	97.0	0	0.008	0.006	0.006	0.005	0.003	0.002	0.001
1997	94.2	0	0.012	0.010	0.008	0.006	0.004	0.003	0.001
1998	97.0	0	0.015	0.012	0.008	0.007	0.005	0.003	0.002
1999	97.8	0	0.012	0.007	0.006	0.005	0.003	0.002	0.001
2000	97.8	0	0.010	0.007	0.006	0.004	0.003	0.001	0.000
2001	93.4	0	0.009	0.008	0.007	0.006	0.004	0.002	0.000
2002	98.4	0	0.012	0.008	0.007	0.006	0.004	0.002	0.000
2003	96.7	0	0.009	0.007	0.006	0.004	0.003	0.002	0.001
2004	99.7	0	0.014	0.009	0.007	0.005	0.004	0.003	0.001
2005	94.5	0	0.011	0.008	0.007	0.005	0.004	0.002	0.001

Table 49: Percentiles of daily maximum one-hour sulfur dioxide at Geelong South (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	76.8	0	0.032	0.026	0.023	0.016	0.010	0.004	0.001
1997	0.0								
1998	68.8	0	0.038	0.023	0.021	0.016	0.012	0.008	0.003
1999	94.0	0	0.029	0.020	0.019	0.015	0.011	0.007	0.003
2000	88.2	0	0.029	0.019	0.014	0.010	0.007	0.004	0.001
2001	50.7	0	0.037	0.024	0.023	0.018	0.012	0.006	0.002
2002	84.9	0	0.040	0.029	0.024	0.016	0.012	0.005	0.001
2003	96.2	0	0.039	0.032	0.026	0.015	0.011	0.005	0.001
2004	90.7	0	0.069	0.026	0.023	0.019	0.013	0.007	0.003
2005	96.4	0	0.054	0.029	0.022	0.017	0.012	0.008	0.003

Years with data availability below 75 per cent shown in italics. Years with data availability below 15 per cent not shown.

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Table 50: Percentiles of daily maximum one-hour sulfur dioxide at Traralgon (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	85.8	0	0.032	0.017	0.014	0.011	0.008	0.006	0.003
1997	<i>67.1</i>	<i>0</i>	<i>0.116</i>	<i>0.025</i>	<i>0.021</i>	<i>0.014</i>	<i>0.011</i>	<i>0.007</i>	<i>0.004</i>
1998	84.1	0	0.055	0.022	0.020	0.016	0.013	0.009	0.006
1999	80.3	0	0.032	0.020	0.017	0.013	0.012	0.007	0.004
2000	90.4	0	0.061	0.038	0.024	0.018	0.013	0.008	0.004
2001	98.6	0	0.063	0.036	0.020	0.014	0.011	0.008	0.005
2002	96.7	0	0.062	0.032	0.022	0.016	0.012	0.008	0.005
2003	97.5	0	0.082	0.038	0.030	0.020	0.015	0.009	0.005
2004	98.4	0	0.079	0.042	0.030	0.018	0.013	0.008	0.005
2005	91.5	0	0.061	0.044	0.034	0.022	0.015	0.009	0.005

Years with data availability below 75 per cent shown in italics.

Table 51: Percentiles of daily average sulfur dioxide at Alphington (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	97.0	0	0.003	0.002	0.002	0.002	0.001	0.001	0.000
1997	94.2	0	0.003	0.002	0.002	0.001	0.001	0.001	0.000
1998	97.0	0	0.003	0.002	0.002	0.002	0.001	0.001	0.000
1999	97.8	0	0.001	0.001	0.001	0.001	0.000	0.000	-0.001
2000	97.8	0	0.002	0.001	0.001	0.000	0.000	0.000	-0.001
2001	93.4	0	0.002	0.001	0.001	0.000	0.000	0.000	-0.001
2002	98.4	0	0.002	0.001	0.001	0.000	0.000	0.000	-0.001
2003	96.7	0	0.002	0.002	0.001	0.001	0.001	0.000	0.000
2004	99.7	0	0.003	0.002	0.002	0.001	0.001	0.001	0.000
2005	94.5	0	0.002	0.002	0.002	0.001	0.001	0.001	0.000

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Table 52: Percentiles of daily average sulfur dioxide at Geelong South (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	76.8	0	0.005	0.004	0.003	0.002	0.001	0.000	-0.001
1997	0.0								
1998	<i>68.8</i>	<i>0</i>	<i>0.006</i>	<i>0.004</i>	<i>0.004</i>	<i>0.003</i>	<i>0.002</i>	<i>0.001</i>	<i>0.001</i>
1999	94.0	0	0.005	0.003	0.003	0.002	0.002	0.001	0.000
2000	88.2	0	0.006	0.003	0.002	0.002	0.001	0.001	0.000
2001	<i>50.7</i>	<i>0</i>	<i>0.006</i>	<i>0.005</i>	<i>0.003</i>	<i>0.002</i>	<i>0.001</i>	<i>0.000</i>	<i>-0.001</i>
2002	84.9	0	0.004	0.002	0.002	0.001	0.001	0.000	-0.001
2003	96.2	0	0.004	0.003	0.002	0.002	0.001	0.000	-0.001
2004	90.7	0	0.006	0.004	0.003	0.002	0.002	0.001	0.000
2005	96.4	0	0.008	0.005	0.004	0.003	0.002	0.001	0.001

Years with data availability below 75 per cent shown in italics. Years with data availability below 15 per cent not shown.

Table 53: Percentiles of daily average sulfur dioxide at Traralgon (1996–2005)

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

Year	Data availability (% of days)	No. of exceedences (days)	Max (ppm)	Percentiles (ppm)					
				99th	98th	95th	90th	75th	50th
1996	85.8	0	0.008	0.004	0.003	0.003	0.002	0.002	0.001
1997	<i>67.1</i>	<i>0</i>	<i>0.028</i>	<i>0.008</i>	<i>0.006</i>	<i>0.004</i>	<i>0.003</i>	<i>0.002</i>	<i>0.001</i>
1998	84.1	0	0.009	0.007	0.007	0.005	0.005	0.004	0.002
1999	80.3	0	0.006	0.005	0.004	0.004	0.003	0.003	0.001
2000	90.4	0	0.013	0.007	0.005	0.004	0.003	0.002	0.001
2001	98.6	0	0.008	0.006	0.005	0.004	0.003	0.002	0.002
2002	96.7	0	0.009	0.008	0.005	0.004	0.004	0.003	0.002
2003	97.5	0	0.008	0.006	0.005	0.005	0.004	0.002	0.001
2004	98.4	0	0.010	0.007	0.006	0.004	0.003	0.002	0.001
2005	91.5	0	0.012	0.007	0.005	0.004	0.003	0.002	0.001

Years with data availability below 75 per cent shown in italics.

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Particles as PM₁₀

Table 54: 2005 percentiles of daily PM₁₀ concentrations in Victoria

AAQ NEPM standard: 50 µg/m³ (24-hour average)

Region Performance monitoring station	Data availability (% of days)	Max (µg/m ³)	Percentiles (µg/m ³)					
			99th	98th	95th	90th	75th	50th
Port Phillip								
Alphington	92.6	46.6	40.7	36.8	34.5	31.4	23.3	17.0
Brighton	84.1	41.5	33.8	32.7	28.0	25.8	19.7	14.4
Dandenong	90.1	43.7	40.5	37.5	34.0	31.5	24.8	17.4
Footscray	96.4	48.9	44.7	41.3	37.4	35.0	26.0	18.9
Geelong South	96.2	83.0	55.2	49.3	40.6	33.7	26.6	18.5
Mooroolbark	99.5	57.6	53.7	52.1	43.1	36.1	27.4	19.3
Richmond	96.2	54.9	39.0	37.0	32.0	28.9	22.5	17.1
RMIT (CBD)	98.4	41.7	36.5	35.2	33.2	29.4	22.8	17.4
Latrobe Valley								
Moe	99.7	36.9	33.4	32.6	28.5	24.7	19.8	14.2
Traralgon	90.1	44.9	41.0	36.8	31.5	26.3	20.8	16.2
Ballarat	<i>38.9</i>	26.0	25.2	24.7	23.5	21.5	18.2	14.6
Bendigo	<i>50.4</i>	55.7	49.2	46.4	40.9	35.2	26.0	16.8
Mildura	<i>64.1</i>	476.0	194.5	112.7	72.8	46.5	32.4	23.5

Years with data availability below 75 per cent shown in italics. Exceedences shown in bold.

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Table 55: Percentiles of 24-hour PM₁₀ at Alphington (1996–2005)

AAQ NEPM standard: 50 µg/m³ (24-hour average)

Year	Data availability (% of days)	No. of exceedences (days)	Max (µg/m ³)	Percentiles (µg/m ³)					
				99th	98th	95th	90th	75th	50th
1996	97.0	0	41.7	39.6	37.8	30.4	26.1	21.5	17.2
1997	98.1	2	68.6	44.3	37.8	33.4	29.5	23.0	18.1
1998	90.1	1	53.5	46.0	42.1	36.6	31.8	24.4	18.5
1999	84.7	0	43.7	34.1	32.7	30.3	26.3	21.6	17.4
2000	95.1	2	56.5	43.6	34.8	31.6	26.8	21.4	16.8
2001	91.0	2	72.6	39.6	35.1	32.8	27.9	23.4	17.2
2002	97.5	1	66.2	35.9	34.5	30.4	27.9	22.4	17.2
2003	95.9	10	181.7	80.9	56.4	38.3	30.9	22.9	17.2
2004	97.0	1	51.6	45.2	36.8	30.9	27.6	22.0	16.5
2005	92.6	0	46.6	40.7	36.8	34.5	31.4	23.3	17.0

Exceedences shown in bold.

Table 56: Percentiles of 24-hour PM₁₀ at Footscray (1996–2005)

AAQ NEPM standard: 50 µg/m³ (24-hour average)

Year	Data availability (% of days)	No. of exceedences (days)	Max (µg/m ³)	Percentiles (µg/m ³)					
				99th	98th	95th	90th	75th	50th
1996	13.1								
1997	98.9	4	65.5	50.1	41.5	38.2	32.5	25.7	19.8
1998	94.8	4	59.8	50.5	43.9	41.4	34.7	26.9	19.8
1999	96.7	1	50.7	41.2	38.0	32.8	28.4	23.9	19.1
2000	89.0	2	57.8	43.6	40.7	36.6	30.0	23.9	17.6
2001	<i>40.5</i>	0	38.9	33.7	28.4	26.3	23.5	18.2	15.1
2002	98.4	2	79.1	42.9	38.7	32.2	28.3	22.1	17.5
2003	87.7	10	314.5	89.1	66.0	41.0	32.2	23.4	17.6
2004	93.2	3	58.1	48.4	40.4	33.5	29.1	22.3	16.1
2005	96.4	0	48.9	44.7	41.3	37.4	35.0	26.0	18.9

Years with data availability below 75 per cent shown in italics. Years with data availability below 15 per cent not shown. Exceedences shown in bold.

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Particles as PM_{2.5}

Table 57: 2005 percentiles of Daily PM_{2.5} Concentrations in Victoria

AAQ NEPM Advisory Reporting Standard: 25 µg/m³ (24-hour average)

Region Performance monitoring station	Data availability (% of days)	Max (µg/m ³)	Percentiles (µg/m ³)					
			99th	98th	95th	90th	75th	50th
Port Phillip								
Alphington	94.3	37.4	30.2	25.5	18.7	16.2	8.9	6.7
Footscray	81.1	31.8	29.5	20.5	15.9	13.0	8.5	5.6

Monitoring by reference method (one-day-in-three). Exceedences shown in bold.

Table 58: PM_{2.5} Equivalence Program 2005 TEOM monitoring – Daily Concentrations in Victoria

Region Performance monitoring station	Data availability (% of days)	Max (µg/m ³)	Percentiles (µg/m ³)					
			99th	98th	95th	90th	75th	50th
Port Phillip								
Alphington	93.4	24.8	17.9	16.2	14.0	11.2	6.9	4.4
Footscray	99.5	20.3	14.3	13.0	10.9	9.1	5.9	3.9

Monitoring for the PM_{2.5} Equivalence Program was conducted using TEOM instruments. Results are presented in Table 58. Preliminary results of comparisons indicate that the ratio of TEOM to reference method is less than one on average and lower in winter than in summer, which is similar to behaviour established for PM₁₀. Seasonal regression analyses such as those in Table 59 may allow readings from the two methods to be related.

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Table 59: Preliminary results of Equivalence Program (2003-2005)

	Regression parameters ^a			Ave(TEOM)/ Ave (reference)
	B	A	Correlation	
Alphington				
Summer	1.12	-1.42	0.91	0.90
Autumn	0.75	0.56	0.91	0.81
Winter	0.77	-0.77	0.76	0.67
Spring	0.89	-0.62	0.74	0.78
All seasons	0.83	-0.33	0.83	0.79
Footscray				
Summer	0.91	-0.53	0.75	0.83
Autumn	0.76	-0.50	0.93	0.71
Winter	0.55	-0.01	0.93	0.55
Spring	0.98	-1.14	0.68	0.76
All seasons	0.71	-0.05	0.87	0.71

a TEOM = B * (Reference method) + A
Reduced major axis regression and R² correlation.