

AIR MONITORING REPORT, 2003

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

Publication 950

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Air quality in Victoria is monitored in accordance with a monitoring plan developed under the Ambient Air Quality National Environment Protection Measure¹ (AAQ NEPM). This report assesses compliance with this measure.

SUMMARY

Victoria's monitoring results for 2003 indicated that:

- Air quality in Victoria in 2003 was adversely affected by drought related dust storms and the north-east Victorian bushfires, leading to numerous exceedences of the particles standard and contributing to exceedences of the ozone standards.
- The goal of the AAQ NEPM, to achieve by 2008 the standards to the extent specified, was met for all pollutants except particles (as PM₁₀) and ozone.
- PM₁₀ exceeded the standard at all monitoring stations, on between seven and 13 days. Over half of these days occurred in January and February, when widespread bushfires were the cause of high PM₁₀ levels. At least half of the remaining days were caused by windblown dust.
- The goal for 4-hour ozone was not met at five stations in the Port Phillip region. The goal for 1-hour ozone was not met at one station. The

bushfires also contributed to these exceedences.

- The 24-hour advisory reporting standard for particles (as PM_{2.5}) was exceeded in the Port Phillip region at all stations monitored.
- The consistently high data capture rates required by the AAQ NEPM guidelines were achieved in most cases during the periods when stations operated.
- Compliance with the standards and the 2008 goal could not be demonstrated at some monitoring stations for carbon monoxide and nitrogen dioxide because the data capture was lower. It is expected that air quality at these stations would most likely have complied.
- Victoria has an on-going program to increase data capture through improvements to systems and instrument upgrades. A significant improvement has occurred over previous years.

Performance monitoring stations operated continuously throughout the year and campaign monitoring was conducted to fulfil commitments in Victoria's monitoring plan.² 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 *Ambient Air Quality NEPM Monitoring Plan Victoria*, (EPA Publication 763), available from www.epa.vic.gov.au.

DETAILS

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: Port Phillip, Latrobe Valley, Ballarat, Bendigo, Shepparton, Wodonga, Warrnambool and Mildura. They are shown in Figure 1. Monitoring stations in the Port Phillip region are shown in Figure 2.

The performance monitoring stations, pollutants monitored and site types are summarised in Appendix 1.

Additions to the Monitoring Network

During 2003 Victoria established additional campaign monitoring stations at:

- *Outer North Metro*: This station to monitor ozone is located at Craigieburn, a semi-rural location on the outskirts of Melbourne.
- *Shepparton*: This station monitors PM₁₀ with a high-volume sampler operating one day in six.

During 2003, campaign monitoring was concluded at:

- *Outer South East Metro*: monitoring ozone.
- *Ballarat*: monitoring PM₁₀ by high-volume sampler operating one day in six.

Following the addition to the NEPM of the advisory reporting standard for particles as PM_{2.5}, PM_{2.5} has been monitored by the reference method (on a one day in three basis) at Inner East Metro and Inner West Metro stations. Campaign monitoring of PM_{2.5} at CBD South East, South Metro and Outer East Metro stations concluded in August. PM_{2.5} is also monitored continuously by tapered element oscillating microbalance (TEOM) at Inner East Metro and Inner West Metro for the PM_{2.5} Equivalence Program.

Further information on these additions and other changes to the monitoring plan is given in Appendix 1.

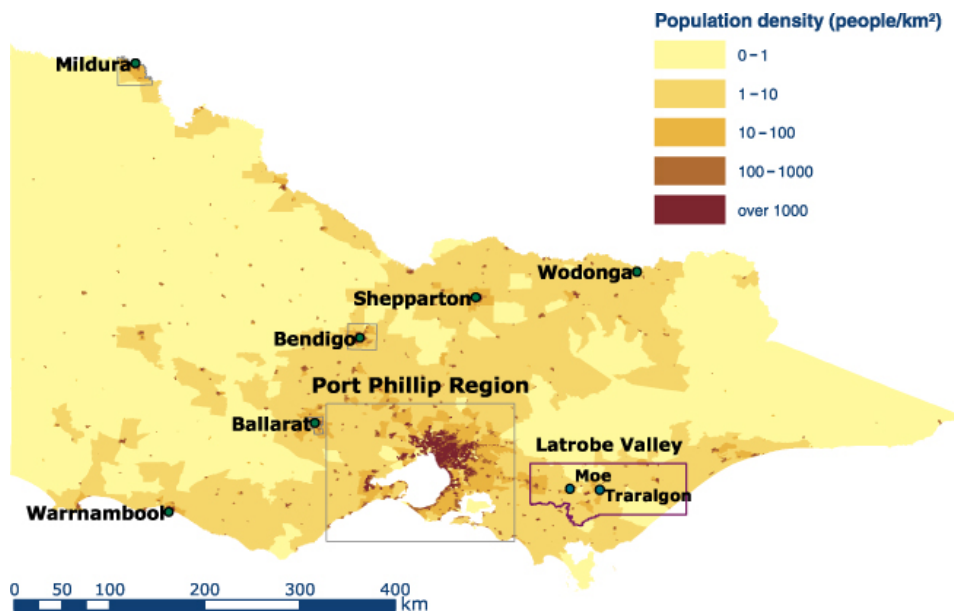


Figure 1. AAQ NEPM Regions and Population Density in Victoria

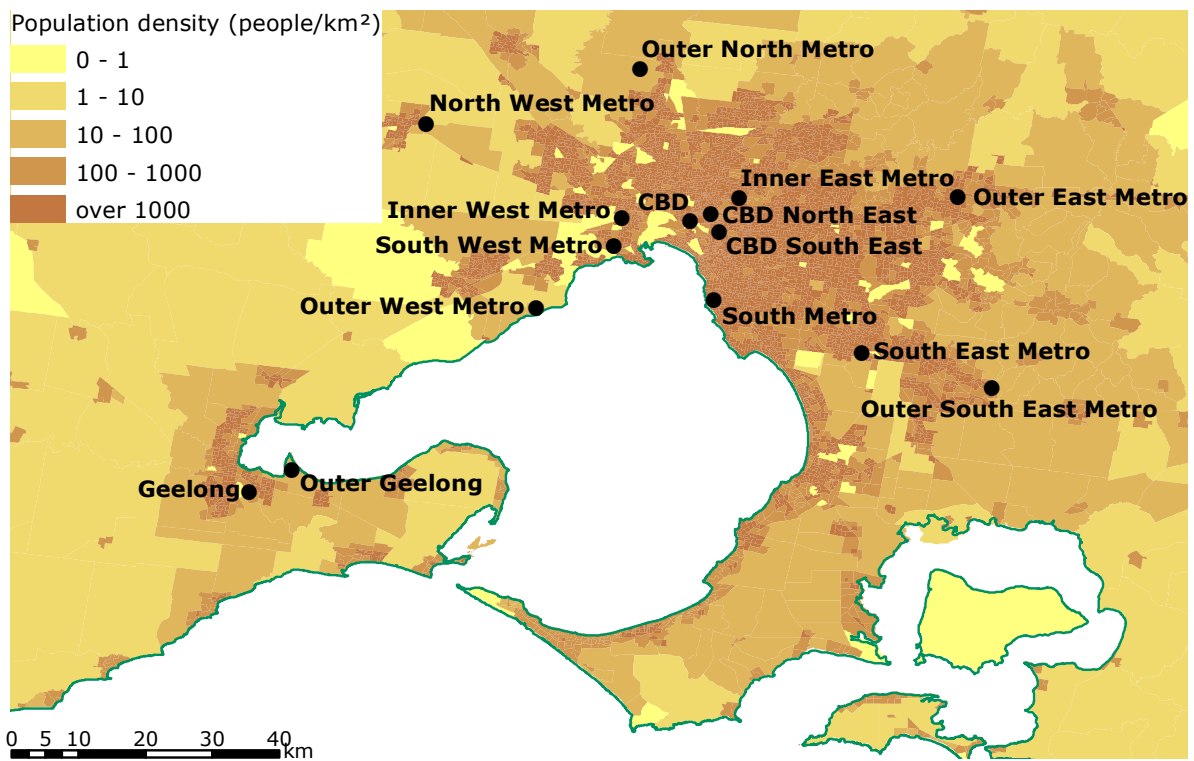


Figure 2. Monitoring Stations in Port Phillip Region

Assessment of Compliance with Standards and 2008 Goal

Tables 1 to 6 summarise the compliance of monitoring with the standards and goal of the AAQ NEPM.

Performance is assessed as meeting the standards and 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 recovery 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 screening³ 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.

Additional monitoring statistics prepared in accordance with AAQ NEPM guidelines are shown in Appendix 2.

Assessment of PM_{2.5} against the Advisory Reporting Standards

The NEPM was revised in 2003 to include advisory reporting standards for particles as PM_{2.5}. There is no timeframe for compliance but monitoring by the reference method and other acceptable methods is required to be reported. 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 scheduled to commence in 2005. Table 7 summarises

Victoria's monitoring of PM_{2.5} by the reference method. Further monitoring statistics are given in Appendix 2.

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

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Table 1. 2003 Compliance Summary for Carbon Monoxide in Victoria

AAQ NEPM Standard
9.0 ppm (8-hour average)

Region Performance monitoring station	Location	Data recovery rates (% of hours)					Number of exceedences (days)	Performance against the standard and 2008 goal
		Q1	Q2	Q3	Q4	Annual		
Port Phillip								
CBD	RMIT	89.9	94.4	94.6	94.9	93.5	0	met
CBD South East	Richmond	94.2	93.4	93.1	90.7	92.8	0	met
Inner East Metro	Alphington	91.2	93.1	93.9	94.6	93.2	0	met
Geelong ^a	Geelong South	68.8	90.7	86.9	87.5	83.6	0	not demonstrated

a Compliance not demonstrated because data capture was less than 75 per cent in one quarter. As all recorded values were low, it is likely that complete monitoring would have shown that standards were met.

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.

Regions for which screening has not been completed and which are therefore reported as 'not demonstrated': Ballarat, Bendigo, Shepparton, Warrnambool, Wodonga, Mildura.

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Table 2. 2003 Compliance Summary for Nitrogen Dioxide in Victoria

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

Region Performance monitoring station	Location	Data recovery rates (% of hours)					Number of exceedences (days)	Annual mean (ppm)	Performance against the standards and 2008 goal	
		Q1	Q2	Q3	Q4	Annual			1-hour	1-year
Port Phillip										
CBD	RMIT	90.0	94.3	94.4	94.9	93.4	0	0.016	met	met
Inner East Metro ^a	Alphington	89.0	92.3	93.3	69.0	85.9	0	0.013	not demonstrated	not demonstrated
Inner West Metro	Footscray	91.8	94.0	93.6	93.4	93.2	0	0.012	met	met
South Metro	Brighton	91.8	89.6	93.9	94.3	92.4	0	0.010	met	met
Outer West Metro	Pt Cook	90.2	92.1	78.8	93.5	88.6	0	0.005	met	met
Geelong ^a	Geelong South	58.2	92.3	92.2	89.2	83.1	0	0.005	not demonstrated	not demonstrated
Latrobe Valley										
LV East Central	Traralgon	95.6	95.6	93.9	94.8	95.0	0	0.008	met	met
LV West Central	Moe	92.9	95.6	95.3	91.8	93.9	0	0.007	met	met

^a Compliance not demonstrated because data capture was less than 75 per cent in one quarter. As all recorded values were low, it is likely that complete monitoring would have shown that standards were met.

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: Shepparton, Warrnambool, Wodonga, Mildura.

Regions for which screening has not been completed and which are therefore reported as 'not demonstrated': Ballarat, Bendigo.

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Table 3. 2003 Compliance Summary for Ozone in Victoria

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

Region Performance monitoring station	Location	Data recovery rates (% of hours)					Number of exceedences (days)		Performance against the standards and 2008 goal	
		Q1	Q2	Q3	Q4	Annual	1-hour	4-hour	1-hour	4-hour
Port Phillip										
Inner East Metro	Alphington	87.5	92.3	91.8	94.1	91.4	1	1	met	met
Inner West Metro	Footscray	92.1	94.0	94.4	92.5	93.3	1	2	met	not met
North West Metro	Melton	90.8	93.5	94.7	94.8	93.5	1	4	met	not met
South Metro	Brighton	92.5	91.3	93.4	94.5	92.9	2	2	not met	not met
South East Metro	Dandenong	91.3	93.6	92.5	94.7	93.0	0	2	met	not met
Outer East Metro	Mooroolbark	94.4	94.4	93.6	93.9	94.1	0	3	met	not met
Outer North Metro ^a	Craigieburn				93.0	23.4	0	0	not demonstrated	not demonstrated
Outer South East ^b	Pakenham	94.1	83.2			43.9	0	0	not demonstrated	not demonstrated
Outer West Metro	Point Cook	91.7	92.4	91.1	92.8	92.0	0	1	met	met
Geelong	Geelong South	92.5	92.3	92.6	89.2	91.6	0	0	met	met
Outer Geelong	Point Henry	94.6	90.9	95.4	95.7	94.2	0	1	met	met
Latrobe Valley										
LV East Central	Traralgon	95.6	93.0	91.3	94.7	93.6	0	0	met	met
LV West Central	Moe	92.8	90.7	95.2	95.7	93.6	0	0	met	met

a Campaign monitoring commenced in September for one ozone season.

b Campaign monitoring ceased in June.

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.

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Table 4. 2003 Compliance Summary for Sulfur Dioxide in Victoria

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

Region Performance monitoring station	Location	Data recovery rates (% of hours)					Number of exceedences (days)		Annual mean (ppm)	Performance against the standards and 2008 goal		
		Q1	Q2	Q3	Q4	Annual	1-hour	24-hour		1-hour	24-hour	1-year
Port Phillip												
CBD	RMIT	89.9	94.4	94.6	94.8	93.4	0	0	0.001	met	met	met
Inner East Metro	Alphington	85.0	92.2	93.8	94.6	91.4	0	0	0.000	met	met	met
South West Metro	Paisley	82.0	92.6	91.4	93.3	89.9	0	0	0.000	met	met	met
Geelong	Geelong South	88.5	92.4	92.6	89.2	90.7	0	0	-0.001 ^a	met	met	met
Latrobe Valley												
LV East Central	Traralgon	92.6	95.7	93.2	94.6	94.0	0	0	0.002	met	met	met
LV West Central	Moe	92.9	95.6	95.3	95.7	94.9	0	0	0.001	met	met	met

^a Negative values result from uncertainty in measurements near zero.

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.

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Table 5. 2003 Compliance Summary for Lead in Victoria

AAQ NEPM Standard
0.50 µg/m³ (1-year average)

Region Performance monitoring station	Location	Data recovery rates (% of days)					Annual mean (µg/m ³)	Performance against the standard and 2008 goal
		Q1	Q2	Q3	Q4	Annual		
Port Phillip CBD North East	Collingwood	100.0	93.8	100.0	100.0	98.4	0.03	met

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: Latrobe Valley, Ballarat, Bendigo, Shepparton, Warrnambool, Wodonga, Mildura

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Table 6. 2003 Compliance Summary for PM₁₀ in Victoria

AAQ NEPM Standard

50 µg/m³ (24-hour average)

Region Performance monitoring station	Location	Data recovery rates (% of days)					Number of exceedences (days)	Performance against the standard and 2008 goal
		Q1	Q2	Q3	Q4	Annual		
Port Phillip								
CBD ^a	RMIT	96.7	95.6	96.7	97.8	96.7	10	not met
CBD South East ^b	Richmond	86.7	93.4	96.7	92.4	92.3	7	not met
Inner East Metro ^b	Alphington	92.2	97.8	95.7	97.8	95.9	11	not met
Inner West Metro	Footscray	86.7	93.4	83.7	87.0	87.7	10	not met
South Metro	Brighton	96.7	92.3	84.8	81.5	88.8	8	not met
South East Metro	Dandenong	86.7	92.3	96.7	97.8	93.4	7	not met
Outer East Metro	Mooroolbark	93.3	86.8	88.0	98.9	91.8	13	not met
Geelong ^a	Geelong South	98.9	85.7	98.9	92.4	94.0	10	not met
Latrobe Valley								
LV East Central	Traralgon	97.8	100.0	97.8	98.9	98.6	7	not met
LV West Central	Moe	94.4	100.0	100.0	97.8	98.1	11	not met
Ballarat^c	Ballarat	14.4	17.6	14.3		11.5	1	not demonstrated
Shepparton^d	Shepparton				4.3	1.1	0	not demonstrated

Monitoring was by TEOM unless indicated otherwise.

- a In addition to TEOM monitoring, PM₁₀ was monitored by high-volume sampler one day in six at CBD and Geelong throughout the year – there were no additional exceedences.
- b In addition to TEOM monitoring, PM₁₀ was monitored by high-volume sampler one day in six at CBD South East and Inner East Metro throughout the year – one exceedence has been included in this table which was not also a TEOM exceedence.
- c Campaign monitoring at Ballarat by high-volume sampler one day in six ceased in September.
- d Campaign monitoring at Shepparton by high-volume sampler one day in six commenced in December.

Regions for which screening has not been completed and which are therefore reported as 'not demonstrated': Shepparton, Warrnambool, Wodonga, Mildura.

EPA Victoria

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Table 7. 2003 Monitoring Summary for PM_{2.5} in Victoria

AAQ NEPM Advisory Reporting Standard

25 µg/m³ (24-hour average)

8 µg/m³ (1-year average)

Region Performance monitoring station	Location	Data recovery rates (% of days)					Number of exceedences (days)	Annual mean (µg/m ³)
		Q1	Q2	Q3	Q4	Annual		
Port Phillip								
CBD South East ^a	Richmond	76.7	90.3	31.3		50.0	4	not reported ^b
Inner East Metro	Alphington	83.3	96.8	87.5	93.5	91.8	4	7.7
Inner West Metro	Footscray	53.3	83.9	84.4	93.5	80.3	3	not reported ^b
South Metro ^a	Brighton	76.7	87.1	53.1		54.9	2	not reported ^b
Outer East Metro ^a	Mooroolbark	73.3	96.8	53.1		56.6	3	not reported ^b

Monitoring by reference method (one day in three).

a Campaign monitoring at Richmond, Brighton and Mooroolbark ceased in August.

b Annual mean not reported because data capture was less than 75 per cent in at least one quarter.

Progress Towards Achieving the AAQ NEPM 2008 Goal

The AAQ NEPM goal 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 2003 the standards and the 2008 goal were met for all pollutants at all stations except for ozone and PM₁₀.

There were no ozone exceedences in the Latrobe Valley. However, in the Port Phillip region the standards and goal were not complied with at Inner West Metro, North West Metro, South Metro, South East Metro and Outer East Metro. These exceedences occurred on five days when the photochemical generation of ozone was exacerbated by emissions from the extensive bushfires in north-eastern Victoria and beyond.

Monitoring at the Outer South East campaign monitoring station for 10 months (including the 2002-03 ozone season) recorded no exceedences, with levels typically lower than most other parts of the Melbourne-Geelong region.⁴

The bushfires also caused an unusual number of exceedences of the PM₁₀ standard, with all performance monitoring stations in the Port Phillip and Latrobe Valley regions recording 'not met' assessments. Exceedences due to smoke from bushfires were recorded on 12 days in January and February. Windblown dust, exacerbated by extended periods of dry weather and high winds, caused exceedences on another six days, including widespread dust storms on 19 March and 6 June. On four other days in the colder part of the year, local

⁴ *Ozone monitoring at Pakenham, August 2002 to June 2003*, (EPA Publication 934), available from www.epa.vic.gov.au.

sources such as open fires and wood heaters caused exceedences at individual stations.

There were instances where compliance with the standards and 2008 goal could not be demonstrated. 'Not demonstrated' assessments for CO and NO₂ due to insufficient data recovery are detailed in Table 1 and Table 2. Comparison with other monitoring suggests that the AAQ NEPM 2008 goal was most likely achieved in all cases where there was insufficient data to demonstrate compliance. Victoria has an on-going program to increase data capture through improvements to systems and instrument upgrades.

In addition, compliance is not demonstrated due to incomplete screening procedures for CO, O₃ and PM₁₀ in the rural regions. Campaign monitoring for PM₁₀, which has been performed at Bendigo⁵ and Ballarat⁶ and is currently underway at Shepparton, has indicated that ongoing monitoring will be required. It is planned to extend PM₁₀ campaign monitoring in the other regions sequentially in future years.

Screening procedures by campaign monitoring for CO and O₃ are being progressively implemented, with a station to be located at Bendigo in the first instance. The Bendigo station opened in May 2004 and will operate for 12 months, monitoring CO, O₃, NO₂, PM₁₀ and visibility. This station infrastructure will then be relocated to other rural regions sequentially in future years.

⁵ *Air quality assessment of fine particles in Bendigo – a pilot study*, (EPA Publication 869), available from www.epa.gov.au.

⁶ *Airborne particle monitoring at Ballarat, February 2002 to September 2003*, (EPA Publication 936), available from www.epa.gov.au.

Extent to Which Standards are Met

On the basis of available data, the following observations may be made:

- For CO, no exceedences were recorded and compliance was demonstrated at all stations where there was adequate data capture.
- For NO₂, no exceedences were recorded and compliance was demonstrated at all stations where there was adequate data capture.
- For O₃, no exceedences were recorded in the Latrobe Valley but five stations in the Port Phillip region failed to meet the compliance requirements against the standards and 2008 goal. In addition, compliance at two campaign monitoring stations was not demonstrated because they did not operate for the full year. A description of the circumstances leading to these exceedences is given in Appendix 3.
- For SO₂, no exceedences were recorded and compliance was demonstrated at all stations.
- For Pb, compliance was demonstrated at the peak station in Port Phillip region.
- For PM₁₀, all stations in the Port Phillip and Latrobe Valley regions had adequate data recovery rates, but failed to demonstrate compliance. The number of exceedences varied between seven and 13. One exceedence was recorded in the Ballarat region. Data recovery was insufficient to demonstrate compliance at Ballarat and Shepparton. A description of the circumstances leading to these exceedences is given in Appendix 3.

Compliance could not be demonstrated at some stations due to insufficient data. CO and NO₂ at

Geelong, and NO₂ at Alphington had low data recovery rates for one quarter of the year due to monitoring instruments being unavailable, but comparisons with other stations and patterns from other years suggest that they would have complied with the standards and 2008 goal.

IMPROVING VICTORIA'S AIR QUALITY

While Victoria's air quality is considered good in an international context, EPA is undertaking a program of activities to promote further improvements in our air quality. Major programs are targeted at reducing emissions from transport, domestic and industry activities.

Transport Highlights

Motor vehicle emissions are a significant source of air pollution. To address this, EPA contributes to national processes to improve vehicle emissions and fuels standards and undertakes a range of programs focused on improving emissions from the Victorian vehicle fleet. Highlights for 2003 include:

- the Victorian motor vehicle regulations were updated in 2003 and a new provision will result in reductions in hydrocarbon emissions from petrol during the summer months;
- the motor vehicle regulations also introduced 'in-service' diesel vehicle emission standards, consistent with the National Environment Protection Measure (Diesel Vehicle Emissions);
- the 'Eco Maintenance' program, which included a pilot program of roadside emission testing of diesel commercial vehicles and seminars across Victoria to inform and train diesel mechanics about maintenance practices for compliance with new national diesel vehicle standards;

- the Victorian community reported over 10,400 smoky vehicles through EPA's smoky vehicle program; and
- EPA ran media campaigns that centred on the improvements motorists can make to air quality by maintaining their cars and driving more efficiently.

Domestic Highlights

Smoke from wood heating is a significant source of air pollution in the winter months. EPA recently joined with the Commonwealth, New South Wales, South Australia, Western Australia and Tasmania to conduct audits of wood heaters on sale, to check for compliance with the Australian Standard (AS4013). When operated correctly, Australian Standard compliant wood heaters produce up to 75 per cent less emissions than an open fire place or non-compliant heater. EPA is finalising statutory requirements that will make it mandatory for new heaters sold to meet the Australian Standard.

Industry Highlights

EPA continues to work with industry, through our business sustainability programs and regional EPA offices, to promote best practice in all industry activities, including reducing emissions to air. Individual industries continue to investigate initiatives as part of achieving compliance with the State Environment Protection Policy (Air Quality Management). These include:

- All EPA licence holders must assess their greenhouse gas emissions and energy use, with the larger users developing an action plan to reduce their contribution to greenhouse gases.

- Emitters of highly hazardous emissions must reduce those to the maximum extent achievable. This has resulted in a number of reductions of emissions within some industry sectors and leading toward actions to eradicate substances that cause those emissions.

The Future

Air quality continues to be a major environmental concern for Victorians. EPA is undertaking a range of activities to ensure that the standards and 2008 goal in the Ambient Air Quality NEPM are consistently met. Victoria is also committed to an on-going review of its air monitoring to ensure that the needs of the Victorian public are being maintained. Key actions include:

- improving data capture through enhancements to our systems and instrumentation,
- employing the available resources to best meet the requirements outlined in our monitoring plan, and
- progress towards implementing our commitments to monitoring in regional Victoria.

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APPENDIX 1: MONITORING DETAILS

Performance Monitoring Stations

The performance monitoring stations, pollutants monitored and site types are summarised in Table 8. Site types are defined⁷ as: generally representative upper bound for community exposure sites, population-average sites and peak sites.

Table 8. Victorian Performance Monitoring Stations

Region Performance monitoring station	Location	Location category	Site type					
			CO	NO ₂	O ₃	SO ₂	Pb	PM ₁₀
Port Phillip								
CBD	RMIT	CBD	G*	G*		G		G*
CBD North East	Collingwood	LI/Res					Pk*	
CBD South East	Richmond	Res	G					G
Inner East Metro	Alphington	Res/LI	G*	G*	Pop	Pop*		G*
Inner West Metro	Footscray	I/Res		G*	G*			G*
North West Metro	Melton	Res				G		
South East Metro	Dandenong	LI				Pop		Pop
South Metro	Brighton	Res		G	Pop*			Pop
South West Metro	Paisley	I/Res				G		
Outer East Metro	Mooroolbark	Res				Pop		Pop
Outer West Metro	Pt Cook	Rur/Res		Pop*	G*			
Geelong	Geelong South	LI/Res	G*	G*	Pop*	G*		G*
Outer Geelong	Point Henry	I/Rur				Pop		
Latrobe Valley								
LV East Central	Traralgon	Res		G*	G*	G*		G*
LV West Central	Moe	Res		Pop	G	G		G

CBD Central business district

I Industrial

Res Residential

G Generally representative upper bound

Pk Peak

RMIT RMIT University

LI Light industrial

Rur Rural

Pop Population-average

* Trend station

⁷ National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 3, Monitoring Strategy, available from www.ephc.gov.au.

Description of Exposed Population

The exposed population represented by each monitoring station is described qualitatively by the location category column in Table 8. Further information is given in Appendix C of the monitoring plan.

Implementation of the Monitoring Plan

When the monitoring plan was published, some stations were included with sites yet to be selected. As described in the 2002 Compliance Report,⁸ the Outer East Metro, North West Metro and Inner West Metro performance monitoring stations and the Outer South East campaign station meet all requirements of the Australian standard for siting of sampling units, while Inner East Metro, CBD South East and Latrobe Valley West Central continue to have minor non-compliances, due to the proximity of trees.

A site for the Outer North Metro station was selected at Craigieburn for campaign monitoring of O₃ and the station commenced monitoring in September 2003. The station meets all siting and monitoring method requirements, as shown in Table 9, and the data are included in this report.

Table 9. Summary of New Stations' Siting Compliance with AS 2922-1987

	Height above ground	Min. 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
Outer North Metro (Craigieburn)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

TEOM PM₁₀ data quoted in this report have been adjusted according to the default procedure⁹, 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 the Environment Protection Authority are covered by its NATA accreditation (number 1576). The NATA status of the monitoring network and laboratory was confirmed by a reaccreditation audit carried out early in 2002.

⁸ *Air monitoring report, 2002*, (EPA Publication 907), available from www.epa.vic.gov.au.

⁹ *National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 10, Collection and Reporting of TEOM PM₁₀ Data*, available from www.ephc.gov.au.

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

Screening

For regions other than Port Phillip and Latrobe Valley, the monitoring plan presents a process to demonstrate whether levels of O₃, NO₂, PM₁₀ and CO are consistently below the standards. This has been done, using Screening Procedure E of the Technical Paper, for O₃ in Ballarat, Bendigo, Shepparton, Wodonga, Warrnambool and Mildura and for NO₂ in Shepparton, Wodonga, Warrnambool and Mildura. Screening procedures for NO₂ at Ballarat and Bendigo, and for CO, are not completed, pending data acquisition and modelling, and compliance is reported as 'not demonstrated'.

Campaign monitoring for PM₁₀ at Bendigo and Ballarat has not met the screening criteria (based on high volume sampler monitoring, one day in six). Monitoring at Albury by the NSW EPA indicates that this is so for Wodonga also. Until resources become available for continuous monitoring in rural regions, PM₁₀ compliance will be reported as 'not demonstrated'.

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, commencing 1 January 2004. PM_{2.5} was monitored by the reference method (on a one day in three basis) at two stations (Inner East Metro and Inner West Metro) throughout 2003 and at a further three stations (CBD South East, South Metro and Outer East Metro) until August; these are all performance monitoring stations for PM₁₀. Difficulties in controlling the humidity of the filter weighing room prevented full compliance with the recommended operating procedures.¹⁰

Victoria also participates in the PM_{2.5} Equivalence Program, with TEOM monitors located at Inner East Metro (Alphington) and Inner West Metro (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.

¹⁰ National Environment Protection (Ambient Air Quality) Measure Technical Paper on Monitoring for PM_{2.5}, available from www.ephc.gov.au.

APPENDIX 2: DATA ANALYSIS

Tables of monitoring statistics presented in this Appendix have been prepared according to AAQ NEPM guidelines.¹¹

Summary Statistics

Annual summary statistics that allow assessment of how close air quality was to the standards are presented in Table 10 to Table 17. The AAQ NEPM states that the short-term standards should not be exceeded on more than one day for CO, NO₂, O₃, SO₂, and on more than five days per year for PM₁₀. The second highest 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.

Percentiles

Results of further analysis of the monitoring data are presented in Table 18 to Table 25. The percentiles in Table 18 and Table 21 are based on running averages, including those that overlap from one day to the next.

Trends

Previous trend analyses have shown that ozone and lead concentrations have decreased markedly over the last 10 to 20 years. Ozone has complied with AAQ NEPM standards in recent years, in contrast with many previous exceedences. Lead levels have decreased to concentrations approaching the detectable level. Environment Australia is proposing to present a detailed analysis of Australia-wide trend data to 2001 in the report of the project Ambient Air Quality: Status and Trends in Australia (currently in preparation).

Equivalence Program

Monitoring for the PM_{2.5} Equivalence Program was conducted using TEOM instruments. Results are presented in Table 26 to Table 28.

¹¹ National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 8, Annual Reports, available from www.ephc.gov.au.

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Table 10. 2003 Summary Statistics for Daily Peak 8-hour Carbon Monoxide in Victoria

AAQ NEPM standard
9.0 ppm (8-hour average)

Region Performance monitoring station	Location	Number of valid days	Highest (ppm)	Highest (date:hour)	2 nd highest (ppm)	2 nd highest (date:hour)
Port Phillip						
CBD	RMIT	353	3.9	Jul 04:03	3.4	Jun 26:01
CBD South East	Richmond	352	6.4	May 07:02	4.1	Jul 18:02
Inner East Metro	Alphington	353	5.4	May 07:02	4.9	Jul 03:02
Geelong	Geelong South	318	3.2	May 08:02	1.9	Jul 04:01

Table 11. 2003 Summary Statistics for Daily Peak 1-hour Nitrogen Dioxide in Victoria

AAQ NEPM standard
0.12 ppm (1-hour average)

Region Performance monitoring station	Location	Number of valid days	Highest (ppm)	Highest (date:hour)	2 nd highest (ppm)	2 nd highest (date:hour)
Port Phillip						
CBD	RMIT	361	0.069	Jan 25:22	0.068	May 06:13
Inner East Metro	Alphington	329	0.065	Jan 25:23	0.055	Apr 22:23
Inner West Metro	Footscray	357	0.065	May 06:14	0.062	Jan 24:13
South Metro	Brighton	358	0.074	Apr 20:21	0.058	Mar 12:20
Outer West Metro	Pt Cook	340	0.064	May 07:13	0.054	Oct 10:16
Geelong	Geelong South	320	0.050	May 07:18	0.036	Nov 28:23
Latrobe Valley						
LV East Central	Traralgon	362	0.053	Jan 20:20	0.037	Aug 08:09
LV West Central	Moe	359	0.034	Jan 20:20	0.033	Jan 30:05

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Table 12. 2003 Summary Statistics for Daily Peak 1-hour Ozone in Victoria

AAQ NEPM standard
0.10 ppm (1-hour average)

Region Performance monitoring station	Location	Number of valid days	Highest (ppm)	Highest (date:hour)	2 nd highest (ppm)	2 nd highest (date:hour)
Port Phillip						
Inner East Metro	Alphington	352	0.102	Feb 03:17	0.084	Jan 24:14
Inner West Metro	Footscray	358	0.105	Jan 24:15	0.089	Feb 03:19
North West Metro	Melton	357	0.112	Feb 03:18	0.097	Feb 23:15
South Metro	Brighton	362	0.109	Jan 24:15 Feb 03:17		
South East Metro	Dandenong	356	0.098	Feb 03:15	0.095	Jan 24:17
Outer East Metro	Mooroolbark	364	0.098	Jan 17:16	0.090	Feb 03:18
Outer North Metro ^a	Craigieburn	87	0.068	Dec 15:15	0.057	Dec 17:17
Outer South East ^b	Pakenham	167	0.071	Jan 17:14	0.058	Feb 03:15
Outer West Metro	Pt Cook	354	0.094	Jan 24:17	0.091	Feb 03:18
Geelong	Geelong South	355	0.081	Feb 03:17	0.076	Jan 20:13
Outer Geelong	Pt Henry	357	0.095	Jan 24:16	0.085	Feb 03:17
Latrobe Valley						
LV East Central	Traralgon	355	0.077	Jan 29:20	0.070	Jan 20:15
LV West Central	Moe	355	0.083	Jan 29:20	0.077	Jan 20:13

a Monitoring commenced in September.

b Monitoring ceased in June.

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Table 13. 2003 Summary Statistics for Daily Peak 4-hour Ozone in Victoria

AAQ NEPM standard
0.08 ppm (4-hour average)

Region Performance monitoring station	Location	Number of valid days	Highest (ppm)	Highest (date:hour)	2 nd highest (ppm)	2 nd highest (date:hour)
Port Phillip						
Inner East Metro	Alphington	350	0.090	Feb 03:19	0.079	Jan 24:17
Inner West Metro	Footscray	357	0.094	Jan 24:18	0.081	Feb 03:19
North West Metro	Melton	357	0.099	Feb 03:19	0.090	Jan 24:18
South Metro	Brighton	359	0.102	Jan 24:17	0.098	Feb 03:19
South East Metro	Dandenong	357	0.093	Feb 03:17	0.086	Jan 24:18
Outer East Metro	Mooroolbark	361	0.090	Jan 17:18	0.086	Feb 03:19
Outer North ^a	Craigieburn	87	0.065	Dec 15:18	0.056	Dec 17:18
Outer South East ^b	Pakenham	167	0.066	Jan 17:15	0.053	Feb 04:17
Outer West Metro	Pt Cook	351	0.093	Jan 24:19	0.080	Feb 03:19
Geelong	Geelong South	354	0.072	Feb 03:18	0.063	Nov 19:22
Outer Geelong	Pt Henry	357	0.083	Feb 03:20	0.079	Jan 25:20
Latrobe Valley						
LV East Central	Traralgon	355	0.067	Jan 20:18	0.063	Dec 17:15
LV West Central	Moe	355	0.072	Jan 29:21	0.069	Jan 20:16

a Monitoring commenced in September.

b Monitoring ceased in June.

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Table 14. 2003 Summary Statistics for Daily Peak 1-hour Sulfur Dioxide in Victoria

AAQ NEPM standard
0.20 ppm (1-hour average)

Region Performance monitoring station	Location	Number of valid days	Highest (ppm)	Highest (date:hour)	2 nd highest (ppm)	2 nd highest (date:hour)
Port Phillip						
CBD	RMIT	362	0.035	Jan 25:22	0.021	May 17:06
Inner East Metro	Alphington	353	0.021	Jul 17:17	0.009	Jan 09:06
South West Metro	Paisley	346	0.036	Mar 22:05	0.033	May 21:15
Geelong	Geelong South	351	0.039	Feb 07:04	0.037	Dec 02:23
Latrobe Valley						
LV East Central	Traralgon	357	0.082	Oct 13:16	0.062	Dec 28:14
LV West Central	Moe	362	0.030	Dec 28:16	0.027	Feb 26:15

Table 15. 2003 Summary Statistics for Daily Peak 24-hour Sulfur Dioxide in Victoria

AAQ NEPM standard
0.08 ppm (24-hour average)

Region Performance monitoring station	Location	Number of valid days	Highest (ppm)	Highest (date:hour)	2 nd highest (ppm)	2 nd highest (date:hour)
Port Phillip						
CBD	RMIT	362	0.006	Mar 26	0.005	May 10
Inner East Metro	Alphington	353	0.002	Jul 31	0.002	Mar 26
South West Metro	Paisley	346	0.009	Feb 28	0.008	Mar 02
Geelong	Geelong South	351	0.004	May 05	0.003	Aug 21
Latrobe Valley						
LV East Central	Traralgon	356	0.008	Aug 26	0.007	Jan 15
LV West Central	Moe	362	0.009	Feb 26	0.008	Feb 11

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Table 16. 2003 Summary Statistics for 24-hour PM₁₀ in Victoria

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

Region Performance monitoring station	Location	Number of valid days	Highest (µg/m ³)	Highest (date)	6 th highest (µg/m ³)	6 th highest (date)
Port Phillip						
CBD	RMIT	353	279.4	Mar 19	81.8	Feb 03
CBD South East	Richmond	337	274.9	Mar 19	72.9	Jan 24
Inner East Metro	Alphington	350	181.7	Mar 19	79.8	Jan 24
Inner West Metro	Footscray	320	314.5	Mar 19	78.7	Jan 24
South Metro	Brighton	324	182.3	Mar 19	80.4	Jan 25
South East Metro	Dandenong	341	295.1	Mar 19	88.3	Jan 20
Outer East Metro	Mooroolbark	335	322.2	Mar 19	106.9	Jan 25
Geelong	Geelong South	343	148.7	Mar 19	71.0	Feb 03
Latrobe Valley						
LV East Central	Traralgon	360	237.8	Mar 19	51.8	Jan 30
LV West Central	Moe	358	288.8	Mar 19	70.4	Jan 20
Ballarat^a	Ballarat	42	68.8	Jun 6	42.3 ^a	Jan 19
Shepparton^b	Shepparton	4	46.6	Dec 15	-	-

Monitoring was by TEOM unless indicated otherwise. In addition, PM₁₀ was monitored by high-volume sampler one day in six at CBD, CBD South East, Inner East Metro and Geelong throughout the year. The highest high-volume sampler readings were 162.6, 161.7, 58.6 and 116.1 µg/m³, respectively.

- a Campaign monitoring by high-volume sampler one day in six at Ballarat, January to September. As monitoring is only one day in six, the 2nd highest rather than 6th highest reading is presented.
- b Campaign monitoring by high-volume sampler one day in six at Shepparton, commencing in December.

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Table 17. 2003 Summary Statistics for 24-hour PM_{2.5} in Victoria

AAQ NEPM advisory reporting standard

25 µg/m³ (24-hour average)

Region Performance monitoring station	Location	Number of valid days	Highest (µg/m ³)	Highest (date)
Port Phillip				
CBD South East ^a	Richmond	61	44.6	Feb 03
Inner East Metro	Alphington	112	38.4	Jul 03
Inner West Metro	Footscray	98	51.1	Feb 03
South Metro ^a	Brighton	67	39.4	Jan 25
Outer East Metro ^a	Mooroolbark	69	33.5	May 25

Monitoring by reference method (one day in three).

a Monitoring ceased in August.

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Table 18. 2003 Percentiles of Daily Peak 8-hour Carbon Monoxide Concentrations in Victoria

AAQ NEPM standard
9.0 ppm (8-hour average)

Region Performance monitoring station	Location	Data availability (% of days)	Max conc. (ppm)	99 th %ile (ppm)	98 th %ile (ppm)	95 th %ile (ppm)	90 th %ile (ppm)	75 th %ile (ppm)	50 th %ile (ppm)
Port Phillip									
CBD	RMIT	96.7	3.9	3.0	2.6	1.8	1.5	0.9	0.6
CBD South East	Richmond	96.4	6.4	4.0	3.6	2.6	1.7	0.8	0.3
Inner East Metro	Alphington	96.7	5.4	3.9	3.5	2.7	1.8	0.9	0.5
Geelong	Geelong South	87.1	3.2	1.8	1.6	1.1	0.7	0.4	0.2

Table 19. 2003 Percentiles of Daily Peak 1-hour Nitrogen Dioxide Concentrations in Victoria

AAQ NEPM standard
0.12 ppm (1-hour average)

Region Performance monitoring station	Location	Data availability (% of days)	Max conc. (ppm)	99 th %ile (ppm)	98 th %ile (ppm)	95 th %ile (ppm)	90 th %ile (ppm)	75 th %ile (ppm)	50 th %ile (ppm)
Port Phillip									
CBD	RMIT	98.9	0.069	0.059	0.053	0.045	0.039	0.032	0.026
Inner East Metro	Alphington	90.1	0.065	0.052	0.046	0.037	0.033	0.029	0.024
Inner West Metro	Footscray	97.8	0.065	0.058	0.054	0.044	0.037	0.029	0.022
South Metro	Brighton	98.1	0.074	0.053	0.045	0.037	0.033	0.027	0.021
Outer West Metro	Pt Cook	93.2	0.064	0.048	0.044	0.031	0.028	0.020	0.013
Geelong	Geelong South	87.7	0.050	0.034	0.033	0.028	0.025	0.021	0.014
Latrobe Valley									
LV East Central	Traralgon	99.2	0.053	0.032	0.030	0.028	0.026	0.021	0.016
LV West Central	Moe	98.4	0.034	0.031	0.029	0.027	0.024	0.020	0.014

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Table 20. 2003 Percentiles of Daily Peak 1-hour Ozone Concentrations in Victoria

AAQ NEPM standard
0.10 ppm (1-hour average)

Region Performance monitoring station	Location	Data availability (% of days)	Max conc. (ppm)	99 th %ile (ppm)	98 th %ile (ppm)	95 th %ile (ppm)	90 th %ile (ppm)	75 th %ile (ppm)	50 th %ile (ppm)
Port Phillip									
Inner East Metro	Alphington	96.4	0.102	0.064	0.059	0.050	0.041	0.030	0.025
Inner West Metro	Footscray	98.1	0.105	0.072	0.061	0.051	0.041	0.027	0.023
North West Metro	Melton	97.8	0.112	0.083	0.074	0.056	0.046	0.032	0.029
South Metro	Brighton	99.2	0.109	0.070	0.065	0.056	0.046	0.029	0.025
South East Metro	Dandenong	97.5	0.098	0.079	0.061	0.053	0.044	0.028	0.024
Outer East Metro	Mooroolbark	99.7	0.098	0.072	0.065	0.055	0.047	0.031	0.026
Outer North Metro ^a	Craigieburn	23.8	0.068	0.059	0.056	0.054	0.050	0.040	0.030
Outer South East ^b	Pakenham	45.8	0.071	0.055	0.049	0.043	0.036	0.025	0.020
Outer West Metro	Pt Cook	97.0	0.094	0.080	0.069	0.053	0.041	0.031	0.025
Geelong	Geelong South	97.3	0.081	0.069	0.063	0.043	0.033	0.023	0.020
Outer Geelong	Pt Henry	97.8	0.095	0.075	0.071	0.052	0.041	0.030	0.025
Latrobe Valley									
LV East Central	Traralgon	97.3	0.077	0.062	0.060	0.049	0.037	0.030	0.024
LV West Central	Moe	97.3	0.083	0.061	0.060	0.051	0.043	0.031	0.026

a Monitoring commenced in September.

b Monitoring ceased in June.

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Table 21. 2003 Percentiles of Daily Peak 4-hour Ozone Concentrations in Victoria

AAQ NEPM standard

0.08 ppm (4-hour average)

Region Performance monitoring station	Location	Data availability (% of days)	Max conc. (ppm)	99 th %ile (ppm)	98 th %ile (ppm)	95 th %ile (ppm)	90 th %ile (ppm)	75 th %ile (ppm)	50 th %ile (ppm)
Port Phillip									
Inner East Metro	Alphington	95.9	0.090	0.058	0.053	0.047	0.038	0.028	0.023
Inner West Metro	Footscray	97.8	0.094	0.063	0.056	0.045	0.038	0.026	0.021
North West Metro	Melton	97.8	0.099	0.077	0.063	0.052	0.042	0.032	0.028
South Metro	Brighton	98.4	0.102	0.065	0.061	0.048	0.042	0.028	0.024
South East Metro	Dandenong	97.8	0.093	0.067	0.059	0.047	0.040	0.027	0.023
Outer East Metro	Mooroolbark	98.9	0.090	0.065	0.056	0.050	0.044	0.030	0.025
Outer North Metro ^a	Craigieburn	23.8	0.065	0.057	0.054	0.050	0.046	0.038	0.028
Outer South East ^b	Pakenham	45.8	0.066	0.048	0.045	0.039	0.032	0.024	0.019
Outer West Metro	Pt Cook	96.2	0.093	0.072	0.063	0.048	0.038	0.029	0.024
Geelong	Geelong South	97.0	0.072	0.059	0.054	0.040	0.029	0.022	0.019
Outer Geelong	Pt Henry	97.8	0.083	0.065	0.061	0.049	0.037	0.029	0.024
Latrobe Valley									
LV East Central	Traralgon	97.3	0.067	0.056	0.052	0.046	0.035	0.027	0.023
LV West Central	Moe	97.3	0.072	0.059	0.056	0.048	0.038	0.029	0.025

a Monitoring commenced in September.

b Monitoring ceased in June.

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Table 22. 2003 Percentiles of Daily Peak 1-hour Sulfur Dioxide Concentrations in Victoria

AAQ NEPM standard
0.20 ppm (1-hour average)

Region	Location	Data availability (% of days)	Max conc. (ppm)	99 th %ile (ppm)	98 th %ile (ppm)	95 th %ile (ppm)	90 th %ile (ppm)	75 th %ile (ppm)	50 th %ile (ppm)
Port Phillip									
Performance monitoring station									
CBD	RMIT	99.2	0.035	0.017	0.013	0.010	0.008	0.005	0.002
Inner East Metro	Alphington	96.7	0.009	0.007	0.006	0.004	0.003	0.002	0.001
South West Metro	Paisley	94.8	0.036	0.032	0.027	0.020	0.014	0.007	0.003
Geelong	Geelong South	96.2	0.039	0.032	0.026	0.015	0.011	0.005	0.001
Latrobe Valley									
LV East Central	Traralgon	97.8	0.082	0.038	0.030	0.020	0.015	0.009	0.005
LV West Central	Moe	99.2	0.030	0.026	0.024	0.019	0.013	0.006	0.003

Table 23. 2003 Percentiles of Daily Sulfur Dioxide Concentrations in Victoria

AAQ NEPM standard
0.08 ppm (24-hour average)

Region	Location	Data availability (% of days)	Max conc. (ppm)	99 th %ile (ppm)	98 th %ile (ppm)	95 th %ile (ppm)	90 th %ile (ppm)	75 th %ile (ppm)	50 th %ile (ppm)
Port Phillip									
Performance monitoring station									
CBD	RMIT	99.2	0.006	0.005	0.004	0.003	0.002	0.001	0.001
Inner East Metro	Alphington	96.7	0.002	0.002	0.001	0.001	0.001	0.000	0.000
South West Metro	Paisley	94.8	0.009	0.007	0.005	0.003	0.002	0.001	0.000
Geelong	Geelong South	96.2	0.004	0.002	0.002	0.002	0.001	0.000	-0.001
Latrobe Valley									
LV East Central	Traralgon	97.5	0.008	0.006	0.005	0.005	0.004	0.002	0.001
LV West Central	Moe	99.2	0.009	0.007	0.007	0.005	0.004	0.002	0.001

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Table 24. 2003 Percentiles of Daily PM₁₀ Concentrations in Victoria

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

Region	Location	Data availability (% of days)	Max conc. (µg/m ³)	99 th %ile (µg/m ³)	98 th %ile (µg/m ³)	95 th %ile (µg/m ³)	90 th %ile (µg/m ³)	75 th %ile (µg/m ³)	50 th %ile (µg/m ³)
Port Phillip									
Performance monitoring station									
CBD	RMIT	96.7	279.4	83.5	58.3	38.8	31.3	23.9	18.7
CBD South East	Richmond	92.3	274.9	73.8	48.2	33.2	29.1	21.6	16.5
Inner East Metro	Alphington	95.9	181.7	80.9	56.4	38.3	30.9	22.9	17.2
Inner West Metro	Footscray	87.7	314.5	89.1	66.0	41.0	32.2	23.4	17.6
South Metro	Brighton	88.8	182.3	89.3	67.8	35.9	30.5	21.5	15.8
South East Metro	Dandenong	93.4	295.1	92.3	52.4	39.0	30.9	23.4	17.6
Outer East Metro	Mooroolbark	91.8	322.2	118.1	91.3	45.6	37.4	26.8	19.1
Geelong	Geelong South	94.0	148.7	80.2	57.7	45.3	35.3	25.6	18.4
Latrobe Valley									
LV East Central	Traralgon	98.6	237.8	59.0	47.3	37.2	27.2	21.6	16.8
LV West Central	Moe	98.1	288.8	81.2	56.2	37.7	31.0	21.2	14.7
Ballarat^a	Ballarat	11.5	68.8	58.0	47.1	40.3	27.8	18.8	10.8
Shepparton^b	Shepparton	1.1	46.6						

a Campaign monitoring by high-volume sampler one day in six at Ballarat, January to December.

b Campaign monitoring by high-volume sampler one day in six at Shepparton, commencing in December.
Insufficient data is available to calculate percentiles.

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Table 25. 2003 Percentiles of Daily PM_{2.5} Concentrations in Victoria

AAQ NEPM Advisory Reporting Standard

25 µg/m³ (24-hour average)

Region Performance monitoring station	Location	Data availability (% of days)	Max conc. (µg/m ³)	99 th %ile (µg/m ³)	98 th %ile (µg/m ³)	95 th %ile (µg/m ³)	90 th %ile (µg/m ³)	75 th %ile (µg/m ³)	50 th %ile (µg/m ³)
Port Phillip									
CBD South East ^a	Richmond	50.0	44.6	44.4	41.5	28.9	19.0	11.5	7.0
Inner East Metro	Alphington	91.8	38.4	36.2	32.9	18.3	15.2	8.5	5.7
Inner West Metro	Footscray	80.3	51.1	38.9	28.1	21.6	14.2	7.9	4.8
South Metro ^a	Brighton	54.9	39.4	34.0	28.8	21.5	14.5	9.9	5.1
Outer East Metro ^a	Mooroolbark	56.6	33.5	29.4	27.1	22.7	17.7	12.7	7.6

Monitoring by reference method (one day in three).

a Monitoring ceased in August.

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Table 26. PM_{2.5} Equivalence Program TEOM Monitoring - Summary

Region Performance monitoring station	Location	Data recovery rates (% of days)					Annual mean (ppm)
		Q1	Q2	Q3	Q4	Annual	
Port Phillip							
Inner East Metro	Alphington	97.8	94.5	89.0	96.7	94.2	7.6
Inner West Metro	Footscray ^a				40.2	10.1	6.3

a Monitoring commenced in November.

Table 27. PM_{2.5} Equivalence Program TEOM Monitoring - Daily Statistics

Region Performance monitoring station	Location	Number of valid days	Highest (µg/m ³)	Highest (date)
Port Phillip				
Inner East Metro	Alphington	344	59.5	Feb 04
Inner West Metro ^a	Footscray	37	14.0	Dec 02

a Monitoring commenced in November.

Table 28. PM_{2.5} Equivalence Program TEOM Monitoring - Daily Percentiles

Region Performance monitoring station	Location	Data availability (% of days)	Max conc. (µg/m ³)	99 th %ile (µg/m ³)	98 th %ile (µg/m ³)	95 th %ile (µg/m ³)	90 th %ile (µg/m ³)	75 th %ile (µg/m ³)	50 th %ile (µg/m ³)
Port Phillip									
Inner East Metro	Alphington	94.2	59.5	39.2	29.9	17.9	13.7	8.3	5.6
Inner West Metro ^a	Footscray	10.1	14.0	13.9	13.7	12.8	10.9	8.4	5.3

a Monitoring commenced in November.

APPENDIX 3: DESCRIPTION OF CIRCUMSTANCES WHICH LED TO EXCEEDENCES

Ozone

Ozone is generated by chemical reactions in strong sunlight as precursor chemicals are transported from the point of emission. In 2003 ozone exceeded the standards more frequently than in recent years. The recorded exceedences of the 1-hour and 4-hour standards are shown in Table 29. Each of the exceedences occurred when there were widespread bushfires burning in Victoria and New South Wales. The fires were responsible for exacerbating photochemical ozone effects in Melbourne because they emit large quantities of hydrocarbons and nitrogen oxides that can react together to form ozone in the smoke plume. All exceedences except 23 February can be traced back to fires by wind trajectories. The exceedence on 23 February, which occurred only at North West Metro, could be due to bushfires but this is uncertain.

There were no exceedences of the ozone standards in the Latrobe Valley.

Particles as PM₁₀

In 2003 PM₁₀ exceeded the standard on an unusually large number of days. The major causes were:

- widespread bushfires occurring summer, particularly in the northeast of Victoria,
- drought conditions leading to windblown dust episodes, and
- calm, cold conditions when the effects of local sources such as open fires and wood heaters are expected.

The circumstances leading to PM₁₀ exceedences are shown in Table 30. TEOM measurements were adjusted where necessary for loss of volatiles at low temperatures. Bushfires were burning on all the exceedence days in January and February but on some of them windblown dust was the principal cause. Particularly high and widespread concentrations on 19 March and 6 June have been designated as due to 'dust storms', which are most unusual in winter.

Particles as PM_{2.5}

As for PM₁₀, exceedences of PM_{2.5} were caused by bushfires, windblown dust and local sources. All exceedences recorded by reference method monitors are shown in Table 31, with the allocated causes.

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Table 29. Ozone Exceedences

AAQ NEPM standard

0.10 ppm (1-hour average)

0.08 ppm (4-hour average)

Region Performance monitoring station	Location	17 Jan	24 Jan		25 Jan	3 Feb		23 Feb
		4h	1h	4h	4h	1h	4h	4h
Port Phillip								
Inner East Metro	Alphington					0.102	0.090	
Inner West Metro	Footscray		0.105	0.094			0.081	
North West Metro	Melton			0.090	0.081	0.112	0.099	0.085
South Metro	Brighton		0.109	0.102		0.109	0.098	
South East Metro	Dandenong			0.086			0.093	
Outer East Metro	Mooroolbark	0.090		0.083			0.086	
Outer West Metro	Point Cook			0.093				
Outer Geelong	Point Henry						0.083	

All readings in parts per million.

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Table 30. PM₁₀ Exceedences

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

Date	Port Phillip								Latrobe Valley			Cause
	CBD	CBD South East	Inner East Metro	Inner West Metro	South Metro	South East Metro	Outer East Metro	Geelong	LV East Central	LV West Central	Ballarat	
	RMIT	Richmond	Alphington	Footscray	Brighton	Dandenong	Mooroolbark	Geelong South	Traralgon	Moe	Ballarat	
13 Jan 2003	56.8	54.7 ^a		62.2			51.3					Dust
19 Jan 2003			58.6 ^a									Bushfires
20 Jan 2003	82.9	73.2	76.4	89.7	77.5	88.3	105.2	56.4	51.0	70.4		Bushfires
24 Jan 2003	81.1	72.9	79.8	78.7	93.2	104.9	124.7			52.1		Bushfires
25 Jan 2003	101.4	81.5	87.7	91.3	80.4		106.9	111.9	54.1	79.0		Bushfires
29 Jan 2003										56.4		Bushfires
30 Jan 2003									51.8			Bushfires
2 Feb 2003							57.2					Bushfires
3 Feb 2003	81.8	74.1	80.2	86.4	84.7	93.6	115.5	71.0	66.1	84.0		Bushfires
4 Feb 2003	84.1		81.6	68.3	90.6	90.3	119.4	86.3	148.2	177.8		Bushfires
5 Feb 2003	58.3		56.0	60.0	56.5	62.0	84.8	53.4	119.5	125.9		Bushfires
14 Feb 2003										50.6		Bushfires
20 Feb 2003							56.2			54.5		Bushfires
18 Mar 2003								61.2				Local or dust
19 Mar 2003	279.4	274.9	181.7	314.5	182.3	295.1	322.2	148.7	237.8	288.8		Dust storm

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Date	Port Phillip								Latrobe Valley			Cause
	CBD	CBD South East	Inner East Metro	Inner West Metro	South Metro	South East Metro	Outer East Metro	Geelong	LV East Central	LV West Central	Ballarat	
	RMIT	Richmond	Alphington	Footscray	Brighton	Dandenong	Mooroolbark	Geelong South	Traralgon	Moe	Ballarat	
5 May 2003							50.1					Local
6 May 2003				57.1			53.5					Local
7 May 2003								57.0				Local
5 Jun 2003 ^b	52.3		50.2									Dust
6 Jun 2003 ^b	157.4	179.0	144.4	138.6	140.5	173.8	215.5	109.2		58.3	68.8	Dust storm
3 Jul 2003			50.1									Local
15 Nov 2003								71.8				Dust

All readings in $\mu\text{g}/\text{m}^3$. Measured by TEOM unless shown otherwise.

- a Measured by high-volume sampler on a day when TEOM did not record an exceedence.
- b TEOM exceedences due to dust are not adjusted for loss of volatiles.

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Table 31. PM_{2.5} Exceedences

AAQ NEPM standard

25 µg/m³ (24-hour average)

Date	Port Phillip					Cause
	CBD South East ^a	Inner East Metro	Inner West Metro	South Metro ^a	Outer East Metro ^a	
	Richmond	Alphington	Footscray	Brighton	Mooroolbark	
25 Jan 2003	44.2	36.4	38.5	39.4		Bushfires
3 Feb 2003	44.6		51.1			Bushfires
6 Feb 2003					26.5	Bushfires
16 May 2003	30.6	27.5				Local
25 May 2003		34.5			33.5	Local
3 Jul 2003	28.9	38.4	27.5	31.3	27.5	Local

Monitoring by reference method (one day in three). All readings in µg/m³.

a Monitoring ceased in August