Queensland

2008 air monitoring report

This report fulfils the annual reporting requirements for Queensland under clause 18 of the National Environment Protection (Ambient Air Quality) Measure

Queensland Government

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2008 air monitoring report

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Summary
Air monitoring at National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) monitoring stations in Queensland between January and December 2008 showed no exceedences of the AAQ NEPM air quality standards for carbon monoxide, nitrogen dioxide, ozone and $PM_{2.5}$ at any monitoring site during the year. Exceedences of the AAQ NEPM standards occurred for:

- 1-hour sulfur dioxide at the Menzies site in Mount Isa due to industrial emissions;
- 24-hour sulfur dioxide at the Menzies site in Mount Isa due to industrial emissions;
- 24-hour particles with an aerodynamic diameter less than 10µm (PM_{10}) at the sites in south-east Queensland, Toowoomba, Gladstone, Mackay and Townsville due to wind blown dust generated by strong winds associated with the passage of weather fronts; and
- 24-hour PM_{10} at the West Mackay site due to locally generated dust from activities at adjoining commercial premises.

The AAQ NEPM 2008 goal was met in all regions during 2008, with the exception of:

- 1-hour sulfur dioxide at the Menzies site in Mount Isa due to industrial emissions; and
- 24-hour PM_{10} at the West Mackay site due to locally generated dust.

Compliance with the standards and the 2008 goal could not be demonstrated for carbon monoxide at the Woolloongabba monitoring site, nitrogen dioxide at the Deception Bay and Rocklea monitoring sites, ozone at the Rocklea monitoring site and sulfur dioxide at the Stuart monitoring site in 2008 because data availability was below the level required to make a valid assessment.

Introduction
Under clause 18 of the AAQ NEPM, jurisdictions are required to submit an annual report on their compliance with the measure in an approved form by the end of June of the year following the reporting year. The National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 8, "Annual Reports" (available from *www.ephc.gov.au*) details the format and data requirements of the annual report.

This report documents compliance information for Queensland for 2008 in accordance with technical paper No. 8. The report is divided into four sections:

Section A: Overview of the AAQ NEPM monitoring network and related activities during 2008.
Section B: Assessment of compliance with the AAQ NEPM Standards and Goals.
Section C: Assessment of monitoring data against the standards (including details of exceedences and the circumstances which led to these exceedences, and information on the highest values measured for all pollutants and regions).
Section D: Data analysis (including pollutant distribution summaries and selected multi-year data for trend stations).

Additional information on the circumstances which led to exceedences of standards during 2008 are provided in an appendix.

Section A – Monitoring summary
Queensland's ambient air monitoring plan (available from *www.epa.qld.gov.au/environmental_management/air/air_quality_monitoring/national_measures*) outlines the monitoring to be undertaken in Queensland to determine compliance with the Standards and 2008 Goal of the AAQ NEPM. It should be noted that this monitoring is only a part of the overall air monitoring network operated by the Department of Environment and Resource Management (DERM). Details of AAQ NEPM monitoring and related activities in Queensland during 2008 follow.

Current AAQ NEPM monitoring stations
During 2008 monitoring was conducted in six of the ten regions identified in the Queensland monitoring plan – south-east Queensland (consisting of four sub-regions), Toowoomba, Gladstone, Mackay, Townsville and Mount Isa. Monitoring site locations are shown in figure 1.

Table 1 contains a descriptive summary of each monitoring site. In line with the descriptions contained in the AAQ NEPM, sites are identified as:

- Performance monitoring station (PMS) – nominated location to measure achievement against the goal of the AAQ NEPM.
- Trend station – nominated location to measure long-term changes in air quality in addition to achievement against the goal of the AAQ NEPM.
- Campaign station – short-term investigation location (operational for a minimum of one calendar year) to assess the need for ongoing monitoring in the region to measure achievement against the goal of the AAQ NEPM.

Sites are further characterised using the population coverage descriptors contained in the National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 3, "Monitoring Strategy" (available from *www.ephc.gov.au*):

- Generally representative upper bound (GRUB) – indicative of pollutant concentrations in the upper range of levels occurring in populated areas in the region.
- Population-average – indicative of air quality experienced by most of the population.

The exposed population represented by each monitoring site is described qualitatively by the location category column in Table 1.

Monitoring methods employed by DERM comply with the relevant Australian Standard specified in the AAQ NEPM, with the exception of the Springwood site where a differential optical absorption spectroscopy

Figure 1: 2008 AAQ NEPM monitoring station locations

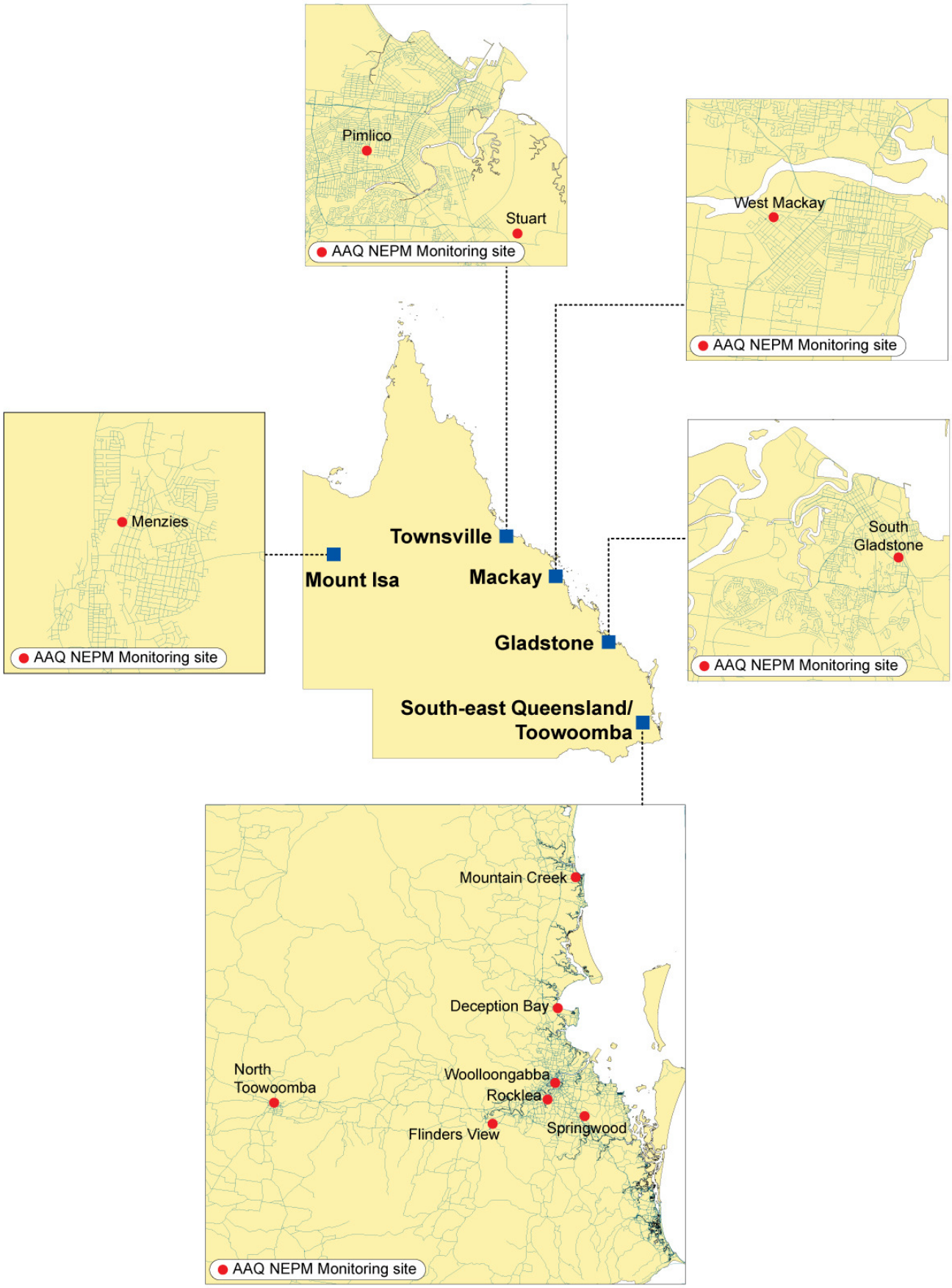


Table 1: 2008 Queensland AAQ NEPM monitoring sites

Site	Station type	Established	Pollutants monitored	Monitoring techniques	Location category	Non-conformance with AS3580.1.1 siting criteria	Major pollutant sources
South-east Queensland							
North Coast sub-region							
Mountain Creek	PMS - GRUB	July 2001	Ozone Nitrogen dioxide PM_{10}	AS3580.6.1-1990 AS3580.5.1-1993 AS3580.9.8-2001	Residential	Nil	Major roads Forestry/agricultural burning
Brisbane sub-region							
Deception Bay	Trend – GRUB	June 1994	Ozone Nitrogen dioxide	AS3580.6.1-1990 AS3580.5.1-1993	Residential	Trees within 20m west of site	Major roads
Woolloongabba	Trend – Peak	June 1998	Carbon monoxide	AS3580.7.1-1992	Inner city roadside	Building within 20m west of site	Major roads
Rocklea	Trend – GRUB	January 1978	Ozone Nitrogen dioxide PM_{10} $PM_{2.5}$ $PM_{2.5}$	AS3580.6.1-1990 AS3580.5.1-1993 AS3580.9.8-2001 Reference method (Partisol sequential air sampler) TEOM, based on AS3580.9.8-2001	Light industrial / residential	Nil	Major roads
Springwood	PMS – Population average	March 1999	Ozone Nitrogen dioxide Sulfur dioxide PM_{10} $PM_{2.5}$ $PM_{2.5}$	Differential Optical Absorption Spectroscopy Differential Optical Absorption Spectroscopy Differential Optical Absorption Spectroscopy AS3580.9.8-2001 Reference method (Partisol sequential air sampler) TEOM, based on AS3580.9.8-2001	Residential	Nil	Major roads
Ipswich sub-region							
Flinders View	Trend – GRUB	January 1993	Ozone Nitrogen dioxide Sulfur dioxide PM_{10}	AS3580.6.1-1990 AS3580.5.1-1993 AS3580.4.1-2008 AS3580.9.8-2001	Industry / residential	Trees within 20m of site	Major roads Industry (power station)
Toowoomba							
North Toowoomba	Campaign – GRUB	July 2003	Carbon monoxide Ozone Nitrogen dioxide PM_{10}	AS3580.7.1-1992 AS3580.6.1-1990 AS3580.5.1-1993 AS3580.9.8-2001	Residential	Nil	Major roads Solid fuel heaters
Gladstone							
South Gladstone	Trend – GRUB	July 1992	Nitrogen dioxide Sulfur dioxide PM_{10}	AS3580.5.1-1993 AS3580.4.1-2008 AS3580.9.8-2001	Industry / residential	Trees within 20m to north-west of site	Major roads Industry (power generation, metals processing)
Mackay							
West Mackay	PMS – GRUB	September 1997	PM_{10}	AS3580.9.8-2001	Light industry / residential	Extraneous dust sources nearby	Agricultural burning
Townsville							
Pimlico	Campaign – Population average	May 2004	Ozone Nitrogen dioxide Sulfur dioxide PM_{10}	AS3580.6.1-1990 AS3580.5.1-1993 AS3580.4.1-2008 AS3580.9.8-2001	Residential	Nil	Major roads Industry (port operations, metals processing)
Stuart	Campaign – GRUB	September 2001	Sulfur dioxide	AS3580.4.1-2008	Industry / rural	Nil	Industry (metals processing)
Mount Isa							
Menzies	Trend – GRUB	January 1983	Sulfur dioxide	AS3580.4.1-2008	Industry / residential	Trees within 20m of site	Industry (metals smelting, sulfuric acid manufacture)

(DOAS) technique is used to measure ozone, nitrogen dioxide and sulphur dioxide levels.

TEOM PM_{10} data in this report have been adjusted using the temperature-dependent factor described in option 2 in the National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 10, "Collection and Reporting of TEOM PM_{10} Data" (available from *www.ephc.gov.au*). The resulting adjustments vary linearly from no change at daily average temperatures at or above 15deg to an increase of 40 percent at a temperature of 5deg.

$PM_{2.5}$ data in this report has been obtained using either reference samplers (Partisol 2025 sequential air samplers) operating on a one in three day basis or TEOM $PM_{2.5}$ instruments operating continuously. The TEOM instrumentation has been operated in accordance with the protocol outlined in the National Environment Protection (Ambient Air Quality) Measure Technical Paper on Monitoring for Particles as $PM_{2.5}$.

Implementation activities

In 2008 DERM continued to monitor ambient air quality in the same six regions as in 2007.

Campaign monitoring of $PM_{2.5}$ in Toowoomba ceased in December 2007 when the monitoring equipment was required to meet other monitoring priorities.

$PM_{2.5}$ monitoring using reference samplers on a one in three day basis continued in south-east Queensland at the Rocklea site for the entire year and at the Springwood site until July 2008. Investigative air monitoring priorities necessitated the removal of the Springwood reference sampler. $PM_{2.5}$ monitoring by reference sampler was conducted for a four year period at the Springwood site. $PM_{2.5}$ monitoring by TEOM sampler is continuing at the Springwood site. $PM_{2.5}$ monitoring using TEOM instrumentation fitted with a Filter Dynamics Measurement System (FDMS) commenced at South Gladstone in November 2008.

Variations to the approved monitoring plan for Queensland

Screening studies

Monitoring is not required to be undertaken in a region where screening procedures outlined in the National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 4, "Screening Procedures" are satisfied, i.e. pollutant levels are reasonably expected to be consistently lower than the standards in the Measure. On the basis of the results of monitoring conducted in larger population centres and/or the findings of generic modelling studies detailed in Appendix A of Technical Paper No. 4, it has been concluded that campaign monitoring of nitrogen dioxide in Bundaberg, Cairns, Mackay, Maryborough/ Hervey Bay and Rockhampton, and campaign monitoring of ozone in Bundaberg, Mackay and Maryborough/Hervey Bay is not required (i.e. performance is "met"). Table 2 summarises those regions and pollutants for which screening procedures are satisfied.

Table 2: Satisfied screening procedures

Region	CO	NO_2	Ozone	SO_2	PM_{10}	Lead
South-east Queensland	–	–	–	–	–	A
Toowoomba	–	–	–	F	–	F
Maryborough/ Hervey Bay	F	E & F	E & F	F	–	F
Bundaberg	F	E & F	E & F	F	–	F
Gladstone	F	–	A	–	–	F
Rockhampton	F	E & F	–	–	–	F
Mackay	F	E & F	E & F	F	–	F
Townsville	F	–	–	–	–	F
Cairns	F	E & F	–	F	–	F
Mount Isa	E	E	E	–	–	–

For further information on the screening procedures, refer to National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 4, *Screening Procedures* (Revision 1, 2007), available from *www.ephc.gov.au*. A '–' symbol indicates that monitoring is required to assess compliance.

Monitoring plan timeframe changes

Delays in establishing monitoring in other centres, commitments under the AAQ NEPM $PM_{2.5}$ Equivalency Program and other monitoring priorities have meant that it has not been possible to begin the following monitoring according to the timeframes set out in the monitoring plan for Queensland:

- ozone and PM_{10} in Cairns,
- ozone, sulfur dioxide and PM_{10} in Rockhampton,
- PM_{10} in Bundaberg,
- PM_{10} in Maryborough/Hervey Bay, and
- PM_{10} and lead in Mount Isa.

Section B – Assessment of compliance with standards and 2008 goal

This section provides details of the annual compliance assessment for January to December 2008. Compliance criteria are applied on an individual basis at each performance monitoring station operating in the various Queensland regions during the year. South-east Queensland performance monitoring stations are further classified under the respective sub-region.

The National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 8 specifies that to make a valid assessment of compliance, a data availability rate of at least 75 percent in each calendar quarter is required. For this reason, compliance with the standards and 2008 goal could not be demonstrated for carbon monoxide at the Woolloongabba monitoring station, nitrogen dioxide at the Deception Bay and Rocklea monitoring stations, ozone at the Rocklea monitoring station and sulfur dioxide at the Stuart monitoring station.

Tables 3 to 8 summarise compliance of monitoring with the standards and 2008 goal for AAQ NEPM pollutants for 2008. Performance is assessed as meeting the standards and goals 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 percent in each quarter of the year, or approved screening procedures are satisfied.

Carbon monoxide

Table 3: 2008 compliance summary for carbon monoxide in Queensland

AAQ NEPM Standard
9.0 ppm (8-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		
South-east Queensland *Brisbane sub-region* Woolloongabba	0.0	62.4	94.8	95.3	63.3	0	ND
Toowoomba North Toowoomba	89.0	93.2	95.4	95.5	93.3	0	met

ND = "not demonstrated" due to insufficient data

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard (i.e. performance is "met").

- Bundaberg
- Cairns
- Gladstone
- Mackay
- Maryborough/Hervey Bay
- Rockhampton
- Townsville
- Mount Isa

Motor vehicles are the major contributor to ambient carbon monoxide levels in urban areas where the use of combustion stoves and wood heaters in winter is minimal. Carbon monoxide concentrations at the Brisbane CBD performance monitoring station in south-east Queensland over the period 2000 to 2004 were consistently less than 40 percent of the AAQ NEPM standard (see section D). On this basis, carbon monoxide monitoring in coastal Queensland centres with lower traffic density and warmer winter temperatures than south-east Queensland is not required under screening procedure F in Table 1 of the National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 4, "Screening Procedures".

Mount Isa satisfies screening criteria for carbon monoxide by generic modelling alone (procedure E in Table 1) and can be considered to comply with the NEPM 8-hour carbon monoxide standard.

Nitrogen dioxide

Table 4: 2008 compliance summary for nitrogen dioxide in Queensland

AAQ NEPM Standard
0.12 ppm (1-hour average)
0.03 ppm (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
South-east Queensland									
North Coast sub-region									
Mountain Creek	90.3	95.4	94.9	81.8	90.6	0	0.004	met	met
Brisbane sub-region									
Deception Bay	50.4	85.6	89.6	93.4	79.8	0	0.008	ND	ND
Rocklea	46.6	85.2	93.2	91.8	79.3	0	0.008	ND	ND
Springwood	89.8	99.2	98.1	98.2	96.3	0	0.006	met	met
Ipswich sub-region									
Flinders View	80.9	95.1	94.7	94.0	91.2	0	0.010	met	met
Toowoomba									
North Toowoomba	87.3	93.2	95.1	95.4	92.7	0	0.007	met	met
Gladstone									
South Gladstone	88.6	95.0	95.1	94.4	93.3	0	0.003	met	met
Townsville									
Pimlico	95.4	93.4	95.5	95.1	94.8	0	0.006	met	met

ND = "not demonstrated" due to insufficient data

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard (i.e. performance is "met").

- Bundaberg
- Cairns
- Mackay
- Maryborough/Hervey Bay
- Mount Isa
- Rockhampton

Appendix A of the National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 4, "Screening Procedures" states that nitrogen dioxide monitoring is not required in coastal and inland centres with a population below 250 000 on the basis of generic modelling conducted by CSIRO (procedure E in Table 1) coupled with data from a NEPM compliant region with greater population, emissions and pollution potential showing nitrogen dioxide levels are below 40 percent of the NEPM standards (procedure F in Table 1).

Monitoring at the Pimlico site in Townsville over the period 2004 to 2008 has shown nitrogen dioxide levels to be consistently below 40 percent of the NEPM standards. The maximum 1-hour average nitrogen dioxide concentration during this period was 0.035ppm (29 percent of the standard). The highest annual average nitrogen dioxide concentration during this period was 0.006ppm (20 percent of the standard).

On this basis, nitrogen dioxide monitoring in the coastal Queensland centres of Bundaberg, Cairns, Mackay, Maryborough/Hervey Bay and Rockhampton is not required as these centres can be considered to comply with the NEPM 1-hour and annual nitrogen dioxide standards.

Mount Isa satisfies screening criteria for nitrogen dioxide by generic modelling alone (procedure E in Table 1) and can be considered to comply with the NEPM 1-hour and annual nitrogen dioxide standards.

Ozone

Table 5: 2008 compliance summary for ozone in Queensland

AAQ NEPM Standard
0.10 ppm (1-hour average)
0.08 ppm (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
South-east Queensland									
North Coast sub-region									
Mountain Creek	90.3	95.4	95.2	81.8	90.7	0	0	met	met
Brisbane sub-region									
Deception Bay	95.2	95.5	95.0	93.3	94.7	0	0	met	met
Rocklea	46.5	85.0	94.2	91.8	79.4	0	0	ND	ND
Springwood	86.4	93.4	93.5	93.2	91.6	0	0	met	met
Ipswich sub-region									
Flinders View	92.0	95.1	94.8	94.0	94.0	0	0	met	met
Toowoomba									
North Toowoomba	88.8	93.3	95.2	95.4	93.2	0	0	met	met
Townsville									
Pimlico	95.1	94.2	95.5	95.0	94.9	0	0	met	met

ND = "not demonstrated" due to insufficient data

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard (i.e. performance is "met").

- Bundaberg
- Gladstone
- Mackay
- Maryborough/Hervey Bay
- Mount Isa

From 2001 to mid-2006, ozone concentrations were monitored at Targinie in the Gladstone region. The Targinie campaign GRUB monitoring station was located 20km north-west of Gladstone and downwind of the major industrial and transport emission sources in the region. Ozone concentrations measured at the Targinie campaign monitoring station over this period were consistently less than 75 percent of the AAQ NEPM standards (maximum 1-hour average 0.056ppm ; maximum 4-hour average 0.046ppm). On this basis, ozone monitoring in Gladstone is not required under screening procedure A in Table 2 of the National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 4, "Screening Procedures". DERM will re-evaluate the need for ozone monitoring in Gladstone should sources of precursor emissions in the region increase significantly.

Appendix A of the National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 4, "Screening Procedures" states that ozone monitoring is not required in coastal centres with a population below 62 000 and inland centres with a population below 25 000 on the basis of generic modelling conducted by CSIRO (procedure E in Table 2).

On this basis, ozone monitoring is not required in the coastal Queensland centres of Bundaberg, Mackay and Maryborough/Hervey Bay, and the inland centre of Mount Isa, as these centres can be considered to comply with the NEPM 1-hour and 4-hour ozone standards.

Regions for which monitoring has not yet been carried out (i.e. performance is "not demonstrated").

- Cairns
- Rockhampton

Sulfur dioxide

Table 6: 2008 compliance summary for sulfur dioxide in Queensland

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	Data availability rates (% of hours)					Number of exceedences (days)		Annual mean (ppm)	Performance against the standards and goal		
	Q1	Q2	Q3	Q4	Annual	1h	24h		1h	24h	1y
South-east Queensland											
Brisbane sub-region											
Springwood	86.7	93.6	94.0	93.5	92.0	0	0	0.000	met	met	met
Ipswich sub-region											
Flinders View	94.9	95.2	94.3	94.2	94.6	0	0	0.001	met	met	met
Gladstone											
South Gladstone	88.6	94.0	95.2	94.5	93.1	0	0	0.002	met	met	met
Townsville											
Pimlico	95.3	93.5	95.5	95.1	94.9	0	0	0.000	met	met	met
Stuart	58.7	72.0	95.8	74.1	75.2	0	0	0.000	ND	ND	ND
Mount Isa											
Menzies	91.8	86.7	95.7	94.5	92.2	38	1	0.007	not met	met	met

ND = "not demonstrated" due to insufficient data

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard (i.e. performance is "met").

- Bundaberg
- Cairns
- Mackay
- Maryborough/Hervey Bay
- Toowoomba

Unless significant industrial point sources of sulfur dioxide exist in a region (e.g. coal-fired power stations and metals smelting), emissions of sulfur dioxide are low. Peak sulfur dioxide concentrations in the Brisbane sub-region of south-east Queensland are less than 40 percent of the AAQ NEPM standard (see section D). On this basis, sulfur dioxide monitoring in other Queensland centres with lower population and no significant sulfur dioxide point sources is not required under screening procedure F in Table 1 of National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 4, "Screening Procedures".

Regions for which monitoring has not yet been carried out (i.e. performance is "not demonstrated").

- Rockhampton

Particles as PM_{10}

Table 7: 2008 compliance summary for PM_{10} in Queensland

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

Region/ Performance monitoring station	Data availability rates (% of days)					Number of exceedences (days)	Performance against the standards and goal
	Q1	Q2	Q3	Q4	Annual		
South-east Queensland							
North Coast sub-region							
Mountain Creek	94.5	100.0	97.8	81.5	93.4	1	met
Brisbane sub-region							
Rocklea	94.5	95.6	95.7	93.5	94.8	1	met
Springwood	95.6	100.0	97.8	95.7	97.3	1	met
Ipswich sub-region							
Flinders View	98.9	100.0	100.0	97.8	99.2	2	met
Toowoomba							
North Toowoomba	90.1	95.6	100.0	97.8	95.9	4	met
Gladstone							
South Gladstone	89.0	100.0	97.8	96.7	95.9	2	met
Mackay							
West Mackay	93.4	100.0	100.0	100.0	98.4	8	not met
Townsville							
Pimlico	96.7	98.9	95.7	96.7	97.0	1	met

Regions for which monitoring has not yet been carried out (i.e. performance is "not demonstrated").

- Bundaberg
- Cairns
- Maryborough/Hervey Bay
- Mount Isa
- Rockhampton

Particles as $PM_{2.5}$

Table 8: 2008 compliance summary for $PM_{2.5}$ in Queensland

AAQ NEPM Advisory Standard
25 µg/m^3 (24-hour average)
8 µg/m^3 (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		
South-east Queensland							
Brisbane sub-region							
Rocklea[†]	31.9	28.6	30.4	26.1	29.2	0	6.4
Rocklea[‡]	95.6	96.7	94.6	93.5	95.1	0	3.8
Springwood[†]	29.7	29.7	1.1	0.0	15.0	0	7.4
Springwood[‡]	93.4	100.0	97.8	95.7	96.7	0	4.1
Gladstone							
South Gladstone[+]	0.0	0.0	0.0	55.4	13.9	0	Insufficient data

[†]Monitoring by reference method (1 in 3 days)
[‡]Monitoring by TEOM instrumentation in accordance with Technical Paper on Monitoring for Particles as $PM_{2.5}$
[+]Monitoring by FDMS TEOM instrumentation

Regions for which monitoring has not yet been carried out:

- Bundaberg
- Cairns
- Mackay
- Maryborough/Hervey Bay
- Mount Isa
- Rockhampton
- Townsville

Lead

No lead monitoring was conducted in Queensland in 2008. In the absence of non-vehicle sources of lead (e.g. metals smelting), no significant sources of lead now exist in most Queensland regions following the phase-out of leaded motor vehicle fuel from March 2001. Annual lead concentrations measured at the south-east Queensland performance monitoring station (Woolloongabba) were less than 10 percent of the AAQ NEPM standard for both 2001 (0.03 µg/m^3) and 2002 (0.02 µg/m^3). As outlined in the National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 9, "Lead Monitoring" (available from *www.ephc.gov.au*), these measurements demonstrate that compliance with the AAQ NEPM standard and 2008 goal has been achieved in south-east Queensland, and monitoring of lead ceased from the end of 2002.

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard (i.e performance is "met").

- Bundaberg
- Cairns
- Gladstone
- Mackay
- Maryborough/Hervey Bay
- Rockhampton
- South-east Queensland
- Toowoomba
- Townsville

Peak lead concentrations in south-east Queensland have been less than 40 percent of the AAQ NEPM standard since 1999 (see section D, Table 46). On this basis, lead monitoring in other Queensland centres with lower population and traffic density (with the exception of Mount Isa where additional lead emission sources exist) is not required under screening procedure F in Table 1 of the National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 4, "Screening Procedures".

Regions for which monitoring has not yet been carried out (i.e. performance is "not demonstrated").

- Mount Isa

Sources of airborne lead in Mount Isa are smelting operations and wind blown dust from mined ore stockpiles and natural soil concentrations. DERM has commenced ambient TSP lead monitoring in 2009.

Section C – Assessment of monitoring data against the standards

Annual summary statistics for the 2008 calendar year are presented in this section. Statistics provided include the listing of exceedences and circumstances which led to these exceedences, and annual maxima, the second highest (for carbon monoxide, nitrogen dioxide, ozone and sulfur dioxide) and sixth highest (for PM_{10}) daily concentrations, together with the date and site of each occurrence. Details of $PM_{2.5}$ measurements obtained using both reference samplers and TEOM instrumentation are also provided. The TEOM instruments were operated in accordance with the method outlined in the AAQ NEPM Technical Paper on Monitoring for Particles as $PM_{2.5}$.

Exceedence details are provided in tables 9 to 10. Summary maxima statistics are provided in tables 11 to 18. Concentrations exceeding the standard are highlighted in bold.

Exceedence summary

During 2008, exceedences of AAQ NEPM standards occurred for sulfur dioxide and PM_{10}. There were no exceedences of the AAQ NEPM standards for carbon monoxide, nitrogen dioxide and ozone, and the AAQ NEPM advisory reporting standards for $PM_{2.5}$. Lead monitoring was not conducted in 2008, as compliance with the standard and 2008 goal was demonstrated in 2002 for all regions with the exception of Mount Isa where monitoring is yet to commence.

Additional information on the circumstances which led to exceedences of standards during 2008 is provided in an appendix.

Table 9: 2008 sulfur dioxide exceedences in Queensland

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	Standard	Concentration (ppm)	Date	Time	Circumstances
Mount Isa					
Menzies	1-hour	0.751	21-Dec	17	Industry emissions
		0.647	08-Dec	17	Industry emissions
		0.645	23-Nov	18	Industry emissions
		0.528	05-Feb	13	Industry emissions
		0.511	11-Oct	14	Industry emissions
		0.493	29-Jun	17	Industry emissions
		0.489	11-Oct	15	Industry emissions
		0.482	25-Aug	17	Industry emissions
		0.470	18-Jan	16	Industry emissions
		0.452	20-Nov	13	Industry emissions
		0.448	22-May	14	Industry emissions
		0.430	17-Sep	15	Industry emissions
		0.390	02-Nov	19	Industry emissions
		0.381	23-Nov	17	Industry emissions
		0.371	19-Dec	17	Industry emissions
		0.362	17-Nov	20	Industry emissions
		0.342	17-Nov	19	Industry emissions
		0.335	22-Nov	15	Industry emissions
		0.335	08-Dec	18	Industry emissions
		0.333	20-Jan	17	Industry emissions
		0.330	08-Dec	16	Industry emissions
		0.315	21-Dec	18	Industry emissions
		0.309	05-Feb	12	Industry emissions
		0.305	05-Feb	16	Industry emissions
		0.294	22-Sep	23	Industry emissions
		0.292	22-Nov	14	Industry emissions
		0.289	07-Dec	14	Industry emissions
		0.280	14-Sep	09	Industry emissions
		0.279	07-Dec	19	Industry emissions
		0.275	29-Nov	16	Industry emissions
		0.270	14-Dec	13	Industry emissions
		0.265	24-Mar	14	Industry emissions
		0.262	25-Aug	15	Industry emissions
		0.259	26-Dec	20	Industry emissions
		0.256	25-Aug	16	Industry emissions
		0.252	07-Dec	15	Industry emissions
		0.249	21-Dec	19	Industry emissions
		0.248	27-Jan	17	Industry emissions
		0.247	27-Apr	13	Industry emissions
		0.246	04-Aug	17	Industry emissions
		0.243	17-Jul	17	Industry emissions
		0.242	06-Oct	03	Industry emissions
		0.234	21-Nov	15	Industry emissions
		0.232	16-May	18	Industry emissions
		0.231	26-Apr	17	Industry emissions
		0.228	20-Jan	16	Industry emissions
		0.225	02-Nov	14	Industry emissions
		0.222	25-Aug	23	Industry emissions
		0.220	18-Jan	14	Industry emissions
		0.220	06-Sep	18	Industry emissions
		0.219	26-Apr	18	Industry emissions
		0.218	19-Jan	15	Industry emissions
		0.217	03-Nov	14	Industry emissions

Table 9: 2008 sulfur dioxide exceedences in Queensland (continued)

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	Standard	Concentration (ppm)	Date	Time	Circumstances
Mount Isa	1-hour	0.206	19-Nov	05	Industry emissions
Menzies		0.204	27-Apr	17	Industry emissions
		0.204	22-Nov	17	Industry emissions
		0.203	27-Jul	15	Industry emissions
		0.203	13-Oct	15	Industry emissions
		0.201	21-Aug	17	Industry emissions
Mount Isa					
Menzies	24-hour	0.089	25-Aug	24	Industry emissions

Table 10: 2008 PM_{10} exceedences in Queensland

AAQ NEPM standard
50 µg/m^3 (24-hour average)

Region/ Performance monitoring station	Concentration (µg/m^3)	Date	Time	Circumstances
South-east Queensland				
Mountain Creek	53.3	17-Sep	24	Wind blown dust
Rocklea	86.8	28-Apr	24	Wind blown dust
Springwood	69.0	28-Apr	24	Wind blown dust
Flinders View	68.5	28-Apr	24	Wind blown dust
	55.5	16-Sep	24	Wind blown dust
Toowoomba				
North Toowoomba	105.5	16-Sep	24	Wind blown dust
	87.1	28-Apr	24	Wind blown dust
	54.4	24-Nov	24	Wind blown dust
	51.9	17-Sep	24	Wind blown dust
Gladstone				
South Gladstone	65.6	04-Apr	24	Wind blown dust
	59.1	29-Apr	24	Wind blown dust
Mackay				
West Mackay	94.0	29-Apr	24	Wind blown dust
	65.2	03-Jul	24	Local dust (not indicative of regional population exposure) caused by movement of soil stockpiles at commercial premises close to monitoring site.
	63.5	18-Aug	24	Local dust
	61.4	01-Jul	24	Local dust and smoke from agricultural burning
	59.3	01-Dec	24	Local dust
	55.6	24-Nov	24	Local dust
	53.1	02-Jul	24	Local dust
	52.9	26-Nov	24	Local dust
Townsville				
Pimlico	50.6	30-Apr	24	Wind blown dust

2008 maximum, second-highest and sixth-highest concentration summaries

Table 11: 2008 summary statistics for daily peak 8-hour CO in Queensland

AAQ NEPM standard
9.0 ppm (8-hour average)

Region/ Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:time)
South-east Queensland					
Woolloongabba	245	2.9	28-Jun 01:00	2.7	21-May 01:00
Toowoomba					
North Toowoomba	360	1.9	26-Jun 01:00	1.8	28-Jun 02:00

Table 12: 2008 summary statistics for daily peak 1-hour nitrogen dioxide in Queensland

AAQ NEPM standard
0.12 ppm (1-hour average)

Region/ Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:time)
South-east Queensland					
Mountain Creek	360	0.030	31-Mar 20:00 09-May 19:00 13-Aug 19:00 19-Aug 19:00		
Deception Bay	310	0.037	19-Aug 20:00	0.035	26-Jun 18:00
Rocklea	311	0.047	26-May 19:00	0.041	27-May 19:00 06-Jun 19:00
Springwood	359	0.038	27-Aug 18:00	0.034	14-Aug 20:00
Flinders View	354	0.040	20-May 18:00	0.039	31-Mar 19:00 27-May 20:00 25-Jun 18:00
Toowoomba					
North Toowoomba	359	0.041	23-Sep 20:00	0.037	25-Jun 18:00
Gladstone					
South Gladstone	361	0.033	26-May 07:00	0.031	26-Apr 12:00
Townsville					
Pimlico	366	0.030	07-Aug 20:00	0.029	07-May 20:00

Table 13: 2008 summary statistics for daily peak 1-hour ozone in Queensland

AAQ NEPM standard
0.10 ppm (1-hour average)

Region/ Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:time)
South-east Queensland					
Mountain Creek	350	0.055	23-Feb 14:00	0.052	29-Sep 13:00
Deception Bay	365	0.082	06-Nov 15:00	0.078	01-Sep 16:00
Rocklea	311	0.079	31-Dec 14:00	0.074	07-Nov 13:00
Springwood	359	0.045	07-Nov 14:00	0.038	02-Dec 13:00
Flinders View	364	0.067	27-Sep 16:00 01-Nov 14:00		
Toowoomba					
North Toowoomba	360	0.063	01-Nov 16:00	0.055	04-Dec 14:00
Townsville					
Pimlico	366	0.059	15-Dec 14:00	0.057	24-Nov 16:00

Table 14: 2008 summary statistics for daily peak 4-hour ozone in Queensland

AAQ NEPM standard
0.08 ppm (4-hour average)

Region/ Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:time)
South-east Queensland					
Mountain Creek	351	0.049	29-Sep 19:00	0.047	29-Sep 14:00
Deception Bay	365	0.073	06-Nov 16:00	0.068	31-Dec 14:00
Rocklea	311	0.064	21-Dec 16:00	0.060	07-Nov 15:00
Springwood	359	0.037	07-Nov 15:00	0.034	02-Dec 15:00
Flinders View	364	0.058	27-Sep 17:00 19-Dec 17:00		
Toowoomba					
North Toowoomba	360	0.056	01-Nov 17:00	0.048	13-Mar 19:00 06-Nov 17:00
Townsville					
Pimlico	366	0.054	15-Dec 16:00	0.053	14-Nov 16:00

Table 15: 2008 summary statistics for daily peak 1-hour sulfur dioxide in Queensland

AAQ NEPM standard
0.20 ppm (1-hour average)

Region/ Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:time)
South-east Queensland					
Springwood	359	0.011	25-Jun 11:00	0.009	07-Feb 12:00
Flinders View	366	0.042	31-Jan 10:00	0.037	26-Nov 10:00
Gladstone					
South Gladstone	361	0.140	29-Sep 09:00	0.091	14-Mar 16:00
Townsville					
Pimlico	366	0.006	28-Nov 02:00	0.005	29-Jun 22:00 23-Aug 21:00 08-Dec 13:00
Stuart	293	0.004	08-Feb 11:00 20-Feb 09:00 22-Feb 20:00 27-Jun 20:00 23-Aug 20:00 24-Aug 21:00		
Mount Isa					
Menzies	355	**0.751**	21-Dec 17:00	**0.647**	08-Dec 17:00

Table 16: 2008 summary statistics for 24-hour sulfur dioxide in Queensland

AAQ NEPM standard
0.08 ppm (24-hour average)

Region/ Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date)	2nd highest (ppm)	2nd highest (date)
South-east Queensland					
Springwood	329	0.002	27-Aug 24:00	0.001	41 days in total
Flinders View	361	0.006	16-Mar 24:00 26-Nov 24:00		
Gladstone					
South Gladstone	355	0.018	14-Mar 24:00	0.016	18-Jan 24:00
Townsville					
Pimlico	362	0.001	11 days in total		
Stuart	283	0.002	8 days in total		
Mount Isa					
Menzies	352	**0.089**	25-Aug 24:00	0.075	21-Dec 24:00

Table 17: 2008 summary statistics for 24-hour PM_{10} in Queensland

AAQ NEPM standard
50 µg/m^3 (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)
South-east Queensland					
Mountain Creek	342	**53.3**	17-Sep	36.0	19-Sep
Rocklea	347	**86.8**	28-Apr	38.6	25-Nov
Springwood	356	**69.0**	28-Apr	35.6	17-Sep
Flinders View	363	**68.5**	28-Apr	44.2	17-Sep
Toowoomba					
North Toowoomba	351	**105.2**	16-Sep	47.5	22-Jul
Gladstone					
South Gladstone	351	**65.6**	04-Apr	37.2	24-Nov
Mackay					
West Mackay	360	**94.0**	29-Apr	**55.6**	24-Nov
Townsville					
Pimlico	355	**50.6**	30-Apr	34.9	17-Sep

Table 18: 2008 summary statistics for 24-hour $PM_{2.5}$ in Queensland

AAQ NEPM advisory reporting standard
25 µg/m^3 (24-hour average)
8 µg/m^3 (1-year average)

Region/ Performance monitoring station	Number of valid days	Highest (µg/m^3)	Highest (date)
South-east Queensland			
Rocklea†	109	**36.1**	24-May
Rocklea‡	348	11.6	28-May
Springwood†	55	19.5	27-May
Springwood‡	354	10.9	27-Aug
Gladstone			
South Gladstone^{+}	51	15.2	24-Nov

†Monitoring by reference method (1 in 3 days)

‡Monitoring by TEOM instrumentation in accordance with Technical Paper on Monitoring for Particles as $PM_{2.5}$

$^{+}$Monitoring by FDMS TEOM instrumentation

Section D – Data analysis

This section provides pollutant distribution information for 2008 (tables 19 to 26), and multi-year data for nominated trend stations in the Queensland air monitoring plan (tables 27 to 50).

2008 pollutant distribution information

Table 19: Percentiles of daily peak 8-hour carbon monoxide concentrations for 2008

AAQ NEPM standard
9.0 ppm (8-hour average)

	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
South-east Queensland								
Woolloongabba	66.9	2.9	2.7	2.5	2.2	1.8	0.9	0.5
Toowoomba								
North Toowoomba	98.4	1.9	1.7	1.5	1.1	0.8	0.2	0.1

Table 20: Percentiles of daily peak 1-hour nitrogen dioxide concentrations for 2008

AAQ NEPM standard
0.12 ppm (1-hour average)

	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
South-east Queensland								
Mountain Creek	95.6	0.030	0.030	0.029	0.026	0.021	0.016	0.010
Deception Bay	84.7	0.037	0.034	0.031	0.029	0.027	0.022	0.015
Rocklea	85.0	0.047	0.041	0.034	0.030	0.027	0.020	0.015
Springwood	98.1	0.038	0.031	0.030	0.029	0.026	0.021	0.016
Flinders View	96.7	0.040	0.039	0.038	0.031	0.028	0.022	0.016
Toowoomba								
North Toowoomba	98.1	0.041	0.035	0.033	0.031	0.029	0.022	0.012
Gladstone								
South Gladstone	98.6	0.033	0.030	0.026	0.023	0.020	0.016	0.012
Townsville								
Pimlico	100.0	0.030	0.028	0.027	0.025	0.023	0.017	0.011

Table 21: Percentiles of daily peak 1-hour ozone concentrations for 2008

AAQ NEPM standard
0.10 ppm (1-hour average)

	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
South-east Queensland								
Mountain Creek	95.6	0.055	0.047	0.045	0.038	0.036	0.032	0.029
Deception Bay	99.7	0.082	0.069	0.064	0.047	0.042	0.037	0.032
Rocklea	85.0	0.079	0.067	0.065	0.050	0.043	0.037	0.031
Springwood	98.1	0.045	0.033	0.031	0.029	0.025	0.021	0.018
Flinders View	99.5	0.067	0.062	0.056	0.049	0.045	0.038	0.031
Toowoomba								
North Toowoomba	98.4	0.063	0.051	0.048	0.043	0.040	0.035	0.030
Townsville								
Pimlico	100.0	0.059	0.045	0.043	0.038	0.036	0.032	0.027

Table 22: Percentiles of daily peak 4-hour ozone concentrations for 2008

AAQ NEPM standard
0.08 ppm (4-hour average)

	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
South-east Queensland								
Mountain Creek	95.9	0.049	0.043	0.041	0.036	0.034	0.031	0.027
Deception Bay	99.7	0.073	0.062	0.054	0.043	0.039	0.035	0.031
Rocklea	85.0	0.064	0.057	0.053	0.044	0.039	0.034	0.030
Springwood	98.1	0.037	0.031	0.029	0.026	0.023	0.020	0.017
Flinders View	99.5	0.058	0.055	0.052	0.045	0.041	0.035	0.029
Toowoomba								
North Toowoomba	98.4	0.056	0.046	0.045	0.040	0.037	0.033	0.029
Townsville								
Pimlico	100.0	0.054	0.043	0.040	0.037	0.034	0.031	0.026

Table 23: Percentiles of daily peak 1-hour sulfur dioxide concentrations for 2008

AAQ NEPM standard
0.20 ppm (1-hour average)

	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
South-east Queensland								
Springwood	98.1	0.011	0.007	0.006	0.006	0.003	0.002	0.001
Flinders View	100.0	0.042	0.030	0.028	0.019	0.016	0.007	0.003
Gladstone								
South Gladstone	98.6	0.140	0.065	0.056	0.042	0.026	0.014	0.007
Townsville								
Pimlico	100.0	0.006	0.005	0.003	0.002	0.002	0.001	0.001
Stuart	80.1	0.004	0.004	0.004	0.003	0.002	0.002	0.001
Mount Isa								
Menzies	97.0	**0.751**	**0.528**	**0.482**	**0.289**	**0.203**	0.040	0.001

Table 24: Percentiles of daily 24-hour sulfur dioxide concentrations for 2008

AAQ NEPM standard
0.08 ppm (24-hour average)

	Data availability rates (%)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
South-east Queensland								
Springwood	89.9	0.002	0.001	0.001	0.001	0.001	0.000	0.000
Flinders View	98.6	0.006	0.005	0.004	0.003	0.002	0.001	0.001
Gladstone								
South Gladstone	97.0	0.018	0.010	0.009	0.006	0.005	0.003	0.001
Townsville								
Pimlico	98.9	0.001	0.001	0.001	0.001	0.000	0.000	0.000
Stuart	77.3	0.002	0.002	0.002	0.001	0.001	0.001	0.000
Mount Isa								
Menzies	96.2	**0.089**	0.064	0.056	0.037	0.025	0.005	0.001

Table 25: Percentiles of daily 24-hour PM_{10} concentrations for 2008

AAQ NEPM standard
50 µg/m^3 (24-hour average)

	Data availability rates (%)	Max conc. (µg/m^3)	99th percentile (µg/m^3)	98th percentile (µg/m^3)	95th percentile (µg/m^3)	90th percentile (µg/m^3)	75th percentile (µg/m^3)	50th percentile (µg/m^3)
South-east Queensland								
Mountain Creek	93.4	**53.3**	42.4	35.3	27.6	23.4	17.9	14.9
Rocklea	94.8	**86.8**	44.2	37.8	30.0	25.8	19.8	15.4
Springwood	97.3	**69.0**	38.4	35.4	25.8	21.2	17.1	13.8
Flinders View	99.2	**68.5**	45.6	38.8	26.6	22.0	17.2	13.3
Toowoomba								
North Toowoomba	95.9	**105.2**	**51.9**	46.5	30.2	25.8	18.5	13.1
Gladstone								
South Gladstone	95.9	**65.6**	43.7	36.7	28.8	24.9	18.9	15.2
Mackay								
West Mackay	98.4	**94.0**	**61.4**	**53.1**	43.9	36.4	28.9	22.4
Townsville								
Pimlico	97.0	**50.6**	36.1	32.6	29.3	23.9	19.1	15.7

Table 26: Percentiles of daily 24-hour $PM_{2.5}$ concentrations for 2008

AAQ NEPM advisory reporting standards
25 µg/m^3 (24-hour average)
8 µg/m^3 (1-year average)

	Data availability rates (%)	Max conc. (µg/m^3)	99th percentile (µg/m^3)	98th percentile (µg/m^3)	95th percentile (µg/m^3)	90th percentile (µg/m^3)	75th percentile (µg/m^3)	50th percentile (µg/m^3)
South-east Queensland								
Rocklea[†]	29.8	**36.1**	**36.1**	**25.3**	14.8	11.0	7.7	5.8
Rocklea[‡]	95.1	11.6	9.8	9.5	7.8	6.9	5.3	3.6
Springwood[†]	15.0	19.5	19.5	19.5	15.4	13.2	8.7	6.5
Springwood[‡]	97.0	10.9	9.9	8.8	7.9	6.7	5.2	3.8
Gladstone								
South Gladstone[+]	13.9	15.2	12.6	12.6	12.3	11.1	9.3	7.9

[†]Monitoring by reference method (1 in 3 days)
[‡]Monitoring by TEOM instrumentation in accordance with Technical Paper on Monitoring for Particles as $PM_{2.5}$
[+]Monitoring by FDMS TEOM instrumentation

Multi-year statistics for trend stations

Table 27: Daily peak 8-hour carbon monoxide summary 1998 to 2004

Trend station/region: Brisbane CBD, south-east Queensland

AAQ NEPM standard
9.0 ppm (8-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1998	*73.7**	*0*	*3.4*	*3.3*	*2.7*	*2.6*	*2.3*
1999	80.0*	0	5.8	3.6	3.5	2.9	2.7
2000	78.1*	0	2.7	2.6	2.4	2.2	1.8
2001	95.9	0	3.3	2.4	2.2	1.9	1.6
2002	*72.9**	*0*	*2.5*	*2.3*	*2.1*	*1.6*	*1.5*
2003	97.0	0	2.7	2.2	1.9	1.5	1.2
2004	81.7*	0	3.3	3.1	2.3	1.7	1.2

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 28: Daily peak 8-hour carbon monoxide summary 1998 to 2008

Trend station/region: Woolloongabba, south-east Queensland

AAQ NEPM standard
9.0 ppm (8-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1998	*57.0**	*0*	*5.1*	*5.0*	*4.4*	*4.1*	*3.4*
1999	92.3*	0	5.7	5.3	4.9	4.0	3.2
2000	92.9	0	5.0	4.7	4.2	3.4	2.9
2001	97.0	0	7.0	4.4	4.3	3.9	3.2
2002	97.0	0	4.7	4.7	4.1	3.6	3.0
2003	83.3*	0	5.4	4.4	4.2	3.5	2.7
2004	98.9	0	4.7	4.2	3.8	3.3	2.6
2005	95.1	0	4.0	3.5	3.3	2.6	2.1
2006	95.3	0	4.0	3.7	3.1	2.4	2.1
2008	*26.0**	*0*	*1.1*	*1.1*	*1.1*	*1.1*	*1.0*
2009	*66.9**	*0*	*2.9*	*2.7*	*2.5*	*2.2*	*1.8*

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 29: Daily peak 1-hour nitrogen dioxide summary 1995 to 2008

Trend station/region: Deception Bay, south-east Queensland

AAQ NEPM standard
0.12 ppm (1-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	Annual average (ppm)
1995	93.4	0	0.058	0.054	0.046	0.038	0.033	0.007
1996	*68.6**	*0*	*0.048*	*0.043*	*0.042*	*0.034*	*0.030*	*0.007*
1997	95.6	0	0.043	0.038	0.036	0.032	0.028	0.007
1998	97.5	0	0.066	0.050	0.039	0.031	0.026	0.006
1999	96.4	0	0.058	0.039	0.030	0.028	0.024	0.006
2000	99.5	0	0.053	0.038	0.034	0.029	0.025	0.005
2001	95.1	0	0.047	0.040	0.039	0.034	0.030	0.006
2002	87.4*	0	0.065	0.044	0.042	0.036	0.030	0.006
2003	94.5	0	0.053	0.036	0.033	0.030	0.028	0.006
2004	97.8	0	0.045	0.036	0.036	0.030	0.027	0.006
2005	95.3	0	0.034	0.033	0.030	0.028	0.026	0.006
2006	99.5	0	0.044	0.035	0.033	0.028	0.027	0.008
2008	94.2*	0	0.063	0.035	0.033	0.030	0.027	0.006
2009	84.7*	0	0.037	0.034	0.031	0.029	0.027	0.008

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 30: Daily peak 1-hour nitrogen dioxide summary 1995 to 2008

Trend station/region: Flinders View, south-east Queensland

AAQ NEPM standard
0.12 ppm (1-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	Annual average (ppm)
1995	91.2*	0	0.038	0.037	0.035	0.031	0.028	0.009
1996	98.4	0	0.055	0.050	0.044	0.037	0.033	0.009
1997	96.4	0	0.046	0.042	0.040	0.036	0.030	0.009
1998	96.4	0	0.048	0.041	0.039	0.034	0.030	0.009
1999	98.4	0	0.046	0.039	0.038	0.032	0.029	0.008
2000	99.2	0	0.042	0.040	0.038	0.034	0.031	0.008
2001	100.0	0	0.045	0.037	0.036	0.034	0.031	0.009
2002	88.8*	0	0.062	0.057	0.043	0.036	0.033	0.010
2003	94.0	0	0.046	0.039	0.037	0.033	0.029	0.009
2004	100.0	0	0.054	0.047	0.038	0.034	0.030	0.009
2005	100.0	0	0.055	0.046	0.038	0.032	0.028	0.008
2006	100.0	0	0.050	0.043	0.041	0.035	0.032	0.012
2008	96.2	0	0.039	0.036	0.035	0.031	0.029	0.008
2009	96.7	0	0.040	0.039	0.038	0.031	0.028	0.010

*Data availability less than 75 percent for one or more quarters.

Table 31: Daily peak 1-hour nitrogen dioxide summary 1980 to 2008

Trend station/region: Rocklea, south-east Queensland

AAQ NEPM standard
0.12 ppm (1-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	Annual average (ppm)
1980	97.3	0	0.070	0.065	0.058	0.043	0.038	0.011
1981	78.9*	0	0.070	0.060	0.051	0.041	0.037	0.010
1982	97.8	0	0.073	0.058	0.054	0.048	0.040	0.010
1983	95.6	0	0.056	0.050	0.042	0.033	0.030	0.006
1984	83.3*	0	0.076	0.061	0.056	0.048	0.041	0.007
1985	91.2	0	0.048	0.044	0.039	0.035	0.031	0.008
1986	83.6*	2	**0.160**	0.099	0.069	0.056	0.045	0.012
1987	92.1	0	0.089	0.078	0.067	0.060	0.052	0.015
1988	*60.1**	*0*	*0.114*	*0.083*	*0.077*	*0.066*	*0.055*	*0.015*
1989	84.4*	0	0.073	0.069	0.061	0.054	0.047	0.016
1990	75.3*	0	0.079	0.070	0.064	0.053	0.046	0.016
1991	89.0	0	0.113	0.085	0.071	0.061	0.052	0.015
1992	77.9*	2	**0.157**	0.072	0.065	0.052	0.042	0.013
1993	89.6	0	0.086	0.066	0.058	0.047	0.040	0.013
1994	91.8	0	0.096	0.062	0.057	0.051	0.045	0.012
1995	79.5*	0	0.066	0.050	0.048	0.040	0.036	0.010
1996	90.4*	0	0.058	0.055	0.044	0.040	0.036	0.010
1997	95.6	0	0.061	0.043	0.042	0.039	0.033	0.010
1998	96.2	0	0.056	0.046	0.041	0.038	0.033	0.009
1999	91.2*	0	0.054	0.044	0.042	0.034	0.029	0.009
2000	96.7	0	0.059	0.046	0.043	0.037	0.032	0.009
2001	98.4	0	0.049	0.042	0.041	0.035	0.032	0.009
2002	98.4	0	0.051	0.046	0.041	0.037	0.033	0.009
2003	97.0	0	0.050	0.039	0.038	0.033	0.030	0.009
2004	95.6	0	0.049	0.047	0.043	0.037	0.033	0.009
2005	98.6	0	0.046	0.042	0.041	0.036	0.031	0.009
2006	96.4	0	0.046	0.039	0.035	0.031	0.027	0.011
2008	100.0	0	0.044	0.041	0.040	0.035	0.031	0.008
2009	79.3*	0	0.047	0.041	0.034	0.030	0.027	0.008

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 32: Daily peak 1-hour nitrogen dioxide summary 1994 to 2008

Trend station/region: South Gladstone, Gladstone

AAQ NEPM standard
0.12 ppm (1-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	Annual average (ppm)
1994	81.6*	0	0.049	0.047	0.044	0.038	0.028	0.005
1995	91.8	0	0.038	0.030	0.028	0.025	0.022	0.005
1996	84.2*	0	0.045	0.039	0.035	0.032	0.029	0.006
1997	*65.8**	*0*	*0.031*	*0.030*	*0.029*	*0.022*	*0.017*	*0.003*
1998	*72.9**	*0*	*0.022*	*0.020*	*0.018*	*0.015*	*0.012*	*0.002*
1999	88.8*	0	0.034	0.029	0.029	0.025	0.021	0.003
2000	97.8	0	0.031	0.025	0.024	0.022	0.019	0.003
2001	96.4	0	0.048	0.033	0.031	0.026	0.023	0.004
2002	98.4	0	0.036	0.031	0.029	0.026	0.021	0.004
2003	95.3	0	0.035	0.030	0.027	0.024	0.022	0.004
2004	100.0	0	0.042	0.030	0.029	0.026	0.023	0.004
2005	99.7	0	0.035	0.030	0.028	0.024	0.022	0.004
2006	100.0	0	0.034	0.027	0.027	0.024	0.021	0.003
2008	98.4	0	0.035	0.030	0.029	0.027	0.024	0.005
2009	98.6	0	0.033	0.030	0.026	0.023	0.020	0.003

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 33: Daily peak 1-hour ozone summary 1995 to 2008

Trend station/region: Deception Bay, south-east Queensland

AAQ NEPM standard
0.10 ppm (1-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1995	95.9	0	0.083	0.075	0.070	0.052	0.047
1996	95.9	0	0.091	0.073	0.064	0.055	0.048
1997	100.0	0	0.079	0.065	0.057	0.048	0.043
1998	94.2	0	0.069	0.060	0.053	0.048	0.044
1999	99.2	0	0.092	0.062	0.057	0.048	0.043
2000	99.7	0	0.070	0.058	0.054	0.046	0.041
2001	86.6*	0	0.079	0.058	0.054	0.048	0.044
2002	89.6*	0	0.071	0.063	0.061	0.048	0.044
2003	97.0	0	0.095	0.063	0.057	0.047	0.043
2004	96.7	0	0.070	0.058	0.055	0.048	0.045
2005	98.4	0	0.079	0.065	0.056	0.050	0.044
2006	99.5	0	0.064	0.056	0.052	0.047	0.042
2008	99.5	0	0.086	0.056	0.054	0.047	0.042
2009	99.7	0	0.082	0.069	0.064	0.047	0.042

*Data availability less than 75 percent for one or more quarters.

Table 34: Daily peak 1-hour ozone summary 1980 to 2008

Trend station/region: Rocklea, south-east Queensland

AAQ NEPM standard
0.10 ppm (1-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1980	97.5	0	0.083	0.078	0.066	0.058	0.050
1981	90.7	0	0.078	0.073	0.062	0.049	0.042
1982	97.8	1	**0.102**	0.070	0.065	0.057	0.047
1983	97.5	0	0.099	0.071	0.068	0.059	0.041
1984	95.1	1	**0.102**	0.070	0.064	0.055	0.046
1985	91.0	1	**0.105**	0.079	0.056	0.047	0.036
1986	84.1*	0	0.074	0.073	0.063	0.057	0.050
1987	*72.1**	*4*	***0.125***	***0.106***	*0.100*	*0.078*	*0.055*
1988	*67.5**	*1*	***0.101***	*0.085*	*0.069*	*0.047*	*0.039*
1989	82.5*	0	0.071	0.058	0.051	0.042	0.036
1990	76.2*	0	0.061	0.051	0.042	0.036	0.031
1991	91.2	0	0.061	0.053	0.045	0.039	0.031
1992	94.0	0	0.069	0.059	0.049	0.039	0.035
1993	94.8	0	0.096	0.063	0.059	0.054	0.050
1994	95.1	1	**0.127**	0.083	0.073	0.059	0.050
1995	78.6*	0	0.098	0.086	0.070	0.061	0.053
1996	97.0	2	**0.135**	0.090	0.085	0.071	0.060
1997	97.0	0	0.093	0.085	0.077	0.065	0.053
1998	95.1	1	**0.103**	0.080	0.078	0.064	0.053
1999	94.2	1	**0.135**	0.093	0.066	0.057	0.047
2000	96.2	0	0.088	0.076	0.066	0.057	0.049
2001	99.2	0	0.093	0.072	0.063	0.055	0.047
2002	98.6	2	**0.118**	0.075	0.073	0.060	0.054
2003	97.8	0	0.065	0.063	0.059	0.052	0.046
2004	95.9	0	0.088	0.080	0.076	0.064	0.055
2005	100.0	0	0.081	0.074	0.070	0.061	0.053
2006	97.5	0	0.079	0.066	0.063	0.055	0.048
2008	95.6	0	0.076	0.070	0.059	0.052	0.049
2009	85.0*	0	0.079	0.067	0.065	0.050	0.043

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 35: Daily peak 1-hour ozone summary 1994 to 2008

Trend station/region: Flinders View, south-east Queensland

AAQ NEPM standard
0.10 ppm (1-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	97.5	0	0.076	0.069	0.062	0.056	0.048
1995	95.1	0	0.079	0.071	0.065	0.056	0.051
1996	98.6	2	**0.125**	0.082	0.075	0.063	0.055
1997	97.5	2	**0.106**	0.094	0.078	0.066	0.056
1998	95.1	0	0.100	0.085	0.076	0.066	0.056
1999	98.6	1	**0.127**	0.082	0.077	0.055	0.048
2000	99.2	1	**0.116**	0.073	0.070	0.060	0.054
2001	99.5	0	0.079	0.074	0.070	0.059	0.051
2002	95.3	0	0.098	0.080	0.078	0.070	0.062
2003	96.7	0	0.087	0.073	0.068	0.056	0.048
2004	100.0	2	**0.114**	0.079	0.077	0.066	0.058
2005	100.0	0	0.085	0.075	0.073	0.063	0.056
2006	100.0	0	0.077	0.069	0.065	0.057	0.050
2008	100.0	0	0.069	0.062	0.060	0.055	0.050
2009	99.5	0	0.067	0.062	0.056	0.049	0.045

Table 36: Daily peak 4-hour ozone summary 1995 to 2008

Trend station/region: Deception Bay, south-east Queensland

AAQ NEPM standard
0.08 ppm (4-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1995	95.9	0	0.077	0.061	0.057	0.047	0.043
1996	95.9	0	0.076	0.065	0.059	0.049	0.045
1997	100.0	0	0.066	0.053	0.050	0.044	0.040
1998	94.2	0	0.059	0.054	0.049	0.043	0.040
1999	99.2	1	**0.083**	0.055	0.052	0.043	0.039
2000	99.7	0	0.063	0.050	0.049	0.042	0.038
2001	86.6*	0	0.075	0.056	0.050	0.044	0.040
2002	89.6*	0	0.067	0.060	0.053	0.044	0.041
2003	97.0	0	0.076	0.060	0.052	0.044	0.040
2004	96.7	0	0.062	0.053	0.049	0.044	0.042
2005	98.6	0	0.063	0.061	0.049	0.046	0.041
2006	99.5	0	0.060	0.055	0.048	0.044	0.039
2008	99.7	0	0.070	0.052	0.050	0.044	0.040
2009	99.7	0	0.073	0.062	0.054	0.043	0.039

*Data availability less than 75 percent for one or more quarters.

Table 37: Daily peak 4-hour ozone summary 1980 to 2008

Trend station/region: Rocklea, south-east Queensland

AAQ NEPM standard
0.08 ppm (4-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1980	97.5	0	0.076	0.063	0.059	0.049	0.043
1981	90.7	0	0.069	0.056	0.051	0.043	0.038
1982	97.8	0	0.076	0.058	0.053	0.048	0.040
1983	97.5	0	0.078	0.058	0.054	0.047	0.036
1984	95.1	0	0.080	0.059	0.054	0.047	0.041
1985	91.0	1	**0.090**	0.069	0.051	0.039	0.031
1986	84.1*	0	0.063	0.059	0.052	0.049	0.041
1987	*72.1**	*8*	***0.110***	***0.094***	***0.093***	*0.066*	*0.049*
1988	*67.5**	*1*	***0.081***	*0.065*	*0.050*	*0.041*	*0.035*
1989	82.5*	0	0.060	0.048	0.042	0.037	0.032
1990	76.2*	0	0.053	0.042	0.037	0.030	0.028
1991	91.2	0	0.054	0.043	0.039	0.032	0.026
1992	94.0	0	0.058	0.052	0.042	0.034	0.031
1993	94.8	0	0.074	0.054	0.053	0.048	0.043
1994	95.1	1	**0.101**	0.075	0.063	0.051	0.043
1995	78.6*	0	0.080	0.070	0.058	0.054	0.047
1996	97.0	1	**0.111**	0.076	0.070	0.061	0.051
1997	97.0	0	0.080	0.069	0.064	0.056	0.045
1998	95.1	1	**0.091**	0.068	0.064	0.057	0.049
1999	94.2	1	**0.102**	0.066	0.058	0.049	0.042
2000	96.2	0	0.072	0.063	0.054	0.049	0.044
2001	99.2	0	0.071	0.063	0.056	0.048	0.043
2002	98.6	1	**0.105**	0.068	0.061	0.054	0.047
2003	97.8	0	0.059	0.053	0.051	0.047	0.042
2004	95.9	0	0.077	0.069	0.064	0.057	0.050
2005	100.0	0	0.067	0.064	0.059	0.052	0.047
2006	97.5	0	0.068	0.056	0.055	0.049	0.043
2008	95.9	0	0.067	0.058	0.053	0.048	0.043
2009	85.0*	0	0.064	0.057	0.053	0.044	0.039

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 38: Daily peak 4-hour ozone summary 1994 to 2008

Trend station/region: Flinders View, south-east Queensland

AAQ NEPM standard
0.08 ppm (4-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)
1994	97.5	0	0.072	0.058	0.056	0.047	0.043
1995	95.1	0	0.066	0.062	0.060	0.050	0.044
1996	98.6	2	**0.091**	0.068	0.065	0.058	0.049
1997	97.5	2	**0.090**	0.073	0.067	0.056	0.049
1998	95.1	0	0.069	0.065	0.064	0.057	0.049
1999	98.6	1	**0.101**	0.067	0.064	0.049	0.043
2000	99.2	1	**0.089**	0.064	0.061	0.052	0.048
2001	99.5	0	0.072	0.066	0.058	0.052	0.047
2002	95.3	1	**0.083**	0.070	0.066	0.061	0.055
2003	96.7	0	0.080	0.067	0.059	0.049	0.044
2004	100.0	1	**0.100**	0.071	0.067	0.057	0.050
2005	100.0	0	0.067	0.066	0.062	0.057	0.050
2006	100.0	0	0.070	0.059	0.056	0.050	0.044
2008	100.0	0	0.062	0.056	0.054	0.049	0.045
2009	99.5	0	0.058	0.055	0.052	0.045	0.041

Table 39: Daily peak 1-hour sulfur dioxide summary 1993 to 2008

Trend station/region: Flinders View, south-east Queensland

AAQ NEPM standard
0.20 ppm (1-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	Annual average (ppm)
1993	88.2*	0	0.049	0.030	0.024	0.018	0.014	0.002
1994	98.9	0	0.033	0.027	0.025	0.021	0.017	0.003
1995	*59.5**	*0*	*0.041*	*0.029*	*0.027*	*0.020*	*0.014*	*0.002*
1996	88.3*	0	0.047	0.037	0.027	0.023	0.017	0.002
1997	97.0	0	0.047	0.040	0.035	0.023	0.019	0.002
1998	95.9	0	0.090	0.037	0.033	0.024	0.019	0.002
1999	96.4	0	0.070	0.035	0.033	0.028	0.021	0.002
2000	89.9	0	0.081	0.049	0.036	0.027	0.022	0.002
2001	99.5	0	0.053	0.048	0.043	0.029	0.023	0.001
2002	97.0	0	0.057	0.035	0.033	0.025	0.018	0.001
2003	96.4	0	0.046	0.031	0.030	0.023	0.017	0.001
2004	99.5	0	0.063	0.036	0.031	0.021	0.016	0.001
2005	100.0	0	0.034	0.028	0.024	0.020	0.014	0.001
2006	100.0	0	0.040	0.037	0.027	0.023	0.018	0.001
2008	100.0	0	0.026	0.024	0.022	0.018	0.014	0.001
2009	100.0	0	0.042	0.030	0.028	0.019	0.016	0.001

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 40: Daily peak 1-hour sulfur dioxide summary 1991 to 2008

Trend station/region: South Gladstone, Gladstone

AAQ NEPM standard
0.20 ppm (1-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	Annual average (ppm)
1991	92.6	0	0.011	0.011	0.009	0.008	0.006	0.002
1992	94.3	0	0.052	0.039	0.029	0.020	0.015	0.003
1993	98.3	0	0.075	0.059	0.050	0.039	0.032	0.004
1994	97.0	0	0.070	0.042	0.040	0.031	0.024	0.003
1995	96.7	0	0.168	0.083	0.065	0.047	0.035	0.004
1996	99.2	0	0.083	0.053	0.042	0.026	0.018	0.002
1997	98.9	0	0.049	0.029	0.023	0.014	0.010	0.001
1998	97.5	0	0.076	0.050	0.042	0.027	0.020	0.001
1999	94.2	0	0.051	0.042	0.039	0.027	0.022	0.002
2000	84.7*	0	0.092	0.071	0.045	0.034	0.024	0.001
2001	98.1	0	0.068	0.046	0.035	0.023	0.018	0.001
2002	94.5	0	0.123	0.040	0.031	0.025	0.020	0.001
2003	93.2	0	0.112	0.058	0.041	0.025	0.019	0.001
2004	96.4	0	0.064	0.040	0.032	0.022	0.017	0.001
2005	99.7	0	0.084	0.063	0.053	0.032	0.027	0.002
2006	100.0	0	0.093	0.071	0.064	0.049	0.034	0.002
2008	98.4	0	0.075	0.069	0.061	0.044	0.035	0.002
2009	98.6	0	0.140	0.065	0.056	0.042	0.026	0.002

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 41: Daily peak 1-hour sulfur dioxide summary 1983 to 2008

Trend station/region: Menzies, Mount Isa

AAQ NEPM standard
0.20 ppm (1-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	Annual average (ppm)
1983	*67.4**	*25*	***0.725***	***0.515***	***0.430***	***0.270***	*0.200*	*0.021*
1984	93.7	31	**1.155**	**0.555**	**0.515**	**0.330**	0.185	0.017
1985	97.3	7	**1.080**	**0.325**	**0.210**	0.100	0.055	0.016
1986	88.5	50	**1.406**	**1.255**	**0.788**	**0.577**	**0.296**	0.031
1987	98.9	51	**1.755**	**1.016**	**0.853**	**0.546**	**0.324**	0.022
1988	91.0*	31	**0.798**	**0.682**	**0.562**	**0.342**	0.159	0.017
1989	85.2	41	**0.957**	**0.585**	**0.503**	**0.348**	**0.241**	0.020
1990	*44.7**	*6*	***0.577***	***0.493***	***0.222***	*0.145*	*0.091*	*0.030*
1991	*54.8**	*28*	***0.673***	***0.638***	***0.440***	***0.294***	***0.215***	*0.018*
1992	88.5*	25	**0.540**	**0.457**	**0.406**	**0.286**	0.170	0.012
1993	95.6	24	**0.718**	**0.434**	**0.403**	**0.282**	0.134	0.015
1994	91.5	20	**0.688**	**0.483**	**0.343**	**0.250**	0.135	0.019
1995	98.9	11	**0.443**	**0.254**	**0.239**	0.184	0.109	0.005
1996	98.6	16	**0.598**	**0.409**	**0.285**	0.198	0.131	0.005
1997	98.9	7	**0.300**	**0.256**	**0.216**	0.128	0.083	0.003
1998	*48.8**	*16*	***0.693***	***0.548***	***0.368***	***0.265***	*0.190*	*0.005*
1999	90.4*	17	**0.675**	**0.366**	**0.269**	**0.202**	0.141	0.004
2000	96.4	31	**0.584**	**0.373**	**0.357**	**0.250**	0.191	0.006
2001	98.9	41	**0.581**	**0.438**	**0.422**	**0.295**	**0.222**	0.006
2002	91.2	49	**1.254**	**0.551**	**0.526**	**0.385**	**0.272**	0.009
2003	98.9	42	**0.658**	**0.503**	**0.493**	**0.312**	**0.217**	0.007
2004	97.5	36	**0.888**	**0.665**	**0.444**	**0.302**	**0.207**	0.007
2005	93.7*	49	**0.964**	**0.663**	**0.512**	**0.395**	**0.271**	0.009
2006	97.0	25	**0.567**	**0.398**	**0.356**	**0.246**	0.176	0.005
2008	96.7	31	**0.608**	**0.408**	**0.375**	**0.282**	0.185	0.007
2009	97.0	38	**0.751**	**0.528**	**0.482**	**0.289**	**0.203**	0.007

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 42: Daily 24-hour sulfur dioxide summary 1993 to 2008

Trend station/region: Flinders View, south-east Queensland

AAQ NEPM standard
0.08 ppm (24-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	Annual average (ppm)
1993	88.2*	0	0.006	0.005	0.005	0.004	0.003	0.002
1994	98.9	0	0.008	0.007	0.006	0.006	0.005	0.003
1995	*59.5**	*0*	*0.009*	*0.008*	*0.006*	*0.005*	*0.004*	*0.002*
1996	88.3*	0	0.010	0.005	0.005	0.004	0.004	0.002
1997	97.0	0	0.009	0.006	0.005	0.004	0.003	0.002
1998	95.9	0	0.011	0.007	0.006	0.004	0.004	0.002
1999	96.4	0	0.009	0.007	0.007	0.005	0.004	0.002
2000	89.9	0	0.013	0.012	0.008	0.006	0.005	0.002
2001	99.5	0	0.014	0.007	0.006	0.004	0.003	0.001
2002	97.0	0	0.006	0.006	0.005	0.003	0.003	0.001
2003	96.4	0	0.006	0.005	0.004	0.003	0.002	0.001
2004	99.5	0	0.007	0.006	0.005	0.003	0.003	0.001
2005	100.0	0	0.006	0.004	0.004	0.002	0.002	0.001
2006	99.7	0	0.007	0.006	0.004	0.004	0.003	0.001
2008	99.5	0	0.006	0.004	0.004	0.003	0.002	0.001
2009	98.6	0	0.006	0.005	0.004	0.003	0.002	0.001

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 43: Daily 24-hour sulfur dioxide summary 1991 to 2008

Trend station/region: South Gladstone, Gladstone

AAQ NEPM standard
0.08 ppm (24-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	Annual average (ppm)
1991	92.6	0	0.007	0.006	0.006	0.004	0.004	0.002
1992	94.3	0	0.012	0.011	0.010	0.009	0.008	0.003
1993	98.3	0	0.014	0.010	0.010	0.008	0.007	0.004
1994	97.0	0	0.013	0.007	0.007	0.006	0.005	0.003
1995	96.7	0	0.017	0.014	0.012	0.008	0.007	0.004
1996	99.2	0	0.010	0.007	0.006	0.005	0.004	0.002
1997	98.9	0	0.007	0.004	0.003	0.002	0.002	0.001
1998	97.5	0	0.012	0.010	0.007	0.005	0.003	0.001
1999	94.2	0	0.009	0.008	0.006	0.005	0.004	0.002
2000	84.7*	0	0.022	0.008	0.006	0.004	0.003	0.001
2001	98.1	0	0.006	0.005	0.004	0.003	0.002	0.001
2002	94.5	0	0.029	0.029	0.006	0.004	0.003	0.001
2003	93.2	0	0.013	0.011	0.007	0.005	0.003	0.001
2004	96.4	0	0.007	0.006	0.006	0.004	0.003	0.001
2005	98.9	0	0.011	0.009	0.006	0.004	0.004	0.002
2006	97.5	0	0.019	0.014	0.011	0.008	0.006	0.003
2008	97.5	0	0.021	0.012	0.010	0.007	0.005	0.002
2009	97.0	0	0.018	0.010	0.009	0.006	0.005	0.002

*Data availability less than 75 percent for one or more quarters.

Table 44: Daily 24-hour sulfur dioxide summary 1984 to 2008

Trend station/region: Menzies, Mount Isa

AAQ NEPM standard
0.08 ppm (24-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (ppm)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	Annual average (ppm)
1984	93.7	3	**0.094**	**0.087**	0.071	0.053	0.033	0.017
1985	97.3	1	**0.111**	0.050	0.042	0.030	0.024	0.016
1986	88.5	11	**0.145**	**0.123**	**0.101**	0.071	0.052	0.031
1987	98.9	12	**0.158**	**0.110**	**0.099**	0.060	0.044	0.022
1988	91.0*	3	**0.123**	**0.091**	0.064	0.041	0.032	0.017
1989	85.2	1	**0.100**	0.066	0.062	0.048	0.035	0.020
1990	*44.7**	*1*	***0.088***	*0.078*	*0.072*	*0.052*	*0.046*	*0.030*
1991	*54.8**	*3*	***0.117***	***0.100***	*0.073*	*0.053*	*0.038*	*0.018*
1992	88.5*	0	0.064	0.056	0.052	0.033	0.025	0.012
1993	95.6	0	0.064	0.052	0.046	0.040	0.027	0.015
1994	91.5	2	**0.085**	0.059	0.054	0.045	0.040	0.019
1995	98.9	0	0.049	0.036	0.028	0.018	0.012	0.005
1996	98.6	0	0.049	0.043	0.040	0.024	0.015	0.005
1997	98.9	0	0.034	0.028	0.022	0.016	0.010	0.003
1998	*48.8**	*0*	*0.055*	*0.041*	*0.037*	*0.029*	*0.019*	*0.005*
1999	90.4*	0	0.049	0.036	0.032	0.024	0.015	0.004
2000	96.4	0	0.078	0.070	0.055	0.032	0.019	0.006
2001	98.9	0	0.075	0.052	0.045	0.033	0.021	0.006
2002	91.2	1	**0.081**	0.057	0.055	0.043	0.033	0.009
2003	98.9	2	**0.093**	0.067	0.057	0.036	0.022	0.007
2004	97.5	1	**0.100**	0.069	0.050	0.034	0.017	0.007
2005	91.8*	2	**0.091**	0.069	0.060	0.044	0.032	0.009
2006	93.7	0	0.065	0.054	0.045	0.032	0.018	0.005
2008	94.5	1	**0.199**	0.060	0.046	0.036	0.023	0.007
2009	96.2	1	**0.089**	0.064	0.056	0.037	0.025	0.007

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Table 45: Daily 24-hour PM_{10} summary 1997 to 2008

Trend station/region: Rocklea, south-east Queensland

AAQ NEPM standard
50 µg/m^3 (24-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (µg/m^3)	99th percentile (µg/m^3)	98th percentile (µg/m^3)	95th percentile (µg/m^3)	90th percentile (µg/m^3)
1997	92.1	0	45.8	42.7	32.1	28.9	26.5
1998	90.1	0	34.7	32.4	29.1	25.7	23.3
1999	96.4	1	**56.7**	31.6	30.4	25.5	22.3
2000	92.3	0	47.6	40.6	38.1	32.8	27.0
2001	97.3	1	**69.5**	35.2	34.2	27.2	24.4
2002	99.2	8	**177.2**	**95.3**	**60.1**	35.0	30.9
2003	98.1	2	**119.9**	41.7	33.6	28.2	24.2
2004	92.6	2	**52.4**	44.5	39.9	33.5	28.8
2005	89.9	2	**52.6**	46.1	37.3	27.8	23.8
2006	96.2	0	45.5	32.6	31.1	27.0	23.8
2008	99.2	1	**53.4**	41.4	38.9	32.1	26.7
2009	94.8	1	**86.8**	44.2	37.8	30.0	25.8

Table 46: Daily 24-hour PM_{10} summary 1999 to 2008

Trend station/region: Flinders View, south-east Queensland

AAQ NEPM standard
50 µg/m^3 (24-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (µg/m^3)	99th percentile (µg/m^3)	98th percentile (µg/m^3)	95th percentile (µg/m^3)	90th percentile (µg/m^3)
1999	95.3	0	44.2	28.4	25.5	20.3	17.9
2000	97.3	1	**61.1**	42.3	38.5	32.0	26.4
2001	99.7	0	42.5	37.5	35.0	25.5	22.9
2002	97.3	7	**197.2**	**103.3**	**60.8**	35.9	31.8
2003	94.8	1	**119.1**	35.1	30.5	26.0	23.0
2004	99.2	3	**64.1**	40.8	38.5	32.9	28.9
2005	97.0	3	**64.3**	44.7	40.7	26.8	24.0
2006	100.0	0	35.7	29.5	28.6	26.0	22.5
2008	99.2	0	44.6	39.6	36.7	28.3	23.4
2009	99.2	2	**68.5**	45.6	38.8	26.6	22.0

Table 47: Daily 24-hour PM_{10} summary 2001 to 2008

Trend station/region: South Gladstone, Gladstone

AAQ NEPM standard
50 µg/m^3 (24-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (µg/m^3)	99th percentile (µg/m^3)	98th percentile (µg/m^3)	95th percentile (µg/m^3)	90th percentile (µg/m^3)
2001	95.6	4	**66.6**	**51.6**	36.0	30.3	25.9
2002	98.1	5	**197.0**	**83.0**	48.5	33.8	26.3
2003	96.4	0	41.3	35.5	33.1	26.2	23.2
2004	99.7	0	42.7	35.6	30.0	25.6	22.4
2005	97.8	4	**196.7**	**53.8**	37.1	26.6	23.0
2006	98.4	1	**54.6**	37.5	34.3	28.6	23.7
2008	96.7	0	38.8	29.5	28.4	25.4	22.9
2009	95.9	2	**65.6**	43.7	36.7	28.8	24.9

Table 48: Daily 24-hour $PM_{2.5}$ summary 1998 to 2008

Trend station/region: Rocklea, south-east Queensland†

AAQ NEPM advisory standard
25 µg/m^3 (24-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (µg/m^3)	99th percentile (µg/m^3)	98th percentile (µg/m^3)	95th percentile (µg/m^3)	90th percentile (µg/m^3)	Annual average (µg/m^3)
1998	80.8*	0	16.1	11.1	9.2	7.7	6.0	3.5
1999	88.8*	0	14.5	13.3	12.4	10.3	8.3	5.0
2000	95.6	3	**37.4**	20.2	17.7	13.3	10.9	5.8
2001	98.6	3	**95.4**	18.4	17.1	12.3	9.2	5.5
2002	96.4	3	**45.3**	22.0	17.1	12.8	10.9	6.1
2003	87.7*	1	**34.7**	23.3	13.9	10.6	8.6	5.1
2004	93.7	5	**32.9**	**28.7**	24.4	17.9	11.6	6.5
2005	90.1*	0	15.3	13.0	12.2	9.6	8.1	4.6
2006	95.3	0	14.2	13.7	11.1	8.6	7.1	4.1
2008	99.7	0	20.5	17.6	13.5	10.6	8.5	4.4
2009	95.3	0	11.6	9.8	9.5	7.8	6.9	3.8

†Monitoring by TEOM instrumentation in accordance with Technical Paper on Monitoring for Particles as $PM_{2.5}$

*Data availability less than 75 percent for one or more quarters.

Table 49: Daily 24-hour $PM_{2.5}$ summary 1999 to 2008

Trend station/region: Springwood, south-east Queensland[†]

AAQ NEPM advisory standard
25 µg/m^3 (24-hour average)

Year	Data availability (%)	No. of exceedences (days)	Max conc. (µg/m^3)	99th percentile (µg/m^3)	98th percentile (µg/m^3)	95th percentile (µg/m^3)	90th percentile (µg/m^3)	Annual average (µg/m^3)
1999	82.7*	0	22.3	12.9	11.8	8.7	7.1	4.3
2000	96.7	6	**35.4**	**28.9**	23.6	17.3	13.2	6.4
2001	97.0	0	19.4	18.0	16.2	11.8	9.1	5.3
2002	95.9	5	**38.9**	**28.4**	20.1	14.9	11.7	6.2
2003	96.2	0	20.5	16.6	15.4	10.9	9.2	5.5
2004	98.4	0	21.7	16.9	15.4	11.7	9.5	5.5
2005	96.4	0	15.2	14.9	13.3	10.3	8.6	4.7
2006	94.0	1	**25.5**	20.1	15.3	9.3	7.9	4.8
2008	98.4	0	17.8	14.0	12.0	9.4	7.8	4.3
2009	96.7	0	10.9	9.9	8.8	7.9	6.7	4.1

[†]Monitoring by TEOM instrumentation in accordance with Technical Paper on Monitoring for Particles as $PM_{2.5}$

*Data availability less than 75 percent for one or more quarters.

Table 50: Annual lead summary 1980 to 2002

Trend station/region: Woolloongabba, south-east Queensland

AAQ NEPM standard
0.5 µg/m^3 (annual average)

Year	Data availability (%)	Annual average (µg/m^3)
1980	91.8	**2.21**
1981	85.2*	**2.69**
1982	96.7	**2.34**
1983	96.7	**2.21**
1984	93.4	**2.56**
1985	86.9*	**2.40**
1986	100.0	**1.90**
1987	96.7	**1.91**
1988	98.4	**2.13**
1989	98.4	**1.64**
1990	98.4	**1.47**
1991	100.0	**0.97**
1992	90.2	**0.63**
1993	93.4	**0.57**
1994	96.7	0.48
1995	100.0	0.38
1996	98.4	0.25
1997	100.0	0.27
1998	*65.6**	*0.22*
1999	98.3	0.19
2000	88.5	0.14
2001	93.4	0.03
2002	96.7	0.02

*Data availability less than 75 percent for one or more quarters. Years shown in italics have less than 75 percent annual data availability.

Appendix – Description of 2008 exceedence events

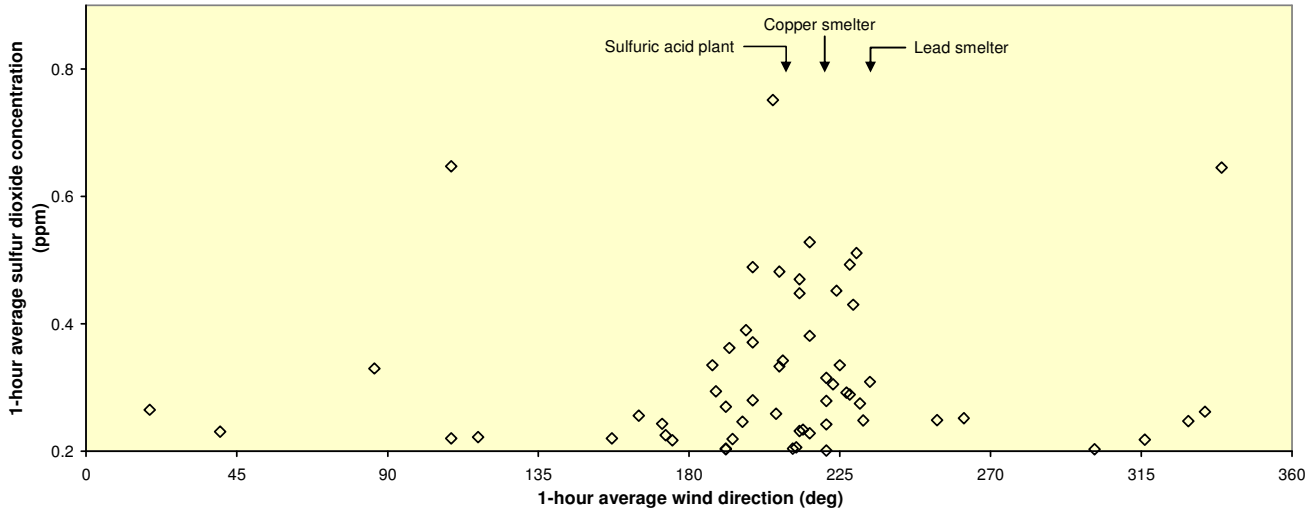
Sulfur dioxide exceedences at Menzies in 2008

Industrial operations (metals smelting and sulfuric acid manufacture) emit sulfur dioxide into the atmosphere in Mount Isa. Under the *Mount Isa Mines Agreement Act 1985*, smelter operations must be managed to maintain ambient sulfur dioxide concentrations in Mount Isa below the levels specified in the Act (these are currently equivalent to the United States Environmental Protection Agency three-hour secondary, 24-hour primary and annual average primary sulfur dioxide standards). As smelter operations were only controlled to meet *Mount Isa Mines Agreement Act 1985* air quality limits during 2008, sulfur dioxide levels exceeded the more stringent Air NEPM 1-hour and 24-hour standards on occasions.

Amendments made to the *Environmental Protection Act 1994* (EP Act) in May 2008 will cause all Special Agreement Act mine operations, including the Mount Isa smelters, to come under contemporary environmental controls under the EP Act. DERM will assess the environmental authority application against the standard criteria in the EP Act which require that any applicable Commonwealth plans, standards, agreements or requirements, including those relating to NEPMs, are considered. The *Environmental Protection (Air) Policy 2008*, which includes ambient air quality objectives for sulfur dioxide, will also be considered as part of this process.

The smelters and sulfuric acid manufacturing plant are situated to the south-southwest of the Menzies monitoring site. The relationship between one-hour average wind direction and sulfur dioxide concentrations greater than 0.200ppm (figure 2) demonstrates that exceedences are highly correlated with winds blowing from these plants towards the Menzies site.

Figure 2: Relationship between 1-hour average wind direction and sulfur dioxide concentrations at the Menzies site during 2008.



PM_{10} exceedence at South Gladstone on 4 April 2008

On 4 April elevated PM_{10} levels were measured at the South Gladstone air monitoring site from 8:00am to 7:00pm (figure 3), leading to an exceedence of the Air NEPM 24-hour PM_{10} standard on this day. Winds were south-westerly when elevated levels were first measured. Other DERM PM_{10} monitoring sites in the Gladstone region showed a similar pattern and levels on this day, indicating that the PM_{10} particles originated from a region-wide source rather than a local source in the vicinity of the South Gladstone site.

The fact that Bsp (nephelometer) measurements at South Gladstone showed only a slight increase compared with the PM_{10} measurements (figure 3) indicates a high proportion of coarse particles, consistent with wind blown dust particles.

Figure 3: Particle concentrations at the South Gladstone site on 4 April 2008.

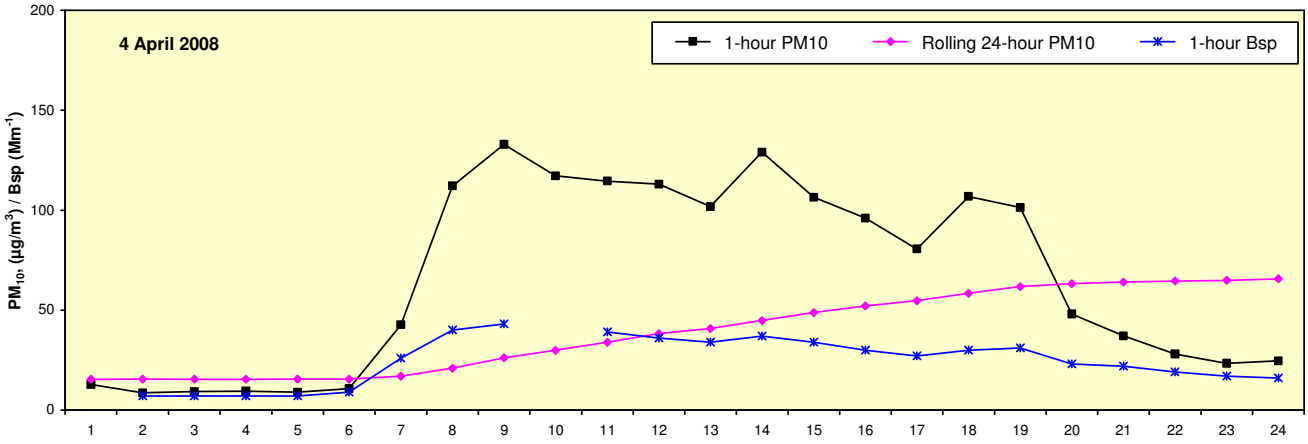
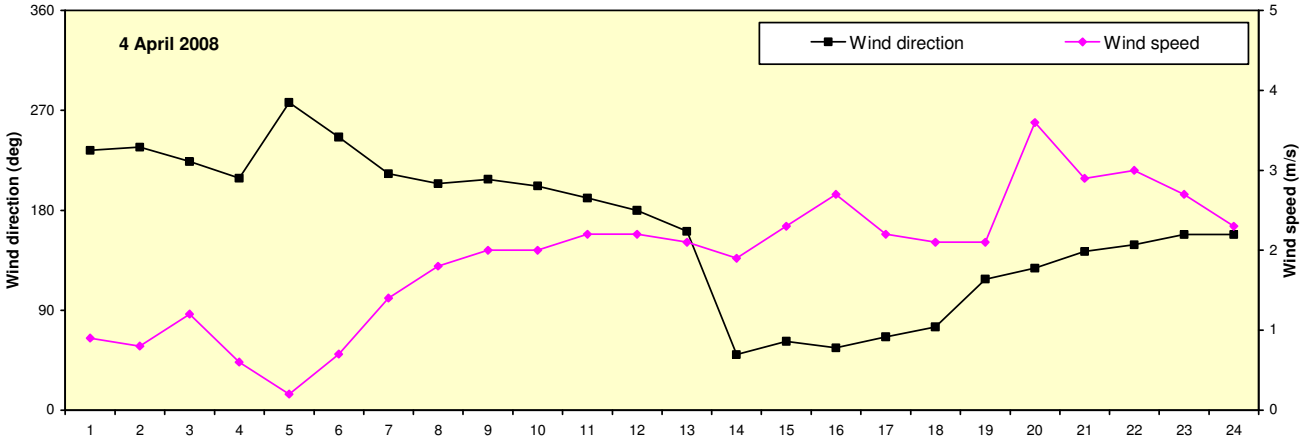


Figure 4: Wind direction and speed at the South Gladstone site on 4 April 2008.



PM_{10} exceedences at coastal Queensland sites over the period 28 to 30 April 2008

Strong south-westerly winds associated with the passage of a weather front carried dust from western Queensland over south-east Queensland on 28 April. The Air NEPM PM_{10} 24-hour standard was exceeded at all south-east Queensland monitoring sites, with the exception of Mountain Creek, on this day.

The south-westerly change was followed by south-easterly winds which carried the dust particles up the Queensland coast, leading to exceedences of the Air NEPM PM_{10} 24-hour standard at Gladstone and Mackay monitoring sites on 29 April and Townsville monitoring sites on 30 April.

Corresponding $PM_{2.5}$ and Bsp (nephelometer) measurements showed little correlation with the PM_{10} measurements, indicating a high proportion of coarse particles, consistent with wind-blown dust.

Figure 5: Particle concentrations at the Rocklea site from 28 April to 30 April 2008.

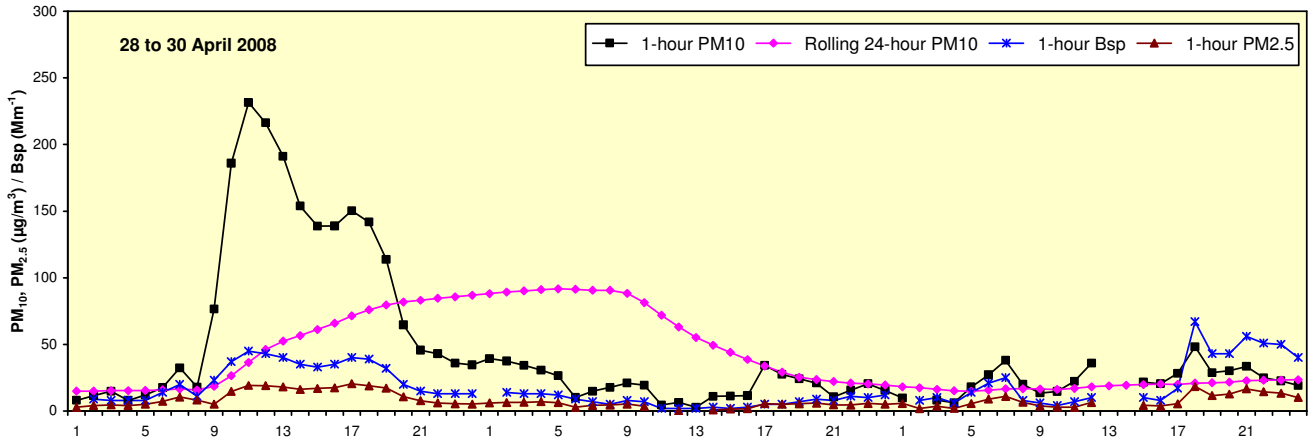


Figure 6: Particle concentrations at the Springwood site from 28 April to 30 April 2008.

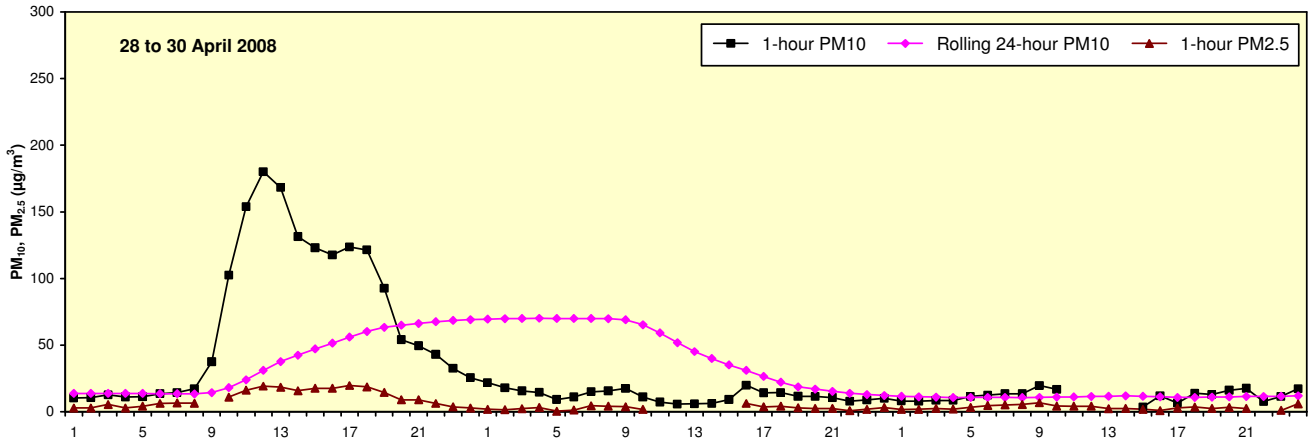


Figure 7: Particle concentrations at the Flinders View site from 28 April to 30 April 2008.

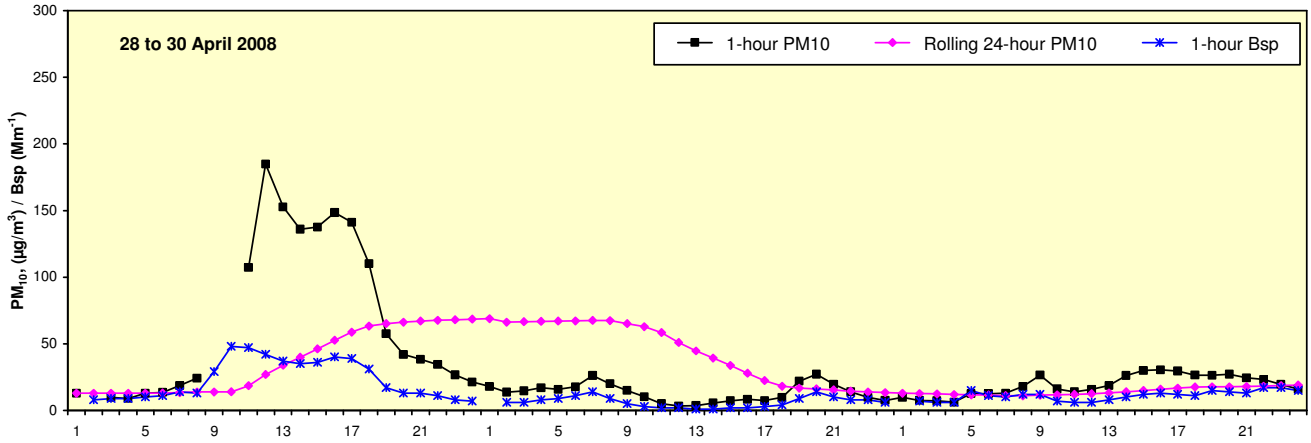


Figure 8: Particle concentrations at the North Toowoomba site from 28 April to 30 April 2008.

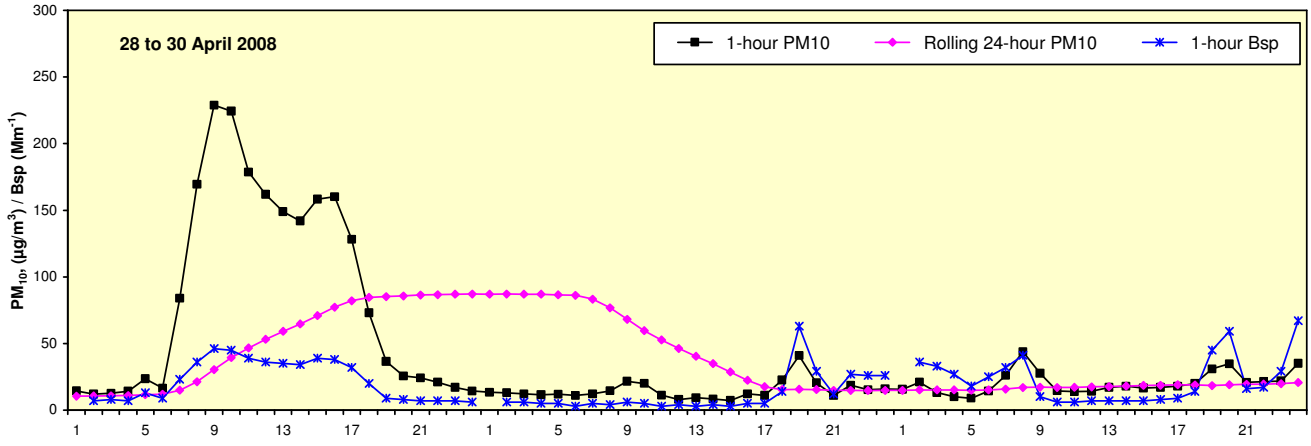


Figure 9: Particle concentrations at the South Gladstone site from 28 April to 30 April 2008.

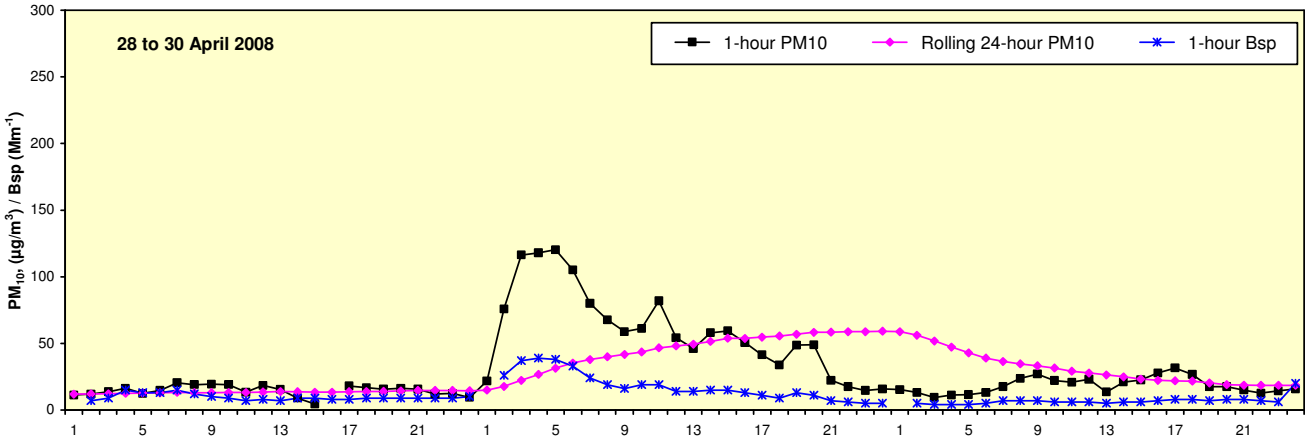


Figure 10: Particle concentrations at the West Mackay site from 28 April to 30 April 2008.

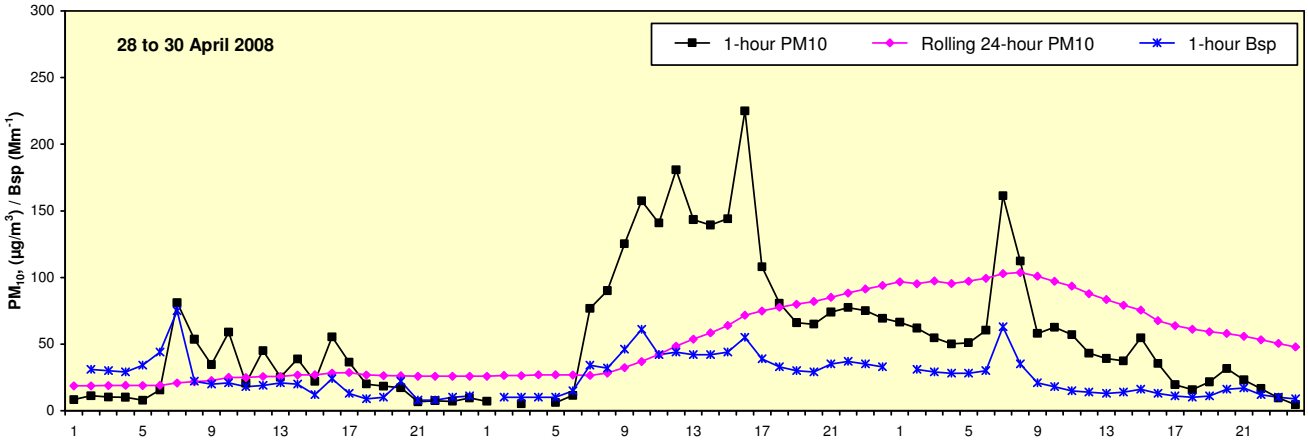
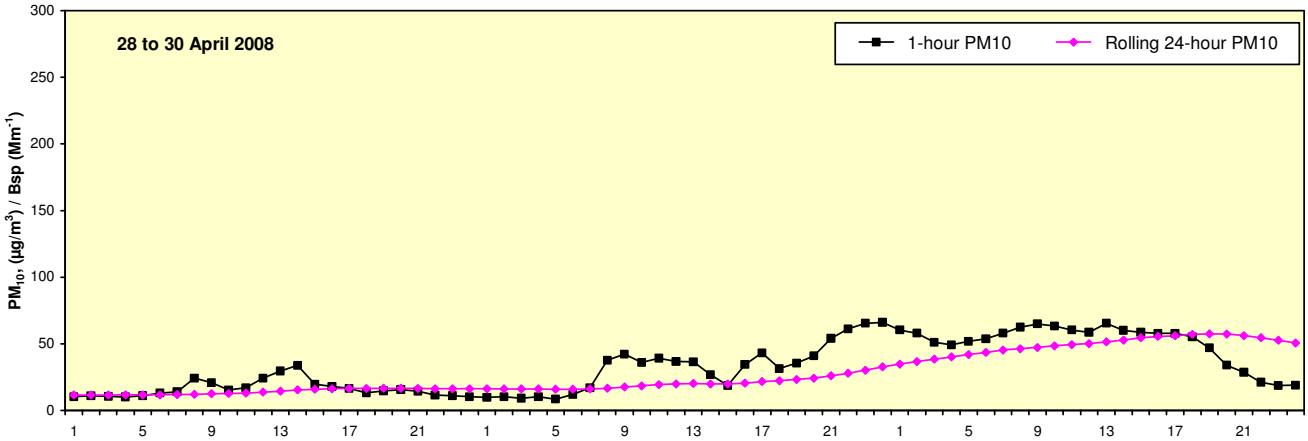


Figure 11: Particle concentrations at the Pimlico site from 28 April to 30 April 2008.



PM_{10} exceedences in south-east Queensland and Toowoomba on 16 and 17 September 2008

Strong south-westerly winds associated with the passage of a weather front carried dust from western Queensland over south-east Queensland on 16 September. This dust led to exceedences of the Air NEPM 24-hour PM_{10} standard at the Flinders View monitoring site on 16 September, the Mountain Creek monitoring site on 17 September, and at the Toowoomba monitoring site on both days.

Corresponding low Bsp measurements point to coarse wind blown dust particles being responsible for the elevated PM_{10} measurements at these sites during this period.

Figure 12: Particle concentrations at the North Toowoomba site from 16 September to 17 September 2008.

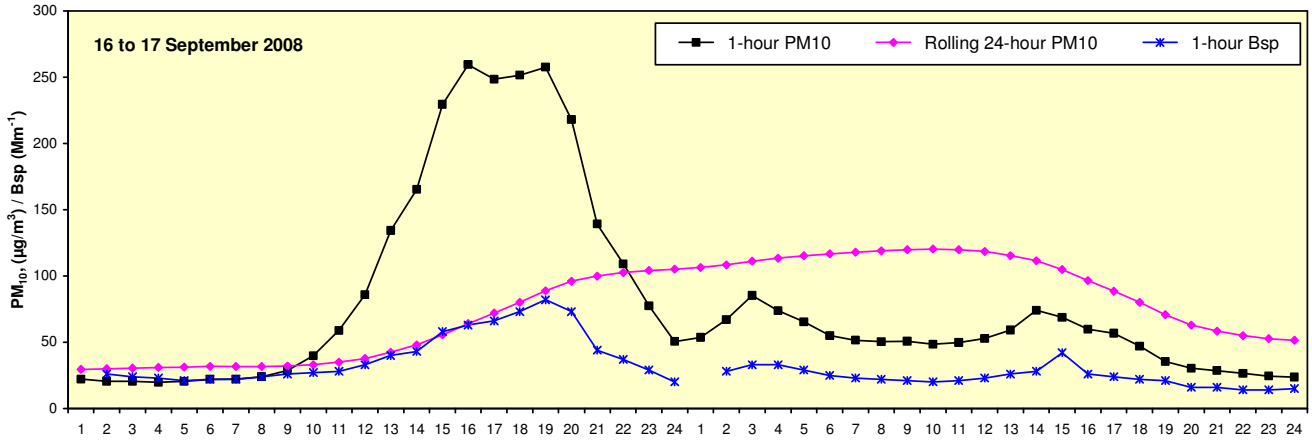


Figure 13: Particle concentrations at the Flinders View site from 16 September to 17 September 2008.

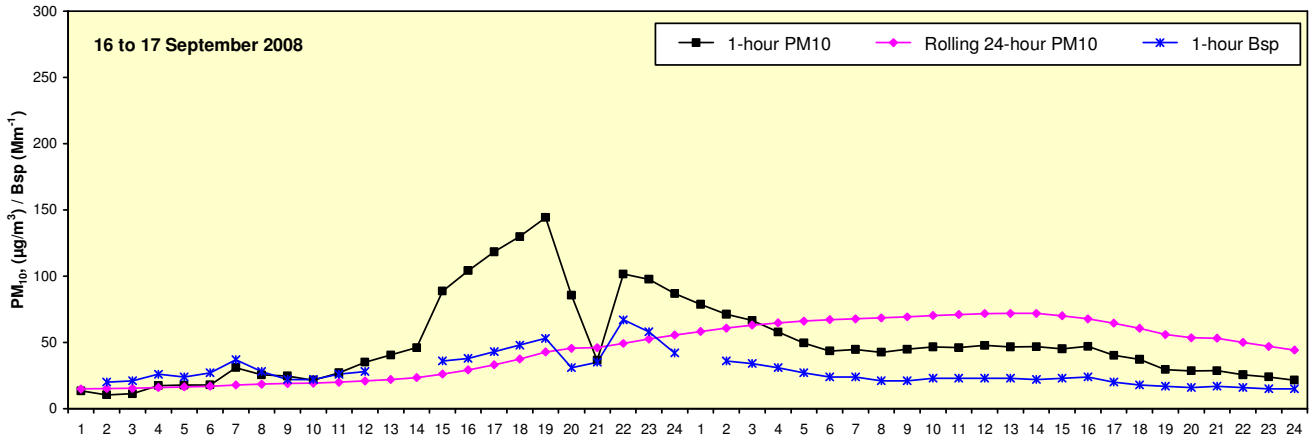
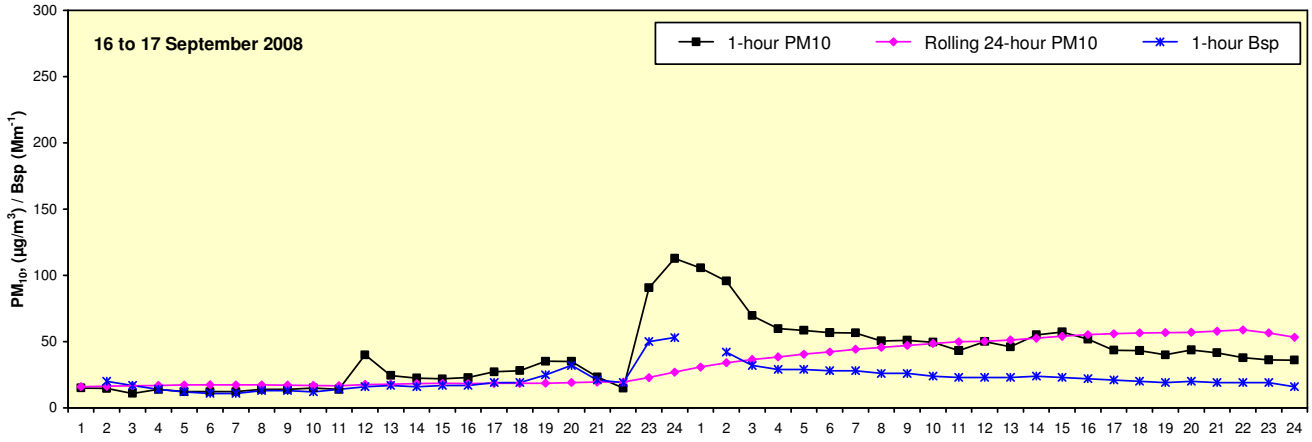


Figure 14: Particle concentrations at the Mountain Creek site from 16 September to 17 September 2008.



PM_{10} exceedence at Toowoomba on 24 November 2008

Strong gusty southerly winds associated with the passage of a weather front late on 23 November carried dust from north-west New South Wales and south-western Queensland over southeast Queensland. Dust levels in Toowoomba were sufficiently high to result in an exceedence of the Air NEPM PM_{10} 24-hour standard at the Toowoomba monitoring sites on 24 November.

Corresponding low Bsp measurements point to coarse wind blown dust particles being responsible for the elevated PM_{10} measurements at the North Toowoomba site on 24 November.

Figure 15: Particle concentrations at the North Toowoomba site on 24 November 2008.

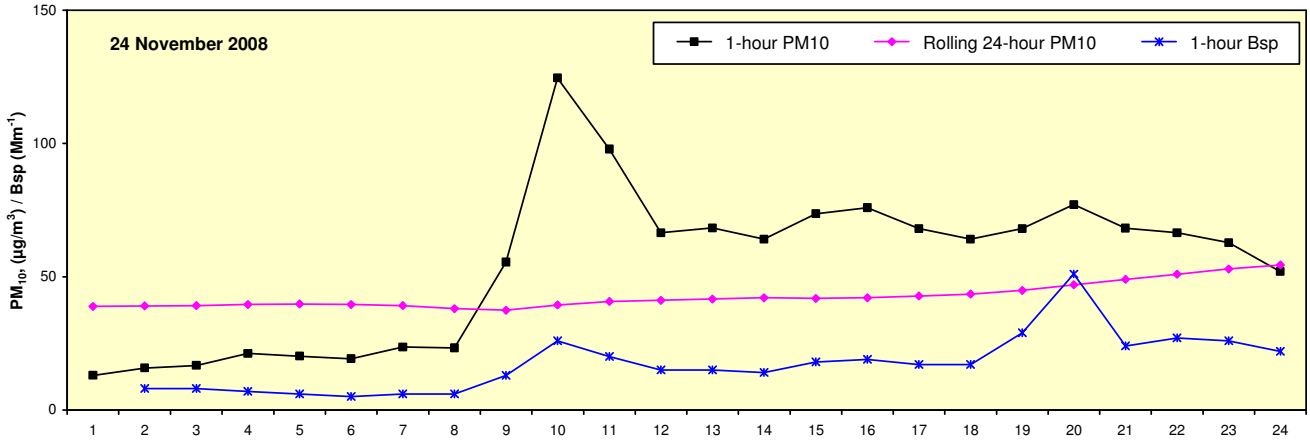
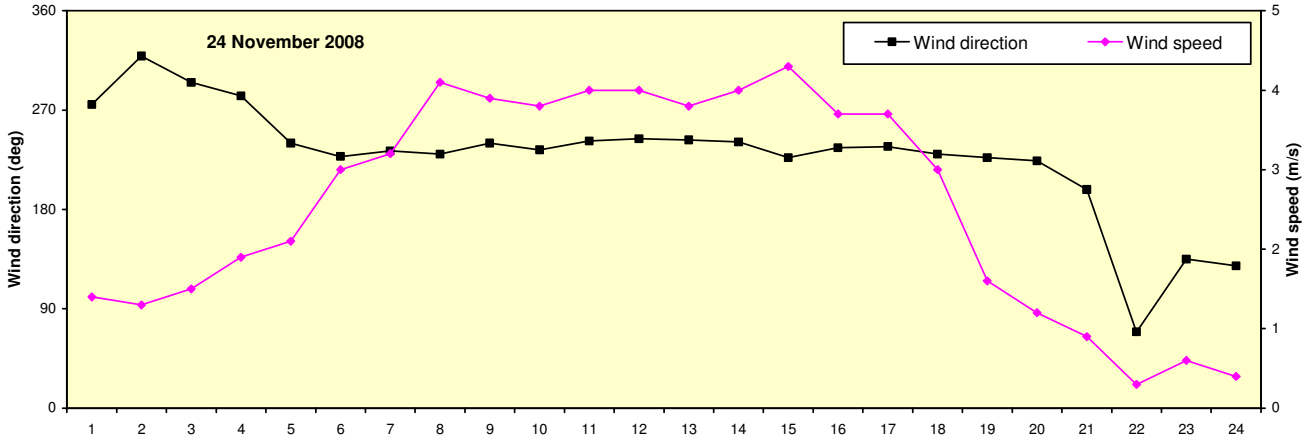


Figure 16: Wind direction and speed at the North Toowoomba site on 24 November 2008.



PM_{10} exceedences at West Mackay in July, August, November and December 2008

A major source of airborne particles in the Mackay region has historically been pre- and post-harvest burning of sugar cane in the Pioneer Valley west of Mackay during the crushing season from June to November each year. With increasing amounts of cane being harvested green (currently over 98 percent of the total crop is green harvested), occurrences of agricultural smoke impacts in Mackay have decreased in recent years.

However, changes in activities at commercial premises in the immediate vicinity of the West Mackay monitoring site (principally movement of soil stockpiles) have seen an increase in occasional but significant episodes of local dust generation impacting on the monitoring site. Elevated dust concentrations due to these activities are not representative of general population exposure in Mackay as a whole. These localised dust-generating activities were the major contributor to exceedences of the PM_{10} 24-hour standard measured at the West Mackay site on 1 July, 2 July, 3 July, 18 August, 24 November, 26 November and 1 December 2008. Figures 17 to 20 show that on these days PM_{10} particle levels were elevated from approximately 6:00am to 4:00pm, which corresponds to the hours of work at nearby premises.

For the most part, corresponding Bsp measurements during these times tended to show much smaller variation, pointing to larger dust particles, rather than smaller smoke particles from agricultural burning, being the cause of these exceedences. An exception to this was on the evening of 1 July when both PM_{10} and Bsp levels rose sharply, indicating smoke from agricultural burning contributed to the PM_{10} exceedence on this day. At the time of the elevated Bsp readings, winds were blowing from the direction of agricultural areas in the Pioneer Valley.

Figure 17: Particle concentrations at the West Mackay site from 1 July to 3 July 2008.

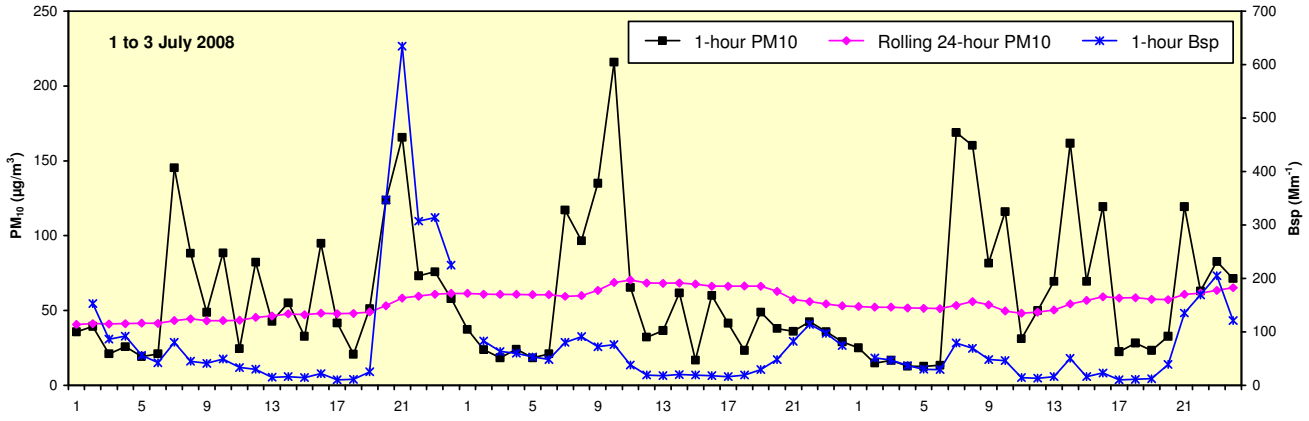


Figure 18: Particle concentrations at the West Mackay site on 18 August 2008.

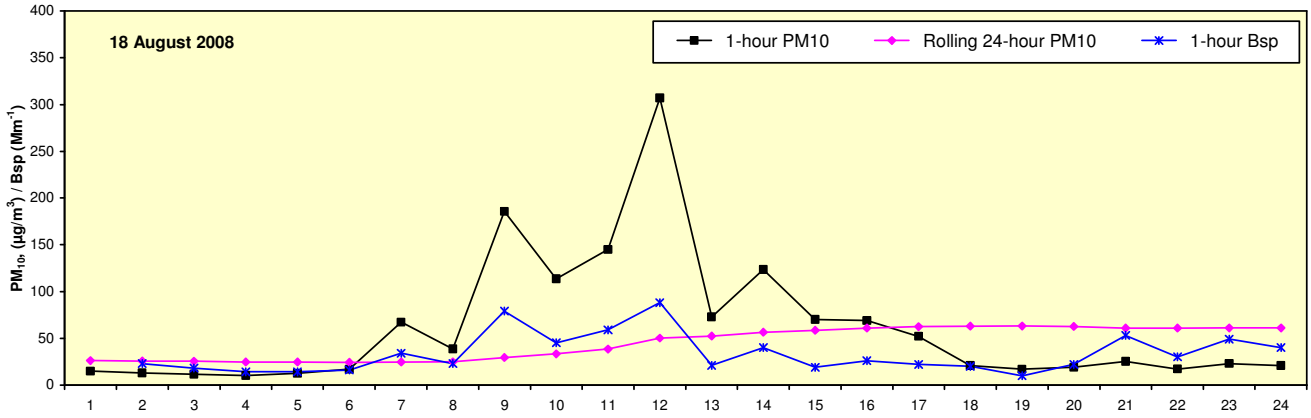


Figure 19: Particle concentrations at the West Mackay site from 24 November to 26 November 2008.

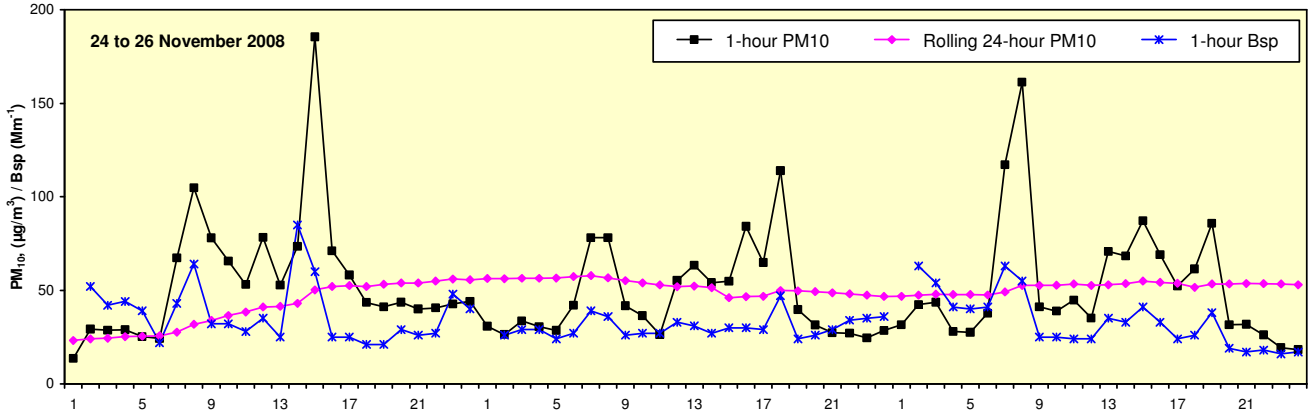


Figure 20: Particle concentrations at the West Mackay site on 1 December 2008.