



Appendix 6

EPA Ambient Air Quality Report for Whyalla

Retention Lease Proposal

On

Mineral Claim 4280

for a

Uranium In-situ Recovery Field Trial

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(a wholly owned subsidiary of UraniumSA Limited)

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5 August 2011

Ambient air quality monitoring at Whyalla South Australia



Monitoring campaign 2004–06

**Ambient air quality at Whyalla
South Australia**

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Ambient air monitoring at Whyalla, South Australia Monitoring campaign 2004–06

Air and Noise Branch, Principal Author: Kelly Rivett

Acknowledgments:

This report has been drafted by Kelly Rivett and utilises data collected by the Air and Noise Branch of the South Australian Environment Protection Authority. The staff involved in the monitoring program and in the assistance of drafting and reviewing this report were John Agar, Konrad Banasiak, Daniel Bellifemine, Paul Compton, Peter Dolan, Gavin Dougherty, Shiloh Gerrity, Jessica Gilding, Chris Harris, Matthew Hartley, Rob Mitchell, Chris Powell and Kelvyn Steer.

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ISBN 978-1-921125-50-8

July 2007

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GLOSSARY

Air NEPM	National Environment Protection (Ambient Air Quality) Measure
Annual Maximum	The largest value measured for a calendar year
Annual Mean	The average value measured for a calendar year
Annual Minimum	The smallest value measured for a calendar year
EPA	South Australian Environment Protection Authority
ND	Not Demonstrated
NEPC	National Environment Protection Council
HVS	High volume sampling
NO ₂	Nitrogen dioxide
O ₃	Ozone
PM ₁₀	Particulate matter with an equivalent aerodynamic diameter of 10 micrometres or less
ppm	Parts per million by volume
PRC	Peer Review Committee
SO ₂	Sulfur dioxide
TEOM	Tapered element oscillating microbalance
TSP	Total suspended particles
µg/m ³	Micrograms per cubic metre
90 th Percentile	The percentile is a value on a scale of 100 that indicates the percentage of the data points that are equal or lesser in value. Therefore, 90% of the data points are equal to, or less than, the 90 th percentile
95 th Percentile	The percentile is a value on a scale of 100 that indicates the percentage of the data points that are equal or lesser in value. Therefore, 95% of the data points are equal to, or less than, the 95 th percentile
99 th Percentile	The percentile is a value on a scale of 100 that indicates the percentage of the data points that are equal or lesser in value. Therefore, 99% of the data points are equal to, or less than, the 99 th percentile
2 nd Highest Value	The second highest value measured for a calendar year
6 th Highest Value	The sixth highest value measured for a calendar year

SUMMARY

The South Australian Environment Protection Authority (EPA) conducted an ambient air quality monitoring campaign in the city of Whyalla between January 2004 and June 2006.

The criteria pollutants, ozone (O₃), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂), were monitored at the Nicolson Avenue site, located within the grounds of Nicolson Avenue Primary School. Particle monitoring, for particulate matter with an equivalent aerodynamic diameter of 10 micrometres or less (PM₁₀), was also conducted using high volume sampling (HVS) method at the Civic Park site.

While this monitoring program was conducted as part of the EPA Monitoring Plan, monitoring in Whyalla for particulate matter has been conducted on a regular basis for many years at various sites utilising high volume samplers (HVS). The frequency of particle concentrations exceeding the National Environment Protection (Ambient Air Quality) Measure or Air NEPM for particles less than 10 micrometres (PM₁₀) in the eastern part of the town has been of concern for some time.

The particles are not only of a displeasing aesthetic nature but in high concentrations, particulate matter of this size has been found to have a negative impact on human health.

All valid data collected was compared to the relevant standard outlined in the Air NEPM (NEPC 1998). As the campaign was conducted to determine whether continued monitoring of these criteria pollutants was required, the data was also compared to 'screening acceptance limits' as outlined by the Peer Review Committee (PRC 2001a). A summary of the results from the monitoring campaign is outlined in Table 1.

Table 1 Summary of campaign monitoring results in Whyalla

Pollutant	Averaging period	Number of exceedances of Air NEPM standard			Air NEPM goal met?			Screening Acceptance Limit met?
		2004	2005	2006	2004	2005	2006	
Ozone	1-hour	0	0	0	ND	Yes	ND	Yes
	4-hour rolling	0	0	0	ND	Yes	ND	Yes
Nitrogen dioxide	1-hour	0	0	0	ND	ND	ND	Yes
Sulfur dioxide	1-hour	0	0	0	ND	Yes	ND	Yes
	24-hour	0	0	0	ND	Yes	ND	Yes
Particulate matter, PM ₁₀	24-hour	0	1	1*	ND	ND	ND*	No

ND—Not demonstrated (not enough data); Yes—Goal or screening acceptance limit met; No—Goal or screening acceptance limit not met

* PM₁₀ data up to and including 6 June 2006. Number of exceedances and whether the goal is met is based only on this data.

The results obtained from the campaign monitoring for ozone, nitrogen dioxide and sulfur dioxide demonstrate that the screening acceptance limits were being met and therefore continued monitoring for these parameters is not required. Screening acceptance limits are somewhat lower than the NEPM standards (see Tables 3, 6, 8 and 11).

However, PM₁₀ levels exceeded both the Air NEPM standard and the screening acceptance limit, indicating that continued monitoring for PM₁₀ would be required. This will be achieved through continuous monitoring at the Walls Street and Schultz Park sites using TEOM.

INTRODUCTION

Between January 2004 and June 2006, the South Australian Environment Protection Authority (EPA) conducted an ambient air quality monitoring campaign in Whyalla.

Whyalla is located on the northwest shore of the upper Spencer Gulf, approximately 396 km northwest of Adelaide (Whyalla 2004) and has a population of approximately 22,000 (ABS 2004). The major industry in the area is the local steelworks, which produces approximately 1.2 million tonnes of raw steel per year (OneSteel 2005).

The criteria pollutants, ozone (O₃), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂), were continuously monitored at the Nicolson Avenue site, located within the grounds of Nicolson Avenue Primary School. Particle monitoring, for particulate matter with an equivalent aerodynamic diameter of 10 micrometres or less (PM₁₀), was also conducted using high volume sampling (HVS) method at the Civic Park site.

Additional particle monitoring for both total suspended particulates (TSP) and PM₁₀ was undertaken at the Walls Street, Civic Park and Hummock Hill sites using either HVS or tapered element oscillating microbalance (TEOM) methods. Meteorological parameters, wind speed and direction, ambient temperature and pressure, were also measured during this time, although they are not discussed in detail in this report. The location of these sites and the duration of monitoring are highlighted in Figure 1 and Table 2.

Table 2 Summary of monitoring conducted in Whyalla

Site	Parameter	Duration of monitoring		
		Date commenced	Date concluded	Number of days
Nicolson Avenue	O ₃	08/01/2004	06/06/2006	881
	NO ₂	08/01/2004	06/06/2006	881
	SO ₂	30/03/2004	06/06/2006	799
Civic Park	PM ₁₀ (HVS)	30/06/2001	Ongoing*	Ongoing
	TSP (HVS)	05/03/1989	31/03/2006	6236
Hummock Hill	PM ₁₀ (HVS)	05/03/1989	27/09/2006*	6416
	TSP (HVS)	05/03/1989	31/03/2006	6236
Walls Street	PM ₁₀ (TEOM)	25/07/2003	Ongoing*	Ongoing

* Only data up to the 6 June has been included in this report for these sites.

Monitoring was conducted as part of the National Environment Protection (Ambient Air Quality) Measure or Air NEPM and the EPA Ambient Air Quality Plan for South Australia (EPA 2001).

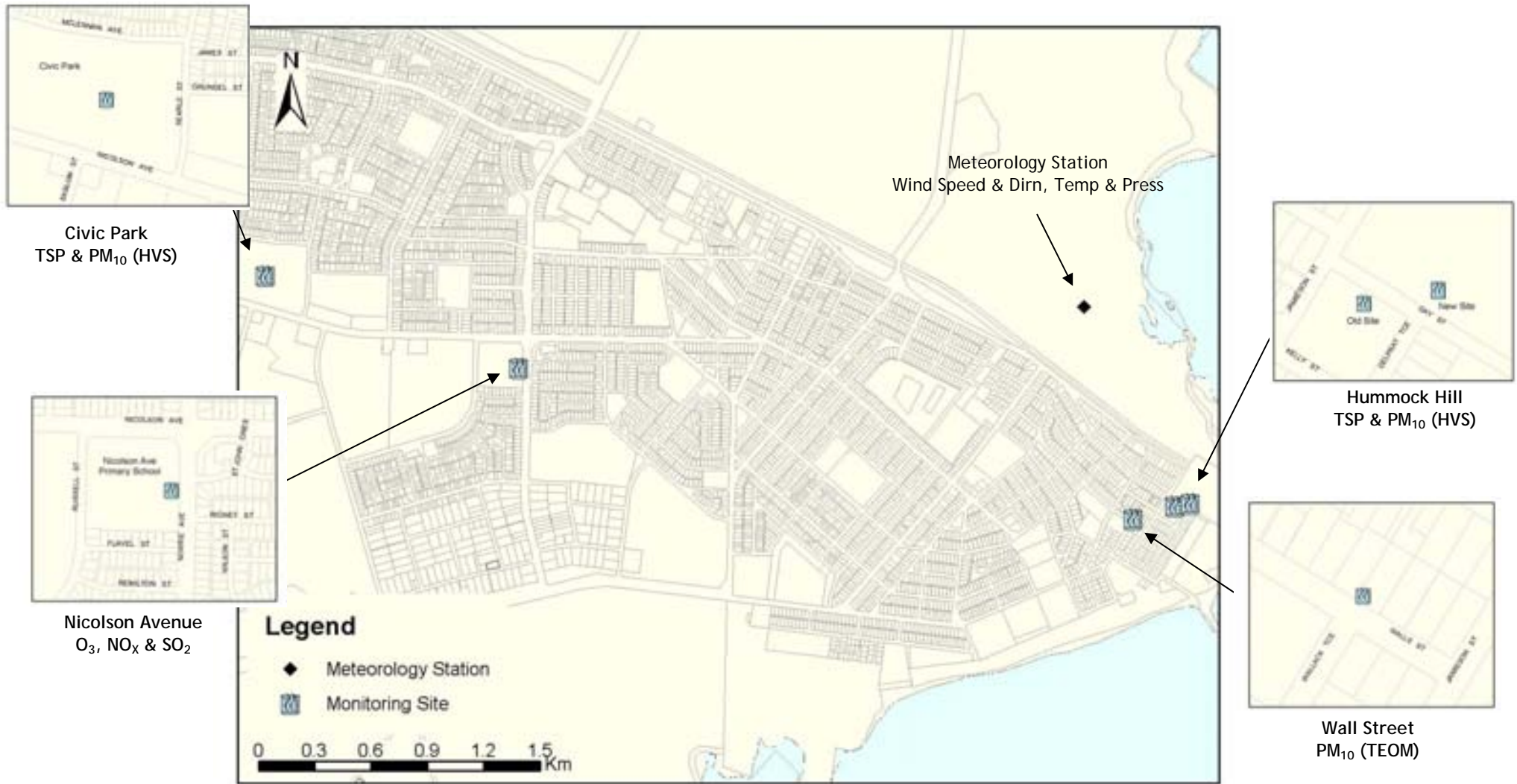


Figure 1 map of whyalla highlighting the location of air pollutant and meteorology monitoring sites

CLIMATE AND GEOGRAPHY

The city of Whyalla is located on locally undulating terrain (Appendix 1, Figures 9 and 10) along the upper western shore of Spencer Gulf and is known as the place 'where the outback meets the sea' (Whyalla 2004). Due to its location, Whyalla has a temperate climate (BOM 2006b) and is classified as being in a grassland region (BOM 2006c).

The Bureau of Meteorology (BOM) conducted monitoring at a site in Whyalla Norrie between 1906 and 2001. This data is summarised as temperature and wind speed trend graphs [Appendix 1, Figures 11 and 12] (BOM 2006a). The monthly mean daily maximum ranges from 29.2°C in January to 16.9°C in July, and the monthly mean daily minimum ranges from 18.8°C in February to 7.2°C in July. The average annual rainfall as monitored at this site is 277.6 mm (BOM 2006a).

The prevailing wind direction in Whyalla as measured by the EPA meteorology station is southerly (Figure 2). This wind pattern dominates for most of the year, except during the winter months when the prevailing wind is northerly (Appendix 1, Figures 13 and 14)

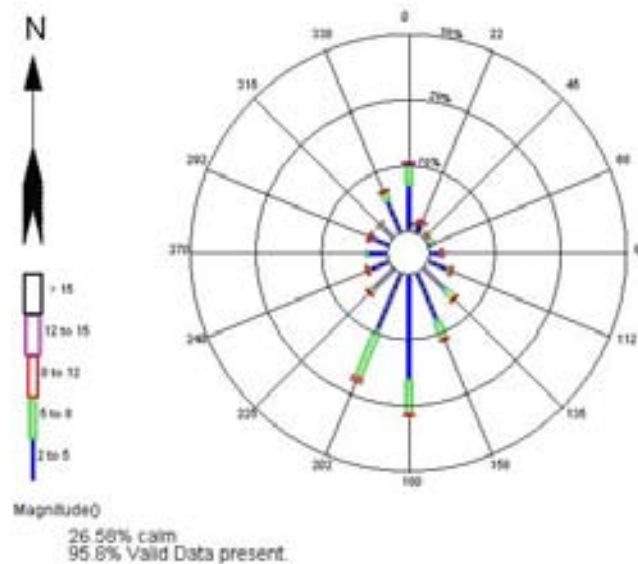


Figure 2 Wind rose of data from January 2004 to January 2005 from the EPA meteorology station in Whyalla

AIR QUALITY STANDARDS, GOALS AND SCREENING PROCEDURES

South Australia has adopted the Air NEPM as state policy under the *Environment Protection Act 1993*, Section 29. The Air NEPM established national environment protection standards and goals for six criteria pollutants (carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead and particulate matter as PM₁₀) against which the data is compared. The Air NEPM sets standards and goals at levels that protect human health and wellbeing, aesthetic enjoyment and local amenity (NEPC 1998).

The standards are set as concentrations in ppm or, for particulate matter, as micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) against which air quality can be assessed. The goals in the Air NEPM specify a maximum permissible number of days per year when the standards can be exceeded and a timeframe of 10 years (1998–2008) within which these goals must be met (NEPC 1998). The Air NEPM was also varied in 2003 to include advisory reporting standards for PM_{2.5}.

The data resulting from this monitoring program was also compared to the acceptance limits specified in *Technical Paper No. 4 Screening Procedures*, published by the Peer Review Committee of the National Environment Protection Council (PRC 2001a). The acceptance limits set by the screening procedures are transparent criteria that can be used to demonstrate that pollutant levels can reasonably be expected to be consistently lower than the Air NEPM standards, and that continued air quality monitoring need not take place (PRC 2001a).

'The screening procedures note that, to maintain a conservative approach, except for particulate matter as PM₁₀, the maximum predicted or measured concentration should be used for comparison with the acceptance limit.' (PRC 2001a)

'For pollutants which have standards for more than one averaging period, the acceptance limit to be used is that of the standard which is most difficult to meet in any given region: in the majority of cases, this is expected to involve the shortest averaging period. For particulate matter as PM₁₀, the screening procedures note that screening in centres subject to wood fires or prescribed burning smoke is not easy.' (PRC 2001a)

The acceptance limits specified in the screening procedures are intended to 'apply to the fifth highest daily reading, where the higher readings can be shown to be due to bushfires or controlled burning.' (PRC 2001a)

The PRC has also published requirements for data collection and handling. 'To demonstrate annual compliance, in addition to a 75% annual data availability requirement, at least 75% data per calendar quarter is required to cover the possible seasonal effects in pollutant behaviour. Years with less than 75% data availability can still demonstrate non-compliance' if the number of days when the standard is exceeded is greater than the goal set by the Air NEPM (PRC 2001b).

In 2004 and 2006 the monitoring did not cover a full calendar year for ozone, nitrogen and sulfur dioxide, so did not meet the PRC requirements for compliance reporting. Ozone and sulfur dioxide were monitored for a full calendar year in 2005 and the quarterly data recovery rates met the 75% requirement specified by the PRC. For nitrogen dioxide, while monitoring was conducted for a full calendar year in 2005, the quarterly data recovery rate was less than 75% in the first and fourth quarters and hence did not meet the PRC requirements for compliance reporting.

Particulate matter as PM₁₀ was monitored at Civic Park using high volume samplers at a sampling rate of one sample every three days. Due to this sampling pattern, the quarterly data recovery rates did not meet the 75% requirement for daily PM₁₀ data specified by the PRC for continuous compliance monitoring. However, for the stated sampling rate and monitoring campaign period, the data returns were 84%, 82% and 98% for 2004, 2005 and 2006 respectively.

OZONE

Summary of ozone monitoring at Whyalla

Ambient air quality monitoring of ozone commenced on the 8 January 2004 at the Nicolson Avenue site and was conducted according to NEPM requirements and the relevant Australian Standard (Appendix 1). Monitoring for ozone ceased on the 6 June 2006. During this time, the Air NEPM standard and the screening acceptance limit were not exceeded for the 1-hour average or the 4-hour rolling average.

Health details

'Exposure to ozone has been associated with increases in daily mortality, increases in hospital admissions and emergency room visits (respiratory and cardiovascular disease), decreases in lung function, increases in symptoms of respiratory illness such as cough, phlegm and wheeze, and increases in bronchodilator usage. These effects are observed in sensitive sub-populations although effects on lung function have been observed in healthy normal population.' (NEPC 2000)

Standards and results

All the valid ozone data collected during the monitoring campaign was compared to the 1-hour average and 4-hour rolling average standards in the Air NEPM and the screening acceptance limits outlined by the PRC as described in Table 3.

Table 3 Air NEPM standards and screening acceptance limits for ozone

Averaging period	Air NEPM Standard (ppm)	Screening Acceptance Limit (for 2 to 4 years of monitoring) (ppm)
1-hour	0.10	0.07
4-hour rolling	0.08	0.06

During the monitoring period neither the Air NEPM standards nor the screening acceptance limits were exceeded. Graphical and statistical data for this time are summarised in Table 4 and Figure 3 for 1-hour averaged, and Table 5 and Figure 4 for 4-hour rolling averaged ozone data.

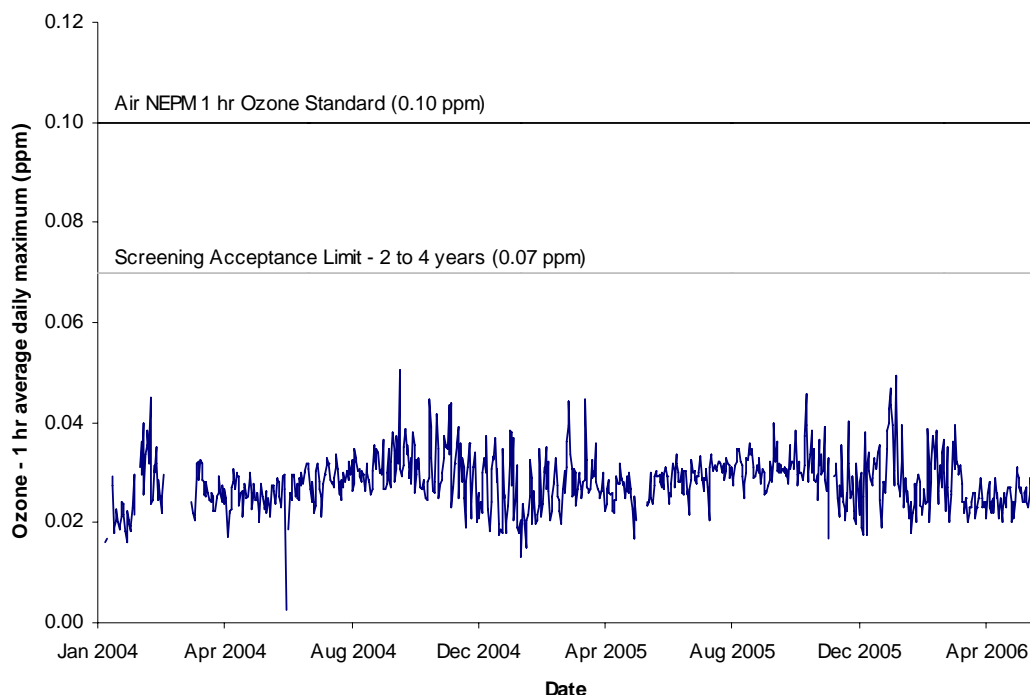


Figure 3 Ozone 1-hour averaged concentrations at Nicolson Avenue for 2004–06

Table 4 Statistics related to the ozone 1-hour averaged concentrations at Nicolson Avenue for 2004–06

Year	Annual Average (ppm)	Annual Maximum (ppm)	2 nd Highest Value (ppm)	Percentiles* (ppm)		
				99 th	95 th	90 th
2004	0.021	0.051	0.045	0.044	0.037	0.035
2005	0.021	0.046	0.045	0.040	0.036	0.034
2006	0.019	0.049	0.047	0.046	0.040	0.036

Year	Annual Data Recovery (%)	Monitoring Period Data Recovery (%) [†]	Air NEPM exceedances	Air NEPM met?	Screening Acceptance Limit met?
2004	85	86	0	ND	Yes
2005	94	94	0	Yes	Yes
2006 [‡]	42	97	0	ND	Yes

ND—not demonstrated (not enough data).

* Percentiles were calculated using 1-hour daily maxima, as outlined in National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 8, Annual Reports, October 2002.

[†] Monitoring conducted between the 8 January 2004 and 6 June 2006.

[‡] Only data up to the 6 June 2006 has been included in this report for this site.

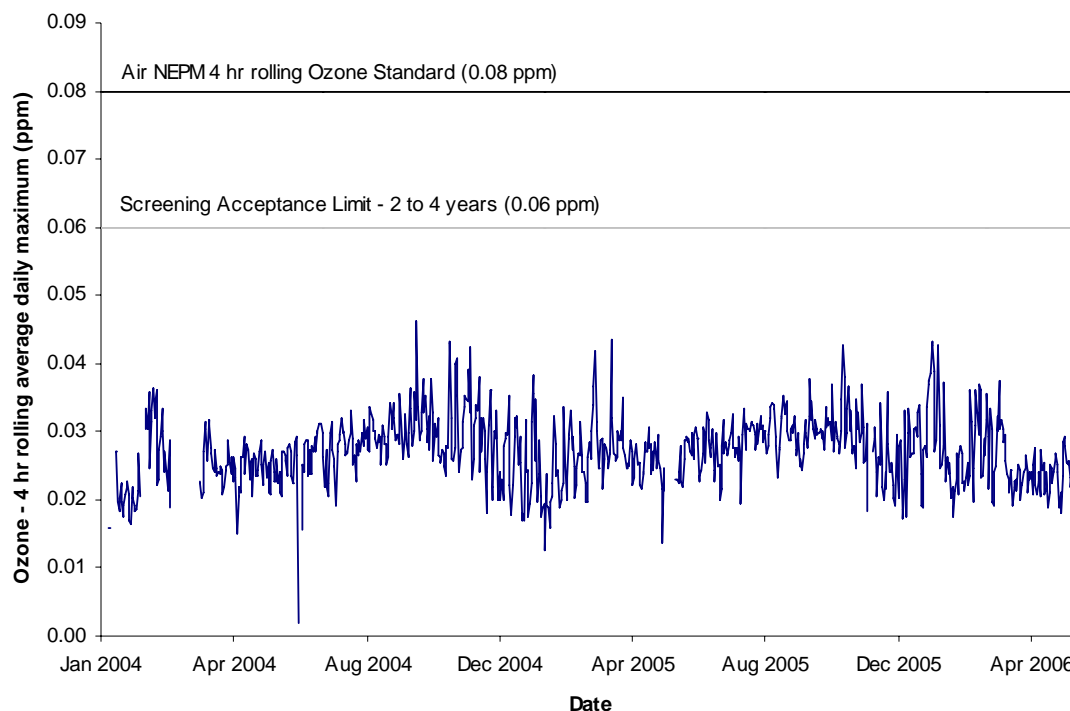


Figure 4 Ozone 4-hour rolling averaged concentrations at Nicolson Avenue for 2004–06

Table 5 Statistics related to the ozone 4-hour rolling averaged concentrations at Nicolson Avenue for 2004–06

Year	Annual Average (ppm)	Annual Maximum (ppm)	2 nd Highest Value (ppm)	Percentiles* (ppm)		
				99 th	95 th	90 th
2004	0.020	0.046	0.043	0.042	0.036	0.033
2005	0.021	0.044	0.043	0.038	0.035	0.033
2006	0.019	0.043	0.042	0.043	0.037	0.034

Year	Annual Data Recovery (%)	Monitoring Period Data Recovery (%) [†]	Air NEPM exceedances	Air NEPM met?	Screening Acceptance Limit met?
2004	87	88	0	ND	Yes
2005	96	96	0	Yes	Yes
2006 [‡]	42	99	0	ND	Yes

ND—Not demonstrated (not enough data).

* Percentiles were calculated using daily maxima for the 4-hour rolling average, as outlined in National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 8, Annual Reports, October 2002.

[†] Monitoring conducted between the 8 January 2004 and the 6 June 2006.

[‡] Only data up to the 6 June 2006 has been included in this report for this site.

NITROGEN DIOXIDE

Summary of nitrogen dioxide monitoring at Whyalla

Ambient air quality monitoring of nitrogen dioxide commenced on 8 January 2004 at the Nicolson Avenue site and was conducted according to NEPM requirements and the relevant Australian Standard (Appendix 1). Monitoring of nitrogen dioxide ceased on 6 June 2006. During this time, the Air NEPM standard and the screening acceptance limit were not exceeded for the 1-hour average.

Health details

'Exposure to NO₂ has been associated with increases in daily mortality, hospital admissions and emergency room attendances for cardiovascular and respiratory disease, increases in respiratory illness and symptoms and decreases in lung function. The elderly, asthmatics, children and people with existing disease are particularly susceptible to the effects of NO₂.' (NEPC 2000)

Standards and results

All the valid nitrogen dioxide data collected during the monitoring campaign was compared to the 1-hour and annual average standards in the Air NEPM and the screening acceptance limits outlined by the PRC as described in Table 6.

Table 6 Air NEPM standards and screening acceptance limits for nitrogen dioxide

Averaging period	Air NEPM Standard (ppm)	Screening Acceptance Limit (for 2 or more years of monitoring) (ppm)
1-hour	0.12	0.07
1-year	0.03	0.02

During the monitoring period neither the Air NEPM standards nor the screening acceptance limits were exceeded. While the required NEPM data recovery rate for nitrogen dioxide was not met during the campaign, the data collected was well below the screening acceptance limit. Graphical and statistical data for this time are summarised in Table 7 and Figure 5.

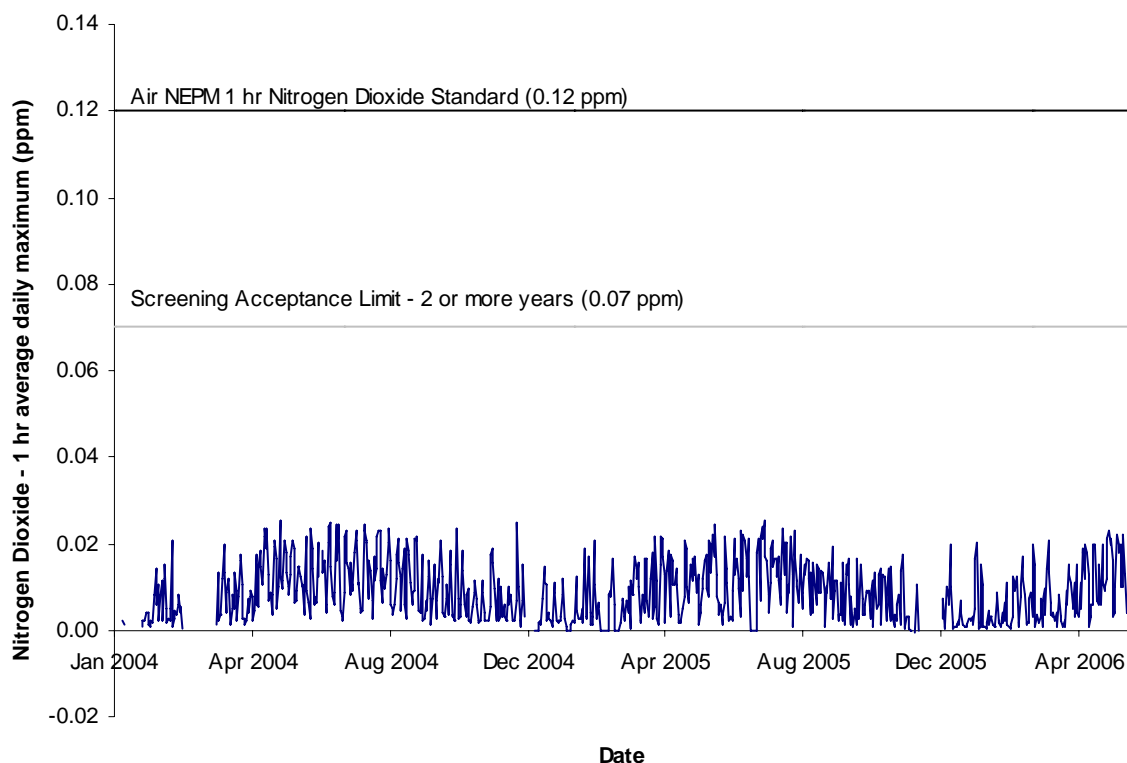


Figure 5 Nitrogen dioxide 1-hour averaged concentrations at Nicolson Avenue for 2004–06

Table 7 Statistics related to the nitrogen dioxide 1-hour averaged concentrations at Nicolson Avenue for 2004–06

Year	Annual Average (ppm)	Annual Maximum (ppm)	2 nd Highest Value (ppm)	Percentiles* (ppm)		
				99 th	95 th	90 th
2004	0.004	0.025	0.024	0.024	0.023	0.021
2005	0.003	0.025	0.024	0.023	0.021	0.018
2006	0.002	0.023	0.022	0.022	0.020	0.019

Year	Annual Data Recovery (%)	Monitoring Period Data Recovery (%) [†]	Air NEPM exceedances	Air NEPM met?	Screening Acceptance Limit met?
2004	79	81	0	ND	Yes
2005	80	80	0	ND	Yes
2006 [‡]	41	97	0	ND	Yes

ND—Not demonstrated (not enough data).

* Percentiles were calculated using 1-hour daily, as outlined in National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 8, Annual Reports, October 2002.

[†] Monitoring conducted between the 30 March 2004 and 6 June 2006.

[‡] Only data up to the 6 June 2006 has been included in this report for this site.

SULFUR DIOXIDE

Summary of sulfur dioxide monitoring at Whyalla

Ambient air quality monitoring of sulfur dioxide commenced on 30 March 2004 at the Nicolson Ave site and was conducted according to Air NEPM requirements and the relevant Australian Standard (Appendix 1). Monitoring for sulfur dioxide ceased on 6 June 2006. During this time, the 1-hour, 24-hour and annual averages did not exceed the Air NEPM standards and the screening acceptance limits were not exceeded.

Health details

'Ambient levels of SO₂ have been associated with increases in daily mortality, hospital admissions and emergency room attendances for respiratory and cardiovascular disease and respiratory symptoms and decreases in lung function. These associations have been observed in epidemiological studies in various parts of the world. Due to the high correlation between ambient SO₂ levels and other pollutants, especially particles, it is difficult in this type of study to confidently attribute the observed effects to SO₂ alone. Experimental evidence demonstrates that brief exposures to high levels of SO₂ can cause transient bronchoconstriction and symptoms on some patients with asthma who exercise during the exposure.' (NEPC 2000)

Standards and results

All the valid sulfur dioxide data collected during the monitoring campaign was compared to the 1-hour, 24-hour and annual averages outlined in the Air NEPM and the screening acceptance limits outlined by the PRC as described in Table 8.

Table 8 Air NEPM standards and screening acceptance limits for sulfur dioxide

Averaging period	Air NEPM Standard (ppm)	Screening Acceptance Limit (for 2 or more years of monitoring) (ppm)
1-hour	0.20	0.12
24-hour	0.08	0.05
1-year	0.02	0.01

During the monitoring period neither the Air NEPM standards nor the screening acceptance limits were exceeded. Graphical and statistical data for this time are summarised in Table 9 and Figure 6 for 1-hour averaged and Table 10 and Figure 7 for 24-hour averaged sulfur dioxide data.

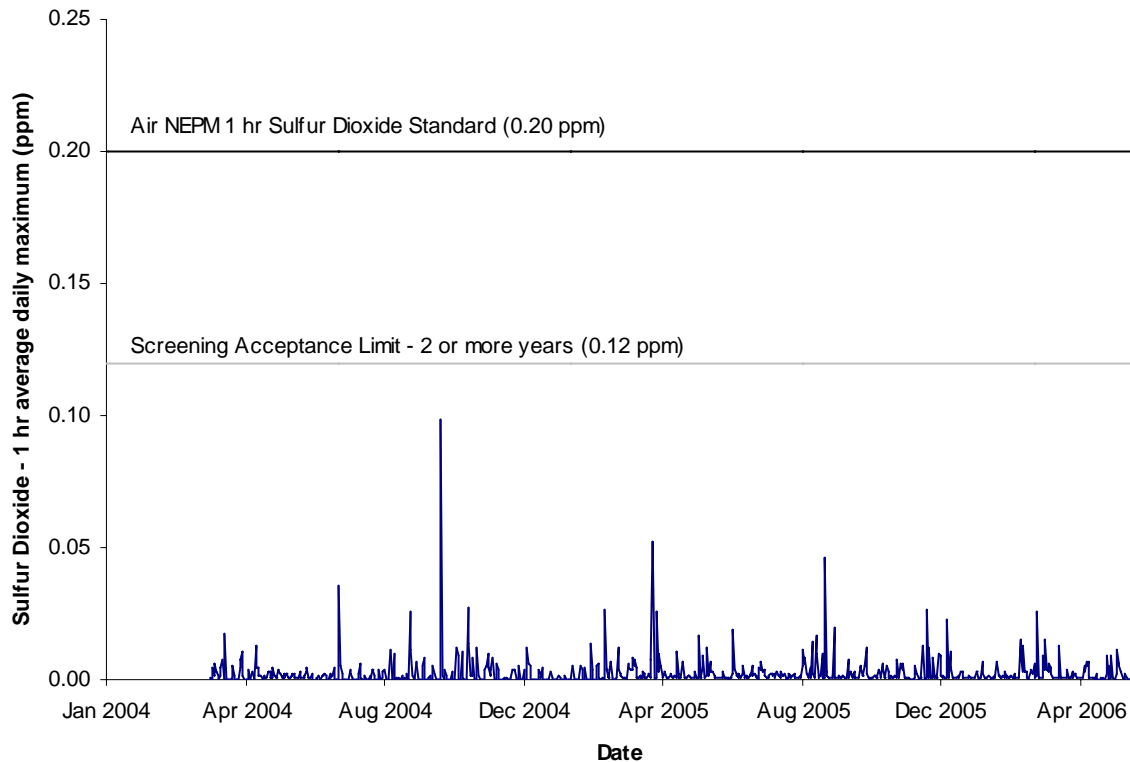


Figure 6 Sulfur dioxide 1-hour averaged concentrations at Nicolson Avenue for 2004–06

Table 9 Statistics related to the sulfur dioxide 1-hour averaged concentrations at Nicolson Avenue for 2004–06

Year	Annual Average (ppm)	Annual Maximum (ppm)	2 nd Highest Value (ppm)	Percentiles* (ppm)		
				99 th	95 th	90 th
2004	0.000	0.099	0.036	0.026	0.010	0.006
2005	0.001	0.052	0.046	0.026	0.011	0.007
2006	0.001	0.026	0.015	0.015	0.009	0.006

Year	Annual Data Recovery (%)	Monitoring Period Data Recovery (%) [†]	Air NEPM exceedances	Air NEPM met?	Screening Acceptance Limit met?
2004	71	94	0	ND	Yes
2005	95	95	0	Yes	Yes
2006 [‡]	41	96	0	ND	Yes

ND—Not demonstrated (not enough data)

* Percentiles were calculated using 1-hour daily maxima, as outlined in National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 8, Annual Reports, October 2002.

[†] Monitoring conducted between 30 March 2004 and 6 June 2006.

[‡] Only data up to the 6 June 2006 has been included in this report for this site.

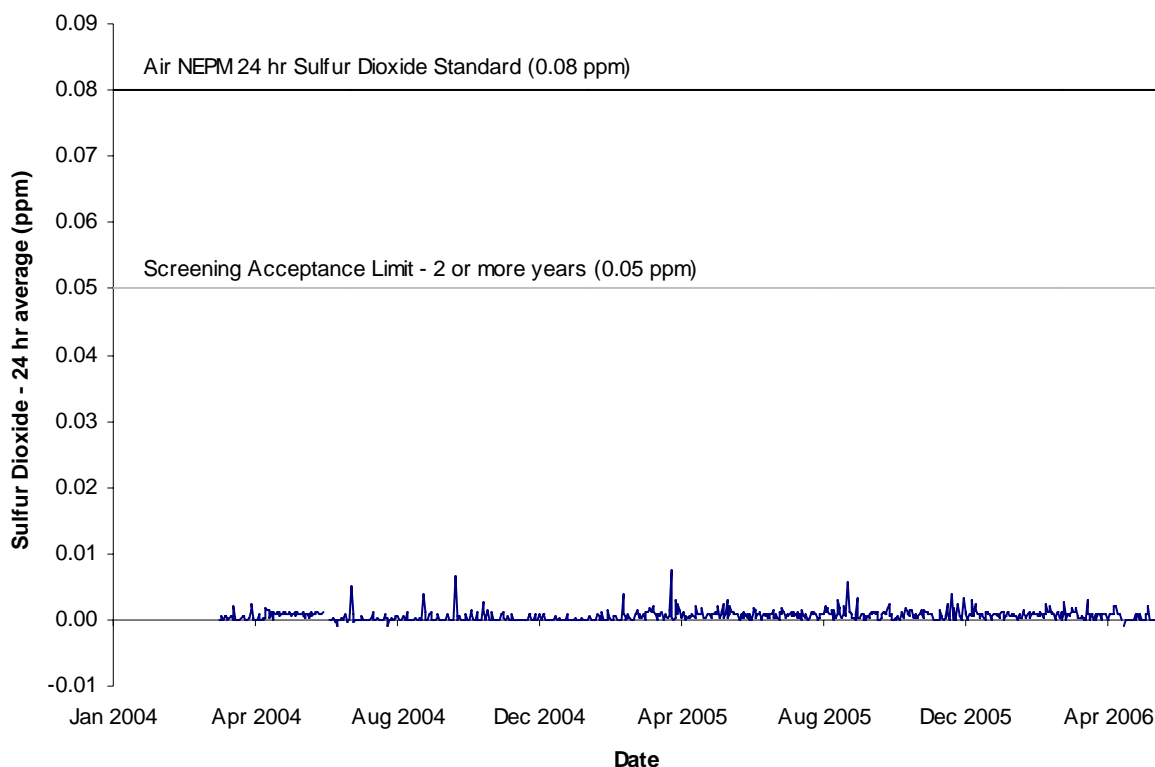


Figure 7 Sulfur dioxide 24-hour averaged concentrations at Nicolson Avenue for 2004–06

Table 10 Statistics related to the sulfur dioxide 24-hour averaged concentrations at Nicolson Avenue for 2004–06

Year	Annual Average (ppm)	Annual Maximum (ppm)	2 nd Highest Value (ppm)	Percentiles (ppm)		
				99 th	95 th	90 th
2004	0.000	0.007	0.005	0.003	0.001	0.001
2005	0.001	0.007	0.006	0.004	0.002	0.002
2006	0.001	0.003	0.002	0.002	0.002	0.001

Year	Annual Data Recovery (%)	Monitoring Period Data Recovery (%) [*]	Air NEPM exceedances	Air NEPM met?	Screening Acceptance Limit met?
2004	74	98	0	ND	Yes
2005	98	98	0	Yes	Yes
2006 [†]	42	97	0	ND	Yes

ND—Not demonstrated (not enough data).

^{*} Monitoring conducted between 30 March 2004 and 6 June 2006.

[†] Only data up to the 6 June 2006 has been included in this report for this site.

PARTICULATE MATTER

Monitoring has been conducted at various locations across Whyalla for many years, with sites currently operating at Hummock Hill, Civic Park and Walls Street. The monitoring conducted at Civic Park has been incorporated into this campaign to meet the Air NEPM requirements for PM₁₀ particle monitoring.

Data from the other particulate monitoring sites across Whyalla has been included in Appendix 3 to help provide a more complete picture of the situation.

Health details

'Epidemiological studies show a correlation between exposure to particles and adverse health effects. At this time there is no conclusive evidence regarding the role of particle size in the response. Different sizes may be important for different health outcomes: for example, PM_{2.5} for mortality and PM₁₀ for asthma. The evidence of chronic health effects arising from long-term exposure to particles is not clear. The studies showing an effect are currently under review in the US.

At this time the results of toxicological studies are indicating that crustal particles can be as damaging as combustion particles for a given size range. There is not clear evidence of a role for particle composition. The biological mechanisms giving rise to the effects observed in epidemiological studies are still unclear, although some information is emerging regarding a possible mechanism for cardiovascular effects.

There is no evidence, based on epidemiological data, that there is a threshold concentration of either PM₁₀ or PM_{2.5} below which adverse health effects will not be observed. The differences observed in the results from the studies conducted in different parts of the world suggest that the dose response relationships determined within a particular country or region may not be readily transferable to other areas.' (NEPC 2000)

Standards and results

All the valid PM₁₀ data collected during the monitoring period from Civic Park was compared to the 24-hour average standard in the Air NEPM and the screening acceptance limit outlined by the PRC as described in Table 11.

Table 11 Air NEPM standard and screening acceptance limit for PM₁₀

Averaging period	Air NEPM Standard ($\mu\text{g}/\text{m}^3$)	Screening Acceptance Limit (for 2 or more years of monitoring) ($\mu\text{g}/\text{m}^3$)
24-hour	50	30

During the monitoring period the Air NEPM standard was exceeded on two occasions, with the screening acceptance limit being exceeded on 13 occasions. The Air NEPM goal for PM₁₀, which allows for five exceedances of the standard to occur annually, was met for each year monitoring was conducted. Care is needed in interpretation of HVS data as it is not collected daily.

Graphical and statistical data for this time are summarised in Table 12 and Figure 8 for PM₁₀ at Civic Park. Additional graphical and statistical information are summarised in Appendix 3, Tables 13–16 and Figures 15–18 for PM₁₀ at Hummock Hill and Walls Street and also for TSP at Civic Park and Hummock Hill.

Particulate matter (PM₁₀) using high volume sampling

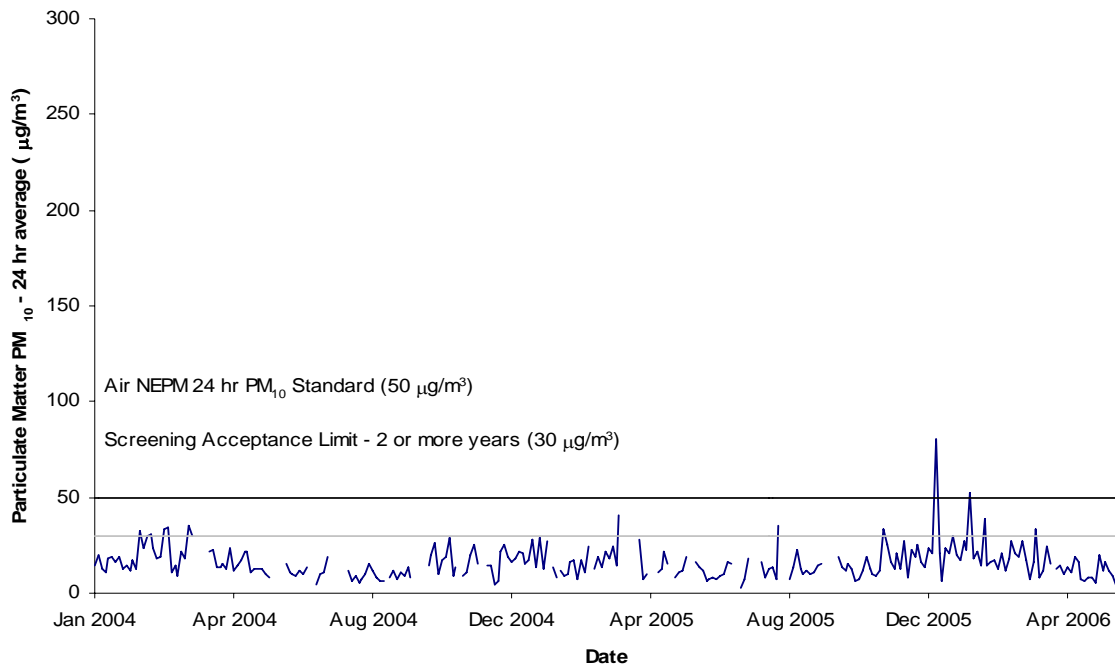


Figure 8 PM₁₀ 24-hour averaged concentrations at Civic Park for 2004–06 (Please note: The scale on Figure 8 has been set for ease of comparison to figures in the Appendix.)

Table 12 Statistics related to PM₁₀ 24-hour averaged concentrations at Civic Park for 2004–06

Year	Annual Average (µg/m ³)	Annual Maximum (µg/m ³)	Annual Minimum (µg/m ³)	6 th Highest Value (µg/m ³)	Percentiles (g/m ³)		
					99 th	95 th	90 th
2004	15.4	35.2	4.7	29.8	33.9	29.8	25.0
2005	16.2	80.6	2.9	28.6	41.1	28.9	25.7
2006*	16.9	52.1	3.4	26.9	45.4	31.7	26.9

Year	Number of samples	Air NEPM exceedances	Air NEPM met?	Screening Acceptance Limit met?
2004	103	0	ND	No
2005	100	1	ND	No
2006*	51	1	ND	No

ND—Not demonstrated (not enough data).

* Only data up to 6 June 2006 has been included in this report for this site.

DISCUSSION

Particles in Whyalla

As part of the EPA program maintenance, an internal review of the particulate monitoring program in Whyalla was conducted. The review was implemented following recommendations of an audit of the Whyalla particle monitoring program conducted in late 2005 by an external consultant. The recommendations from this audit were incorporated into the review.

The major recommendations from the review were:

- remove the TSP high volume samplers from both the Civic Park and Hummock Hill sites
- remove the PM₁₀ high volume sampler from the Hummock Hill site
- remove the PM₁₀ high volume sampler from the Civic Park site and replace it with a TEOM PM₁₀ particulate monitor at a nearby site in Schultz Park. Schultz Park is proposed as a replacement site as the current Civic Park site has become overgrown and no longer meets the siting requirements specified in *AS 2922-1987*
- remove the Automated Cartridge Collection Unit (ACCU) from the Walls Street site
- remove the meteorological monitoring equipment from within the OneSteel boundary and re-install it at the Walls Street site. This will allow the meteorology data to be directly relevant to other data collected at this site
- retain the PM₁₀ TEOM sampler at the Walls Street site
- retain the cameras at Hummock Hill.

All of the above recommendations from the review have been completed.

CONCLUSION

During the monitoring campaign conducted in Whyalla between 2004 and 2006, no exceedances of the Air NEPM standards and screening acceptance limits for ozone, nitrogen dioxide and sulfur dioxide were recorded. While the data collection threshold for nitrogen dioxide did not meet NEPM requirements, the data collected demonstrated that the concentrations were well below both the NEPM standard and the screening acceptance limit; therefore, in accordance with the PRC screening procedures (PRC 2001a), the EPA does not need to continue monitoring for these pollutants in Whyalla.

However, the Air NEPM standard for PM₁₀ at Civic Park was exceeded on two occasions while the screening acceptance limit was exceeded on 13 occasions during the monitoring campaign; therefore, continued PM₁₀ monitoring at this site, or at a similar site nearby, should be undertaken.

Particulate matter in Whyalla has been and will continue to be an area of concern for the EPA. The review of the particulate monitoring program and the subsequent changes made should allow for the continued collection and analysis of high quality particle data.

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APPENDIX 1 WHYALLA AIRSHED

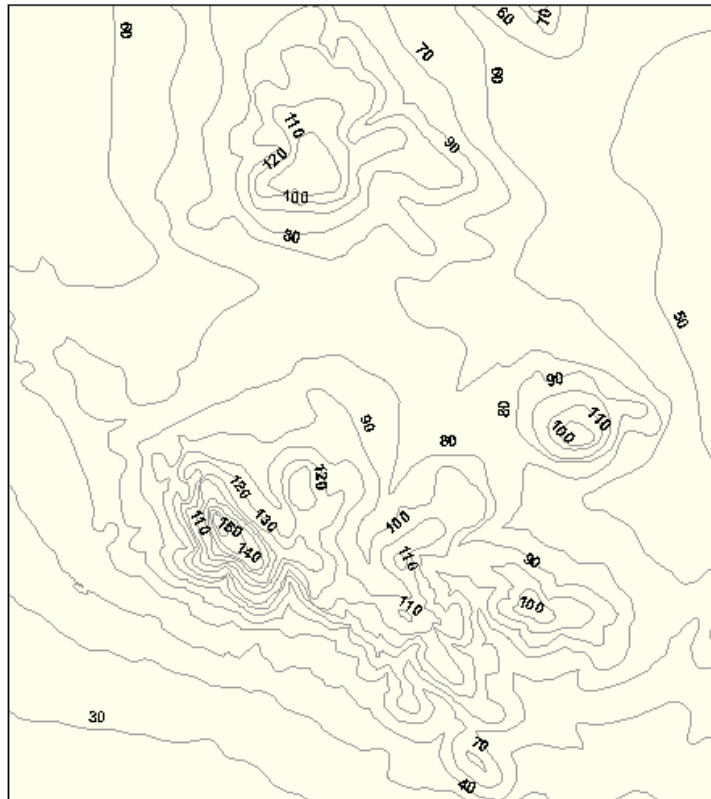


Figure 9 Expanded view of the complex topography within the Whyalla air shed

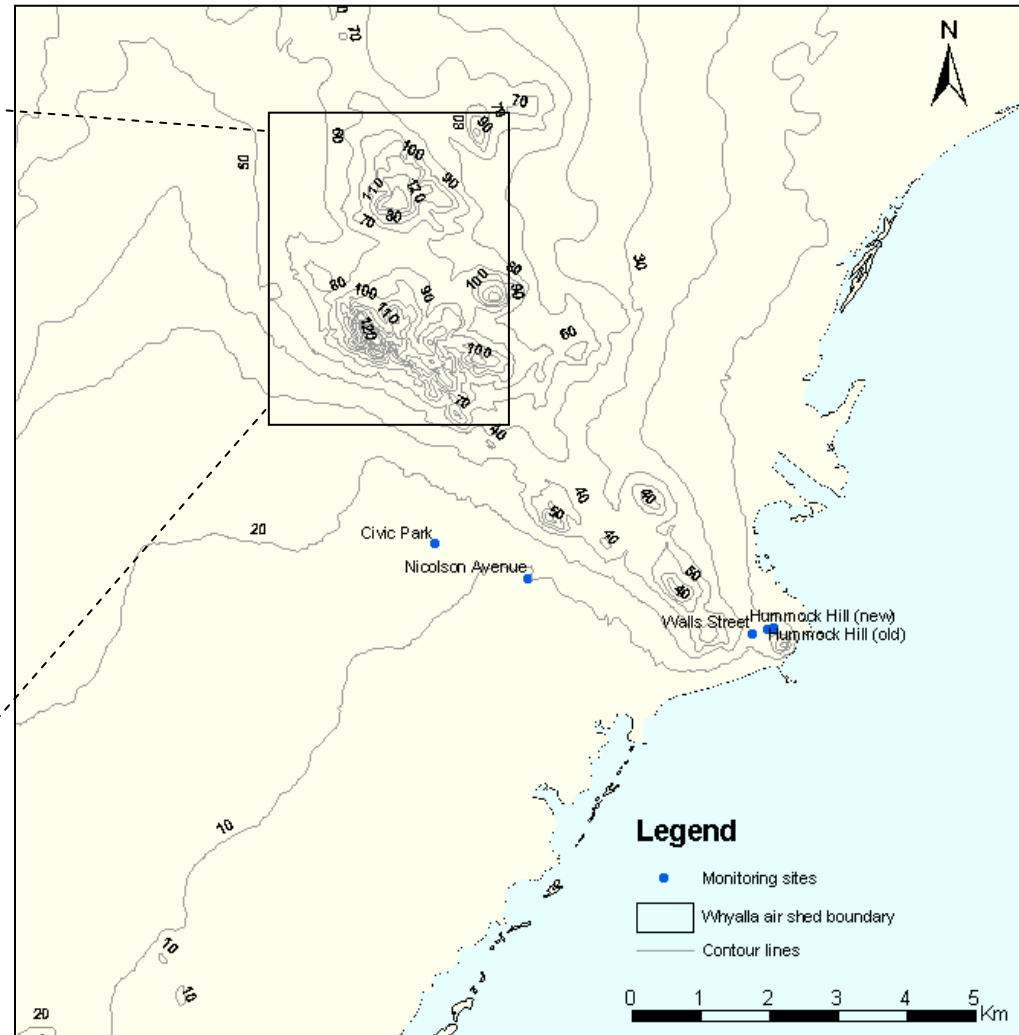


Figure 10 Topographic map of the Whyalla air shed

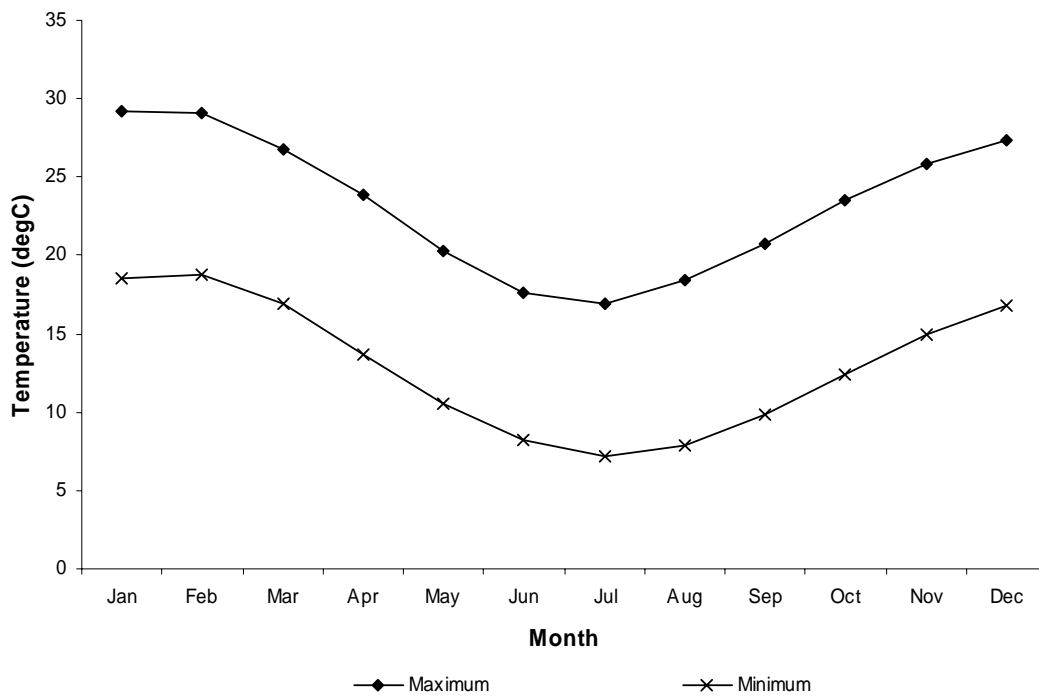


Figure 11 Monthly mean daily temperatures from the Bureau of Meteorology Whyalla Norrie site

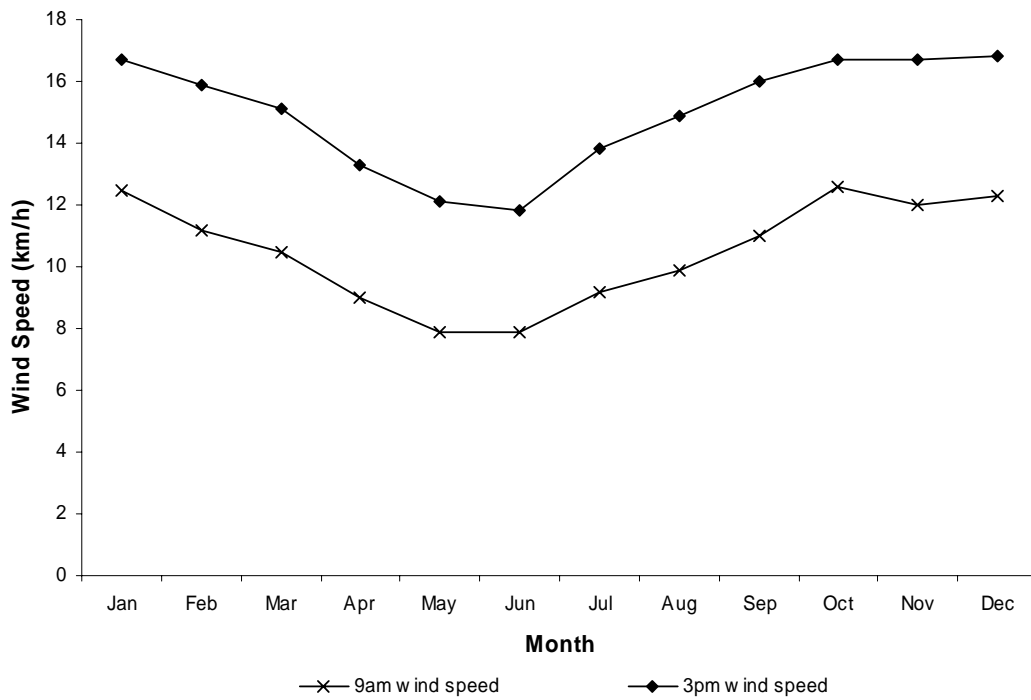


Figure 12 Monthly mean wind speeds, averaged at 9 am and 3 pm, from the Bureau of Meteorology Whyalla Norrie site

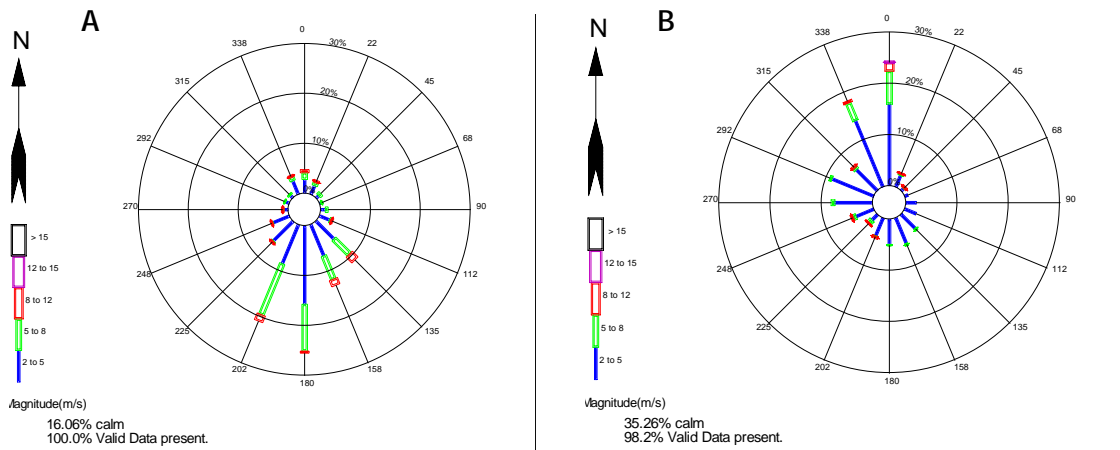


Figure 13 Wind rose for [A] autumn (March–May 2004) and [B] winter (June 2004–August 2004) at the EPA meteorology station in Whyalla

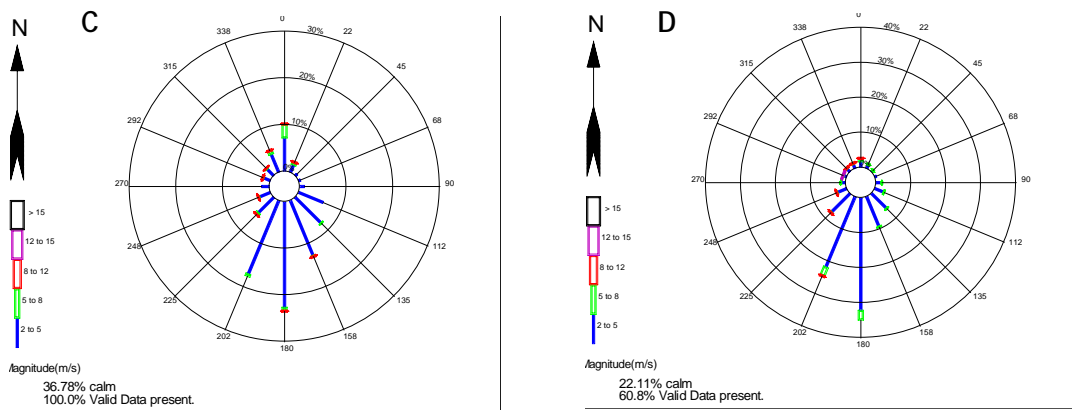


Figure 14 Wind rose for [C] spring (September–November 2004) and [D] summer (December 2004–February 2005) at the EPA meteorology station in Whyalla

APPENDIX 2 MONITORING INFORMATION

Monitoring site information

Site Name	Whyalla Nicolson Avene
Map coordinates	
Datum	MGA94
Projection	Zone 53
Easting	738230.1
Northing	6342537.9
Site elevation	~10m above sea level
Street address	Nicolson Avenue Primary School, Nicolson Avenue, Whyalla Norrie
Date site established	8 January 2004
Date site terminated	6 June 2006
List of exceptions to siting guidelines (AS 2922–1987)	Trees within 20 metres of site
Surrounding land use	Residential
Nearby emission sources	OneSteel Steelworks
Pollutants monitored	Ozone, nitrogen dioxide, sulfur dioxide, particles as PM ₁₀ (TEOM)

Site Name	Whyalla Civic Park
Map coordinates	
Datum	MGA94
Projection	Zone 53
Easting	736885.5
Northing	6343029.9
Site elevation	~15m above sea level
Street address	Civic Park, Searle Street, Whyalla Norrie
Date site established	5 March 1989
Date site terminated	Ongoing
List of exceptions to siting guidelines (AS 2922–1987)	Trees within 20 metres of site
Surrounding land use	Parklands and residential
Nearby emission sources	OneSteel Steelworks
Pollutants monitored	Particles as PM ₁₀ and TSP (HVS)

Australian Standards

Substance monitored	Australian Standard Method
Nitrogen dioxide	AS 3580.5.1–1993 <i>Methods for sampling and analysis of ambient Air–determination of oxides of nitrogen–chemiluminescence method</i>
Ozone	AS 3580.6.1–1990 <i>Methods for sampling and analysis of ambient Air–determination of ozone–direct reading instrumental method</i>
Sulfur dioxide	AS 3580.4.1–1990 <i>Methods for sampling and analysis of ambient Air–determination of sulfur dioxide–direct reading instrumental method</i>
Particulate matter, as PM ₁₀ , by TEOM	AS 3580.9.8–2001 <i>Methods for sampling and analysis of ambient Air–determination of suspended particulate matter, PM₁₀–continuous direct mass method using a tapered element oscillating microbalance analyser</i>
Particulate matter, as PM ₁₀ , by high volume sampling	AS 3580.9.6–2003 <i>Methods for sampling and analysis of ambient Air–determination of suspended particulate matter, PM₁₀–high volume sampler with size-specific inlet–gravimetric method</i>
Total suspended particles, by high volume sampling	AS 3580.9.3–2003 <i>Methods for sampling and analysis of ambient Air–determination of suspended particulate matter (TSP) –high volume sampler gravimetric method</i>

Sampling equipment information

Pollutant monitored	Nitrogen dioxide
Instrument type	Nitrogen oxides monitor
Make	Monitor Labs/Ecotech
Model	EC 9841B
Serial number	Various (as maintenance and calibration requirements need)
Minimum detection level	0.0001 ppm
Measuring units	ppm
Logging interval	10-minute average
Clock adjustment	Australian Central Standard Time (without daylight saving)

Pollutant monitored	Ozone
Instrument type	Ultraviolet photometric ozone analyser
Make	Thermo Electron Corporation
Model	49C
Serial number	Various (as maintenance and calibration requirements need)
Minimum detection level	0.001 ppm
Measuring units	ppm
Logging interval	10-minute average
Clock adjustment	Australian Central Standard Time (without daylight saving)

Pollutant monitored	Sulfur dioxide
Instrument type	Fluorescence monitor
Make	Monitor Labs/Ecotech
Model	ML9850B
Serial number	Various (as maintenance and calibration requirements need)
Minimum detection level	0.001 ppm
Measuring units	ppm
Logging interval	10-minute average
Clock adjustment	Australian Central Standard Time (without daylight saving)

Pollutant monitored	Particulate matter, as PM ₁₀
Instrument type	Tapered element oscillating microbalance (TEOM)
Make	Rupprecht & Patashnick Co. Inc.
Model	1400AB
Serial number	Various (as maintenance and calibration requirements need)
Minimum detection level	0.01 µg/m ³
Measuring units	µg/m ³
Logging interval	10-minute average
Clock adjustment	Australian Central Standard Time (without daylight saving)

Pollutant monitored	Particulate matter, as PM ₁₀
Instrument type	High volume sampler (HVS)
Make	Ecotech
Model	Hivol 3000
Serial number	Various (as maintenance and calibration requirements need)
Minimum detection level	0.1 mg (balance limit)
Measuring units	µg/m ³
Logging interval	24 hours
Clock adjustment	Australian Central Standard Time

Pollutant monitored	Particulate matter, as total suspended particles (TSP)
Instrument type	High volume sampler (HVS)
Make	Ecotech
Model	Hivol 3000
Serial number	Various (as maintenance and calibration requirements need)
Minimum detection level	0.1 mg (balance limit)
Measuring units	µg/m ³
Logging interval	24 hours
Clock adjustment	Australian Central Standard Time

APPENDIX 3 PARTICULATE MATTER MEASUREMENT

Particulate matter (PM₁₀) using high volume sampling

Hummock Hill

This site is not designated as an Air NEPM monitoring site and the data cannot be compared to any Air NEPM standard.

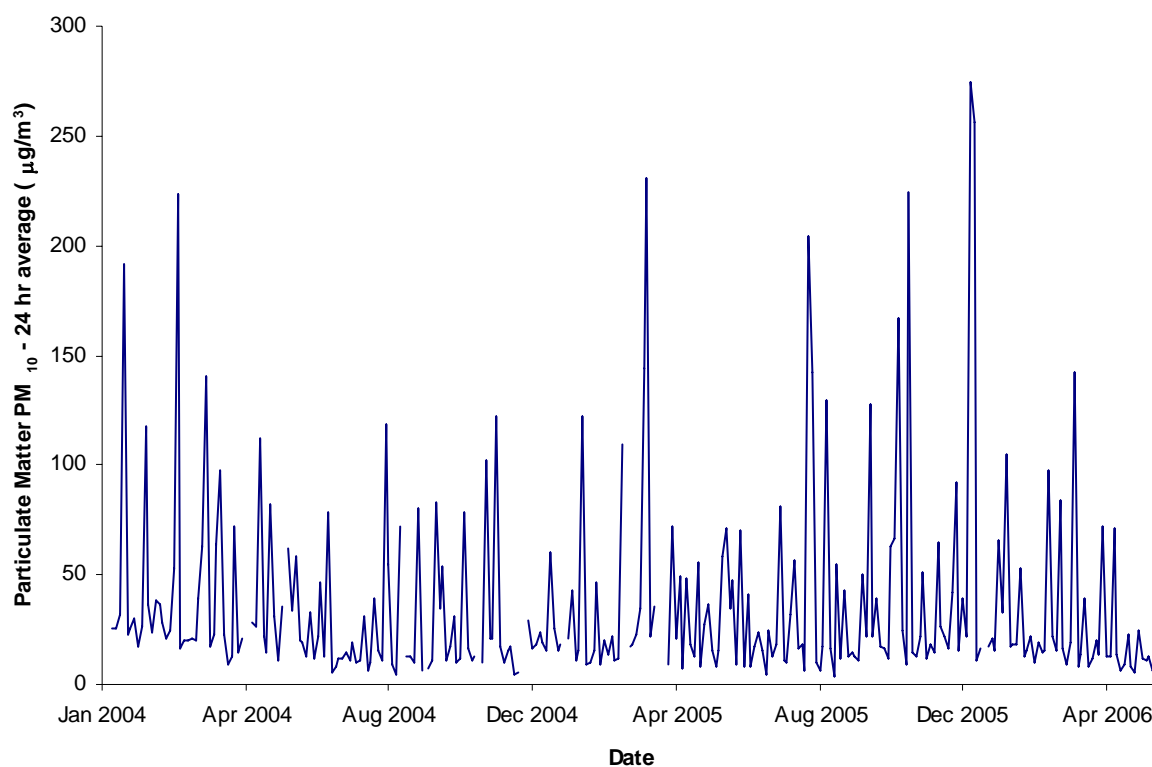


Figure 15 PM₁₀ 24-hour averaged concentrations at Hummock Hill for 2004–06

Table 13 Statistics related to the PM₁₀ 24-hour averaged concentrations at Hummock Hill for 2004–06

Year	Annual Average (µg/m ³)	Annual Maximum (µg/m ³)	Annual Minimum (µg/m ³)	6 th Highest Value (µg/m ³)	Number of Samples	Percentiles (µg/m ³)		
						99 th	95 th	90 th
2004	34.8	223.5	4.4	117.3	112	186.2	114.7	80.5
2005	41.6	274.2	3.8	167.0	117	252.0	148.3	99.2
2006*	26.1	142.4	4.7	71.1	51	123.6	90.7	71.1

* Only data up to 6 June 2006 has been included in this report for this site.

Particulate matter (TSP) using high volume sampling

Civic Park

There is no recognised standard to which TSP data can be compared.

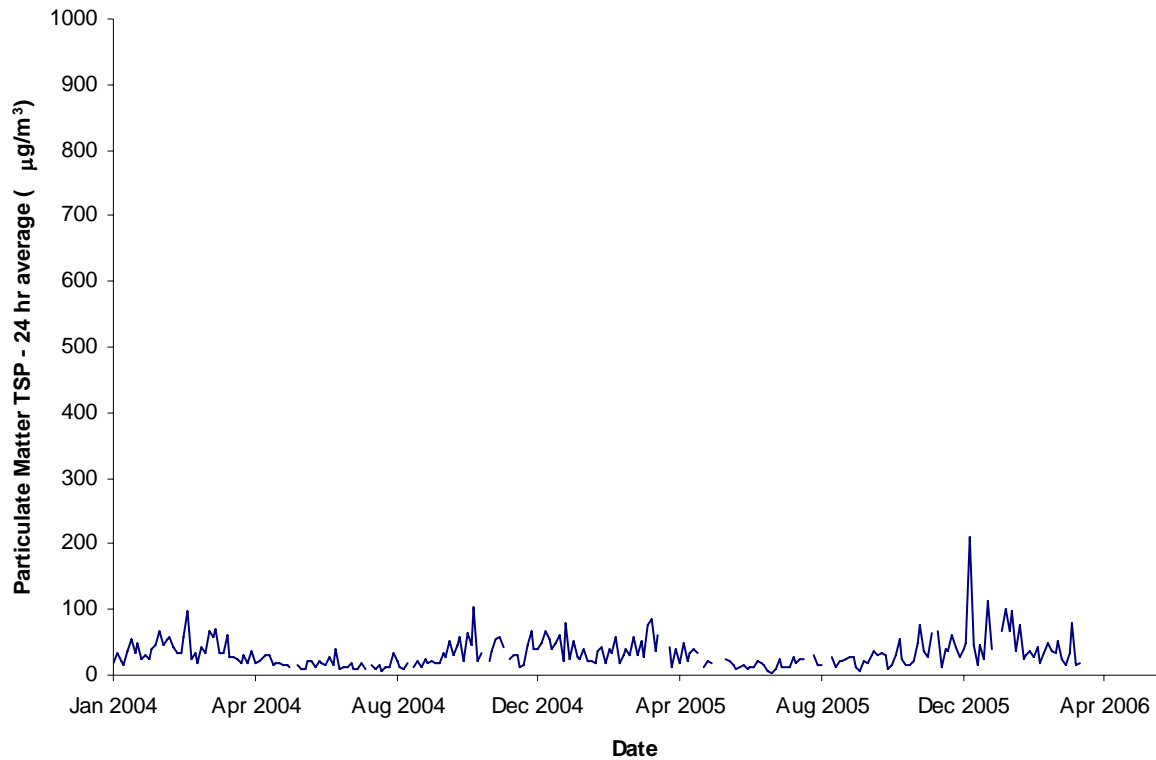


Figure 16 TSP 24-hour averaged concentrations at Civic Park for 2004–06

Table 14 Statistics related to TSP 24-hour averaged concentrations at Civic Park for 2004–06

Year	Annual Average ($\mu\text{g}/\text{m}^3$)	Annual Maximum ($\mu\text{g}/\text{m}^3$)	Annual Minimum ($\mu\text{g}/\text{m}^3$)	6 th Highest Value ($\mu\text{g}/\text{m}^3$)	Number of Samples	Percentiles ($\mu\text{g}/\text{m}^3$)		
						99 th	95 th	90 th
2004	30.3	104.1	7.5	65.0	117	92.1	65.3	58.0
2005	32.4	211.0	3.6	66.0	111	84.4	65.9	57.7
2006	44.5	111.9	14.0	67.4	28	109.2	100.1	84.1

Hummock Hill

There is no recognised standard to which TSP data can be compared.

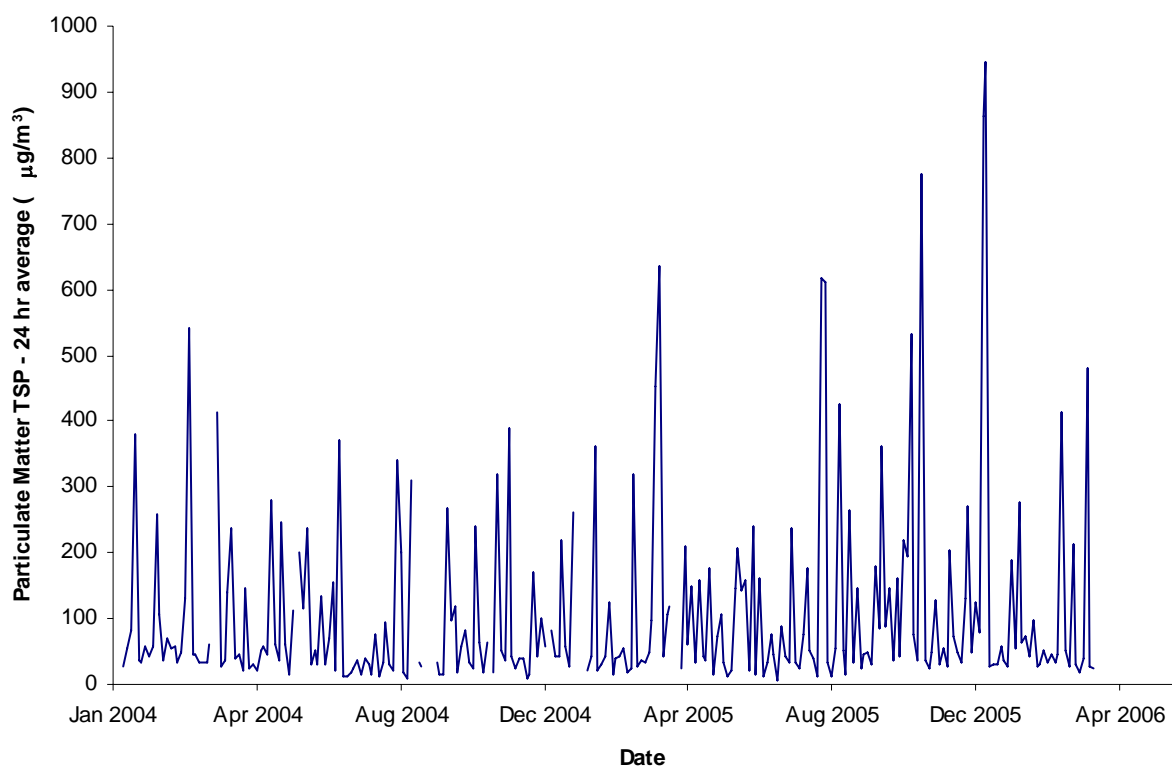


Figure 17 TSP 24-hour averaged concentrations at Hummock Hill for 2004–06

Table 15 Statistics related to TSP 24-hour averaged concentrations at Hummock Hill for 2004–06

Year	Annual Average ($\mu\text{g}/\text{m}^3$)	Annual Maximum ($\mu\text{g}/\text{m}^3$)	Annual Minimum ($\mu\text{g}/\text{m}^3$)	6 th Highest Value ($\mu\text{g}/\text{m}^3$)	Number of Samples	Percentiles ($\mu\text{g}/\text{m}^3$)		
						99 th	95 th	90 th
2004	90.1	539.7	7.9	340.6	113	411.1	327.7	255.2
2005	130.3	944.1	7.5	609.5	117	849.3	548.2	290.9
2006	86.4	480.2	16.9	96.7	30	460.8	352.3	217.9

Particulate matter (PM10) using TEOM

Walls Street

Particulate matter (PM₁₀) is continuously monitored using a tapered element oscillating microbalance (TEOM) at Walls Street (Figure 1). Sampling has been conducted at this site since 25 July 2003. The site was moved ~6 m in a northerly direction on 1 July 2004.

This site is not designated as an Air NEPM monitoring site and the data cannot be compared to any Air NEPM standard.

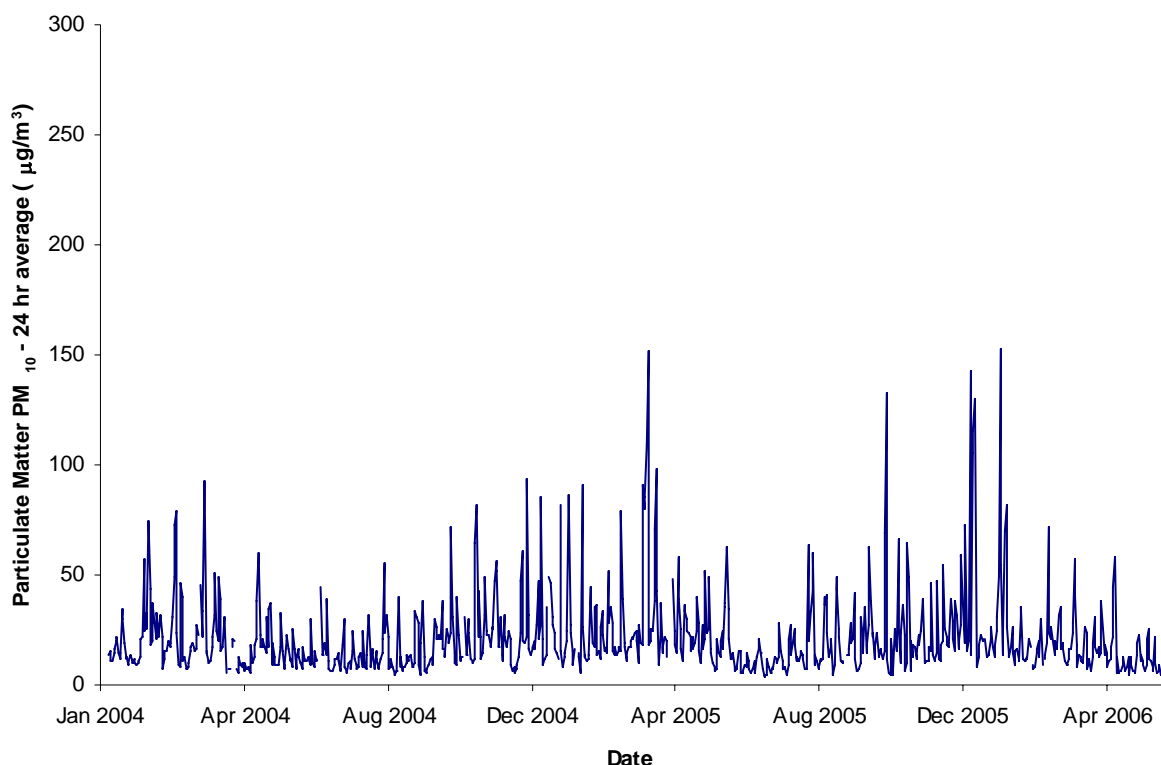


Figure 18 PM₁₀ 24-hour averaged concentrations at Walls Street for 2004–06

Table 16 Statistics related to PM₁₀ 24-hour averaged concentrations at Walls Street for 2004–06

Year	Annual Average (µg/m ³)	Annual Maximum (µg/m ³)	Annual Minimum (µg/m ³)	6 th Highest Value (µg/m ³)	Data Recovery (%)	Percentiles (µg/m ³)		
						99 th	95 th	90 th
2004	19.3	93.7	4.4	73.1	96	76.8	48.2	36.9
2005	24.3	151.8	3.8	109.1	98	122.2	70.0	46.9
2006*	18.5	153.0	4.4	57.0	97	76.2	46.6	30.9

* Only data up to the 6 June 2006 has been included in this report for this site.