E N V I R O N M E N T P R O T E C T I O N A U T H O R I T Y

SOUTH AUSTRALIAN EPA AIR QUALITY REPORT 2007

EPA
South Australia

South Australian EPA
Air Quality Report 2007

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Author: Air and Noise Branch

Principal Author: Kelly Rivett

Other contributors: John Agar, Konrad Banasiak, Daniel Bellifemine, Paul Compton, Shiloh Gerrity, Matthew Hartley, Chris Harris, Rob Mitchell, Phil Morgan, Monica Moss, Christopher Powell, Kelly Rivett, Briony Spragg, Kelvyn Steer and Polly Weckert.

For further information please contact:

Information Officer
Environment Protection Authority
GPO Box 2607
Adelaide SA 5001

Telephone: (08) 8204 2004
Facsimile: (08) 8204 9393
Free call (country): 1800 623 445

Website: <www.epa.sa.gov.au>

Email: <epainfo@epa.sa.gov.au>

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ABBREVIATIONS

Air NEPM	National Environment Protection (Ambient Air Quality) Measure
AQI	Air quality index
CO	Carbon monoxide
DOAS	Differential Optical Absorption Spectrometry
EPA	South Australian Environment Protection Authority
HVS	High volume sampler, an instrument used for collecting samples of airborne particulate matter
NEPC	National Environment Protection Council, operating under the umbrella of the Environment Protection and Heritage Council
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Oxides of nitrogen
O_3	Ozone
Pb	Lead
$PM_{2.5}$	Particulate matter with an equivalent aerodynamic diameter of 2.5 μm or less
PM_{10}	Particulate matter with an equivalent aerodynamic diameter of 10 μm or less
ppm	Parts per million (by volume)
SA DEH	South Australian Department of Environment and Heritage
SA DoH	South Australian Department of Health
SO_2	Sulfur dioxide
TEOM	Tapered Element Oscillating Microbalance, an instrument used to continuously monitor airborne particulate matter
TSP	Total suspended particulates
μg/m^3	Micrograms per cubic metre, the unit used for determining concentrations of particulate matter in air
μm	Micrometre, one-millionth of a metre
VOCs	Volatile organic compounds

REPORT FINDINGS

- During 2007, there were no exceedences of the *National Environment Protection (Ambient Air Quality) Measure* (Air NEPM) standards at any of South Australian Environment Protection Authority monitoring sites in the Adelaide airshed for the following pollutants:
  - ozone
  - nitrogen dioxide
  - sulfur dioxide
  - carbon monoxide
  - particulate matter as $PM_{2.5}$.

- Particulate matter as PM_{10} was the major issue in the Adelaide airshed with **at least one** exceedence of the 24-hour average Air NEPM standard **at every site** where PM_{10} was monitored.
- Particulate matter was also a major issue in the regional airshed of Pt Augusta and Pt Pirie, with:
  - 3 exceedences of the 24-hour average PM_{10} NEPM standard at the Pt Augusta Hospital site, Pt Augusta when measured one day in six by High Volume Sampler
  - 11 exceedences of the 24-hour average PM_{10} NEPM standard at Oliver St, Pt Pirie when measured continuously by TEOM
  - 4 exceedences of the 24-hour average PM_{10} NEPM standard at Oliver St, Pt Pirie when measured one-day-in-six by High Volume Sampler
  - the 24-hour average PM_{10} concentration at 58 The Terrace, Pt Pirie was greater than 50.0 $\mu g/m^3$ on eleven occasions when measured continuously by TEOM.

- There were **29** exceedences of the 1-hour sulfur dioxide NEPM standard measured at the Oliver St, Pt Pirie site.
- **Lead** continues to be a issue in Pt Pirie with the annual lead concentrations of:
  - 2.4 $\mu g/m^3$ measured at the Ellen St site along the industry boundary
  - 0.5 $\mu g/m^3$ at the Oliver St site
  - 0.4 $\mu g/m^3$ at the Pt Pirie West Primary site
  - 0.2 $\mu g/m^3$ at the Frank Green Park site.

- There were **five** exceedances of the 24-hour PM_{10} NEPM standard at Schulz Park, Whyalla when measured continuously by TEOM
- **High** levels of particulate matter were also measured at Walls St, Whyalla, with the 24-hour average PM_{10} concentration greater than 50.0 $\mu g/m^3$ on 25 occasions when measured continuously by TEOM .
- Adelaide's air quality compares **favourably** with that measured in other Australian capital cities.

INTRODUCTION

Air quality monitoring has been conducted by the South Australian Government since the 1970s. Monitoring is currently the responsibility of the South Australian Environment Protection Authority (EPA) and is undertaken by the Air and Noise Branch. Monitoring in 2007 was conducted at various locations across the State, including in Adelaide, Pt Augusta, Pt Pirie and Whyalla (Figures 1, 2 and 3).

This report summarises the results of air quality monitoring from across the state in 2007. This is compared to results from previous years and how air quality in Adelaide compares to that of other capital cities in Australia.

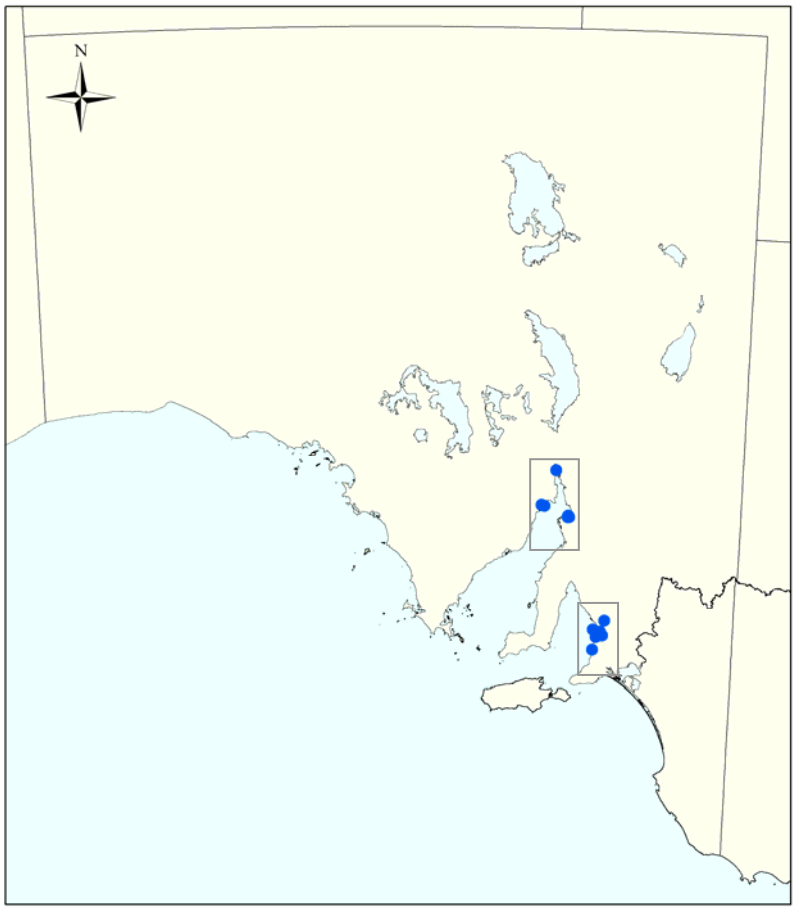

Figure 1 **Location of SA EPA monitoring sites. See figures 2 and 3 for larger view of insets**

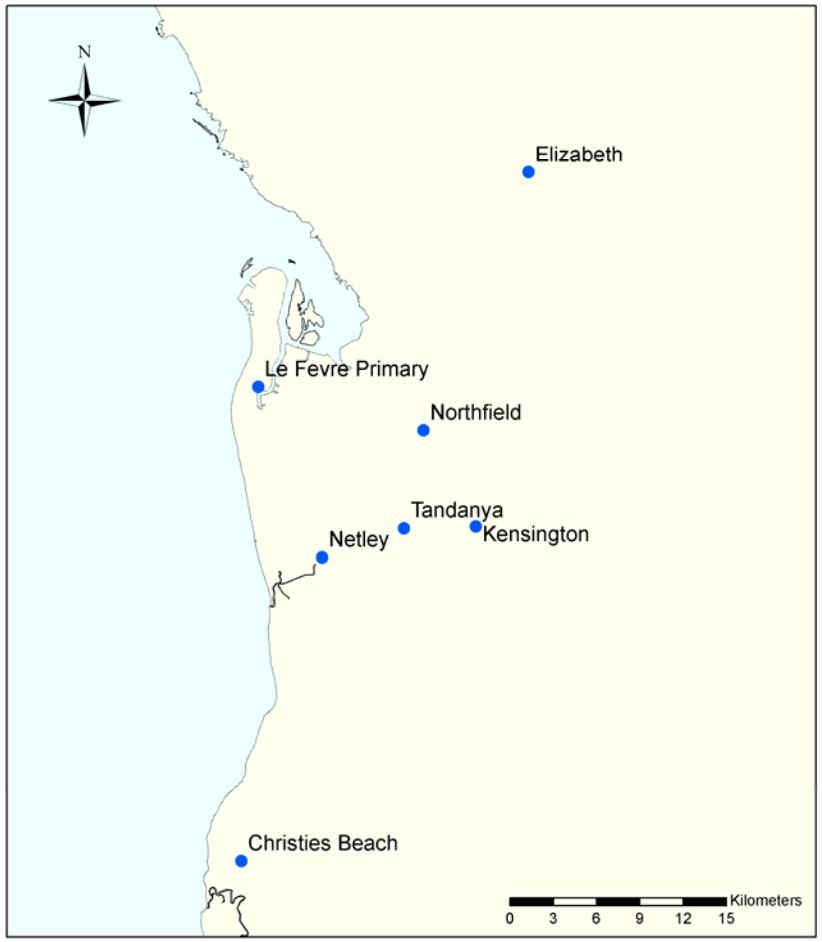

Figure 2 **EPA monitoring sites in the Adelaide region in 2007**

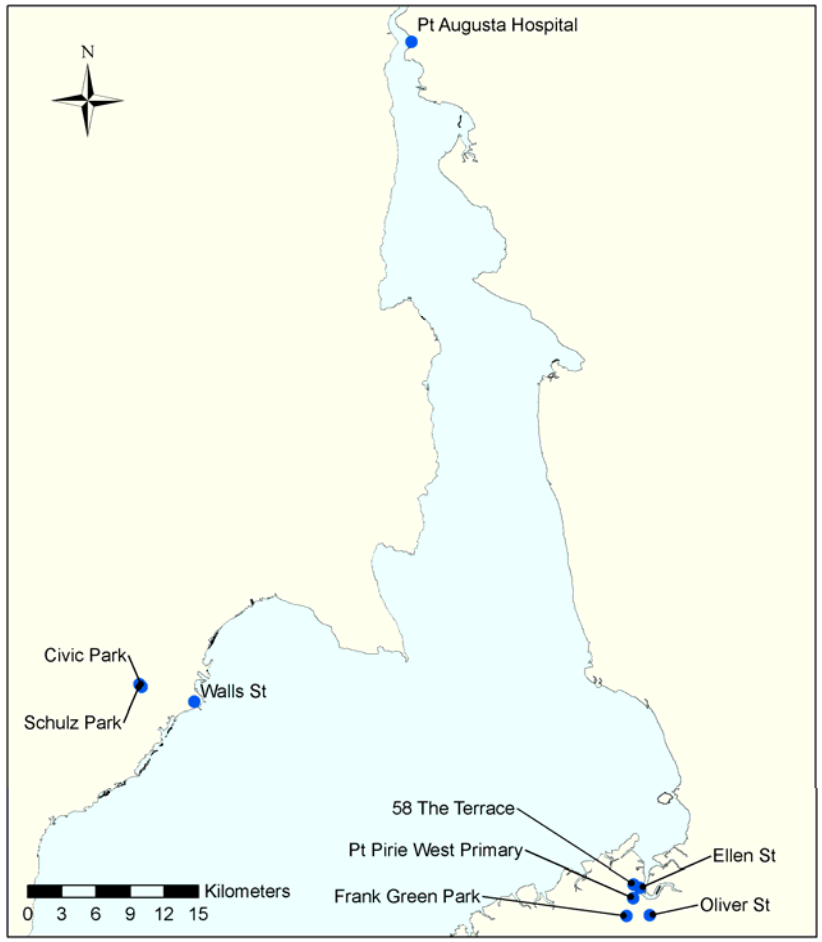

Figure 3 **EPA monitoring sites in the Spencer Gulf region in 2007**

POLLUTANTS MEASURED AND THEIR IMPORTANCE

The Environment Protection Authority (EPA) measures air pollution in South Australia due to the impacts that they have on human health. According to the National Environment Protection Councils (NEPC) final impact statement:

> Air pollutants cause adverse effects on human health if they are present in air at sufficient concentrations and for a sufficient length of time. Health effects associated with the six common pollutants include respiratory effects, ranging from minor symptoms such as cough to the more serious, eg chest congestion and asthma, to the very serious such as chronic illness and possibly death. Where a relatively minor symptom occurs the aggregate effect can often be very debilitating, particularly for susceptible subgroups.

After much national consideration and consultation, the *National Environment Protection (Ambient Air Quality) Measure* (Air NEPM) was created. This is national legislation that has been adopted in South Australia through the *Environment Protection Act* (EP Act). The Air NEPM specifies standards and goals for six air pollutants:

- ozone
- particulate matter
- nitrogen dioxide
- sulfur dioxide
- carbon monoxide
- lead.

All six of these air pollutants were measured in South Australia in 2007.

Following is a summary of the characteristics, major sources and health impacts of the of the air pollutants. Further information on the Air NEPM can be found at <www.ephc.gov.au/nepms/air/air_nepm.html>.

Ozone

Ozone is a highly reactive gas, created in the atmosphere by the reaction of nitrogen dioxide with volatile organic compounds (VOCs) under the influence of sunlight. As ozone is a secondary pollutant, it does not have any direct sources from within the airsheds.

Ozone irritates the respiratory system and aggravates existing respiratory problems.

Particulate matter

The three types of particulate matter measured are TSP (total suspended solids), PM_{10} (particles with an aerodynamic diameter of 10 μm or less) and $PM_{2.5}$ (particles with an aerodynamic diameter of 2.5 μm or less).

Particulate pollution originates from a wide range of sources, including vehicle exhausts, residential wood heaters, and industrial processes such as furnaces and boilers. Natural sources contribute mineral dusts, sea salt and pollen as components of particulate matter. Unlike some other air pollutants, particles are a broad mix of chemically and physically diverse substances.

Based on National Pollutant Inventory (NPI) industry and aggregate emissions data, the relative source of particulate matter is different for each airshed. This difference is highlighted in Figure 4, where industry is the main contributor to particle emissions in Whyalla and Pt Pirie while particle emissions come from many sources in the Adelaide airshed. Figure 4 shows the percentage contribution of each source based on aggregate emissions from 2002–03 and industry emissions from 2005–06.

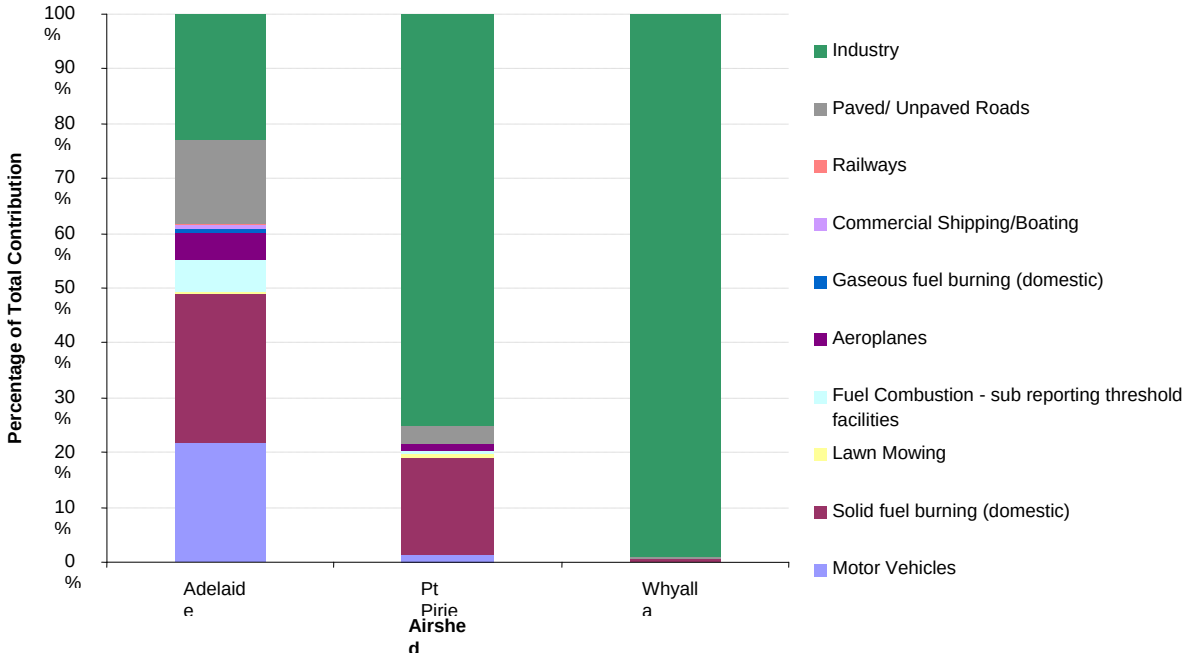

Figure 4 **NPI emission estimates of particulate matter sources in Adelaide, Pt Pirie and Whyalla**

The effects of particulate matter depend on the particle's chemical nature and size, how the particles are carried through the respiratory system and how the body responds to the particles. Medical studies have linked the levels of particulate matter in the air with the daily death rate and the rates of hospital admissions for respiratory ailments or heart problems in major cities (Dockery *et al* 1993)

Nitrogen dioxide

Nitrogen dioxide (NO_2) is created in combustion processes and its most common source is the exhaust gas of motor vehicles. In the atmosphere, nitric oxide is oxidised to nitrogen dioxide by reaction with ozone, or in cold winter-time conditions by reaction with oxygen.

Based on NPI industry and aggregate emissions data, the relative source of oxides of nitrogen varies between each airshed. This difference is highlighted in Figure 5, with motor vehicles being the major source in the Adelaide airshed while industrial emissions make a much larger contribution in Pt Pirie and Whyalla. Figure 5 shows the percentage contribution of each source based on aggregate emissions from 2002–03 and industry emissions from 2005–06.

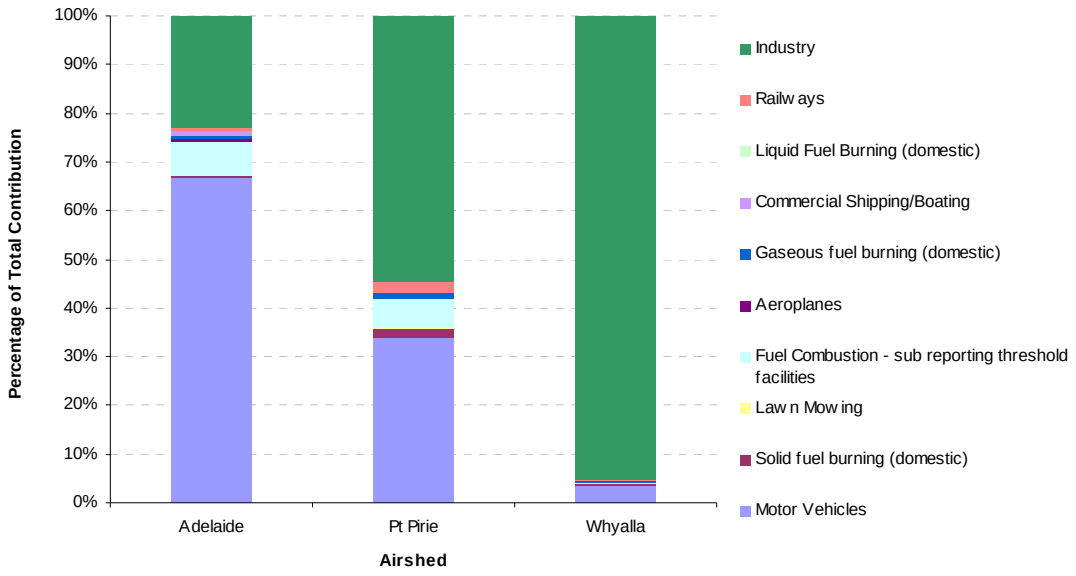

Figure 5 **NPI emission estimates of oxides of nitrogen sources in Adelaide, Pt Pirie and Whyalla**

Nitrogen dioxide irritates the eyes, nose, throat and respiratory system and aggravates existing respiratory problems.

Sulfur dioxide

Sulfur dioxide (SO_2) is an acid gas created by the combustion of fuels that contain sulfur.

Based on NPI industry and aggregate emissions data, the relative source of sulfur dioxide is significantly different between the Adelaide and regional airsheds. This difference is highlighted in Figure 6, with industry being the predominant source in both Whyalla and Pt Pirie while there is a multitude of sources in the Adelaide airshed. Figure 6 shows the percentage contribution of each source based on aggregate emissions from 2002–03 and industry emissions from 2005–06.

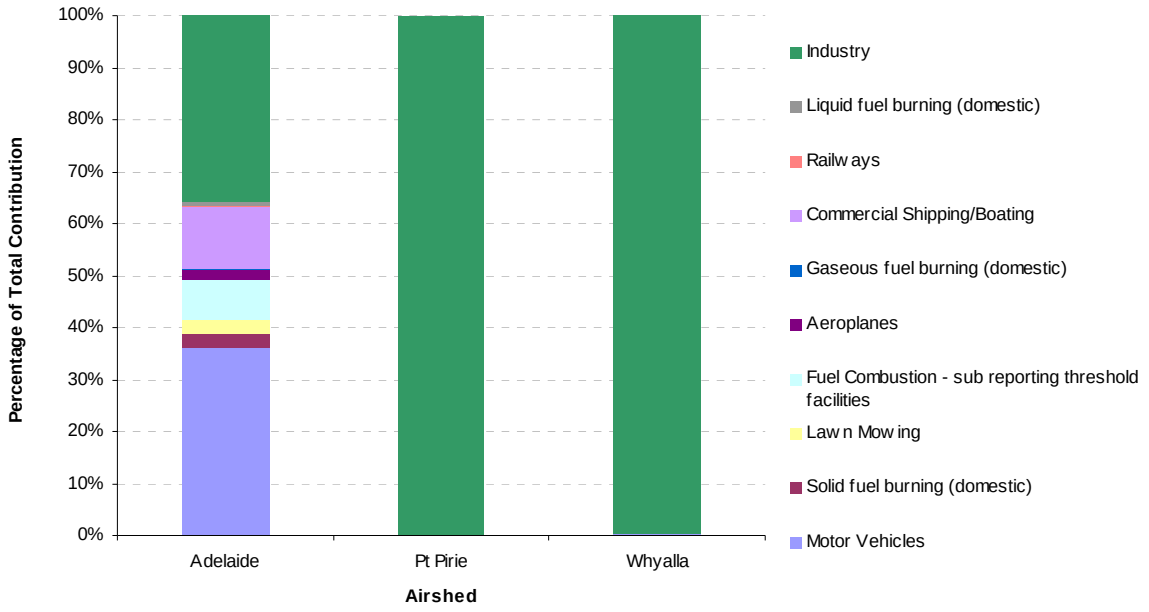

Figure 6 **NPI emission estimates of sulfur dioxide sources in the Adelaide, Pt Pirie and Whyalla**

Sulfur dioxide irritates the eyes, nose, throat and respiratory system and aggravates existing respiratory problems.

Carbon monoxide

Carbon monoxide (CO) is a toxic gas created by the incomplete burning of fuels that contain carbon. It is a component of the exhaust gases of motor vehicles.

Based on NPI industry and aggregate emissions data, the relative source of carbon monoxide is again significantly different between the Adelaide and regional airsheds. This difference is highlighted in Figure 7, with industry being the predominant source in both Whyalla and Pt Pirie while the predominant pollutant in the Adelaide airshed is motor vehicles. Figure 7 shows the percentage contribution of each source based on aggregate emissions from 2002–03 and industry emissions from 2005–06.

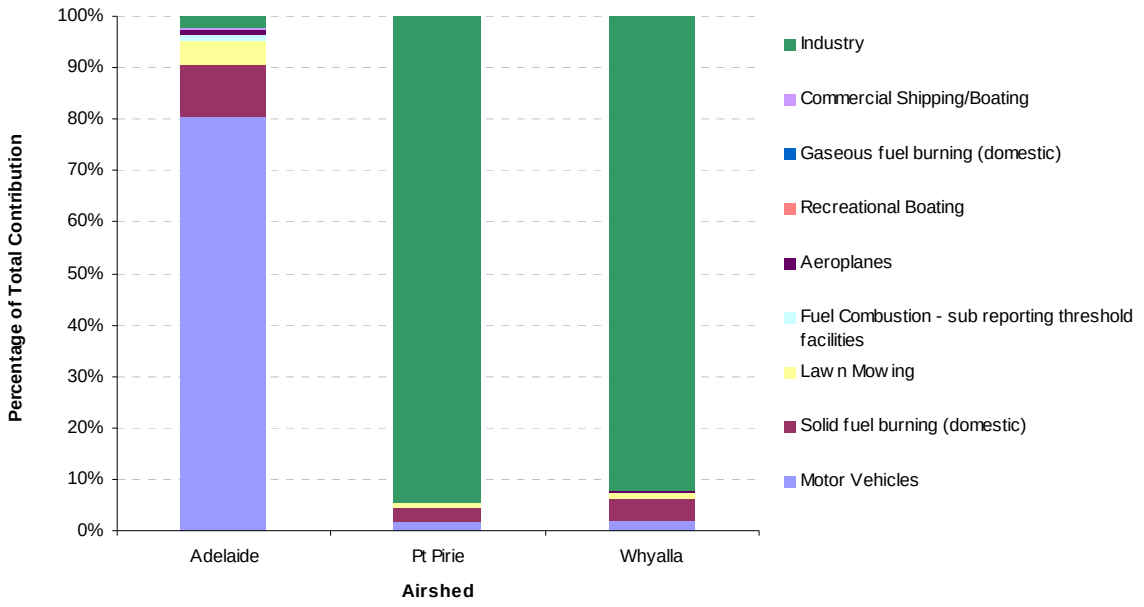

Figure 7 **NPI emission estimates of carbon monoxide sources in the Adelaide, Pt Pirie and Whyalla**

Exposure to carbon monoxide is a health risk, especially for people with existing heart or circulatory problems as it replaces oxygen in the blood.

Lead

Lead (Pb) is a heavy metal pollutant originating from industrial sources, particularly in Pt Pirie where the world's largest primary lead smelter is located. Leaded petrol for motor vehicles was once the principle source of lead in Adelaide and the other urban centres. It has not been sold in Australia since late 2000 after which airborne concentrations rapidly decreased to negligible levels. The EPA no longer monitors for lead pollution in Adelaide (EPA 2003). Further information regarding previous lead monitoring in Adelaide can be found at <www.epa.sa.gov.au/pdfs/lead_aq_report.pdf>

Based on NPI industry and aggregate emissions data, the relative source of lead varies between the Adelaide and regional airsheds. This difference is highlighted in Figure 8, with industry being the predominant source in both Whyalla and Pt Pirie while unpaved and paved roads as well as aeroplanes make a more significant contribution in the Adelaide airshed. Figure 8 shows the percentage contribution of each source based on aggregate emissions from 2002–03 and industry emissions from 2005–06.

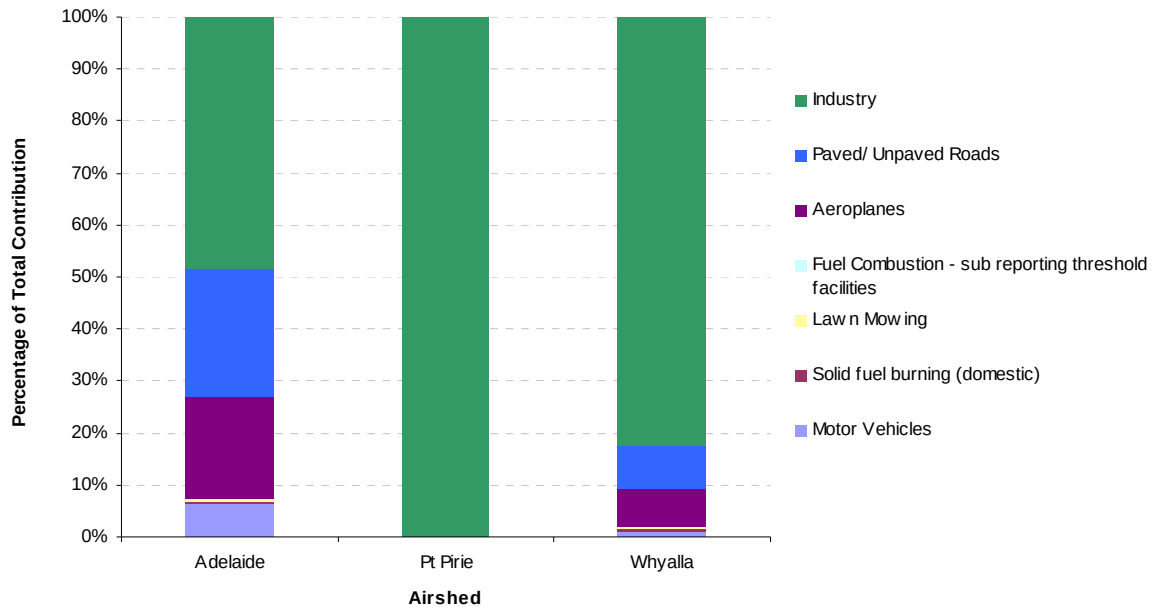

Figure 8 **NPI emission estimates of lead and compounds sources in Adelaide, Pt Pirie and Whyalla**

Lead is a toxic metal that particularly affects intellectual development and the central nervous system. Infants and toddlers are particularly susceptible because their central nervous systems are rapidly developing. This risk is compounded as young children have a higher risk of exposure and an increased ability to absorb lead.

ADELAIDE

Ozone

Monitoring results for 2007

The EPA monitored ambient ground level ozone concentrations at five sites across the Adelaide airshed. These sites were located at Christie Downs, Elizabeth, Kensington, Netley and Northfield (Figures 1 and 2).

Ozone concentrations were found to be below the national standards for 1-hour averages (0.100 ppm) and for 4-hour rolling averages (0.08 ppm) at each site (Figures 11 and 12). The maximum 4-hour rolling average at Elizabeth however was 0.002 ppm below the NEPM standard (Figure 12), indicating that ozone concentrations higher than the national standard could be obtained should the meteorological conditions be favourable or if there is an increase in the precursor pollutants needed for ozone production. Further information on ozone concentrations in Adelaide can be found in Tables 1 and 2 in Appendix 1.

Changes in ozone concentrations over time

The change in ozone concentrations in the Adelaide airshed can be seen in Figure 9, which shows the annual 1-hour average 90th percentile ozone concentrations at Northfield between 1979 and 2007. This site is representative of the general pattern seen at EPA monitoring sites across Adelaide.

A general decrease in annual average concentrations can be seen in the 1980s and 1990s, likely to be due to the improvements in car exhaust systems during that time. Since then, there seems to be a slow increase in the annual average ozone concentrations.

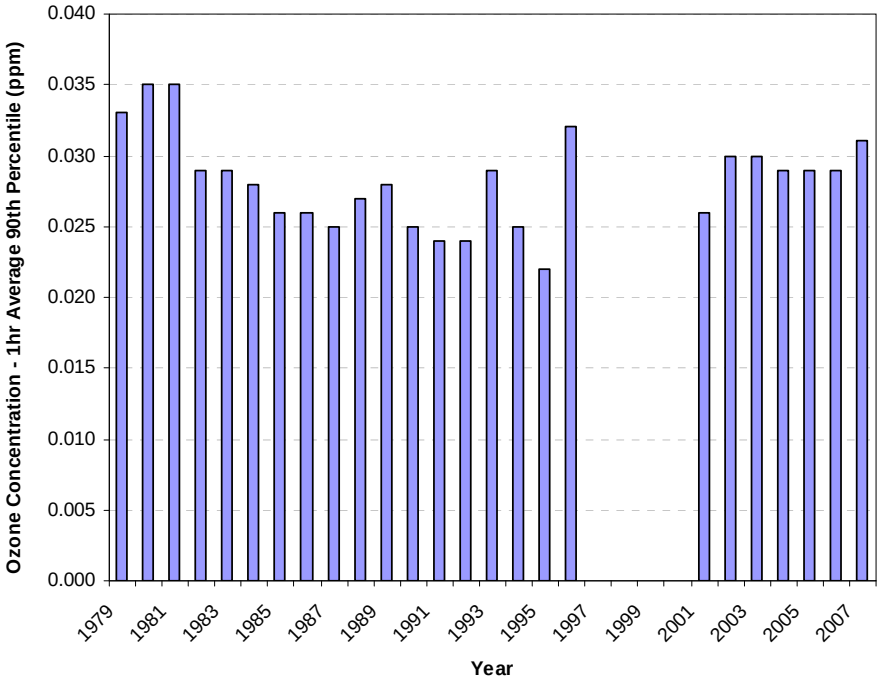

Figure 9 **The annual 1-hour average 90th percentile for ozone at Northfield between 1979 and 2007**

Ozone concentrations in Australia

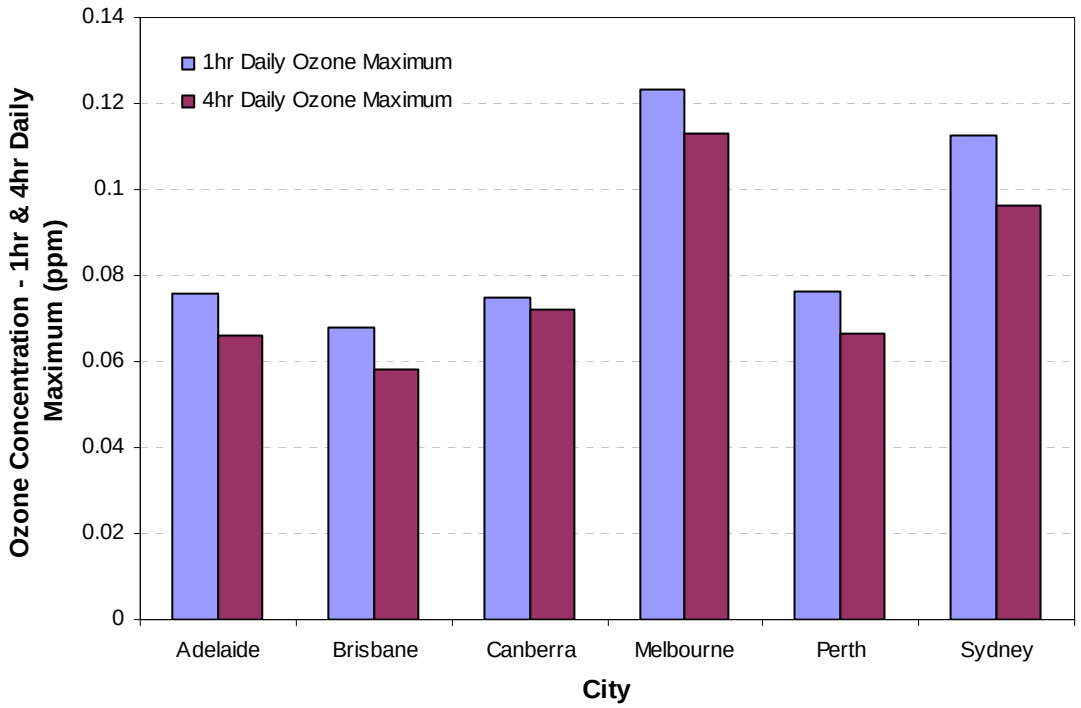

Figure 10 **Averaged 1-hour and 4-hour daily ozone maximas for each Australian capital city for 2007**[1]

Figure 10 shows the averaged 1-hour and 4-hour rolling average daily maximum concentrations for ozone in Australian capital cities for 2007 (note that ozone measurements were not reported in Darwin or Hobart in 2007). These values were determined by taking the average of all of the 1-hour and 4-hour rolling daily maximum values from monitoring sites in each capital city (see Appendix 3). Melbourne recorded the highest averaged 1-hour daily and 4-hour maximas of 0.123 ppm and 0.113 ppm respectively while Brisbane recorded the lowest ozone averaged 1-hour and 4-hour rolling daily maxima of 0.068 ppm and 0.058 ppm respectively. Melbourne and Sydney, based on this average value, exceeded both the 1-hour and 4-hour rolling average ozone NEPM standards 0.10 ppm and 0.08 ppm respectively. Adelaide's ozone concentrations are similar to those measured in Canberra and Perth.

Comparisons of Adelaide's ozone concentrations with those in other cities in the world can be found on page 15 in the 2005 annual air quality report produced by the Ontario Ministry for the Environment <www.ene.gov.on.ca/publications/6041e.pdf>.

[1] Source: 2007 NEPC Ambient Air NEPM compliance reports.

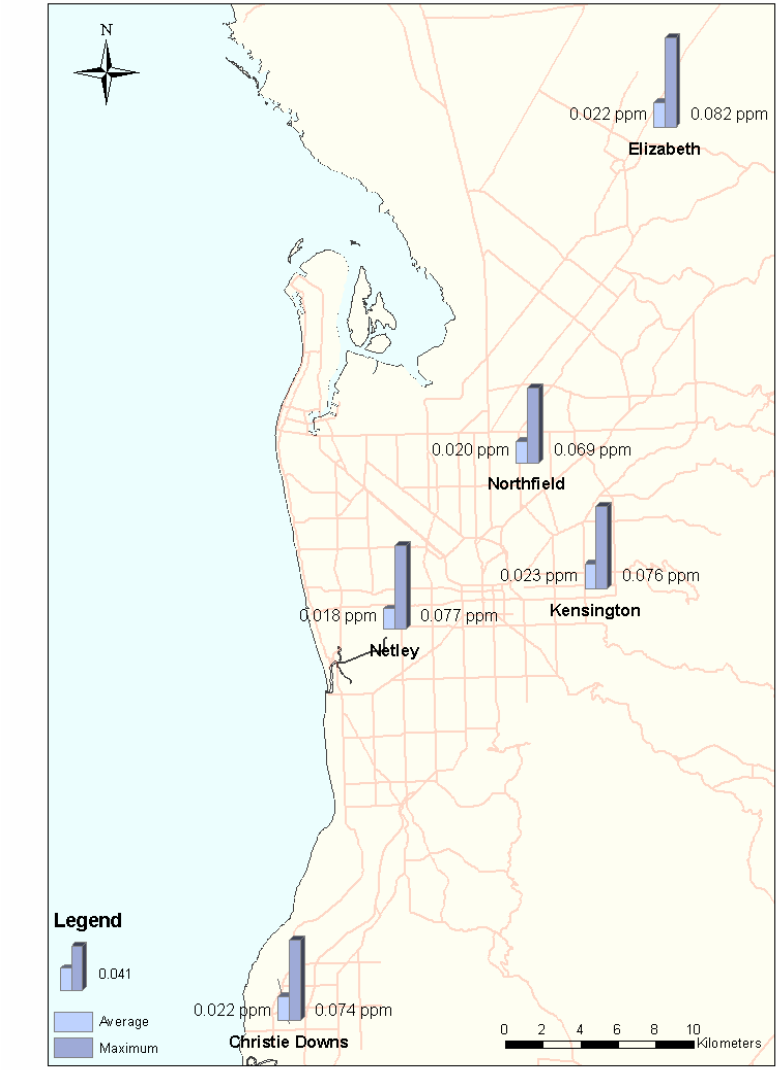

Figure 11 **1-hour ozone annual average and maximum concentrations in the Adelaide airshed**

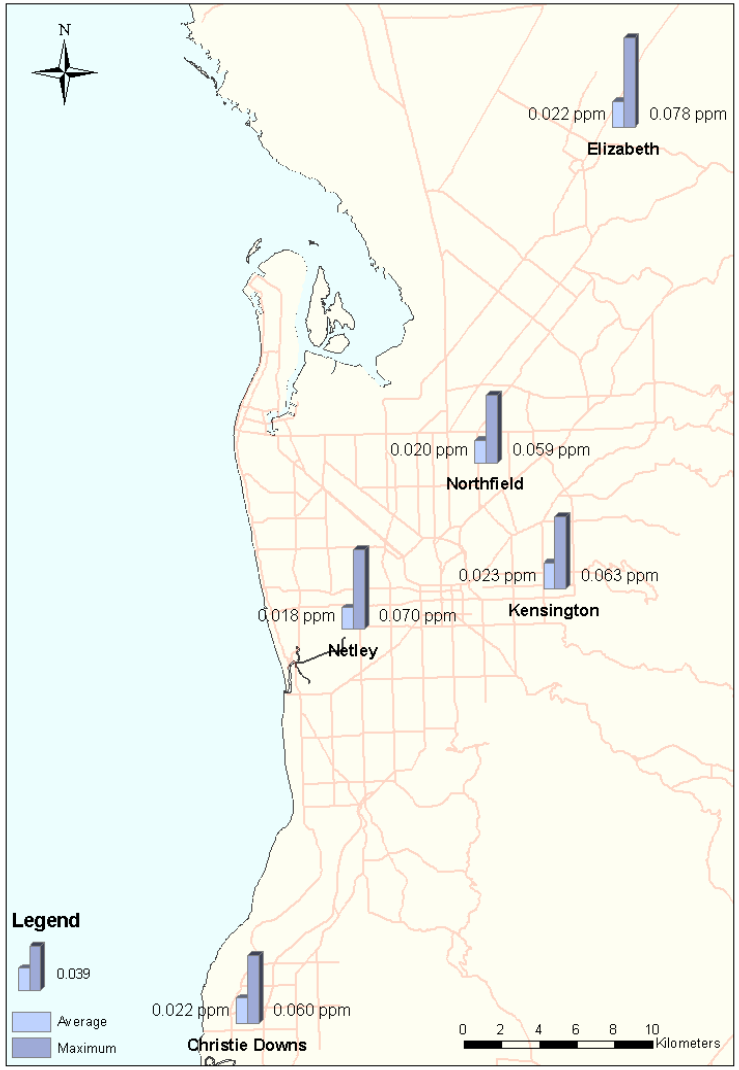

Figure 12 **4-hour rolling ozone annual average and maximum concentrations in the Adelaide airshed**

Particulate matter (PM_{10} and $PM_{2.5}$)

Monitoring results for 2007

PM_{10} TEOM

The EPA monitored for particulate matter as PM_{10} in five locations across the Adelaide airshed. The sites were located at Christie Downs, Elizabeth, Kensington, Le Fevre Primary and Netley (Figures 1 and 2).

The average 24-hour PM_{10} concentration in Adelaide ranged from 15.3 $\mu g/m^3$ at Kensington to 20.9 $\mu g/m^3$ at Le Fevre Primary (Figure 15). The 24-hour NEPM standard of 50.0 $\mu g/m^3$ was exceeded at each site, ranging from on one occasion at Kensington to 11 occasions at Netley (Figure 16). This number of exceedences at Netley was higher than the NEPM goal of no more than five exceedences at a site in a calendar year. Further information on PM_{10} TEOM concentrations in Adelaide can be found in Table 9 in Appendix 1.

$PM_{2.5}$ TEOM

Particulate matter as $PM_{2.5}$ is measured at one site, Netley, in the Adelaide airshed. The average $PM_{2.5}$ concentration measured at this site was found to be 7.9 $\mu g/m^3$. The 24-hour average NEPM advisory reporting standard for $PM_{2.5}$ of 25.0 $\mu g/m^3$ was not exceeded on any occasion during 2007, with the maximum concentration measured being 21.9 $\mu g/m^3$ (Figure 17). Further details on $PM_{2.5}$ concentrations in Adelaide can be found in Table 8 in Appendix 1.

Changes in concentrations of particulate matter over time

The change in PM_{10} and $PM_{2.5}$ concentrations in the Adelaide airshed can be seen in Figure 13 below, which shows the annual 24-hour average 90th percentile PM_{10} and $PM_{2.5}$ concentrations at Netley between 2001 and 2007. This site is representative of the general pattern seen at EPA monitoring sites across Adelaide.

A minor increase in annual average concentrations can be seen for PM_{10} over this time, while a very slight decrease in annual average $PM_{2.5}$ concentrations can be seen for $PM_{2.5}$.

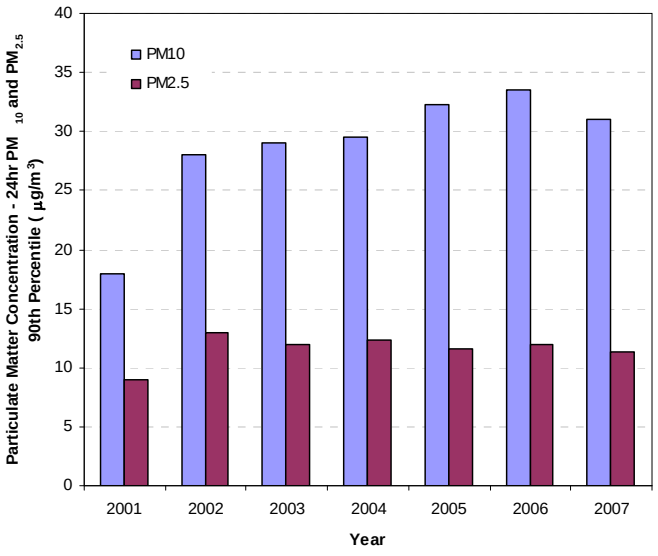

Figure 13 **The 24-hour average 90th percentile for PM_{10} and $PM_{2.5}$ at Netley between 2001 and 2007**

Australia-wide concentrations of particulate matter

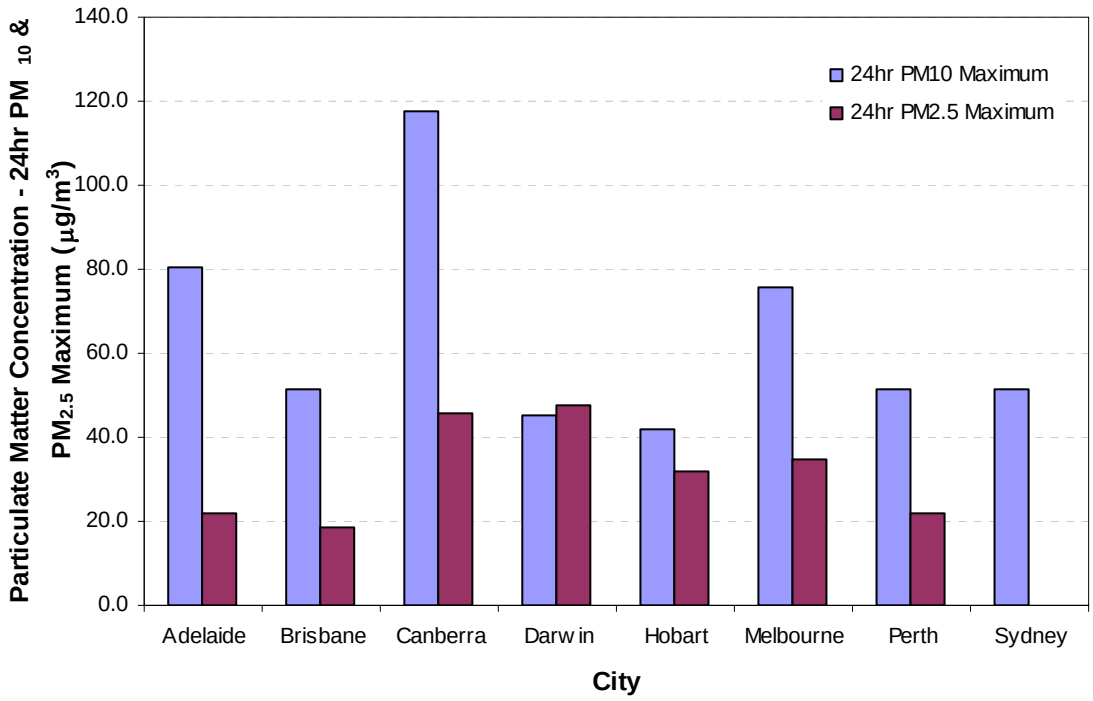

Figure 14 **Averaged 24-hour PM_{10} and $PM_{2.5}$ concentrations across Australian capital cities for 2007[2]**

Figure 14 shows the averaged 24-hour average concentrations for PM_{10} and $PM_{2.5}$ at each of the Australian capital cities for 2007. These values were determined by taking the average of all of the 24-hour values from monitoring sites in each capital city (See Appendix 3 for more details). Canberra recorded the highest averaged 24-hour PM_{10} concentration of 117.7 $\mu g/m^3$ while Darwin recorded the averaged highest 24-hour $PM_{2.5}$ concentration of 47.7 $\mu g/m^3$. Hobart recorded the averaged lowest PM_{10} concentration of 42.0 $\mu g/m^3$ while Brisbane recorded the averaged lowest $PM_{2.5}$ concentration of 18.6 $\mu g/m^3$. All capital cities except Hobart and Darwin, based on the average PM_{10} value, exceeded the 24-hour PM_{10} NEPM standard of 50.0 $\mu g/m^3$. Based on the average $PM_{2.5}$ measurement, Canberra, Darwin, Hobart and Melbourne exceeded the $PM_{2.5}$ NEPM advisory reporting standard of 25.0 $\mu g/m^3$. Adelaide's PM_{10} concentrations are similar to those in Melbourne while the $PM_{2.5}$ concentrations are similar to those measured in Perth. $PM_{2.5}$ measurements were not reported in Sydney in 2007.

Comparisons of Adelaide's particulate matter concentrations with those in other cities in the world can be found on page 23 in the 2005 annual air quality report produced by the Ontario Ministry for the Environment <www.ene.gov.on.ca/publications/6041e.pdf>.

[2] Source: 2007 NEPC Ambient Air NEPM compliance reports.

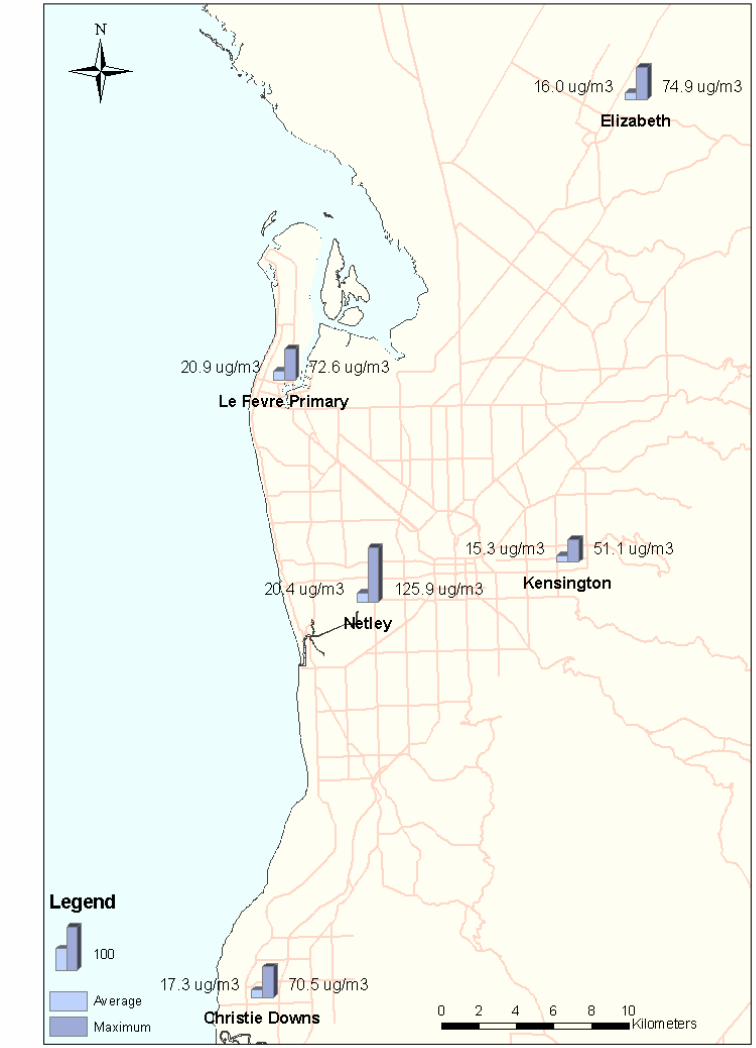

Figure 15 **24-hour PM_{10} annual average and maximum concentrations in the Adelaide airshed**

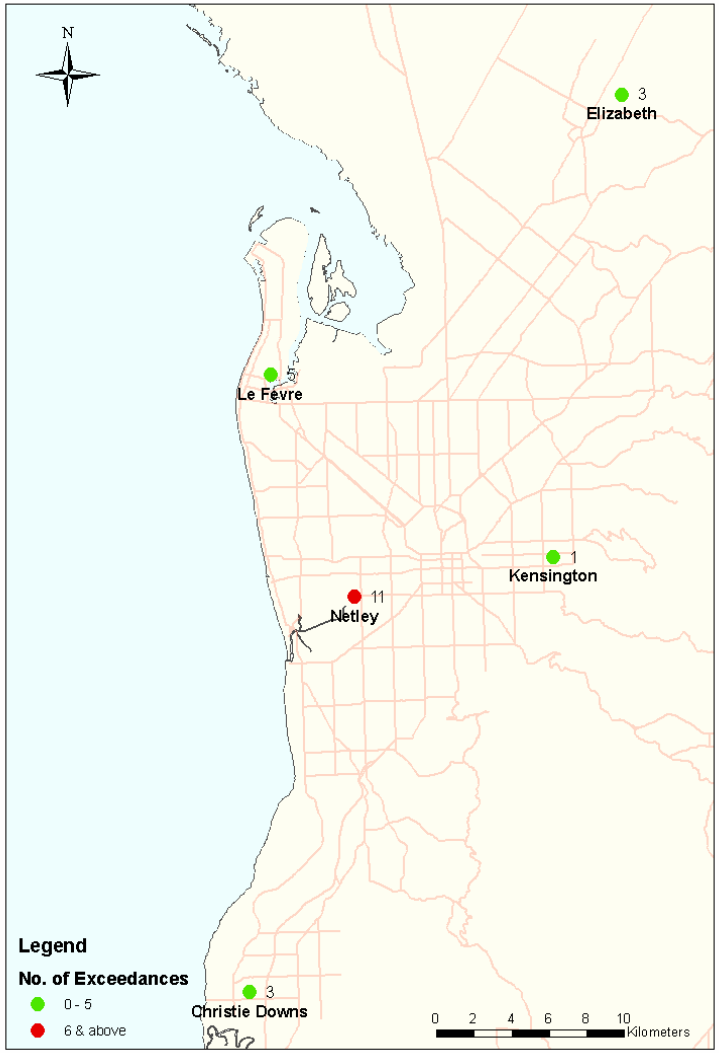

Figure 16 **Number of exceedences of the 24-hour PM_{10} NEPM standard (50.0 $\mu g/m^3$) in the Adelaide airshed**

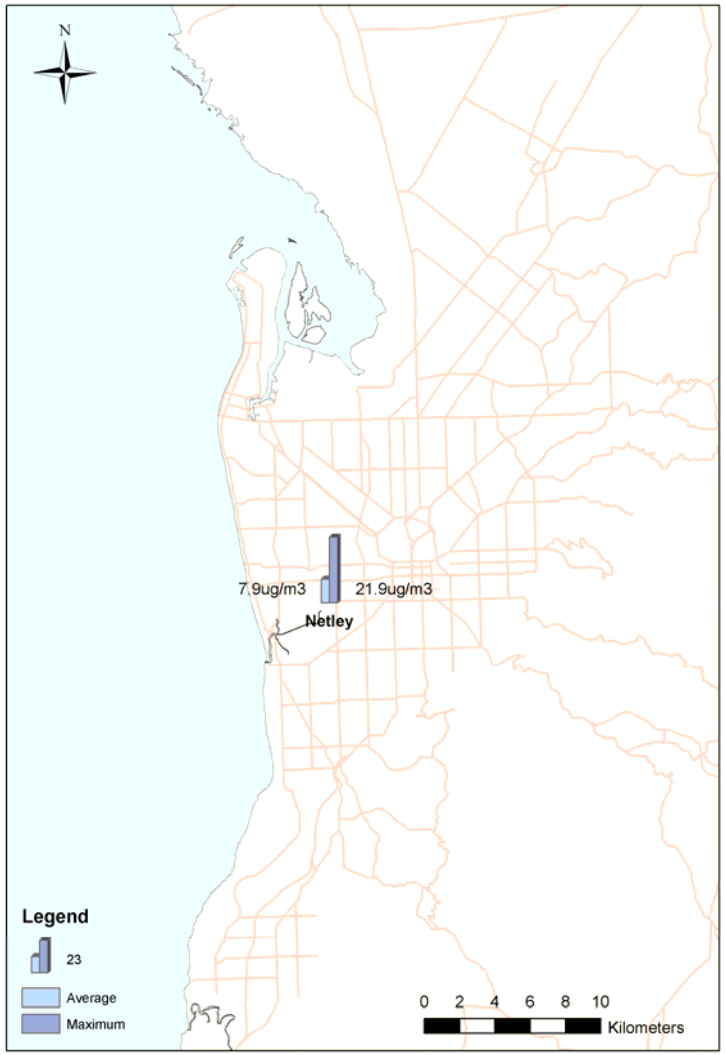

Figure 17 **24-hour $PM_{2.5}$ annual average and maximum concentrations in the Adelaide airshed**

Nitrogen dioxide

Monitoring results for 2007

The EPA monitored for nitrogen dioxide in five locations across the Adelaide airshed. The sites were located at Christie Downs, Elizabeth, Kensington, Netley and Northfield (Figures 1 and 2).

The average 1-hour nitrogen dioxide concentrations ranged from 0.003 ppm at Elizabeth through to 0.009 ppm at Netley (Figure 20). The NEPM standard of 0.120 ppm for a 1-hour average was not exceeded at any of the monitoring sites. The NEPM also specifies a standard of 0.03 ppm for an annual average, which was not exceeded at any site. Further information on nitrogen dioxide concentrations in Adelaide can be found in Table 3 in Appendix 1.

Changes in nitrogen dioxide concentrations over time

The annual 1-hour average 90th percentile nitrogen dioxide concentrations at Northfield between 1979 and 2007 are shown in Figure 18 below. This site is representative of the general pattern seen at EPA monitoring sites across Adelaide.

The annual average concentrations were quite variable during the 1980s and 1990s. Since 2003, while a slight decrease in concentrations can be seen, average concentrations have remained close to 0.015 ppm.

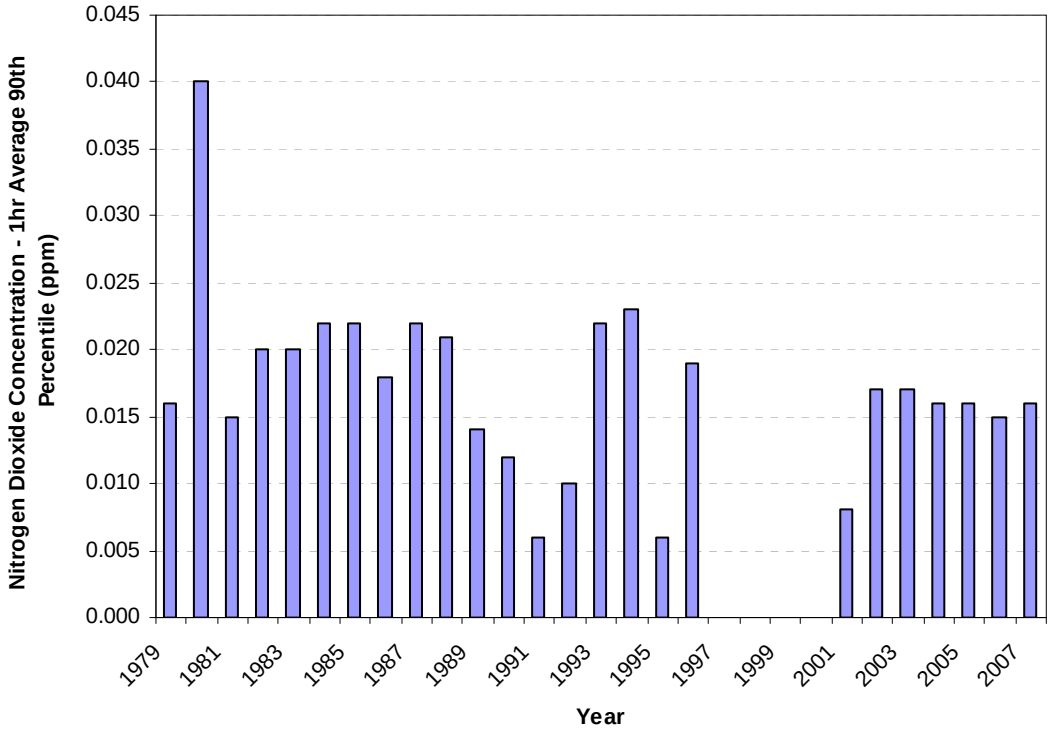

Figure 18 **The 1-hour average 90th percentile for nitrogen dioxide at Northfield between 1979 and 2007**

Nitrogen dioxide concentrations in Australia

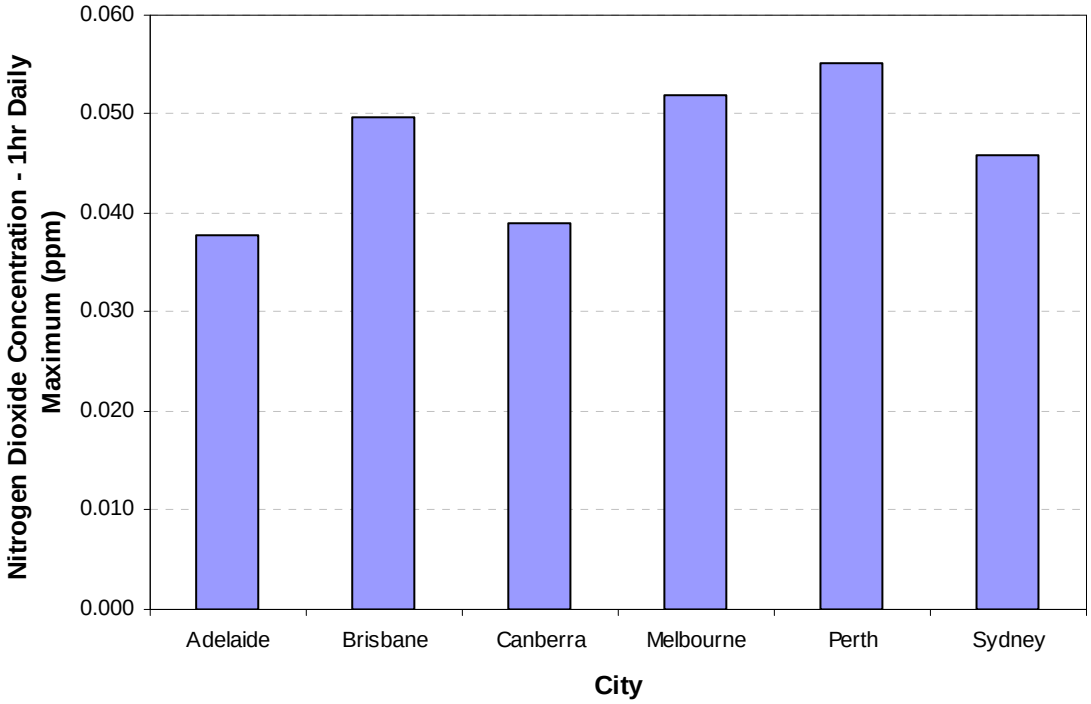

Figure 19 **Averaged 1-hour daily nitrogen dioxide maximum concentrations across Australian capital cities for 2007**[3]

Figure 19 shows the averaged 1-hour average daily maximum concentrations for nitrogen dioxide at each of the Australian capital cities for 2007. These values were determined by taking the average of all of the 1-hour daily maximum values from monitoring sites in each capital city (See Appendix 3). Perth recorded the highest averaged 1-hour daily maximum nitrogen dioxide concentration of 0.055 ppm while Adelaide recorded the lowest averaged 1-hour daily maximum nitrogen dioxide concentration of 0.038 ppm. All capital cities, based on the average 1-hour daily maximum value, did not exceed the 1-hour nitrogen dioxide NEPM standard of 0.12 ppm. Nitrogen dioxide measurements were not reported in Darwin or Hobart in 2007.

Comparisons of Adelaide's nitrogen dioxide concentrations with those in other cities in the world can be found on page 26 in the 2005 annual air quality report produced by the Ontario Ministry for the Environment: <www.ene.gov.on.ca/publications/6041e.pdf>.

[3] Source: 2007 NEPC Ambient Air NEPM compliance reports.

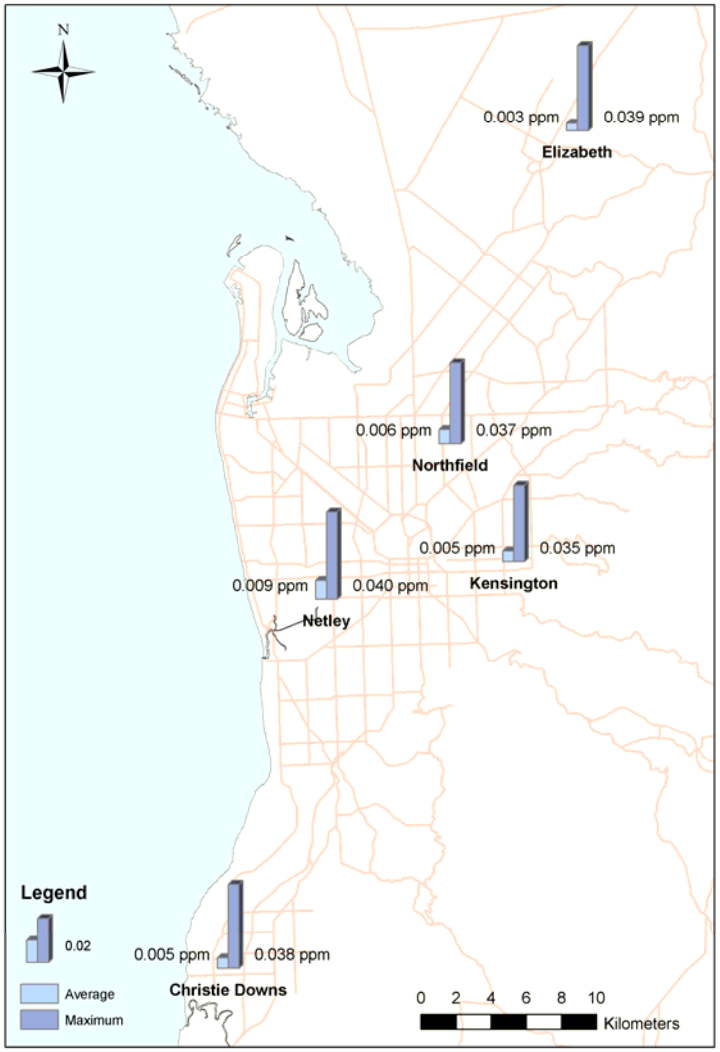

Figure 20 **1-hour nitrogen dioxide annual average and maximum concentrations in the Adelaide airshed**

Sulfur dioxide

Monitoring results for 2007

The EPA monitored for sulfur dioxide at one location, Northfield, in the Adelaide airshed (Figures and 2 1).

The 1-hour and 24-hour annual average concentration measured at this site was 0.000 ppm, with maximum concentrations of 0.008 ppm and 0.002 ppm respectively (Figures 23 and 24). These concentrations were well below the 1-hour NEPM standard of 0.200 ppm and the 24-hour NEPM standard of 0.080 ppm. Further information on sulfur dioxide concentrations in Adelaide can be found in Tables 4 and 5 in Appendix 1.

Information on previously conducted sulfur dioxide monitoring can be found at <www.epa.sa.gov.au/pdfs/so2_report.pdf>.

Changes in sulfur dioxide concentrations over time

The change in sulfur dioxide concentrations in the Adelaide airshed can be seen in Figure 21 below, which shows the change in annual 1-hour average 90th percentile sulfur dioxide concentrations at Christies Beach (now closed) and Northfield between 1979 and 2007. Concentrations at Northfield are believed to be representative of the general pattern seen across Adelaide.

The annual average concentrations are very low, with a slight decrease in concentrations seen over the past five years.

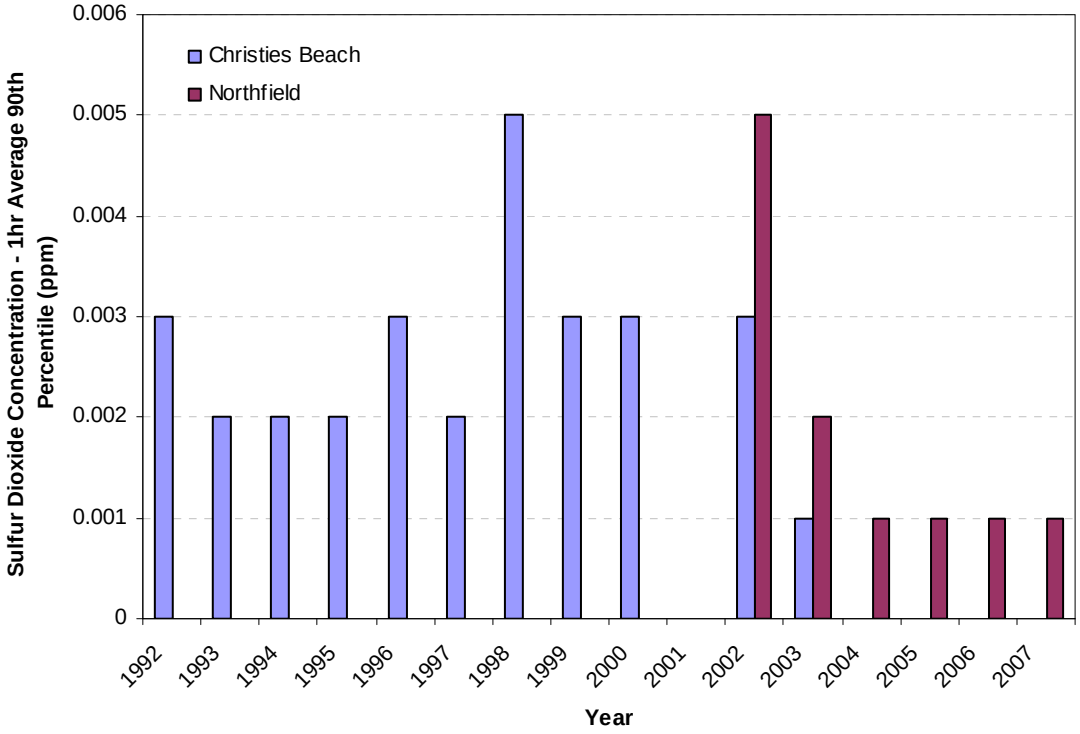

Figure 21 **The 1-hour average 90th percentile for sulfur dioxide at Christies Beach and Elizabeth between 1992 and 2007**

Sulfur dioxide concentrations in Australia

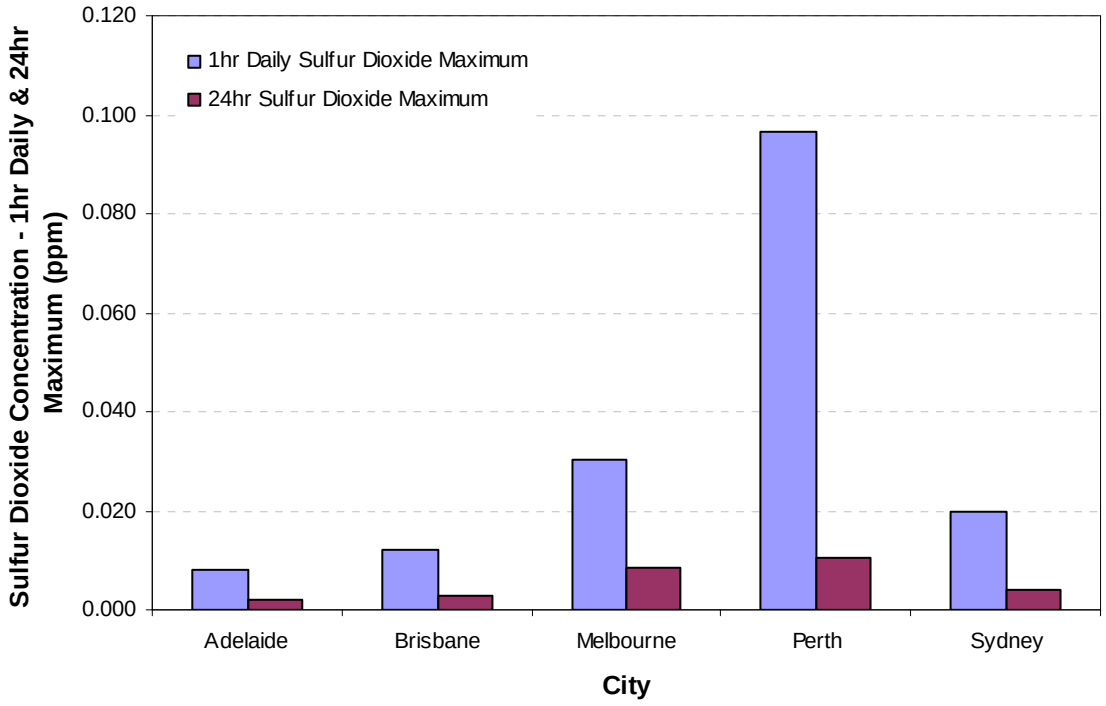

Figure 22 **Averaged 1-hour daily and 24-hour maximum sulfur dioxide concentrations across Australian capital cities in 2007[4]**

Figure 22 shows the averaged 1-hour daily and 24-hour maximum sulfur dioxide concentrations for Australian capital cities in 2007 (not that sulfur dioxide measurements were not reported in Canberra, Darwin or Hobart in 2007). These values were determined by taking the average of all of the 1-hour daily and 24-hour maximum values from monitoring sites in each capital city (See Appendix 3). Perth recorded the highest averaged 1-hour daily and 24-hour maxima of 0.97 ppm and 0.010 ppm respectively. This is likely to be attributed to industry sources within the area. Adelaide recorded the lowest averaged sulfur dioxide 1-hour daily and 24-hour maxima of 0.008 ppm and 0.002 ppm respectively. Each of these sites, on average, did not exceed any of the sulfur dioxide NEPM standards. .

Comparisons of Adelaide's sulfur dioxide concentrations with those in other cities in the world can be found on page 32 in the 2005 annual air quality report produced by the Ontario Ministry for the Environment <www.ene.gov.on.ca/publications/6041e.pdf>.

[4] Source: 2007 NEPC Ambient Air NEPM compliance reports

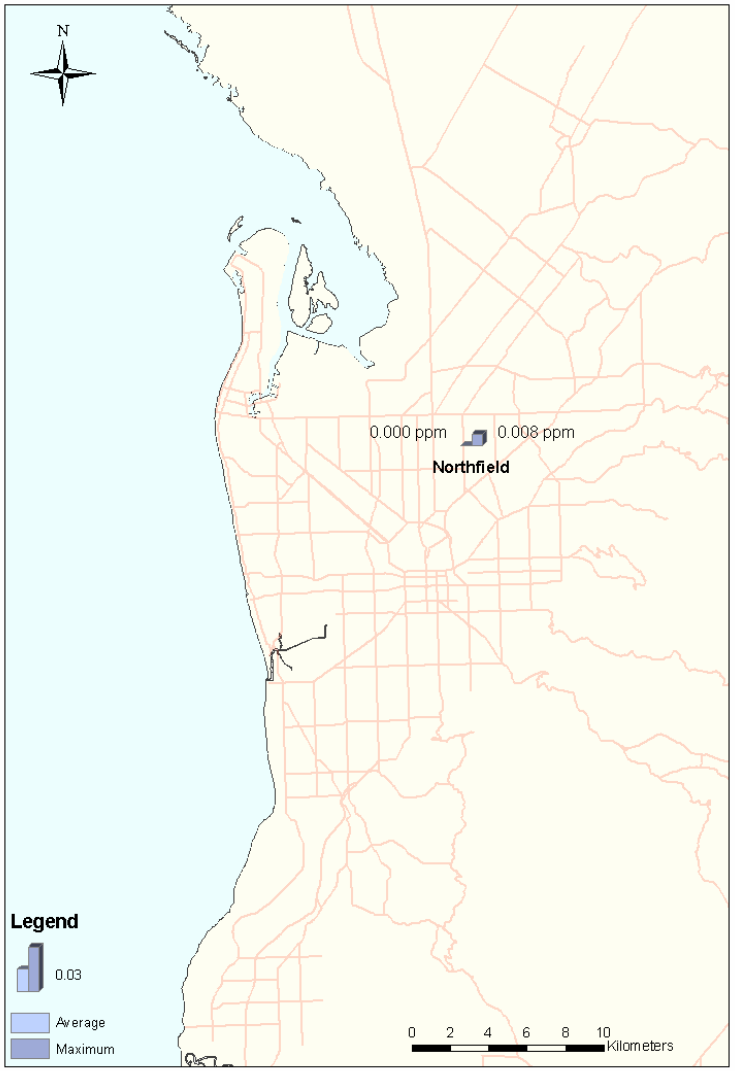

Figure 23 **1-hour sulfur dioxide annual average and maximum concentrations in the Adelaide airshed**

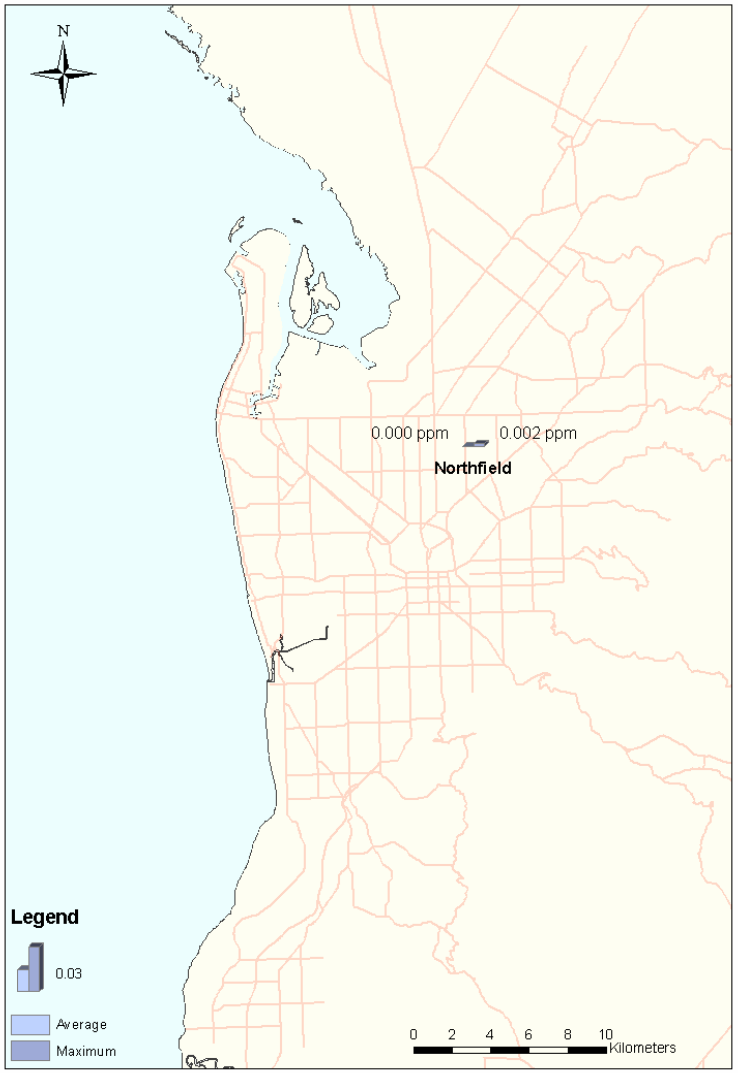

Figure 24 **24-hour sulfur dioxide annual average and maximum concentrations in the Adelaide airshed**

Carbon monoxide

Monitoring results for 2007

The EPA monitored for carbon monoxide at two locations, Tandanya and Elizabeth, within the Adelaide airshed (Figures 1 and 2). These sites were selected to represent the 'worst case' for carbon monoxide as they are in an urban canyon with high-volume, low-speed traffic passing through it.

The concentrations measured at these sites were well below the 8-hour rolling NEPM standard of 9.0 ppm, with a maximum concentration of 2.2 ppm measured at Tandanya (Figure 27). It should be noted that monitoring at the Tandanya site was only conducted in 2007 until the 28 March when monitoring stopped due to site access variability. A new site for carbon monoxide monitoring within the Adelaide central business district (CBD) is currently being investigated. Further information on carbon monoxide concentrations in Adelaide can be found in Table 6 in Appendix 1.

Changes in carbon monoxide concentrations over time

The change in carbon monoxide concentrations in the Adelaide airshed can be seen in Figure 25 below, which shows the annual 8-hour rolling average 90th percentile carbon monoxide concentrations at Hindley St (now closed) and Elizabeth between 1988 and 2007.

The annual average concentrations steadily decreased in the 1980s, 1990s and early 2000s at Hindley St. Slowly decreasing concentrations have also been seen at Elizabeth since 2002.

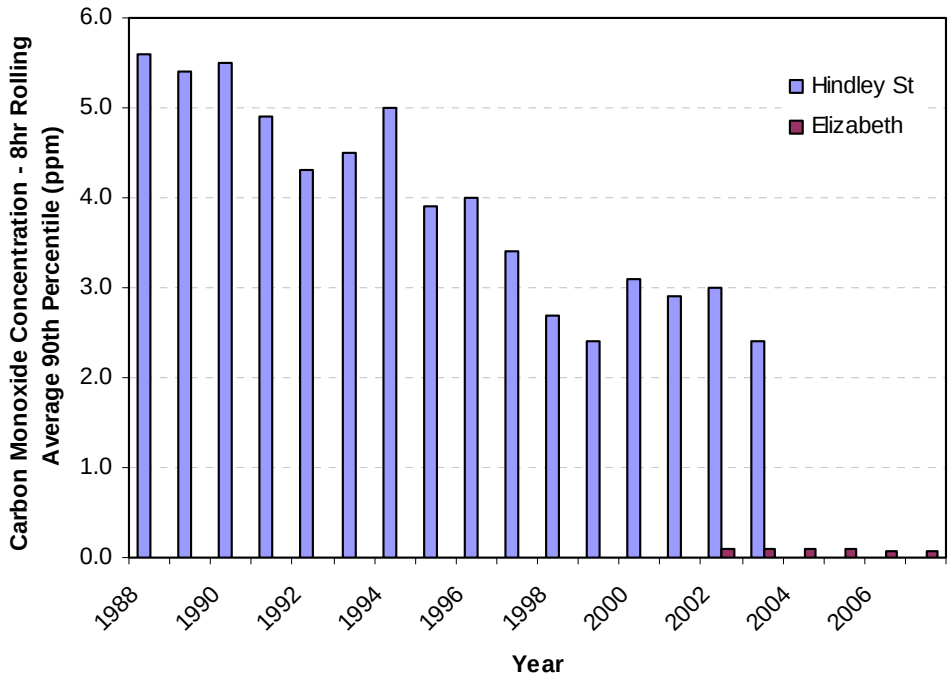

Figure 25 **The 8-hour rolling average 90th percentile for carbon monoxide in the Adelaide airshed between 1988 and 2007**

Carbon monoxide concentrations in Australia

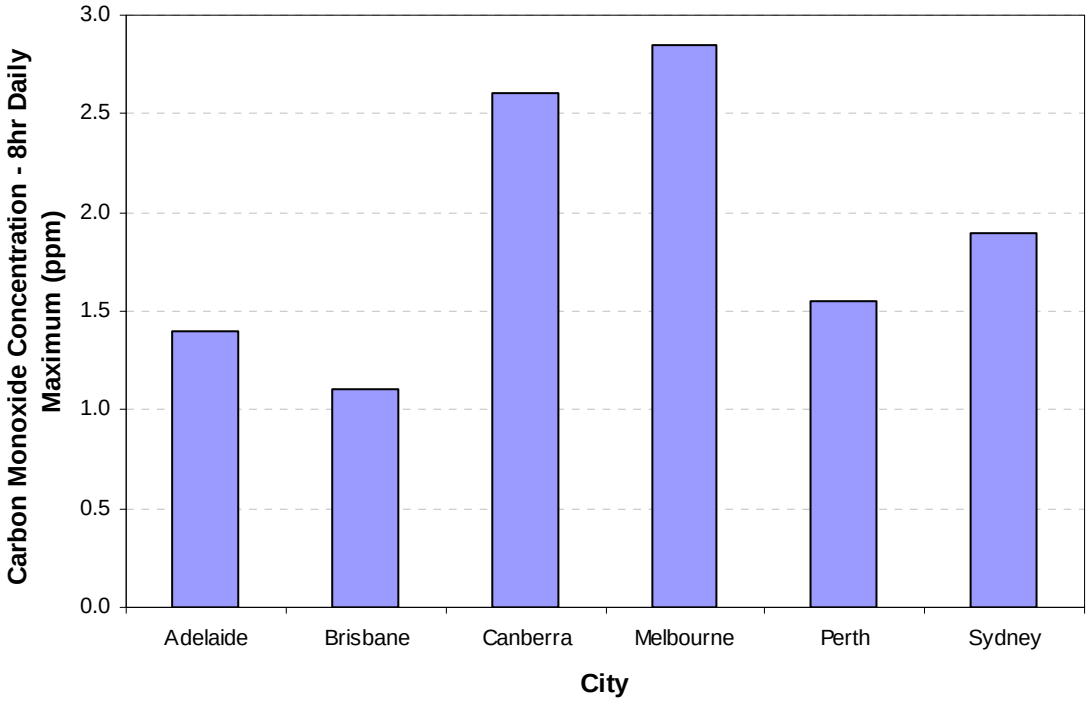

Figure 26 **Averaged 8-hour rolling average carbon monoxide daily maximum concentrations across Australian capital cities in 2007[5].**

Figure 26 shows the averaged 8-hour rolling average daily maxima for carbon monoxide for 2007 for capital cities in Australia (note that carbon monoxide measurements were not reported in Darwin or Hobart in 2007). These values were determined by taking the average of all of the 1-hour daily and 24-hour maximum values from monitoring sites in each capital city (See Appendix 3). Melbourne recorded the highest averaged 8-hour rolling average daily maximum of 2.9 ppm, while Brisbane recorded the lowest concentration with 1.1 ppm. None of the capital cities exceeded the 8-hour rolling average NEPM standard of 9.0 ppm. Adelaide's carbon monoxide average concentration was similar to that in Perth.

Comparisons of Adelaide's carbon monoxide concentrations with those in other cities in the world can be found on page 29 in the 2005 annual air quality report produced by the Ontario Ministry for the Environment <www.ene.gov.on.ca/publications/6041e.pdf>.

[5] Source: 2007 NEPC Ambient Air NEPM compliance reports.

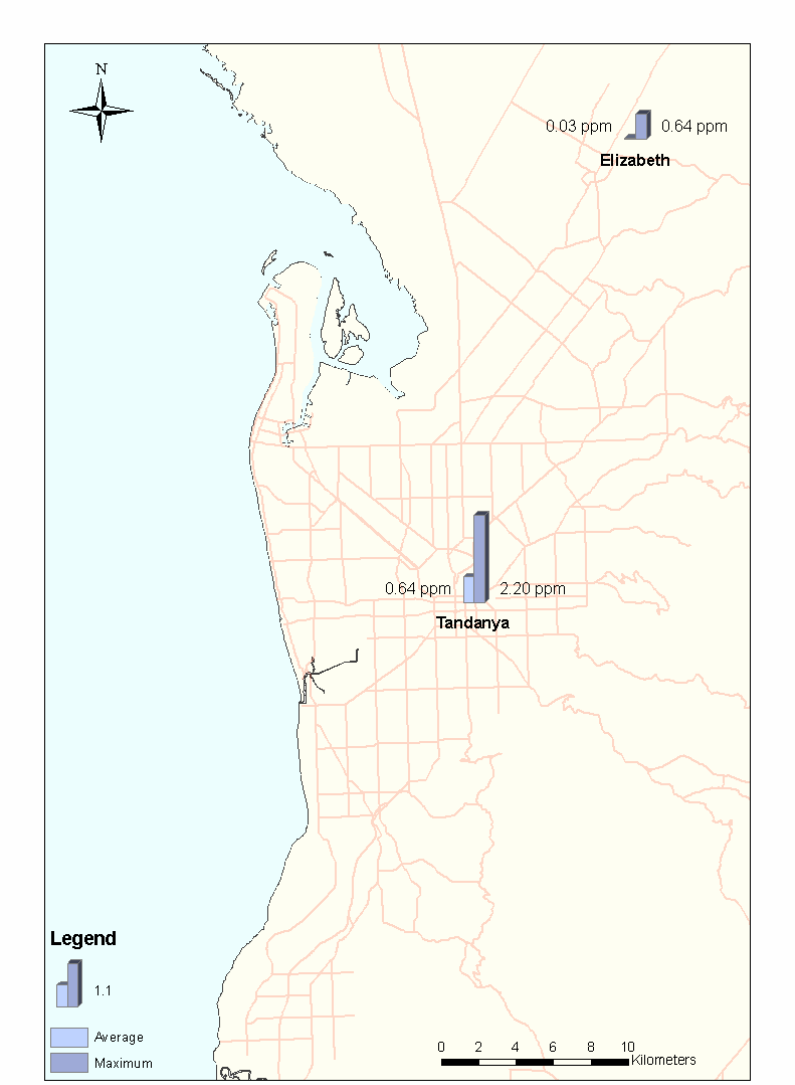

Figure 27 **8-hour rolling carbon monoxide annual average and maximum concentrations in the Adelaide airshed**

REGIONAL

Particulate matter (TSP and PM_{10})

EPA measured particulate matter using various sampling techniques in the regional townships of Pt Augusta, Pt Pirie and Whyalla during 2007. EPA conducted continuous PM_{10} sampling at the Oliver St and 58 The Terrace sites in Pt Pirie and both the Walls St and Schulz Park sites in Whyalla using a continuous particle sampling instrument known as a Tapered Element Oscillating Microbalance (TEOM).

Over a 24-hour period, particulate matter samples were collected using a high volume sampler (HVS) and averaged at the Pt Augusta (PM_{10}) site, the Whyalla Civic Park (PM_{10}) site and at the following Pt Pirie sites: Oliver St (PM_{10} and TSP), Frank Green Park (TSP), Pt Pirie West Primary (TSP) and Ellen St (TSP). The Pt Pirie 24-hour samples were used to determine the particle loading and also the lead concentration within the sample collected. These samples were only collected on a one-day-in-six basis. Lead results will be discussed later in the report.

Monitoring results for 2007

Port Augusta

PM_{10} HVS

The EPA measured PM_{10} at a single site located on the grounds of the Pt Augusta Hospital for the first five months of 2007. The PM_{10} concentrations at this site measured were above the 24-hour NEPM standard of 50.0 $\mu g/m^3$ on three occasions during this time, with an average measured concentration of 27.9 $\mu g/m^3$ (Figures 31 and 32). Further information on PM_{10} HVS concentrations in Pt Augusta can be found in Table 10 in Appendix 1.

Port Pirie

PM_{10} TEOM

In Pt Pirie, the concentrations at Oliver St were above the 24-hour NEPM standard of 50.0 $\mu g/m^3$ on 11 occasions (Figures 33 and 34). This number of exceedences was higher than the NEPM goal of no more than five exceedences at a site in a calendar year. The 58 The Terrace site is not an Air NEPM compliance site and as such cannot be compared to the Air NEPM standard however the number of occurrences that the 24-hour average concentrations were above 50.0 $\mu g/m_3$ is included in Table 14 in Appendix 1 for completeness. The average concentrations measured at these sites were 19.4 $\mu g/m^3$ at 58 The Terrace and 21.2 $\mu g/m^3$ at Oliver St. Further information on PM_{10} TEOM concentrations at Oliver St, Pt Pirie can be found in Table 9 in Appendix 1.

PM_{10} HVS

High volume samplers were used to measure PM_{10} at Pt Pirie at only one site, Oliver St, in 2007. While the average 24-hour concentration measured at this site was 25.2 $\mu g/m^3$, the 24-hour PM_{10} NEPM standard of 50.0 $\mu g/m^3$ was exceeded on four occasions (Figures 35 and 36). The highest 24-hour averaged concentration measured was 140.3 $\mu g/m^3$, more than double the national standard. Further information on PM_{10} HVS concentrations in Pt Pirie can be found in Table 10 in Appendix 1.

TSP HVS

The concentrations measured at the sites in Pt Pirie varied considerably depending on their location within the township. The average concentrations at these sites, Oliver St, Frank Green Park, Pt Pirie West Primary and Ellen St, ranged from 49.8 μg/m^3 at Frank Green Park to 67.0 μg/m^3 at Ellen St. The maximum concentrations ranged from 260.1 μg/m^3 at Frank Green Park to 304.7 μg/m^3 at Ellen St (Figure 37). Further information on TSP concentrations in Pt Pirie can be found in Table 12 in Appendix 1.

Whyalla

PM_{10} TEOM

At the sites in Whyalla, the concentrations were above the 24-hour NEPM standard of 50.0 μg/m^3 (Figure 38) on five occasions at the Schulz Park site (Figure 39). It should be noted that monitoring at Schulz Park did not commence until 27 April 2007. The Walls St site is not an Air NEPM compliance site and as such cannot be compared to the Air NEPM standard however the number of occurrences that the 24-hour average concentrations were above 50.0 μg/m$_3$ is included in Table 14 in Appendix 1 for completeness. Further information on PM_{10} TEOM concentrations at Schulz Park, Whyalla can be found in Table 9 in Appendix 1.

PM_{10} HVS

The EPA measured PM_{10} using HVS at one site, Civic Park, in 2007. However, samples were only taken until 29 May 2007. During this time, the average 24-hour PM_{10} concentration was found to be 20.2 μg/m^3, with a maximum concentration of 45.3 μg/m^3 (Figure 40). Further information on PM_{10} HVS concentrations in Whyalla can be found in Table 10 in Appendix 1.

Changes in particulate matter concentrations over time

Pt Augusta

The change in PM_{10} concentrations at the Pt Augusta Hospital site can be seen in Figure 28 below, which shows the annual 24-hour average 90th percentile PM_{10} concentrations between 1996 and 2007.

The annual average concentrations at each of these sites are highly variable. While monitoring was conducted at this site during 1996, 2006 and 2007, the data capture rate was not high enough to produce a valid average.

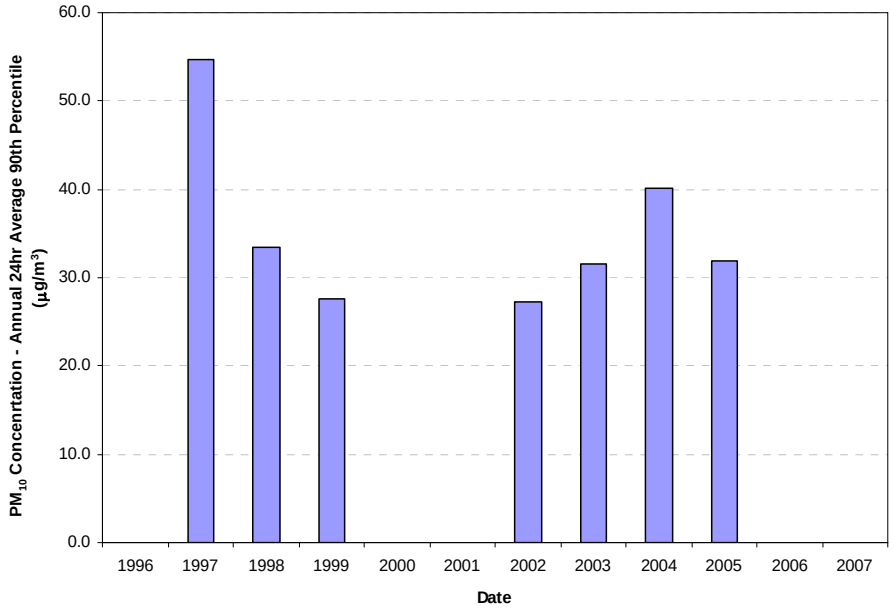

Figure 28 **The 24-hour average 90th percentile for PM_{10} at the Pt Augusta Hospital site between 1996 and 2007**

Pt Pirie

The change in PM_{10} concentrations at the Oliver St site can be seen in Figure 29, which shows the annual 24-hour average 90th percentile PM_{10} concentrations measured by both HVS and TEOM between 1998 and 2007.

The annual average concentrations at each of these sites are highly variable.

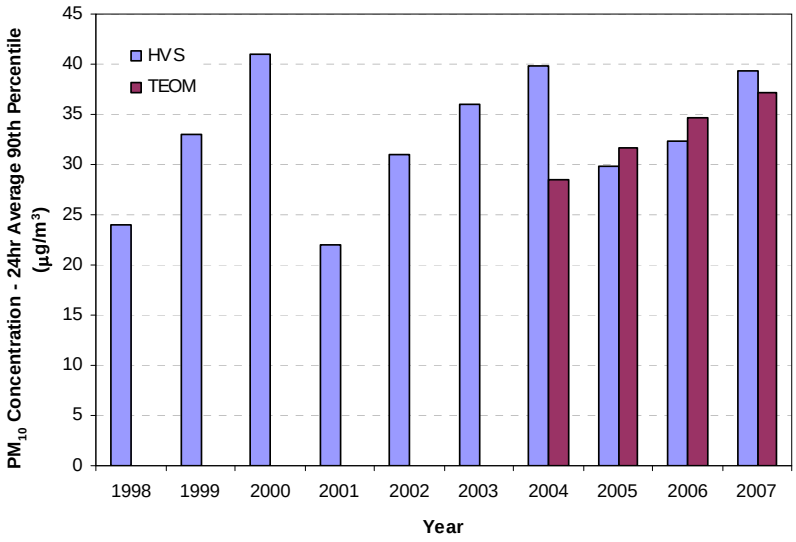

Figure 29 **The 24-hour average 90th percentile for PM_{10} at Oliver St between 1998 and 2007**

Whyalla

The change in PM_{10} concentrations at the Walls St site can be seen in Figure 30, which shows the annual 24-hour average 90th percentile PM_{10} concentrations measured by TEOM between 2003 and 2007. It should be noted that the Walls St site was moved approximately six metres in a northerly direction on 1 July 2004.

The annual average concentrations at each of these sites are variable.

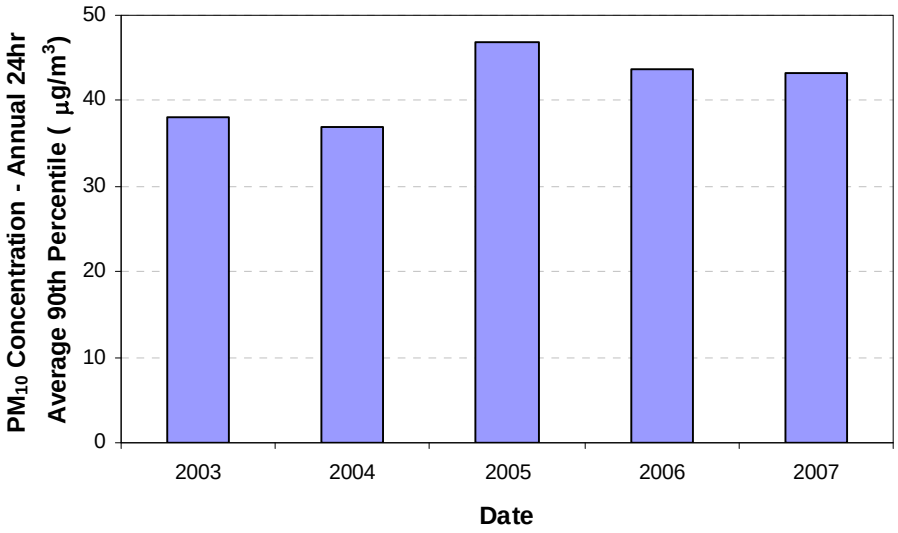

Figure 30 **The 24-hour average 90th percentile for PM_{10} at Whyalla Walls St between 2003 and 2007**

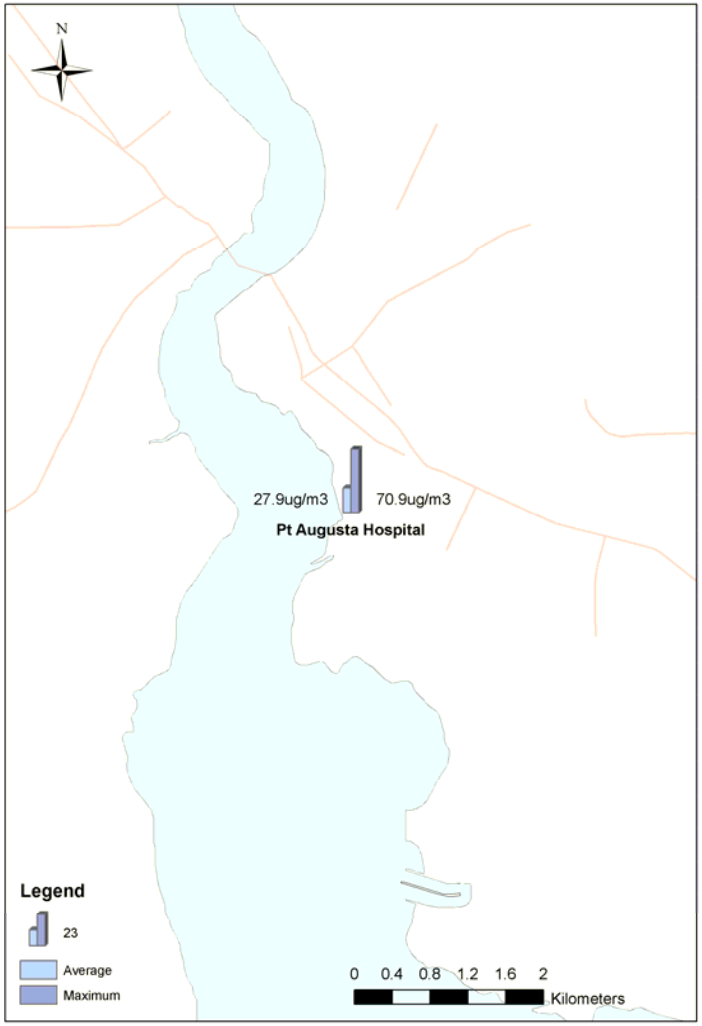

Figure 31 **24-hour PM_{10} annual average and maximum concentrations in the Pt Augusta airshed as measured by HVS**

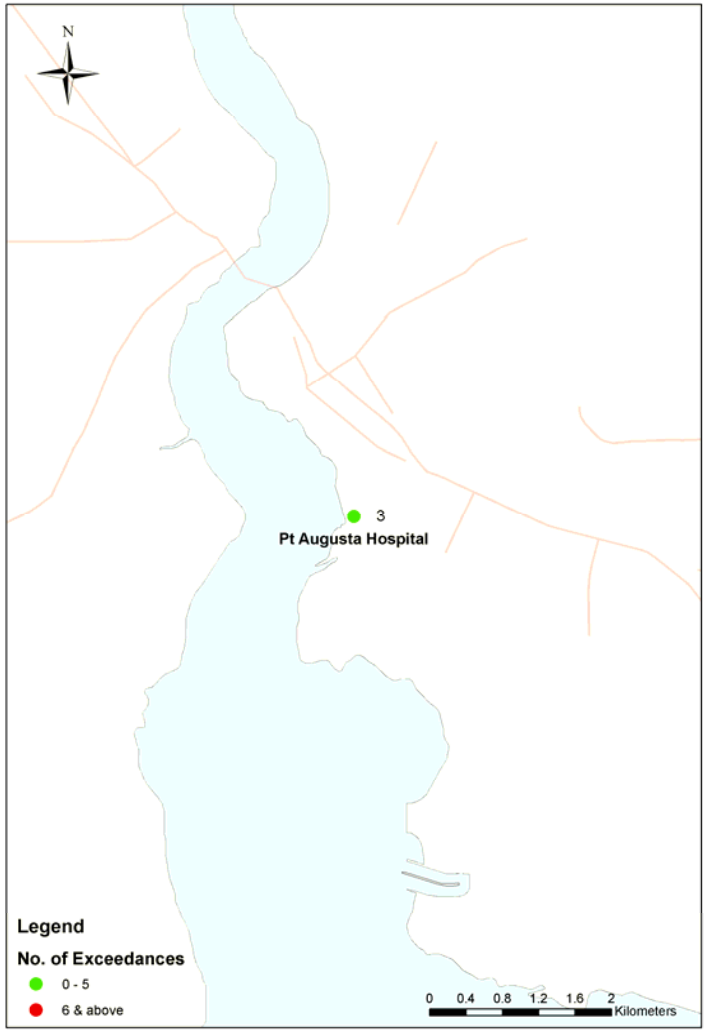

Figure 32 **Number of exceedences of the 24-hour PM_{10} NEPM standard (50.0 $\mu g/m^3$) in the Pt Augusta airshed as measured by HVS**

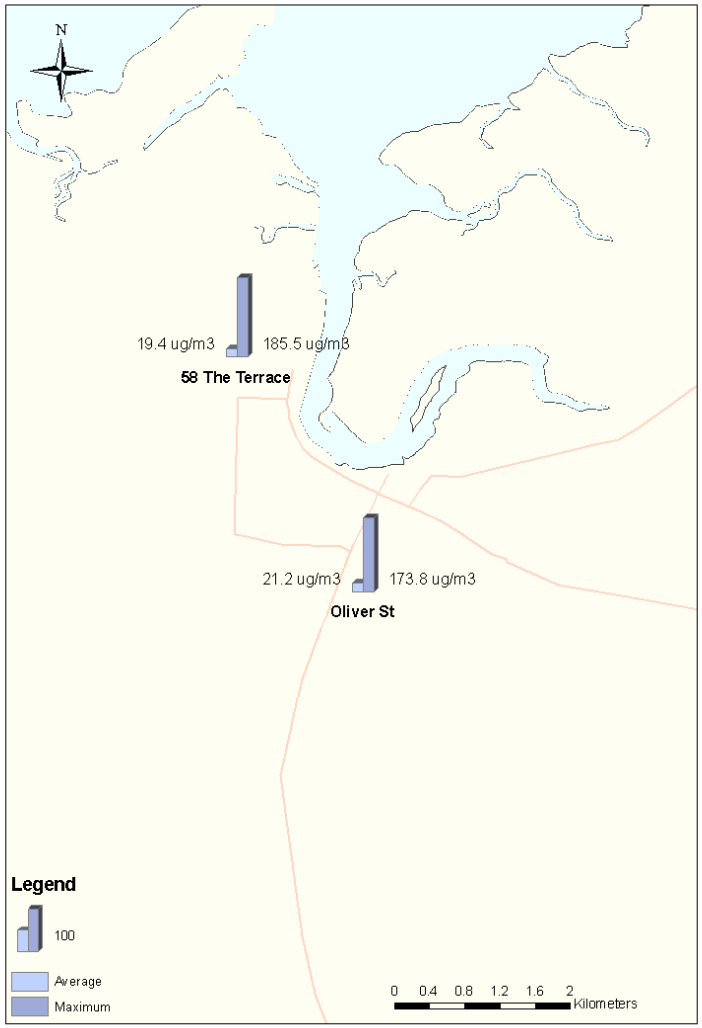

Figure 33 **24-hour PM_{10} annual average and maximum concentrations in the Pt Pirie airshed as measured by TEOMs**

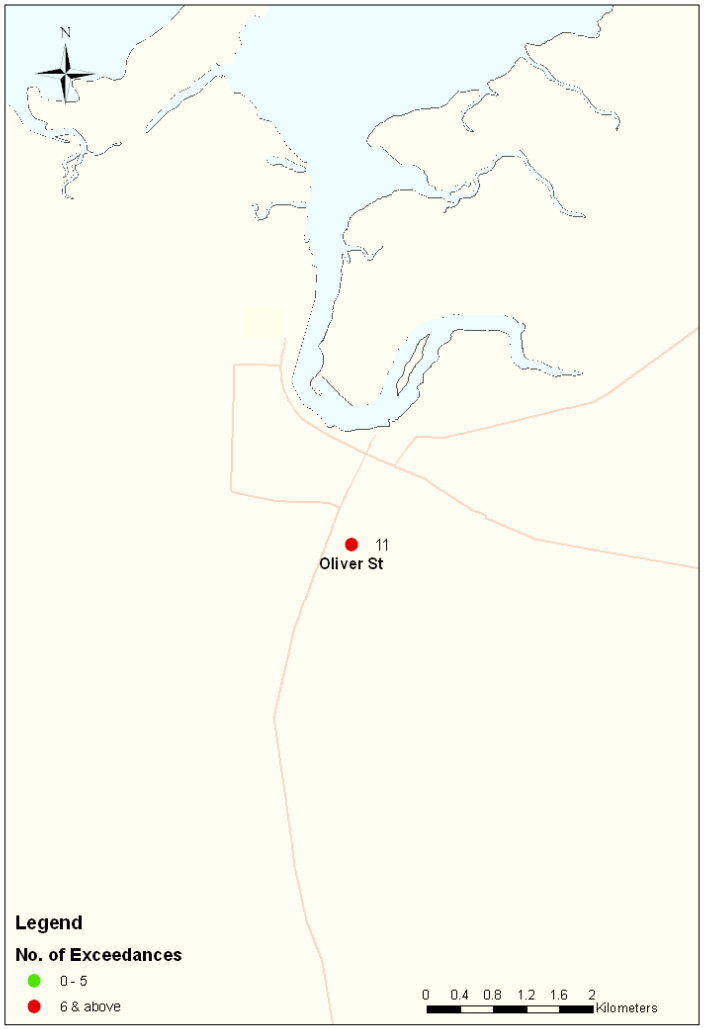

Figure 34 **Number of exceedances of the 24-hour PM_{10} NEPM standard (50.0 $\mu g/m^3$) in the Pt Pirie airshed as measured by TEOMs**

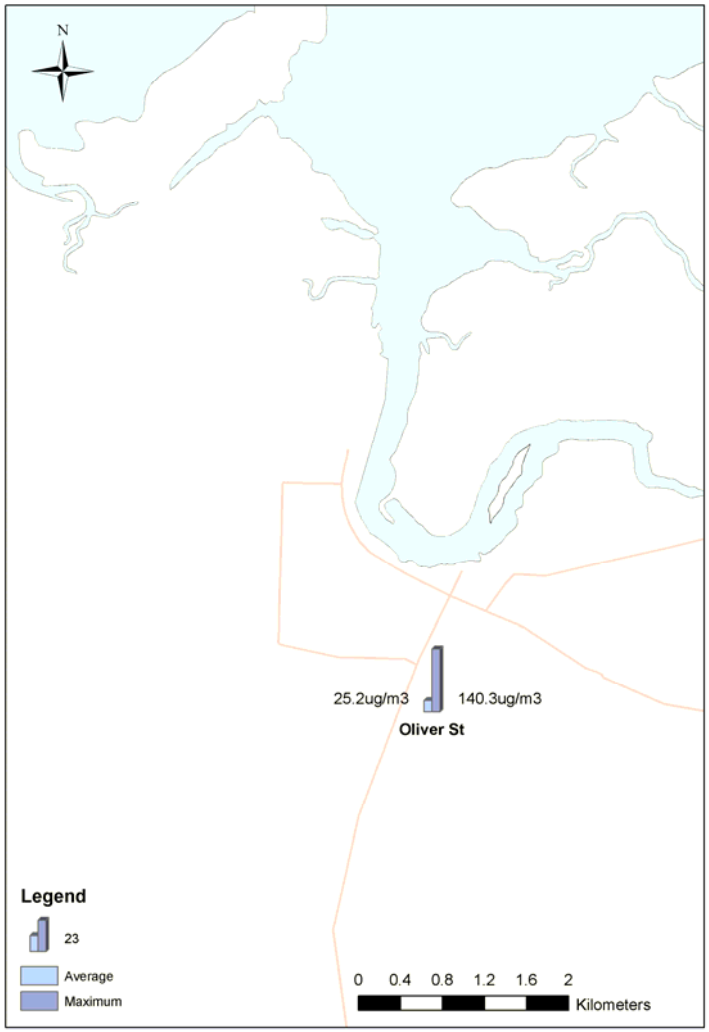

Figure 35 **24-hour PM_{10} annual average and maximum concentrations in the Pt Pirie airshed as measured by HVS**

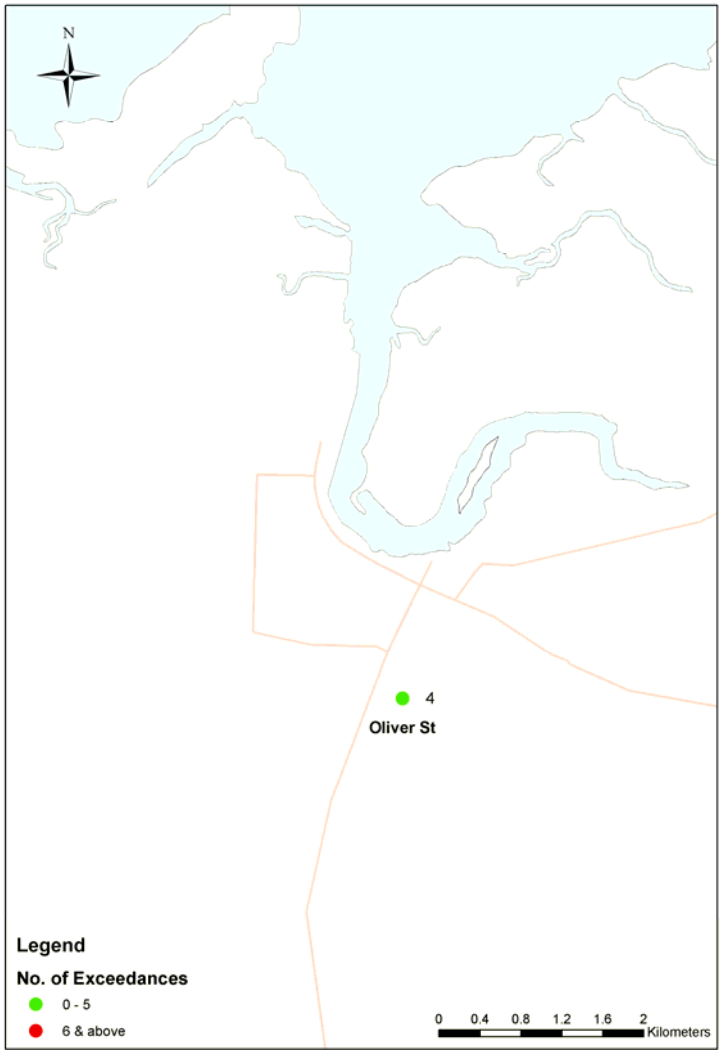

Figure 36 **Number of exceedances of the 24-hour PM_{10} NEPM standard (50.0 $\mu g/m^3$) in the Pt Pirie airshed as measured by HVS**

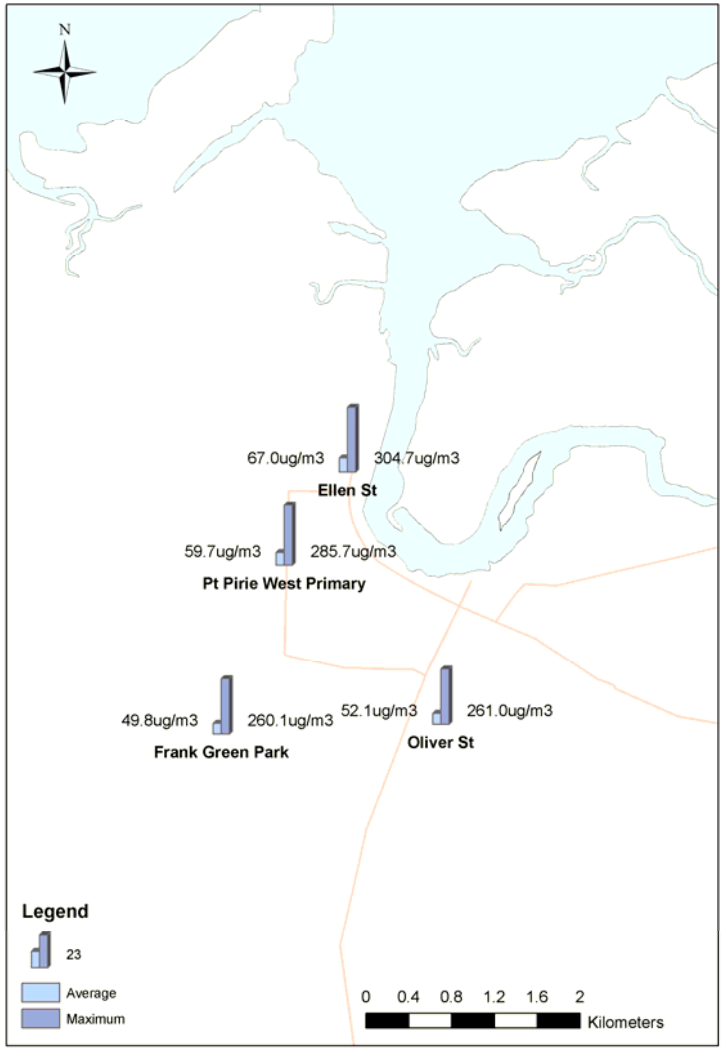

Figure 37 **24-hour TSP annual average and maximum concentrations in the Pt Pirie airshed as measured by HVS**

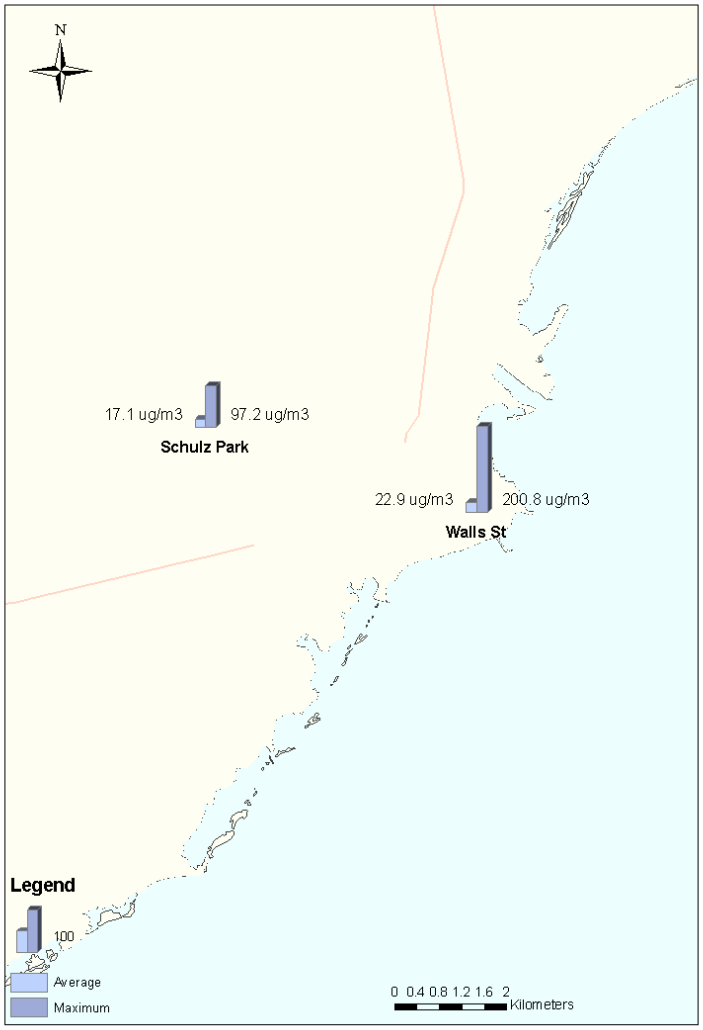

Figure 38 **24-hour PM_{10} annual average and maximum concentrations in the Whyalla airshed as measured by TEOMs**

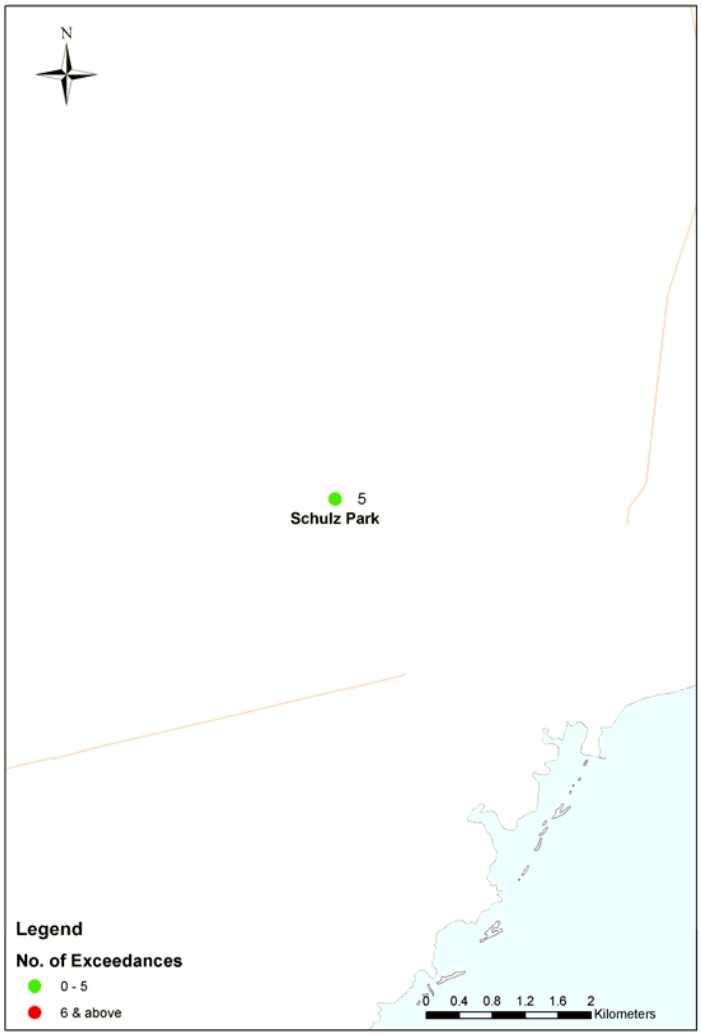

Figure 39 **Number of exceedences of the 24-hour PM_{10} NEPM standard (50.0 μg/m^3) in the Whyalla airshed as measured by TEOMs**

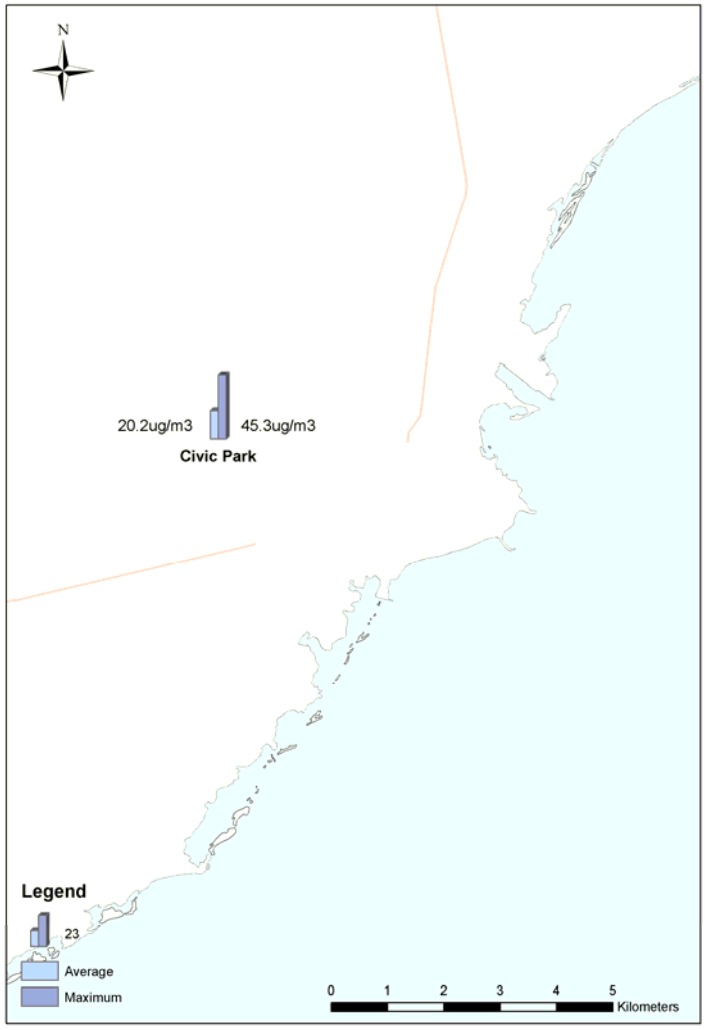

Figure 40 **24-hour PM_{10} annual average and maximum concentrations in the Whyalla airshed as measured by HVS**

Lead

Monitoring results for 2007

Port Pirie

PM_{10} Lead

The EPA monitored for PM_{10} lead at one site, Oliver St, during 2007. The average concentration measured at this site was 0.2 $\mu g/m^3$, with a maximum measured concentration of 1.4 $\mu g/m^3$ (Figure 42). There is currently no national standard for PM_{10} lead concentrations in Australia. Further information on PM_{10} lead concentrations in Pt Pirie can be found in Table 11 in Appendix 1.

TSP Lead

TSP lead was monitored at four sites, Oliver St, Frank Green Park, Pt Pirie West Primary and Ellen St, across Pt Pirie during 2007. The annual average concentrations at these sites ranged from 0.2 $\mu g/m^3$ at Frank Green Park through to 2.4 $\mu g/m^3$ at Ellen St, with Pt Pirie West Primary and Oliver St measuring 0.4 $\mu g/m^3$ and 0.5 $\mu g/m^3$ respectively (Figure 43). The annual Australian standard for TSP lead in Australia is 0.5$\mu g/m^3$. While the Ellen St site may have measured a higher annual lead concentration than allowed by the NEPM, the site is located along the boundary of the lead smelter and because of this, the NEPM standard does not apply to this site. Further information on TSP lead concentrations in Pt Pirie can be found in Table 13 in Appendix 1.

Changes in lead concentrations over time

The change in lead concentrations at the four sites in Pt Pirie can be seen in Figure 41, which shows the annual 24-hour average 90th percentile lead concentrations at Oliver St (top left), Pt Pirie West Primary (top right), Frank Green Park (bottom left) and Ellen St (bottom right) between 1995 and 2007.

The annual average concentrations at each of these sites are highly variable.

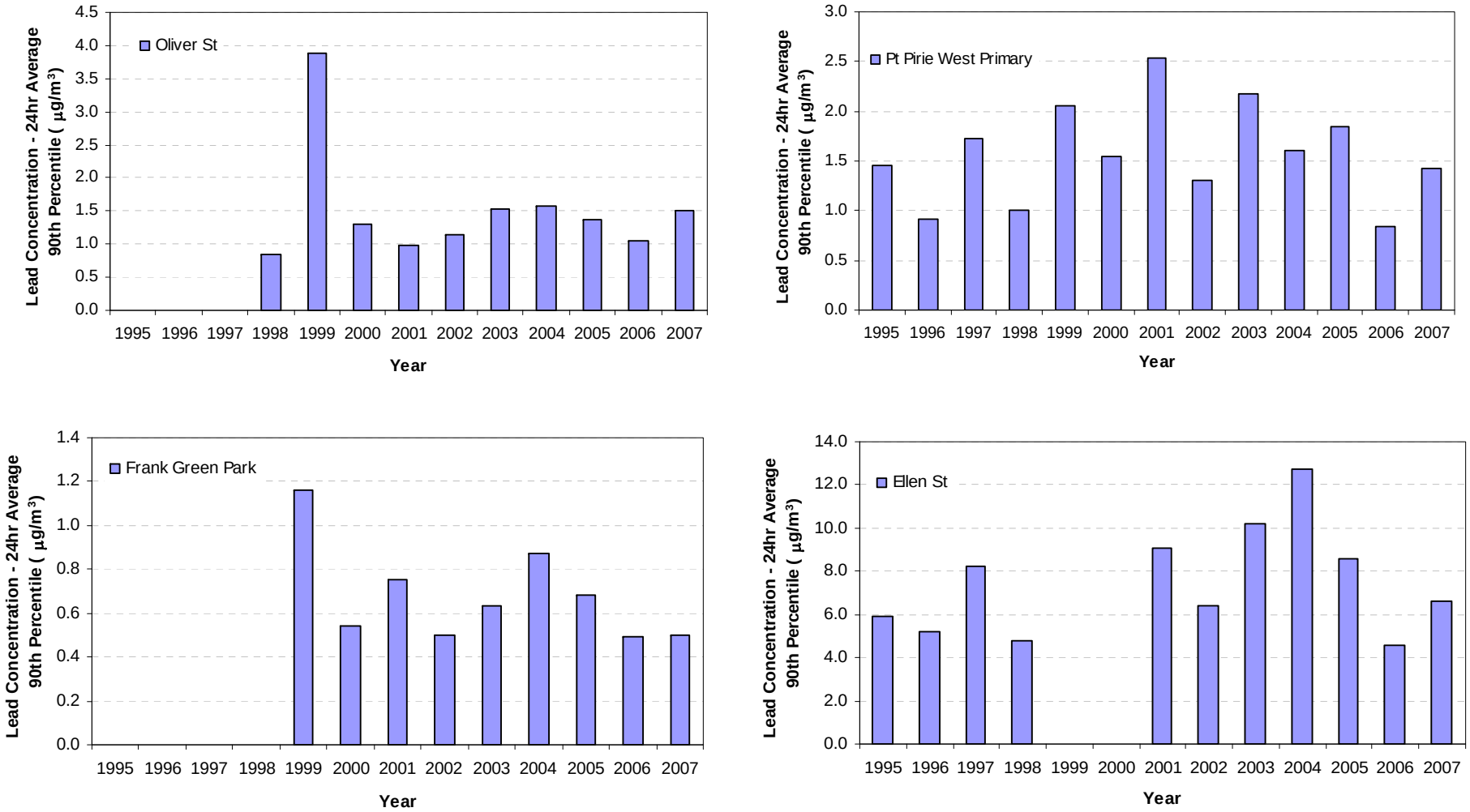

Figure 41 **The 24-hour average 90th percentile for Total Solid Particulate (TSP) lead at sites in Port Pirie between 1995 and 2007**

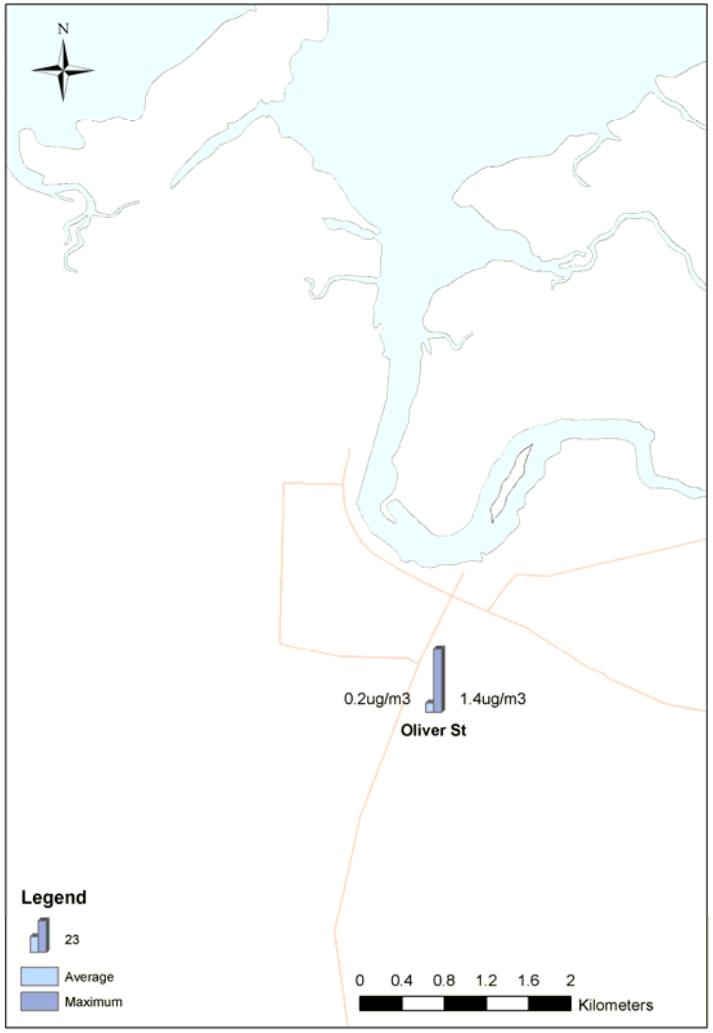

Figure 42 **24-hour PM_{10} lead annual average and maximum concentrations in the Pt Pirie airshed as measured by HVS**

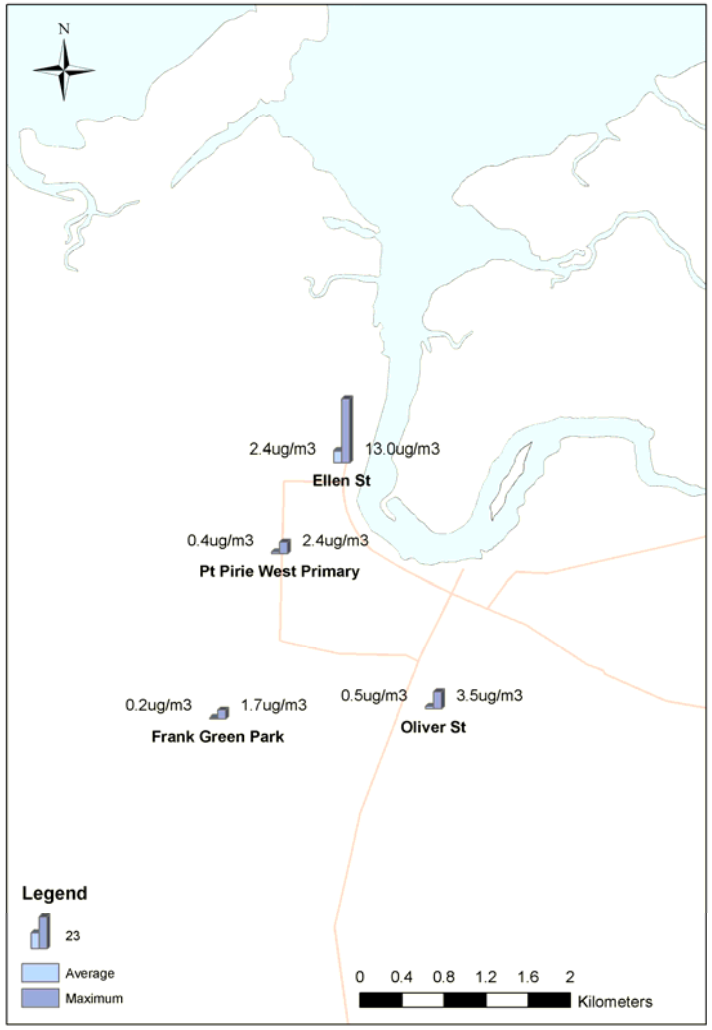

Figure 43 **24-hour TSP lead annual average and maximum concentrations in the Pt Pirie airshed as measured by HVS**

Sulfur dioxide

Monitoring results for 2007

Port Pirie

Monitoring for sulfur dioxide was only conducted at the Pt Pirie Oliver St site in regional areas in 2007.

The results of this monitoring found that the 1-hour NEPM standard was exceeded on 29 occasions in 2007 (Figure 46), where the maximum 1-hour concentration measured was 0.594 ppm (Figure 45). This is almost three times the 1-hour NEPM standard of 0.2 ppm. The average 1-hour concentration at this site for 2007 was 0.009 ppm. This number of exceedences was well above the NEPM goal of no more than one exceedence per year.

The average 24-hour sulfur dioxide concentration for 2007 was found to be 0.009 ppm, with a maximum 24-hour average concentration of 0.061 ppm (Figure 47). These concentrations are below the 24-hour NEPM standard of 0.08 ppm. Further information on sulfur dioxide concentrations in Pt Pirie can be found in Tables 4 and 5 in Appendix 1.

Changes in sulfur dioxide concentrations over time

The change in sulfur dioxide concentrations in Pt Pirie can be seen in Figure 44 below, which shows the annual 1-hour average 90th percentile sulfur dioxide concentrations at Oliver St between 2002 and 2007.

The annual average concentrations at this site are highly variable.

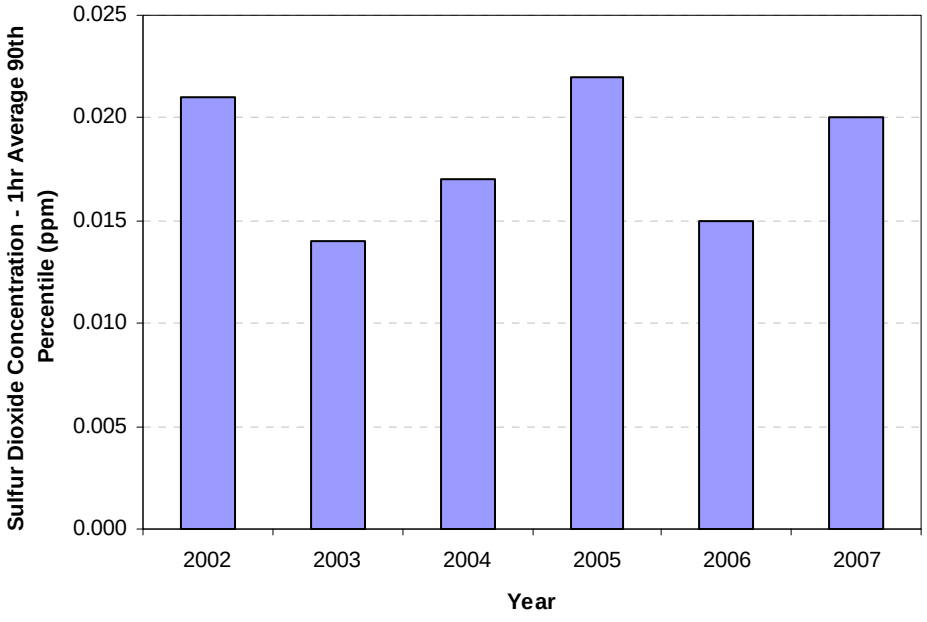

Figure 44 **The 1-hour average 90th percentile for sulfur dioxide at the Pt Pirie Oliver St site between 2002 and 2007**

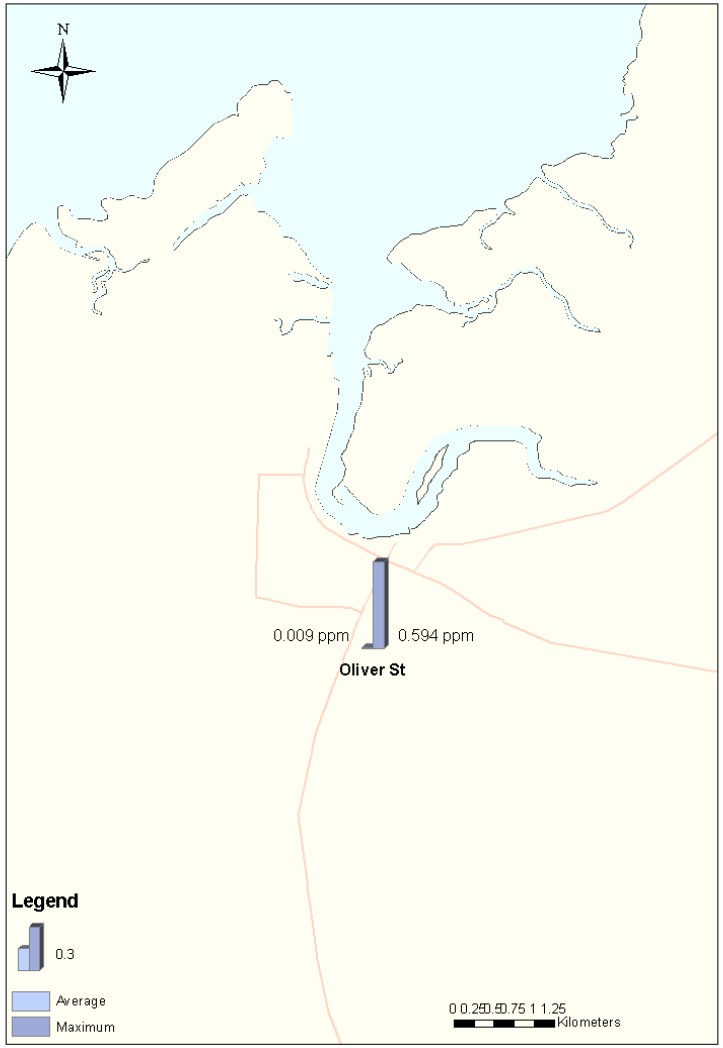

Figure 45 **1-hour sulfur dioxide annual average and maximum concentrations in the Pt Pirie airshed**

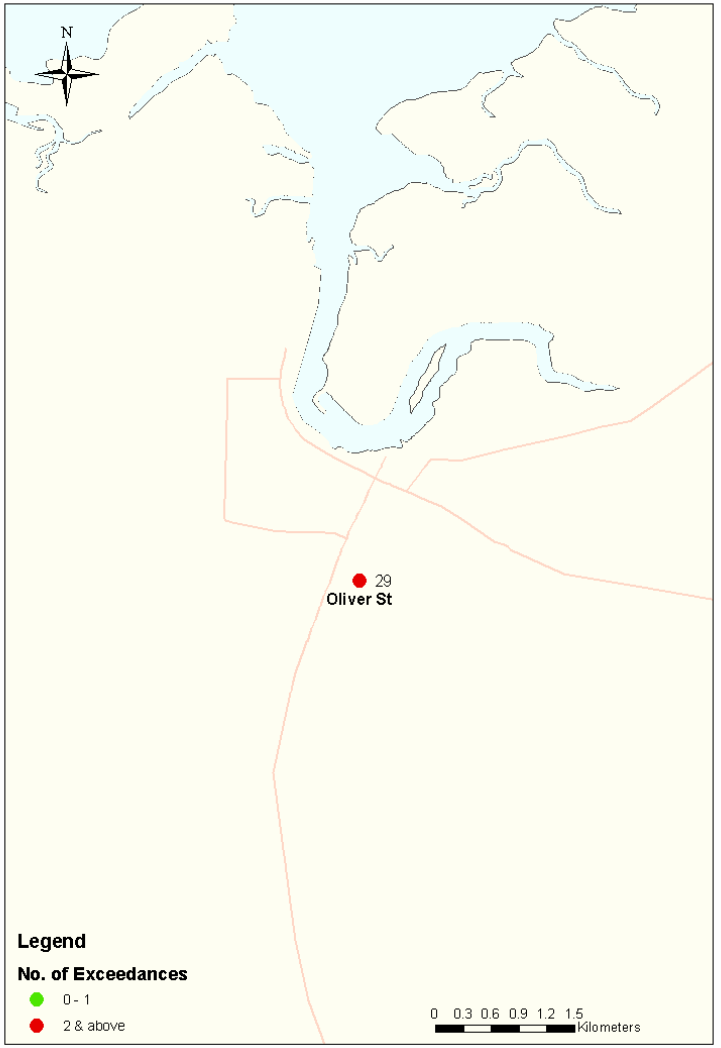

Figure 46 **Number of exceedences of the 1-hour sulfur dioxide NEPM standard (0.20 ppm) in the Pt Pirie airshed**

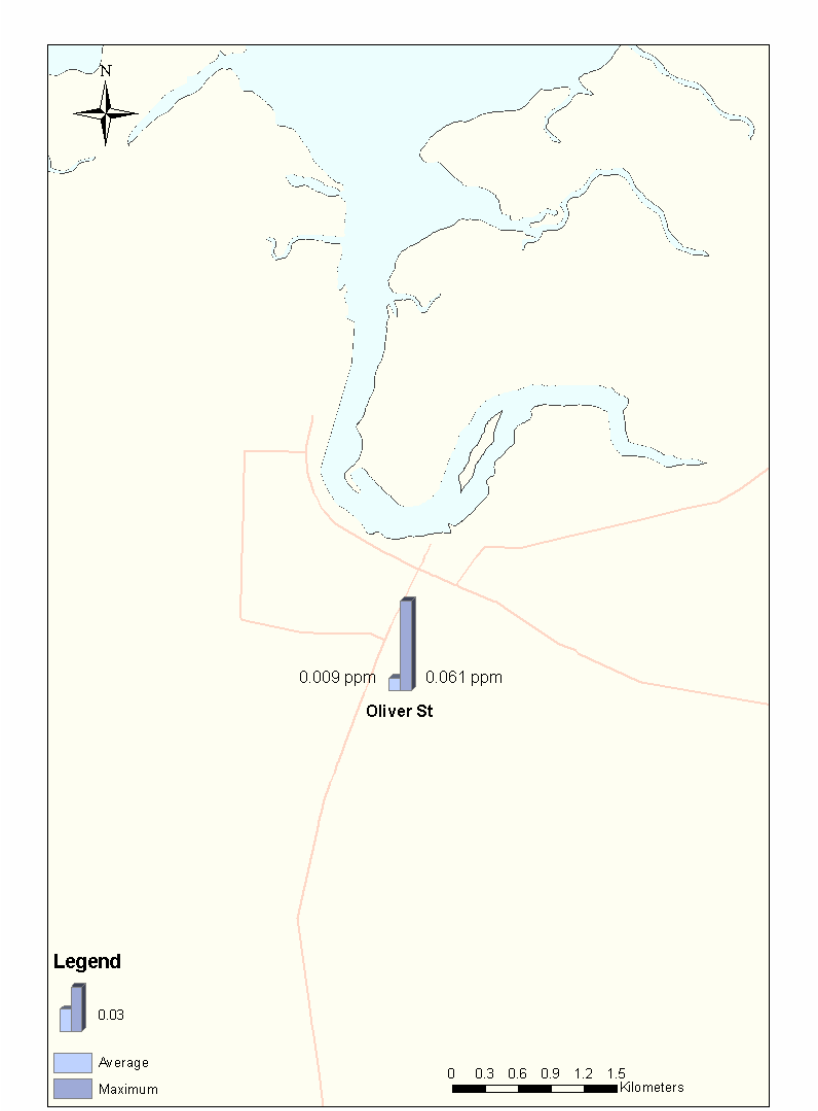

Figure 47 **24-hour sulfur dioxide annual average and maximum concentrations in the Pt Pirie airshed**

WHAT IS BEING DONE ABOUT AIR QUALITY ISSUES IN SOUTH AUSTRALIA?

Throughout 2007, the EPA was involved in a number of programs to improve the air quality in South Australia.

AirWatch

In mid-2007, the EPA undertook a review of the AirWatch schools program to provide recommendations on how the program can be made more attractive and relevant to school communities.

In developing the recommendations, interviews were conducted with:

- other environmental education program educators
- teachers
- Department of Education and Children's Services
- EPA Air and Noise Branch members.

Information was also gathered from AirWatch programs in other states.

Results from the review found that schools were keen for AirWatch to continue and offered various suggestions to improve the delivery of the program. Furthermore, investigations into other environmental education programs and emerging concepts regarding sustainability education have led to the proposed whole-school approach to delivering AirWatch in the future.

Recommendations of this review were developed in light of this proposed new delivery approach, while also taking into consideration the wider goals of the Air and Noise Branch, and the impending development of an Air Quality Management Strategy.

Further information on AirWatch can be found on the EPA website at <www.epa.sa.gov.au/involved.html>.

SmokeWatch

From late June to the end September 2007, the EPA delivered Part 2 of the SmokeWatch behaviour change pilot program in the Adelaide Hills Council (AHC) area. However, in 2007 the SmokeWatch program concentrated behaviour change strategies predominantly in and around the Woodside township, in contrast to the 2006 program where emphasis was placed across the Adelaide Hills Council (AHC) area. The aim of the change of focus was to allow the EPA to evaluate if behaviour change strategies were effective in reducing wood smoke pollution in a particular area, ie Woodside.

Consistent with the 2006 program, a 'SmokeWatch Challenge' was promoted to residents to encourage the adoption of efficient wood heater practices. Woodside Primary School was also engaged to increase student understanding of wood smoke issues with the aim that these messages would be filtered through to school families.

Additional emphasis was placed on engaging the community through visits to businesses in and around the AHC area and a mail-out to all residents in and around the Woodside area to encourage support for the program.

Air quality monitoring was repeated in the township of Woodside to support the behaviour change program, evaluate any discernible change in the air quality and to determine a smoke 'signature' which may be used in other environments.

At the conclusion of the program, a telephone survey was also conducted to evaluate the success of the SmokeWatch program in facilitating behaviour change.

The survey found that there was an increase in the use of efficient wood heater practices among residents in the AHC area since the inception of the SmokeWatch program in 2006. However, despite this, residents still remain generally apathetic to the negative impact of wood smoke in the AHC area.

These findings suggest that the detection of wood smoke only during cold and still nights (ie when residents were most likely to be inside) is generally not recognised by residents, leading to the perception that there is not a wood smoke problem and therefore not negatively impacting on them.

The report on this project can be found on the EPA website at <www.epa.sa.gov.au/pdfs/smokewatch.pdf>.

Guidelines for Separation Distances

In August 2000 the EPA published *Guidelines for Separation Distances* consultation draft. The draft guidelines gave a recommended separation distance for a range of new or expanding industries to ensure that environmental nuisance was minimised at neighbouring sensitive receptors.

Taking into account feedback received as part of consultation on the draft in 2000, and changes to developments referred to the EPA, the EPA has finalised the document in 2007. The input from councils, planners and others have been particularly appreciated.

The guidelines aim to assist businesses locate their operations at an appropriate distance away from neighbouring dwellings. Furthermore, developers can propose smaller separation distances by demonstrating (via date/evidence) that a smaller distance is still appropriate.

The guidelines, although in published form, are still subject to alteration and/or addition (the guidelines will change when new information is brought to light).

The EPA has consulted with stakeholders, including councils and the LGA, to develop the guidelines in a transparent manner and they are already being successfully used by stakeholders.

The document is available at <www.epa.sa.gov.au/pdfs/sepguidepcd.pdf>.

Airshed computer modelling and inventory development

The EPA has commenced a program developing fine scale air emissions inventories for South Australia, commencing with a comprehensive motor vehicle emissions inventory for metropolitan Adelaide, due for completion in 2008. An enhanced motor vehicle inventory will provide a clearer indication of the contribution of motor vehicles to air pollution in South Australia. Coupling the inventory with dispersion models will also allow assessment of air pollution around roadways (EPA 2008a).

Supporting national work

The EPA has continued to support the EPHC/NEPC process by contributing to committees and working groups at all levels, including the current review of the Air NEPM, which is projected for completion in early 2009 (EPA 2008a).

Supporting industry in pollution reductions initiatives

Dust at Whyalla

The EPA continues to supply real time PM_{10} monitoring data to the steelworks at Whyalla. This information is being made available to OneSteel so that the company can monitor the impact of operations on the Whyalla community in real time (EPA 2008a). The EPA has also supported the development and implementation of OneSteel's Project Magnet, which allows the steel works to use magnetite instead of haematite ore in its steel production (OneSteel 2004). For more information on Project Magnet, see <www.onesteel.com/images/db_images/annualreports/ASX%20Announcement%20Project%20Magnet%2017%20Aug%202004.pdf>.

Lead at Port Pirie

An ambitious program was launched in February 2006 to reduce blood lead levels in children with the goal of ensuring that at least 95% of children aged between 0–4 years residing in Port Pirie have blood lead levels below 10 ug/dL by the end of 2010. Known as 'tenby10', the program involves a collaborative approach between Nyrstar, EPA, SA Department of Health and the Port Pirie Regional Council. Nyrstar has committed $56 million to the achievement of the tenby10 goal (EPA 2008a).

Results of ambient air monitoring conducted by the EPA indicate that lead in air levels have continued to fall over the past 12 months, maintaining a trend which has been observed since 2005. This result is supported by ambient monitoring undertaken by the smelter operators within the township. Blood lead levels have also fallen significantly during the same period (Department of Health 2008, EPA 2008a).

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GLOSSARY

Average	The sum of all the values in a set of data, divided by the number of values in the set. The average is also known as the arithmetic mean.
Data recovery	For hourly data, the data recovery rate is the number of hours when valid data was collected expressed as a percentage of the total number of hours when monitoring was conducted. When the data is a rolling average covering a longer averaging period (4 or 8 hours), the data recovery rate is the number of valid data points expressed as a percentage of the total number of hours when monitoring was conducted.
Maximum	The largest value in a set of data.
90th percentile	The 90th percentile is used to determine the distribution of data over a particular time frame. For example, in 2007, the 90th percentile for 1-hour ozone at Northfield was 0.031 ppm. This means that 90% of all measurement of ozone taken throughout 2007 were lower than or equal to 0.031 ppm and 10% of measurements were higher (EPA 2004).

APPENDIX 1 DATA TABLES

Table 1 1-hour averaged ozone concentrations from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)	No. of days NEPM std exceeded	Average (ppm)	Maximum (ppm)
Christie Downs	97	0	0.022	0.074
Elizabeth	98	0	0.022	0.082
Kensington	96	0	0.023	0.076
Netley	97	0	0.018	0.077
Northfield	97	0	0.020	0.069

Table 2 4-hour rolling average ozone concentrations from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)	No. of days NEPM std exceeded	Average (ppm)	Maximum (ppm)
Christie Downs	98	0	0.022	0.060
Elizabeth	100	0	0.022	0.078
Kensington	98	0	0.023	0.063
Netley	100	0	0.018	0.070
Northfield	100	0	0.020	0.059

Table 3 1-hour average nitrogen dioxide concentrations from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)	No. of days NEPM std exceeded	Average (ppm)	Maximum (ppm)
Christie Downs	97	0	0.005	0.038
Elizabeth	94	0	0.003	0.039
Kensington	94	0	0.005	0.035
Netley	97	0	0.009	0.040
Northfield	96	0	0.006	0.037

Table 4 1-hour average sulfur dioxide concentrations from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)	No. of days NEPM std exceeded	Average (ppm)	Maximum (ppm)
Northfield	96	0	0.000	0.008
Oliver St	97	29	0.009	0.594

Table 5 24-hour average sulfur dioxide concentrations from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)	No. of days NEPM std exceeded	Average (ppm)	Maximum (ppm)
Northfield	99	0	0.000	0.002
Oliver St	99	0	0.009	0.061

Table 6 8-hour rolling average carbon monoxide concentrations from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)	No. of days NEPM std exceeded	Average (ppm)	Maximum (ppm)
Elizabeth	100	0	0.0	0.6
Tandanya *	87	0	0.6	2.2

* Monitoring at Tandanya ceased on the 28 March 2007. The data recovery rate is calculated for the period of operation, not the full calendar year.

Table 7 24-hour average particulate matter ($PM_{2.5}$) concentrations from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)	No. of days NEPM level exceeded	Average ($\mu g/m^3$)	Maximum ($\mu g/m^3$)
Netley	99	0	7.9	21.9

Table 8 24-hour average particulate matter (PM_{10}) concentrations via TEOM from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)	No. of days NEPM std exceeded	Average ($\mu g/m^3$)	Maximum ($\mu g/m^3$)
Christie Downs	93	3	17.3	70.5
Elizabeth	97	3	16.0	74.9
Kensington	92	1	15.3	51.1
Le Fevre Primary	96	5	20.9	72.6
Netley	95	11	20.4	125.9
Oliver St	98	11	21.2	173.8
58 The Terrace*	88	NA	19.4	185.5

Monitoring site	Data recovery (%)	No. of days NEPM std exceeded	Average (μg/m^3)	Maximum (μg/m^3)
Walls St[†]	96	NA	22.9	200.8
Schulz Park[‡]	97	5	17.1	97.2

[*] No exceedences are reported at the 58 The Terrace site as it is not an Air NEPM compliance site and therefore can not be compared to the Air NEPM standards. See table 14 for more details.

[†] No exceedences are reported at the Walls St site as it is not an Air NEPM compliance site and therefore can not be compared to the Air NEPM standards. See table 14 for more details.

[‡] Monitoring at Schulz Park commenced on 27 April 2007. The data recovery rate is calculated for the period of operation, not the full calendar year.

Table 9 24-hour average particulate matter (PM_{10}) concentrations via HVS from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)[*]	No. of days NEPM std exceeded	Average (μg/m^3)	Maximum (μg/m^3)
Oliver St	97	4	25.2	140.3
Civic Park[†]	92	0	20.2	45.3
Pt Augusta[‡]	96	3	27.9	70.9

[*] Monitoring at Pt Pirie and Pt Augusta is conducted on a one-day-in-six basis, and monitoring at Whyalla is conducted on a one-day-in-three basis. The data recovery rate is calculated taking this into account.

[†] Monitoring at Civic Park ceased on 29 May 2007. The data recovery rate is calculated for the period of operation, not the full calendar year.

[‡] Monitoring at Pt Augusta ceased on 29 May 2007. The data recovery rate is calculated for the period of operation, not the full calendar year.

Table 10 24-hour average lead (PM_{10}) concentrations via HVS from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)*	No. of days NEPM std exceeded	Average (μg/m^3)	Maximum (μg/m^3)
Oliver St	97	NA	0.2	1.4

* Monitoring at Pt Pirie is conducted on a one day in six basis. The data recovery rate is calculated taking this into account.

Table 11 24-hour average particulate matter (TSP) concentrations via HVS from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)*	No. of days NEPM std exceeded	Average (μg/m3)	Maximum (μg/ m^3)
Oliver St	100	NA	52.1	261.0
Pt Pirie West Primary	100	NA	59.7	285.7
Frank Green Park	98	NA	49.8	260.1
Ellen St	100	NA	67.0	304.7

* Monitoring at Pt Pirie is conducted on a one-day-in-six basis. The data recovery rate is calculated taking this into account.

Table 12 24 hour average lead (TSP) concentrations via HVS from EPA air monitoring sites for 2007

Monitoring site	Data recovery (%)*	NEPM std exceeded	Average (μg/m^3)	Maximum (μg/m^3)
Oliver St	100	Yes	0.5	3.5
Pt Pirie West Primary	100	NA	0.4	2.4
Frank Green Park	98	No	0.2	1.7
Ellen St	100	NA	2.4	13.0

* Monitoring at Pt Pirie is conducted on a one-day-in-six basis. The data recovery rate is calculated taking this into account.

Table 13 The number of occurrences of 24-hour average PM_{10} concentrations (via TEOM) measuring above 50.0 μg/m^3 at non-Air NEPM sites

Monitoring site	Number of occurrences
58 The Terrace	11
Walls St	25

APPENDIX 2 METADATA

Air quality standards and guidelines

As listed in National Environment Protection (Ambient Air Quality) Measure and accompanying technical papers

Sampling locations

Conducted on ambient air at each location under the conditions present at the time of testing as outlined in the Ambient Monitoring Plan for South Australia (SA DEH 2001) <www.epa.sa.gov.au/pdfs/airnepm.pdf>.

Additional monitoring sites and details not included in the Ambient Monitoring Plan for South Australia:

Christie Downs	Sabina Crescent, Christie Downs
	Site operation between 24 March 2006 and current
	Monitoring ozone, nitrogen oxides and PM_{10} TEOM
Le Fevre Primary	Le Fevre Primary School, Shorney St, Birkenhead
	Site operation between 21 June 2005 and current
	Monitoring PM_{10} TEOM
Tandanya	Tandanya Building, 253 Grenfell St, Adelaide
	Site operational between 25 September 2006 and 28 March 2007
	Monitored carbon monoxide
58 The Terrace	58 The Terrace, Pt Pirie West
	Site operational between 24 August 2005 to current
	Monitoring PM_{10} TEOM on behalf of SA DOH
Walls St	Walls St, Whyalla
	Site operation between 25 July 2003 to current
	Monitoring PM_{10} TEOM
Schulz Park	Schulz Park, Whyalla Norrie
	Site operation between 24 April 2007 to current
	Monitoring PM_{10} TEOM

Laboratory

EPA Air Quality Laboratory, 310 Richmond Rd, Netley, SA 5037

Sampling and analysis methods

Carbon monoxide	AS3850.7.1–1992	U_{95}= ±1.46 ppm @ 40 ppm
Nitrogen oxides	AS3580.5.1–1993	U_{95}= ±0.050 ppm @ 0.400 ppm
Ozone	AS3580.6.1–1993	U_{95}= ±0.005 ppm @ 0.100 ppm
Sulfur dioxide	AS3580.4.1–1990	U_{95}= ±0.011 ppm @ 0.200 ppm
Lead*		U_{95}= ±10 μg/m^3 @ 100 μg/m^3
PM_{10} TEOM	AS3580.9.8–2001	U_{95}= ±1.5 μg/m^3 for 1-hour average
PM_{10} HVS	AS3580.9.6–2003	U_{95}= ±7 μg/m^3 @ 100 μg/m^3
TSP HVS	AS3580.9.3–2003	U_{95}= ±9 μg/m^3 @ 100 μg/m^3

* Lead analysis conducted by Queensland Health Scientific Services. NATA accredited laboratory number 41.

Uncertainty of measurement

The expanded uncertainties of measurements (U_{95}) quoted above are at a confidence level of 95% with a coverage factor of 2. The values shown do not include any estimate of the effects associated with the sampling location.

APPENDIX 3 AUSTRALIAN CAPITAL CITIES DATA

The data used to calculate the values for each of the capital cities were sourced from annual compliance reports supplied by each jurisdiction to the National Environment Protection Council (NEPC) as required under the NEPM.

Only sites that are located within each capital city was used (see Table 7 for the names of the sites used), with the annual maximum for each pollutant and reported averaging period averaged together to give a general 'capital city' value. The annual maximum was chosen as the statistic to use for this comparison as it was reported for every pollutant and averaging period in the compliance reports.

Table 14 Sites used to produce averages for each of the Australian capital cities

Capital city	Sites included in average
Adelaide	Christie Downs
	Elizabeth
	Kensington
	Netley
	Northfield
	Tandanya
Brisbane	Deception Bay
	Rocklea
	Springwood
	Woolloongabba
Canberra	Monash
Darwin	Casurina
Hobart	New Town
Melbourne	Alphington
	Altona North
	Brighton
	Footscray
	Richmond

Capital city	Sites included in average
Perth	Caversham
	Duncraig
	Gosnells
	Hope Valley
	Queen's Building
	South Lake
	Swanbourne
	Wattleup
Sydney	Bringelly
	Chullora
	Liverpool
	Macarthur
	Oakdale
	Prospect
	Richmond
	Rozelle
	St Marys