South Australia's air quality 2008

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Disclaimer

This publication is a guide only and does not necessarily provide adequate information in relation to every situation. This publication seeks to explain your possible obligations in a helpful and accessible way. In doing so, however, some detail may not be captured. It is important, therefore, that you seek information from the EPA itself regarding your possible obligations and, where appropriate, that you seek your own legal advice.

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Definitions and abbreviations

Air NEPM	National Environment Protection (Ambient Air Quality) Measure
AQI	Air quality index
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.
CO	carbon monoxide
Data recovery	The number of data points expressed as a percentage of the total number of data points possible for a given period of time.
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
NO_x	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)
Rolling or running averages	An average concentration over the averaging period (4 or 8 hours corresponding to 4- or 8-hour rolling periods) up to that data point. For example, the 8-hour average for 10 am includes data from 2 am to 10 am for the averaging calculation.
DoH	South Australian Department of Health
SO_2	sulfur dioxide
TEOM	tapered element oscillating microbalances, 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

Executive summary

The South Australian Environment Protection Authority (EPA) monitored the air quality around regional South Australia (in Port Pirie and Whyalla), and at various locations in Adelaide in 2008.

This report provides a summary of the air quality monitoring conducted and also examines some indicative trend analysis covering recent years.

Some important outcomes of the 2008 monitoring are as follows:

- There were no exceedences of the National Environment Protection (Ambient Air Quality) Measure (Air NEPM) standards at any of the EPA monitoring sites in the Adelaide airshed for the pollutants: ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide.
- Ozone levels in Elizabeth are marginally below the 1-hour Air NEPM standard with the 4-hour standard being exceeded once at Elizabeth. It is of concern that the 1-hour standard could be easily exceeded given more favourable meteorological conditions and increase in precursor pollutants needed for ozone production.
- Particulate matter below 10 µm in size continues to be of concern in the Adelaide airshed with all five sites exceeding the Air NEPM standard on at least three occasions. The goal (of no more than five days per year above the standard) was also exceeded at Le Fevre Primary, with six days measured above the standard.
- Particulate matter below 10 µm in size continues to be an issue in the Port Pirie and Whyalla airsheds with the Air NEPM standard concentration and goal exceeded at all sites in both cities on numerous occasions.
- The sulfur dioxide 1-hour standard continues to be exceeded by significant amounts at Oliver Street in Port Pirie on numerous occasions.
- Lead continues to be an issue in Port Pirie as reflected in child blood lead levels (EPA 2007, SA Department of Health 2008) where one site in the town was found to be higher than the Air NEPM standard. The other sites were found to be at approximately 80% of the annual standard. Annual averages are below the NEPM standard (0.50 $\mu g/m^3$) and show a downward trend due to operational improvements by Nyrstar.
- Adelaide's air quality compares favourably with those measured in Australian capital cities and other cities around the world.

1 Introduction

The South Australian Government has conducted air quality monitoring in South Australia since the 1970s. The accumulation of long-term air quality data allows for assessment of trends despite daily and seasonal variations. Air quality monitoring is currently the responsibility of the South Australian Environment Protection Authority (EPA) and is conducted by the Air and Noise Branch.

The EPA conducted monitoring in regional South Australia at Port Pirie and Whyalla, and at various locations in Adelaide. Industry also undertakes their own ambient air monitoring at regional centres around South Australia, including as a condition of their licence. Industry data is not included in this report.

This report is a summary of the air quality monitoring conducted around South Australia in 2008 and also provides trend analysis for data from the previous few years (depending on data availability). Comparisons are also made with other Australian capital cities and cities around the world.

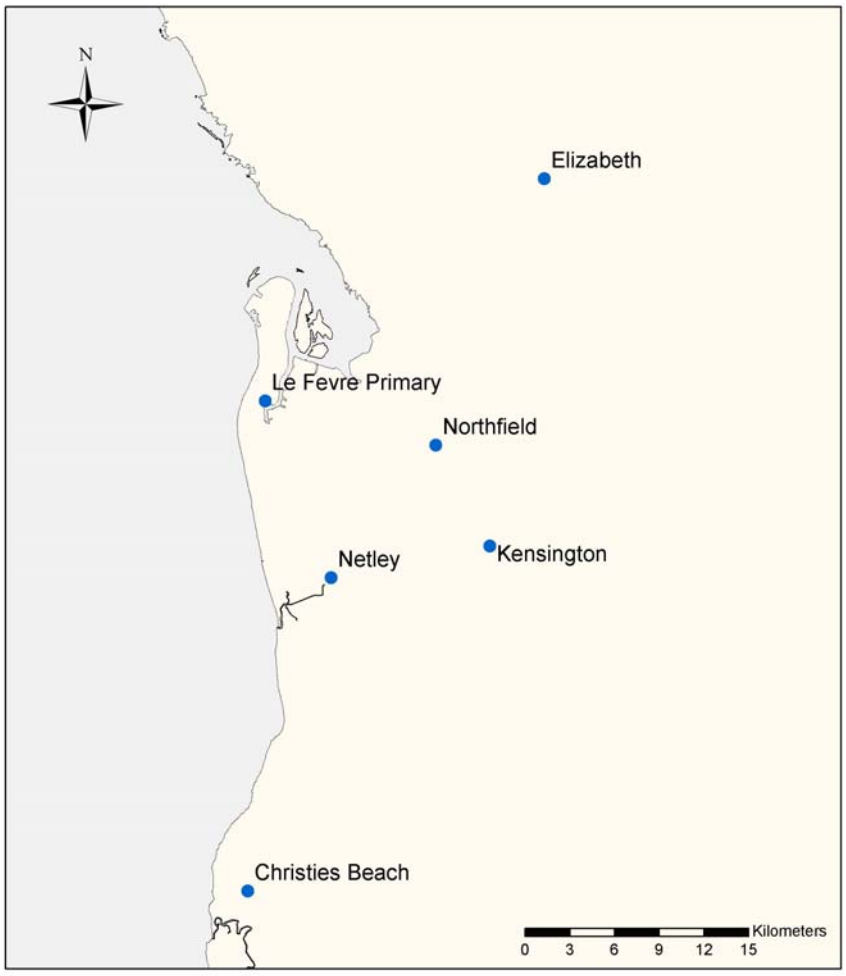

Figure 1 Locations of EPA monitoring sites around Adelaide

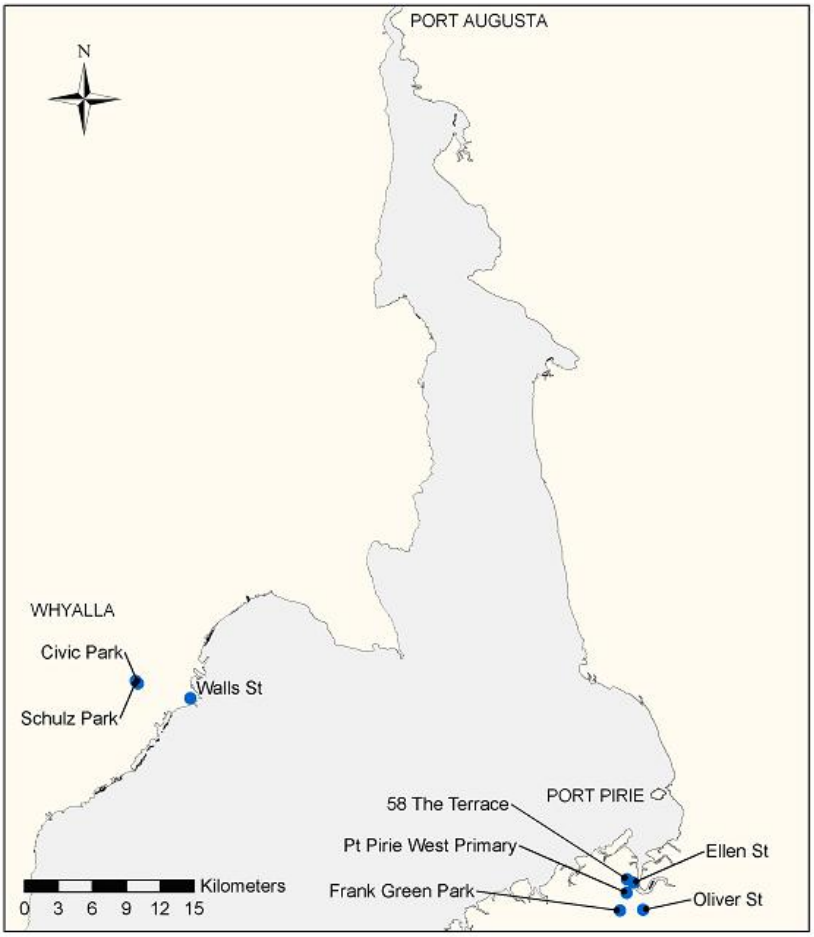

Figure 2 Locations of EPA monitoring sites in the Northern Spencer Gulf

2 National Environment Protection Measure on air quality

The National Environment Protection Council (NEPC) is a national statutory body with ministerial membership (state and federal). Its two primary functions are to make National Environment Protection Measures (NEPMs), and to assess and report on the implementation and effectiveness of the NEPMs by the jurisdictions.

The *Environment Protection Act 1993* adopts national measures as statutory legislation. Accordingly, the *National Environment Protection (Ambient Air Quality) Measure* (the Air NEPM) requires South Australia to meet certain obligations. The Air NEPM specifies standards and goals for the following seven air pollutants, although $PM_{2.5}$ is currently a reporting standard and not a compliance standard:

- ozone
- particulate matter as $PM_{2.5}$ and PM_{10}
- nitrogen dioxide
- sulfur dioxide
- carbon monoxide
- lead.

These pollutants were chosen by the NEPC based on several factors including their prevalence in the environment caused by industrial and domestic activity, and their adverse effects on human health if present for sufficient time and at high enough concentrations.

Pollutants such as $PM_{2.5}$ and PM_{10}, sulfur dioxide and carbon monoxide are called 'primary pollutants', because they are emitted directly into the air from industrial processes. In contrast, ozone is called a 'secondary pollutant', as it is not emitted directly, but is formed by chemical reactions in the atmosphere in the presence of sunlight. The haziness in polluted atmospheres that is known as 'photochemical smog' ('photo' = light + 'chemical') results from these reactions. Ozone, which is one of its main products, is a highly reactive chemical of a type known as 'photochemical oxidants'. Because of this, ozone is measured as an indicator of photochemical oxidants in the Air NEPM; that is, it is taken to represent all of this class of oxidants. Photochemical smog also produces very fine particles.

Nitrogen dioxide is interesting in that it is both a primary pollutant, which is toxic in its own right, and also a secondary pollutant, as it is both made by, and takes part in, the formation of photochemical smog. For this reason, it is often termed a *precursor pollutant* or simply *precursor*, meaning that it must be present for photochemical smog to occur. Other precursors include a wide range of organic (carbon-containing) chemicals from unburnt petrol, diesel and domestic fires, and other chemicals emitted by industries and vegetation.

All seven pollutants were measured at various locations in South Australia during 2008.

A statutory review of the performance of the Air NEPM was commenced in 2005 and the first discussion paper has been completed. The paper reviews the performance, structure and scope, functions and policy positions of the NEPM. Development of a second paper addressing health impacts of the pollutants, standards and goals and cost-benefit estimation is underway, with completion projected for early 2010.

3 National Pollutant Inventory

The National Pollutant Inventory (NPI) is a publicly available national database of estimated pollutant emissions of two types: industrial (point) source emissions and aggregated emissions released each year to the environment (to air, water and land). In the case of air pollutants, we speak of emissions into an airshed, which may be an area or a region such as a city or a town, where air pollution readily accumulates.

Aggregated emissions data means the combined estimates for emissions of pollutants from small sources such as motor vehicles, domestic heaters and gardening equipment, and smaller industries (industries such as dry cleaners) which are not required to report to the NPI.

Air emissions industry data is updated annually and aggregate air emissions data estimates (from non-industrial sources such as transport) nominally every five years.

There are currently 93 primary pollutants listed as NPI substances requiring reporting, of which six are also Air NEPM substances.

3.1 Particulate matter as PM_{10}

Particulate matter, by its very nature, varies in composition and size. Conventionally, particulate matter has been monitored in three different size classifications (often called fractions) based on known health effects. These particles are so small that we measure them in 'micrometres' (millionths of a metre), written as 'µm'. Size is also measured in a special way, as aerodynamic diameter, which tells us how deeply particles can enter into in the human nose, throat and lungs.

Particulate matter include:

- total suspended particles (TSP) – particles in this fraction may include both very fine particles and some which are relatively large, about 30–50µm aerodynamic diameter. In general, the larger particles are more a nuisance than a health effect, as they lodge in the nose and throat and are swallowed or expelled by coughing.
- PM_{10} – this fraction includes the smaller particles up to an aerodynamic diameter of 10 µm and also includes some very fine particles (see $PM_{2.5}$ below). The largest particles can enter the upper areas of the lungs.
- $PM_{2.5}$ – similarly this fraction includes very fine particles up to an aerodynamic diameter of 2.5 µm. They are especially common in emissions from combustion sources, such as motor vehicles (particularly diesel vehicles), domestic sources such as wood heaters and bushfires. Particles in this size range can enter the deep areas of the lungs, including the tiny air sacs, called 'alveoli'. Research around the world, including Adelaide, has shown that concentrations of these particles are strongly associated with lung and heart disease.

Particle pollution originates from a wide range of sources including:

- vehicle exhausts
- dusts and other particles stirred up from roadways by moving vehicles
- residential wood heaters and other domestic burning,
- industrial processes such as furnaces, boilers and other chemical works
- mining and ore processing
- chemical reactions in the air
- residential development.

Natural sources also contribute significantly to the amount of mineral dust (erosion), pollen, smoke (from bushfires) and sea salt from sea spray.

Based on industry and aggregate emissions data from the NPI, the relative contributing sources of particulate matter between Adelaide, Port Pirie, Whyalla and Mount Gambier (the airsheds chosen for comparison) vary significantly.

Figure 3, taken from the 2006–07 NPI database (which does not include natural emissions or agriculture as sources), shows that the Port Pirie and Whyalla airsheds are dominated by industrial emissions of particulates, which is not surprising given the size of the main industries within those two airsheds and their relatively small populations, Adelaide and Mount Gambier have a more even spread with domestic solid fuel burning, motor vehicles and roads contributing significantly. Mount Gambier also has a considerable contribution from fuel combustion where the sources do not trigger the NPI reporting threshold. This means that when using NPI data for comparison, care must be taken that sources are being compared in an equivalent manner.

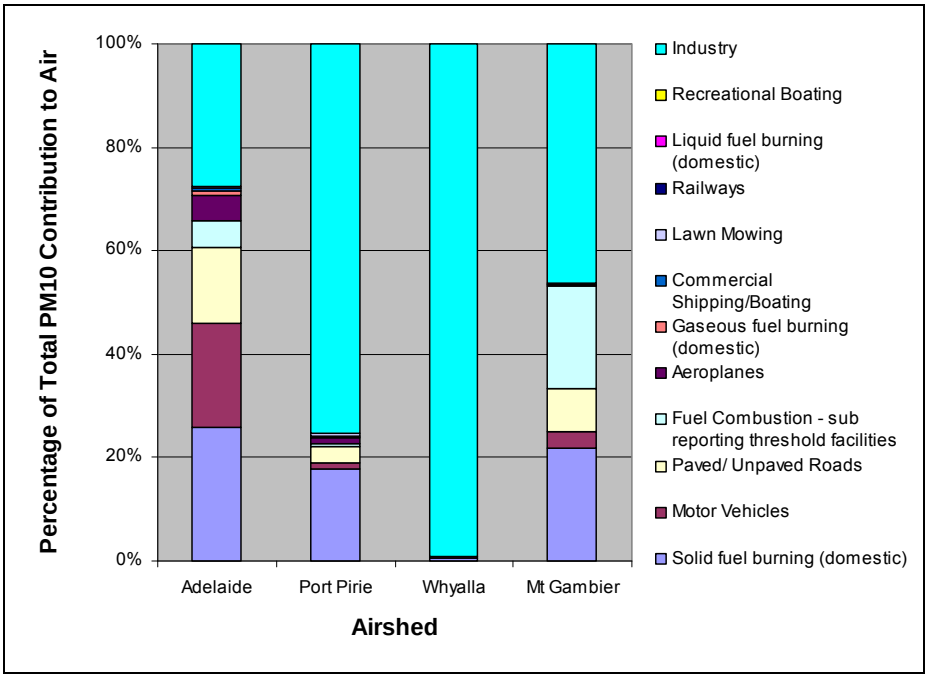

Figure 3 NPI emission estimates of particulate matter as PM_{10} sources in Adelaide, Port Pirie, Whyalla and Mount Gambier

As a comparison between airsheds, total PM_{10} contribution NPI estimates are:

- Adelaide – 3,746 tonnes
- Port Pirie – 324 tonnes
- Whyalla – 12,565 tonnes
- Mount Gambier – 423 tonnes.

3.2 Oxides of nitrogen

The Air NEPM lists nitrogen dioxide (NO_2) as an air pollutant requiring measurement against a standard and a goal. Although NO_2 is monitored around South Australia, the NPI pollutant list requires reporting for total oxides of nitrogen (NO_x) emissions. Therefore, the NPI only provides information on total oxides of nitrogen, both as aggregated and industrial emissions. In most circumstances total oxides of nitrogen can be taken as a mixture of nitrogen dioxide and nitric oxide (NO), as in general other oxides are in very small concentrations. However, the two forms strongly interact in the atmosphere and are key components of photochemical smog.

Total oxides of nitrogen are created in combustion processes, where nitrogen in the atmosphere is oxidised at high temperatures, and its most common sources are motor vehicle exhausts and industrial boilers.

Figure 4, taken from the 2006–07 NPI database, provides a comparison between the four chosen airsheds on total oxides of nitrogen emissions. Based on NPI data for the 2006–07 reporting year, Whyalla's main source of total oxides of

nitrogen is industrial emissions. Based on the most recent aggregate emission data (from 2002–03) the main contribution of NO_x to the Adelaide airshed is motor vehicles. Previous campaign monitoring in country areas showed relatively low nitrogen dioxide concentrations and it was not considered there was a need to continue this monitoring. This campaign monitoring is reported on the EPA website.

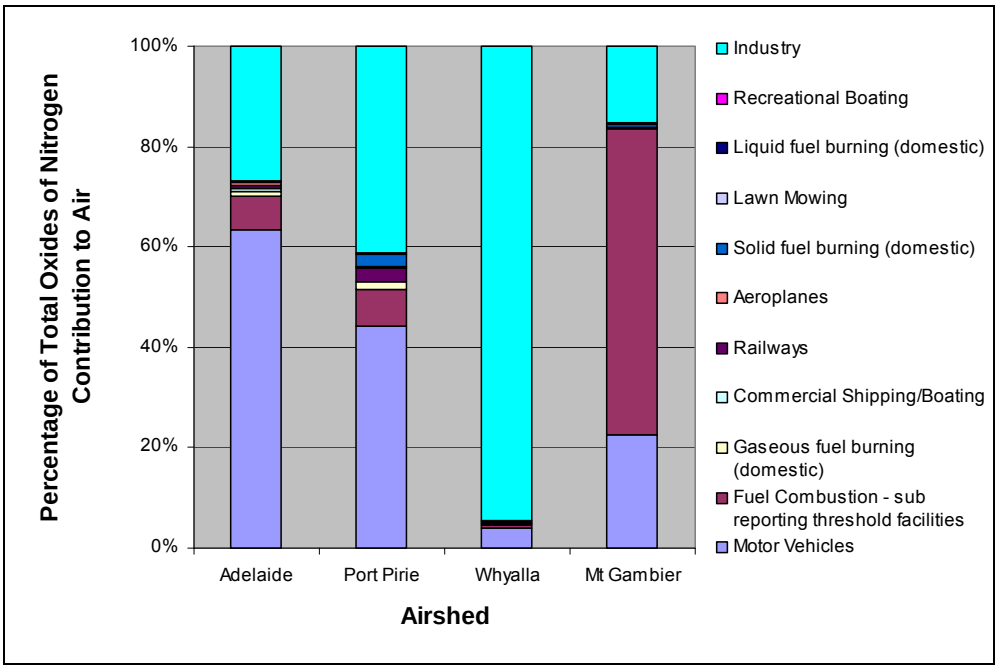

Figure 4 NPI emission estimates of oxides of nitrogen sources in Adelaide, Port Pirie, Whyalla and Mount Gambier

As a comparison between airsheds, total oxides of nitrogen contribution NPI estimates are:

- Adelaide – 38,426 tonnes
- Port Pirie – 270 tonnes
- Whyalla – 3,287 tonnes
- Mount Gambier – 1,821 tonnes.

Comparison of quantities of emissions of oxides of nitrogen released into each airshed shows that emissions from vehicles to the Adelaide airshed are significant and considerably greater than the three other airsheds in total.

3.3 Sulfur dioxide

Sulfur dioxide (SO_2) is an acidic gas created by burning sulfur-containing materials, including fuels that contain sulfur compounds. Most petroleum fuels contain some sulfur, although stringent limits are now in place in Australia on the level of sulfur allowed in fuels. Sulfur dioxide may also be emitted from works producing sulfuric acid.

Based on NPI industrial and aggregate emission data, sulfur dioxide sources vary significantly as can be seen in Figure 5, where data are taken from the 2006–07 database. The Adelaide and Mount Gambier airsheds, while still having a significant contribution from industrial sources, also have major contributions from motor vehicles, while almost all sulfur dioxide in the Port Pirie and Whyalla airsheds is from industrial sources.

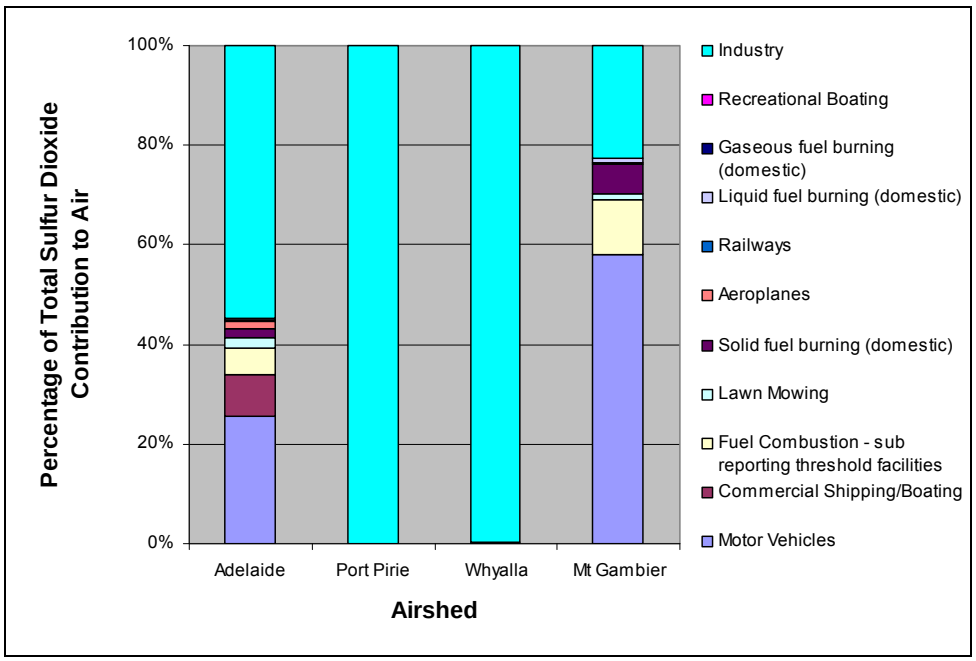

Figure 5 NPI emission estimates of sulfur dioxide sources in Adelaide, Port Pirie, Whyalla and Mount Gambier

As a comparison between airsheds, total sulfur dioxide contribution NPI estimates are:

- Adelaide – 2,597 tonnes
- Port Pirie – 54,403 tonnes
- Whyalla – 1,506 tonnes
- Mount Gambier – 19 tonnes.

Comparison of quantities of emissions of sulfur dioxide released into each airshed shows that although the percentages of sulfur dioxide released to the Whyalla and Port Pirie airsheds by industry are similar, the emissions into the Port Pirie airshed are by far the largest in the state, arising from the large quantities of sulfide ores and the type of smelting processes in use in the plant.

3.4 Carbon monoxide

Carbon monoxide (CO) is a toxic gas created by incomplete combustion of fuels containing carbon. Industrial boilers and motor vehicles are the main contributors to carbon monoxide emissions to air. Within urban areas, carbon monoxide from motor vehicles will generally only become an issue where it can build up in the 'canyons' formed by high-rise buildings. Even then, significant levels only tend to occur when weather conditions are very still and in areas where lines of traffic regularly queue up at traffic lights.

According to NPI industrial and aggregate emission data taken from the 2006–07 database, the proportions of carbon monoxide emission sources vary considerably between airsheds. Figure 6 illustrates this variability, showing that in Port Pirie and Whyalla, most carbon monoxide comes from industry, while in Adelaide, motor vehicles emit about 80% of the total carbon monoxide in the air shed.

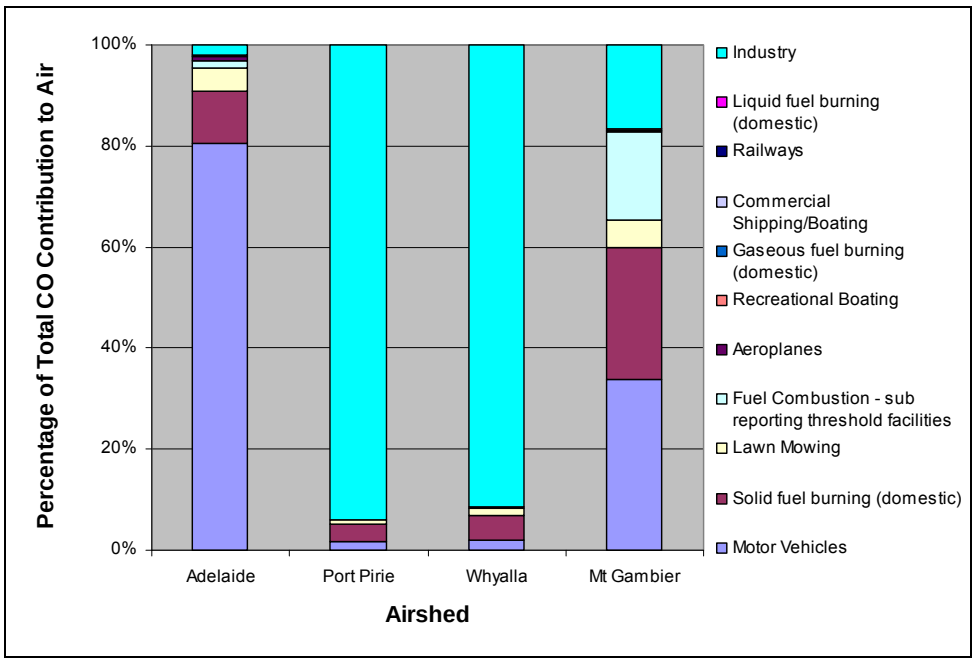

Figure 6 NPI emission estimates of carbon monoxide sources in Adelaide, Port Pirie, Whyalla and Mount Gambier

As a comparison between airsheds, total carbon monoxide contribution NPI estimates are:

- Adelaide – 134,479 tonnes
- Port Pirie – 26,399 tonnes
- Whyalla – 26,643 tonnes
- Mount Gambier – 5,194 tonnes.

As can be seen from the quantities released into these airsheds, motor vehicles are by far the largest source of carbon monoxide in the state.

3.5 Lead

Lead (Pb) is a heavy metal pollutant found in industrial emissions mainly associated with smelting such as in Port Pirie, the location of the world's primary lead smelter. Leaded petrol was once a significant source of airborne lead pollution from motor vehicle exhaust around the world, but has not been sold in Australia since late 2000. Consequently, lead pollution due to motor vehicle exhaust has dropped to negligible levels.

Based on NPI industrial and aggregate emission data, taken from the 2006–07 database, lead sources vary significantly between the various airsheds as can be seen in Figure 7. Industrial lead emissions are a significant proportion in the Port Pirie and Whyalla airsheds, which is not surprising given the main industries in those two regional centres.

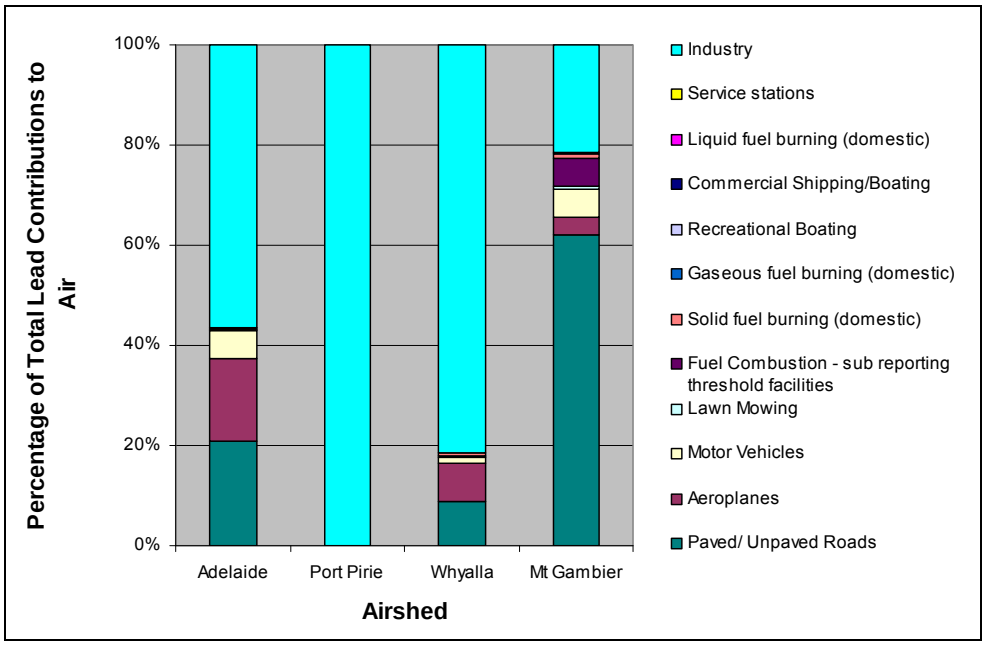

Figure 7 NPI emission estimates of lead sources in Adelaide, Port Pirie, Whyalla and Mount Gambier

As a comparison between airsheds, total lead contribution NPI estimates are:

- Adelaide – 6 tonnes
- Port Pirie – 53 tonnes
- Whyalla – 0.2 tonnes
- Mount Gambier – 0.1 tonnes.

Comparison of quantities of emissions of lead released into each airshed demonstrates that lead released in the Adelaide airshed is insignificant since the complete phase-out of lead-based petrol. This is supported by the historical lead monitoring in Adelaide which was discontinued due to low levels. Lead released in the Port Pirie airshed is consistent with the existence of the world's largest lead smelter.

In general where the corresponding pollutants are being monitored, relativities are maintained between monitoring and the NPI. For example both NPI emissions and monitoring for sulfur dioxide are higher in Port Pirie than in Adelaide. However, actual concentrations cannot be predicted directly from NPI emissions due to the large part played by meteorology in producing ground-level concentrations of a pollutant.

4 South Australia's air quality in 2008

4.1 Adelaide

4.1.1 Ozone

The EPA monitored ambient ground-level ozone concentrations at five sites within the Adelaide airshed, located at Christie Downs, Elizabeth, Kensington Gardens, Netley and Northfield.

The Air NEPM standards for ozone, as an indicator of photochemical oxidants are:

- **1-hour average** – **0.10 ppm**, with a goal that this concentration is not exceeded on more than **one day a year**
- **4-hour average** – **0.08 ppm**, with a goal that this concentration is not exceeded on more than **one day a year**

Monitoring results for ozone in 2008

The 1-hour NEPM standard and goal for ozone was met at all Adelaide monitoring sites in 2008. The maximum value was recorded at Elizabeth (0.097 ppm). Given the uncertainties in the measurement of about 0.005 ppm, the concentration effectively equalled the value of standard (0.10 ppm), indicating that ozone concentrations could easily exceed the standard in Elizabeth under right weather conditions, with an increase in precursor pollutants needed for ozone production.

The national standard for a 4-hour rolling average was exceeded at Elizabeth, while the NEPM goal has been met at all the Adelaide monitoring sites for 2008. The maximum 4-hour rolling average was measured at Elizabeth which exceeded the standard of 0.08 ppm on one day at 0.086 ppm. This met the NEPM goal (allowance of one day per year exceeding the standard) but suggests that ozone levels detected by the monitoring in Elizabeth may become a problem in the future.

Further information on ozone concentrations in Adelaide can be found in Tables 1 and 2 in Appendix 1.

Trends in ozone concentrations over time

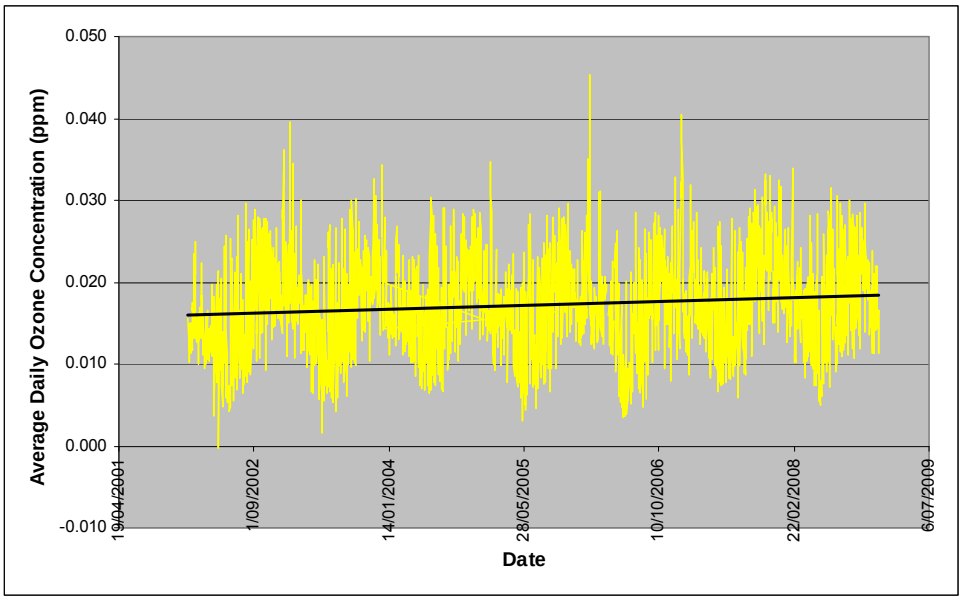

Figure 8 Netley average daily ozone concentrations trend data 2001–08

As discussed in section 2, build-up of higher concentrations of ozone in the atmosphere requires simultaneous strong sunlight, the right concentrations of precursor pollutants and favourable weather conditions. Recorded concentrations vary quite widely from day to day and between different seasons. So exceedences of the ozone standards are relatively rare in Adelaide, although concentrations close to the standard are fairly common.

The wide variation of values makes prediction of long-term trends fairly uncertain, but they remain an important tool for planning and management of air quality. Using a technique called trendline analysis, we can show that, on average, 24-hour ozone concentrations have been increasing slowly in Adelaide over the last decade (solid black line in Figure 8). This suggests that it will not take much of an increase in precursors or the number of still, sunny days to push concentrations over the standard more often. Given projected increases in population and vehicle use in Adelaide and likely increases in frequencies of hot, dry weather and bushfires, exceedences of the ozone standard may become more common in Adelaide over the next decade or two.

Ozone levels in Adelaide are comparable to those found in other Australia cities (see Figure 9) and compare favourably with other cities from around the world (see Figure 10).

Ozone concentrations in Australia and around the world

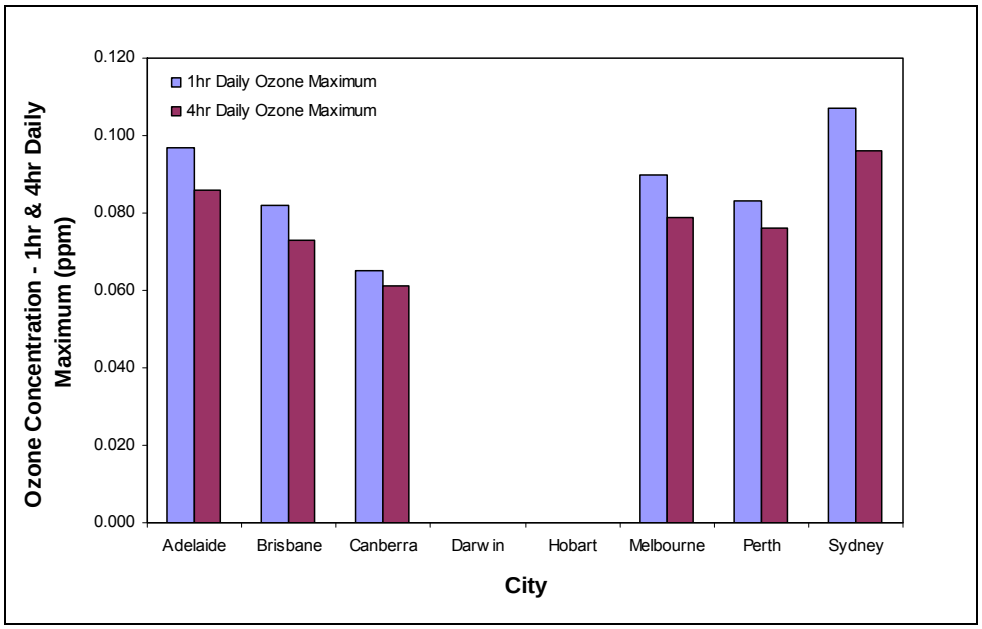

Figure 9 Ozone concentrations around Australia (2008)

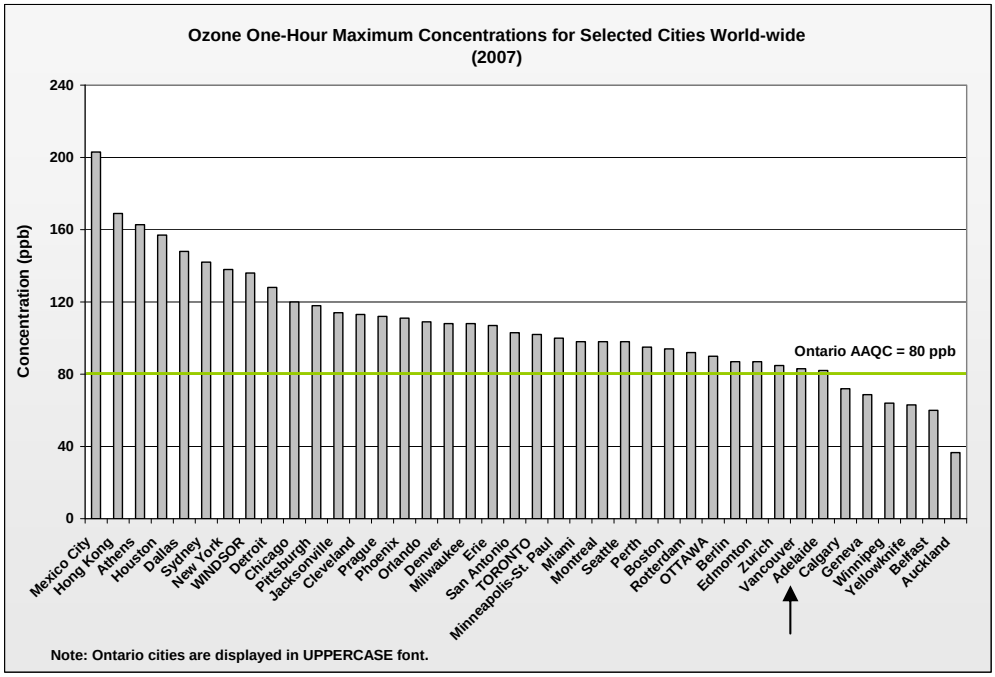

Figure 10 Ozone 1-hour maximum concentrations for selected cities worldwide (2007)

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

The EPA monitored particulate matter as PM_{10} using continuous monitors called TEOMs (which are type of extremely sensitive weighing machine) in five locations within the Adelaide airshed. These sites are located at Christies Beach, Elizabeth, Kensington Gardens, Le Fevre Primary and Netley.

The Air NEPM standard for PM_{10} is:

- **24-hour average – 50 µg/m^3**, with a Goal that this concentration is not exceeded more than **five days a year**

The EPA monitored for particulate matter as $PM_{2.5}$ using continuous monitors (TEOM) at Netley in Adelaide.

The Air NEPM advisory reporting standard for $PM_{2.5}$ is:

- **24-hour average – 25 µg/m^3**
- **Annual average – 8 µg/m^3.**

Monitoring results for PM_{10} TEOM in 2008

The average daily PM_{10} concentration in Adelaide ranged from 15.6 µg/m^3 at Kensington Gardens to 19.7 µg/m^3 at Netley. The daily NEPM standard of 50 µg/m^3 was exceeded at all five sites. For example:

- exceedences were recorded on three days at Christies Beach, Elizabeth and Kensington.
- Six exceedences were recorded at Le Fevre Primary School. This means that particle air quality did not meet the Air NEPM goal, which allows no more than five exceedences of the PM_{10} standard per calendar year.

Almost 50% of estimated particulate emissions into the Adelaide airshed (from the NPI) come from solid fuel burning and vehicle exhausts. The Adelaide community continues to rely on solid fuel burning and vehicles, and in the absence of other measures to change this dependence, further pressures from increasing population are likely to maintain or possibly increase particle levels in the future.

Further information on PM_{10} TEOM monitoring data can be found in Table 3 in Appendix 1.

Monitoring results for $PM_{2.5}$ TEOM in 2008

The annual $PM_{2.5}$ concentration for 2008 was 7.7 µg/m^3, measured at the single site in the Netley laboratories. This is very close to the annual reporting standard (8 µg/m^3**)**.

The 24-hour average NEPM advisory reporting standard for $PM_{2.5}$ of 25.0 µg/m^3 was not exceeded during 2008. The maximum concentration recorded was 20.2 µg/m^3 .

Further information on $PM_{2.5}$ TEOM monitoring data can be found in Table 4 in Appendix 1.

Trends in particulate matter concentrations over time

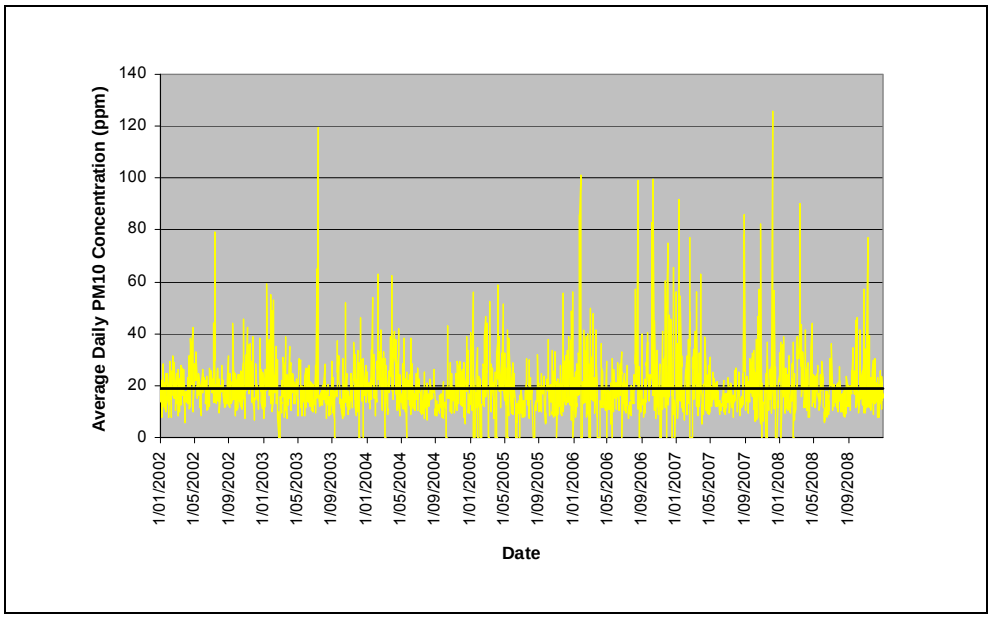

Figure 11 Netley average daily PM_{10} concentrations trend data 2002–08

Figure 11 shows that seasonal variations in average daily PM_{10} concentrations at Netley are not as marked as those for ozone at the same site (see figure 8). However, they are still quite wide across different seasons of each year and between years due to many factors, including varied weather conditions, dust storms and fires. The trendline graphs in Figures 11 and 12 (solid black line) show that, on average, daily PM_{10} concentrations neither increased nor decreased over the years 2002–08.

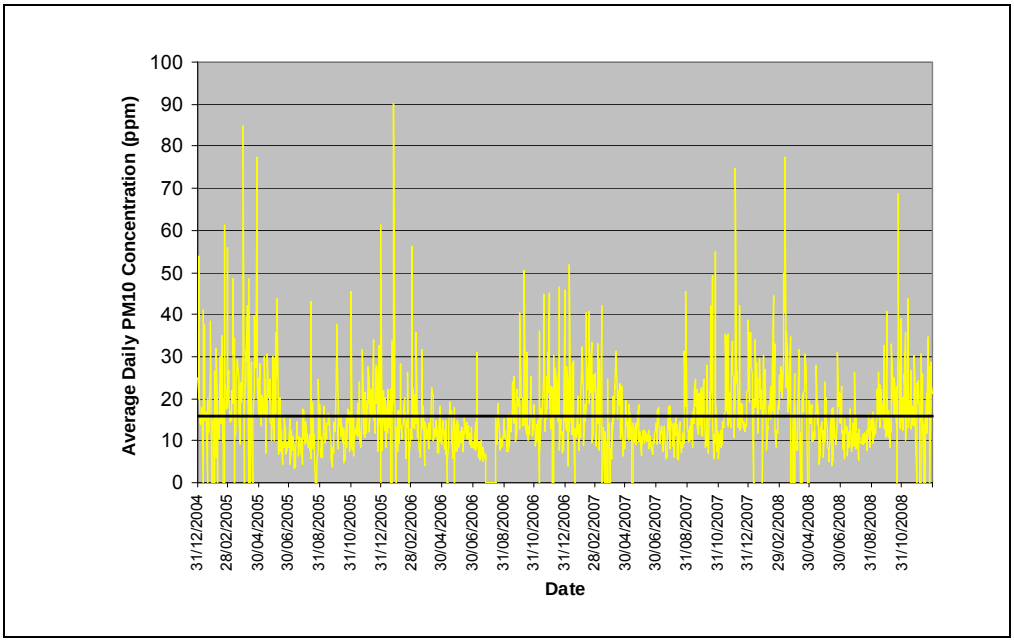

Figure 12 Elizabeth average daily PM_{10} concentrations trend data 2004–08

Figure 12 illustrates more clearly the distinct seasonal variations of recorded PM_{10} concentrations in Elizabeth over the years 2004 to 2008. Again the trend graph (solid black line) shows that daily PM_{10} concentrations are neither increasing nor decreasing over the period.

Although Adelaide is at the upper end of particulate matter concentrations in Australian cities, it compares more than favourably with cities from around the world (see Figures 13 and 14).

Particulate matter concentrations in Australia and around the world

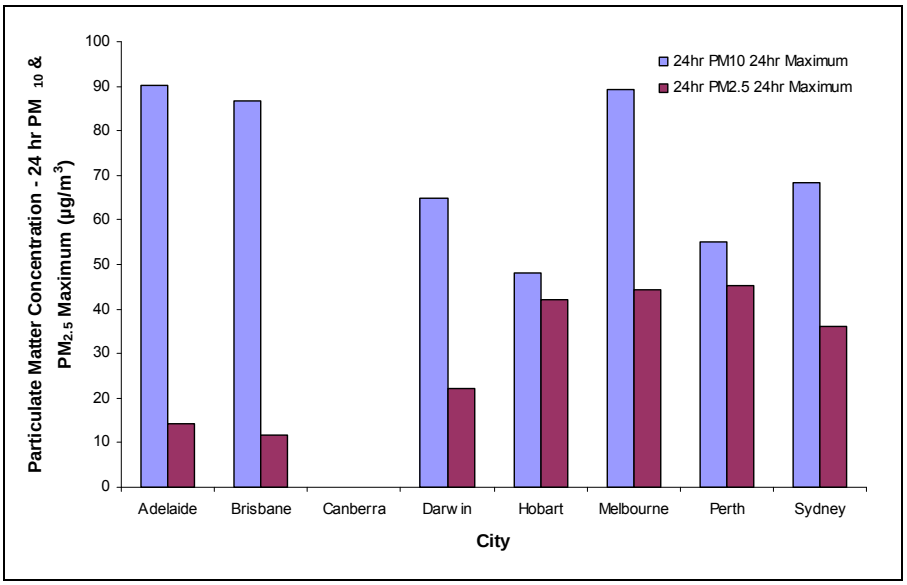

Figure 13 Particulate matter concentrations around Australia (2008)

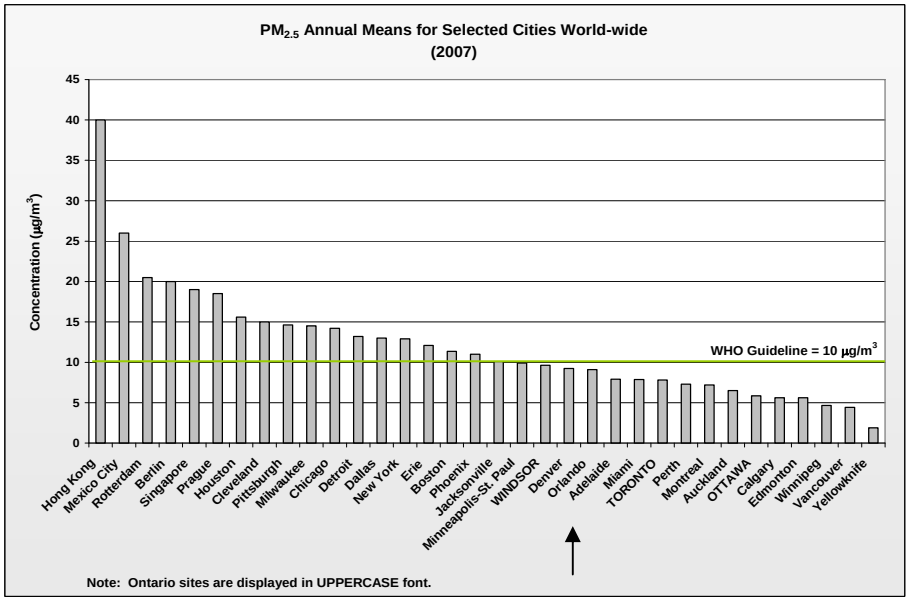

Figure 14 $PM_{2.5}$ annual means for selected cities worldwide (2007)

4.1.3 Nitrogen dioxide

The EPA monitored nitrogen dioxide at five locations within the Adelaide airshed. These sites are located at Christies Beach, Elizabeth, Kensington Gardens, Netley and Northfield.

The Air NEPM standards for nitrogen dioxide are:

- **1 hour average** – **0.12ppm**, with a goal that this concentration ins not exceeded on more than **one day a year**
- **Yearly average** – **0.03ppm.**

Monitoring results for nitrogen dioxide in 2008

The NEPM standard for 1-hour average nitrogen dioxide concentration has been met at all sites. The maximum 1-hour average concentrations ranged between 0.031 ppm at Elizabeth and 0.047 ppm at Netley, well below the NEPM 1-hour average standard of 0.12 ppm. Also, the NEPM yearly average standard was met at all five sites, with values ranging

between 0.004 ppm at Elizabeth and Kensington Gardens, and 0.008 ppm at Netley, well below the NEPM yearly standard of 0.03 ppm.

Further information on nitrogen dioxide concentrations can be found in Table 5 in Appendix 1.

Trends in nitrogen dioxide concentrations over time

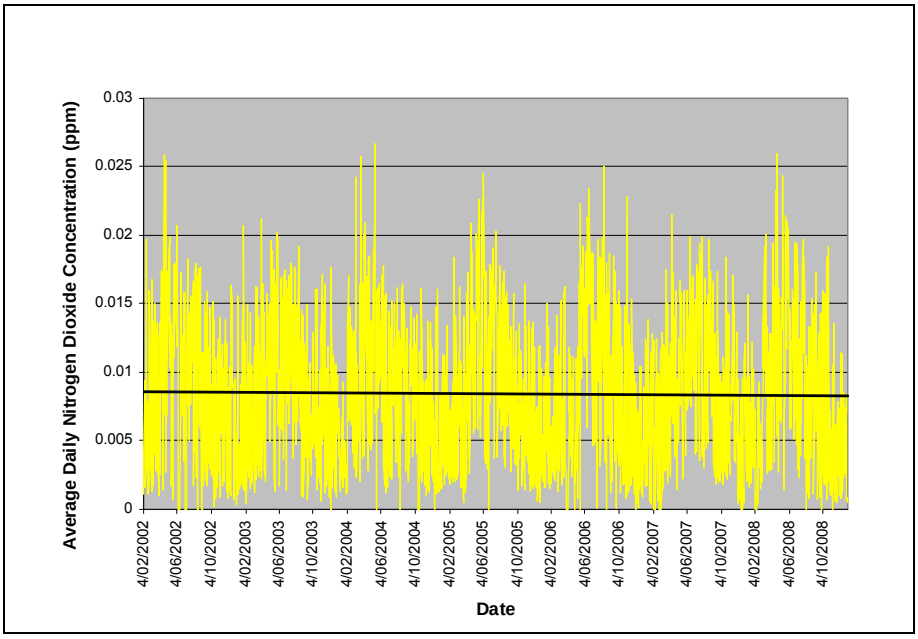

Figure 15 Netley average daily nitrogen dioxide concentrations trend data 2002–08

Figure 15 shows that average daily nitrogen dioxide concentrations at Netley in Figure 15 varies considerably from day to day and between seasons. Over the years 2002–08 the high variability in the data makes prediction of a trend uncertain. However trendline analysis does suggest that there is a slight decrease, on average, in daily average concentrations of nitrogen dioxide for this period.

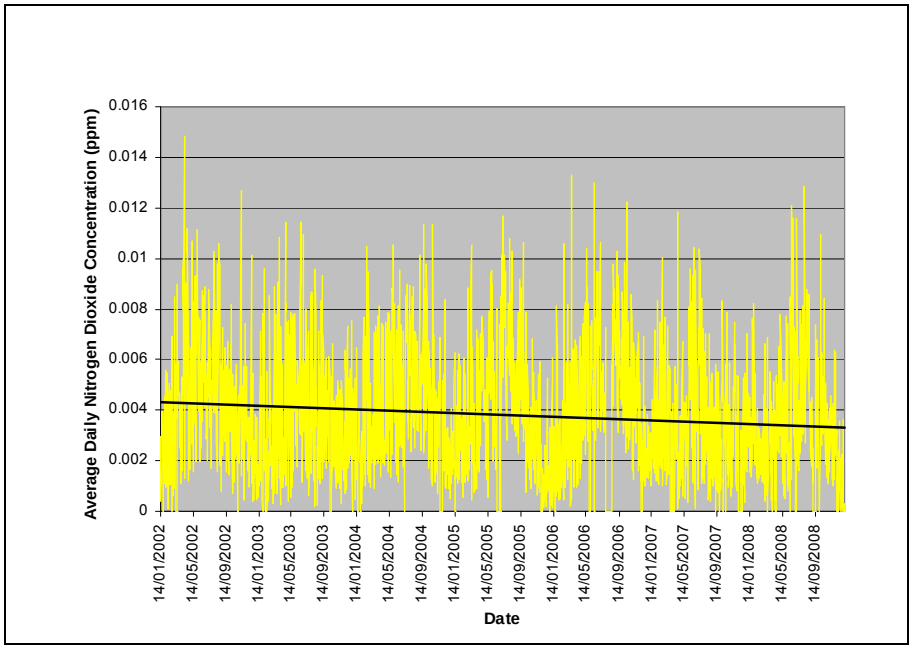

Figure 16 Elizabeth average daily nitrogen dioxide concentrations trend data 2002–08

Figure 16 shows similar variations in nitrogen dioxide concentrations measured at Elizabeth during 2002–08. However, the trendline assessment shows a downward trend in nitrogen dioxide daily average concentrations for this period.

Adelaide is at the lower end of nitrogen dioxide concentrations in Australian cities and compares more than favourably to cities from around the world (see Figures 17 and 18).

Nitrogen dioxide concentrations in Australia and around the world

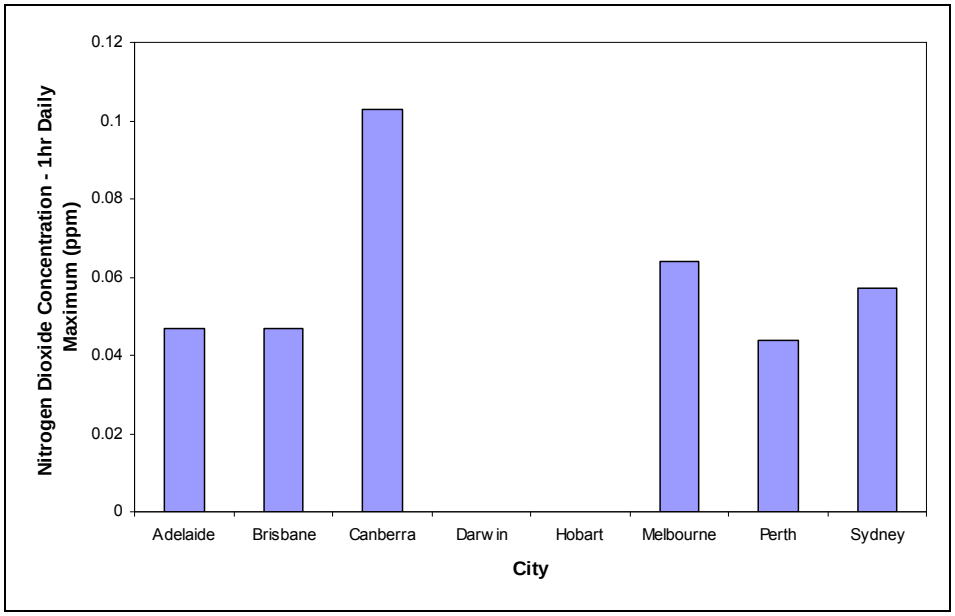

Figure 17 Nitrogen dioxide concentrations around Australia (2008)

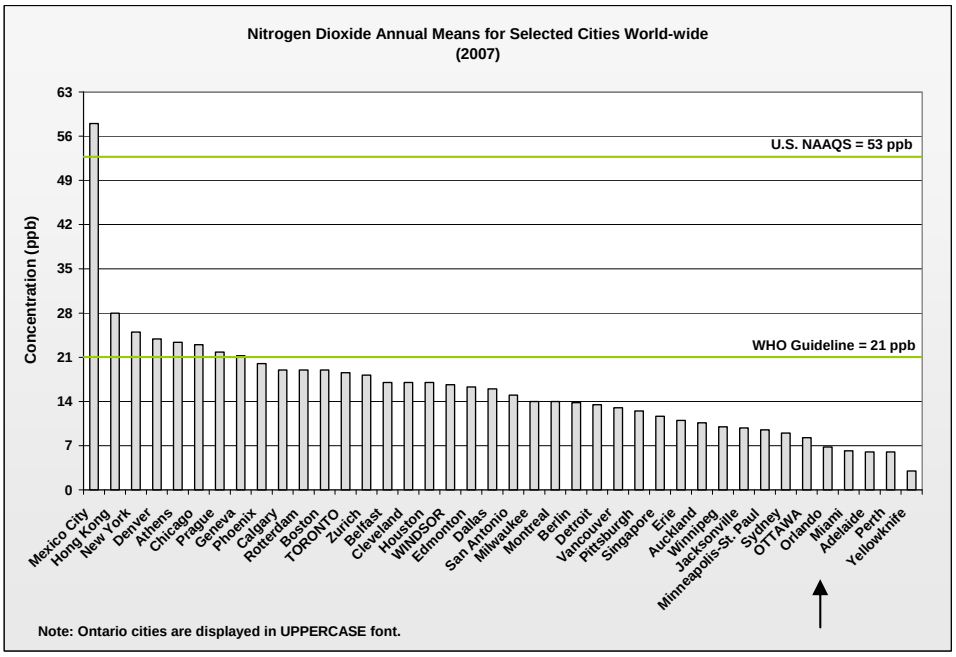

Figure 18 Nitrogen dioxide annual means for selected cities worldwide (2007)

4.1.4 Sulfur dioxide

The EPA monitored sulfur dioxide at one location at Northfield within the Adelaide airshed.

The Air NEPM standards for sulfur dioxide are:

- **1-hour average** – **0.20 ppm**, with a goal that this concentration not be exceeded more than **one day a year**
- **24-hour average** – **0.08 ppm**, with a goal that this concentration not be exceeded more than **one day a year**
- **Yearly average** – **0.02 ppm**.

Monitoring results for sulfur dioxide in 2008

The 1-hour and 24-hour average annual concentrations measured at Northfield were 0.000 ppm, with maximum concentrations of 0.009 ppm and 0.002 ppm against the standard respectively. These results are below the NEPM 1-hour average standard of 0.200 ppm and NEPM 24-hour average standard of 0.080 ppm respectively.

The NPI emission data in the Adelaide airshed indicates relatively low quantities of sulfur dioxide released and this is reflected in the low concentrations monitored around Adelaide.

Further information on sulfur dioxide monitoring data can be found in Tables 6 and 7 in Appendix 1.

Trends in sulfur dioxide concentrations over time

The sulfur dioxide concentrations measured in the Adelaide airshed during 2008 were extremely low (Figure 19), as they have remained for many years. They are so low that trendline analysis is not possible. Figure 20 shows sulfur dioxide data for cities across the world. Levels found in Adelaide would not show up on this graph.

Sulfur dioxide concentrations in Australia and around the world

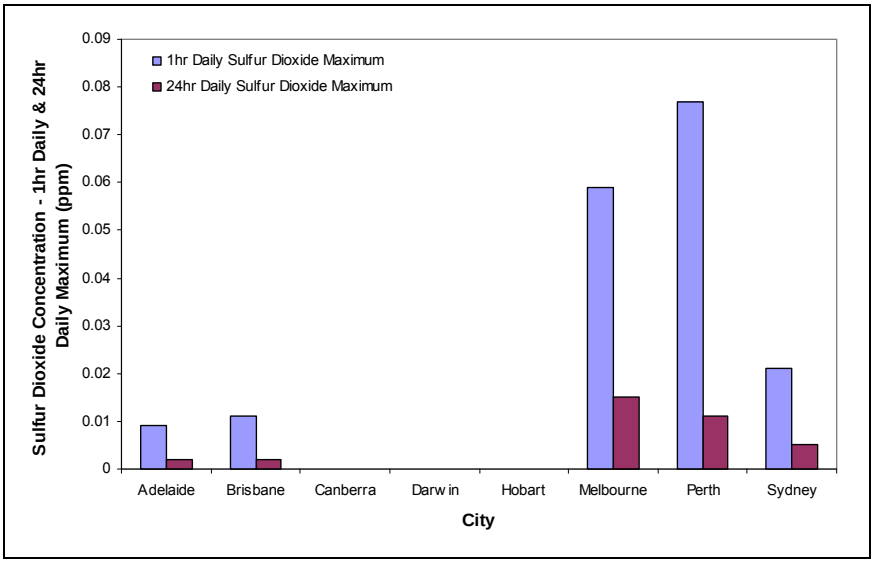

Figure 19 Sulfur dioxide concentrations around Australia (2008)

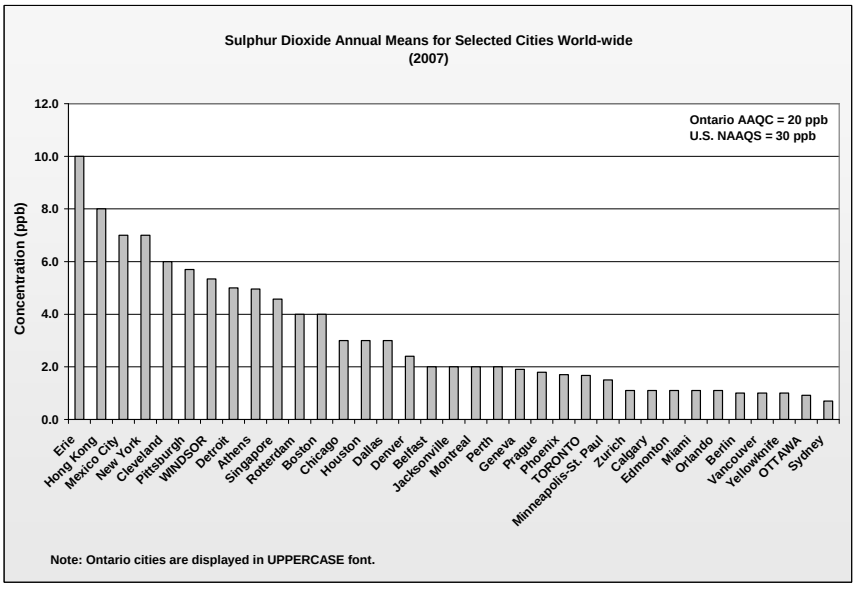

Figure 20 Sulfur dioxide annual means for selected cities worldwide (2007)

4.1.5 Carbon monoxide

The EPA monitored for carbon monoxide in one location at Elizabeth within the Adelaide airshed.

The Air NEPM standard for carbon monoxide is:

- **8-hour average** – **9.0 ppm**, with a goal that this concentration not be exceeded on more than **one day a year**

Monitoring results for carbon monoxide in 2008

The 8-hour NEPM standard was met at the Elizabeth site which is classified as a background station. The maximum concentration measured was 0.5 ppm, and the annual 8-hour average concentration was effectively 0.0 ppm. EPA intends to establish a peak carbon monoxide station in the network in the near future.

The NPI emissions estimates indicate that around 80% of carbon monoxide released to the Adelaide airshed is from motor vehicles.

Further information on carbon monoxide monitoring data can be found in Table 8 in Appendix 1.

Trends in carbon monoxide concentrations over time

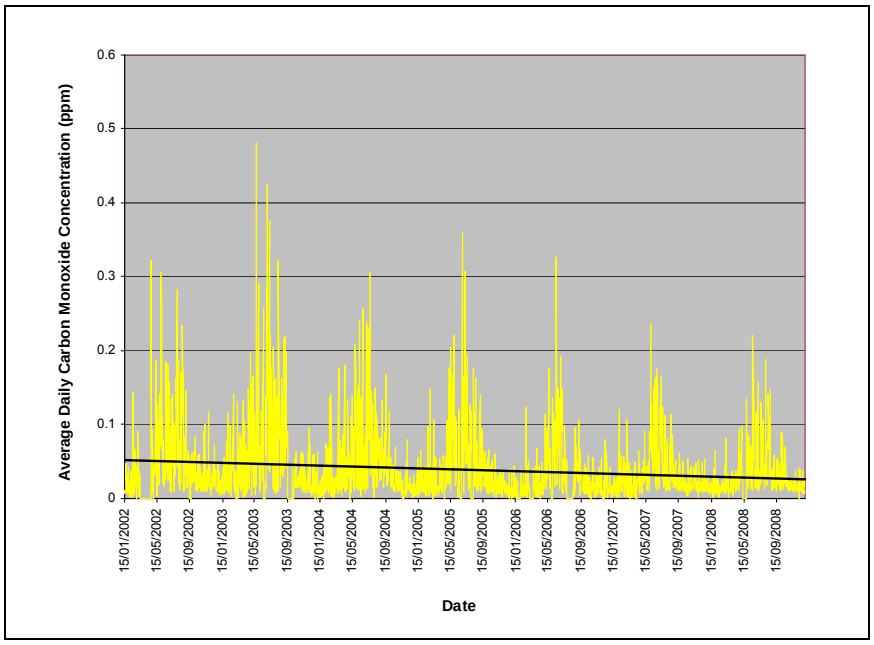

Figure 21 Elizabeth average daily carbon monoxide concentrations trend data 2002–08

Figure 21 shows strong seasonal variations in average daily carbon monoxide concentration in Elizabeth for 2002–08. Trendline analysis portrays a quite marked decrease, on average, of concentrations during the period. Continuous monitoring provides the best information available to demonstrate long-term trends in carbon monoxide concentration, and is useful in evaluating the combined impacts of improved traffic flows and better emissions achieved through advances in engine technology. This information will continue to underpin strategies to manage both carbon monoxide and other engine emissions over the next couple of decades.

Carbon monoxide concentrations in Australia and around the world

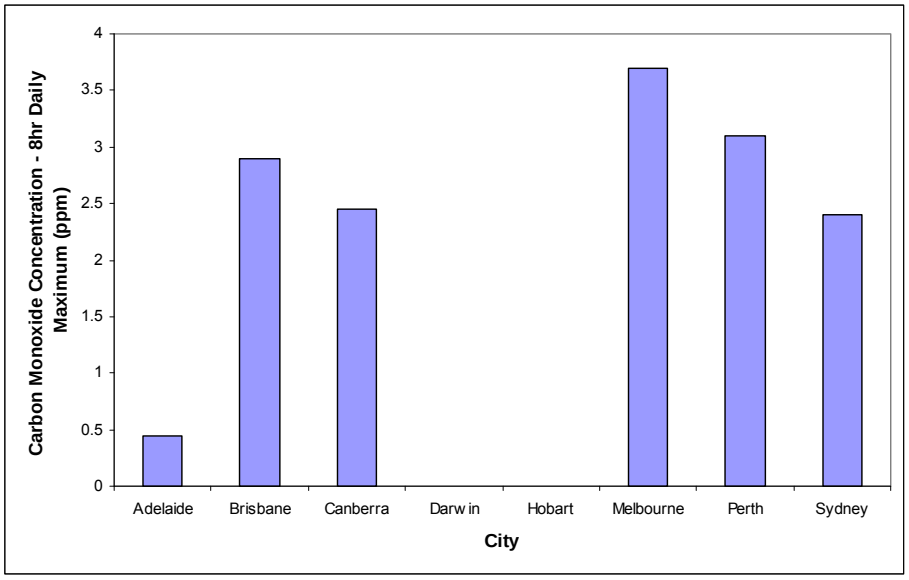

Figure 22 Carbon monoxide concentrations around Australia (2008)

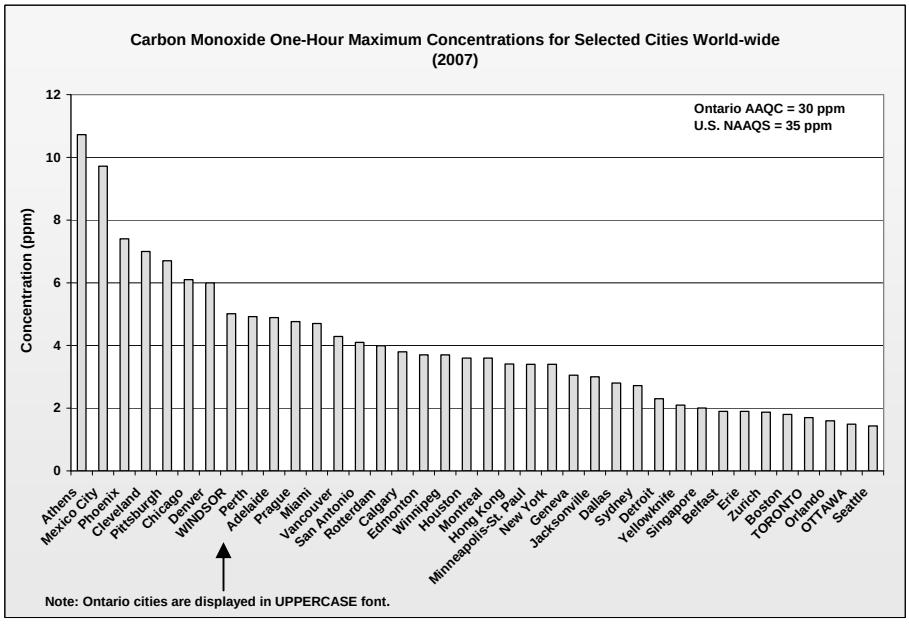

Figure 23 Carbon monoxide 1-hour maximum concentrations for selected cities worldwide (2007)

4.2 Port Augusta

The EPA no longer monitors total suspended particulates (TSP) or PM_{10} in Port Augusta, having ceased in May 2007. Alinta Energy (Flinders Power Station) are required to undertake regional air quality monitoring as part of their EPA licence. This data is used to assess regional air quality but is not included in this report.

4.3 Port Pirie

4.3.1 Particulate matter (TSP and PM_{10})

The EPA monitored for TSP at four sites in Port Pirie at a frequency of one day in six. High volume samplers (HVS) were used for this monitoring. The sites are located at Port Pirie West Primary School, Oliver Street, Ellen Street and Frank Green Park. PM_{10} particles and PM_{10} lead were also monitored at Oliver Street using HVS.

The EPA also monitored for PM_{10} in Port Pirie using continuous monitors (TEOM) at two sites, located at Oliver Street and 58 The Terrace. The latter site is operated in conjunction with the Department of Health.

Monitoring results for HVS TSP in Port Pirie in 2008

The results of total suspended particulates measured across the four sites in Port Pirie vary depending on location. Annual average concentrations of TSP in Port Pirie ranged from 40 µg/m^3 at Frank Green Park to 61 µg/m^3 at Ellen Street.

Maximum concentrations ranged from 140 µg/m^3 at Oliver Street to 152 µg/m^3 at Frank Green Park.

Monitoring results for HVS PM_{10} in Port Pirie in 2008

Monitoring results for PM_{10} by HVS at Oliver Street show an average daily concentration of 22 µg/m^3 with the NEPM standard of 50 µg/m^3 being exceeded on two occasions. The highest daily average concentration measured was 74 µg/m^3.

Monitoring results for TEOM PM_{10} in Port Pirie in 2008

The concentrations of PM_{10} by TEOM at Oliver Street were above the 24-hour NEPM standards of 50 µg/m^3 on 17 occasions. This exceeded the NEPM goal of no more than five exceedences in a calendar year. The average concentration measured at Oliver Street was 21 µg/m^3, and the maximum concentration was 235 µg/m^3.

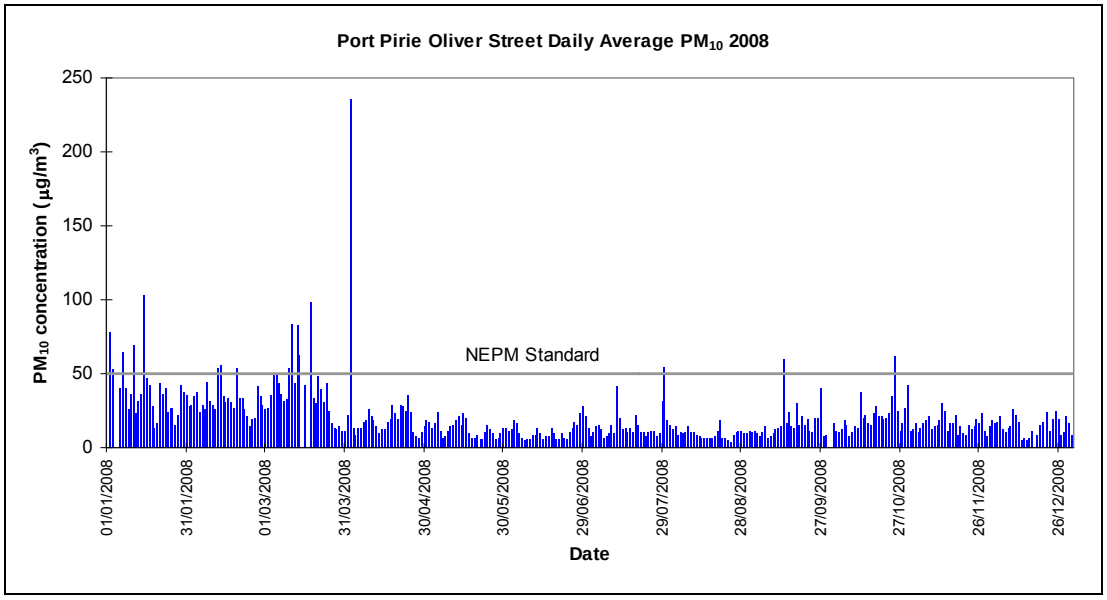

Figure 24 Oliver Street, Port Pirie daily average PM_{10} in 2008

Monitoring by the EPA of PM_{10} by TEOM (on behalf of the Department of Health) at 58 The Terrace showed concentrations were above the 24-hour NEPM standards of 50 µg/m^3 on 13 occasions. This exceeded the NEPM goal of no more than five exceedences in a calendar year. The average concentration measured was 20 µg/m^3 and the maximum concentration was 170 µg/m^3.

Although 58 The Terrace is not an Air NEPM compliance site, comparisons against the NEPM standards provide important data assessment of air quality in the region.

4.3.2 Lead

The EPA monitored TSP lead at four sites in Port Pirie using high volume samplers (HVS): at Port Pirie West Primary, Oliver Street, Ellen Street and Frank Green Park, as well as PM_{10} lead by HVS at the Oliver Street site.

Monitoring results for HVS TSP lead in Port Pirie in 2008

The average annual TSP lead concentrations ranged from 0.14 µg/m^3 at Frank Green Park to 1.94 µg/m^3 at Ellen Street, with Port Pirie West Primary and Oliver Street measuring 0.39 µg/m^3 and 0.41 µg/m^3 respectively.

The annual NEPM standard for TSP lead is 0.5 µg/m^3. Although concentrations measured at Ellen Street were considerably higher than the national standard for lead, this site is located adjacent to the smelter boundary and, whilst the NEPM standard does not strictly apply in the sense that Ellen Street is not an allocated NEPM site, such national standards are important in any assessment of regional air quality.

The NPI data for lead emission estimates into the Port Pirie airshed shows that the majority of lead is emissions from industry. Consequently, it is not surprising that lead levels monitored in Port Pirie are elevated (especially near the smelter), although the trend below shows that industrial improvements are making a difference. The EPA has mandated targets for lead emission reductions as part of the tenby10 project (more details are available in Section 5.4).

Monitoring results for HVS PM_{10} lead in Port Pirie in 2008

PM_{10} lead measured at Oliver Street during 2008 had an average concentration of 0.19 µg/m^3 and a maximum of 1.18 µg/m^3. There currently is no national standard for PM_{10} lead concentrations in Australia.

Trends in lead concentrations in Port Pirie over time

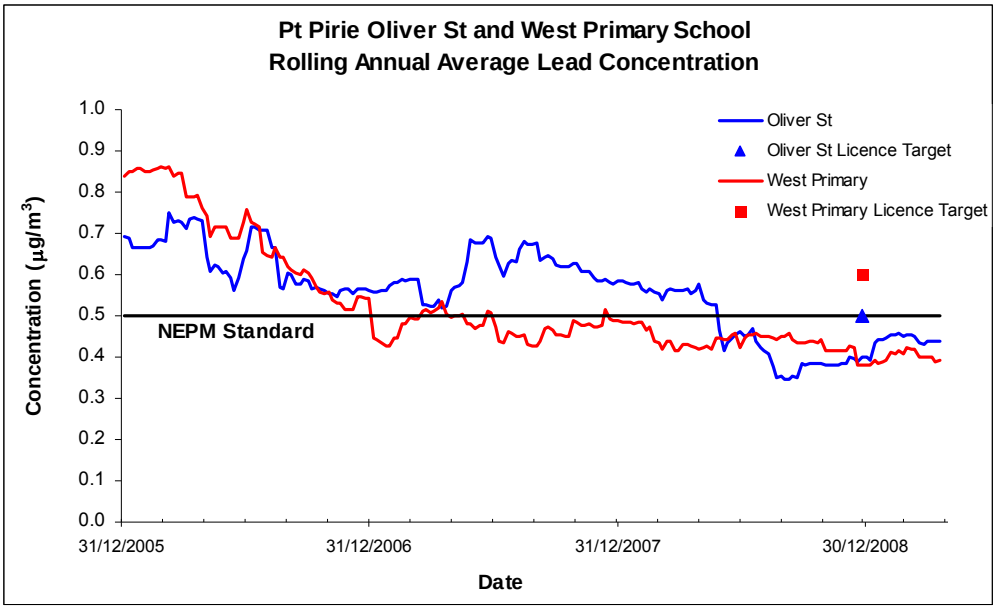

Figure 25 Rolling annual average lead concentration in Port Pirie 2006–08

Figure 25 shows the decrease over time in lead concentrations measured at two locations, a direct result of the improvements at the Nyrstar Port Pirie lead smelter.

4.3.3 Sulfur dioxide

Monitoring for sulfur dioxide in Port Pirie was only conducted at Oliver Street in 2008.

Monitoring results for sulfur dioxide in Port Pirie in 2008

Monitoring sulfur dioxide in Port Pirie resulted in the 1-hour NEPM standard of 0.2 ppm being exceeded on 28 occasions in 2008, well above the NEPM goal of no more than one exceedence per year. The maximum 1-hour concentration measured was 0.522 ppm, considerably higher than the NEPM standard of 0.2 ppm. The annual average 1-hour concentration in Port Pirie at this site for 2008 was 0.009 ppm. This highlights the very transient nature of sulfur dioxide from a point source and how plume events are the typical mechanism for exposure through the city of Port Pirie.

The NPI data for sulfur dioxide emission estimates into the Port Pirie airshed shows that the majority of sulfur dioxide emissions are from industry. Consequently, sulfur dioxide levels monitored in Port Pirie are elevated given the quantity of SO_2 emitted.

4.4 Whyalla

The EPA monitored two sites in Whyalla for particulates using TEOM at Walls Street and Schulz Reserve.

4.4.1 Particulate matter PM_{10}

Monitoring comparison shows that at Walls Street in Whyalla:

- the average 24-hour average concentration for 2008 was 21 µg/m^3
- the national 24-hour standard of 50 µg/m^3 was exceeded on 17 occasions.
- the highest 24-hour average concentration measured was 120 µg/m^3.

It should be noted that although Walls Street is not an Air NEPM compliance site, comparisons with national standards are still very important for assessment of air quality in the region.

At the Schulz Reserve site:

- the average PM_{10} concentration measured for 2008 was 19 µg/m^3
- the NEPM daily standard was exceeded on six occasions, one more than the allowable goal of five per calendar year
- the maximum 24-hour concentration recorded was 97 µg/m^3.

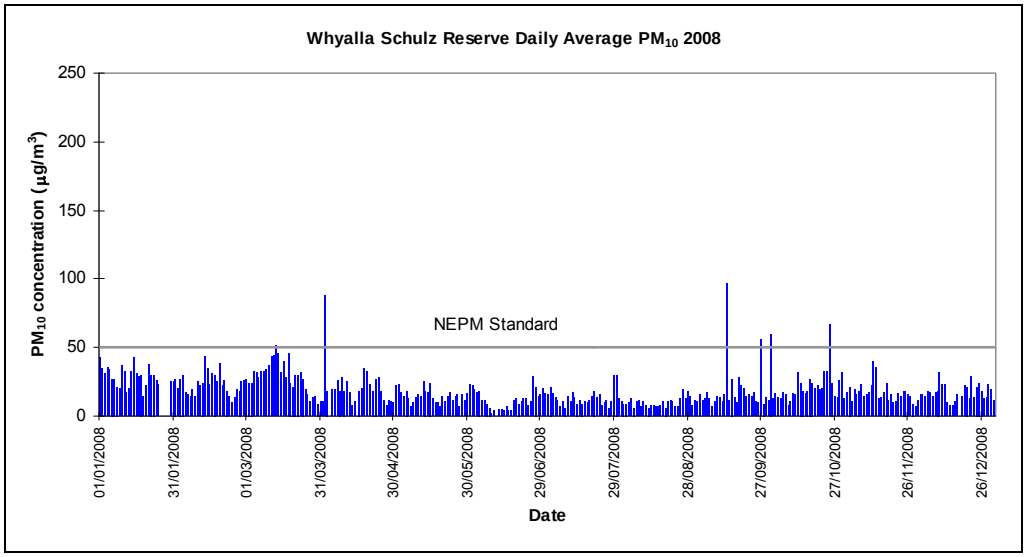

Figure 26 Schulz Reserve, Whyalla daily average PM_{10} in 2008

The NPI data for particulate matter as PM_{10} emission estimates into the Whyalla airshed shows that the majority of PM_{10} emissions are from industry. Consequently, PM_{10} levels monitored in Whyalla are elevated given the quantity emitted.

5 Improving South Australia's air quality

5.1 AirWatch

In 2008 the AirWatch schools program began delivery with a new look and a new approach, informed by an internal review undertaken in 2007. Through this revised whole-school approach, AirWatch offered schools throughout the state support and resources to enable them to investigate air quality issues in aspects of the school—in its operation, in the classroom, the physical surrounds and in its relationships with the local community, with the aim of improving the quality of air in and around the school and local community.

New resources were developed to assist schools in investigating air quality including tools to assist in identifying any air quality issues in and around the school and where there may be opportunities for improvement.

Nine professional development training sessions were held for both primary and secondary teachers and non-teaching staff throughout the year. These training sessions provided information about air quality issues, both globally and locally, the AirWatch program, and how schools can be involved. In addition seven schools were loaned monitoring equipment from the EPA to undertake their own local monitoring.

5.2 SmokeWatch

Following the delivery of the two-year pilot of the SmokeWatch program, in partnership with the Adelaide Hills Council, during the winters of 2006 and 2007, the EPA limited its role in delivering SmokeWatch to enable the council to take a leadership role in promoting the SmokeWatch message during winter 2008. Various communication materials were provided to the council by the EPA to assist in this.

The EPA made a decision to focus efforts in Mount Gambier, as it too has been identified as a location affected by wood smoke pollution during the winter months. At that time, there had been no previous education or behaviour change programs relating to wood smoke undertaken in the area.

In August 2008 an external research company was utilised by the EPA to undertake a telephone survey of residents in Mount Gambier. This assisted understanding of wood heater use in the area to inform future education and behaviour change programs and to allow for comparisons to be made in evaluating such programs. The survey results identified that one third of respondents use wood heaters (35%) of which 86% use this as their main form of heating, typically using the slow combustion heater (91% of wood heater users) [Square Holes 2008].

During the latter part of 2008 the EPA in partnership with the Mount Gambier council began developing a revised approach to SmokeWatch which was delivered in 2009.

5.3 Hot spot monitoring

During 2008, EPA constructed a new mobile station in a lightweight trailer specifically for small projects. Concerns over air quality impacts from construction activities in Birkenhead provided the first opportunity to deploy the trailer station in December. In particular, teachers and parents at the nearby Le Fevre Peninsula Primary School raised concerns about impacts of harmful dust. Inspections of the school were carried out and PM_{10} particle monitoring commenced on 23 December 2008. Monitoring continued for three months.

The monitor was established in the school grounds adjacent to Semaphore Road, directly opposite the development site, to monitor dust emissions generated by the relocation of stockpiles of earth used for used for construction fill. The removal of the stockpiles was carried out during school holidays, to minimise any potential impacts on the staff and students. Results showed only short periods when PM_{10}, concentrations were elevated above background levels.

EPA was able to develop improved management practices for the stockpiles in conjunction with the developers and these resulted in recorded PM_{10} concentrations that were lower than would otherwise have been expected.

The monitoring program showed clearly that particles were being carried to the station by winds blowing from several different directions, leading to the conclusion that a range of sources contributed to particle exposures at LeFevre school. Further investigations are underway to assist in identifying these sources.

5.4 Supporting industry in pollution reduction initiatives

Dust at Whyalla

The transition of OneSteel's Pellet Plant from a dry haematite feed to magnetite slurry (Project Magnet) has significantly reduced the deposition of red dust over eastern Whyalla. There has been some deposition of magnetite (not to the same extent as red dust) as pellet plant management learnt how to operate the new feed. OneSteel has commenced remediation of the Northern Stockpile area and demolition of redundant Pellet Plant structures which should further reduce dust impacts on eastern Whyalla.

The EPA's monitoring station at Walls Street showed a significant reduction in exceedences of the NEPM limit for PM_{10} over the previous year but it would be premature to ascribe this to Project Magnet.

The EPA's monitoring station at Schulz Reserve operated for a full year and detected six exceedences of the NEPM limit for PM_{10}.

The EPA and OneSteel continue to share PM_{10} monitoring data to better understand the underlying trends and impacts.

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 0−4 years residing in Port Pirie have blood lead levels below 10 µg/dL by the end of 2010. Known as tenby10, the program involves a collaborative approach between Nyrstar, EPA, Department of Health and the Port Pirie Regional Council. To date, 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).

Nyrstar's EPA licence was significantly amended in July 2008. The inclusion of revised airborne lead targets (reducing stepwise over time) was aimed at encouraging site improvements which would contribute to the achievement of the tenby10 goal.

Supporting national work

The EPA provided support to many national programs in 2008 through a substantial number of avenues such as follows:

- Membership of the Ambient Air NEPM Review team.
- Membership of the Fuels Standards Committee.
- Provision of compliance and implementation reports to NEPC.
- Membership on the Peer Review Committee, providing papers on uncertainty.
- Data provided for the comparative data assessment of different quality assurance methodologies around Australia.
- Provision of information to the *South Australian State of Environment Report 2008*.
- Support to National Association of Testing Authorities through audits and the technical committee.

6 References

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EPA Northern Territory 2008, *Annual Compliance Report for the Northern Territory*, Environment Protection Authority Northern Territory, Darwin.

EPA Queensland 2008, 2008 Air Monitoring Report, State of Queensland Environmental Protection Agency, Brisbane.

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EPA Tasmania 2009, *Report Against the National Environment Protection Measure for Ambient Air Quality for 2008*, Environment Protection Authority Tasmania, Hobart.

EPA Victoria 2008, *Air Monitoring Report 2008–Compliance with the National Environment Protection Ambient Air Quality) Measure*, Environment Protection Authority Victoria, Melbourne.

EPA Western Australia 2009, *Western Australian Air Monitoring Report 2008*, Environmental Protection Authority of Western Australia, Perth.

National Environment Protection Council 1998, *National Environment Protection (Ambient Air Quality) Measure, 7 July 2003*, viewed 18 March 2010, NEPC, Canberra, <www.ephc.gov.au/sites/default/files/AAQ_NEPM__Ambient_Air_Quality_NEPM_Varied_scaleplus_Final_200305_1.pdf >

Ontario Ministry for the Environment 2008, *Air Quality in Ontario 2007 Report*, viewed 18 March 2010, Queen's Printer for Ontario, Ontario, Canada, <www.ene.gov.on.ca/publications/6930e.pdf>.

Square Holes 2008, *Mount Gambier wood smoke benchmark evaluation*, consultancy report for EPA, Adelaide.

South Australian Department of Health 2008, *Blood Lead Report for First Quarter of 2008−Internal Memorandum,* SA DoH, Adelaide

Appendix 1 Data tables

Ozone

Table 1 **1-hour average ozone concentrations from EPA air monitoring sites for 2008 (NEPM Standard: 0.10 ppm, 1 day per year)**

Monitoring site	Data recovery (%)	No. of days NEPM standard exceeded	Average (ppm)	Maximum (ppm)
Christies Beach	96	0	0.020	0.068
Elizabeth	97	0	0.021	0.097
Kensington Gardens	95	0	0.021	0.072
Netley	97	0	0.018	0.071
Northfield	97	0	0.019	0.074

Table 2 **4-hour rolling average ozone concentrations from EPA air monitoring sites for 2008 (NEPM Standard: 0.08 ppm, 1 day per year)**

Monitoring site	Data recovery (%)	No. of days NEPM standard exceeded	Average (ppm)	Maximum (ppm)
Christies Beach	98	0	0.020	0.060
Elizabeth	99	1	0.021	0.086
Kensington Gardens	97	0	0.022	0.067
Netley	99	0	0.018	0.061
Northfield	100	0	0.020	0.068

Particulate matter PM_{10}

Table 3 **24-hour average particulate matter (PM_{10}) concentrations using TEOM data from EPA air monitoring sites for 2008 (NEPM Standard: 50 µg/m^3, 5 days per year)**

Monitoring site	Data recovery (%)	No. of days NEPM standard exceeded	Annual average (µg/m^3)	Maximum (µg/m^3)
Adelaide				
Christies Beach	96	3	17.0	89.7
Elizabeth	94	3	17.7	77.5
Kensington Gardens	97	3	15.6	69.1
Le Fevre Primary	98	6	19.5	60.8
Netley	99	4	19.7	90.3

Monitoring site	Data recovery (%)	No. of days NEPM standard exceeded	Annual average (µg/m^3)	Maximum (µg/m^3)
Port Pirie				
Oliver Street	98	17	20.8	235.1
58 The Terrace	92	13	20.2	170.4
Whyalla				
Walls Street	98	17	20.5	119.9
Schulz Reserve	98	6	18.8	96.5

Particulate matter $PM_{2.5}$

Table 4 24-hour average particulate matter ($PM_{2.5}$) concentrations from EPA air monitoring sites for 2008 (NEPM Standard: 25.0 µg/m^3)

Monitoring site	Data recovery (%)	No. of days NEPM standard exceeded	Average (µg/m^3)	Maximum (µg/m^3)
Netley	92	0	7.7	20.2

Nitrogen dioxide

Table 5 1-hour average nitrogen dioxide concentrations from EPA air monitoring sites for 2008 (NEPM Standards: 0.12 ppm, 1 day per year and 0.03 ppm, yearly average)

Monitoring site	Data recovery (%)	No. of days NEPM standard exceeded	Average (ppm)	Maximum (ppm)
Christies Beach	95	0	0.005	0.036
Elizabeth	93	0	0.004	0.031
Kensington Gardens	95	0	0.004	0.032
Netley	97	0	0.008	0.047
Northfield	97	0	0.006	0.041

Sulfur dioxide

Table 6 1-hour average sulfur dioxide concentrations from EPA air monitoring sites for 2008 (NEPM Standard: 0.20 ppm, 1 day per year)

Monitoring site	Data recovery (%)	No. of days NEPM standard exceeded	Average (ppm)	Maximum (ppm)
Northfield	97	0	0.000	0.009
Oliver Street	97	28	0.009	0.522

Table 7 24-hour average sulfur dioxide concentrations from EPA air monitoring sites for 2008 (NEPM Standard: 0.08 ppm, 1 day per year)

Monitoring site	Data recovery (%)	No. of days NEPM standard exceeded	Average (ppm)	Maximum (ppm)
Northfield	99	0	0.000	0.002
Oliver Street	99	0	0.009	0.076

Carbon monoxide

Table 8 8-hour average carbon monoxide concentrations from EPA air monitoring sites for 2008 (NEPM Standard: 9.0 ppm, 1 day per year)

Monitoring site	Data recovery (%)	No. of days NEPM standard exceeded	Average (ppm)	Maximum (ppm)
Elizabeth	96	0	0.0	0.5

Lead

Table 9 Annual average TSP Lead concentrations via HVS from EPA air monitoring sites for 2008 (NEPM Standard: 0.50 µg/m^3)

Monitoring site	Data recovery (%)	Average (µg/m^3)	Maximum (µg/m^3)
Port Pirie West Primary School	100	0.39	1.7
Oliver Street*	95	0.41	2.37
Ellen Street	98	1.94	9.09
Frank Green Park*	100	0.14	0.95

Monitoring in Port Pirie is conducted on a 'one day in six' basis.
Data recovery rate is calculated taking this into account.

* NEPM Sites: both met the NEPM standard

Table 10 Annual average PM_{10} Lead concentrations via HVS from EPA air monitoring sites for 2008

Monitoring site	Data recovery (%)	Average (µg/m^3)	Maximum (µg/m^3)
Oliver Street	90	0.19	1.18

Monitoring in Port Pirie is conducted on a 'one day in six' basis.
Data recovery rate is calculated taking this into account.

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 Peninsula 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, Port Pirie West Site operational since 24 August 2005 Monitoring PM_{10} TEOM on behalf of SA DOH
Walls Street	Walls Street, Whyalla Site operation since 25 July 2003 Monitoring PM_{10} TEOM
Schulz Reserve	Schulz Reserve, Whyalla Norrie Site operation since 24 April 2007 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

Annual NEPC compliance reports, provided by each jurisdiction as required by the NEPM, were the source of data used to calculate the values for each capital city. The sites located within each capital city were used, with the annual maximum for each pollutant and reported averaging period averaged to give a general 'capital city' value.

The annual maximum was chosen as the appropriate reporting criterion for comparison as it is considered worse case scenario and therefore provides a conservative approach.

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

Appendix 4 Quality assurance

The EPA operates all monitoring stations described in this report. It obtained National Association of Testing Authorities (NATA) accreditation of its monitoring network, laboratory and staff in February of 2006 (accreditation number 15220).

During 2008 the air quality Laboratory maintained NATA accreditation. This is a quality assurance and control system based on *ISO/IEC 17025:2005–General Requirements for the competence of testing and calibration laboratories.* The accreditation assures both procedures are of a high quality and that staff are competent to perform these procedures.