



*National Environment Protection
(Ambient Air Quality) Measure*

Review of the Practicability
of a
10 Minute Sulfur Dioxide Standard

**Technical Background
Document to
Issues Paper**

March 2004

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CHAPTER 1: DESCRIPTION OF SULFUR DIOXIDE MONITORING SITES

New South Wales, Victoria, South Australia, Western Australia and Queensland all conduct sulfur dioxide monitoring. The Northern Territory, Australian Capital Territory and Tasmanian governments do not conduct any sulfur dioxide monitoring as ambient levels of sulfur dioxide have been assessed to be well below the standards in the Ambient Air Quality National Environment Protection Measure (NEPM).

Those jurisdictions which monitor sulfur dioxide have provided 10 minute sulfur dioxide data for inclusion in this Issues Paper and for analysis and interpretation as part of this Review. This document provides a description of the monitoring sites from which 10 minute sulfur dioxide data has been provided.

All jurisdictions have provided 10 minute sulfur dioxide data from sites where they monitor sulfur dioxide under the NEPM. Information is provided here on the regions where this monitoring is conducted and, for which, the NEPM sites are intended to measure general population exposure.

Some jurisdictions have also provided 10 minute sulfur dioxide data from non-NEPM sites, including monitoring sites owned and operated by industry. Although the Tasmanian Government does not monitor sulfur dioxide, it has provided some data from industry.

For both NEPM and non-NEPM sites, a description is provided here of proximity to major sulfur dioxide sources. Where possible, maps have also been provided to illustrate the extent to which sulfur dioxide levels recorded at monitoring sites are likely to be affected by major sulfur dioxide emitting industries.

The 10 minute sulfur dioxide data provided by jurisdictions is discussed in the Issues Paper in Chapters 2 and 5.

NEW SOUTH WALES

Description of Monitoring Sites

Under New South Wales's Air Quality Monitoring Plan, approved by the National Environment Protection Council, air quality monitoring is conducted in three regions: Sydney, the Illawarra and the Lower Hunter.

Sydney

The Sydney region consists of a large basin bounded by the coast to the east and on the other sides by high ground, with the Blue Mountains to the west, Wollondilly Shire to the south and Hawkesbury and Wyong shires to the north. The Sydney basin meets the sea via the Parramatta River valley, which runs into the Sydney Harbour, and the Georges River valley to the south, which runs into Botany Bay. The region has a population of around 3.8 million. Monitoring of sulfur dioxide is conducted at the following sites, which have been chosen as being representative of general population exposure in the region:

Blacktown – This site is located in the Sydney Water depot on Flushcombe Road, Blacktown. It is situated on a ridge, which divides the Hawkesbury basin from Eastern Sydney, near the centre of the Sydney basin. It is in a residential area within the north-west Sydney region. The main source of sulfur dioxide in the area is vehicle exhaust emissions. Sulfur dioxide emitters within a 20 km radius include Shell Clyde Refinery.

Bringelly – This site is located on council reserve on Ramsay Road, Bringelly. It is situated in the south of the Hawkesbury basin in a semi-rural area in the south-west Sydney region. The main source of sulfur dioxide in the area is vehicle exhaust emissions.

Richmond – This site is located inside the University of Western Sydney, Hawkesbury campus. It is situated in the north of the Hawkesbury basin in a residential / semi-rural area within the north-west Sydney region. The main source of sulfur dioxide in the area is vehicle exhaust emissions.

Woolooware – This site is located beside the Woolooware Golf Course, off Woolooware Road. It is situated in a residential area to the south of Botany Bay in the south-east Sydney region. The main source of sulfur dioxide in the area is motor vehicle exhaust emissions. Sulfur dioxide emitters within a 20 km radius include Caltex Kurnell Refinery.

The Illawarra

Wollongong and Port Kembla lie in a distinct region termed the Illawarra which has a population of around 220,000 people. The region is characterized by a coastal plain bounded by a steep escarpment to the west. Monitoring of sulfur dioxide is conducted at the following sites, which have been chosen as being representative of general population exposure in the region:

Wollongong – This site is located in the Australian Army Depot, Gipps Street, North Wollongong. It is situated in a residential area close to the commercial centre of Wollongong. Sulfur dioxide emitters within a 15 km radius include Port Kembla Copper Smelter (now closed) and BHP Port Kembla.

Warrawong – This site is located in Darcy Wentworth Park, off Carlotta Crescent, Warrawong. It is situated in a residential/industrial area. Sulfur dioxide emitters within a 5 km radius include Port Kembla Copper Smelter (now closed) and BHP Port Kembla.

Albion Park – This site is located in the Croome Sporting Complex on Croom Road, Albion Park. It is situated in a semi-rural area in the south of the Illawarra basin. Sulfur dioxide emitters within a 30 km radius include Port Kembla Copper Smelter (now closed) and BHP Port Kembla.

Lower Hunter Region

Newcastle, its satellite towns, the northern parts of the Central Coast urban centre, and Maitland all lie in a single region termed the Lower Hunter. This region has a population of around 460,000. Monitoring of sulfur dioxide is conducted at Wallsend which has been chosen as being representative of general population exposure in the region. There are plans to also monitor in the future at Maitland and on the Central Coast.

Wallsend – This site is located in the Newcastle City Council Swimming Pool, off Frances Street, Wallsend. It is situated in a residential area south-west of Newcastle. Sulfur dioxide emitters within a 7-130 km radius include smelters and power stations.

Industry Monitoring Data

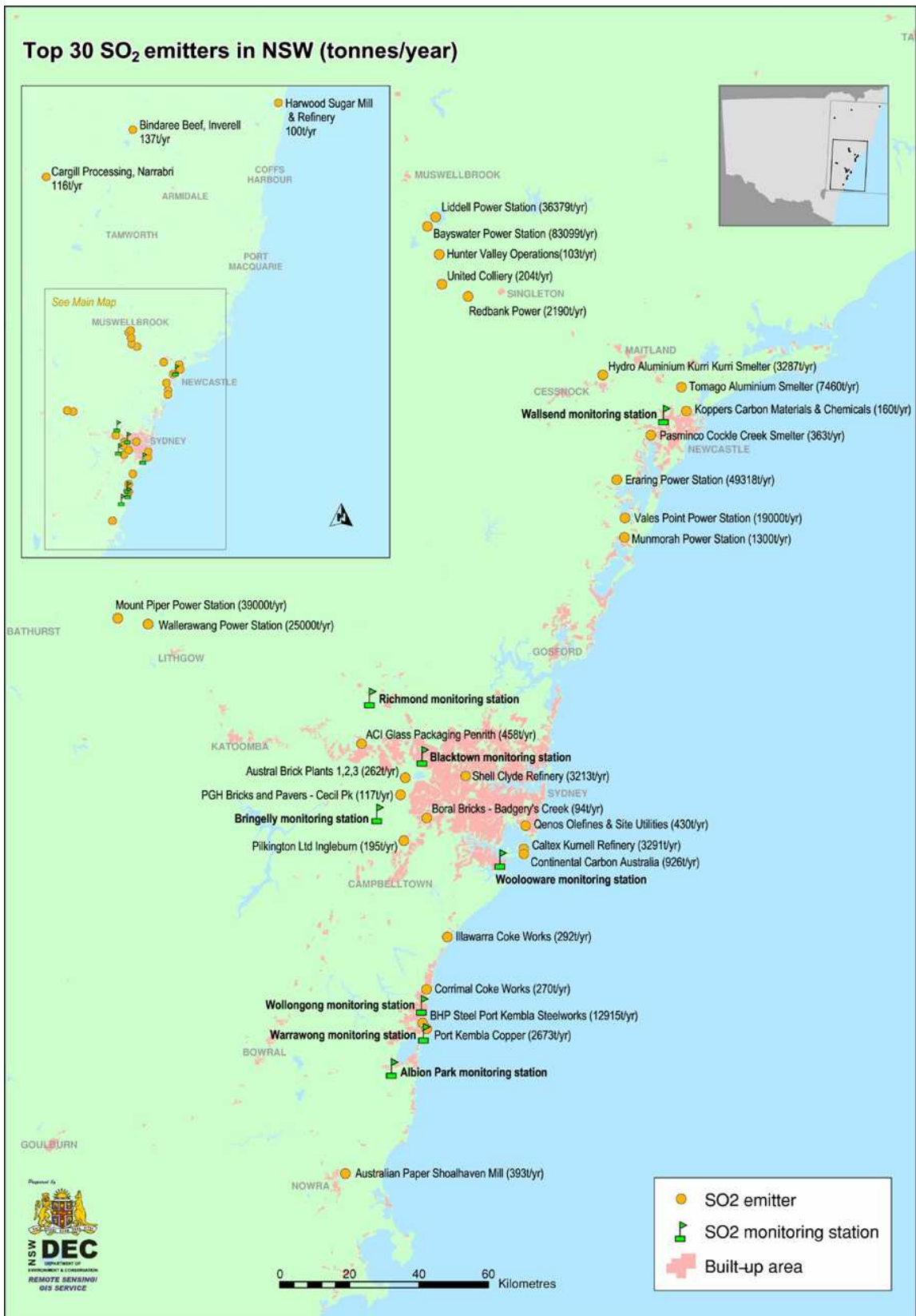
Industry monitoring data from Port Kembla Copper smelter has been included in the Issues Paper to indicate what short-term sulfur dioxide peaks might look like in the near vicinity of major sulfur dioxide emitting industries. Port Kembla Copper levels would be at the upper bound of short term sulfur dioxide concentrations in New South Wales.

Monitoring data is from the Port Kembla Public School site, one of several sites that were located in the community (the Primbee site was 3km from Port Kembla Copper) surrounding the smelter. The data has not been subject to the usual validation procedures and the results should therefore only be seen as indicative.

The Port Kembla Copper smelter ceased operations in August 2003.

Map

The locations of monitoring stations and major sources of sulfur dioxide in New South Wales are shown on the map over the page.



VICTORIA

Description of Monitoring Sites

Sulfur dioxide is monitored at four NEPM sites in the Port Phillip Region (population 3,450,862) and two NEPM sites in the Latrobe Valley Region (population 130,000, 1996 census figures):

Central Business District (CBD) Generally Representative Upper Bound (GRUB) station: This station is located at RMIT University. Measurements are representative of the central business district. The sampling site is on the roof of a multi-story building and the station does not fully conform to the Australian standard for station siting or to the definition of a GRUB station.

Inner East Metro trend station: This station is located in Alphington, a high population and traffic area; it is considered neighbourhood in scale. The site is representative of Melbourne's inner suburban residential areas. Recorded sulfur dioxide concentrations reflect the road traffic as well as residential wood burning open fires. A nearby paper mill is not a major source of sulfur dioxide.

Southwest Metro GRUB station: This station, located at Paisley, is considered an important station for sulfur dioxide as it will record the impact of industry, including the Altona petrochemical complex.

Geelong GRUB and trend station: This station is of neighbourhood scale, in a residential area at Geelong South and about 100 m from medium-traffic roads. There are oil refineries and an aluminium smelter in the Geelong area. The station records occasional elevated sulfur dioxide levels and monitoring at this site would indicate sulfur dioxide levels in the general residential areas of Geelong.

Latrobe Valley East Central GRUB and trend station: This station is located in a residential area of Traralgon, the largest town in the region. The Latrobe Valley's brown coal power stations are major sources of sulfur dioxide emissions.

Latrobe Valley West Central GRUB station: This station is located in a residential area of Moe, the second largest town in the region. The Latrobe Valley's brown coal power stations are major sources of sulfur dioxide emissions.

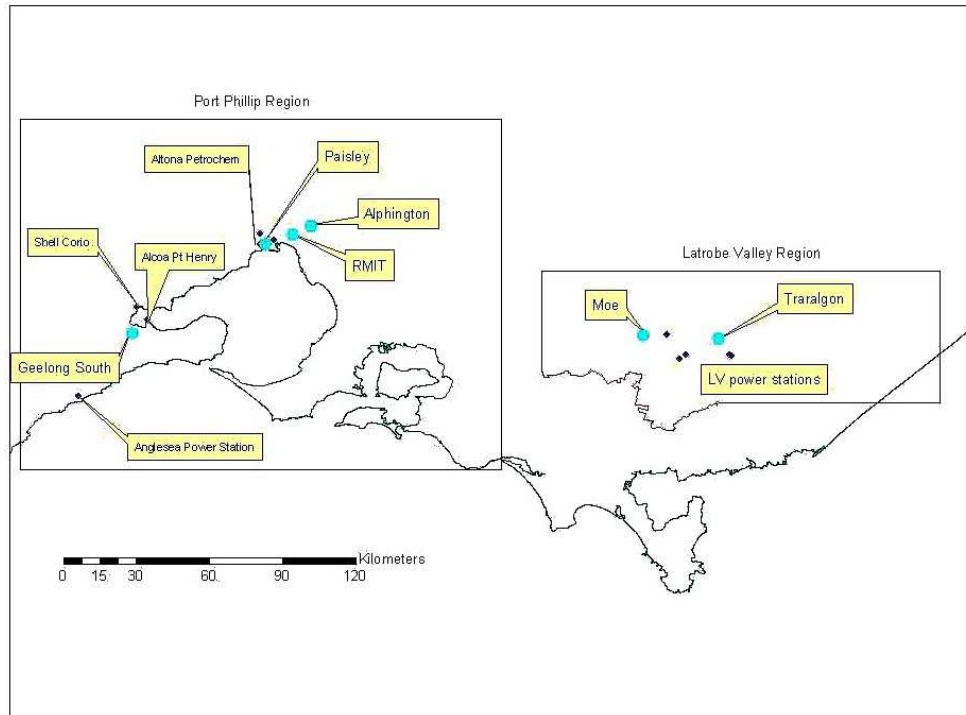
Areas Represented

The exposed population at each performance monitoring station is qualitatively described by the location categories in the following table.

Station name	Location	Location category
CBD	RMIT University	CBD
Inner East Metro	Alphington	Residential/industrial
Southwest Metro	Paisley	Residential/industrial
Geelong	Geelong South	Residential/industrial
Latrobe Valley East Central	Traralgon	Residential
Latrobe Valley West Central	Moe	Residential

Map

The locations of NEPM stations and major sources of sulfur dioxide in the Port Phillip and Latrobe Valley regions are shown below. There have been no recent closures of major sulfur dioxide sources.



QUEENSLAND

Description of Monitoring Sites

Brisbane CBD	Central Business District, within 500m of freeway, exposed population high.
Springwood	Springwood High School, residential area 1.5km from Brisbane-Gold Coast motorway, Air NEPM performance monitoring station - population-average, exposed population high.
Barney Point	Barney Point, Gladstone, light industrial area 2km from alumina refinery, 5.5km from power station, exposed population low.
Clinton	Clinton, Gladstone, open area at airport surrounded by residential suburb, 2km from power station, 6.5km from alumina refinery, exposed population medium.
Targinie	Targinie, Gladstone, rural area downwind of industrial area, 14km from power station, 5km from cement plant, 4km from shale oil plant, exposed population low.
Menzies	Menzies, Mount Isa, industrial area (lead and copper smelters) 200m to adjacent residential area, 1.5km from smelter, exposed population low.

Map

The locations of monitoring stations and major sources of sulfur dioxide in Queensland are shown below



WESTERN AUSTRALIA

Description of Monitoring Sites

Under Western Australia's Air Quality Monitoring Plan, approved by the National Environment Protection Council, air quality monitoring for sulfur dioxide is conducted in the Perth region.

The Perth region extends beyond Two Rocks in the North, Rockingham in the South and Armadale in the East. The population of the region exceeds 1 million. Monitoring for sulfur dioxide is conducted at South Lake, which has been chosen as being representative of general population exposure in the region.

The South Lake site is in a Perth residential area 10 km North-East of the Kwinana Industrial Area¹ in the direction of the prevailing winds. The main source of sulfur dioxide in the area is industry emissions, with some emissions also coming from vehicle fuel.

Western Australia also monitors for sulfur dioxide at the following sites:

- Hope Valley, Kwinana Industrial Buffer Area;
- Wattleup, Kwinana Industrial Buffer Area; and
- North Rockingham, Perth residential area on the southern edge of the Kwinana Industrial Buffer. Main source of sulfur dioxide in the area is industry emissions with some minor contributions from vehicle fuel.

Industry Monitoring Data

Monitoring data from Kalgoorlie gold and nickel processing industries has been included in the Issues Paper to indicate what short-term sulfur dioxide peaks might look like in the near vicinity of major sulfur dioxide emitting industries. Kalgoorlie levels would be at the upper bound of short term sulfur dioxide concentrations in Western Australia.

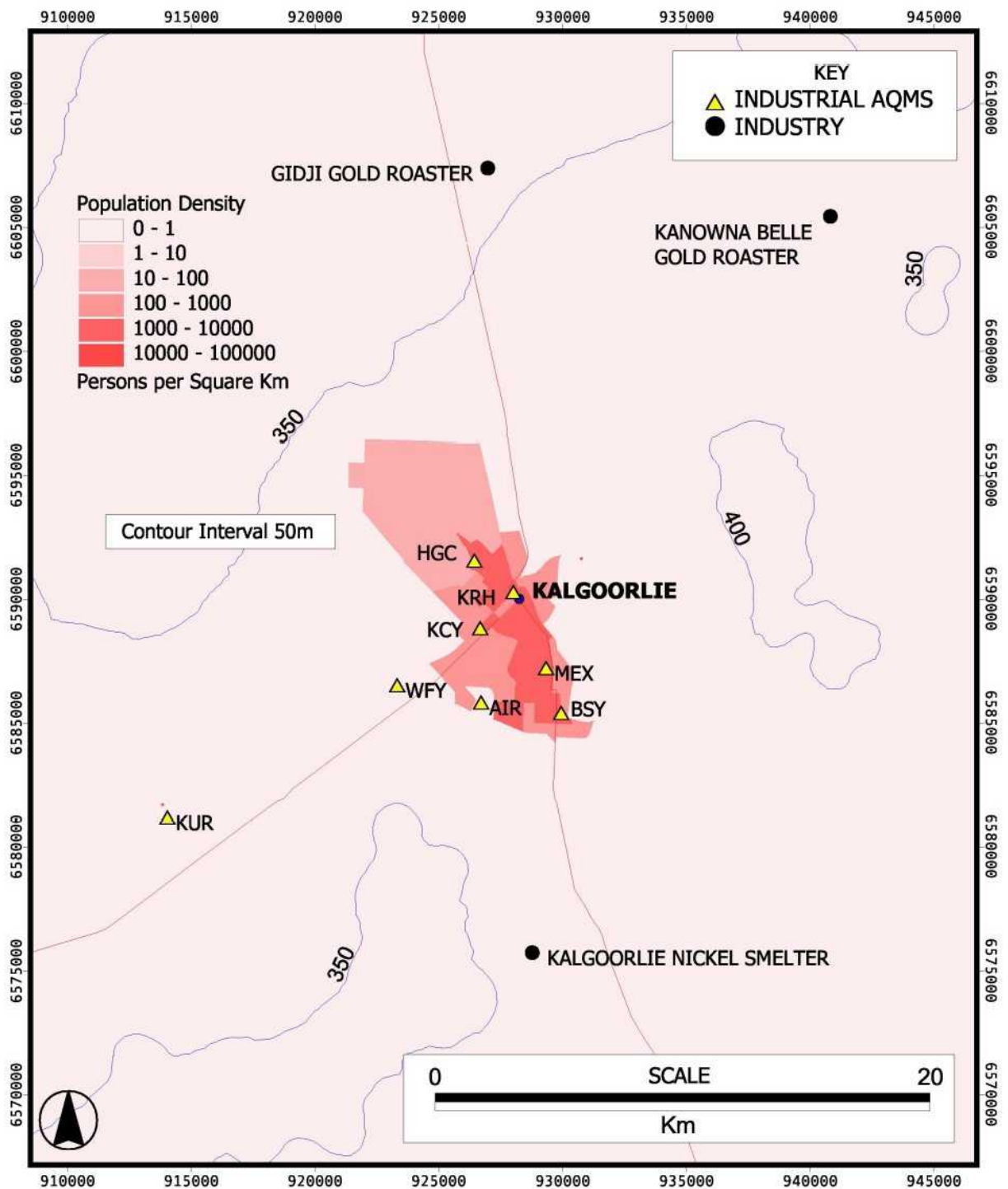
Monitoring data is from the following sites:

- Kalgoorlie Hospital, Kalgoorlie - industry, residential site in the vicinity of 3 significant industry sources of sulfur dioxide (gold and nickel processing).
- Westrail Freight Yard, Kalgoorlie - industry, residential site in the vicinity of 3 significant industry sources of sulfur dioxide (gold and nickel processing).

Map

The locations of monitoring stations and major sources of sulfur dioxide in Western Australia are shown below.

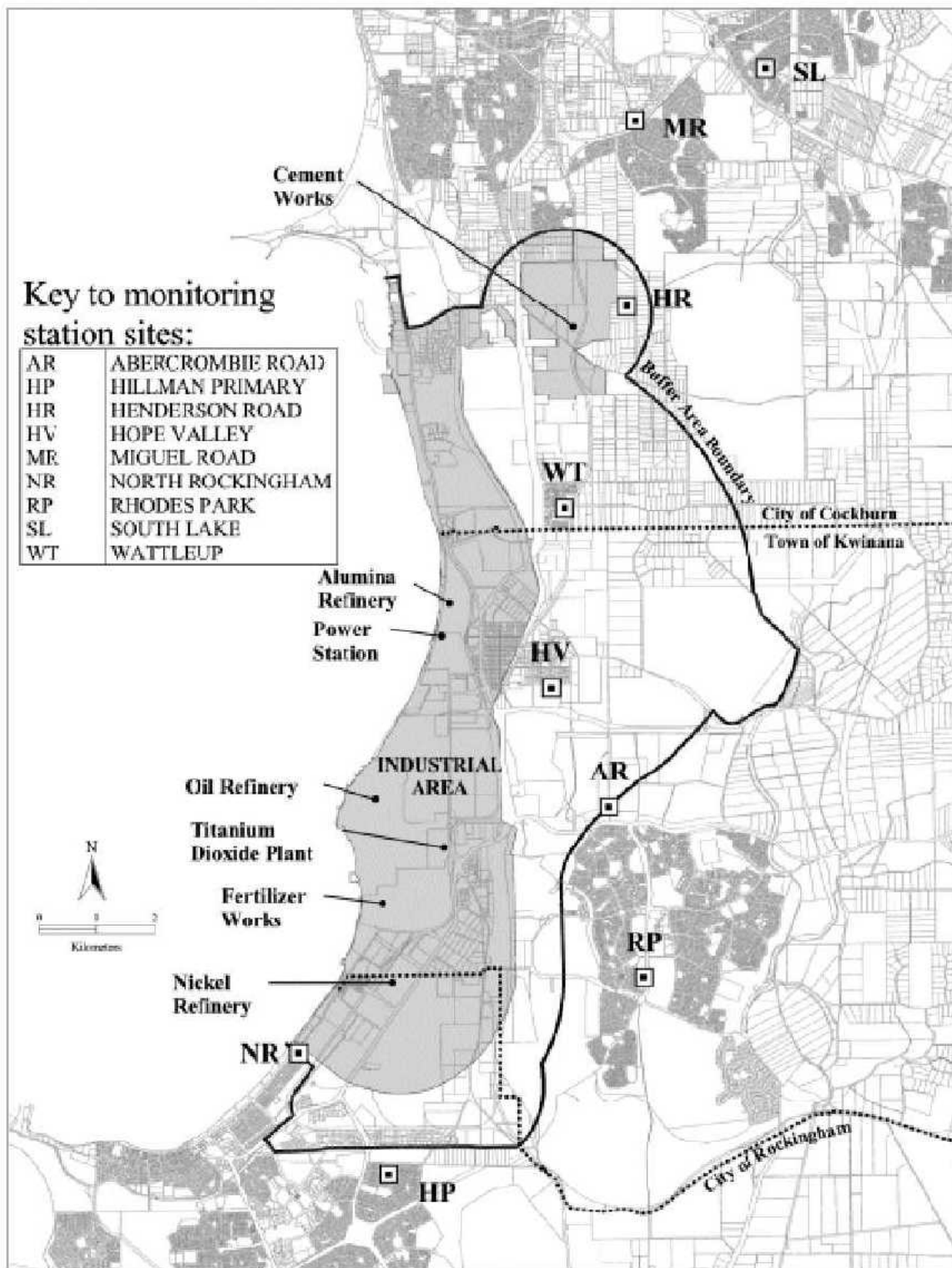
¹ Kwinana is a major heavy industrial area 30 km South-West of Perth. Facilities at Kwinana include power station, oil refinery and nickel refinery.



KEY to monitoring station codes:

- HGC Hannans Golf Course AIR Kalgoorlie Airport
- KRH Kalgoorlie Regional Hospital MEX Metals Exporation site
- KCY Kalgoorlie Council Yard BSY Boulder Shire Yard
- WFY Westrail Freight Yard KUR Kurrawang

Map of the Kalgoorlie Region, showing the three major sources of sulfur dioxide emissions and the locations of sulfur dioxide monitoring stations.



Sulfur dioxide monitoring network in the Kwinana Industrial Area. Monitoring stations are marked as box symbols with the accompanying initials explained in the Key.

SOUTH AUSTRALIA

Description of Monitoring Sites

Adelaide

The Environment Protection Agency conducts Air NEPM monitoring of sulfur dioxide in the ambient atmosphere at a variety of locations throughout the Adelaide airshed (Northfield, Kensington, Elizabeth and Christies Beach). Apart from Christies Beach, all monitoring is in residential locations, without significant sulfur dioxide sources nearby. The Christies Beach site, which monitors near the Mobil Refinery at Port Stanvac has now closed due to closure of the refinery.

The Adelaide region has a population of approximately 1.03 million.

Spencer

The EPA conducts campaign monitoring of sulfur dioxide in the Spencer Region at Port Pirie. This forms part of a five-year mobile monitoring program commenced by the EPA in 2000 to ascertain levels of air pollutants in regional areas, as part of its implementation of the Air NEPM, and to gain a more accurate understanding of air quality issues in those regions.

The sulfur dioxide monitoring site is located in a suburb immediately south of the Pasminco lead smelter.

Port Pirie is a population centre within the Spencer region which also encompasses Port August and Whyalla. Port Pirie has a population of approximately 14,000 while the Spencer region as a whole has a population of approximately 54,000 people.

TASMANIA

Description of Monitoring Sites

The Tasmanian Government does not conduct any sulfur dioxide monitoring as ambient levels of sulfur dioxide have been assessed to be well below the NEPM standards.

However, as part of its operating requirements, Pasminco zinc smelter in Hobart conducts monitoring for sulfur dioxide at 3 sites in the surrounding community at the boundary of the smelter. These sites are referred to as the Birch Rd, Tennis Court and Techno Park sites.

CHAPTER 2: SULFUR DIOXIDE MONITORING SITES IN AUSTRALIA -SUMMARY TABLES

NEW SOUTH WALES

Site	Location	SO ₂
Sydney		
Bargo	Rur	✓
Blacktown	Res	T
Bringelly	Res	T
Kurrajong Hgts	Res/Rur	✓
Lindfield	Res	✓
Randwick	Res	✓
Richmond	Res	T
Vineyard	Res/Rur	✓
Woolooware	Res	T
Lower Hunter		
Beresfield	Res/Rur	✓
Wallsend	Res	C
Illawarra		
Albion Park	Rur/Res	P
Warrawong	Res/Ind	P
Wollongong	CBD	T

VICTORIA

Site	Location	SO ₂
Alphington	Res	T
Box Hill	Res	✓
CBD RMIT	CBD	P
Footscray	Ind	✓
Geelong South	Res/Ind	T
Paisley	Res/Ind	P
Pt Henry (industry site)	Ind	✓
Latrobe Valley		
Jeeralang Hill (industry site)	Rur	✓
Rosedale Sth (industry site)	Rur	✓
Moe	Res	P
Traralgon	Res	T

Key

Res Residential
 Rur Rural
 Ind Industrial
 Com Commercial
 RS Roadside

P NEPM Performance Monitoring Station *
 T Trend Performance Monitoring Station *
 C Campaign Monitoring *
 ✓ Other Monitoring

* as described in the Air NEPM Monitoring Plan

QUEENSLAND

Site	Location	SO ₂
South-East Queensland		
Brisbane CBD	Com	✓
Eagle Farm	Ind	✓
Flinders View	Res	T
Springwood	Res	P
Pinkenba (industry site)	Res/Ind	✓
Gladstone		
Barney Point	Ind	✓
Clinton	Res/Ind	✓
South Gladstone	Res/Ind	T
Targinie (Stupkin Lane)	Rur/Ind	✓
Targinie (Swans Road)	Rur/Ind	✓
Townsville		
Stuart	Rur/Ind	C
Mount Isa		
Menzies	Res/Ind	T
Mount Isa Mines (industry sites)	Res/Ind	✓ (10 sites)

Note: Performance monitoring in Mount Isa is not formally required under the Air NEPM but, because of the region's industrial activities, it has been included for Air NEPM monitoring and its performance is to be reported against the Air NEPM standards.

WESTERN AUSTRALIA

Site	Location	SO ₂
Perth Region		
Hope Valley	Res/Ind	✓
Nth Rockingham	Res	✓
South Lake	Res	T
Wattleup	Res/Ind	✓
Regional		
Kalgoorlie (industry site)	Res/Ind	✓ 10 sites

SOUTH AUSTRALIA

Site	Location	SO ₂
Adelaide Metro		
Elizabeth	Res	C
Kensington	Res	C
Northfield	Res	C
St John's Christies B	Ind	T
Regional		
Mt Gambier	Res	C
Pt Pirie (Oliver St)	Res	C

Key

Res Residential

Rur Rural

Ind Industrial

Com Commercial

RS Roadside

P NEPM Performance Monitoring Station *

T Trend Performance Monitoring Station *

C Campaign Monitoring *

✓ Other Monitoring

* as described in the Air NEPM Monitoring Plan

CHAPTER 3: 10 MINUTE SULFUR DIOXIDE DATA

As part of the current review, jurisdictions were requested to provide 10 minute sulfur dioxide averages for 2000–02 for NEPM monitoring sites where available. For each site, jurisdictions were asked to provide:

- a cumulative frequency distribution of 10 minute average sulfur dioxide concentrations for each year; and
- the highest, 2nd highest and / or 99.9th percentile 10 minute average sulfur dioxide concentrations for each year.

Some jurisdictions also provided industry monitoring data. This data is summarised in the table below.

The 10 minute sulfur dioxide data provided by jurisdictions is discussed in the Issues Paper in Chapters 2 and 5. This document sets out the data in greater detail.

Jurisdictions have presented their 10 minute sulfur dioxide average in slightly different formats. There are 3 main types of graph:

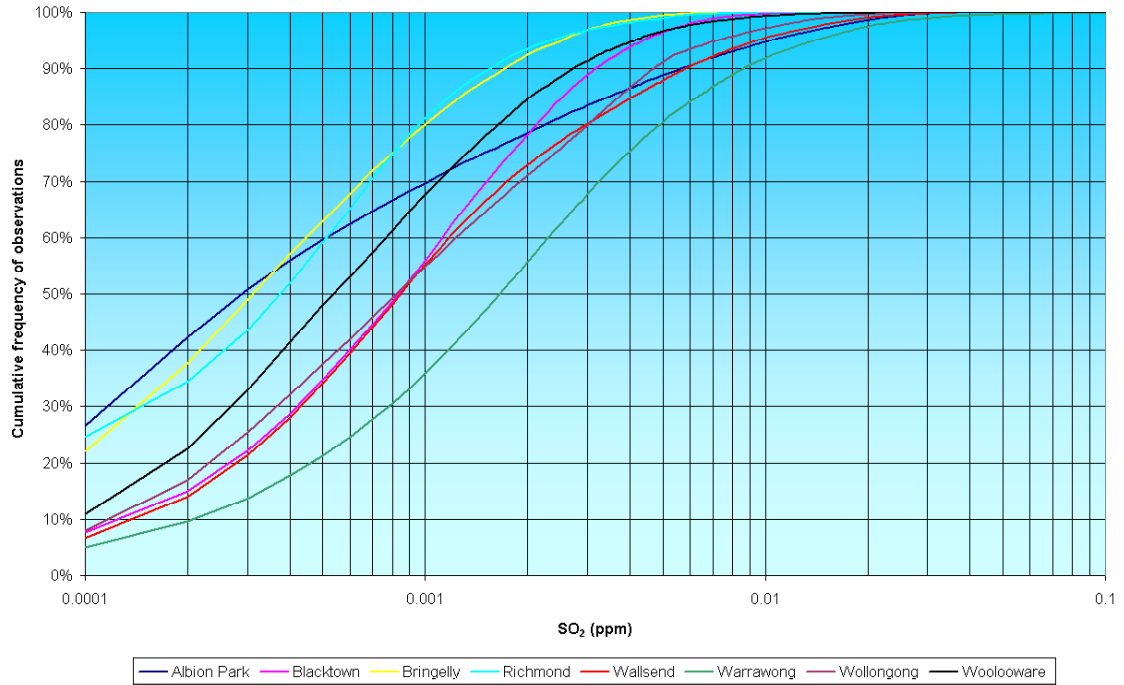
- those showing a cumulative frequency distribution of 10 minute average sulfur dioxide concentrations; and
- those showing the highest, 2nd highest and 99.9th percentile 10 minute average sulfur dioxide concentrations.

Chapter 1 provides a description of the monitoring sites from which 10 minute sulfur dioxide data has been provided.

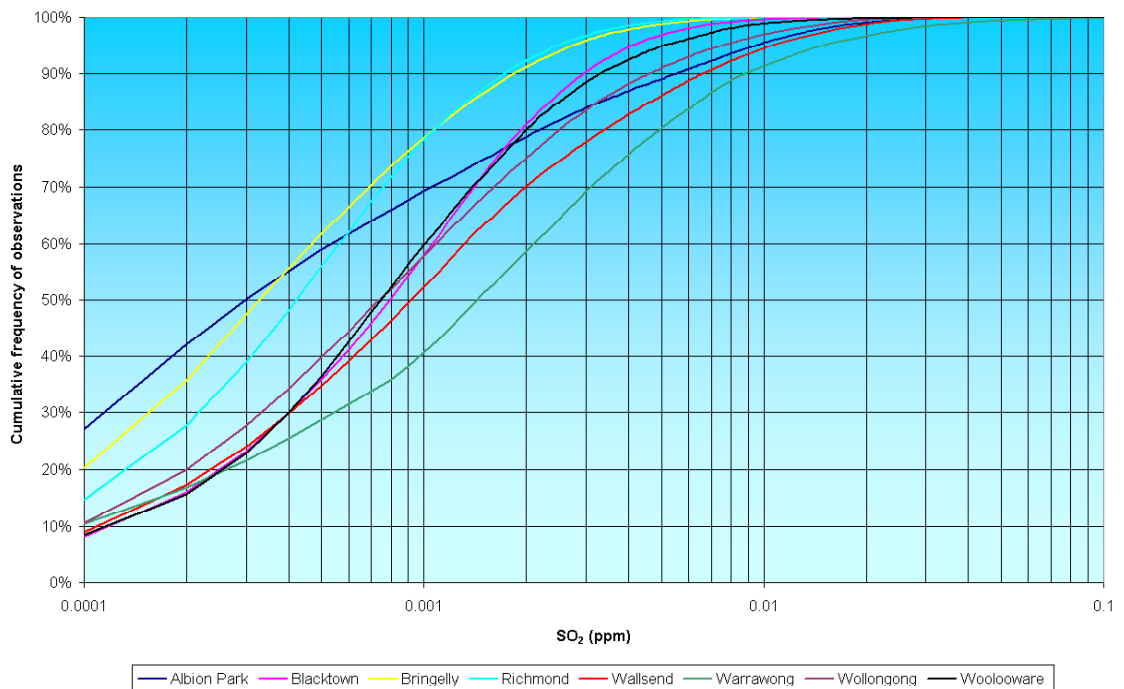
Sulfur dioxide (10 minute averages) for 2000, 2001 and 2002 as monitored at Industry Monitoring Stations

State	Location	2000		2001		2002	
		Highest ppm	99.9 percentile ppm	Highest ppm	99.9 percentile ppm	Highest ppm	99.9 percentile ppm
NSW	Port Kembla Copper, Port Kembla	Not provided	Not provided	0.347	0.081	Not provided	Not provided
Western Australia	Kalgoorlie Hospital	0.333	0.086	0.604	0.094	0.258	0.083
	Westrail Freight Yard	0.333	0.121	0.477	0.093	0.183	0.085
Tasmania	Pasminco Hobart: Tennis Court	Not provided	Not provided	0.076	0.025	0.403	0.036
	Birch Rd			0.320	0.058	0.497	0.017
	Technology Park			0.192	0.032	0.352	0.011

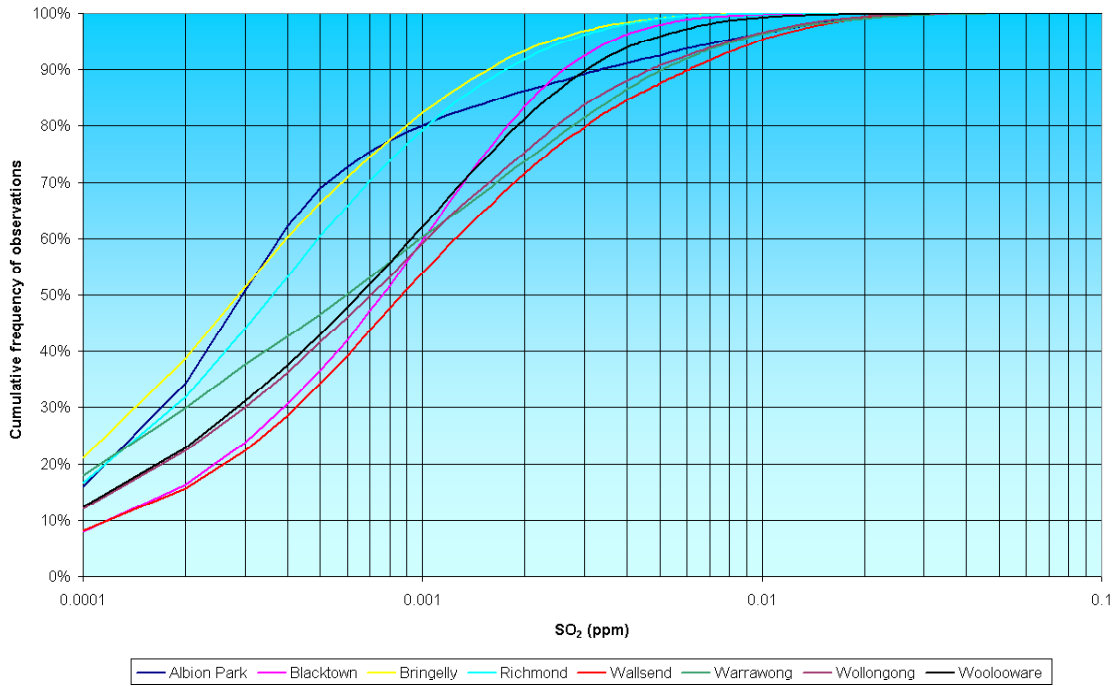
**Cumulative frequency analysis for ten-minute average SO₂ - 2000
NEPM monitoring stations**



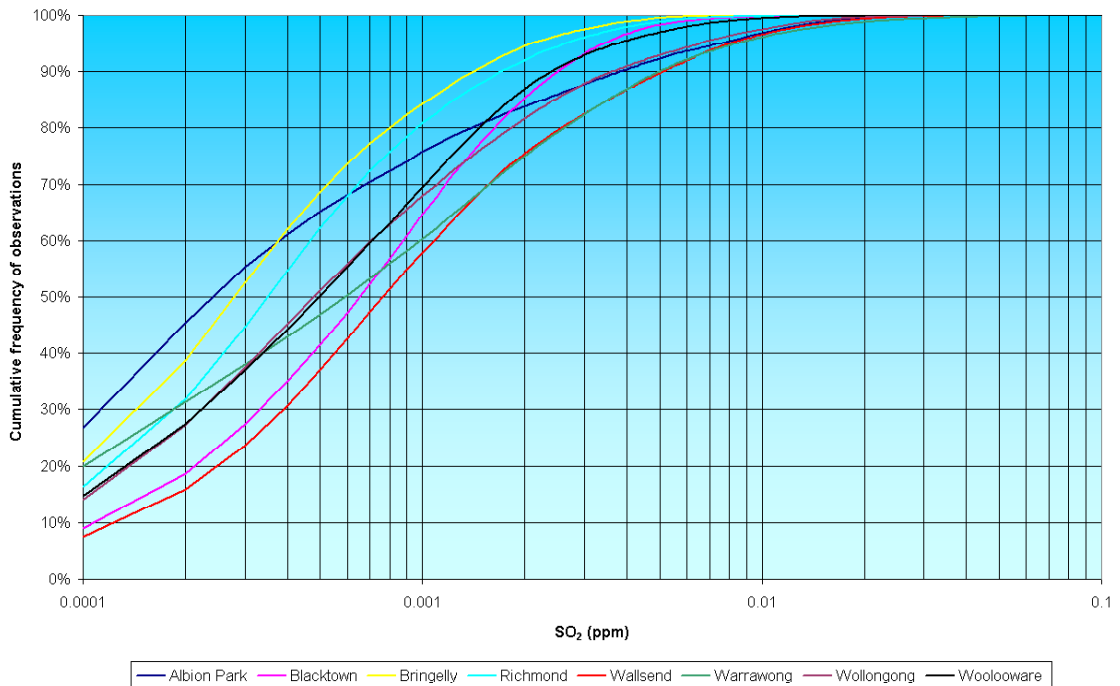
**Cumulative frequency analysis for ten-minute average SO₂ - 2001
NEPM monitoring stations**



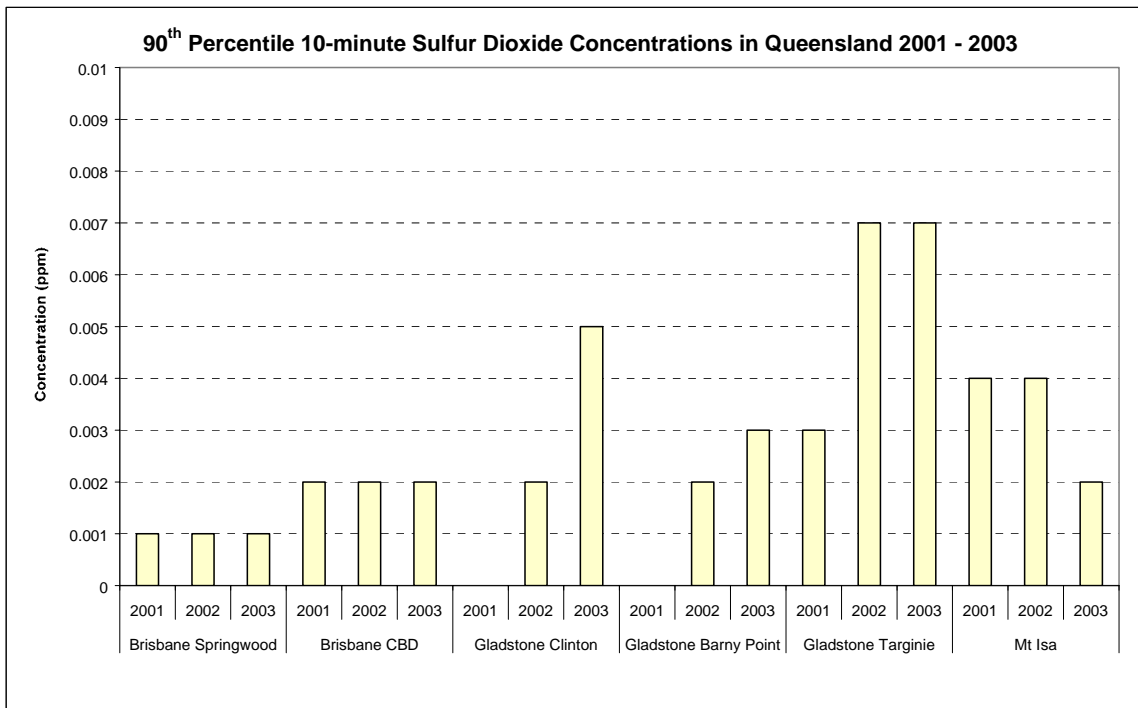
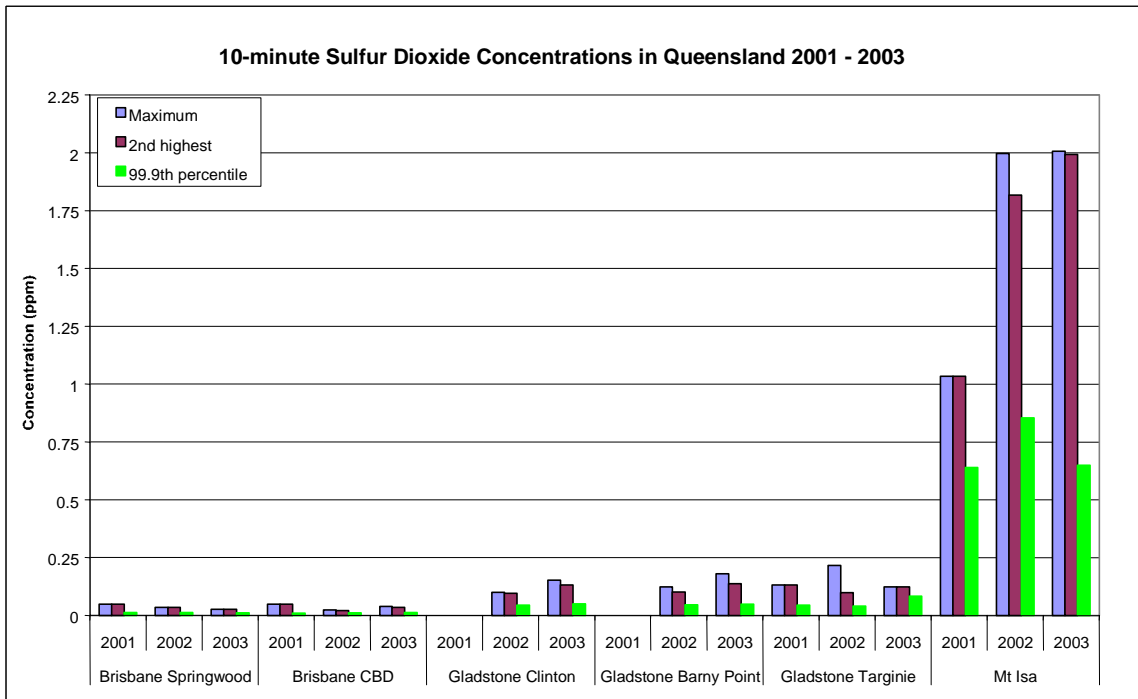
**Cumulative frequency analysis for ten-minute average SO₂ - 2002
NEPM monitoring stations**



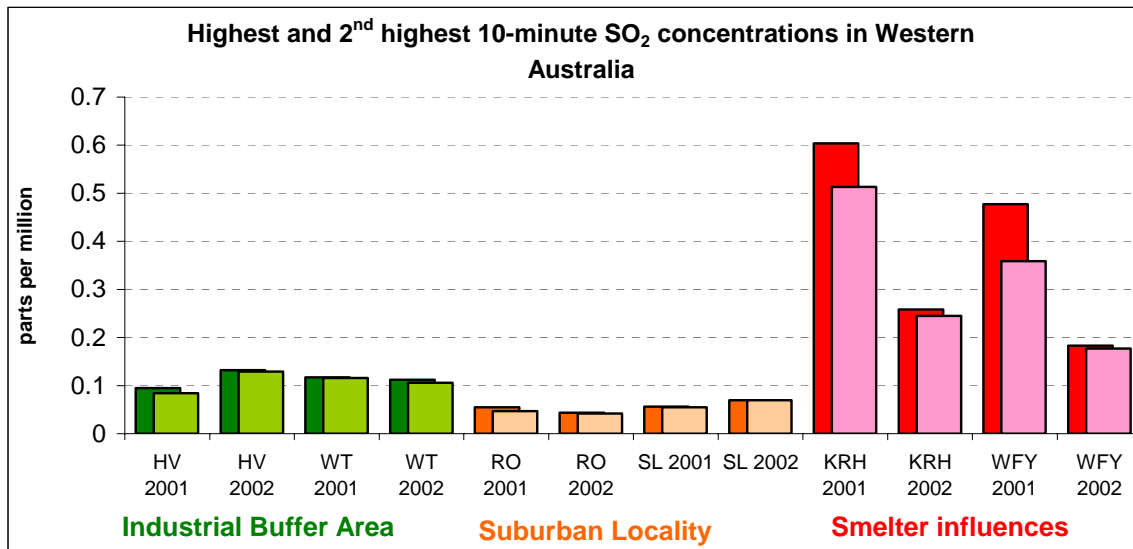
**Cumulative frequency analysis for ten-minute average SO₂ - 2003
NEPM monitoring stations**



QUEENSLAND

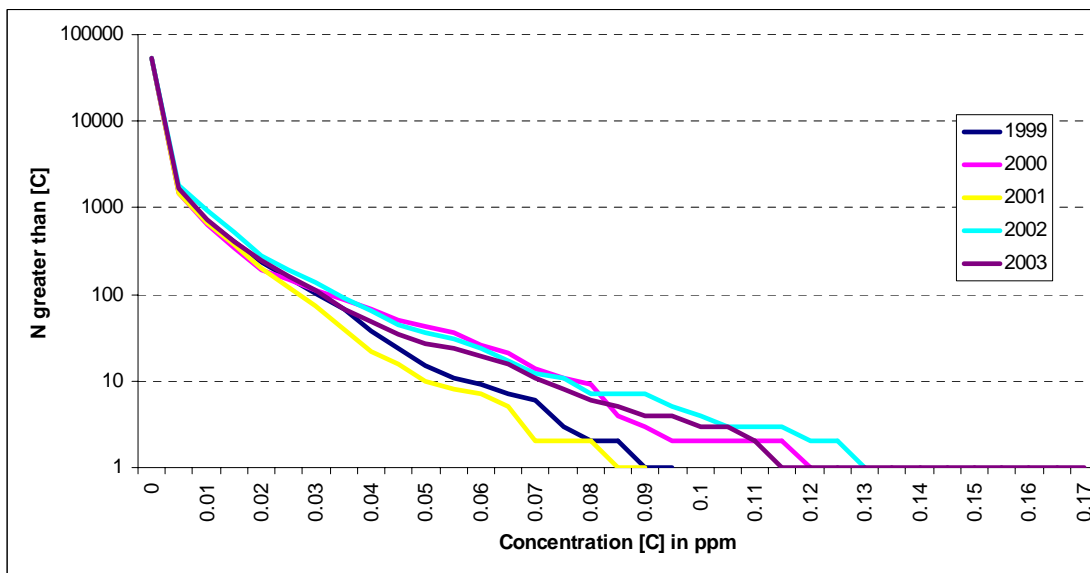


WESTERN AUSTRALIA

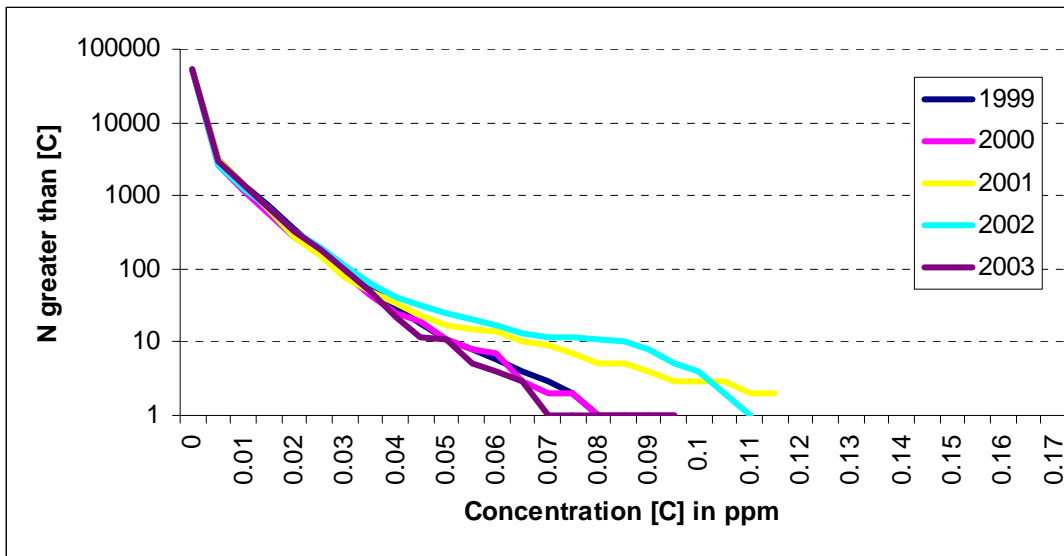


- HV - Hope Valley
- WT - Wattleup
- RO - North Rockingham
- SL - South Lake [NEPM monitoring station]
- KRH - Kalgoorlie Hospital [industry monitoring station]
- WFY - Westrail Freight Yard [industry monitoring station]

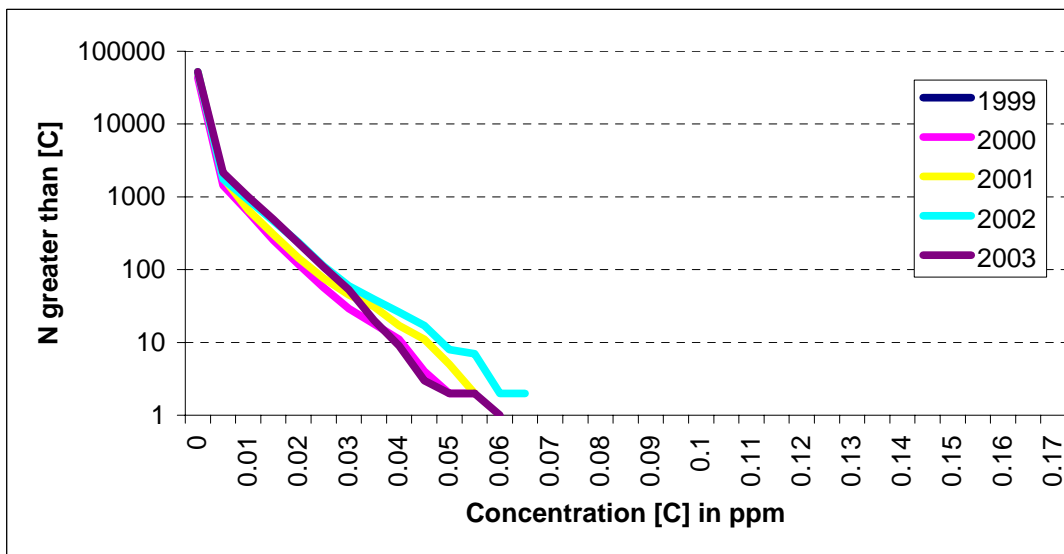
Hope Valley - Cumulative Frequency Graph



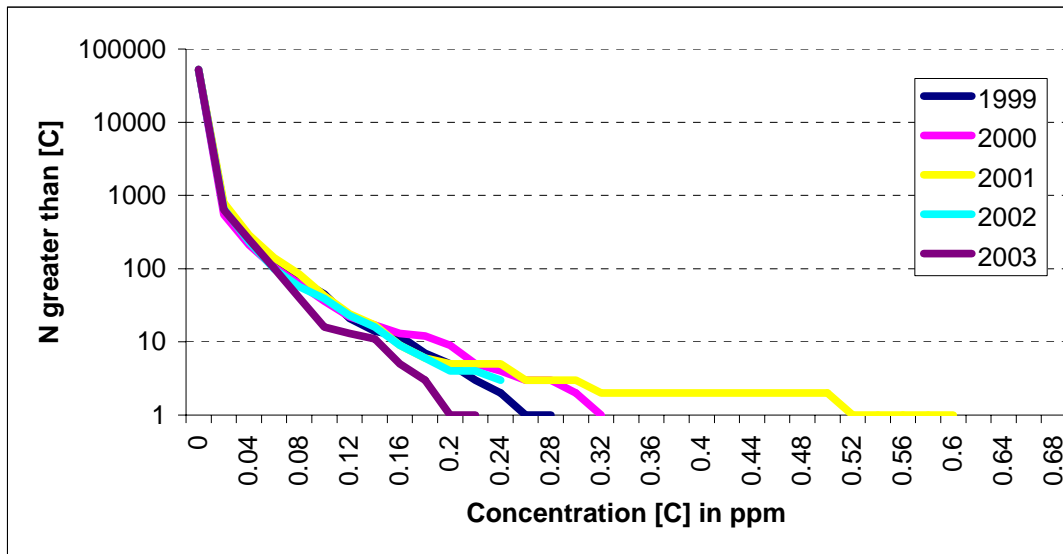
Wattleup - Cumulative Frequency Graph



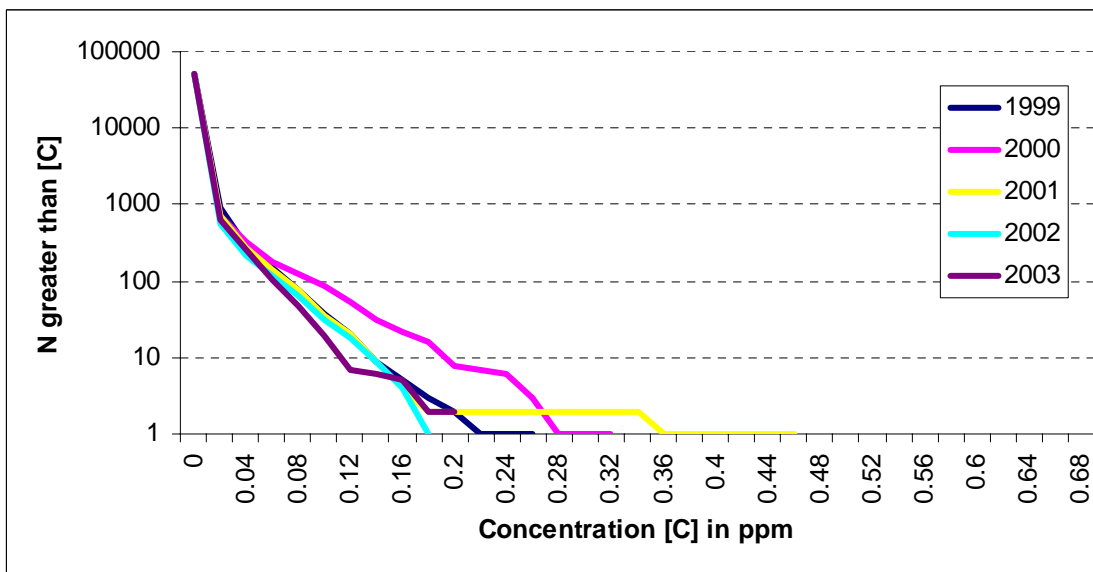
South Lake [NEPM Monitoring Station] - Cumulative Frequency Graph



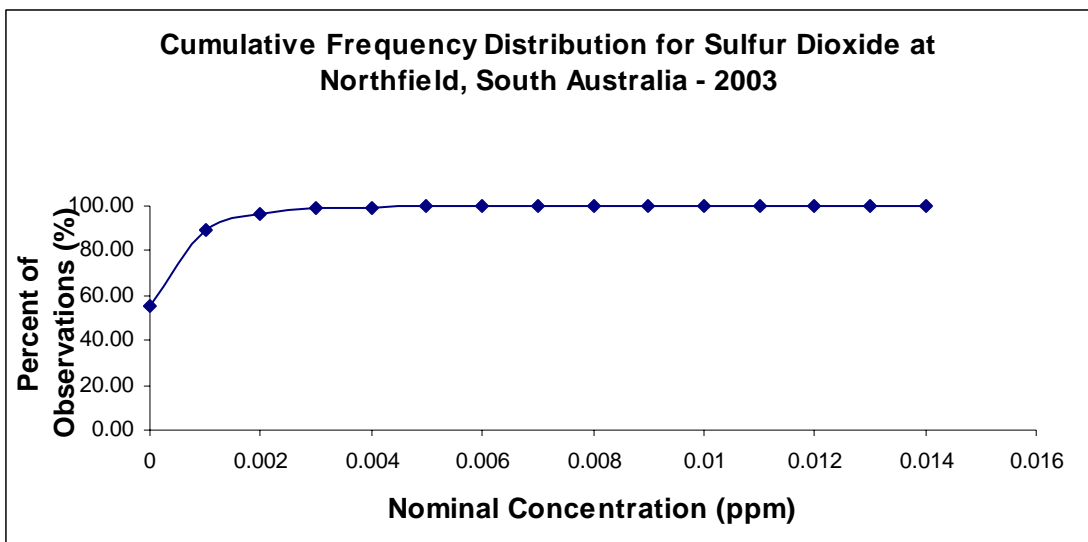
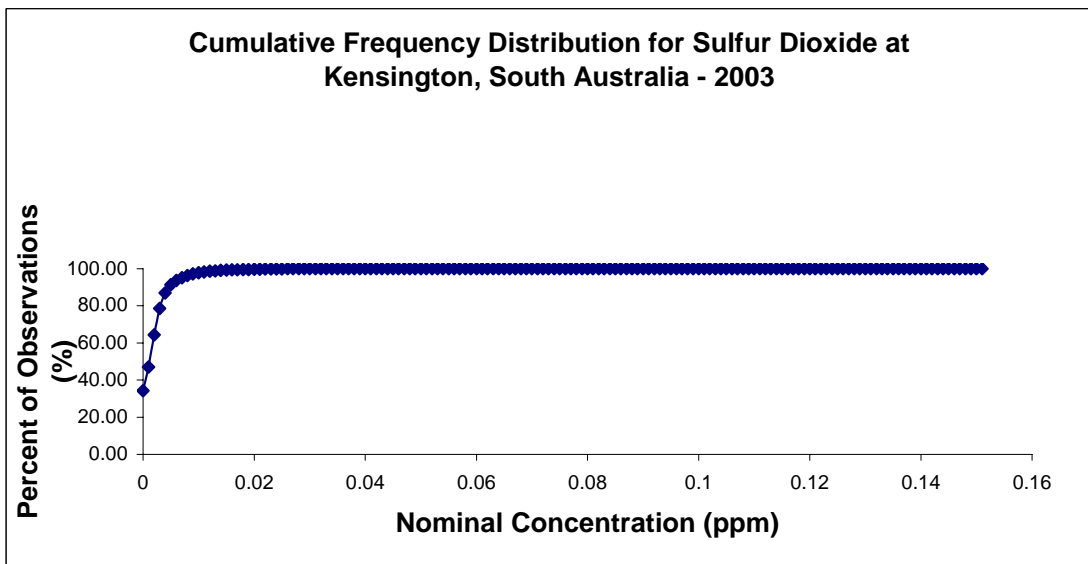
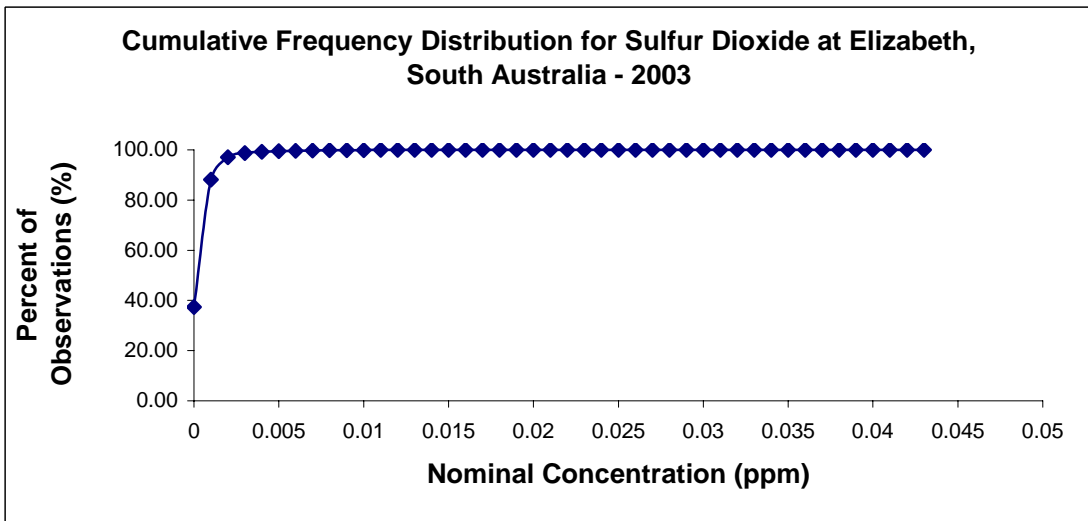
Kalgoorlie Hospital [Industry Monitoring Site] - Cumulative Frequency Graph

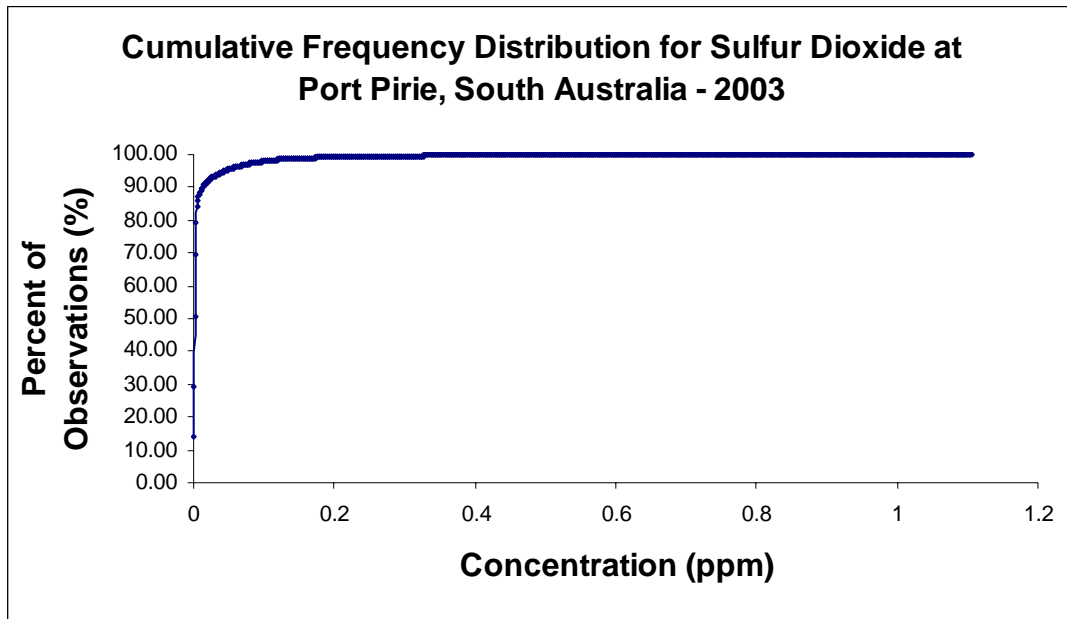


Westrail Freight Yard [Industry Monitoring Site] - Cumulative Frequency Graph



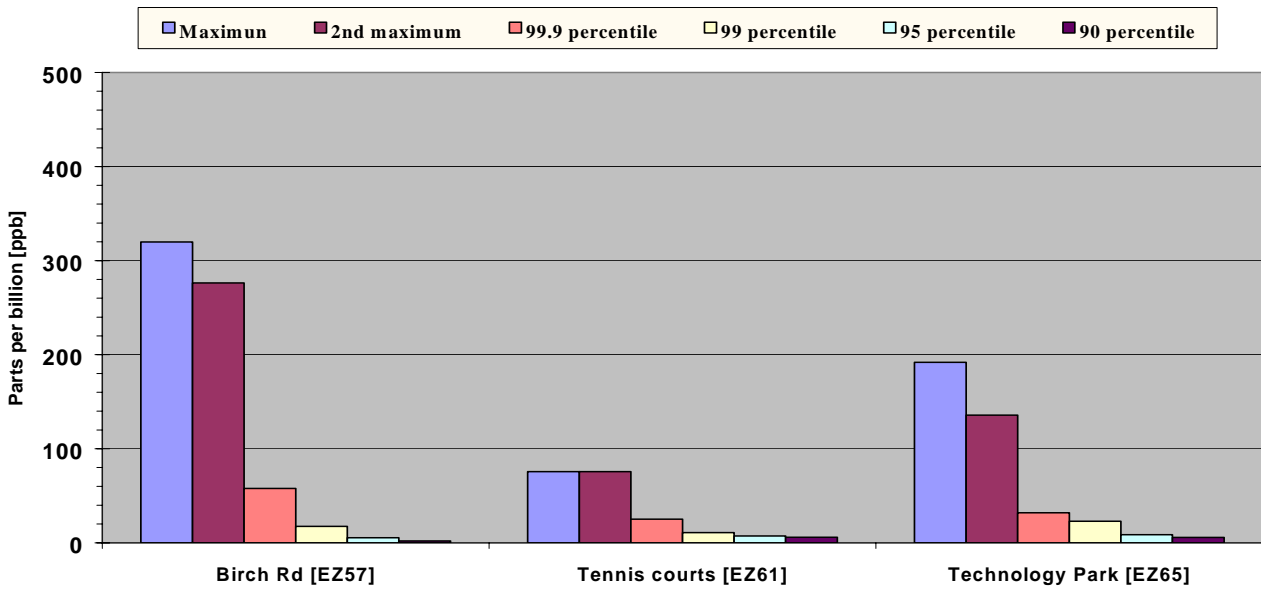
SOUTH AUSTRALIA



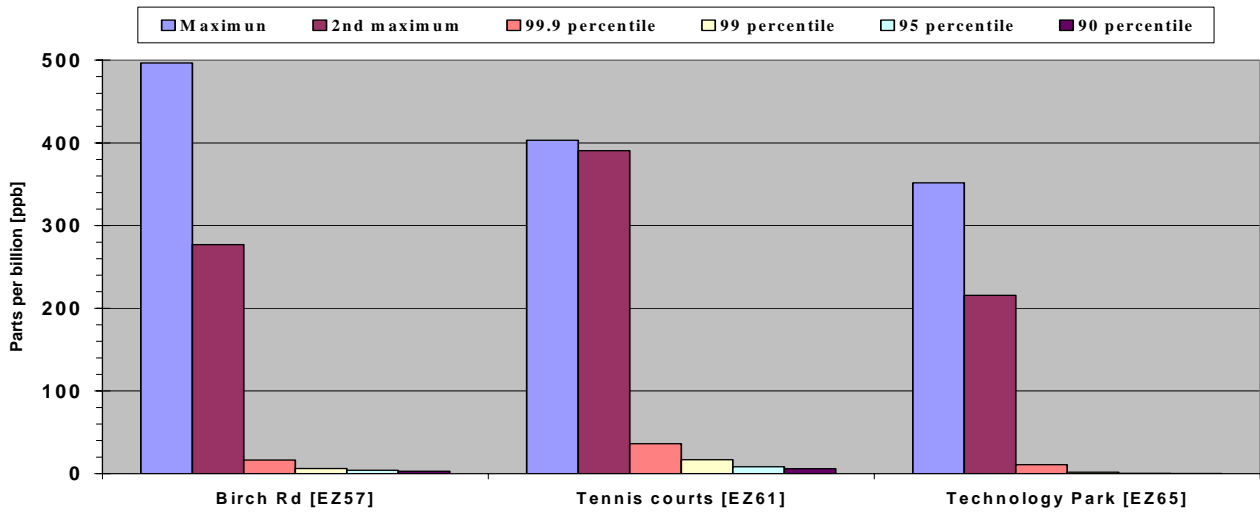


TASMANIA

2001 - Pasmenco Hobart SO2 10 minute averages



2002 - Pasmenco Hobart SO2 10 minute averages



2003 - Pasmenco Hobart SO2 10 minute averages

